2003.0 Mondeo Workshop Manual

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Group

1

General Information

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VEHICLE APPLICATION: 2003.0 Mondeo

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DESCRIPTION AND OPERATION

About This Manual

Introduction

This manual has been written in a format that is designed to meet the needs of Ford technicians worldwide. The objective is to use common formats and include similar content in each manual worldwide.

This manual provides general descriptions for accomplishing service and repair work with tested, effective techniques. Following them will help assure reliability.

Replacement Parts

Ford and Motorcraft parts are made to the same exacting standards as the original factory fitted components. For this reason, it is recommended that only genuine Ford or Motorcraft parts are installed during service or repair.

Special Tools

The Special Tool(s) Table provided at the beginning of each procedure shows all special tools required to carry out a repair. Where possible, illustrations are provided to assist in identifying the special tool required.

Special tools may be ordered from Loewener OTC GmbH, Rotunda Equipment, or their agents/distributors.

Europe	North America
Loewener OTC GmbH Industriestrasse 67 D40764 Langenfeld Germany Tel: +49 (0) 2173 928-0 Fax: +49 (0) 2173 928-199	Rotunda Equipment PO Box 1450 Kenosha W1 53141-1450 Phone 1-800-ROTUNDA FAX 1-800-762-6181 WWW.FORDROTUNDA.COM

Important Safety Instructions

Appropriate service methods and correct repair procedures are essential for the safe, reliable operation of all motor vehicles as well as the personal safety of the individual carrying out the work.

This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Anyone who departs from the instructions provided in this manual must first establish that he compromises neither his personal safety nor the vehicle integrity by his choice of methods, tools or parts.

Warnings, Cautions and Notes in This Manual

WARNING: Warnings are used to indicate that failure to follow a procedure correctly may result in personal injury.

CAUTION: Cautions are used to indicate that failure to follow a procedure correctly may result in damage to the vehicle or equipment being used.

NOTE: Notes are used to provide additional essential information required to carry out a complete and satisfactory repair.

As you read through this manual, you will come across WARNINGS, CAUTIONS and NOTES.

A warning, caution or note is placed at the beginning of a series of steps if it applies to multiple steps. If the warning, caution or note only applies to one step, it is placed at the beginning of the specific step (after the step number).

How to Use This Manual

This manual covers service and repair procedures.

DESCRIPTION AND OPERATION (Continued)

This manual is structured into groups and sections, with specific system sections collected together under their relevant group.

A group covers a specific portion of the vehicle. The manual is divided into five groups, General Information, Chassis, Powertrain, Electrical and Body and Paint. The number of the group is the first number of a section number.

Pages at the start of the manual list all sections available. Each section has a contents list detailing General Specifications, Description and Operation and Service Adjustment and Checks.

If components need to be removed or disassembled in sequence, the sequence will be identified numerically in a graphic and the corresponding text will be numbered accordingly (refer to `Samples').

All left and right-hand references to the vehicle are taken from a position sitting in the driver seat looking forward.

All left and right-hand references to the engine are taken from a position at the flywheel looking towards the front camshaft pulley.

Where appropriate, instructions will be given for the use of WDS, FDS2000 or New Generation STAR Tester diagnostic equipment.

Inspection and Verification

Visual Inspection Charts, Symptom Charts and other information charts (such as diagnostic routines), supplement test procedures with technical specifications, or navigate the user to a specific test procedure.

Sympton Chart

The symptom chart indicates symptoms, sources and actions to address a condition.

Pinpoint Tests

For electrical systems, pinpoint test steps are used to identify the source of a concern in a logical, step-by-step manner. Pinpoint tests have two columns: CONDITIONS and DETAILS/RESULTS/ACTIONS.

The CONDITIONS column is used exclusively for graphics and icons (with or without captions) and the DETAILS/RESULTS/ACTIONS column provides direction to another test step or specific corrective actions.

The boxed numbers indicate the order in which the described action is to be performed.

Component Tests

A component test is used when a component is tested in multiple pinpoint tests, or if a procedure is too complicated to be formatted within a single page of the pinpoint test.

Graphics

Test graphics show the measurement or test to be performed in a test step.

A representative tester graphic is used for voltmeters and ohmmeters.

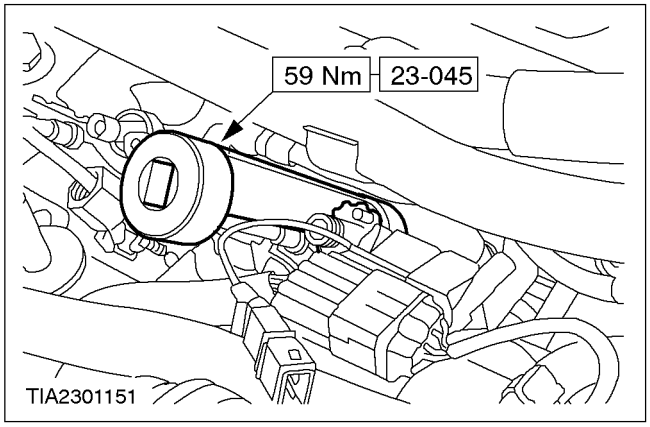
If multiple measurements are made in a single graphic, the test leads are drawn with a solid line until the test lead splits to indicate the multiple measurements, at which point dashed lines are used.

Breakout box-type testers are represented by a double circle test pin. Test pins are labelled with the pin number.

Samples

Special Tools and Torque Figures

Any requirement for special tools will picture the tool, showing it in use and with its tool number shown. Torque settings will be given at the relevant point in the procedure.



DESCRIPTION AND OPERATION

Health and Safety Precautions

Introduction

Many of the procedures associated with vehicle maintenance and repair involve physical hazards or other risks to health. This subsection lists, alphabetically, some of these hazardous operations and the materials and equipment associated with them. Precautions necessary to avoid these hazards are identified.

The list is not exhaustive and all operations and procedures, and the handling of materials, should be carried out with health and safety in mind.

Before using any product the Materials Safety Data Sheet supplied by the manufacturer or supplier should be consulted.

Acids and Alkalis

See also Battery Acids.

For example caustic soda, sulphuric acid.

Used in batteries and cleaning materials.

Irritant and corrosive to the skin, eyes, nose and throat. Cause burns. Can destroy ordinary protective clothing.

Avoid splashes to the skin, eyes and clothing. Wear suitable protective impervious apron, gloves and goggles. Do not breath mists.

Make sure access to eye wash bottles, shower and soap are readily available for splashing accidents.

Display Eye Hazard sign.

Air Bags

See also Fire, Chemical Materials

Highly flammable, explosive – observe No Smoking policy.

Used as a safety restraint system mounted in the steering wheel and passenger side of the instrument panel.

The inflator contains a high-energetic propellant which, when ignited, produces a VERY HOT GAS (2500°C).

The gas generant used in air bags is Sodium Azide. This material is hermetically sealed in the module and is completely consumed during deployment. No attempt should be made to open an air bag inflator as this will lead to the risk of exposure to Sodium Azide. If a gas generator is ruptured, full protective clothing should be worn when dealing with the spillage.

After normal deployment, gloves and safety goggles should be worn during the handling process.

Deployed air bags should be disposed of in a plastic bag in accordance with local regulations at an approved chemical waste site.

Following any direct contact with gas generant.

- wash affected areas thoroughly with water.
- seek medical assistance if necessary.

Air Bags - Do's

- do store modules in an upright position.
- do keep modules dry.
- do carry modules with the cover side pointing away from the body.
- do place modules with their cover side upwards.
- do carefully inspect modules for damage.
- do stand to one side when connecting modules.
- do make sure all test equipment is properly calibrated and maintained.
- do wash hands after handling deployed air bags.

Air Bags - Do Nots

DESCRIPTION AND OPERATION (Continued)

- do not store highly flammable material together with modules or gas generators.
- do not store gas generators at temperatures exceeding 80°C.
- do not store modules upside down.
- do not attempt to open a gas generator housing.
- do not expose gas generators to open flame or sources of heat.
- do not place anything on top of a module cover.
- do not use damaged modules.
- do not touch a fired module or gas generator for at least 10 minutes.
- do not use any electrical probes on the wiring circuit.

Air Conditioning Refrigerant

See also Chlorofluorocarbon, Chemical Materials

Highly flammable, combustible – observe No Smoking policy.

Skin contact may result in frostbite.

Instructions given by the manufacturer must be followed. Avoid naked lights, wear suitable protective gloves and goggles.

If refrigerant comes into contact with the skin or eyes, rinse the affected areas with water immediately. Eyes should also be rinsed with an appropriate irrigation solution and should not be rubbed. SEEK MEDICAL ASSISTANCE IF NECESSARY.

Air Conditioning Refrigerant - Do Nots

- do not expose refrigerant bottles to sunlight or heat.
- do not stand refrigerant bottles upright; when filling, hold them with the valve downwards.
- do not expose refrigerant bottles to frost.
- do not drop refrigerant bottles.
- do not vent refrigerant to atmosphere under any circumstance.
- do not mix refrigerants, for example R12 (Freon) and R134a.

Adhesives and Sealers

See also Fire, Chemical Materials

Highly flammable, flammable, combustible – observe No Smoking policy.

Generally should be stored in No Smoking areas. Cleanliness and tidiness in use should be observed, for example disposable paper covering benches; should be dispensed from applicators where possible; containers, including secondary containers, should be labelled appropriately.

Solvent-based Adhesives/Sealers - See Solvents

Follow manufacturers instructions.

Water-based Adhesives/Sealers

Those based on polymer emulsions and rubber latexes may contain small amounts of volatile toxic and harmful chemicals. Skin and eye contact should be avoided and adequate ventilation provided during use.

Hot Melt Adhesives

In the solid state, they are safe. In the molten state they may cause burns and health hazards may arise from the inhalation of toxic fumes.

Use appropriate protective clothing and a thermostatically controlled heater with a thermal cut-out and adequate extraction.

Resin-based Adhesives/Sealers, for example Epoxide and Formaldehyde Resin-based

Mixing should be carried out in well ventilated areas, as harmful or toxic volatile chemicals may be released.

Skin contact with uncured resins and hardeners can result in irritation, dermatitis, and absorption of toxic or harmful chemicals through the skin. Splashes can damage the eyes.

Provide adequate ventilation and avoid skin and eye contact.

Anaerobic, Cyanoacrylate (super-glues) and other Acrylic Adhesives

Many are irritant, sensitizing or harmful to the skin and respiratory tract. Some are eye irritants.

Skin and eye contact should be avoided and the manufacturers instructions followed.

Cyanoacrylate adhesives (super-glues) MUST NOT contact the skin or eyes. If skin or eye tissue is bonded, cover with a clean moist pad

DESCRIPTION AND OPERATION (Continued)

and SEEK IMMEDIATE MEDICAL ATTENTION. Do not attempt to pull tissue apart. Use in well ventilated areas as vapours can cause irritation to the nose and eyes.

For two-pack systems see Resin-based and Isocyanate Adhesives/Sealers.

Isocyanate (Polyurethane) Adhesives/Sealers

See also Resin-based Adhesives

Individuals suffering from asthma or respiratory allergies should not work with or near these materials as sensitivity reactions can occur.

Over exposure is irritating to the eyes and respiratory system. Excessive concentrations may produce effects on the nervous system including drowsiness. In extreme cases, loss of consciousness may result. Long term exposure to vapour concentrations may result in adverse health effects.

Prolonged contact with the skin may have a defatting effect which may lead to skin irritation and in some cases, dermatitis.

Splashes entering the eye will cause discomfort and possible damage.

Any spraying should preferably be carried out in exhaust ventilated booths, removing vapours and spray droplets from the breathing zone.

Wear appropriate gloves, eye and respiratory protection.

Antifreeze

See also Fire, Solvents.

For example isopropanol, ethylene glycol, methanol.

Highly flammable, flammable, combustible.

Used in vehicle coolant systems, brake air pressure systems, screenwash solutions.

Vapours may be given off from coolant antifreeze (glycol) when heated. Avoid breathing these vapours.

Antifreeze may be absorbed through the skin in toxic or harmful quantities. Antifreeze, if swallowed, can be fatal and MEDICAL ATTENTION SHOULD BE SOUGHT IMMEDIATELY.

These products must not be used in any cooling or industrial water system which is connected or linked to general, food preparation or drinking water supplies.

Asbestos

See also Warning Symbols on Vehicles at the end of this subsection.

Breathing asbestos dust may cause lung damage or, in some cases, cancer.

Used in brake and clutch linings, transmission brake bands and gaskets. Ford original production and replacement items for this model are asbestos free.

The use of drum cleaning units, vacuum cleaning or damp wiping is preferred.

Asbestos dust waste should be dampened, placed in a sealed container and marked for safe disposal. If any cutting or drilling is attempted on materials containing asbestos the item should be dampened and only hand tools or low speed power tools used.

Battery Acids

See also Acids and Alkalis.

Gases released during charging are explosive. Never use naked flames or allow sparks near charging or recently charged batteries.

Make sure there is adequate ventilation.

Brake and Clutch Linings and Pads

See Asbestos.

Brakes Fluids (Polyalkylene Glycols)

See also Fire.

Splashes to the skin and eyes are slightly irritating. Avoid skin and eye contact as far as possible. Inhalation vapour hazards do not arise at ambient temperatures because of the very low vapour pressure.

Brazing

See Welding.

Chemical Materials

See also Legal Aspects.

DESCRIPTION AND OPERATION (Continued)

Chemical materials such as solvents, sealers, adhesives, paints, resin foams, battery acids, antifreeze, brake fluids, fuels, oils and grease should always be used with caution and stored and handled with care. They may be toxic, harmful, corrosive, irritant or highly flammable and give rise to hazardous fumes and dusts.

The effects of excessive exposure to chemicals may be immediate or delayed; briefly experienced or permanent; cumulative; superficial; life threatening; or may reduce life expectancy.

Chemical Materials - Do's

- Do carefully read and observe hazard and precaution warnings given on material containers (labels) and in any accompanying leaflets, posters or other instructions. Material health and safety data sheets can be obtained from manufacturers.
- Do remove chemical materials from the skin and clothing as soon as practicable after soiling. Change heavily soiled clothing and have it cleaned.
- Do organise work practices and protective clothing to avoid soiling of the skin and eyes; breathing vapours, aerosols, dusts or fumes; inadequate container labelling; fire and explosion hazards.
- Do wash before job breaks, before eating, smoking, drinking or using toilet facilities when handling chemical materials.
- Do keep work areas clean, uncluttered and free of spills.
- Do store chemical materials according to national and local regulations.
- Do keep chemical materials out of the reach of children.

Chemical Materials - Do Nots

- Do not mix chemical materials except under the manufacturers instructions; some chemicals can form other toxic or harmful chemicals, give off toxic or harmful fumes or become explosive when mixed together.
- Do not spray chemical materials, particularly those based on solvents, in confined spaces, for example when people are inside a vehicle.
- Do not apply heat or flame to chemical materials except under the manufacturers instructions. Some are highly flammable and some may release toxic or harmful fumes.
- Do not leave containers open. Fumes given off can build up to toxic, harmful or explosive concentrations. Some fumes are heavier than air and will accumulate in confined areas such as pits.
- Do not transfer chemical materials to unlabelled containers.
- Do not clean hands or clothing with chemicals. Chemicals, particularly solvents and fuels, will dry skin and may cause irritation leading to dermatitis or be absorbed through the skin in toxic or harmful quantities.

DESCRIPTION AND OPERATION (Continued)

- Do not use emptied containers for other materials except when they have been cleaned under supervised conditions.
- Do not sniff or smell chemical materials. Brief exposure to high concentrations of fumes can be toxic or harmful.

Chlorofluorocarbons (CFC)

There is concern in the scientific community that CFCs and Halons are depleting the upper ozone layer which filters out harmful ultraviolet radiation. Decreased filtration of ultraviolet radiation may result in increases in skin cancer, cataracts and immune system suppression in humans, as well as decreased productivity of crops and aquatic systems.

CFCs are used primarily as refrigerants in vehicle air conditioning systems and as aerosol propellants. Halons are used as fire extinguishants.

Ford supports worldwide elimination of CFC usage and it is recommended that Company subsidiaries and affiliates should phase out CFC usage as soon as acceptable substitutes are commercially available.

Clutch Fluids

See Brake fluids.

Clutch Linings and Pads

See Asbestos.

Corrosion Protection Materials

See also Solvents, Fire.

Highly flammable, flammable – observe No Smoking policy.

These materials are varied and the manufacturers instructions should be followed. They may contain solvents, resins or petroleum products. Skin and eye contact should be avoided. They should only be sprayed in conditions of adequate ventilation and not in confined spaces.

Cutting

See Welding.

Dewaxing

See Solvents and Fuels (Kerosene).

Dusts

Powder, dusts or clouds may be irritant, harmful or toxic. Avoid breathing dusts from powdery chemical materials or those arising from dry abrasion operations. Wear respiratory protection if ventilation is inadequate.

Fine dusts of combustible material can present an explosion hazard. Avoid explosive limits and sources of ignition.

Electric Shock

Electric shock can result from the use of faulty electrical equipment or from the misuse of equipment in good condition.

Make sure that electrical equipment is maintained in good condition and frequently tested. Faulty equipment should be labelled and preferably removed from the work station.

Make sure that flexes, cables, plugs and sockets are not frayed, kinked, cut, cracked or otherwise damaged.

Make sure that electrical equipment and flexes do not come into contact with water.

Make sure that electrical equipment is protected by the correct rated fuse.

Never misuse electrical equipment and never use equipment which is in any way faulty. The results could be fatal.

Make sure that the cables of mobile electrical equipment cannot get trapped and damaged, such as in a vehicle hoist.

Make sure that the designated electrical workers are trained in basic First Aid.

In cases of electrocution:

DESCRIPTION AND OPERATION (Continued)

- switch off the power supply before approaching the victim.
- if this is not possible push or drag the victim from the source of electricity using dry non-conductive material.
- commence resuscitation if trained to do so.
- SUMMON MEDICAL ASSISTANCE.

Engine Oils

See Lubricants and Grease.

Exhaust Fumes

These contain asphyxiating, harmful and toxic chemicals and particles such as carbon oxides, nitrogen oxides, aldehydes, lead and aromatic hydrocarbons. Engines should be run only under conditions of adequate exhaust extraction or general ventilation and not in confined spaces.

Gasolene (petrol) engine

There may not be adequate warning of odour or of irritation before toxic or harmful effects arise. These may be immediate or delayed.

Diesel engine

Soot, discomfort and irritation usually give adequate warning of hazardous fume concentrations.

Fibre Insulation

See also Dusts.

Used in noise and sound insulation.

The fibrous nature of surfaces and cut edges can cause skin irritation. This is usually a physical and not a chemical effect.

Precautions should be taken to avoid excessive skin contact through careful organization of work practices and the use of gloves.

Fire

See also Welding, Foams, Legal Aspects.

Many of the materials found on or associated with the repair of vehicles are highly flammable. Some give off toxic or harmful fumes if burnt.

Observe strict fire safety when storing and handling flammable materials or solvents, particularly near electrical equipment or welding processes.

Make sure, before using electrical or welding equipment, that there is no fire hazard present.

Have a suitable fire extinguisher available when using welding or heating equipment.

First Aid

Apart from meeting any legal requirements it is desirable for someone in the workshop to be trained in First Aid procedures.

Splashes in the eye should be flushed carefully with clean water for at least ten minutes.

Soiled skin should be washed with soap and water.

In case of cold burns, from alternative fuels, place affected area in cool to cold water.

Individuals affected by inhalation of gases and fumes should be removed to fresh air immediately. If effects persist, consult a doctor.

If liquids are swallowed inadvertently, consult a doctor giving him the information on the container or label. Do not induce vomiting unless this action is indicated on the label.

Fluoroelastomer

See Viton.

Foams - Polyurethane

See also Fire.

Used in sound and noise insulation. Cured foams used in seat and trim cushioning.

Follow manufacturers instructions.

Unreacted components are irritating and may be harmful to the skin and eyes. Wear gloves and goggles.

Individuals with chronic respiratory diseases, asthma, bronchial medical problems, or histories of allergic diseases should not work in or near uncured materials.

The components, vapours or spray mists can cause direct irritation, sensitivity reactions and may be toxic or harmful.

DESCRIPTION AND OPERATION (Continued)

Vapours and spray mists must not be inhaled. These materials must be applied with adequate ventilation and respiratory protection. Do not remove the respirator immediately after spraying, wait until the vapour/mists have cleared.

Burning of the uncured components and the cured foams can generate toxic and harmful fumes. Smoking, naked flames or the use of electrical equipment during foaming operations and until vapours/mists have cleared should not be allowed. Any heat cutting of cured foams or partially cured foams should be conducted with extraction ventilation. See also the vehicle Body Repair Manual.

Freon

See Air Conditioning Refrigerant.

Fuels

See also, Fire, Legal Aspects, Chemicals and Solvents.

Avoid skin contact with fuel where possible. Should contact occur, wash the affected skin with soap and water.

Gasoline (Petrol)

Highly flammable - observe No Smoking policy.

Swallowing can result in mouth and throat irritation and absorption from the stomach can result in drowsiness and unconsciousness. Small amounts can be fatal to children. Aspiration of liquid into the lungs, through vomiting, is a very serious hazard.

Gasolene dries the skin and can cause irritation and dermatitis on prolonged or repeated contact. Liquid in the eye causes severe smarting.

Motor gasolene may contain appreciable quantities of benzene, which is toxic upon inhalation, and the concentration of gasolene vapours must be kept very low. High concentrations will cause eye, nose and throat irritation, nausea, headache, depression and symptoms of drunkenness. Very high concentrations will result in rapid loss of consciousness.

Make sure there is adequate ventilation when handling and using gasolene. Great care must be taken to avoid the serious consequences of inhalation in the event of vapour build up arising from spillages in confined spaces.

Special precautions apply to cleaning and maintenance operations on gasolene storage tanks.

Gasolene should not be used as a cleaning agent. It must not be siphoned by mouth. See First Aid.

Gas-oil (Diesel Fuel)

Combustible.

Gross or prolonged skin contact with high boiling point gas oils may also cause serious skin disorders including skin cancer.

Kerosene (Paraffin)

Used also as heating fuel, solvent and cleaning agent.

Flammable - observe No Smoking policy.

Irritation of the mouth and throat may result from swallowing. The main hazard from swallowing arises if liquid aspiration into the lungs occurs.

Liquid contact dries the skin and can cause irritation or dermatitis. Splashes in the eye may be slightly irritating.

In normal circumstances the low volatility does not give rise to harmful vapours. Exposure to mists and vapours from kerosene at elevated temperature should be avoided (mists may arise in dewaxing). Avoid skin and eye contact and make sure there is adequate ventilation.

Alternative Fuel

Highly flammable. Observe ``NO SMOKING" signs.

Make sure there is adequate ventilation when working on alternative fuelled vehicles. Great care must be taken to avoid the serious consequences of inhalation in the event of vapour build up in confined spaces.

Inhalation in high concentrations may cause dizziness, headache, nausea and loss of co-ordination. Very high concentrations may result in loss of consciousness.

Contact with liquidified petroleum gas (LPG) or compressed natural gas (CNG) to skin may cause cold burns and may cause frost bite.

DESCRIPTION AND OPERATION (Continued)

Long sleeved cotton overalls, steel toe capped safety boots and rubber neoprene gloves should be worn during removal and installation of LPG/CNG fuel system components.

LPG/CNG fuel leaks could cause a fire and be a hazard to health that can lead to personal injury, illness or even death.

If a leak is detected, under no circumstances attempt to seal the leak by tightening the union/connection until the fuel in the system or component is depressurised. Once tightened the system should be checked for integrity following the specified procedures.

If the fuel tank is to be removed for service or repair the fuel must be evacuated using dedicated equipment and following the specified procedures.

Gas Cylinders

See also Fire.

Gases such as oxygen, acetylene, argon and propane are normally stored in cylinders at pressures of up to 138 bar (2000 psi) and great care should be taken in handling these cylinders to avoid mechanical damage to them or to the valve gear attached. The contents of each cylinder should be clearly identified by appropriate markings.

Cylinders should be stored in well ventilated enclosures, and protected from ice and snow, or direct sunlight. Fuel gases, for example acetylene and propane, should not be stored in close proximity to oxygen cylinders.

Care should be exercised to prevent leaks from gas cylinders and lines, and to avoid sources of ignition.

Only trained personnel should undertake work involving gas cylinders.

Gases

See Gas Cylinders.

Gaskets (Fluoroelastomer)

See Viton.

General Workshop Tools and Equipment

It is essential that all tools and equipment are maintained in good condition and the correct safety equipment is used where required.

Never use tools or equipment for any purpose other than that for which they were designed. Never overload equipment such as hoists, jacks, axle and chassis stands or lifting slings. Damage caused by overloading is not always immediately apparent and may result in a fatal failure the next time that the equipment is used.

Do not use damaged or defective tools or equipment, particularly high speed equipment such as grinding wheels. A damaged grinding wheel can disintegrate without warning and cause serious injury.

Wear suitable eye protection when using grinding, chiselling or sand blasting equipment.

Wear a suitable breathing mask when using abrasive blasting equipment, working with asbestos-based materials or using spraying equipment.

Make sure there is adequate ventilation to control dusts, mists and fumes.

High Pressure Air, Lubrication and Oil Test Equipment

See also Lubricants and Greases.

Always keep high pressure equipment in good condition, and regularly maintained, particularly at joints and unions.

Never direct a high pressure nozzle, for example diesel injector, at the skin as the fluid may penetrate to the underlying tissue, and cause serious injury.

Halon

See CFCs.

Legal Aspects

There are many laws and regulations relating to health and safety in the use and disposal of materials and equipment in a workshop.

For a safe working environment and to avoid environmental pollution, workshops should be familiar, in detail, with the many health and safety

DESCRIPTION AND OPERATION (Continued)

laws and regulations within their country, published by both national and local authorities.

Lubricants and Greases

Avoid all prolonged and repeated contact with mineral oils. All lubricants and greases may be irritating to the eyes and skin.

Used Engine Oil

Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer. Adequate means of skin protection and washing facilities must be provided.

Do not employ used engine oils as lubricants or for any application where appreciable skin contact is likely to occur.

Health Protection Precautions

- Avoid prolonged and repeated contact with oils, particularly used engine oils.
- Wear protective clothing, including impervious gloves where practicable.
- Do not put oily rags into pockets.
- Avoid contaminating clothes, particularly underpants, with oil.
- Heavily soiled clothing and oil-impregnated footwear should not be worn. Overalls must be cleaned regularly.
- First Aid treatment should be obtained immediately for open cuts and wounds.
- Use barrier creams, applying them before each work period, to help the removal of oil from the skin.
- Wash with soap and water to make sure all oil is removed (skin cleansers and nail brushes will help). Preparations containing lanoline replace the natural skin oils which have been removed.
- Do not use gasolene (petrol), kerosene (paraffin), diesel fuel (gas oil), thinners or solvents for cleaning skin.
- If skin disorders develop, obtain medical advice without delay.
- Where practicable, degrease components prior to handling.
- Where there is a risk of eye contact, eye protection should be worn, for example chemical goggles or face shields; in addition an eye wash facility should be provided.

Environmental Precautions

Burning used engine oil in small space heaters or boilers can be recommended only for units of approved design. If in doubt check with the appropriate local authority and manufacturer of approved appliances.

Dispose of used oil and used oil filters through authorized waste disposal contractors or licensed waste disposal sites, or to the waste oil reclamation trade. If in doubt, contact the relevant local authority for advice on disposal facilities.

It is illegal to pour used oil on to the ground, down sewers or drains, or into water courses.

DESCRIPTION AND OPERATION (Continued)

Noise

Some operations may produce high noise levels which could, in time, damage hearing. In these cases, suitable ear protection must be worn.

Noise Insulation Materials

See Foams, Fibre Insulation.

O-Rings (Fluoroelastomer)

See Viton.

Paints

See also Solvents, Chemical Materials.

Highly flammable, flammable - observe No Smoking policy

One Pack

Can contain harmful or toxic pigments, driers and other components as well as solvents. Spraying should be carried out only with adequate ventilation.

Two Pack

Can also contain harmful and toxic unreacted resins and resin hardening agents. The manufacturers instructions should be followed. See also Resin-based Adhesives and Isocyanate Adhesives and Sealers under Adhesives and Sealers.

Spraying should preferably be carried out in exhausted ventilated booths removing vapour and spray mists from the breathing zone. Individuals working in booths should wear appropriate respiratory protection. Those doing small scale repair work in the open workshop should wear air-fed respirators.

Pressurized Equipment

See High Pressure Air, Lubrication and Oil Test Equipment.

Solder

Solders are mixtures of metals such that the melting point of the mixture is below that of the constituent metals (normally lead and tin). Solder application does not normally give rise to toxic lead fumes, provided a gas/air flame is used. Oxy-acetylene flames should not be used, as they are much hotter and will cause lead fumes to be produced.

Some fumes may be produced by the application of any flame to surfaces coated with grease, and inhalation of these should be avoided.

Removal of excess solder should be undertaken with care, to make sure that fine lead dust is not produced, which can give toxic effects if inhaled. Respiratory protection may be necessary.

Solder spillage and filings should be collected and removed promptly to prevent general air contamination by lead.

High standards of personal hygiene are necessary in order to avoid ingestion of lead or inhalation of solder dust from clothing.

Solvents

See also Chemical Materials, Fuels (Kerosene), Fire.

For example acetone, white spirit, toluene, xylene, trichloroethane.

Used in cleaning and dewaxing materials, paints, plastics, resins and thinners.

Some may be highly flammable or flammable.

Skin contact will degrease the skin and may result in irritation and dermatitis following repeated or prolonged contact. Some can be absorbed through the skin in toxic or harmful quantities.

Splashes in the eye may cause severe irritation and could lead to loss of vision.

Brief exposure of high concentrations of vapours or mists will cause eye and throat irritation, drowsiness, dizziness, headaches and, in the worst circumstances, unconsciousness.

Repeated or prolonged exposure to excessive but lower concentrations of vapours or mists, for which there might not be adequate warning indications, can cause more serious toxic or harmful effects.

Aspiration into the lungs, for example through vomiting, is the most serious consequence of swallowing.

Avoid splashes to the skin, eyes and clothing. Wear protective gloves, goggles and clothing if necessary.

DESCRIPTION AND OPERATION (Continued)

Make sure there is good ventilation when in use, avoid breathing fumes, vapours and spray mists and keep containers tightly sealed. Do not use in confined spaces.

When spraying materials containing solvents, for example paints, adhesive, coatings, use extraction ventilation or personal respiratory protection in the absence of adequate general ventilation.

Do not apply heat or flame except under specific and detailed manufacturers instructions.

Sound Insulation

See Fibre Insulation, Foams.

Suspended Loads

⚠CAUTION: Never improvise lifting tackle.

There is always a danger when loads are lifted or suspended. Never work under an unsupported, suspended or raised load, for example a suspended engine.

Always make sure that lifting equipment such as jacks, hoists, axle stands and slings are adequate and suitable for the job, in good condition and regularly maintained.

Transmission Brake Bands

See Asbestos.

Underseal

See Corrosion Protection.

Viton

In common with many other manufacturers vehicles, some components fitted to the Ford range have O-rings, seals or gaskets which contain a material known as `Viton'.

Viton is a fluoroelastomer, that is a synthetic rubber type which contains Fluorine. It is commonly used for O-rings, gaskets and seals of all types. Although Viton is the most well known fluoroelastomer, there are others, including Fluorel and Tecmoflon.

When used under design conditions fluoroelastomers are perfectly safe. If, however, they are exposed to temperatures in excess of 400°C, the material will not burn, but will decompose, and one of the products formed is hydrofluoric acid.

This acid is extremely corrosive and may be absorbed directly, through contact, into the general body system.

O-rings, seals or gaskets which have been exposed to very high temperatures will appear charred or as a black sticky substance.

DO NOT, under any circumstances touch them or the attached components.

Enquiries should be made to determine whether Viton or any other fluoroelastomer has been used in the affected O-ring, seal or gasket. If they are of natural rubber or nitrile there is no hazard. If in doubt, be cautious as the material may be Viton or any fluoroelastomer.

If Viton or any other fluoroelastomers have been used, the affected area should be decontaminated before the commencement of work.

Disposable heavy duty plastic gloves should be worn at all times, and the affected area washed down using wire wool and a limewater (calcium hydroxide) solution to neutralise the acid before disposing of the decomposed Viton residue and final cleaning of the area. After use, the plastic gloves should be discarded carefully and safely.

Welding

See also Fire, Electric Shock, Gas Cylinders.

Welding processes include Resistance Welding (Spot Welding), Arc Welding and Gas Welding.

Resistance Welding

This process may cause particles of molten metal to be emitted at a high velocity, and the eyes and skin must be protected.

Arc Welding

This process emits a high level of ultra-violet radiation which may cause arc-eye and skin burns to the operator and to other persons nearby. Gas-shielded welding processes are particularly hazardous in this respect. Personal protection must be worn, and screens used to shield other people.

DESCRIPTION AND OPERATION (Continued)

CONTACT LENS WEARERS ARE ADVISED TO REVERT TO ORDINARY SPECTACLES WHEN ARC WELDING as the arc spectrum is believed to emit microwaves which dry out the fluid between the lens and the eye. This may result in blindness when the lens is removed from the eye.

Metal spatter will also occur, and appropriate eye and skin protection is necessary.

The heat of the welding arc will produce fumes and gases from the metals being welded, the rods and from any applied coatings or contamination on the surfaces being worked on. These gases and fumes may be toxic and inhalation of these should be avoided. The use of extraction ventilation to remove the fumes from the working area may be necessary particularly in cases where the general ventilation is poor, or where considerable welding work is anticipated. In extreme cases or confined spaces where adequate ventilation cannot be provided, air-fed respirators may be necessary.

Gas Welding (and Cutting)

Oxy-acetylene torches may be used for welding and cutting, and special care must be taken to prevent leakage of these gases, with consequent risk of fire and explosion.

The process will produce metal spatter and eye and skin protection is necessary.

The flame is bright, and eye protection should be used, but the ultra-violet emission is much less than that from arc welding, and lighter filters may be used.

The process itself produces few toxic fumes, but such fumes and gases may be produced from coatings on the work, particularly during cutting away of damaged body parts, and inhalation of the fumes should be avoided.

In brazing, toxic fumes may be produced from the metals in the brazing rod, and a severe hazard may arise if brazing rods containing cadmium are used. In this event particular care must be taken to avoid inhalation of fumes and expert advice may be required.

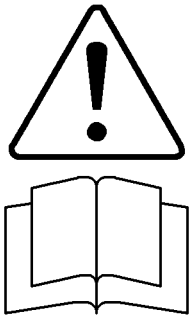
SPECIAL PRECAUTIONS MUST BE TAKEN BEFORE ANY WELDING OR CUTTING TAKES PLACE ON VESSELS WHICH HAVE CONTAINED COMBUSTIBLE MATERIALS, FOR EXAMPLE BOILING OR STEAMING OUT OF FUEL TANKS.

Warning Symbols on Vehicles

Decals showing warning symbols will be found on various vehicle components.

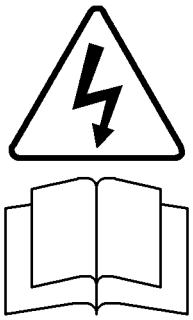
These decals must not be removed. The warnings are for the attention of owners/operators and persons carrying out service or repair operations on the vehicle.

The most commonly found decals are reproduced below together with an explanation of the warnings.



TIM0101001

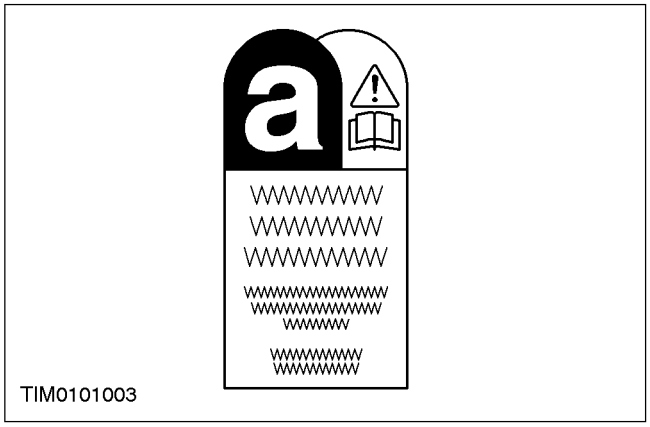
1. Components or assemblies displaying the caution triangle and open book symbol advise consultation of the relevant section of the owners handbook before touching or attempting adjustments of any kind.



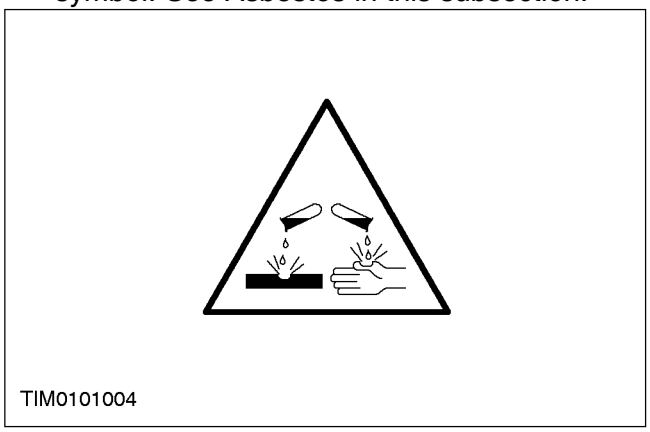
TIM0101002

DESCRIPTION AND OPERATION (Continued)

2. Components or assemblies displaying the warning triangle with the `electrified' arrow and open book symbol give warning of inherent high voltages. Never touch these with the engine running or the ignition switched on. See Electric Shock in this subsection.



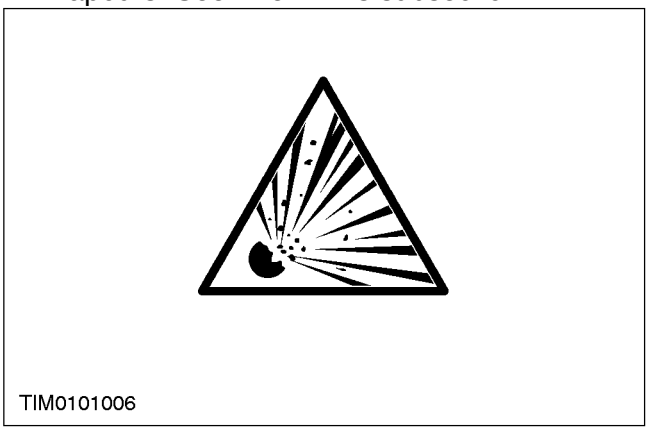
3. Ford vehicles and replacement parts which contain asbestos are identified by this symbol. See Asbestos in this subsection.



4. Components or assemblies displaying this symbol give warning that the component contains a corrosive substance. See Acids and Alkalis in this subsection.



5. Displaying the caution circle with a deleted lighted match symbol, caution against the use of naked lights or flames within the immediate vicinity due to the presence of highly flammable or explosive liquids or vapours. See Fire in this subsection.



6. Displaying this symbol (normally in conjunction with 5 above) warn of the presence of potentially explosive matter within the immediate vicinity.



7. Displaying this symbol warn that children should not be allowed in the immediate vicinity unsupervised.

White Spirit

See Solvents.

DESCRIPTION AND OPERATION

Standard Workshop Practices

Vehicle in Workshop

When working on a vehicle in the workshop always make sure that:

- the parking brake is applied or the wheels are securely chocked to prevent the vehicle moving forwards or backwards.
- the key is removed from key operated hood locks before any work is carried out around the front of the vehicle.
- if the engine is to be run, there is adequate ventilation, or an extraction hose to remove exhaust fumes.
- there is adequate room to raise the vehicle and remove the wheels, if necessary.
- fender covers are always fitted if any work is to be carried out in the engine compartment.
- the battery is disconnected if working on the engine, underneath the vehicle, or if the vehicle is raised.

⚠ CAUTION: When electric arc welding on a vehicle, always disconnect the generator wiring to prevent the possibility of a surge of current causing damage to the internal components of the generator.

- If using welding equipment on the vehicle, a suitable fire extinguisher is readily available.

Alternative Fuel

⚠ WARNING: When servicing the fuel system always follow the recommended procedures. Failure to follow these instructions may result in personal injury.

If the odour of liquified petroleum gas (LPG) or compressed natural gas (CNG) is present in the air in the workshop, warn all persons in the area to:

- extinguish all flames and lighted tobacco.
- shut off electrical and air powered equipment.
- evacuate the area.
- ventilate the area.
- contact fire control authorities.
- remove the vehicle to a dedicated, ventilated area.

Alternative Fuel — Do's

- do work on the vehicle in a designated area that is well ventilated and its access restricted to qualified personnel only
- install new warning labels to their original locations
- if possible always isolate the alternative fuel tank, run the vehicle on the alternative fuel until it automatically switches to its normal fuel prior to taking the vehicle into the workshop/service area
- only use tested and approved components and pipes when repairing or servicing LPG and CNG systems

Alternative Fuel — Do Nots

- do not vent off LPG fuel
- do not use shop air pressure to force LPG fuel from the fuel tank
- do not use paint drying ovens above 40°C for any alternative fuel vehicles. LPG and CNG fuel tanks should be removed from the vehicles prior to being put into paint drying ovens above 40°C
- do not modify the system or install new components with parts not designed for gas vehicles
- do not evacuate fuel tanks unless there is repair that requires removed of the fuel tank
- do not work on the fuel lines or system components unless the alternative fuel has been evacuated and the pressure in the system is reduced to atmospheric, or less
- do not use anything other than the specified leak detector fluid to trace fuel leaks

Be aware of situations that may cause the LPG or CNG fuel system to vent off fuel, such as:

DESCRIPTION AND OPERATION (Continued)

– extremely hot days
– parking by a space heater
– hoisting a vehicle up near a ceiling heater

Only personnel fully trained to Ford and local standards are to work on alternative fuel vehicles.

Towing the Vehicle

WARNING: When the vehicle is being towed the ignition switch must be in position II (steering lock released and warning lights illuminated). Only then will the steering, turn signal lamps, horn and stop lamps be operational. Failure to follow these instructions may result in personal injury.

NOTE: The removable towing eye (if equipped) has a left-hand thread and must be fully tightened before towing can commence.

When towing is necessary, the vehicle towing eyes should be used. The rope must be securely fastened to the towing eyes and must also be attached to the other vehicle such that the rope will not foul the bodywork.

When a vehicle with automatic transmission is towed, the gear selector must be in position N (Neutral). Never tow a vehicle with automatic transmission faster than 30 mph (50 km/h) or further than 30 miles (50 km). If it is necessary to tow the vehicle a greater distance, the drive wheels must be lifted clear off the ground.

Alternatively the vehicle can be transported on a low loader or a trailer.

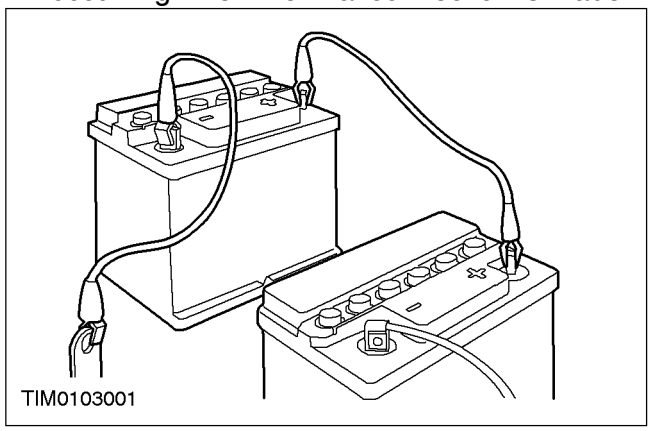
Connecting a Slave Battery Using Jumper Cables

WARNING: If the slave battery has recently been charged and is gassing, cover the vent plugs or covers with a damp cloth to reduce the risk of explosion should arcing occur when connecting the jumper cables. Failure to follow these instructions may result in personal injury.

CAUTION: A discharged battery condition may have been caused by an electrical short circuit. If this condition exists there will be an apparently live circuit on the vehicle even when all normal circuits are switched off. This can cause arcing when the jumper cables are connected.

CAUTION: While it is not recommended that the vehicle is jump started, it is recognized that this may occasionally be the only practical way to mobilize a vehicle. In such an instance the discharged battery must be recharged immediately after jump starting to avoid permanent damage.

– Always make sure that the jumper cables are adequate for the task. Heavy duty cables must be used.
– Always make sure that the slave battery is of the same voltage as the vehicle battery. The batteries must be connected in parallel.
– Always make sure that switchable electric circuits are switched off before connecting jumper cables. This reduces the risk of arcing occurring when the final connection is made.


TIM0103001

WARNING: Make sure that the ends of the jumper cables do not touch each other or ground against the vehicle body at any time while the cables are attached to the battery. A fully charged battery, if shorted through jumper cables, can discharge at a rate well above 1000 amps causing violent arcing and very rapid heating of the jumper cables and terminals, and can even cause the battery to explode. Failure to follow these instructions may result in personal injury.

DESCRIPTION AND OPERATION (Continued)

Always connect the jumper cables in the following sequence:

- slave battery positive first then vehicle battery positive
- slave battery negative next and then vehicle ground at least 12 inches (300 mm) from the battery terminal, for example engine lifting eye

Always reduce the engine speed to idle before disconnecting the jumper cables.

Before removing the jumper cables from the vehicle that had the discharged battery, switch on the heater blower (high) or the heated rear window, to reduce the voltage peak when the cables are removed.

Always disconnect the jumper cables in the reverse order to the connecting sequence and do not short the ends of the cables.

Do not rely on the generator to restore a discharged battery. For a generator to recharge a battery, it would take in excess of eight hours continuous driving with no additional loads placed on the battery.

Component Cleaning

To prevent ingress of dirt, accumulations of loose dirt and greasy deposits should be removed before disconnecting or dismantling components or assemblies.

Components should be thoroughly cleaned before inspection prior to reassembly.

Cleaning Methods:

- dry cleaning
- removal of loose dirt with soft or cable brushes
- scraping dirt off with a piece of metal or wood
- wiping off with a rag

⚠ **CAUTION: Compressed air is sometimes 'wet' so use with caution, especially on hydraulic systems.**

- blowing dirt off with compressed air. (Eye protection must be worn when using this method)
- removal of dry dust using vacuum equipment. This method should always be used to remove friction lining material dust (asbestos particles)
- steam cleaning

⚠ **WARNING: Most solvents require careful handling and some are harmful. Refer to Health and Safety Precautions and to the manufacturers literature for safety precautions. Failure to follow these instructions may result in personal injury.**

Various solvents are available which are suitable for component cleaning. Some components such as brake hydraulic parts and electrical assemblies should be cleaned only with recommended solvents — refer to Solvents, Sealers and Adhesives or to the section of the manual relevant to the component.

Calibration of Essential Measuring Equipment

⚠ **WARNING: Failure to follow these instructions may result in personal injury or damage to components.**

It is of fundamental importance that certain essential equipment, for example torque wrenches, multimeters, exhaust gas analysers or rolling roads, are regularly calibrated in accordance with the manufacturers instructions.

DESCRIPTION AND OPERATION

Solvents, Sealers and Adhesives

Introduction

WARNING: Always handle all solvents, sealers and adhesives with extreme care. Some contain chemicals or give off fumes which can be dangerous to health. Always follow the manufacturers instructions. If in doubt about any substance, particularly a solvent, DO NOT use it.

CAUTION: If in doubt about the suitability of any proprietary solvent or sealer for a particular application, contact the manufacturer of the product for information regarding storage, handling and application.

The Health and Safety Precautions subsection refers to some commonly used chemicals and materials, hazards associated with their use, and safety measures to be taken. Some of these chemicals may be included in the following list either in their own right or as an ingredient in a sealer or adhesive.

General Specifications

Anti-Seize Compound

		ROCOL	KS PAUL
General	SAM-1C-9107A	Foliac J166	PBC or PBC
	SAM-1C-9107A	KluberUnimoly	492 TAC 2
Spark plug threads	ESE-M1244-A	`Never-Seize' Catalogue No. NSBT-8N, 227g; obtainable through Snap-on Tools Limited, Palmer House, 150/154 Cross Street, Sale, Cheshire. M33 1AQ	Catalogue No. NSN 165 from local Bostic supplier.

Sealers

Application	Ford Spec.	Manufacturer and Identification
For camshaft bearing caps	ESK-M4G260-A	Loctite 518
For cylinder block	WSK-M4G320-A	Hylosil 502
For fitting rear lamp assembly	WSK-M4G329-ABC	
For transmission housing (80 gram can)	Finis Code 6 160 443	

Adhesives

Application	Ford Spec.
PU for windscreen, side and rear glass	Finis Code 6 997 259

DESCRIPTION AND OPERATION

Road/Roller Testing

Road or roller testing may be carried out for various reasons and a procedure detailing pre-test checks, through engine starting and stopping, pre-driving checks, on-test checks to final checks on completion of the test is given overleaf.

Unless complete vehicle performance is being checked, the full road test procedure need not be carried out. Instead, those items particularly relevant to the system/s being checked can be extracted.

Pre-Test Checks

⚠ **WARNING: If the brake system hydraulic fluid level is low, pedal travel is excessive or a hydraulic leak is found, do not attempt to road test the vehicle until the reason for the low fluid level, excessive pedal travel or hydraulic leak is found and rectified.**

It is suggested that pre-test checks, and functional tests of those systems/circuits which affect the safe and legal operations of the vehicle, such as brakes, lights and steering, should always be carried out before the road or roller test.

- Engine oil level
- Engine coolant level
- Tires, for correct pressure, compatible types and tread patterns, and wear within limits.
- There is sufficient fuel in the tank to complete the test.
- All around the engine, transmission and under the vehicle for oil, coolant, hydraulic and fuel leaks. Make a note of any apparent leaks and wipe off the surrounding areas to make it easier to identify the extent of the leak on completion of the test.

Starting the Engine

NOTE: On initial drive away from cold and within the first 1.5 km (1 mile), do not depress accelerator pedal beyond half travel until the vehicle has attained a minimum speed of 25 km/h (15 miles/h). Never operate at high engine speed or with the accelerator pedal at full travel whilst the engine is cold.

With the ignition switched off, check:

- The handbrake is applied.
- The gear lever is in neutral.
- All instrument gauges (except fuel gauge) read zero.

With the ignition switched on, check:

- Ignition controlled warning lights come on.
- Engine temperature gauge registers a reading compatible with the engine temperature.
- Fuel gauge registers a reading appropriate to the fuel level in the tank.
- The operation of the handbrake warning light and fluid level warning indicator light.

On Road or Roller Test Check:

⚠ **CAUTION: If road testing, check the brake operation while still travelling at low speed before continuing with the test. If the brakes pull to one side, or appear to be otherwise faulty, do not continue with the road test until the fault has been found and rectified.**

DESCRIPTION AND OPERATION (Continued)

- Clutch pedal operation is not stiff or heavy.
- Initial gear engagement is smooth and there is no evidence of clutch drag.
- Handbrake control operates smoothly and the handbrake releases quickly and completely.
- Clutch takes up the drive smoothly, without slip or judder.
- Gear changing is smooth, and there are no abnormal noises or vibrations from the transmission.
- The engine power output is satisfactory, full power is achieved, acceleration is smooth and pedal operation not stiff or heavy, and engine speed returns to idle correctly.
- There is no excessive or abnormally colored smoke from the engine under normal driving, heavy load or overrun conditions.
- Steering operation, including power steering where fitted, is smooth, accurate, not excessively heavy or with excessive free play or vibration. Does not pull to one side and self centres smoothly after cornering.
- Speedometer, oil pressure warning lamp, coolant temperature gauge and tachometer (where fitted) register the correct readings or operate correctly.
- Switches and controls operate smoothly and positively, warning or indicator lights operate correctly and the direction indicator control self cancels when the steering is returned to the straight ahead position.
- Heating and ventilation systems work correctly and effectively.
- Brake operation and efficiency.

Brake Testing

WARNING: When brake testing, avoid breathing the smoke or fumes from hot brakes, this may contain asbestos dust which is hazardous to health, see Health and Safety Precautions.

Avoid brake testing on busy roads where it can cause inconvenience or danger to other road users.

CAUTION: Brake testing which includes heavy brake applications should not be carried out with new brake pads/discs or linings/drums until the components have bedded-in. New brake friction components will not reach full efficiency until the bedding-in process is complete.

Test the brakes at several speeds within the normal operating range using both light and heavy pedal pressure. Note any tendency to snatch, pull or drag, and any undue delay in application or release.

Allow the vehicle to coast and note any tendency to pull to one side, or evidence that the brakes are binding.

After stopping the vehicle (not immediately after a period of heavy braking), carefully check the brake temperature. A disc which feels hot, or appreciably hotter than the others, indicates that the brake is binding.

After completion of the test, check for:

- Oil, coolant, hydraulic, air and fuel leaks.
- Abnormal temperature of any moving components or assemblies, e.g. wheel hubs, transmission, axle etc., which might indicate overtightness or lack of lubrication.

SECTION 100-01 Identification Codes

VEHICLE APPLICATION: 2003.0 Mondeo

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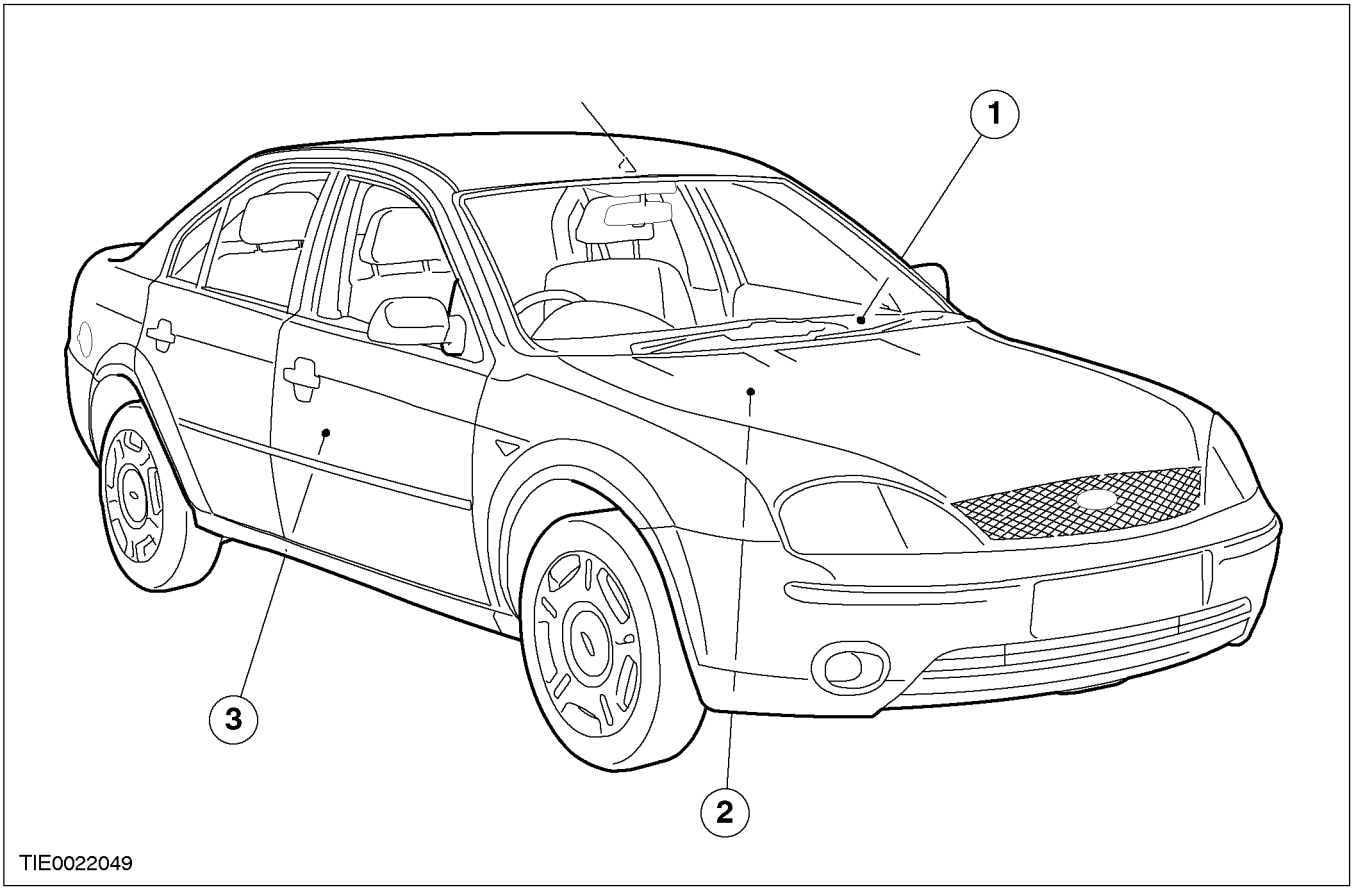
DESCRIPTION AND OPERATION

Identification Codes 100-01-2
Vehicle Identification Number 100-01-3
Vehicle Certification Label (Typical) or VIN Plate 100-01-4

DESCRIPTION AND OPERATION

Identification Codes

The vehicle identification plate is located on the right-hand B-pillar. The codes stamped on the plate during production enable the precise details of the vehicle build specification to be established. The vehicle identification number (VIN) may also be checked through the windshield, or on the bulkhead under the hood, where it is stamped onto the body.

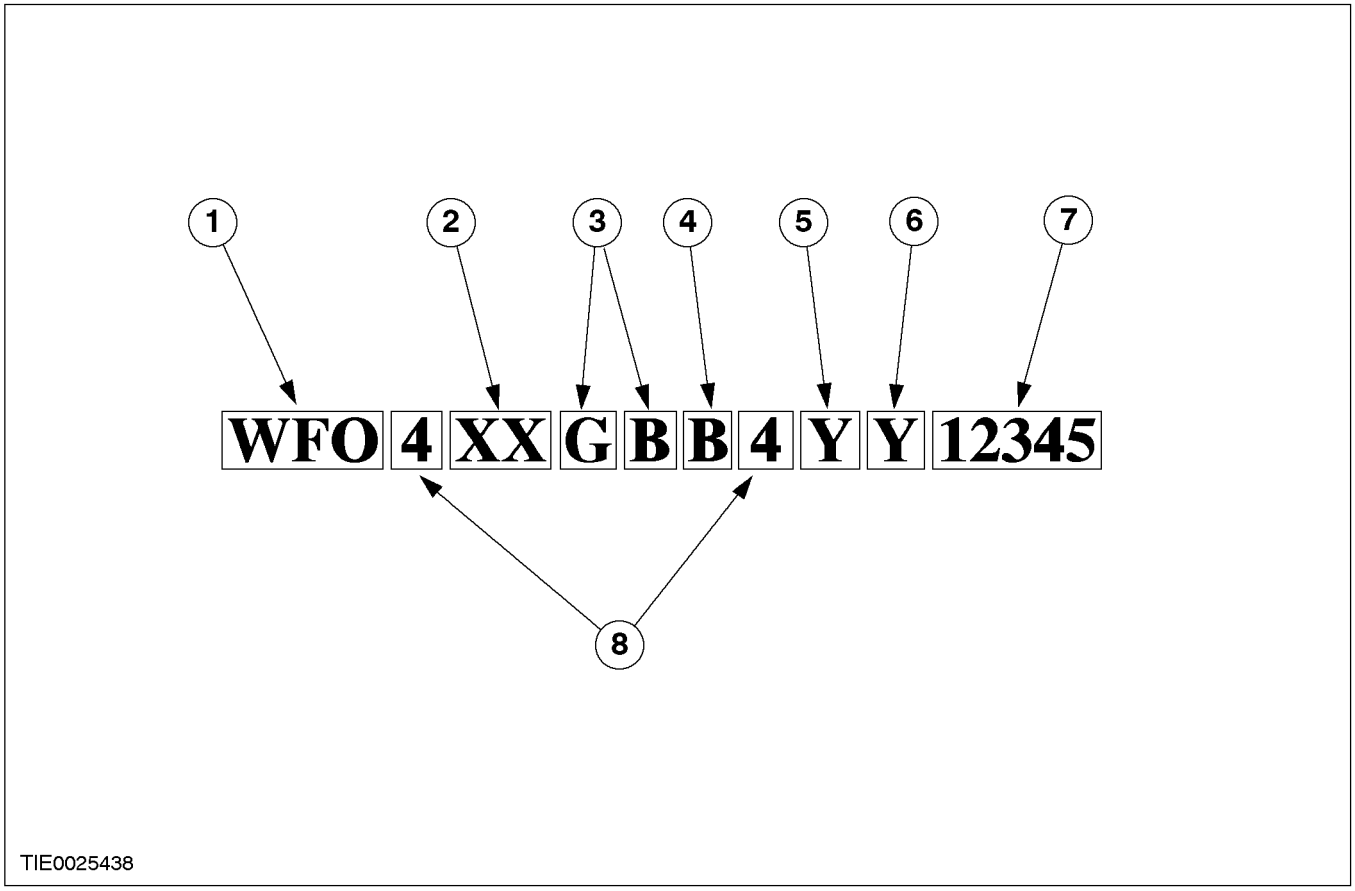


Item	Part Number	Description
1	–	Visible VIN

Item	Part Number	Description
2	–	VIN on the bulkhead
3	–	Vehicle identification plate

DESCRIPTION AND OPERATION

Vehicle Identification Number



Item	Part Number	Description
1	-	VIN Position 1, 2 and 3 — World manufacturer identifier
2	-	VIN Position 5 and 6 — Constant X
3	-	VIN Position 7 and 8 — Product source company and assembly plant
4	-	VIN Position 9 — Model

Item	Part Number	Description
5	-	VIN Position 11 — Year of manufacture
6	-	VIN Position 12 — Month of manufacture
7	-	VIN Position 13 to 17 — Vehicle serial number
8	-	VIN Position 4 and 10 — Body type

VIN Position 1, 2 and 3 — World Manufacturer Identifier

Codes	World Manufacturer
WF0	Ford Werke AG Germany (European vehicles)
WF1	Ford Werke A.G. Germany (Federal vehicles)

VIN Position 4 and 10 — Model Variants

Code	Model Variant
W	Wagon
4	4-door

DESCRIPTION AND OPERATION (Continued)

Code	Model Variant
5	5-door

VIN Positions 5 and 6 — Constant X

VIN Position 7 and 8 — Product Source Company and Assembly Plant

Code	Product Source Company and Assembly Plant
GA	Ford of Germany/Cologne
GB	Ford of Germany/Genk

VIN Position 9 — Model Range

Code	Model Range
B	Mondeo

VIN Position 11 — Year of Manufacture

Code	Year of Manufacture
Y	2000
1	2001
2	2002
3	2003
4	2004
5	2005

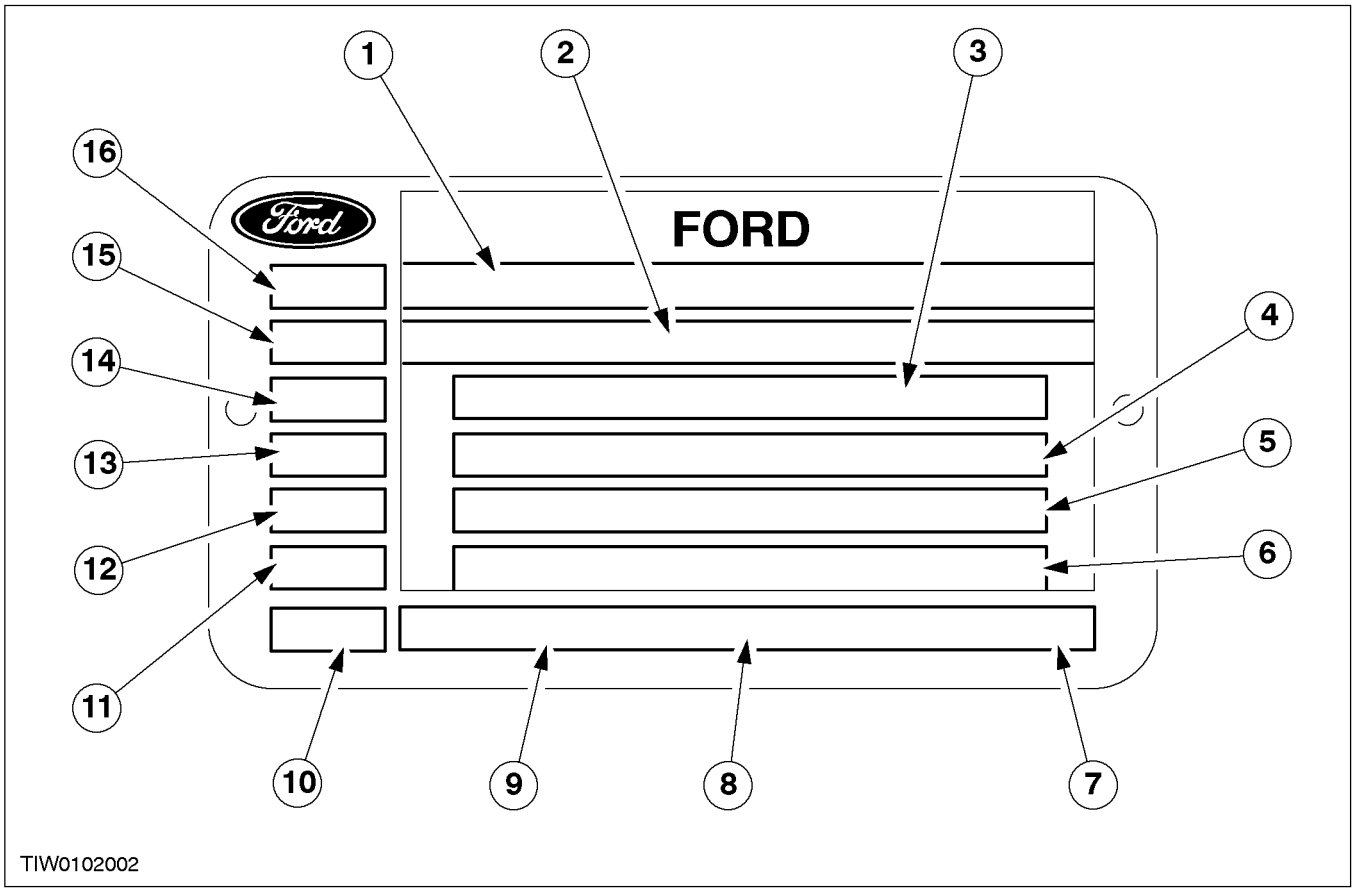
VIN Position 12 — Month of Manufacture

Month	2000	2001	2002	2003	2004	2005
January	B	J	L	C	B	J
February	R	U	Y	K	R	U
March	A	M	S	D	A	M
April	G	P	T	E	G	P
May	C	B	J	L	C	B
June	K	R	U	Y	K	R
July	D	A	M	S	D	A
August	E	G	P	T	E	G
September	L	C	B	J	L	C
October	Y	K	R	U	Y	K
November	S	D	A	M	S	D
December	T	E	G	P	T	E

VIN Position 13 to 17 — Vehicle Serial Number
Five Digit Number

Vehicle Certification Label (Typical) or VIN Plate

DESCRIPTION AND OPERATION



Item	Part Number	Description
1	-	Type approval codes
2	-	Vehicle identification number (VIN)
3	-	Gross vehicle mass (GVM)
4	-	Gross train mass (GTM)
5	-	Maximum permissible front axle mass
6	-	Maximum permissible rear axle mass
7	-	Smoke value (diesel only)

Item	Part Number	Description
8	-	Variants
9	-	Type
10	-	Emission level codes
11	-	Body color codes
12	-	Interior trim codes
13	-	Transaxle final drive ratio
14	-	Transaxle codes
15	-	Engine codes
16	-	Hand of drive

Item 1 to 6: Vehicle Certification Label

Item	Details
Item 1: Type Approval Codes	A unique code required by legislation in certain territories.
Item 2: Vehicle Identification Number (VIN)	Vehicle identification number.
Item 3: Gross Vehicle Mass	Indicates maximum legal laden mass, in territories where this is required.

DESCRIPTION AND OPERATION (Continued)

Item	Details
Item 4: Gross Train Mass	Indicates the maximum combined mass of vehicle and trailer or caravan.
Item 5: Maximum Permissible Front Axle Mass	Maximum permissible loading on the front wheels of the vehicle.
Item 6: Maximum Permissible Rear Axle Mass	Maximum permissible loading on the rear wheels of the vehicle.

Item 7: Smoke Value (Diesel only)

Code	Smoke value
—	—
—	—
—	—

Item 8 and 9: Variants

Code	Variant
B4Y	4-door
B5Y	5-door
BWY	Wagon

Item 10: Emission Level Codes

Code	Exhaust Emissions
E	1504 requirements
L	Mexico requirements
S	2000 EEC
7	Stage IV requirements

Item 11: Body Color Codes

Code	Body Color
A	Nantucket Grey
B	Diamond White
C	Colorado Red
D	Dark True Blue
F	Aquamarine Frost Pearl
G	Panther Black
K	State Blue
M	Magnum Grey
N	Neptune Green
P	Spruce Green Pearl
Q	Metropolis Blue
R	Infra Red
S	Oyster Silver
T	Medium Harvest Gold
1	Pepper Red
2	Medium Steele Blue
3	Juice Green
4	Spruce Green
5	Amparo Blue Metallic
6	Stardust Silver

DESCRIPTION AND OPERATION

For vehicles built in continental plants, the second digit of the paint code, on the VIN label, denotes the original model year of the color's introduction, ('0' = color introduction in 2000 model year).

For vehicles built in UK plants, the second digit of the vehicle paint code, on the VIN label, denotes the current model year, ('0' = built in 2000 model year).

Item 12: Interior Trim Codes

Code	Interior Trim
EB	Baskey - Ebony
EL	Leather - Ebony
GB	Basket — Light Graphite
GL	Leather - Light Graphite
IL	Leather - Infra Red
MM	Mars — Midnight Blue
NL	Leather — Non/Color
NN	Zeuz — Non Color
PB	Basket — Light Parchment
PL	Leather — Light Parchment
PM	Mars — Light Parchment
RZ	Zeus — Radiant Red
SZ	Zeuz — State Blue

Item 13: Transaxle Final Drive Ratio

Code	Transaxle Final Drive Ratio
3	4.06
4	3.82
5	4.23
7	3.41
8	3.56
9	3.92

Item 14: Transaxle Codes

Code	Transaxle
A	CVT automatic ZFI Ford
F	6-speed manual transmission MMT6
H	5-speed manual transaxle MTX75 high torque
Q	5-speed manual transaxle MTX75
T	5-speed automatic - jatco select shift
6	4-speed automatic CD4E

Item 15: Engine Codes

Code	Engine
F	Mazda 1.8L DOHC SCV 14
G	Mazda 1.8L DOHC SFI 110 PS
H	Mazda 1.8L DOHC SFI 125 PS
J	Mazda 2.0L DOHC SCV 14
M	2.0L I4 160 PS
S	Duratec 2.5L DOHC V6
U	3.0L Duratec OHC V6 220 PS
5	Puma 2.0L TCI 90 PS Diesel
6	Puma 2.0L TCI 115 PS Diesel
7	Puma 2.0L HPCR 115 PS Diesel

DESCRIPTION AND OPERATION (Continued)

Code	Engine
8	Puma 2.0L OHC TC 130 PS Diesel

Item 16: Hand of Drive

Code	Drive
1	Left-hand drive
2	Right-hand drive
3	Left-hand drive
4	Right-hand drive
5	Left-hand drive
6	Right-hand drive
7	Left-hand drive
8	Right-hand drive

SECTION 100-02 Jacking and Lifting

VEHICLE APPLICATION: 2003.0 Mondeo

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DESCRIPTION AND OPERATION

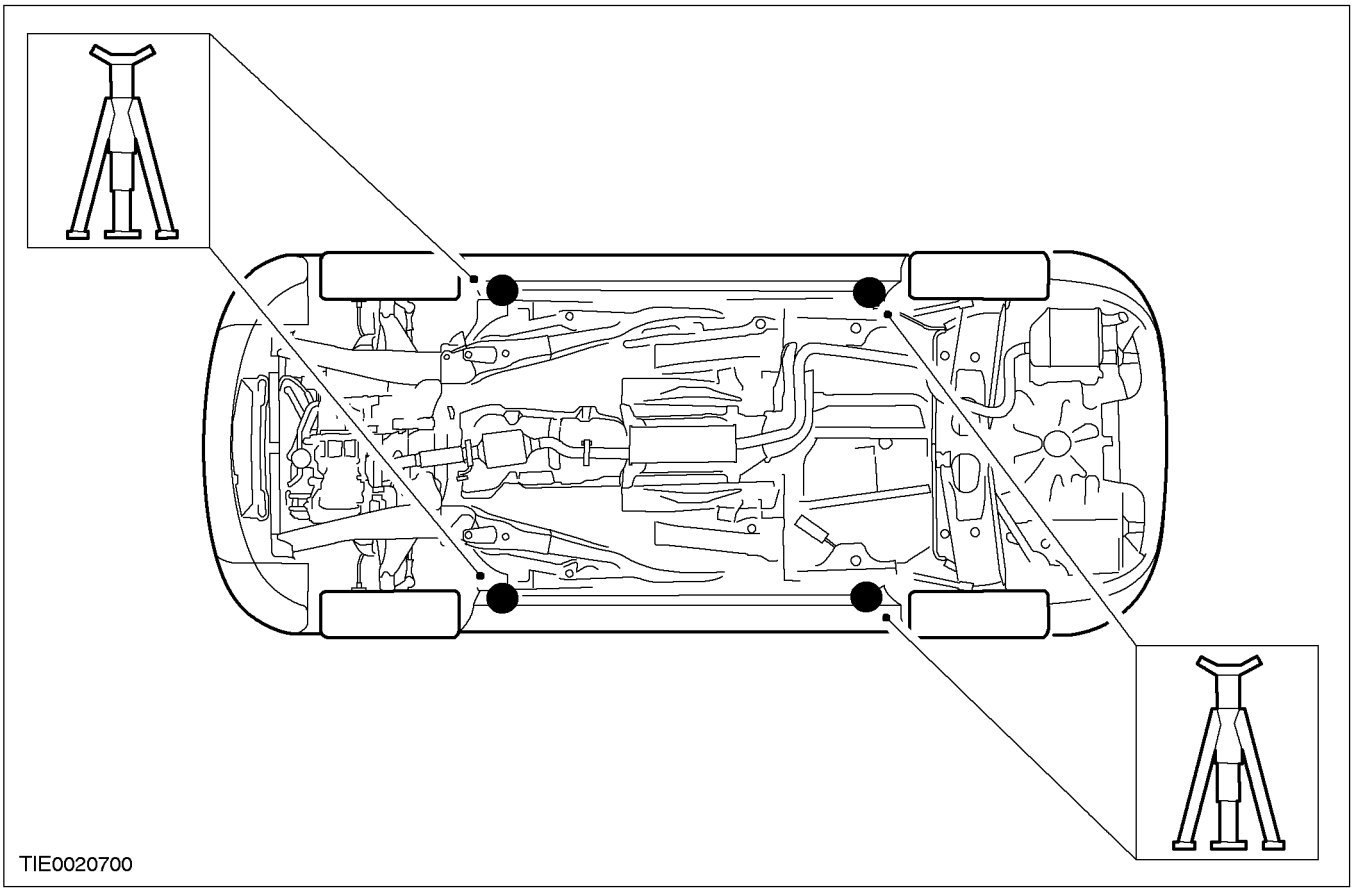
Jacking 100-02-2
Lifting 100-02-3

DESCRIPTION AND OPERATION

Jacking

WARNING: Always position the vehicle on a hard level surface. If the vehicle must be jacked up on a soft surface use load spreading blocks under the jack. Always chock the wheel diagonally opposite the jacking point. Failure to follow these instructions may result in personal injury.

CAUTION: It is important that only the correct jacking and support locations are used at all times.

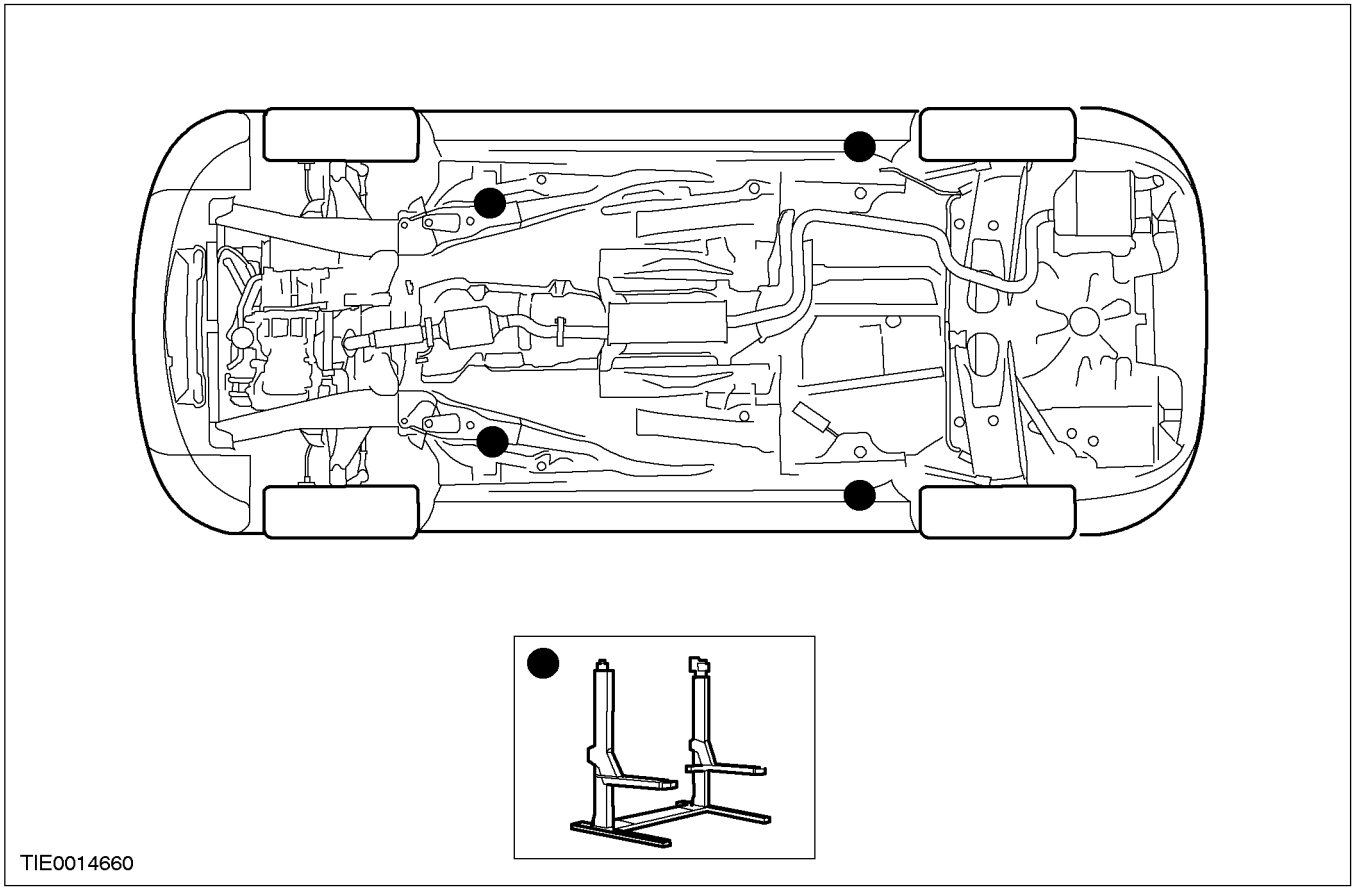


DESCRIPTION AND OPERATION

Lifting

CAUTION: When lifting a vehicle with a two-post lift, vehicle leveling pads must be used under the lifting points.

CAUTION: It is important that only the correct lifting and support locations are used at all times.



TIE0014660

SECTION 100-04 Noise, Vibration and Harshness

VEHICLE APPLICATION: 2003.0 Mondeo

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DIAGNOSIS AND TESTING

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How to Use this Diagnostic Procedure Section 100-04-2
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Identify the Condition 100-04-2
Noise Diagnostic Procedure 100-04-2
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Road Test Quick Checks 100-04-4
Road Conditions 100-04-4
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Symptom Chart 100-04-5
Pinpoint Tests 100-04-5

GENERAL PROCEDURES

Exhaust System Neutralizing ..... (25 001 0) 100-04-10

DIAGNOSIS AND TESTING

Noise, Vibration and Harshness (NVH)

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

How to Use this Diagnostic Procedure Section

- Noise, vibration and harshness (NVH) concerns have become more important as vehicles have become more sensitive to these vibrations. This section is designed to aid in identifying these concerns.
- The section provides diagnostic procedures based on symptom. If the condition occurs at high speed, for instance, the most likely place to start is under Shake and Vibration While Driving.
- The road test procedure will tell how to sort the conditions into categories and how to tell a vibration from a shake.
- A series of Road Test Quick Checks are provided to make sure that a cause is either pinpointed or eliminated.
- Name the condition, proceed to the appropriate section and locate the correct diagnosis. When the condition is identified, the job is partly done.
- Follow the diagnostic procedure as outlined.
- Quick Checks are described within the step, while more involved tests and adjustments are outlined in General Procedures.
- Always follow each step exactly and make notes to recall important findings later.

Customer interview

The road test and customer interview (if available) provide information that will help identify the concern and will provide direction to the correct starting point for diagnosis.

Identify the Condition

NVH usually occur in four areas:

- tires
- engine accessories
- suspension
- driveline

It is important, therefore, that an NVH concern be isolated into its specific area(s) as soon as possible. The easiest and quickest way to do this is to carry out the Road Test as outlined. To assist in the diagnosis and testing procedure(s), use a suitable approved NVH diagnosis tester.

Noise Diagnostic Procedure

Non-Axle Noise

The five most common sources of non-axle noise are exhaust, tires, roof racks, trim panels and transmission.

Therefore, make sure that none of the following conditions are the cause of the noise before proceeding with a driveline teardown and diagnosis.

DIAGNOSIS AND TESTING (Continued)

- In certain conditions, the pitch of the exhaust may sound very much like gear noise. At other times, it can be mistaken for a wheel bearing rumble.
- Tires, especially snow tires, can have a high pitched tread whine or roar, similar to gear noise. Radial tires may have this characteristic. Also, any non-standard tire with an unusual tread construction may emit a roar or whine noise.
- Trim panels can also cause whistling or whining noise.
- Clunk may be a metallic noise heard when the automatic transaxle is engaged in reverse or drive, or it may occur when the throttle is applied or released. It is caused by backlash somewhere in the driveline.
- Bearing rumble sounds like marbles being tumbled. This condition is usually caused by a damaged wheel bearing.

Noise Conditions

- Gear noise is typically a howling or whining due to gear damage or incorrect bearing preload. It can occur at various speeds and driving conditions, or it can be continuous.
- Chuckle is a particular rattling noise that sounds like a stick against the spokes of a spinning bicycle wheel. It occurs while decelerating from 64 km/h (40 mph) and can usually be heard all the way to a stop. The frequency varies with vehicle speed.
- Knock is very similar to chuckle, though it may be louder and occurs on acceleration or deceleration. The teardown will disclose what has to be corrected

Clicking, popping or grinding noises may be caused by the following:

- worn, damaged or incorrectly installed wheel bearing, suspension or brake component.

Check and rule out tires, exhaust and trim items before disassembling the transmission to diagnose and correct gear noise.

The noises described under Road Test usually have specific causes that can be diagnosed by observation as the unit is disassembled. The initial clues are the type of noise heard on the road test and driving conditions.

Vibration Conditions

Vibration at highway speeds may be caused by the following:

- out-of-balance front or rear wheels
- out-of-round tires

Shudder or vibration during acceleration may be caused by the following:

- damaged powertrain/drivetrain mounts
- excessively high constant velocity (CV) joint operating angles caused by incorrect ride height. Check ride height, verify correct spring rate and check items under inoperative conditions.

Road Test

A gear-driven unit will produce a certain amount of noise. Some noise is acceptable and may be audible at certain speeds or under various driving conditions, as on a newly paved asphalt road. The slight noise is in no way detrimental and must be considered normal.

The road test and customer interview (if available) provide information needed to identify the condition and give direction to the correct starting point for diagnosis.

DIAGNOSIS AND TESTING (Continued)

1. Make notes throughout the diagnosis routine. Make sure to write down even the smallest bit of information, because it may turn out to be the most important.
2. Do not touch anything until a road test and a thorough visual inspection of the vehicle have been carried out. Leave the tire pressures and vehicle load just where they were when the condition was first observed. Adjusting tire pressures, vehicle load or making other adjustments may reduce the condition(s) intensity to a point where it cannot be identified clearly. It may also inject something new into the system, preventing correct diagnosis.
3. Make a visual inspection as part of the preliminary diagnosis routine, writing down anything that does not look right. NOTE tire pressures, but do not adjust them yet. NOTE leaking fluids, loose nuts and bolts, or bright spots where components may be rubbing against each other. Check the load space for unusual loads.
4. Road test the vehicle and define the condition by reproducing it several times during the road test.
5. Carry out the Road Test Quick Checks as soon as the condition is reproduced. This will identify the correct diagnostic procedure. Carry out the Road Test Quick Checks more than once to verify they are providing a valid result. Remember, the Road Test Quick Checks may not tell where the concern is, but they will tell where it is not.

Road Test Quick Checks

1. 24-80 km/h (15-50 mph): with light acceleration, a moaning noise is heard and possibly a vibration felt in the front floor pan. It is usually worse at a particular engine speed and at a particular throttle setting during acceleration at that speed. It may also produce a moaning sound, depending on what component is causing it. Refer to Tip-in Moan in the Symptom Chart.
2. Acceleration/Deceleration: With slow acceleration and deceleration, a shake is sometimes noticed in the steering wheel/column, seats, front floor pan, front door trim panel or front end sheet metal. It is a low frequency vibration (around 9-15 cycles per second). It may or may not be increased by applying the brakes lightly. Refer to Idle Boom/Shake/Vibration in the Symptom Chart.
3. High Speed: A vibration is felt in the front floor pan or seats with no visible shake, but with an accompanying sound or rumble, buzz, hum, drone or booming noise. Coast with the clutch pedal depressed (manual transmission) or shift control selector lever in neutral (automatic transmission) and engine idling. If vibration is still evident, it may be related to wheels, tires, front brake discs, wheel hubs or front wheel bearings. Refer to Shake and Vibration While Driving in the Symptom Chart.
4. Engine rpm Sensitive: A vibration is felt whenever the engine reaches a particular rpm. It will disappear in neutral coasts. The vibration can be duplicated by operating the engine at the problem rpm while the vehicle is stationary. It can be caused by any component, from the accessory drive belt to the clutch or torque converter which turns at engine speed when the vehicle is stopped. Refer to Shake and Vibration While Driving in the Symptom Chart.
5. Noise and Vibration While Turning: Clicking, popping, or grinding noises may be due to the following:

- worn, damaged or incorrectly installed front wheel bearing
- damaged powertrain/drivetrain mounts

Road Conditions

An experienced technician will always establish a route that will be used for all NVH diagnosis road tests. The road selected should be reasonably smooth, level and free of undulations (unless a particular condition needs to be identified). A smooth asphalt road that allows driving over a range of speeds is best. Gravel or bumpy roads are unsuitable because of the additional road noise produced. Once the route is established and consistently used, the road noise variable is eliminated from the test results.

NOTE: Some concerns may be apparent only on smooth asphalt roads.

If a customer complains of a noise or vibration on a particular road and only on a particular road, the source of the concern may be the road surface. If possible, try to test the vehicle on the same type of road.

DIAGNOSIS AND TESTING (Continued)

Vehicle Preparation

Carry out a thorough visual inspection of the vehicle before carrying out the road test. NOTE anything which is unusual. Do not repair or adjust any condition until the road test is carried out, unless the vehicle is inoperative or the condition could pose a hazard to the technician. After verifying that the condition has been corrected, make sure all components removed have been installed.

Symptom Chart

Condition	Possible Sources	Action
•Shake and vibration while driving	•Wheel end vibration. •Engine/transmission.	• GO to Pinpoint Test A
•Tip-in moan	•Air cleaner. •Power steering (PAS). •Powertrain. •Powertrain/drivetrain mounts. •Exhaust system.	• GO to Pinpoint Test B
•Idle boom/shake/vibration/shudder	•Cable(s)/hose(s). •Powertrain/drivetrain mounts. •Exhaust system.	• GO to Pinpoint Test C
•Wheel end vibration analysis	•Suspension. •Wheel bearings.	• GO to Pinpoint Test D
•Non-axle noise	•Trim Panels. •Air conditioning (A/C) system. •Accessories.	• GO to Pinpoint Test E

Pinpoint Tests

NOTE: These Pinpoint Tests are designed to take the technician through a step-by-step diagnosis procedure to determine the cause of a condition. It may not always be necessary to follow the chart to its conclusion. Carry out only the pinpoint test steps necessary to correct the condition. Then check the operation of the system to make sure the condition has been corrected. After verifying that the condition has been corrected, make sure all components removed have been installed.

PINPOINT TEST A: SHAKE AND VIBRATION WHILE DRIVING

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: NEUTRAL COAST	
	1 Carry out the neutral coast test. • Does the vibration disappear during the neutral coast test? → **Yes** GO to **A2** → **No** GO to Pinpoint Test D
A2: CHECK THE POWERTRAIN/DRIVETRAIN MOUNTS	
	1 Check the powertrain/drivetrain mounts. • Are the mounts OK?

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** Vehicle condition corrected. ROAD TEST as necessary. → **No** INSTALL new powertrain/drivetrain mounts as necessary. ROAD TEST as necessary.

PINPOINT TEST B: TIP-IN MOAN

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK THE AIR CLEANER	
	1 Check the air cleaner. - Inspect the air cleaner, intake pipe, outlet pipe, resonators and all other components associated with the intake air filtering and distribution system for correct installation and tightness of all connections. • Are the components OK? → **Yes** GO to **B2** → **No** REPAIR or INSTALL new components as necessary. ROAD TEST as necessary.
B2: CHECK THE EXHAUST SYSTEM	
	1 Carry out the exhaust system neutralizing procedure in this section. • Is the exhaust system OK? → **Yes** GO to **B3** → **No** REPAIR as necessary. ROAD TEST as necessary.
B3: CHECK THE POWER STEERING	
	1 Remove the accessory drive belt and test for tip-in moan. REFER to Section 303-05. • Is the tip-in moan OK? → **Yes** REPAIR the power steering as necessary. REFER to Section 211-02. → **No** GO to **B4**
B4: CHECK THE POWERTRAIN/DRIVETRAIN MOUNTS	
	1 Check the powertrain/drivetrain mounts • Are the mounts OK? → **Yes** Vehicle condition corrected. ROAD TEST as necessary. → **No** INSTALL new powertrain/drivetrain mounts as necessary. ROAD TEST as necessary.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST C: IDLE BOOM/SHAKE/VIBRATION/SHUDDER

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK THE CABLE/HOSES	
	1 Check the engine compartment for any component that may have a touch condition between the engine and body or chassis. For example: control cable, air conditioning (A/C) hoses, acceleration cable. • Are the components OK? → **Yes** GO to **C2** → **No** REPAIR or INSTALL new components as necessary. ROAD TEST as necessary.
C2: CHECK THE ENGINE COOLING RADIATOR	
	1 Check the engine cooling radiator mountings and bushings for security and condition. Check the radiator installation for any component that may have a touch condition. • Is the installation and bushings OK? → **Yes** GO to **C3** → **No** REPAIR or INSTALL new components as necessary. ROAD TEST as necessary.
C3: CHECK THE EXHAUST SYSTEM	
	1 Carry out the exhaust system neutralizing procedure in this section. • Is the exhaust system OK? → **Yes** GO to **C4** → **No** REPAIR as necessary. ROAD TEST as necessary.
C4: CHECK THE POWERTRAIN/DRIVETRAIN MOUNTS	
	1 Check the powertrain/drivetrain mounts. • Are the mounts OK? → **Yes** Vehicle condition corrected. ROAD TEST as necessary. → **No** INSTALL new powertrain/drivetrain mounts as necessary. ROAD TEST as necessary.

PINPOINT TEST D: WHEEL END VIBRATION ANALYSIS

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: INSPECT THE WHEELS AND TIRES	
	1 Inspect the wheels and tires. REFER to Section 204-04.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Are the wheels and tires OK? → **Yes** GO to **D2** → **No** INSTALL new wheels and tires as necessary. REFER to Section 204-04. ROAD TEST as necessary.
D2: INSPECT THE WHEEL BEARINGS	
	1 Inspect the wheel bearings. REFER to Section 204-00. • Are the wheel bearings OK? → **Yes** GO to **D3** → **No** INSTALL new wheel bearings as necessary. ROAD TEST as necessary.
D3: INSPECT THE WHEEL AND TIRE RUNOUT	
	1 Inspect the wheel and tire runout. REFER to Section 204-00. • Is the wheel and tire runout OK? → **Yes** Balance the wheels and tires. Refer to the wheel balance equipment manufacturer's instructions. ROAD TEST as necessary. → **No** INSTALL new wheels and tires as necessary. REFER to Section 204-04. ROAD TEST as necessary.

PINPOINT TEST E: NON-AXLE NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: INSPECT THE VEHICLE TRIM	
	1 Inspect the grille and trim panels to see if they are the source of the noise. • Are the vehicle trim components causing the noise? → **Yes** INSTALL new trim components or REPAIR as necessary. → **No** GO to **E2**
E2: CHECK THE AIR CONDITIONING (A/C) SYSTEM FOR NOISE	
	1 Key in START position. 2 Key in ON position. 3 Check the A/C system components for noise by turning the A/C system on and off. • Is the A/C system causing the noise? → **Yes**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	INSPECT the A/C system. REFER to Section 412-00. → **No** GO to **E3**
E3: CHECK NON-FACTORY FITTED ACCESSORIES	
	1 Check any non-factory fitted accessories for being the source of the noise. For example: touch condition body-to-frame, antennas, sun visors, deflectors and fog lights. • Are the accessories the cause of the noise? → **Yes** ADJUST, REPAIR, or INSTALL new accessories or fasteners as required. → **No** Vehicle is OK. VERIFY the customer concern.

GENERAL PROCEDURES

Exhaust System Neutralizing (25 001 0)

1. Loosen the muffler inlet pipe and resonator pipe to exhaust manifold fasteners at the flanges and the muffler inlet connection.
2. Place a stand to support the muffler parallel to the vehicle frame with the muffler pipe bracket free of stress.
3. Tighten the muffler connection.
4. Position the exhaust pipes to the manifolds and tighten. Make sure that the catalytic converter and heat shield do not contact the frame rails.
5. With the complete exhaust system tight (and cooled) the rear hanger insulator should be angled forward, to allow the system to expand rearward when heated during normal running.

Group

Chassis 2

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SECTION 204-00 Suspension System - General Information

VEHICLE APPLICATION: 2003.0 Mondeo

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GENERAL PROCEDURES

Wheel Bearing Inspection 204-00-13
Front Toe Adjustment ..... (14 117 0) 204-00-14
Rear Toe Adjustment ..... (15 211 0) 204-00-15

SPECIFICATIONS

Front Wheel Alignment (at kerb weight) — Caster (Vehicles with 1.8L, 2.0L or 2.5L engines)

Model	Decimal Degrees		Degrees and Minutes	
	Nominal	Tolerance Range	Nominal	Tolerance Range
4-door and 5-door	+2.65°	+3.77° to +1.53°	+2° 39'	+3° 46' to +1° 31'
Wagon without load levelling shock absorber	+2.30°	+3.40° to +1.20°	+2° 18'	+3° 24' to +1° 12'
Wagon with load levelling shock absorber	+2.08°	+3.16° to +1.00°	+2° 05'	+3° 10' to +1° 00'

Maximum variance left-hand side to right-hand side Caster 1.00° (1° 00')

Front Wheel Alignment (at kerb weight) — Caster (Vehicles with 3.0L engines)

Model	Decimal Degrees		Degrees and Minutes	
	Nominal	Tolerance Range	Nominal	Tolerance Range
4-door and 5-door	+2.54°	+3.56° to +1.52°	+2° 32'	+3° 34' to +1° 31'
Wagon without load levelling shock absorber	+2.30°	+3.40° to +1.20°	+2° 18'	+3° 24' to +1° 12'
Wagon with load levelling shock absorber	+2.31°	+3.31° to +1.31°	+2° 19'	+3° 19' to +1° 19'

Maximum variance left-hand side to right-hand side Caster 1.00° (1° 00')

Front Wheel Alignment (at kerb weight) — Camber (Vehicles with 1.8L, 2.0L or 2.5L engines)

Model	Decimal Degrees		Degrees and Minutes	
	Nominal	Tolerance Range	Nominal	Tolerance Range
4-door and 5-door	-0.55°	+0.75° to -1.85°	-0° 33'	+0° 45' to -1° 51'
Wagon without load levelling shock absorber	-0.60°	+0.72° to -1.87°	-0° 36'	+0° 43' to -1° 52'
Wagon with load levelling shock absorber	-0.60°	+0.67° to -1.87°	-0° 36'	+0° 40' to -1° 52'

Maximum variance left-hand side to right-hand side Camber 1.25° (1° 15')

Front Wheel Alignment (at kerb weight) — Camber (Vehicles with 3.0L engines)

Model	Decimal Degrees		Degrees and Minutes	
	Nominal	Tolerance Range	Nominal	Tolerance Range
All vehicles	-1.00°	+0.25° to -2.25°	-1° 00'	-0° 15' to -2° 15'

Maximum variance left-hand side to right-hand side Camber 1.25° (1° 15')

Front Wheel Alignment (at kerb weight) — Total Toe Setting

Derivative	Tolerance Range	Setting Adjustment, if required
All variants (decimal degrees)	-0.00° (Toe-out) ± 0.35°	-0.00° (Toe-out) ± 0.14°
All variants (degrees and minutes)	-0° 00' (Toe-out) ± 0° 21'	-0° 00' (Toe-out) ± 0° 08'
All variants (mm)	-0.0 mm (Toe-out) ± 2.5 mm	-0.0 mm (Toe-out) ± 1.0 mm

Rear Wheel Alignment (at kerb weight) — Camber (Vehicles with 1.8L, 2.0L or 2.5L engines)

Model	Decimal Degrees		Degrees and Minutes	
	Nominal	Tolerance Range	Nominal	Tolerance Range
4-door and 5-door	-1.21°	+0.14° to -2.56°	-1° 12'	+0° 08' to -2° 33'

SPECIFICATIONS (Continued)

Model	Decimal Degrees		Degrees and Minutes	
	Nominal	Tolerance Range	Nominal	Tolerance Range
Wagon without load levelling shock absorber	-0.92°	+0.38° to -2.22°	-0° 55'	+0° 22' to -2° 13'
Wagon with load levelling shock absorber	-0.77°	+0.53° to -2.07°	-0° 46'	+0° 31' to -2° 04'

Maximum variance left-hand side to right-hand side Camber 1.25° (1° 15')

Rear Wheel Alignment (at kerb weight) — Camber (Vehicles with 3.0L engines)

Model	Decimal Degrees		Degrees and Minutes	
	Nominal	Tolerance Range	Nominal	Tolerance Range
4-door and 5-door	-1.33°	-0.06° to -2.60°	-1° 20'	-0° 04' to -2° 36'
Wagon without load levelling shock absorber	-0.92°	+0.38° to -2.22°	-0° 55'	-0° 22' to -2° 13'
Wagon with load levelling shock absorber	-1.27°	-0.02° to -2.52°	-1° 16'	+0° 01' to -2° 31'

Maximum variance left-hand side to right-hand side Camber 1.25° (1° 15')

Rear Wheel Alignment (at kerb weight) — Total Toe Setting

Derivative	Tolerance Range	Setting Adjustment, if required
All variants (decimal degrees)	0.45° (Toe-in) ± 0.34°	0.28° (Toe-in) ± 0.14°
All variants (degrees and minutes)	0° 27' (Toe-in) ± 0° 20'	0° 17' (Toe-in) ± 0° 08'
All variants (mm)	3.2 mm (Toe-in) ± 2.5 mm	2.0 mm (Toe-in) ± 1.0 mm

Torque Specifications

Description	Nm	lb-ft	lb-in
Tie-rod end locknut	40	30	–

DIAGNOSIS AND TESTING

Suspension System

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Visual Inspection Chart

Mechanical
- Tire pressure - Wheel and tires - Wheel knuckles - T ie-rod ends - Front suspension lower arm ball joints - Front suspension lower arm bushings - Front strut and spring assemblies - Front and rear stabilizer bar and connecting links - Rear springs - Rear shock absorbers - Rear suspension lower arms

Symptom Chart

Condition	Possible Sources	Action
•Drift left or right	•Vehicle attitude incorrect (front or rear is high or low).	•CHECK for abnormal loading, coil spring sag, or non-standard springs.
	•Steering gear or linkage worn or damaged.	•CHECK the steering system. REFER to Section 211-00.
	•Brake system.	•CHECK the brakes. REFER to Section 206-00.
	•Incorrect wheel alignment.	•ADJUST the wheel alignment.
	•Worn front wheel bearings.	•CHECK the front wheel bearings. REFER to Wheel Bearing Inspection in this Section.
	•Wheel and tires.	•Go to Pinpoint Test A.
•Steering wheel off center	•Vehicle attitude incorrect (front or rear is high or low).	•CHECK for abnormal loading, coil spring sag or non-standard springs.
	•Steering gear or linkage.	•CHECK the steering system. REFER to Section 211-00.
	•Suspension lower arm ball joint.	•CARRY OUT the Ball Joint Component Test in this section.
	•Incorrect wheel alignment.	•ADJUST the wheel alignment.
•Tracks incorrectly	•Incorrect castor angle.	•GO to Pinpoint Test B.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
	•Rear suspension damage.	•GO to Pinpoint Test B.
•Rough ride	•Front or rear stabilizer connecting bar, links or bushings.	•CHECK or INSTALL new suspension components as necessary. REFER to Section 204-01 / 204-02.
	•Front suspension lower arm bushing.	•CHECK or INSTALL new suspension components as necessary. REFER to Section 204-01.
	•Rear suspension arm bushing.	•CHECK or INSTALL new components as necessary. REFER to Section 204-02.
	•Front strut and spring assemblies.	•GO to Pinpoint Test C.
	•Rear shock absorbers.	•GO to Pinpoint Test C.
•Excessive noise	•Worn front wheel bearings.	•CHECK the wheel bearings. REFER to Wheel Bearing Inspection in this Section.
	•Suspension lower arm ball joint.	•CARRY OUT the Ball Joint Component test in this Section
	•Suspension damage.	•GO to Pinpoint Test D
•Incorrect tire wear	•Incorrect tire pressure.	•ADJUST the tire pressure. REFER to the Owner's Guide.
	•Incorrect wheel alignment.	•ADJUST the wheel alignment.
•Vibration	•Damaged or worn front wheel bearings.	•CHECK the front wheel bearings. REFER to Wheel Bearing Inspection in this Section.
	•Wheels and tires.	•CHECK the tires. BALANCE or INSTALL new tires as necessary. REFER to Section 204-04.
	•Incorrect wheel alignment.	•ADJUST the wheel alignment.
	•Steering system inoperative.	•CHECK the steering system. REFER to Section 211-00.
	•Front strut and spring assemblies.	•GO to Pinpoint Test C.
	•Damaged front suspension lower arm(s).	•GO to Pinpoint Test D.
	•Wheel and tire excessive runout.	•GO to Pinpoint Test E.

DIAGNOSIS AND TESTING (Continued)

Pinpoint Tests

PINPOINT TEST A: DRIFT LEFT OR RIGHT

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: To avoid personal injury due to the loss of vehicle control, the inspection should be carried out by two people to maintain safe driving conditions. Adequate grip should always be maintained on the steering wheel. Failure to follow these instructions may result in personal injury.	
NOTE: The following conditions must be met when evaluating the vehicle.	
NOTE: The tire swapping procedures are for bi-directional rotating tires only.	
A1: SWAP THE FRONT WHEEL AND TIRE ASSEMBLIES	
	1 Raise and support the vehicle. REFER to Section 100-02. - Swap the front left-hand wheel and tire assembly with the front right-hand wheel and tire assembly. - Road test the vehicle. • Does the vehicle drift? → **Yes** GO to **A2** → **No** The concern has been corrected.
A2: SWAP THE REAR WHEEL AND TIRE ASSEMBLIES	
	1 Raise and support the vehicle. REFER to Section 100-02. - Swap the rear left-hand wheel and tire assembly with the rear right-hand wheel and tire assembly. - Road test the vehicle. • Does the vehicle drift? → **Yes** GO to **A3** → **No** The concern has been corrected.
A3: SWAP THE LEFT-HAND WHEEL AND TIRE ASSEMBLIES	
	1 Raise and support the vehicle. REFER to Section 100-02. - Swap the front left-hand wheel and tire assembly with the rear left-hand wheel and tire assembly. - Road test the vehicle. • Does the vehicle drift? → **Yes** GO to **A4** → **No** The concern has been corrected.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A4: SWAP THE RIGHT-HAND WHEEL AND TIRE ASSEMBLIES	
	1 Raise and support the vehicle. REFER to Section 100-02. - Swap the front right-hand wheel and tire assembly with the rear right-hand wheel and tire assembly. - Road test the vehicle. • Does the vehicle drift? → **Yes** GO to **A5** → **No** The concern has been corrected.
A5: SWAP THE FRONT LEFT-HAND WHEEL AND TIRE ASSEMBLY	
	1 Raise and support the vehicle. - Swap the front left-hand wheel and tire assembly with the rear right-hand wheel and tire assembly. - Road test the vehicle. • Does the vehicle drift? → **Yes** GO to **A6** → **No** The concern has been corrected.
A6: SWAP THE FRONT RIGHT-HAND WHEEL AND TIRE ASSEMBLY	
	1 Raise and support the vehicle. REFER to Section 100-02. - Swap the front right-hand wheel and tire assembly with the rear left-hand wheel and tire assembly. - Road test the vehicle. • Does the vehicle drift? → **Yes** GO to **A7** → **No** The concern has been corrected.
A7: INSTALL NEW TIRES	
NOTE: Install new tires only once.	
	1 Install new tires to the four road wheels. TEST the system for normal operation. • Does the vehicle drift? → **Yes** Verify possible sources, refer to the Symptom Chart. → **No** The concern has been corrected.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST B: TRACKS INCORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK THE CASTOR	
	1 Check the vehicle wheel alignment. • Is the castor angle within specification? → **Yes** GO to **B2** → **No** INSTALL new suspension components as necessary. ADJUST alignment to specification. TEST the system for normal operation.
B2: CHECK THE REAR SUSPENSION	
	1 Measure the vehicle wheel base left-hand and right-hand side. - Compare the measurements. • Are the measurements the same? → **Yes** VERIFY the customer concern. → **No** INSPECT the rear suspension components for wear or damage. INSTALL new components as necessary. REFER to Section 204-02. TEST the system for normal operation.

PINPOINT TEST C: ROUGH RIDE

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK THE FRONT STRUT AND SPRING ASSEMBLIES	
	1 Raise and support the vehicle. REFER to Section 100-02. - Inspect the front strut and spring assemblies for oil leaks or damage. • Are the front strut and spring assemblies damaged or leaking? → **Yes** INSTALL new components as necessary. REFER to Section 204-01. TEST the system for normal operation. → **No** GO to **C2**
C2: CHECK THE REAR SHOCK ABSORBERS	
	1 Raise and support the vehicle. REFER to Section 100-02. - Inspect the rear shock absorbers for oil leaks or damage. • Are the rear shock absorbers damaged or leaking? → **Yes** INSTALL new components as necessary. REFER to Section 204-02. TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **No** VERIFY the customer concern.

PINPOINT TEST D: EXCESSIVE NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: INSPECT THE SUSPENSION	
	1 Raise and support the vehicle. REFER to Section 100-02. - Inspect the suspension mounting bolts. • Are the mounting bolts loose or broken? → **Yes** TIGHTEN or INSTALL new suspension mounting bolts. REFER to Section 204-01. (Front). REFER to Section 204-02. (Rear). TEST the system for normal operation. → **No** GO to **D2**
D2: INSPECT THE SPRINGS	
	1 Inspect the springs for damage. • Are the springs damaged? → **Yes** INSTALL new springs. REFER to Section 204-01. (Front). REFER to Section 204-02. (Rear). TEST the system for normal operation. → **No** GO to **D3**
D3: INSPECT THE FRONT SUSPENSION LOWER ARM	
	1 Inspect the front suspension lower arm bushings for excessive wear or damage. • Are the front suspension lower arm bushings worn or damaged? → **Yes** INSTALL new lower arm. REFER to Section 204-01. TEST the system for normal operation. → **No** GO to **D4**
D4: INSPECT THE TIRES	
	1 Inspect the tires for uneven wear. • Is there uneven wear? → **Yes** INSTALL new tires. ADJUST the wheel alignment to specification. TEST the system for normal operation. → **No** VERIFY the customer concern.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST E: VIBRATION

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: INSPECT THE TIRES	
	1 Raise and support the vehicle. REFER to Section 100-02. - Inspect the tires for damage or excessive wear. • Are the tires damaged or worn? → **Yes** INSTALL new tires. TEST the system for normal operation. → **No** GO to **E2**
E2: MEASURE THE WHEEL AND TIRE RUNOUT ON THE VEHICLE	
	1 Measure the wheel and tire runouts on the vehicle using suitable equipment. Assembly runout should be less than 1.14 mm (0.045 inch) radial and lateral. • Is the measurement within specification? → **Yes** GO to **E8** → **No** GO to **E3**
E3: MEASURE THE WHEEL AND TIRE RUNOUT OFF THE VEHICLE	
	1 Measure the wheel and tire from any position that exceeds 1.14 mm (0.045 inch) radial or lateral. Before removing the wheel, mark a wheel stud and corresponding stud hole so the wheel can be installed in same position. Remove the wheel and mount on a wheel balancer. Measure the runout. Wheel and tire runout should be less than 1.14 mm (0.045 inch) radial and lateral. • Is the measurement to specification? → **Yes** GO to **E6** → **No** GO to **E4**
E4: MATCH MOUNTING	
	1 Mark the high runout location on the tire and also on the wheel. Deflate the tire and rotate the tire 180 degrees on the wheel. Inflate the tire and measure the runouts. • Are the wheel and tire balanced? → **Yes** INSTALL the wheel to the vehicle. TEST the system for normal operation. → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	If the high spot is not within 101.6 mm (4 inches) of first high spot on the tire, GO to **E5**
E5: MEASURE WHEEL RUNOUT	
	1 Remove the tire and mount the wheel on a wheel balancer. Measure the runout on both flanges. Runout should be less than 1.14 mm (0.045 inch) radial and lateral. • Is the runout to specification? → **Yes** LOCATE and MARK the low spot on wheel and INSTALL the tire matching the high spot on the wheel. BALANCE the wheel and tire assembly. TEST the system for normal operation. → **No** INSTALL a new wheel. CHECK the runout on the new wheel. If the new wheel is within limits, LOCATE and MARK the low spot. INSTALL the tire, matching the high spot of the tire with the low spot of the wheel. BALANCE the wheel and tire assembly. INSTALL the wheel and tire to the vehicle. TEST the system for normal operation.
E6: REAR HUB AND STUD PITCH CIRCLE DIAMETER RUNOUT	
	1 Remove the rear wheel and brake drum or disc. - Measure the hub flange face runout (greater than 0.254 mm (0.010 inch)), stud circle runout (greater than 0.08 mm (0.003 inch)) and radial runout (greater than 0.05 mm (0.002 inch)). • Are the measurements correct? → **Yes** GO to **E7** → **No** INSTALL a new rear hub. REFER to Section 204-02.
E7: FRONT HUB AND STUD PITCH CIRCLE DIAMETER RUNOUT	
	1 Remove the front wheel and brake disc. - Measure the stud circle runout (greater than 0.06 mm (0.002 inch)). • Are the measurements correct? → **Yes** GO to **E8** → **No** INSTALL a new hub. REFER to Section 204-01.
E8: WHEEL BALANCE	
	1 Balance all wheels. Road test the vehicle.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is a vibration felt? → **Yes** REFER to Section 100-04. → **No** VERIFY the customer concern.

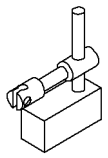
Component Tests

Ball Joint Inspection

1. Raise and support the vehicle. REFER to Section 100-02.
2. Firmly grasp the outer end of the suspension lower arm and try to move it up and down, watching and feeling for any movement. Free movement will usually be accompanied by an audible "click''. There should be no free movement.
3. If there is any free movement install a new lower arm. REFER to Section 204-01.
4. If a new lower arm is installed it will be necessary to check and adjust the front wheel alignment. For additional information, refer to Specifications in this Section.

GENERAL PROCEDURES

Wheel Bearing Inspection

Special Tool(s)	
 15008	Holding Fixture, Dial Indicator Gauge 205-044 (15-008)

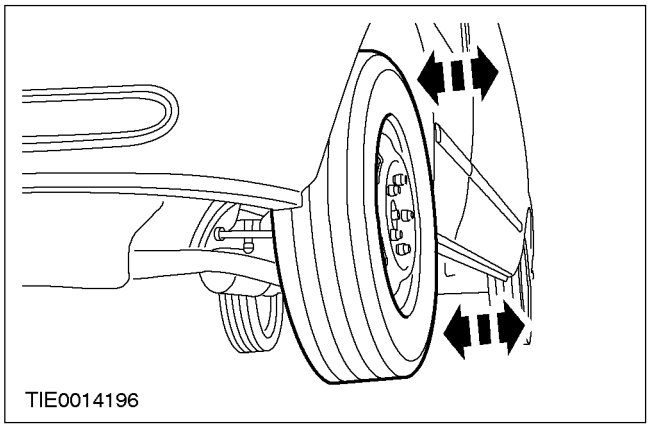
General Equipment
Dial indicator gauge

Check

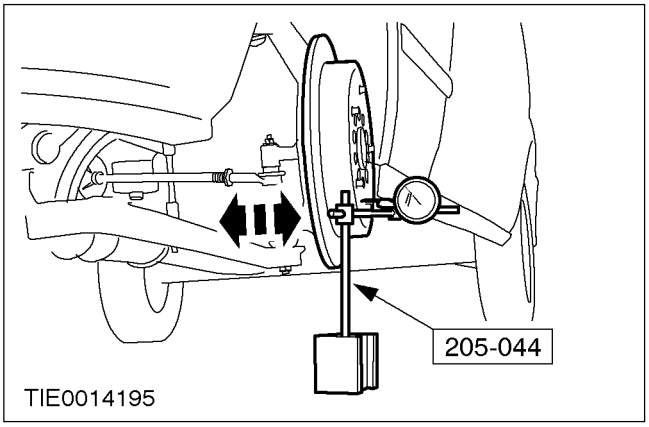
1. **NOTE:** Do not to confuse lower arm ball joint looseness with bearing looseness.

   Raise and support the front of the vehicle. For additional information, refer to Section 100-02.

2. **Check for loose front wheel bearings by rocking the wheels at the top and bottom.**



3. **Spin the wheel quickly by hand and make sure the wheel turns smoothly without noise from the wheel bearings.**
4. **Remove the front brake caliper and anchor plate. For additional information, refer to Section 206-03.**
5. **Position a suitable Dial indicator gauge fixture or equivalent, against the wheel hub, then push and pull the wheel hub. Measure the end play of the wheel hub and front wheel bearing assembly. There should be no end play. If end play exists, install new wheel bearings.**



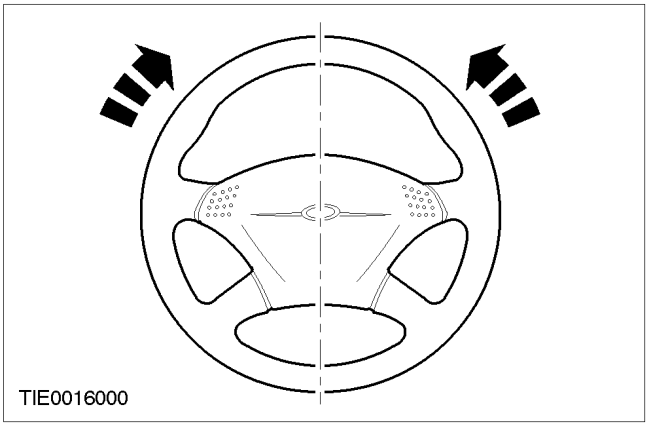
6. **Install the front brake caliper. For additional information, refer to Section 206-03.**

GENERAL PROCEDURES

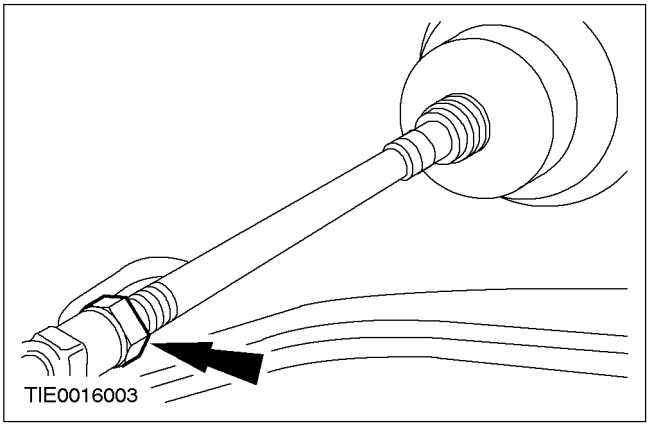
Front Toe Adjustment (14 117 0)

NOTE: The checking and subsequent adjustment of the front toe setting should be carried out on a flat surface and in accordance with the manufacturers instructions for the wheel alignment equipment used.

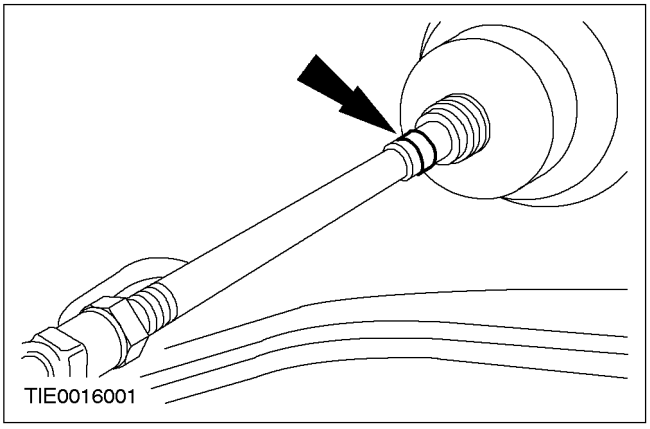
1. Centralize the steering and lock it in position.



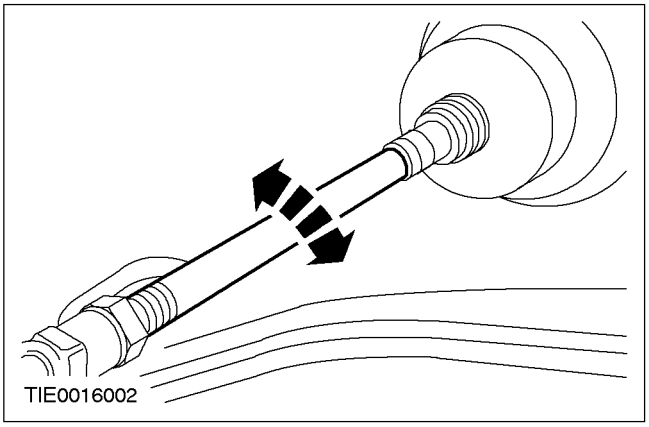
2. Loosen the tie-rod end locknuts.



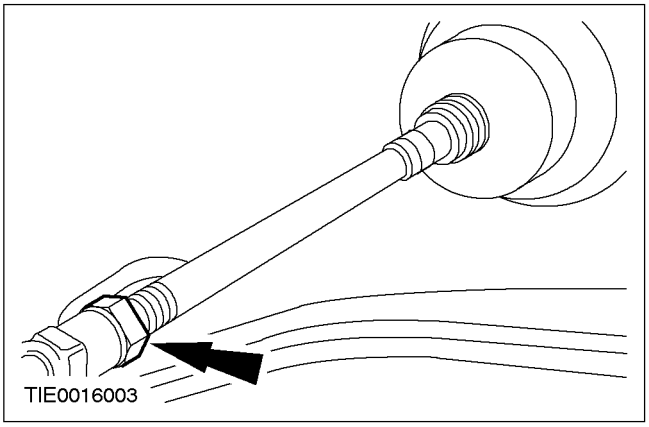
3. Remove the steering gear boot outer clamps.



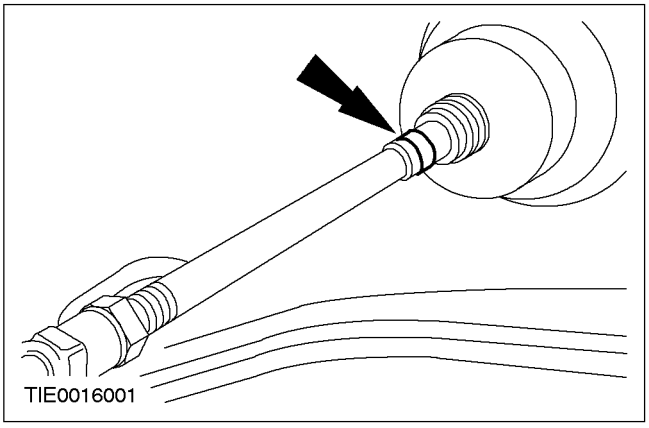
4. Rotate the tie-rods an equal amount in either a clockwise or a counterclockwise direction to adjust the toe setting.



5. Tighten the tie-rod end locknuts. For additional information, refer to Section 211-03.



6. Install the steering gear boot outer clamps.



7. Check the toe setting.

GENERAL PROCEDURES

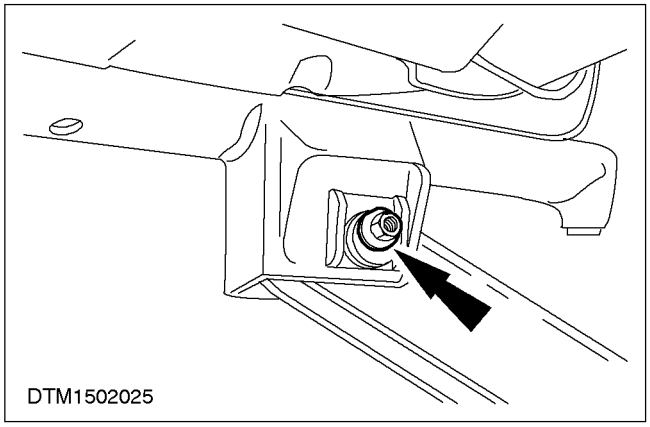
Rear Toe Adjustment (15 211 0)

General Equipment
Four wheel alignment equipment

NOTE: The checking and subsequent adjustment of the rear toe setting should be carried out on a flat surface and in accordance with the manufacturers instructions for the particular wheel alignment equipment being used.

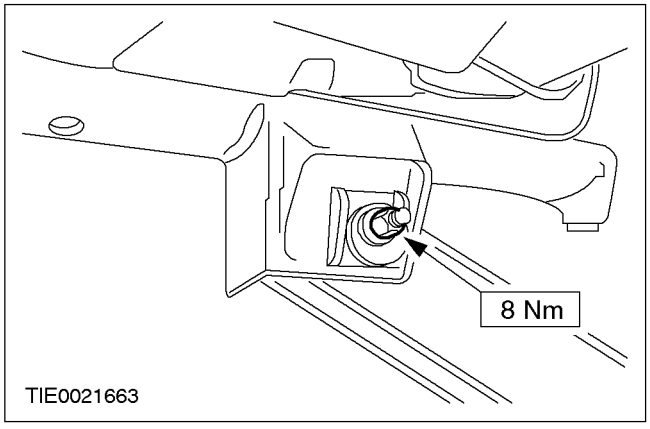
1. **NOTE:** Final tightening of the rear suspension components should be carried out when the vehicle weight is on the road wheels.

   Using suitable four wheel alignment equipment, check the toe setting.
2. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
3. **Loosen the rear lower arm cam nut (Wagon shown, 4-door and 5-door similar).**

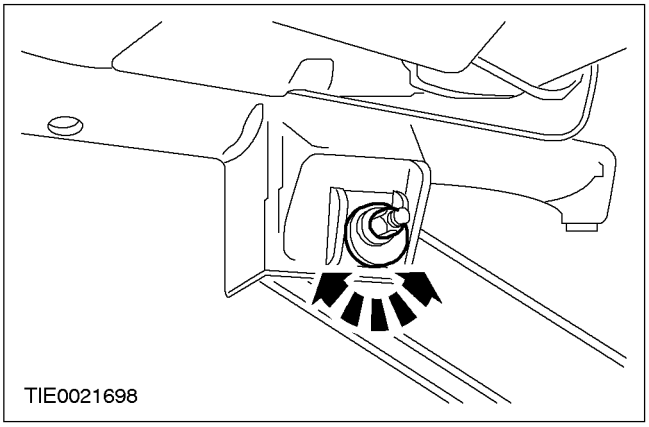


4. **NOTE:** Do not fully tighten the lower arm cam nut at this stage (Wagon shown, 4-door and 5-door similar).

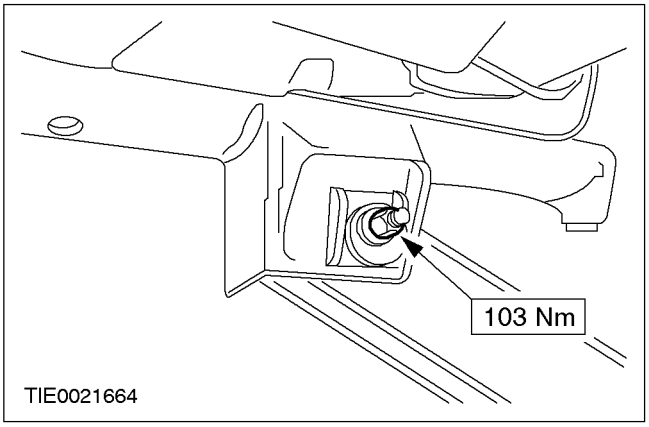
   Tighten the lower arm cam nut.



5. **Lower the vehicle.**
   - Bounce the vehicle to make sure that the suspension is in its normal resting position.
6. **Adjust the toe setting (Wagon shown, 4-door and 5-door similar).**



7. **Tighten the lower arm cam nut (Wagon shown, 4-door and 5-door similar)**



SECTION 204-01 Front Suspension

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

Specifications 204-01-2

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Front Suspension 204-01-3

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Front Suspension 204-01-5

REMOVAL AND INSTALLATION

Wheel Bearing	(14 411 0)	204-01-6
Lower Arm	(14 706 0)	204-01-8
Stabilizer Bar	(14 752 0)	204-01-14
Stabilizer Bar Bushing	(14 754 0)	204-01-22
Wheel Knuckle	(14 343 0)	204-01-23
Strut and Spring Assembly	(14 781 0)	204-01-33

DISASSEMBLY AND ASSEMBLY

Strut and Spring Assembly	(14 783 4)	204-01-41

SPECIFICATIONS

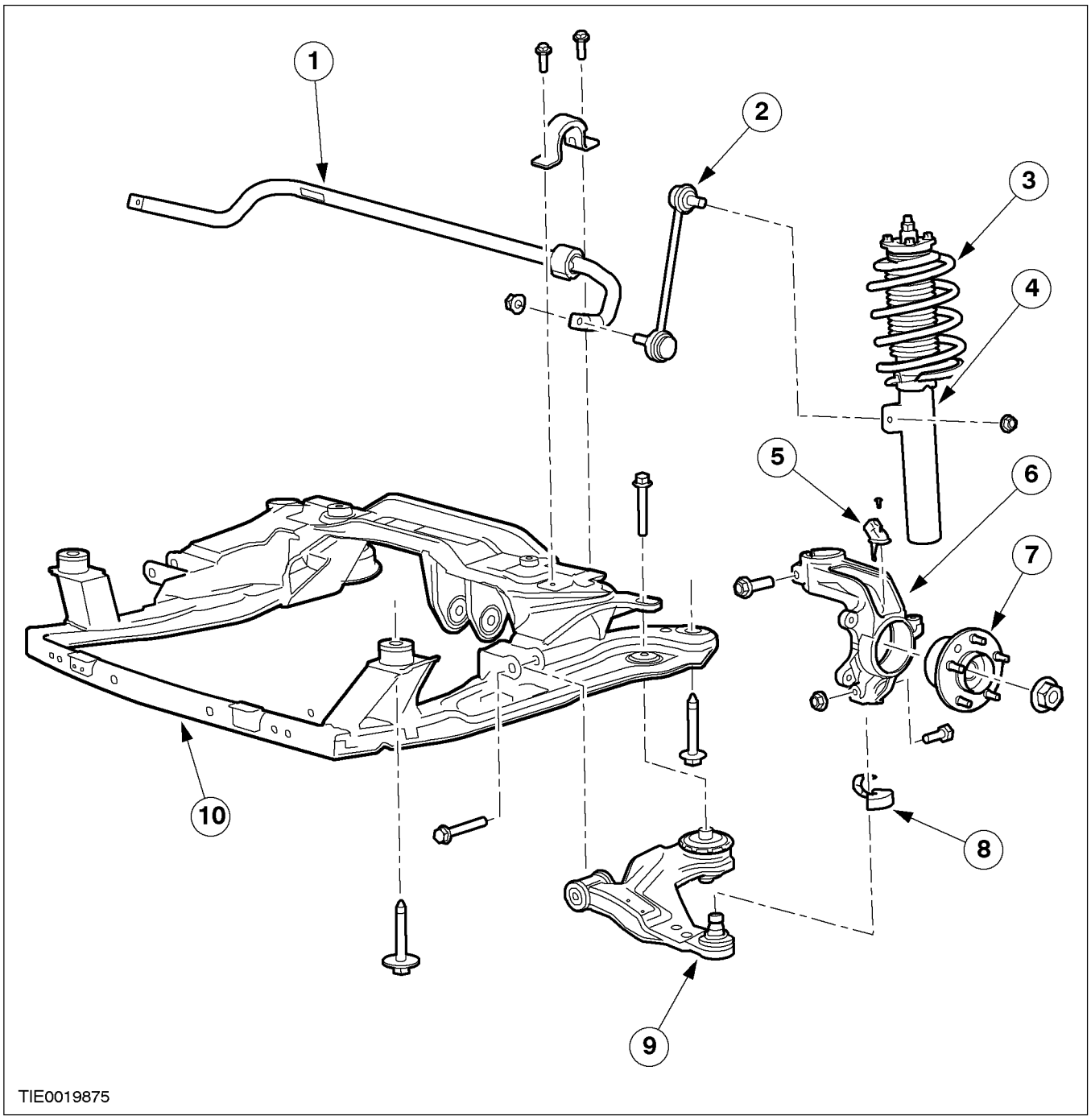
Torque Specifications

Description	Nm	lb-ft	lb-in
Stabilizer bar connecting link nuts	48	35	–
Stabilizer bar clamp retaining bolts	48	35	–
Subframe retaining bolts	142	105	–
Lower arm to subframe rear retaining nut and bolt	a)	–	–
Lower arm to subframe front retaining bolt	a)	–	–
Wheel knuckle pinch bolt	83	61	–
Lower arm to wheel knuckle pinch nut and bolt	83	61	–
Wheel hub retaining nut	290	214	–
Top mount retaining nuts	30	22	–
Thrust bearing retaining nut	59	44	–
Wheel speed sensor retaining bolt	6	–	53
Brake caliper anchor plate retaining bolt	130	96	–
Engine rear support insulator retaining bolt	80	59	–
Steering gear retaining bolts	130	96	–
Tie-rod end retaining nut	40	30	–
Radiator support bracket retaining bolts	25	18	–
Steering column shaft to flexible coupling bolt	20	15	–
Brake hose support bracket retaining nut	48	35	–

a) Refer to the procedure in this section.

DESCRIPTION AND OPERATION

Front Suspension



Item	Part Number	Description
1		Stabilizer bar
2		Stabilizer bar connecting link
3		Spring

Item	Part Number	Description
4		Strut
5		Wheel speed sensor
6		Wheel knuckle
7		Wheel hub

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
8		Lower arm ball joint heat shield
9		Lower arm
10		Subframe

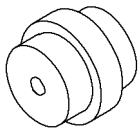
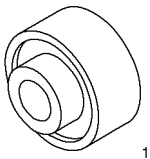
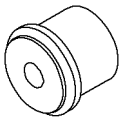
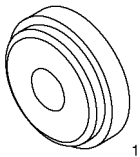
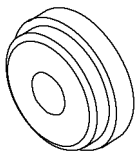
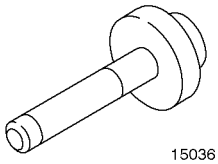
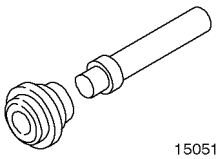
DIAGNOSIS AND TESTING

Front Suspension

REFER to Section 204-00.

REMOVAL AND INSTALLATION

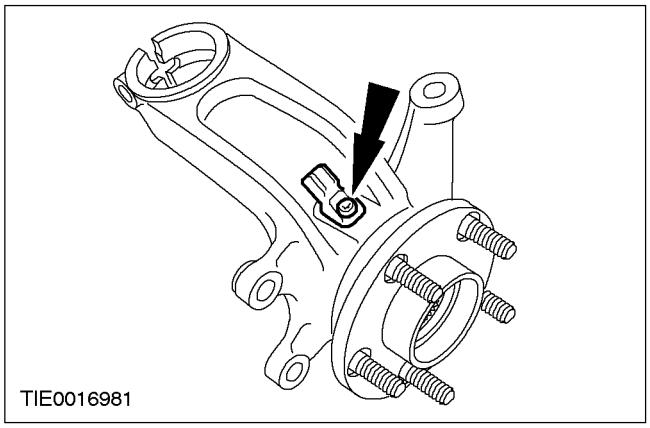
Wheel Bearing (14 411 0)

Special Tool(s)	
 1403801	Adapter for 204-158 (Thrust Pad) 204-158-01 (14-038-01)
 14040	Installer, Front Wheel Bearing 204-160 (14-040)
 1503303	Adapter for 205-066 205-066-03 (15-033-03)
 15068	Adapter for 205-066 205-066-04 (15-068)
 15064	Adapter for 205-074 205-074-01 (15-064)
 15036	Installer, Rear Hub Oil Seal 205-075 (15-036)
 15051	Installer, Wheel Hub Bearing Cone/Seal 205-101 (15-051)

General Equipment
Bearing separator

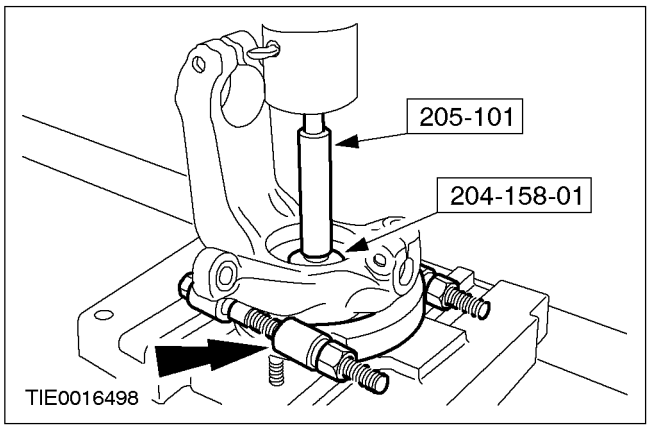
Removal

1. **Remove the wheel knuckle.** **For additional information, refer to Wheel Knuckle in this section.**
2. **Remove the front wheel speed sensor.**



3. **NOTE:** When removing the wheel hub from the wheel knuckle the bearing will be destroyed. The bearing inner ring will be on the wheel hub and the bearing outer ring will be in the wheel knuckle.

   Using a suitable bearing seperator and the special tools, remove the wheel hub.

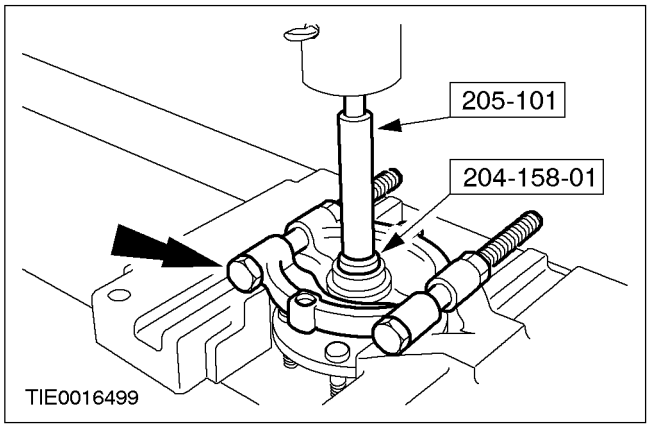


REMOVAL AND INSTALLATION (Continued)

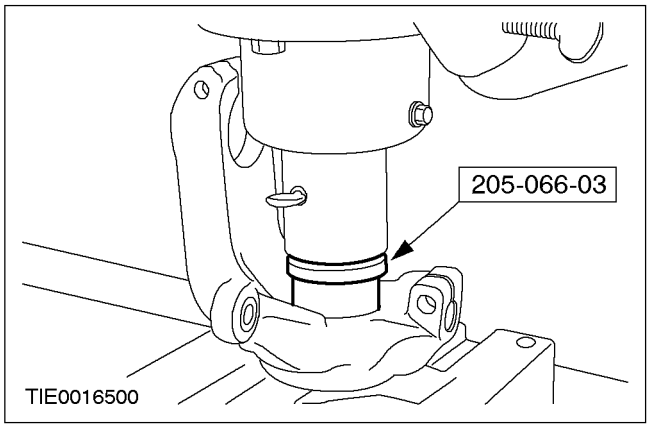
4. **CAUTION: A suitable bearing seperator and the special tools must be used to prevent damage to the hub. If the hub is damaged a new hub must be installed.**

CAUTION: Do not use heat to remove the bearing inner ring.

Using a suitable bearing seperator and the special tools, remove the bearing inner ring.



5. **Using the special tool, remove the bearing outer ring.**



Installation

CAUTION: Avoid any impact on the wheel speed sensor ring.

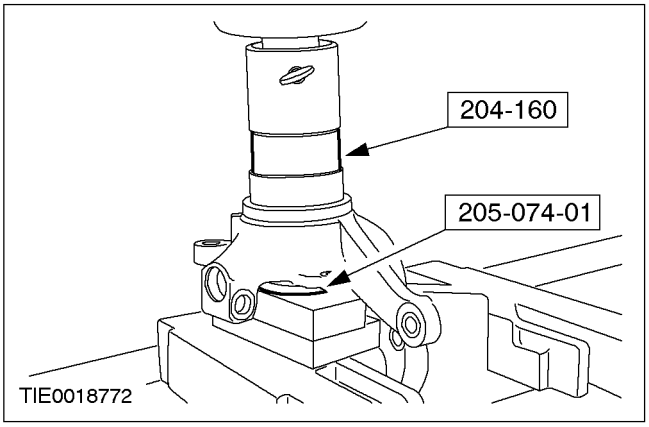
CAUTION: Make sure the wheel speed sensor ring is clean.

CAUTION: Avoid any contact between the wheel speed sensor ring and a magnetic surface.

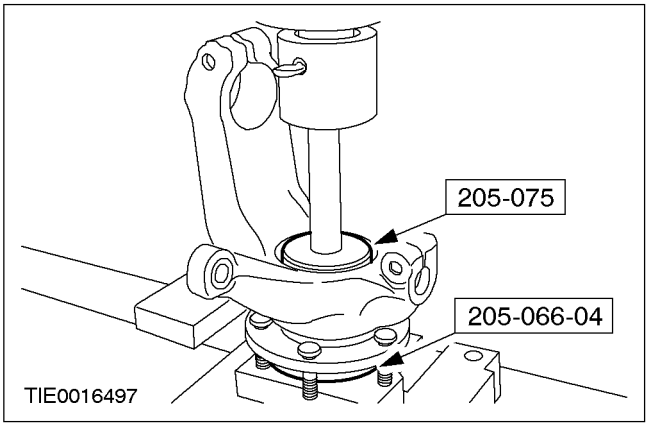
1. **CAUTION: Make sure the mating surfaces of the wheel bearing and the wheel knuckle are free from oil and grease.**

CAUTION: Make sure the wheel bearing is installed into the wheel knuckle with the wheel speed sensor ring, colored black, at the wheel speed sensor end of the wheel knuckle.

Using the special tools, install the new wheel bearing.



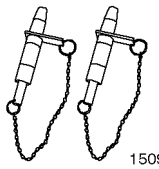
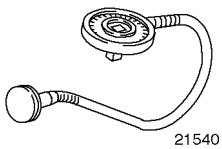
2. **Using the special tools, install the wheel hub.**



3. **Install the wheel knuckle.** **For additional information, refer to Wheel Knuckle in this section.**

REMOVAL AND INSTALLATION

Lower Arm (14 706 0)

Special Tool(s)	
 15097A	Alignment Pins, Subframe 205-316 (15-097A)
 21540	Angle Gauge, Bolt Tightening 303-174 (21-540)

General Equipment
Transmission jack
Wooden block

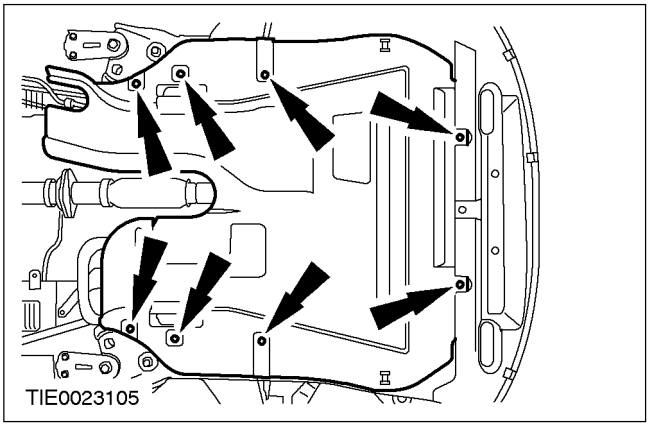
Removal

All vehicles

1. **Remove the wheel and tire. For additional information, refer to Section 204-04.**

Vehicles with diesel engine

2. **Remove the engine undershield.**



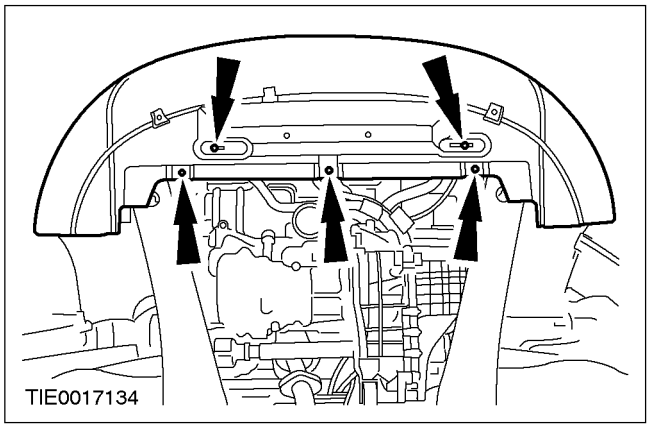
Vehicles with xenon headlamps

3. **NOTE:** The left-hand lower arm is equipped with a headlamp leveling sensor.

   Remove the headlamp leveling sensor. For additional information, refer to Section 417-01.

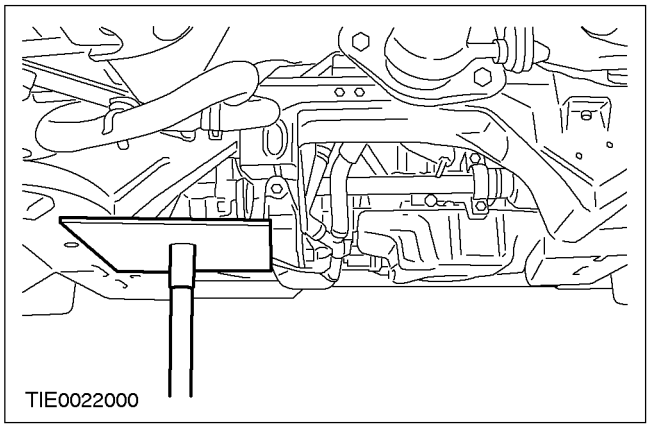
All vehicles

4. **Detach the splash shield from the subframe.**

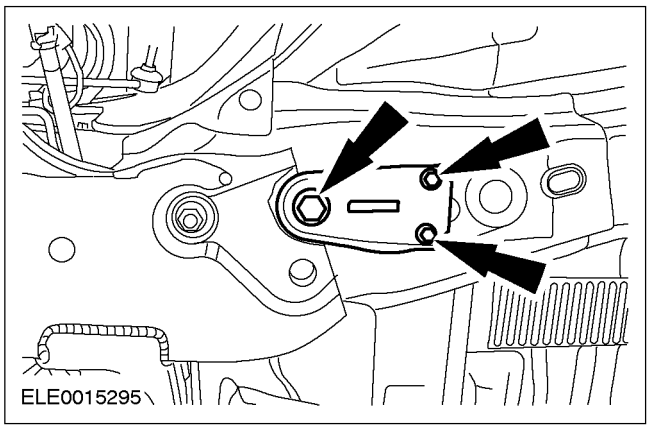


5. **NOTE:** Only one side of the subframe needs to be lowered for the removal of the lower arm.

   Using a suitable wooden block and a transmission jack, support the side of the subframe to be lowered.

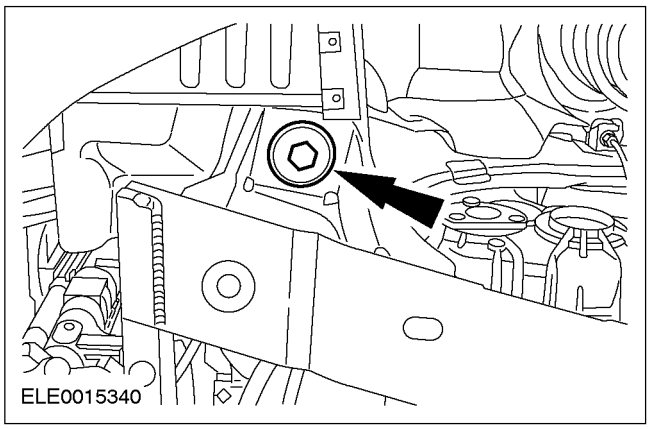


6. **Remove the subframe rear retaining bolt and the subframe rear bracket retaining bolts, on the side the lower arm is being removed (right-hand side shown).**

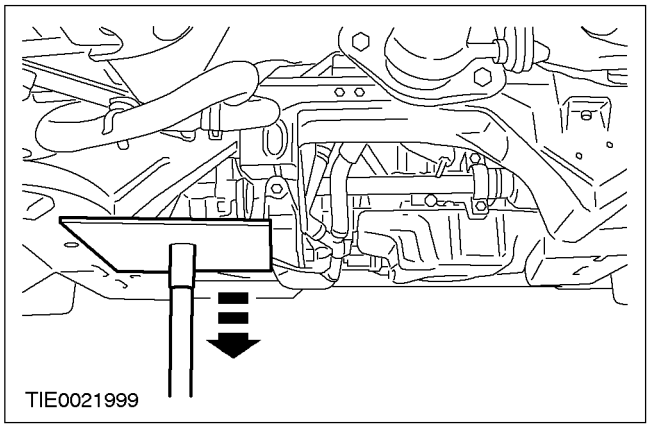


REMOVAL AND INSTALLATION (Continued)

7. **Loosen the subframe rear retaining bolt and the subframe rear bracket retaining bolts, on the opposite side, by five turns.**
8. **Remove the subframe front retaining bolt, on the side the lower arm is being removed (right-hand side shown).**

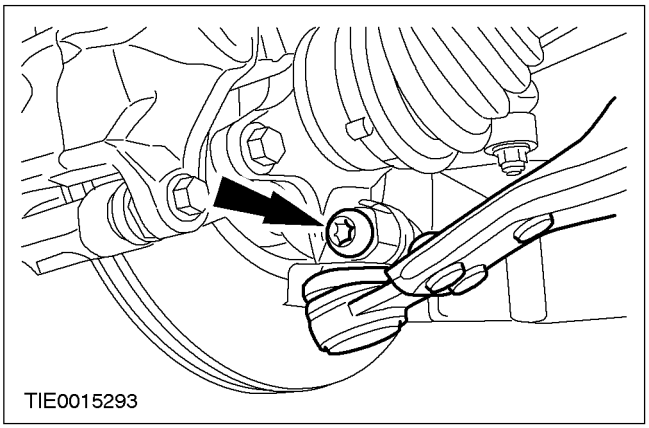


9. **Loosen the subframe front retaining bolt, on the opposite side, by five turns.**
10. **Lower the subframe to gain access to the lower arm rear retaining bolt.**



11. **CAUTION: To prevent damage to the lower arm hydro-bushing, make sure the subframe is lowered before detaching the lower arm ball joint from the wheel knuckle.**

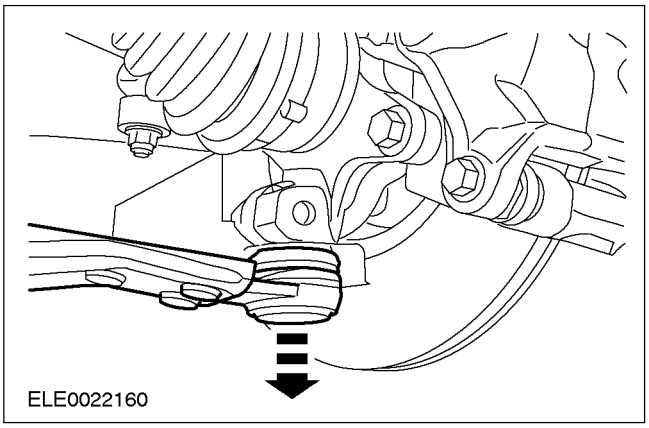
    Remove the lower arm ball joint to wheel knuckle pinch bolt and nut.



12. **CAUTION: Protect the ball joint seal using a soft cloth to prevent damage.**

    Detach the lower arm ball joint from the wheel knuckle.

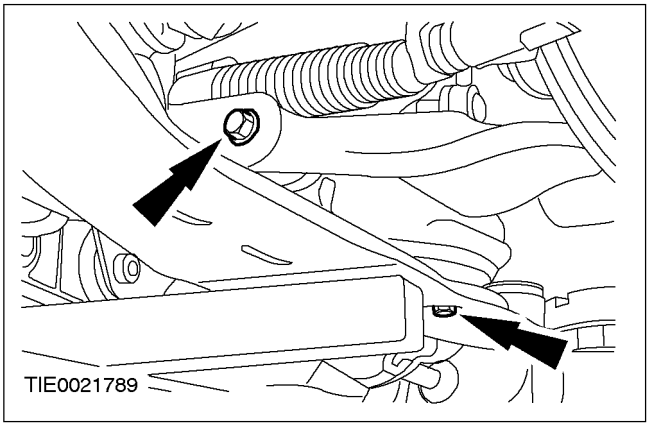
    - Remove the heat shield.



REMOVAL AND INSTALLATION (Continued)

13. Remove the lower arm.

- Discard the retaining bolts and nut.



Installation

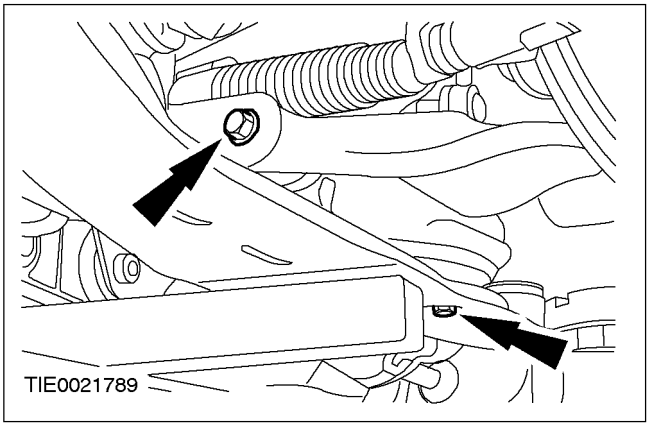
All vehicles

NOTE: Final tightening of the lower arm retaining bolts should be carried out when the vehicle weight is on the road wheels.

1. WARNING: Install a new front retaining bolt and rear retaining bolt and nut. Failure to follow this instruction may result in personal injury.

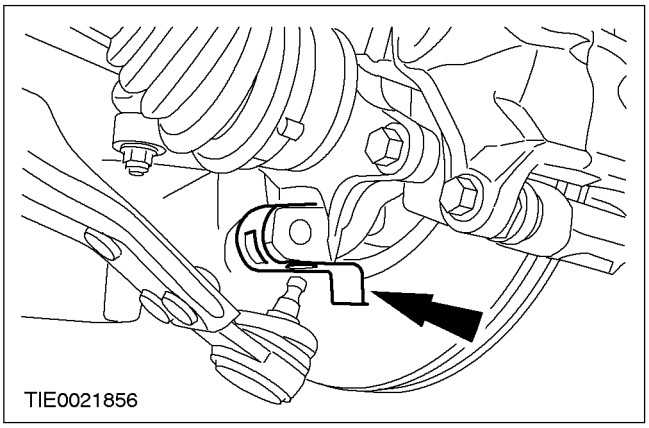
NOTE: Do not fully tighten the lower arm retaining bolts at this stage.

Install the lower arm.



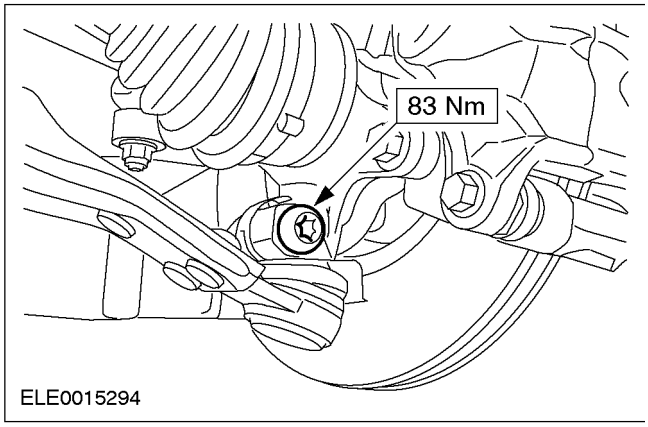
2. CAUTION: Make sure the heat shield is installed to prevent damage to the ball joint.

Install the heat shield.



3. CAUTION: The lower arm pinch bolt must be installed from the rear of the wheel knuckle.

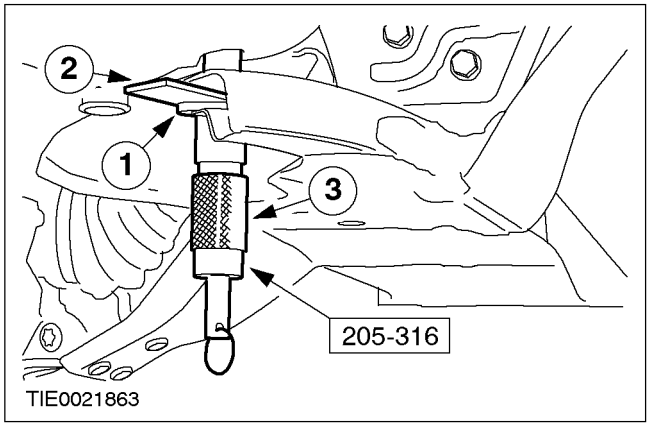
Attach the lower arm ball joint to the wheel knuckle.



REMOVAL AND INSTALLATION (Continued)

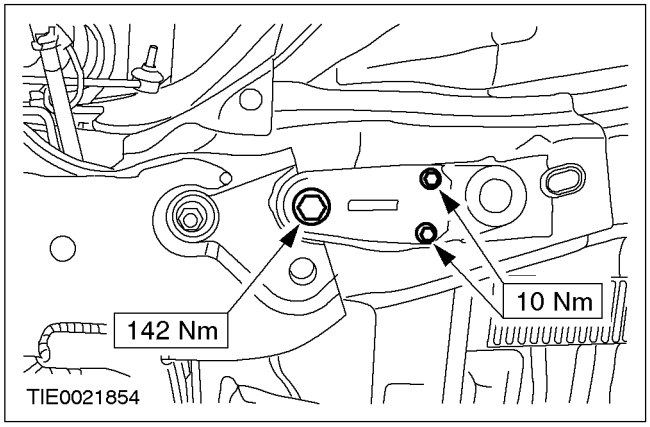
4. Using the special tool and a suitable washer, align the subframe.

1. Insert the washer, with inside diameter 22 mm, outside diameter 44 mm and height 5 mm, into the subframe above the lower alignment hole.
2. Insert the alignment pin through the subframe alignment holes and the washer.
3. Slide the locking plates on top of the washer and into the groove of the tool and tighten the alignment pin sleeve.

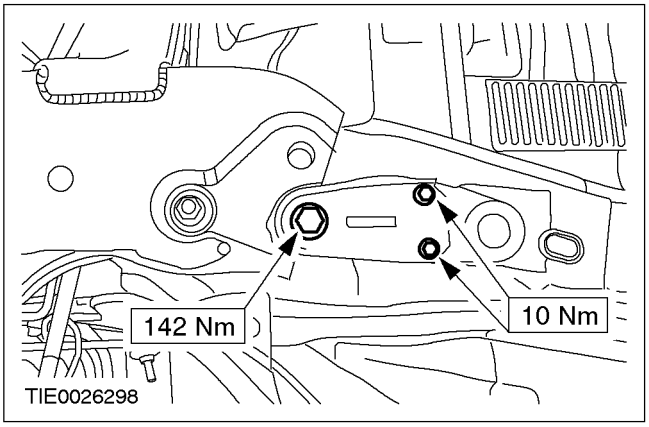


5. CAUTION: While tightening the subframe retaining bolts, make sure the subframe does not move.

Install the subframe rear retaining bolt and the subframe bracket retaining bolts, on the side the lower arm was installed (right-hand side shown).

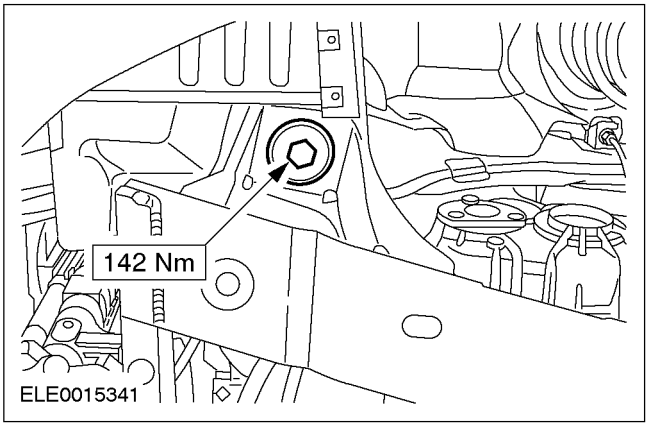


6. Tighten the subframe rear retaining bolt and the subframe bracket retaining bolts, on the opposite side (left-hand side shown).



7. CAUTION: While tightening the subframe retaining bolts, make sure the subframe does not move.

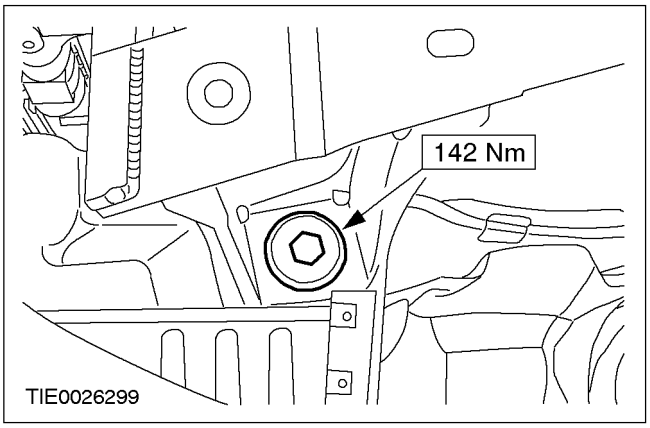
Install the subframe front retaining bolt, on the side the lower arm was installed (right-hand side shown).



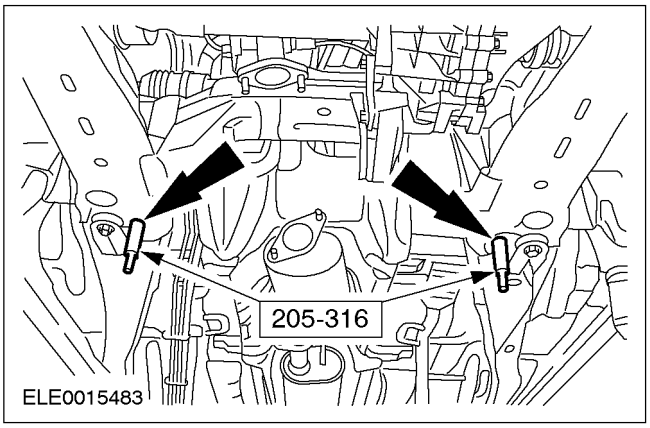
REMOVAL AND INSTALLATION (Continued)

8. Tighten the subframe front retaining bolt, on the opposite side (left-hand side shown).

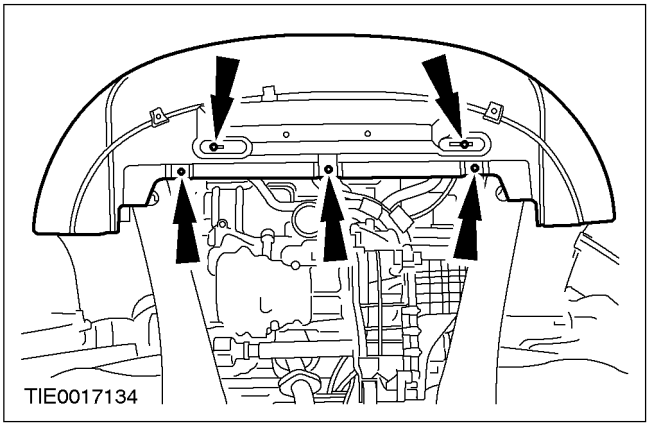
- Lower and remove the transmission jack.



9. Remove the special tools.



10. Attach the splash shield to the subframe.



Vehicles with xenon headlamps

11. NOTE: The left-hand lower arm is equipped with a headlamp leveling sensor.

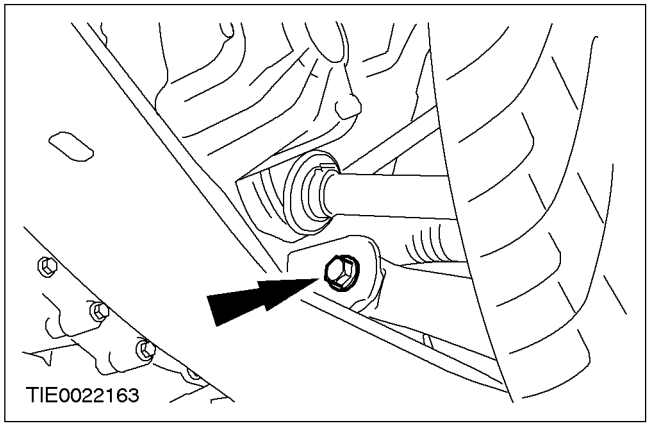
Install the headlamp leveling sensor. For additional information, refer to Section 417-01.

All vehicles

12. Install the wheel and tire. For additional information, refer to Section 204-04.

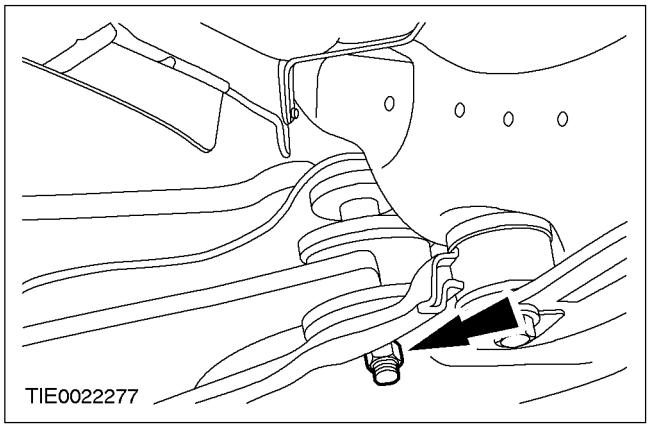
13. Tighten the lower arm front retaining bolt in two stages.

- Stage 1: 80 Nm
- Stage 2: 60 degrees



14. Tighten the lower arm rear retaining bolt in two stages.

- Stage 1: 90 Nm
- Stage 2: 60 degrees

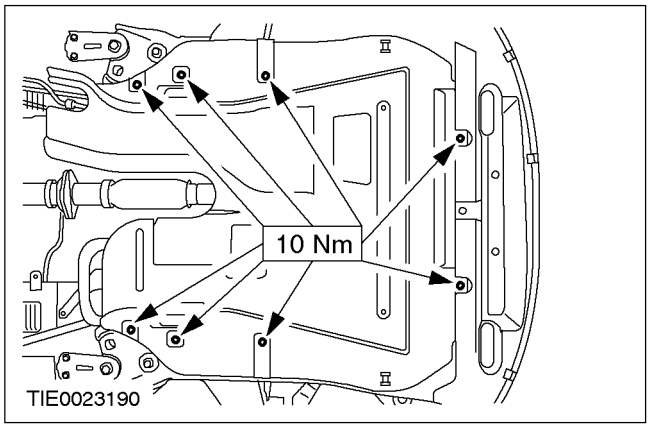


Vehicles with diesel engine

15. Raise and support the vehicle. For additional information, refer to Section 100-02.

REMOVAL AND INSTALLATION (Continued)

16. **Install the engine undershield.**



17. **Lower the vehicle.**

All vehicles

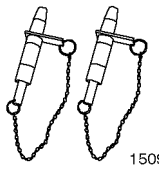
18. **Check the toe setting and adjust as necessary. For additional information, refer to Section 204-00.**

Vehicles with xenon headlamps

19. **Initialize the headlamp leveling system using WDS.**

REMOVAL AND INSTALLATION

Stabilizer Bar (14 752 0)

Special Tool(s)	
 15097A	Alignment Pins, Subframe 205-316 (15-097A)

General Equipment
Transmission jack

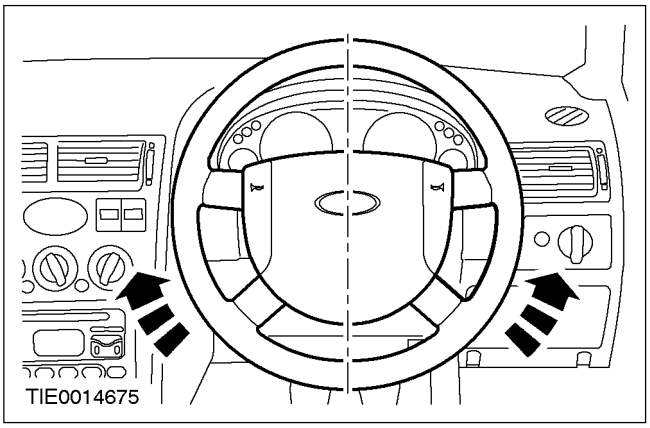
Name	Specification
Anti-seize grease	SAM-1C9107-A

Removal

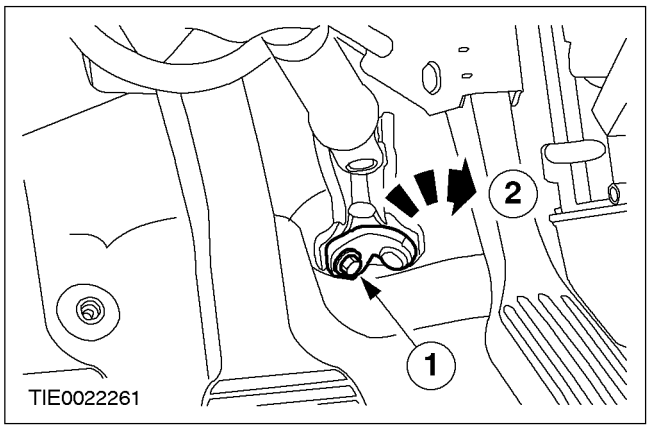
All vehicles

1. **NOTE:** Make sure the road wheels are in the straight ahead position.

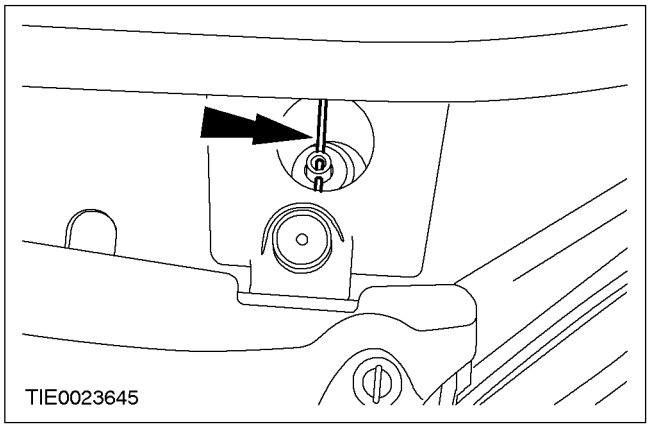
   Centralize the steering and lock it in position.



2. **Detach the steering column shaft from the steering column flexible coupling.**
   1. Remove the retaining bolt.
   2. Rotate the clamp plate.
   - Discard the bolt.



3. **Using suitable pins, support the radiator on the radiator grill opening panel (left-hand side shown).**

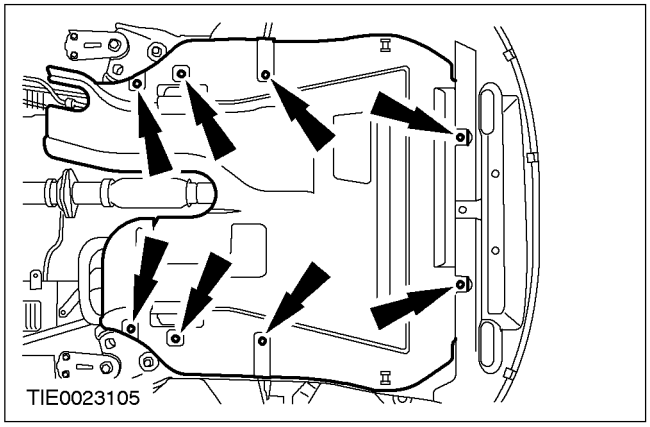


4. **Remove the front wheels and tires. For additional information, refer to Section 204-04.**

REMOVAL AND INSTALLATION (Continued)

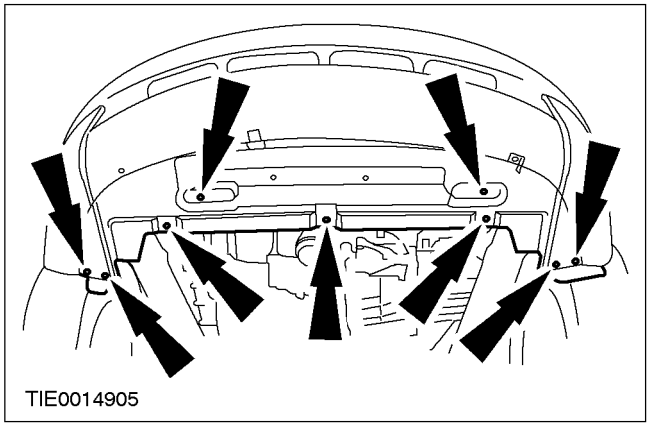
Vehicles with diesel engines

5. Remove the engine undershield.

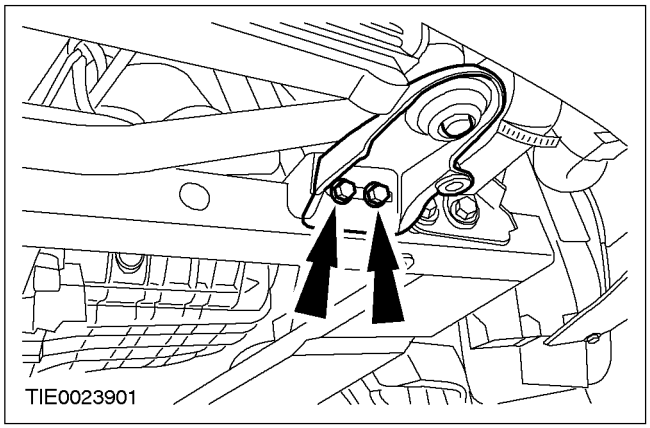


All vehicles

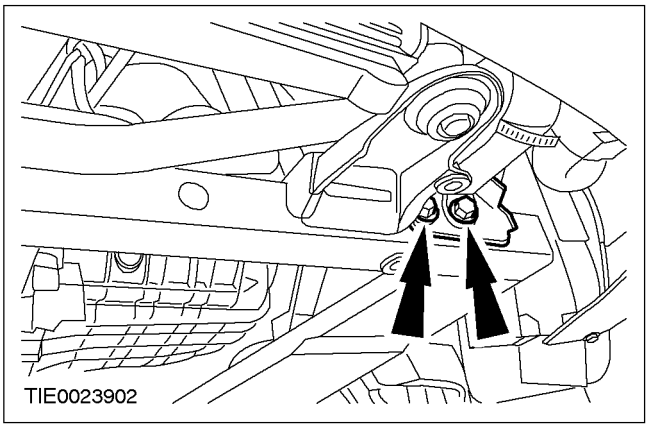
6. Remove the splash shield.



7. Remove the radiator support brackets retaining bolts (left-hand side shown).

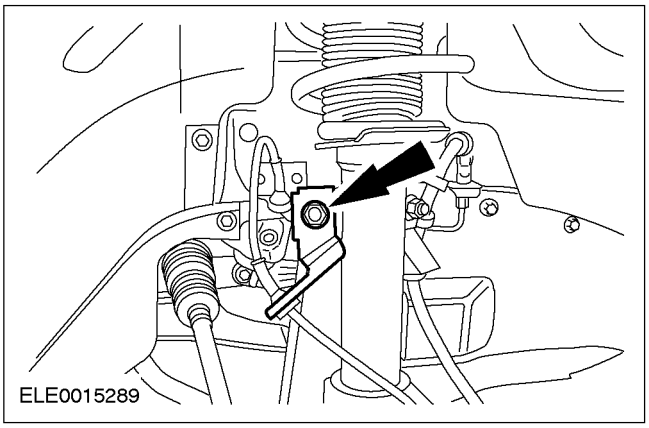


8. Remove the coolant hose support bracket.



9. NOTE: Use a 5 mm Allen key to prevent the ball joint from rotating.

Detach the stabilizer bar connecting links from the suspension struts (right-hand side shown).



Vehicles with 1.8L, 2.0L or diesel engine

10. Remove the exhaust flexible pipe. For additional information, refer to Section 309-00.

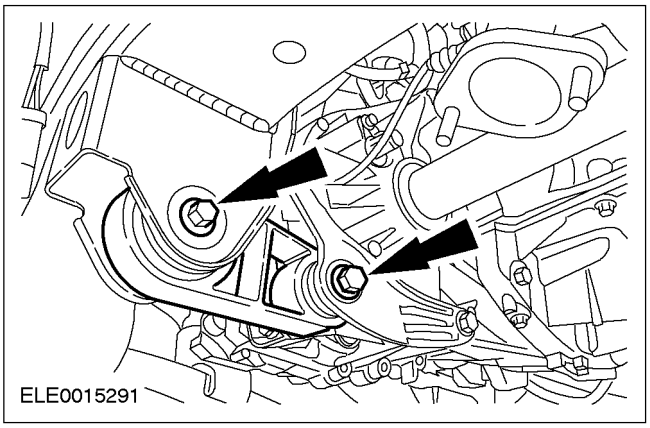
Vehicles with 2.5L engine

11. Remove the dual converter Y-pipe. For additional information, refer to Section 309-00.

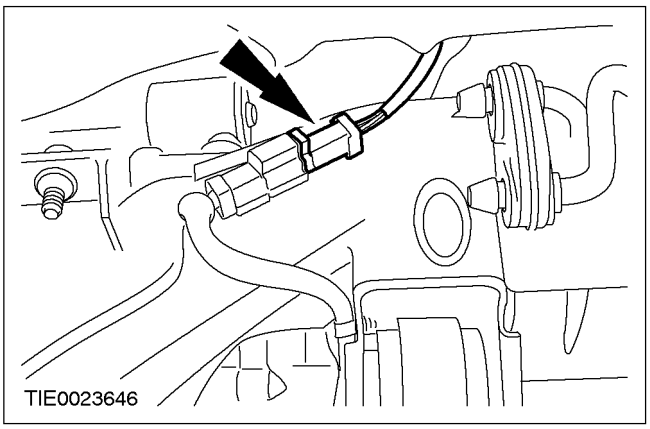
REMOVAL AND INSTALLATION (Continued)

All vehicles

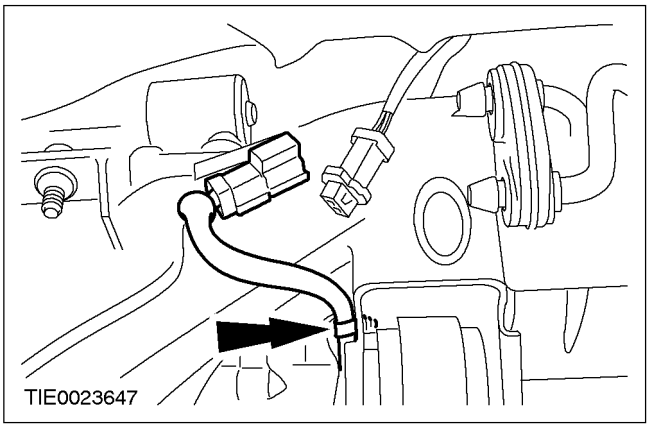
12. Remove the engine rear support insulator.



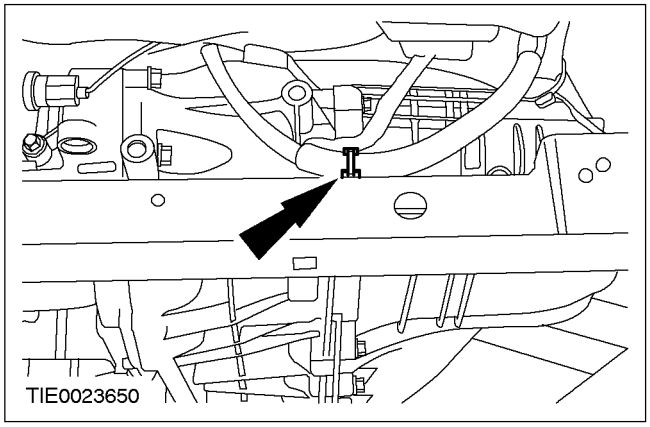
13. Disconnect the catalyst monitor sensor electrical connector.



14. Detach the catalyst monitor sensor wiring harness from the subframe.

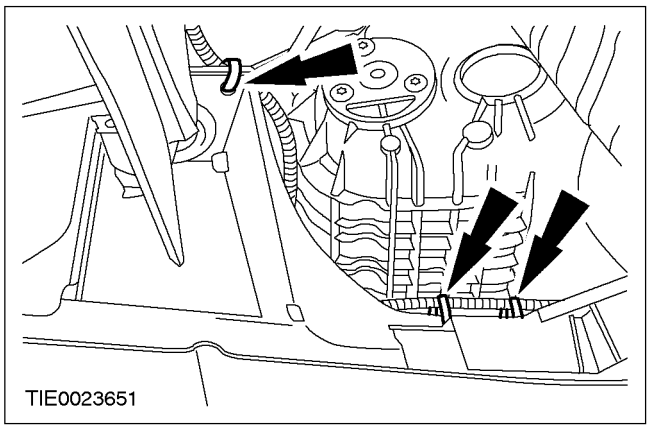


15. Detach the radiator cooling fan wiring harness from the subframe.



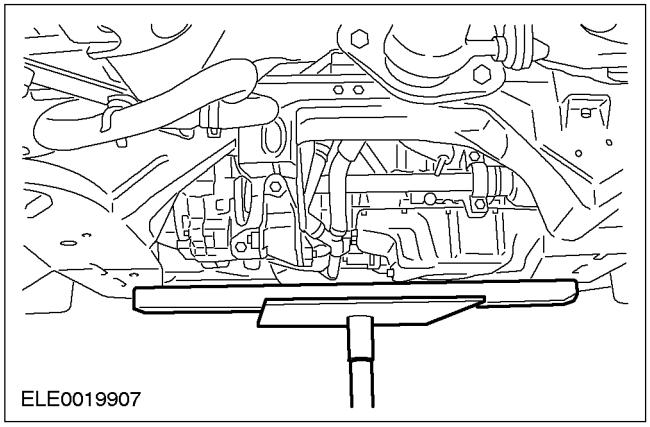
Vehicles with xenon headlamps

16. Detach the headlamp leveling sensor wiring harness from the subframe.



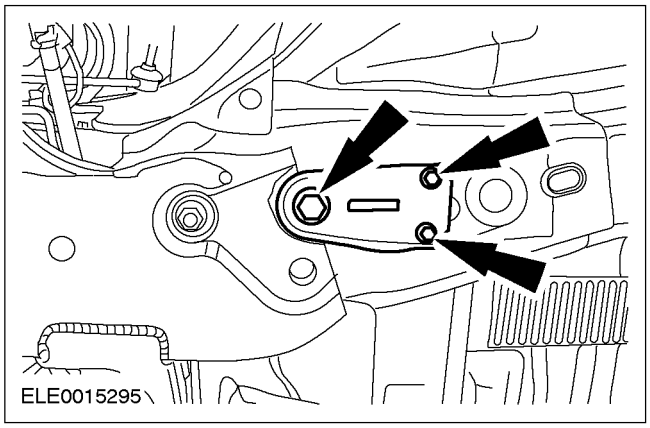
All vehicles

17. Using two suitable wooden blocks and suitable transmission jack, support the subframe.

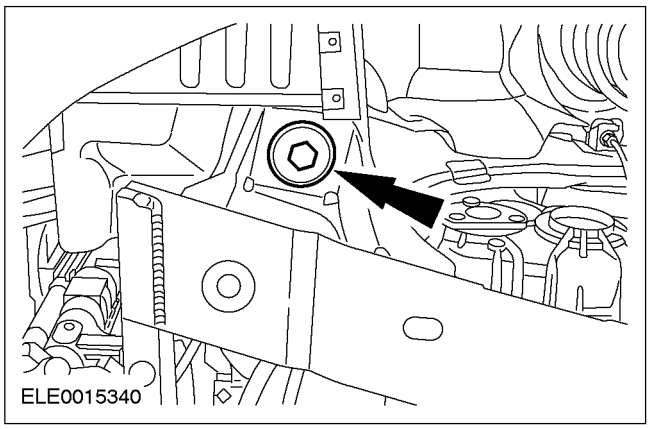


REMOVAL AND INSTALLATION (Continued)

18. **Remove the subframe rear retaining bolts and the subframe rear bracket retaining bolts (right-hand side shown).**

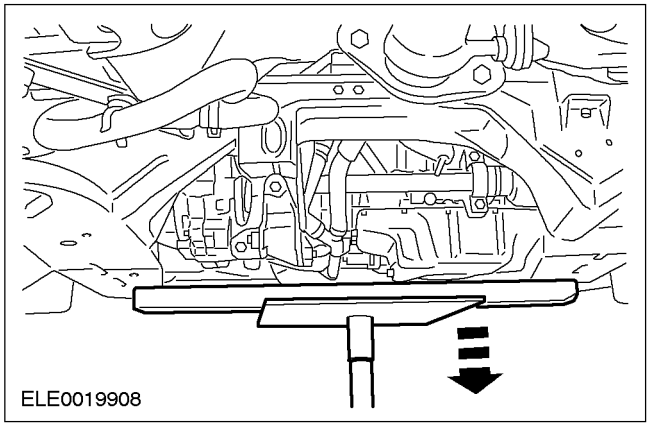


19. **Remove the subframe front retaining bolts (right-hand side shown).**



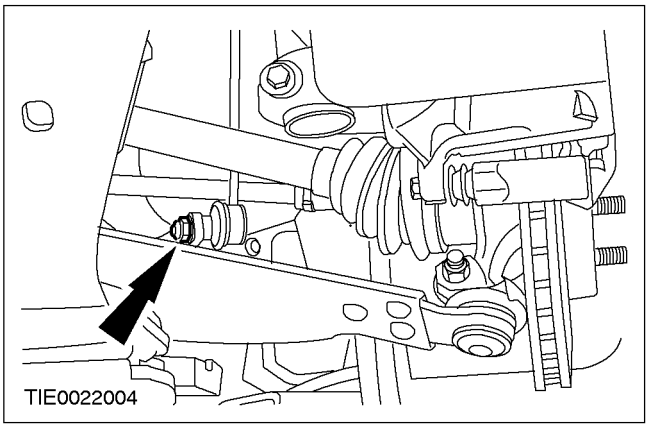
20. **CAUTION: Lower the subframe uniformly, to prevent the lower arm hydro-bushings from damage.**

    Using the transmission jack, lower the subframe approximately 150 mm.

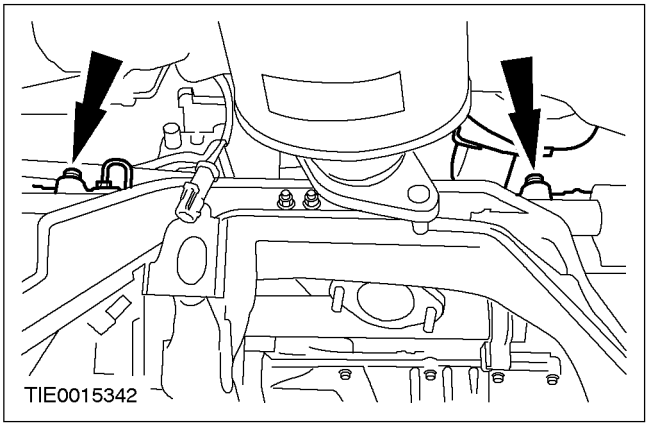


21. **NOTE:** Use a 5 mm Allen key to prevent the ball joint from rotating.

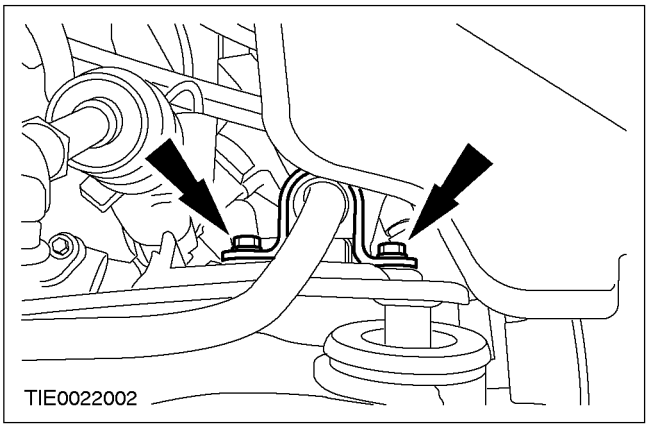
    Remove the stabilizer bar connecting links (left-hand side shown).



22. **Detach the steering gear from the subframe.**
    - Using cable ties, support the steering gear.



23. **Remove the stabilizer bar (two bolts each side).**

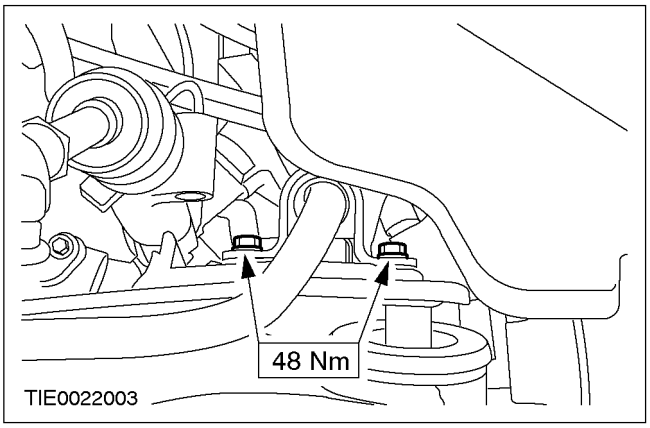


REMOVAL AND INSTALLATION (Continued)

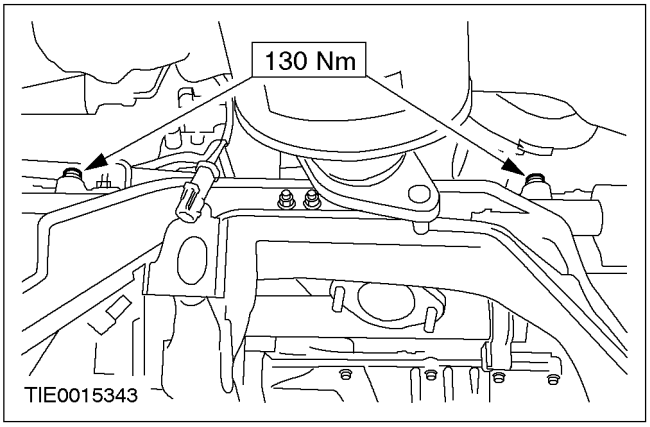
Installation

All vehicles

1. Install the stabilizer bar (two bolts each side).

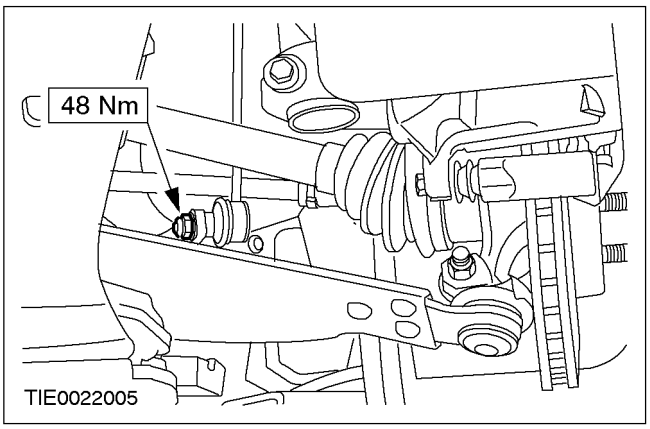


2. Attach the steering gear to the subframe.



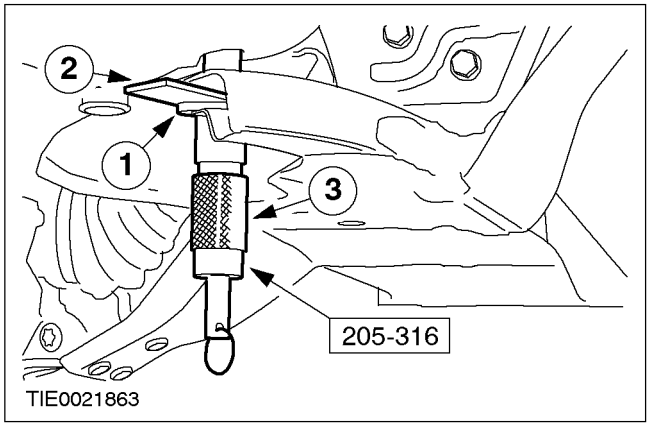
3. NOTE: Use a 5 mm Allen key to prevent the ball joint from rotating.

Install the stabilizer bar connecting links (left-hand side shown).



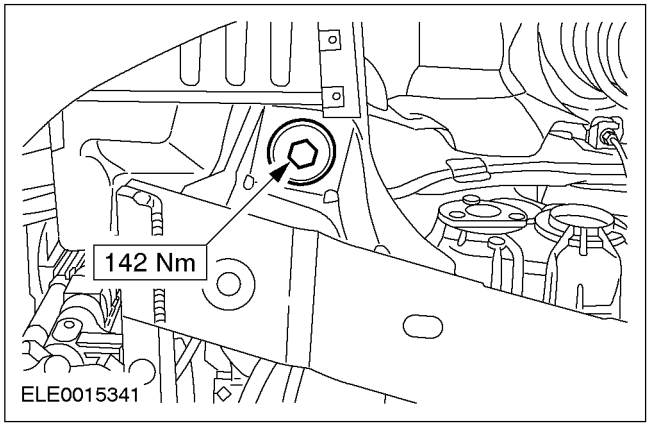
4. Using the special tool and a suitable washer, align the subframe.

1. Insert the washer, with inside diameter 22 mm, outside diameter 44 mm and height 5 mm, into the subframe above the lower alignment hole.
2. Insert the alignment pins through the subframe alignment holes and the washer.
3. Slide the locking plates on top of the washer and into the groove of the tool and tighten the alignment pin sleeve.



5. ⚠ CAUTION: While tightening the subframe retaining bolts, make sure the subframe does not move.

Install the subframe front retaining bolts (right-hand side shown).

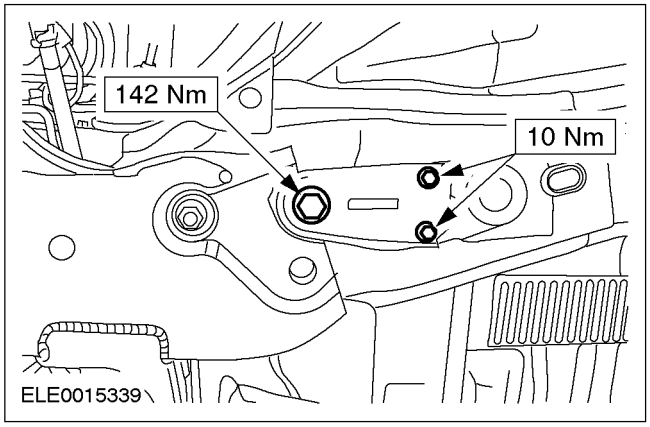


REMOVAL AND INSTALLATION (Continued)

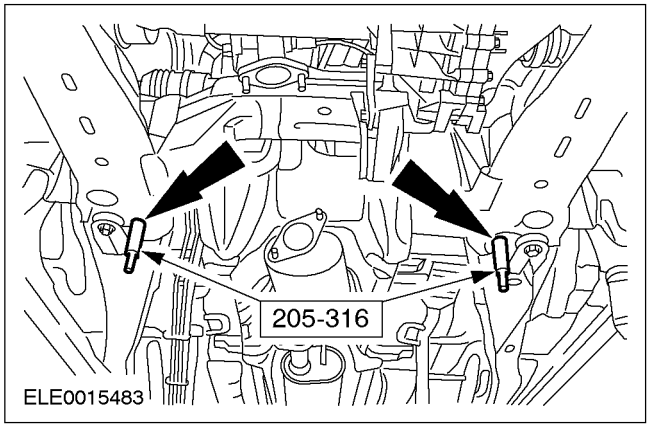
6. **CAUTION: While tightening the subframe retaining bolts, make sure the subframe does not move.**

   Install the subframe rear retaining bolts and the subframe bracket retaining bolts (right-hand side shown).

   • Lower and remove the transmission jack.

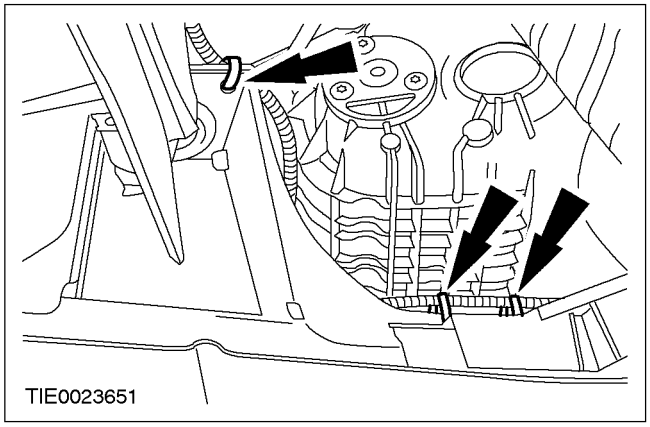


7. **Remove the special tools.**



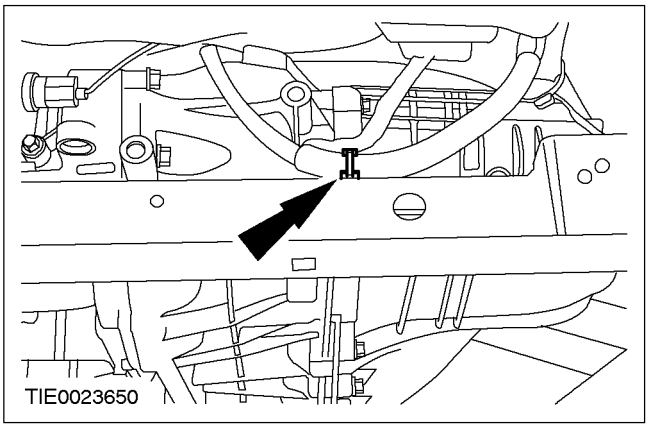
Vehicles with xenon headlamps

8. **Attach the headlamp leveling sensor wiring harness to the subframe.**

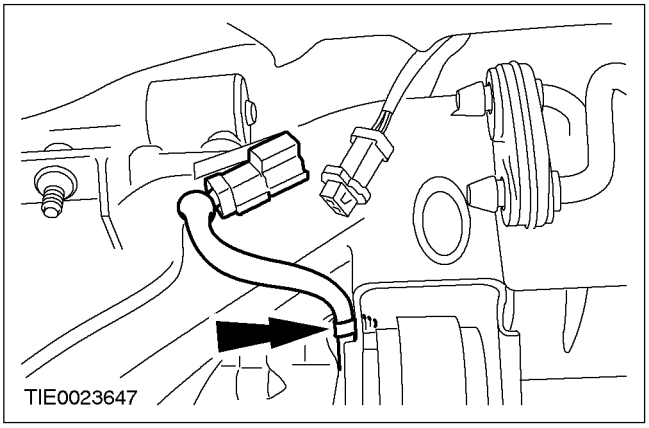


All vehicles

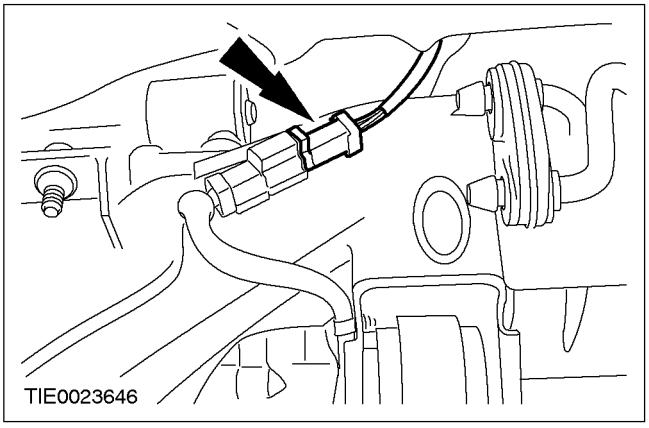
9. **Attach the radiator cooling fan wiring harness to the subframe.**



10. **Attach the catalyst monitor sensor wiring harness to the subframe.**

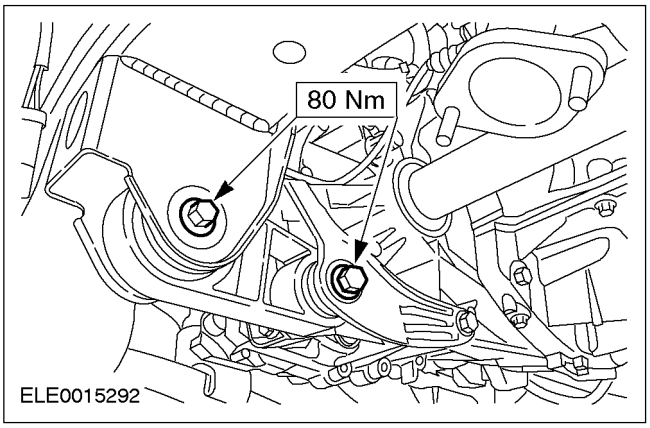


11. **Connect the catalyst monitor sensor electrical connector.**



REMOVAL AND INSTALLATION (Continued)

12. Install the engine rear support insulator.



Vehicles with 2.5L engine

13. Install the dual converter Y-pipe. For additional information, refer to Section 309-00.

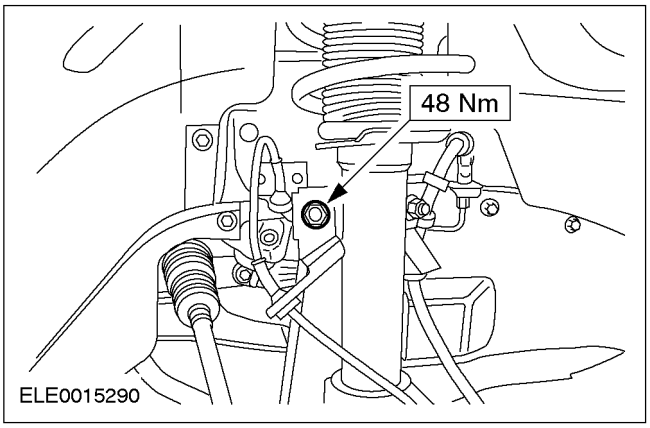
Vehicles with 1.8L, 2.0L or diesel engine

14. Install the exhaust flexible pipe. For additional information, refer to Section 309-00.

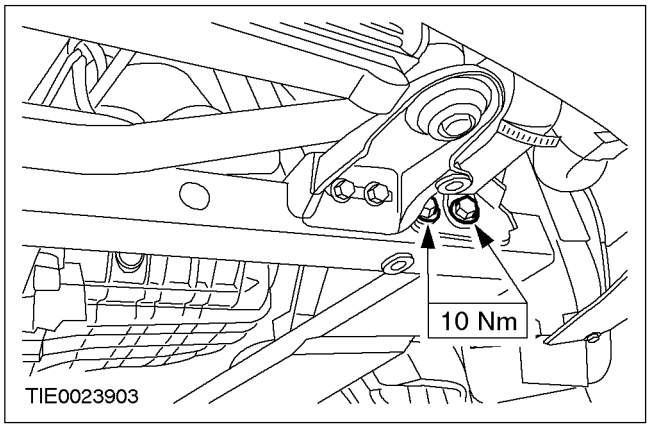
All vehicles

15. NOTE: Use a 5 mm Allen key to prevent the ball joint from rotating.

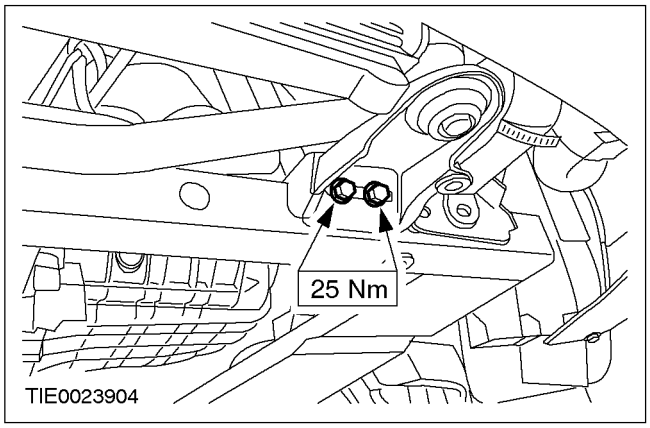
Attach the stabilizer bar connecting links to the suspension struts (right-hand side shown).



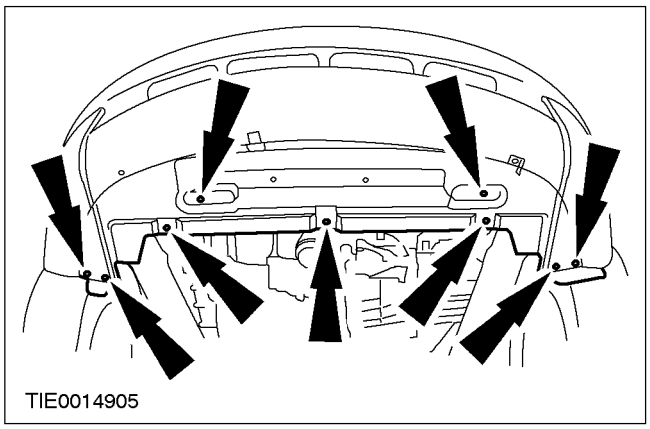
16. Install the coolant hose support bracket.



17. Install the radiator support brackets (left-hand side shown).



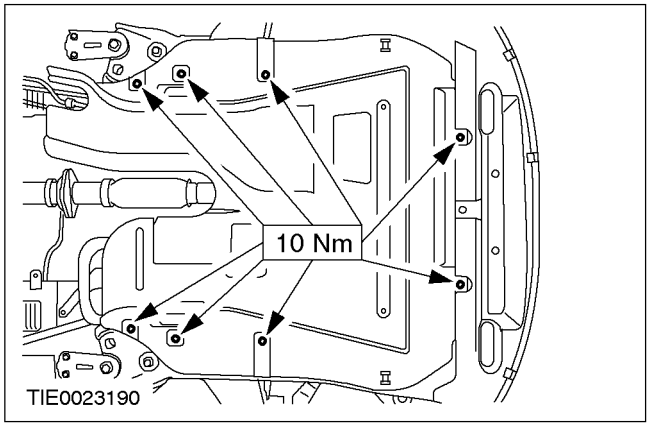
18. Install the splash shield.



REMOVAL AND INSTALLATION (Continued)

Vehicles with diesel engine

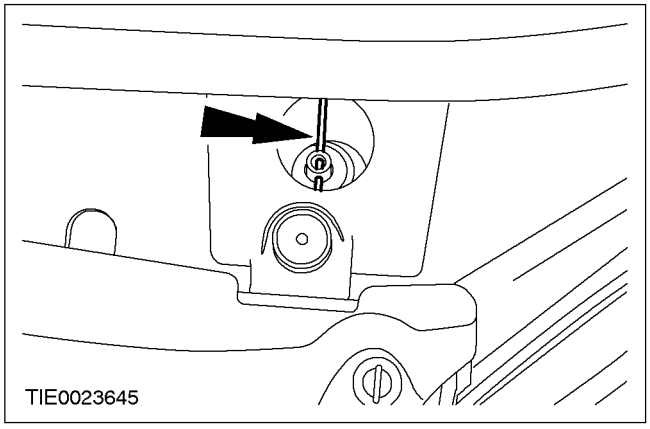
19. Install the engine undershield.



All vehicles

20. Install the front wheels and tires. For additional information, refer to Section 204-04.

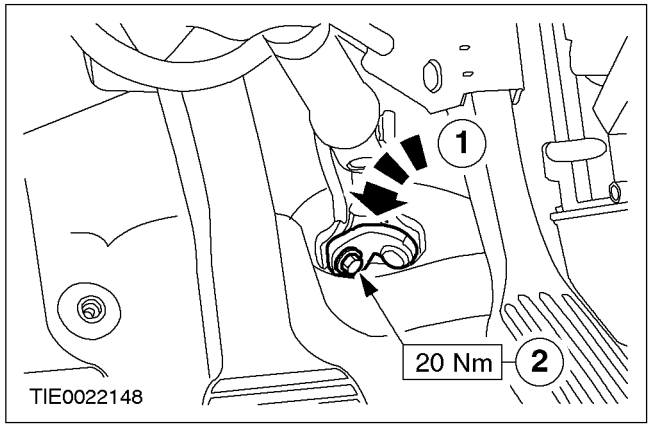
21. Remove the radiator support pins (left-hand side shown).



22. WARNING: Install a new steering column to steering column flexible coupling retaining bolt. Failure to follow this instruction may result in personal injury.

Connect the steering column shaft to the steering column flexible coupling.

1. Rotate the clamp plate.
2. Install the retaining bolt.



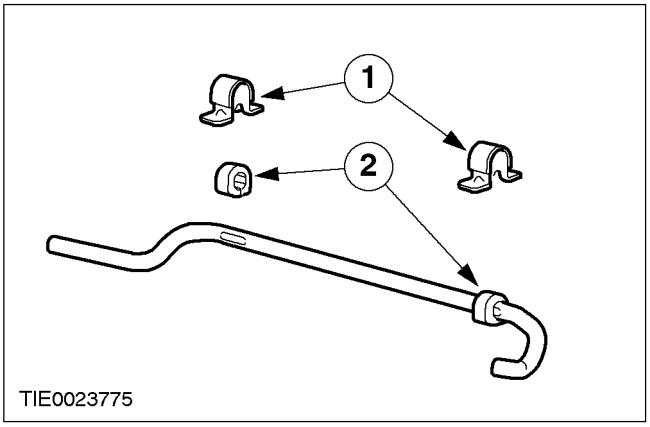
REMOVAL AND INSTALLATION

Stabilizer Bar Bushing (14 754 0)

General Equipment
Vise
Vise jaw protectors

Removal

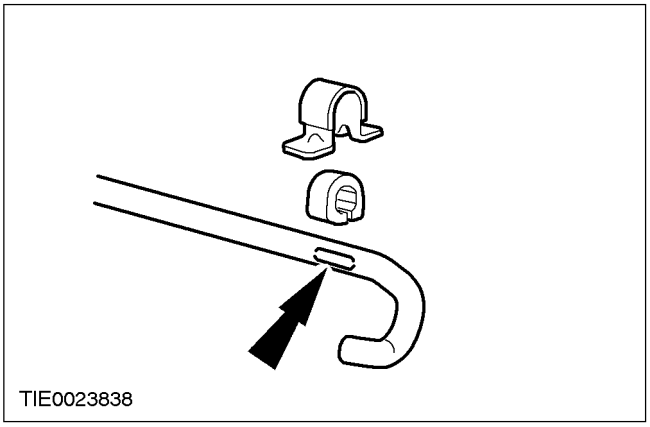
1. **Remove the stabilizer bar.** **For additional information, refer to Stabilizer Bar in this section.**
2. **Remove the stabilizer bar bushings.**
   1. Remove the clamps.
   2. Remove the bushings.



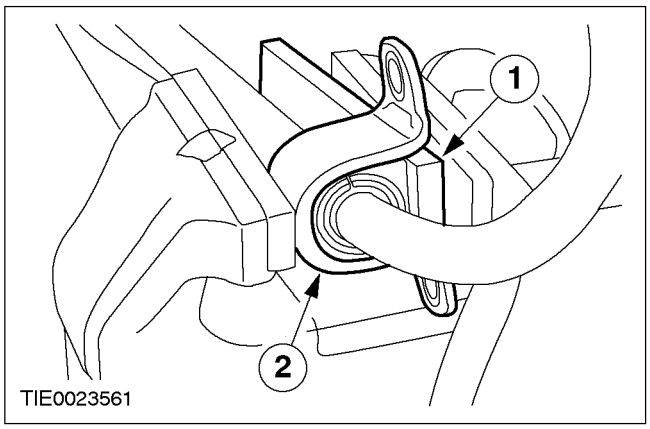
Installation

1. **CAUTION: The stabilizer bar bushings must be located correctly on the flats of the stabilizer bar.**

   Install the stabilizer bar bushings.



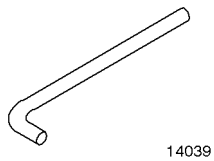
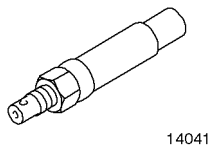
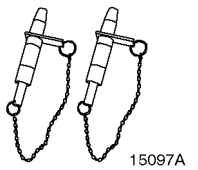
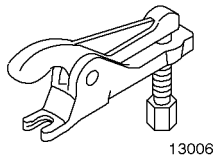
2. **Using a suitable vise fitted with vise jaw protectors, install the stabilizer bar clamps.**
   1. Support the stabilizer bar bushing with a metal bar of 10 mm depth, 30 mm wide and 100 mm long.
   2. Install the clamps.



3. **Install the stabilizer bar.** **For additional information, refer to Stabilizer Bar in this section.**

REMOVAL AND INSTALLATION

Wheel Knuckle (14 343 0)

Special Tool(s)	
 14039	Lever, Wheel Knuckle 204-159 (14-039)
 14041	Installer, Halfshaft 204-161 (14-041)
 15097A	Alignment Pins, Subframe 205-316 (15-097A)
 13006	Separator, Ball Joint 211-020 (13-006)

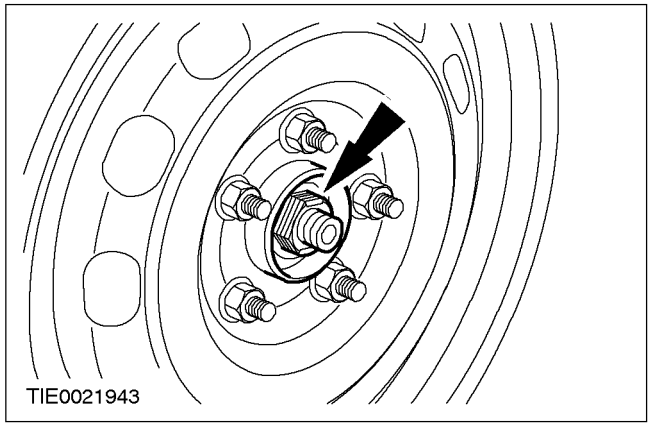
General Equipment
Transmission jack
Three leg puller

Removal

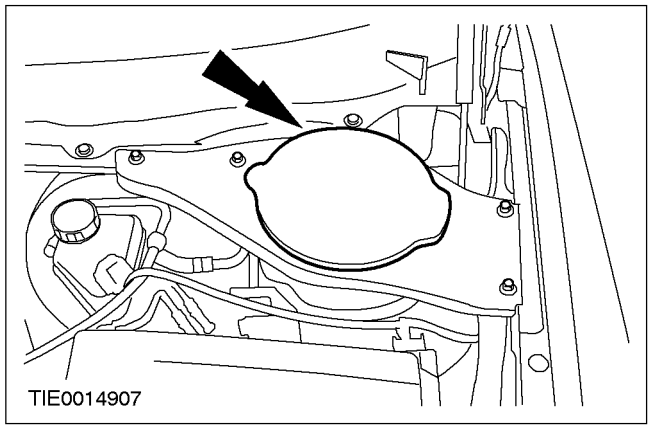
All vehicles

1. ⚠ **CAUTION: Use a socket to loosen the wheel hub retaining nut to prevent damage.**

   Loosen the wheel hub retaining nut.



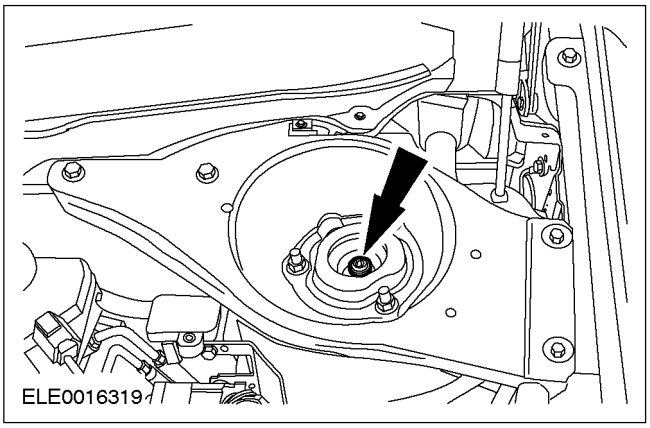
2. **Remove the strut and spring assembly top mount brace cover.**



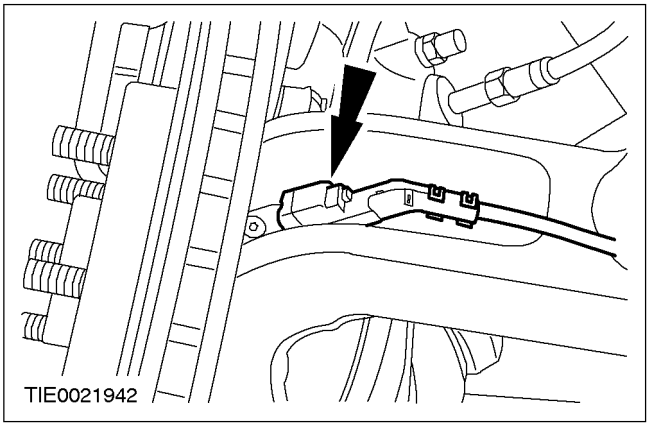
REMOVAL AND INSTALLATION (Continued)

the piston rod from rotating.

Loosen the strut and spring assembly top mount nut by five turns.



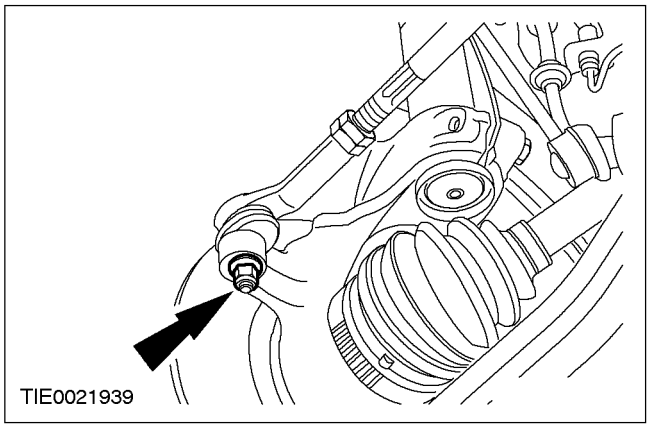
4. **Remove the wheel and tire. For additional information, refer to Section 204-04.**
5. **Disconnect the front wheel speed sensor electrical connector from the front wheel speed sensor.**



6. **CAUTION: Leave the tie-rod end retaining nut in place to protect the ball joint stud.**

NOTE: Use a 5 mm Allen key to prevent the ball joint stud from rotating.

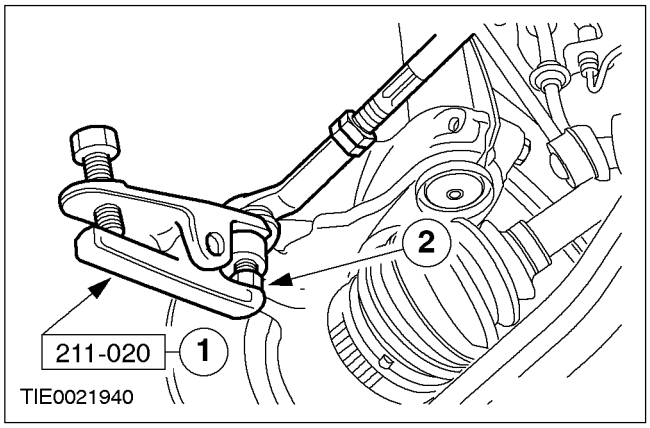
Loosen the tie-rod end retaining nut.



7. **CAUTION: Protect the ball joint seal using a soft cloth to prevent damage.**

Using the special tool, detach the tie-rod end from the wheel knuckle.

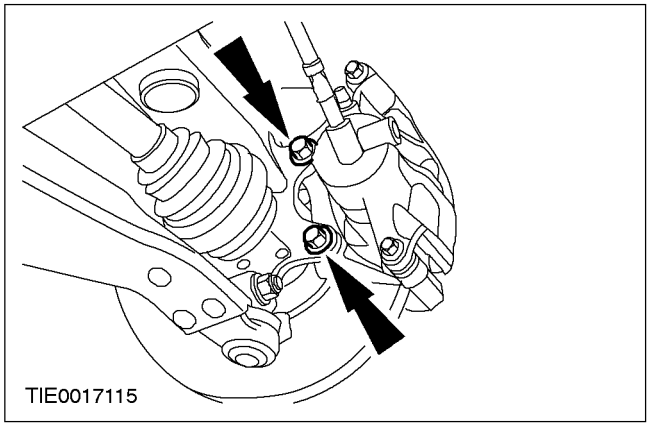
1. Release the tie-rod end.
2. Remove the tie-rod end retaining nut.
   - Discard the retaining nut.



REMOVAL AND INSTALLATION (Continued)

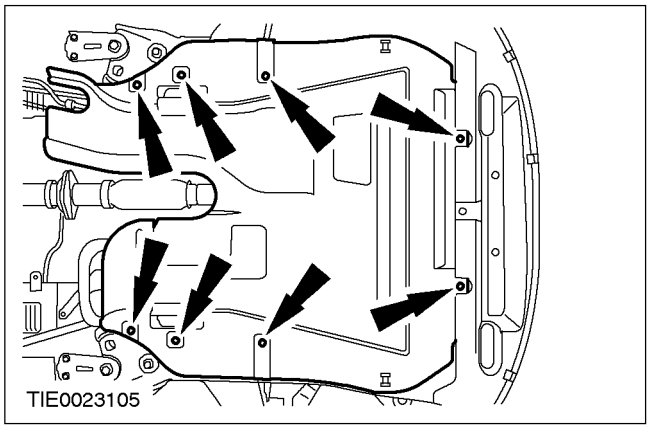
8. **CAUTION: Suspend the brake caliper and anchor plate to prevent load being placed on the brake hose.**

   Detach the brake caliper and anchor plate from the wheel knuckle.



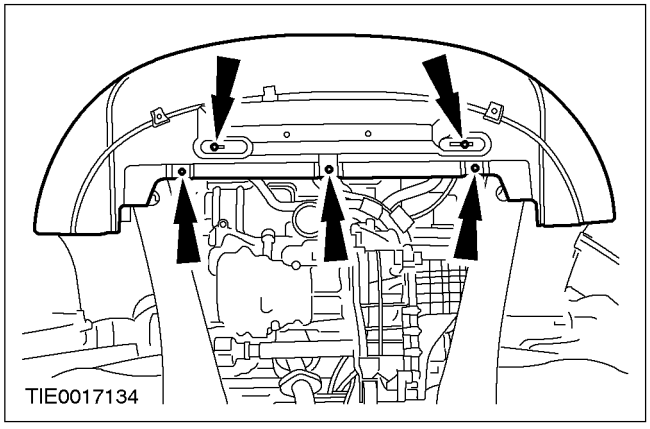
Vehicles with diesel engine

9. **Remove the engine undershield.**



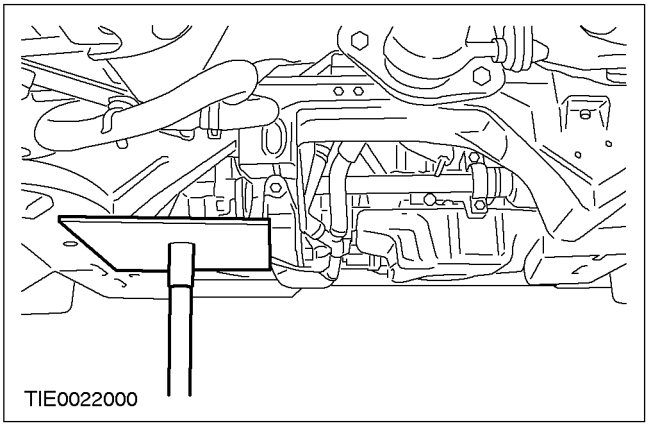
All vehicles

10. **Detach the splash shield from the subframe.**

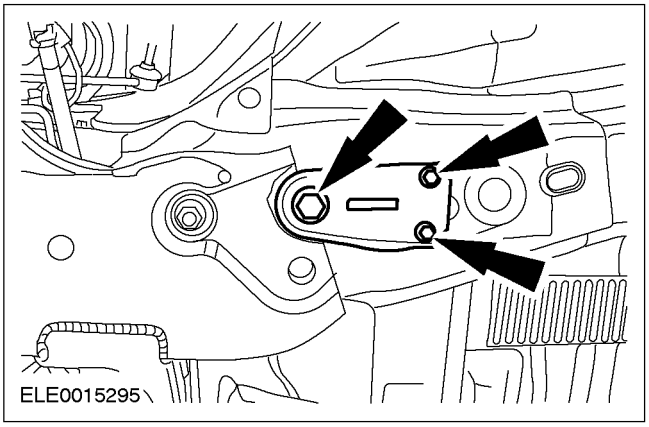


11. **NOTE:** Only one side of the subframe needs to be lowered to detach the lower arm ball joint from the wheel knuckle.

    Using a suitable transmission jack, support the side of the subframe to be lowered.



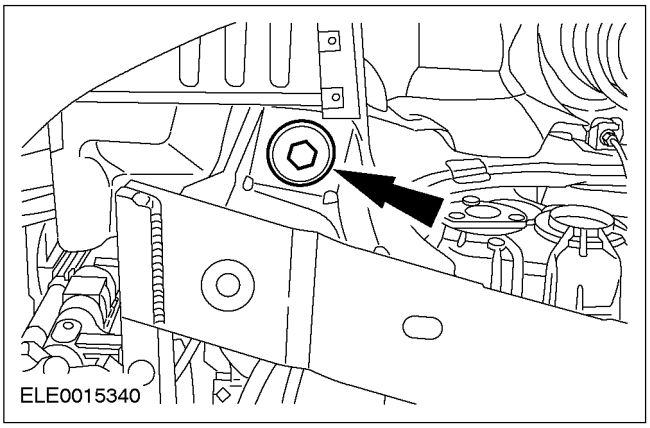
12. **Remove the subframe rear retaining bolt and the subframe rear bracket retaining bolts, on the side the wheel knuckle is being removed (right-hand side shown).**



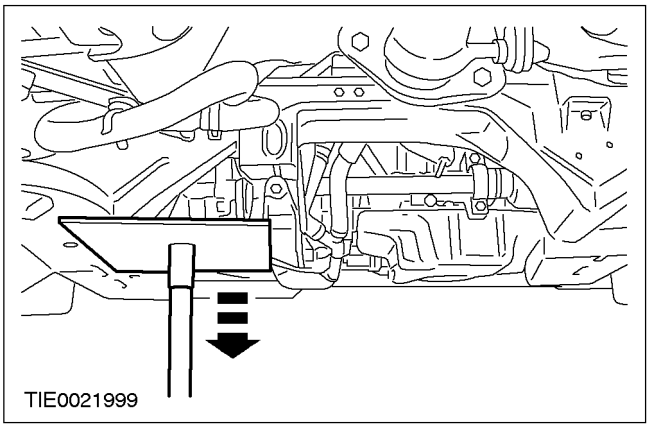
13. **Loosen the subframe rear retaining bolt and the subframe rear bracket retaining bolts, on the opposite side, by five turns.**

REMOVAL AND INSTALLATION (Continued)

14. **Remove the subframe front retaining bolt, on the side the wheel knuckle is being removed (right-hand side shown).**

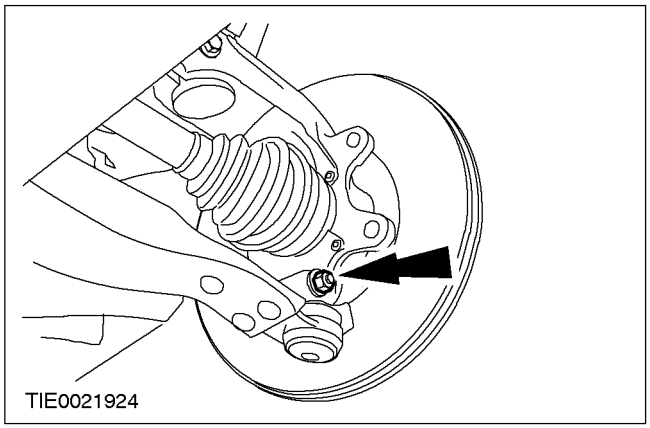


15. **Loosen the subframe front retaining bolt, on the opposite side, by five turns.**
16. **Lower the subframe to gain access to the lower arm rear retaining bolt.**



17. **CAUTION: To prevent damage to the lower arm hydro-bushing, make sure the subframe is lowered before detaching the lower arm ball joint from the wheel knuckle.**

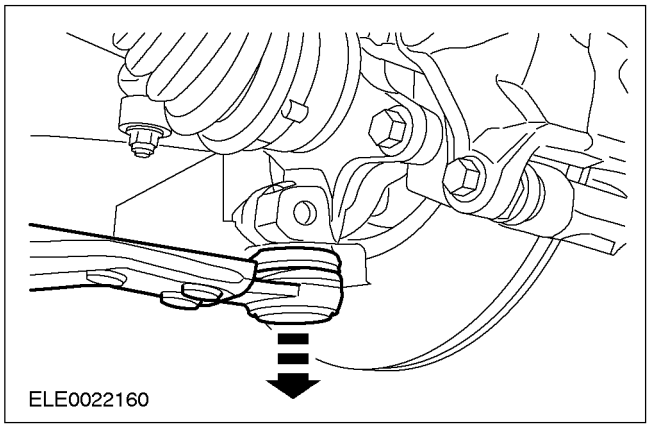
    Remove the lower arm ball joint to wheel knuckle pinch bolt and nut.



18. **CAUTION: Protect the ball joint seal using a soft cloth to prevent damage.**

    Detach the lower arm ball joint from the wheel knuckle.

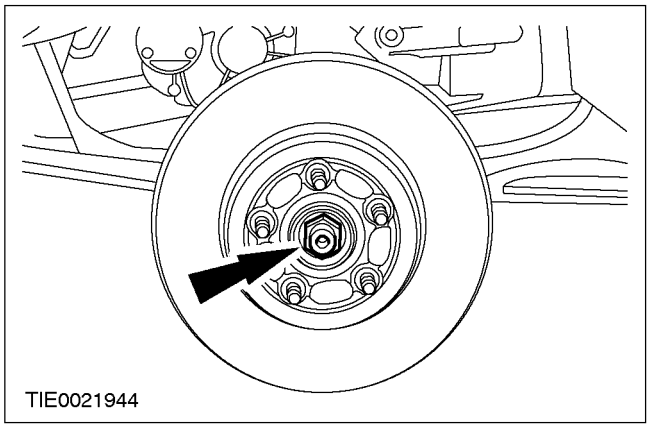
    - Remove the heat shield.



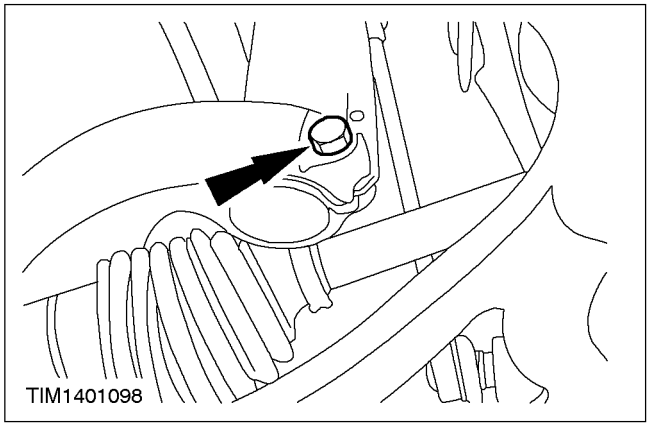
REMOVAL AND INSTALLATION (Continued)

19. **CAUTION: The wheel hub retaining nut can be re-used four times, mark the retaining nut.**

    Remove the wheel hub retaining nut.

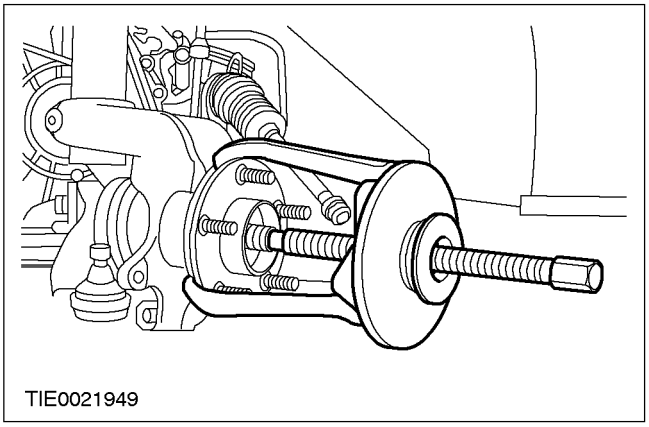


20. **Remove the brake disc.**
21. **Remove the wheel knuckle to suspension strut pinch bolt.**

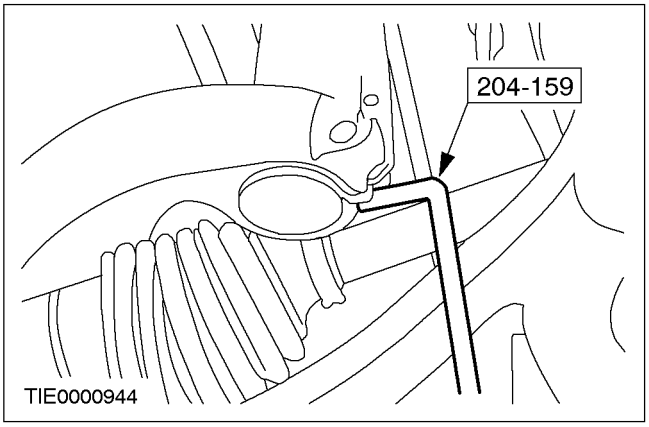


22. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

    Using a suitable three leg puller, detach the wheel hub from the halfshaft.



23. **Using the special tool, remove the wheel knuckle.**

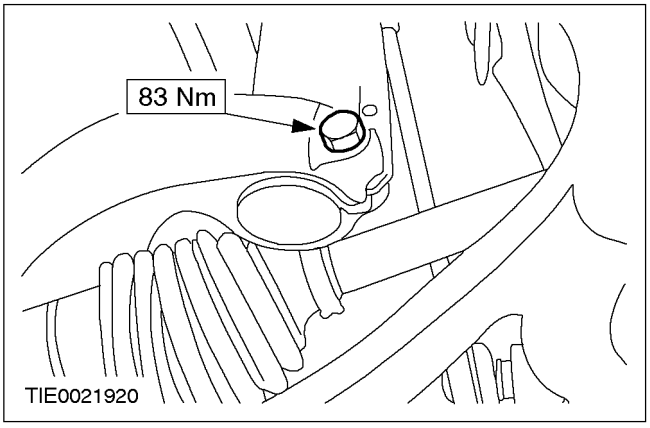


REMOVAL AND INSTALLATION (Continued)

Installation

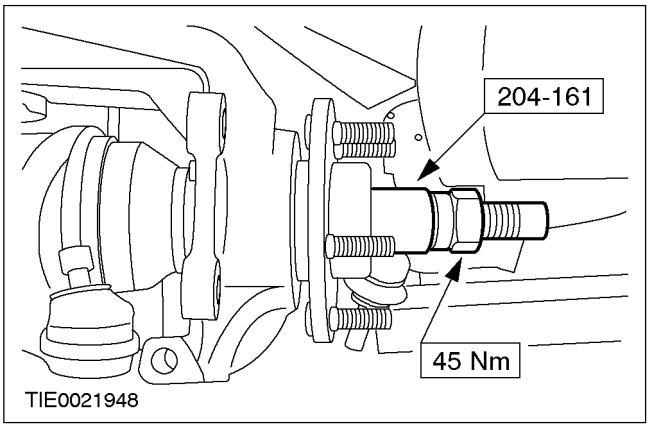
All vehicles

1. Install the wheel knuckle.



2. CAUTION: Make sure the halfshaft is completely installed into the wheel hub.

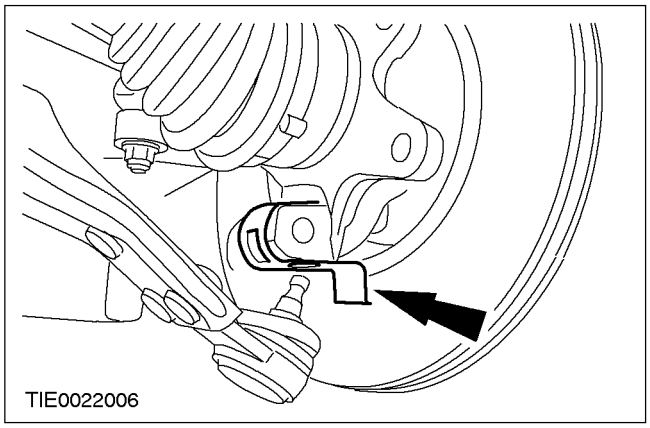
Using the special tool, attach the wheel hub to the halfshaft.



3. Install the brake disc.

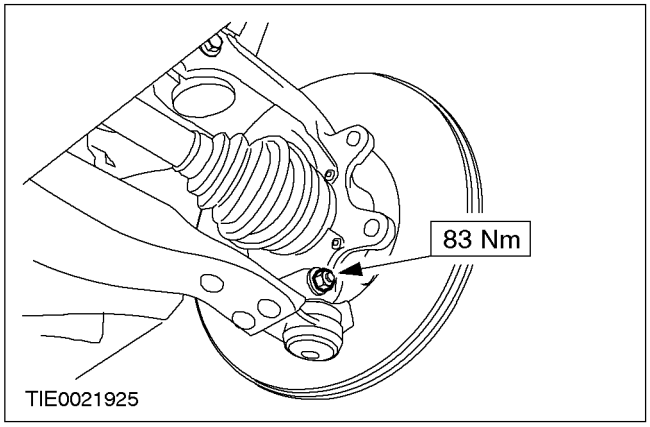
4. CAUTION: Make sure the heat shield is installed to prevent damage to the ball joint.

Install the heat shield.



5. CAUTION: The lower arm pinch bolt must be installed from the rear of the wheel knuckle.

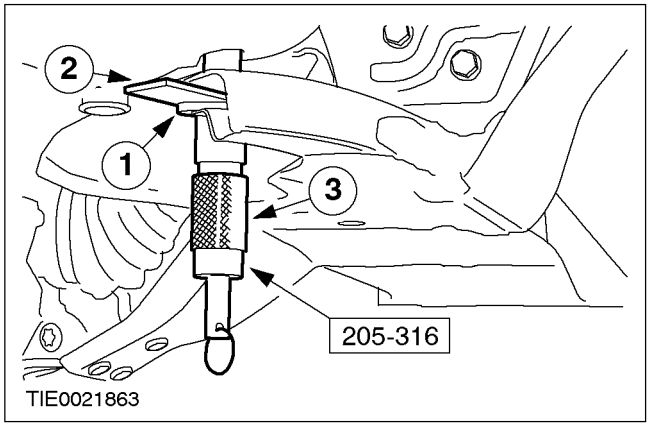
Attach the lower arm ball joint to the wheel knuckle.



REMOVAL AND INSTALLATION (Continued)

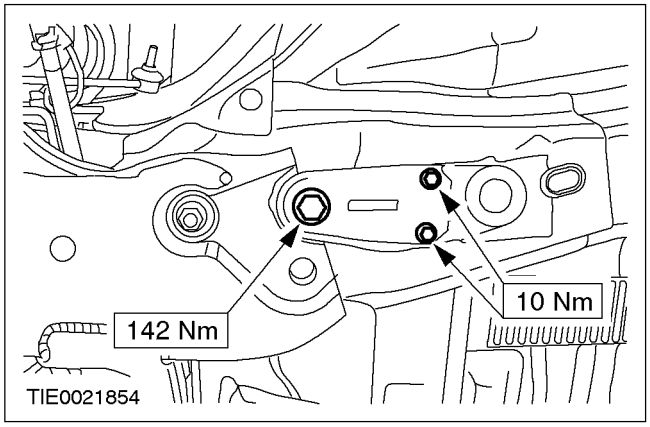
6. Using the special tool and a suitable washer, align the subframe.

1. Insert the washer, with inside diameter 22 mm, outside diameter 44 mm and height 5 mm, into the subframe above the lower alignment hole.
2. Insert the alignment pin through the subframe alignment holes and the washer.
3. Slide the locking plates on top of the washer and into the groove of the tool and tighten the alignment pin sleeve.

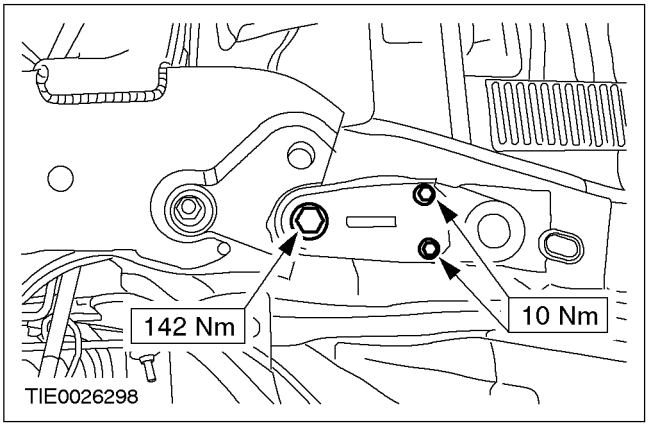


7. CAUTION: While tightening the subframe retaining bolts, make sure the subframe does not move.

Install the subframe rear retaining bolt and the subframe bracket retaining bolts, on the side the wheel knuckle was installed (right-hand side shown).

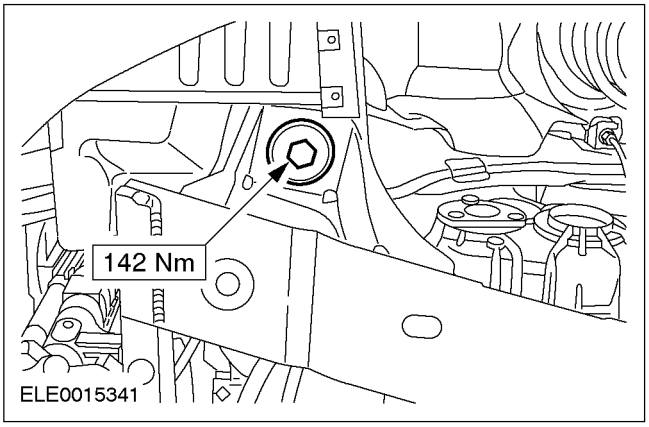


8. Tighten the subframe rear retaining bolt and the subframe bracket retaining bolts, on the opposite side (left-hand side shown).



9. CAUTION: While tightening the subframe retaining bolts, make sure the subframe does not move.

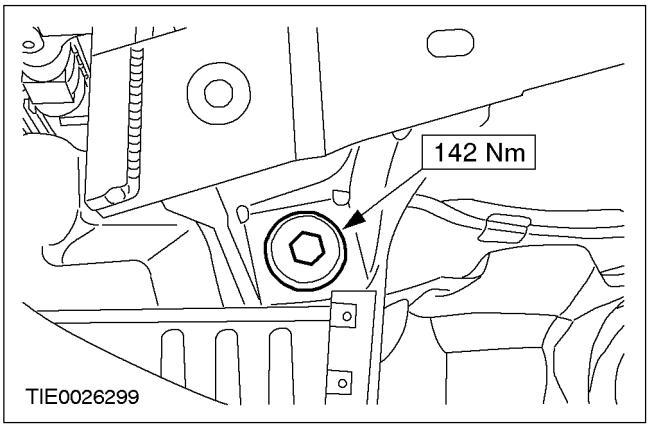
Install the subframe front retaining bolt, on the side the wheel knucle was installed (right-hand side shown).



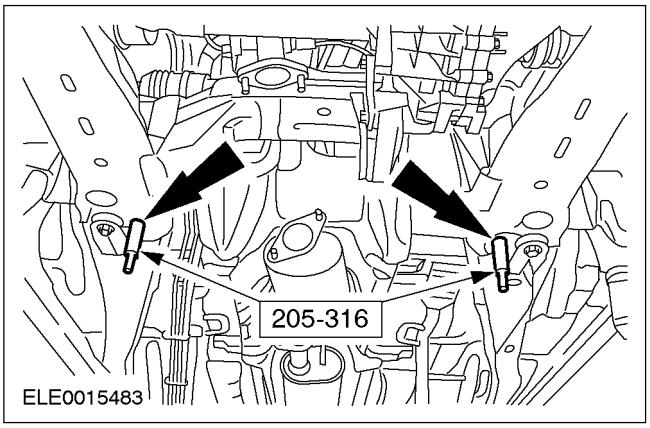
REMOVAL AND INSTALLATION (Continued)

10. Tighten the subframe front retaining bolt, on opposite side (left-hand side shown).

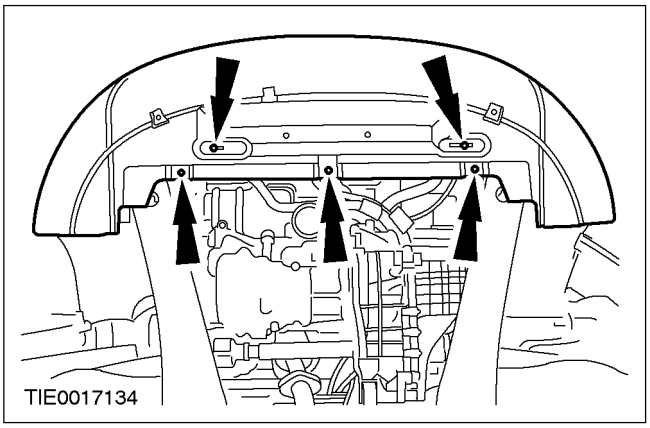
- Lower and remove the transmission jack.



11. Remove the special tools.

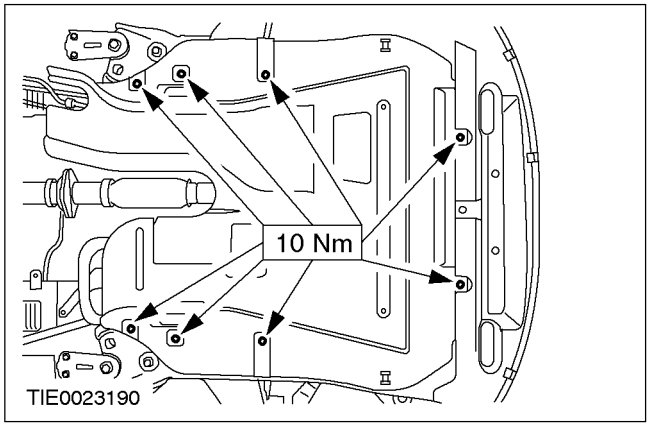


12. Attach the splash shield to the subframe.



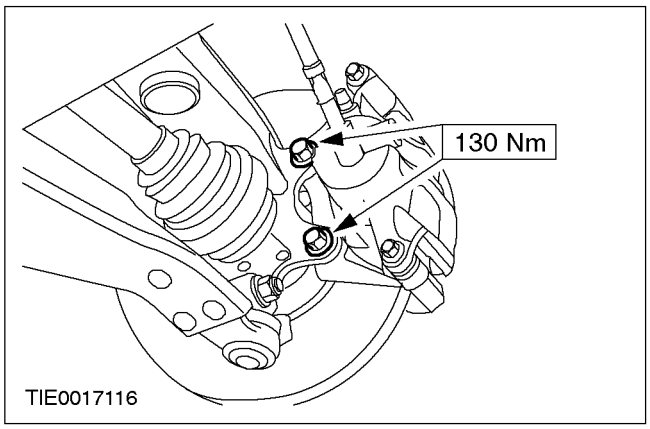
Vehicle with diesel engine

13. Install the engine undershield.



All vehicles

14. Attach the brake caliper and anchor plate to the wheel knuckle.

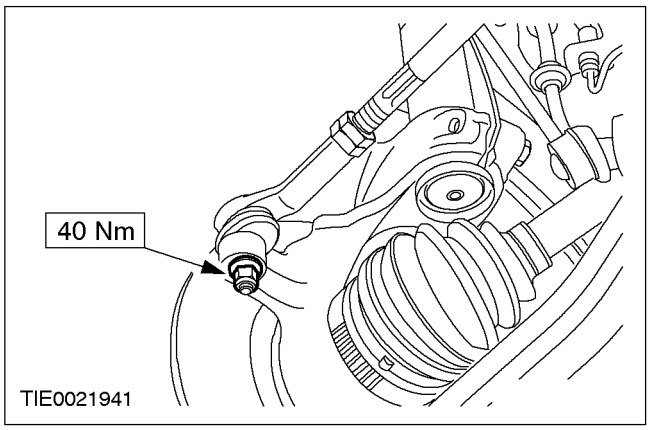


REMOVAL AND INSTALLATION (Continued)

15. **WARNING: Install a new tie-rod end retaining nut. Failure to follow this instruction may result in personal injury.**

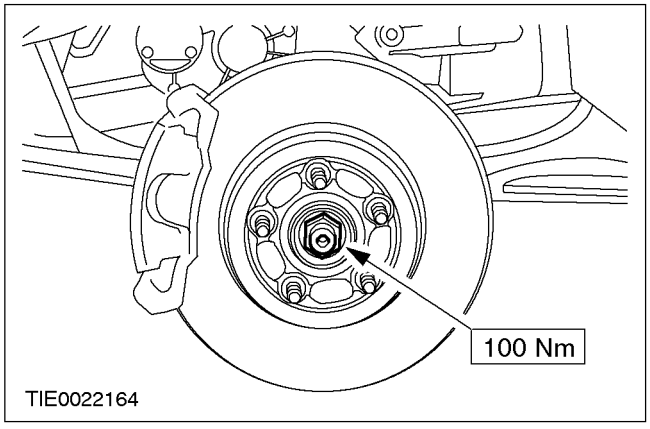
NOTE: Use a 5 mm Allen key to prevent the ball joint stud from rotating.

Attach the tie-rod end to the wheel knuckle.

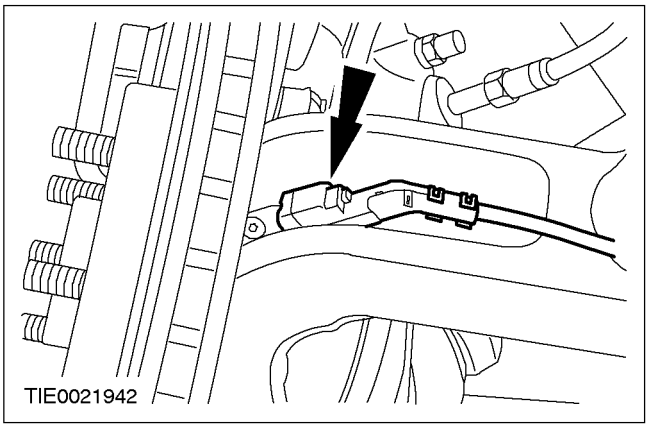


16. **CAUTION: The wheel hub retaining nut can be re-used four times, inspect the markings on the retaining nut and install a new retaining nut if necessary.**

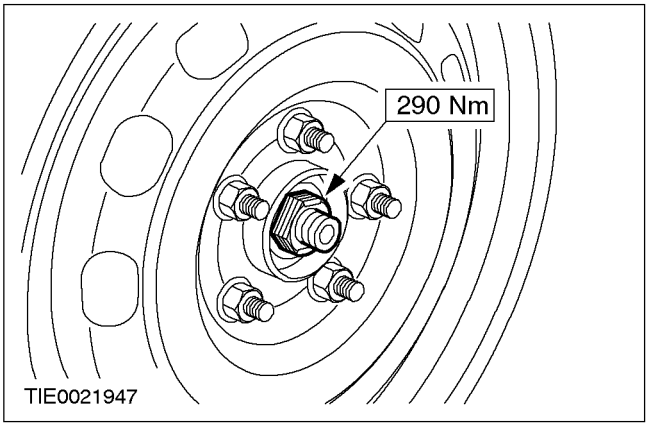
With the aid of another technician, apply the brakes and pre load the wheel bearing by installing the wheel hub retaining nut.



17. **Connect the front wheel speed sensor electrical connector to the front wheel speed sensor.**

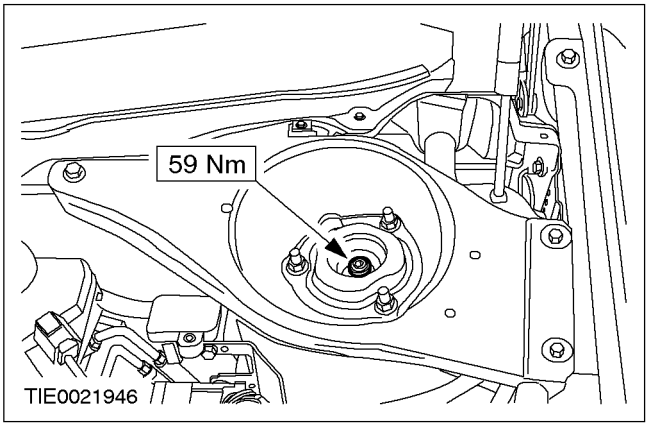


18. **Install the wheel and tire. For additional information, refer to Section 204-04.**
19. **Tighten the wheel hub retaining nut.**



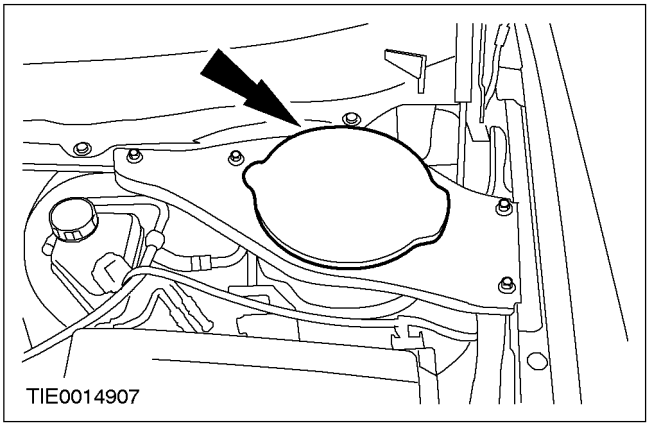
20. **CAUTION: Use an Allen key to prevent the piston rod from turning.**

Tighten the strut and spring assembly top mount nut.



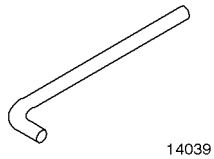
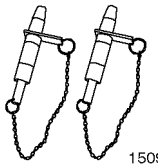
REMOVAL AND INSTALLATION (Continued)

21. Install the strut and spring assembly top mount brace cover.



REMOVAL AND INSTALLATION

Strut and Spring Assembly (14 781 0)

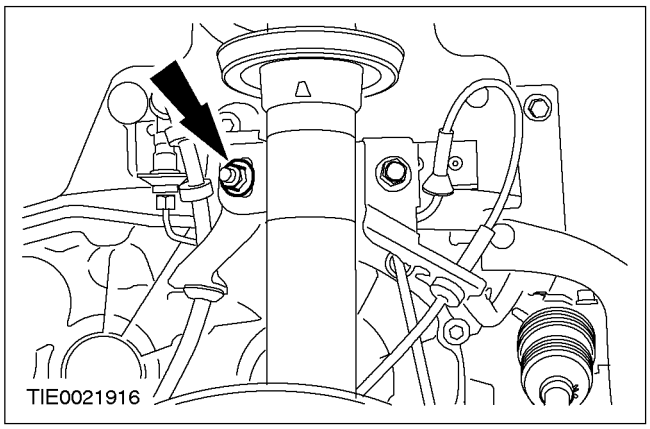
Special Tool(s)	
 14039	Lever, Wheel Knuckle 204-159 (14-039)
 15097A	Alignment Pins, Subframe 205-316 (15-097A)

General Equipment
Transmission jack

Removal

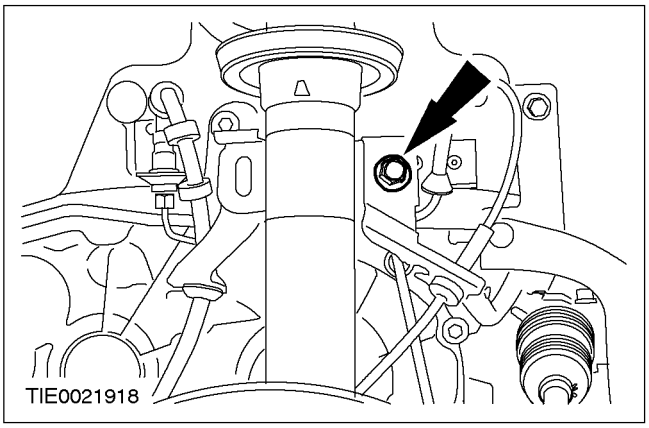
All vehicles

1. **Remove the wheel and tire. For additional information, refer to Section 204-04.**
2. **Detach the brake hose support bracket from the suspension strut.**



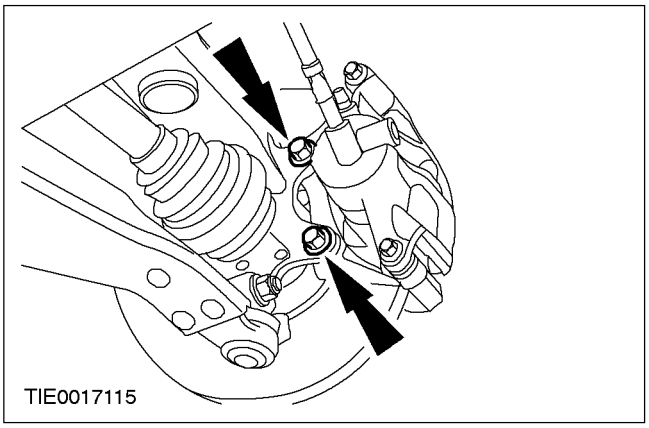
3. **NOTE:** Use a 5 mm Allen key to prevent the ball joint from rotating.

   Detach the stabilizer bar connecting link from the suspension strut.



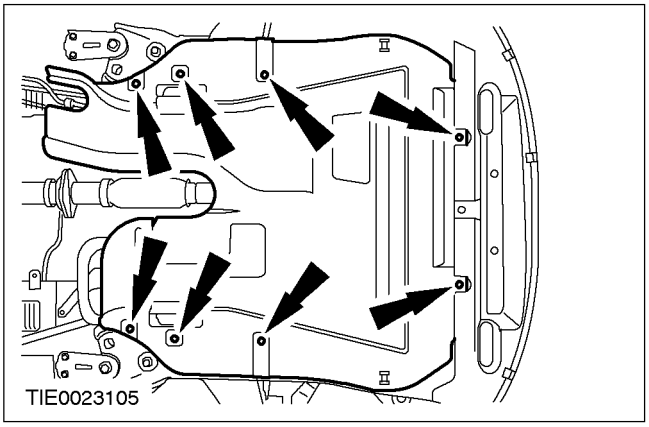
4. **CAUTION: Suspend the brake caliper and anchor plate to prevent load being placed on the brake hose.**

   Detach the brake caliper and anchor plate from the wheel knuckle.



Vehicles with diesel engine

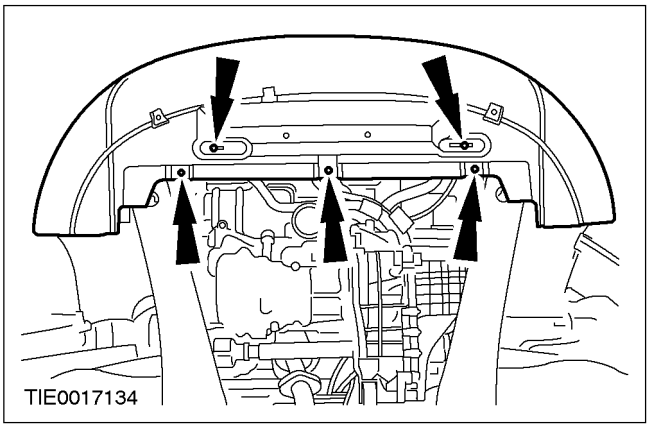
5. **Remove the engine undershield.**



REMOVAL AND INSTALLATION (Continued)

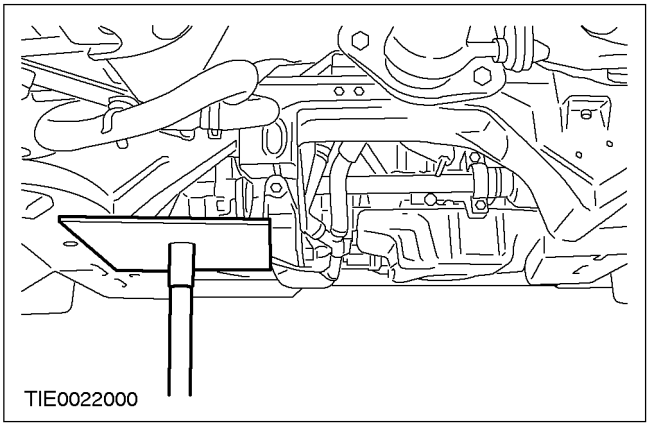
All vehicles

6. **Detach the splash shield from the subframe.**

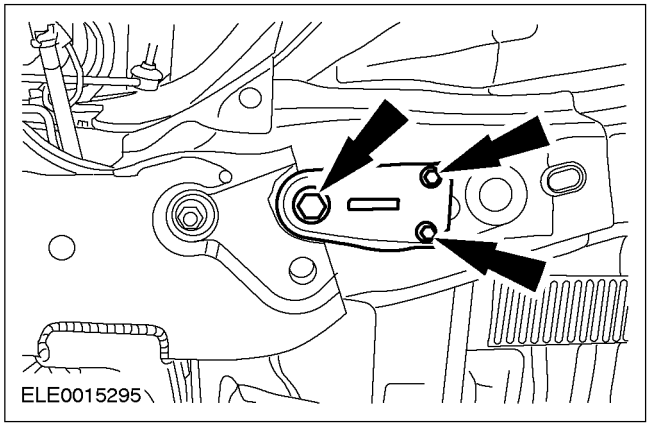


7. **NOTE:** Only one side of the subframe needs to be lowered to detach the lower arm ball joint from the wheel knuckle.

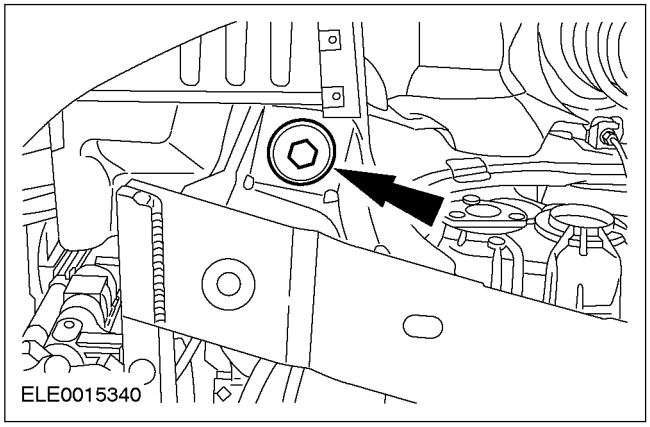
   Using a suitable transmission jack, support the side of the subframe to be lowered.



8. **Remove the subframe rear retaining bolt and the subframe rear bracket retaining bolts, on the side the strut and spring assembly is being removed (right-hand side shown).**



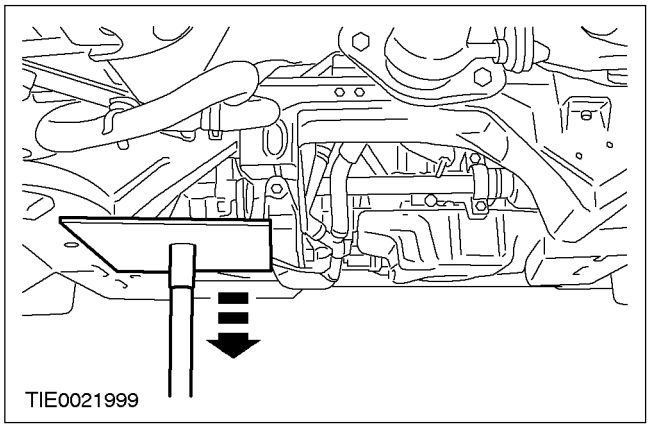
9. **Loosen the subframe rear retaining bolt and the subframe rear bracket retaining bolts, on the opposite side, by five turns.**
10. **Remove the subframe front retaining bolt, on the side the strut and spring assembly is being removed (right-hand side shown).**



11. **Loosen the subframe front retaining bolt, on the opposite side, by five turns.**

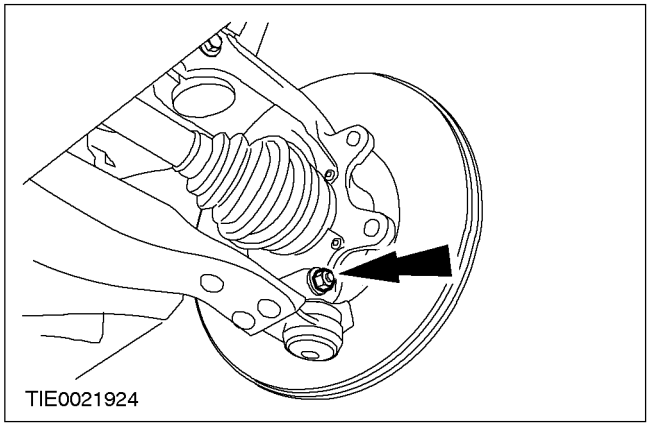
REMOVAL AND INSTALLATION (Continued)

12. Lower the subframe.



13. CAUTION: To prevent damage to the lower arm hydro-bushing, make sure the subframe is lowered before detaching the lower arm ball joint from the wheel knuckle.

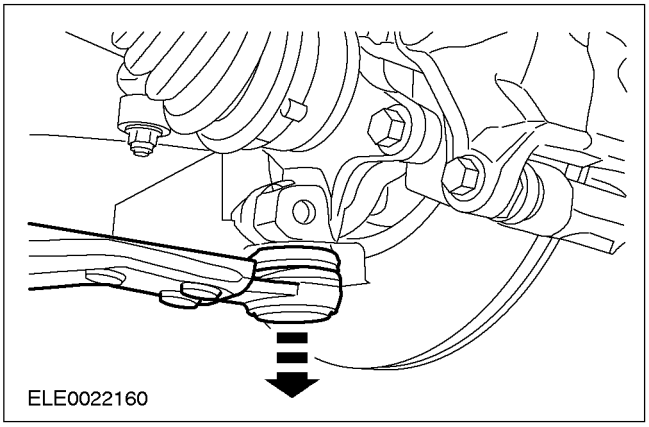
Remove the lower arm ball joint to wheel knuckle pinch bolt and nut.



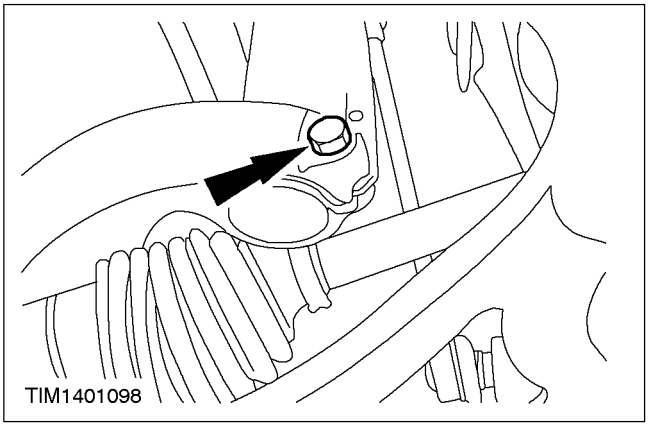
14. CAUTION: Protect the ball joint seal using a soft cloth to prevent damage.

Detach the lower arm ball joint from the wheel knuckle.

- Remove the heat shield.



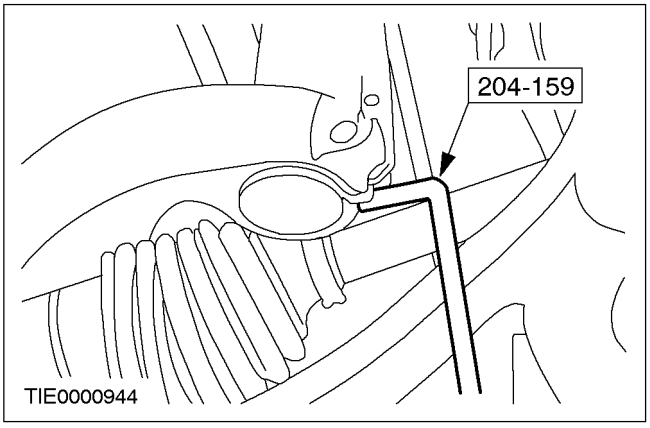
15. Remove the wheel knuckle to suspension strut pinch bolt.



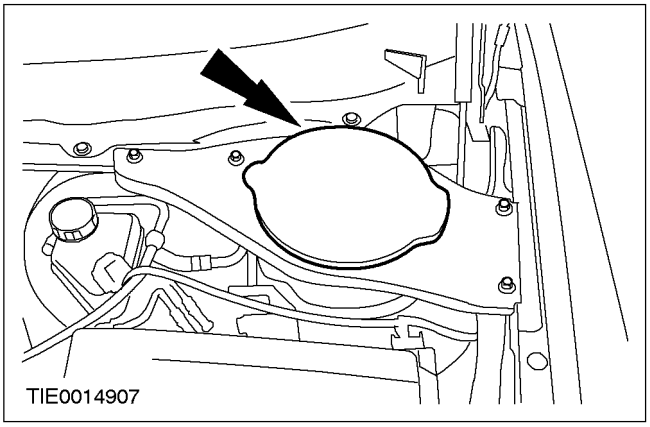
REMOVAL AND INSTALLATION (Continued)

16. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

    Using the special tool, detach the wheel knuckle from the suspension strut.

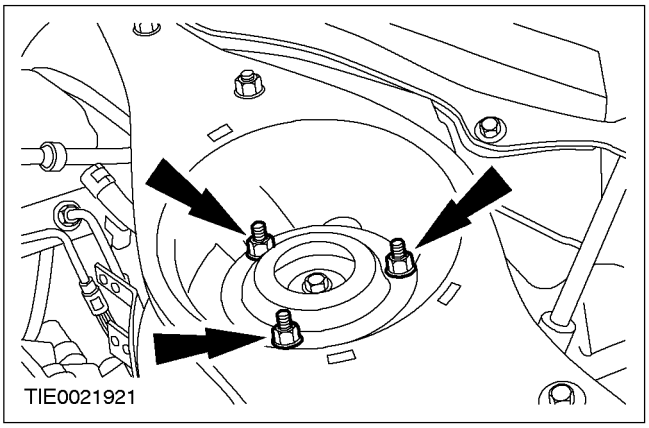


17. **Remove the strut and spring assembly top mount brace cover.**



18. **CAUTION: With the aid of another technician, support the strut and spring assembly.**

    Remove the strut and spring assembly.

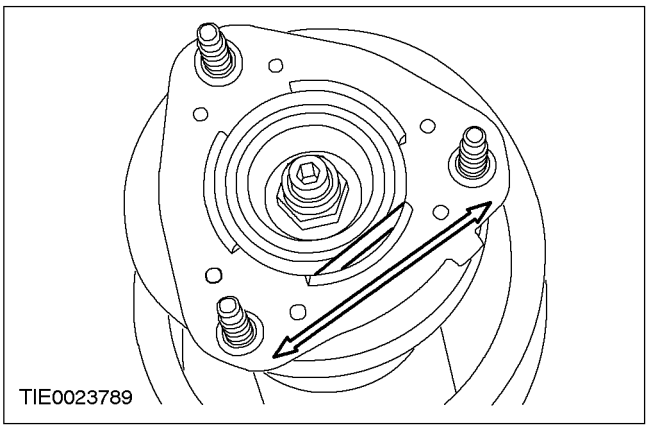


Installation

All vehicles

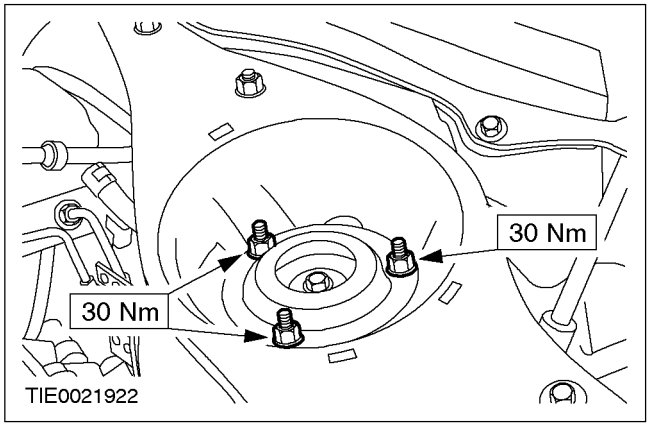
1. **NOTE:** Make sure the arrow and the white line on the top mount are pointing to the front of the vehicle.

   Install the strut and spring assembly.

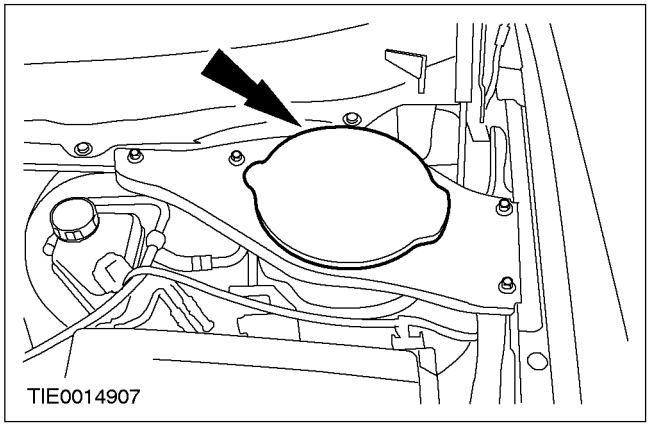


REMOVAL AND INSTALLATION (Continued)

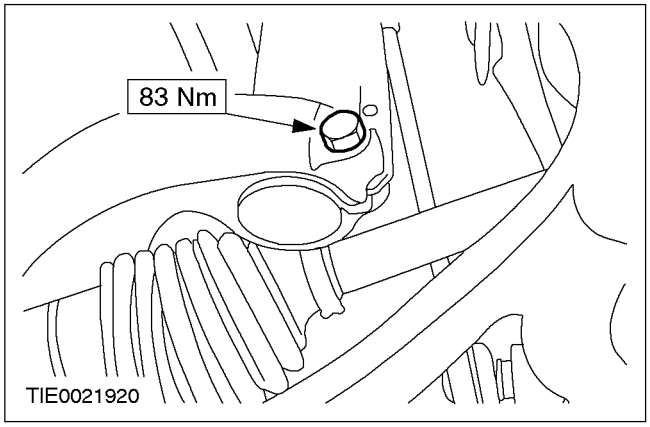
2. **Tighten the strut and spring assembly top mount retaining nuts.**



3. **Install the strut and spring assembly top mount brace cover.**

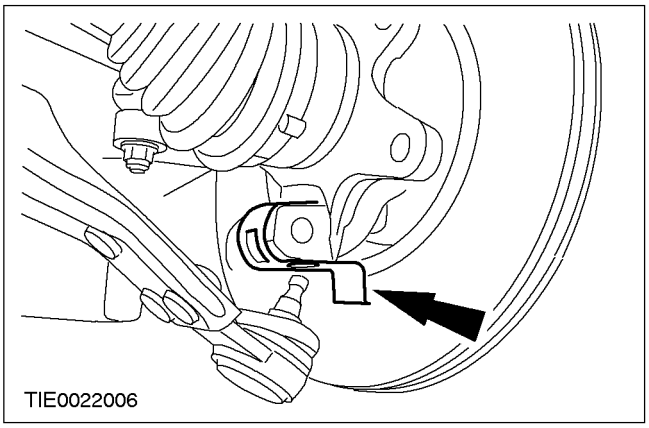


4. **Attach the wheel knuckle to the suspension strut.**



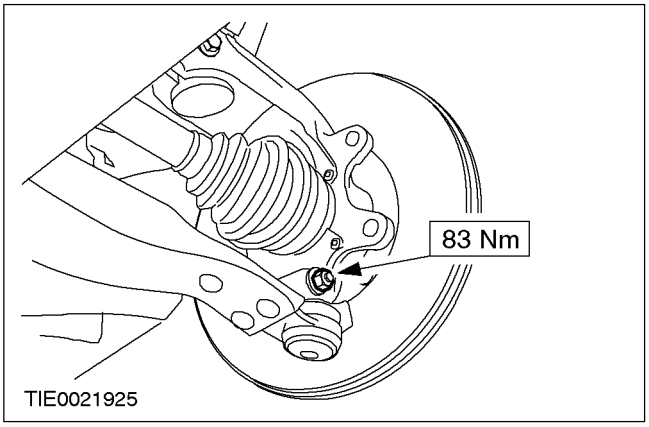
5. **CAUTION: Make sure the heat shield is installed to prevent damage to the ball joint.**

   Install the heat shield.



6. **CAUTION: The lower arm pinch bolt must be installed from the rear of the wheel knuckle.**

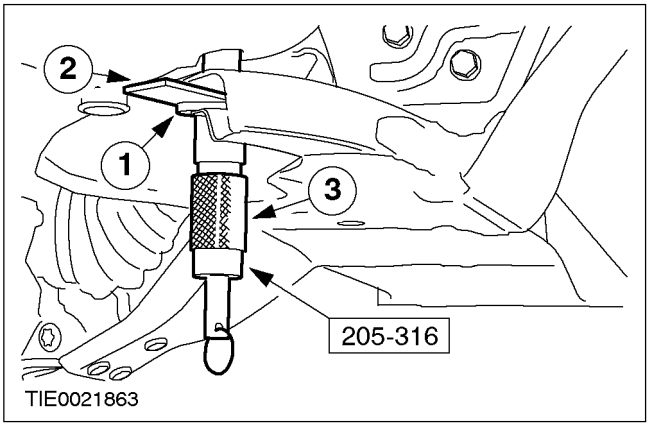
   Attach the lower arm ball joint to the wheel knuckle.



REMOVAL AND INSTALLATION (Continued)

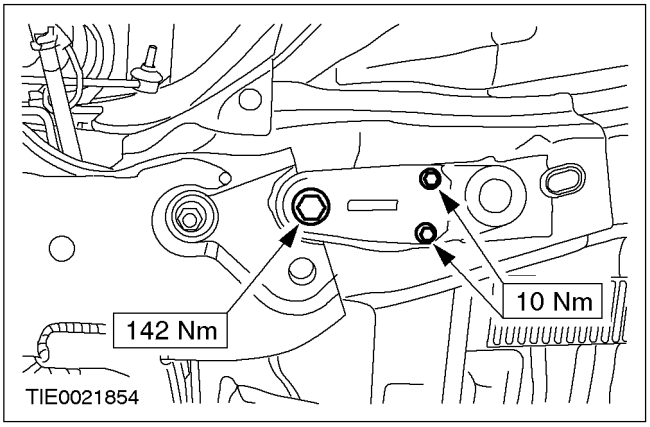
7. Using the special tool and a suitable washer, align the subframe.

1. Insert the washer, with inside diameter 22 mm, outside diameter 44 mm and height 5 mm, into the subframe above the lower alignment hole.
2. Insert the alignment pin through the subframe alignment holes and the washer.
3. Slide the locking plates on top of the washer and into the groove of the tool and tighten the alignment pin sleeve.

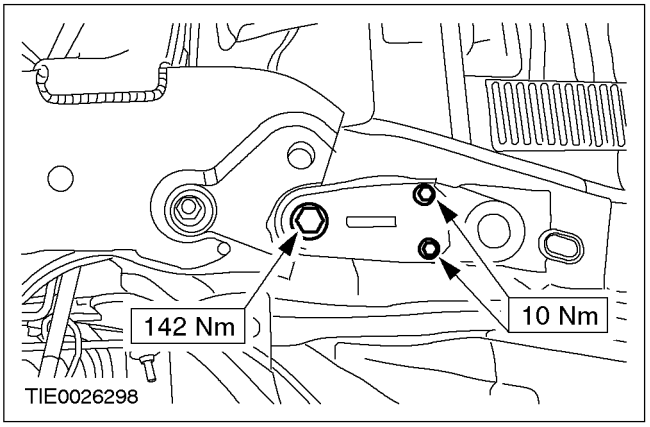


8. ⚠ CAUTION: While tightening the subframe retaining bolts, make sure the subframe does not move.

Install the subframe rear retaining bolt and the subframe bracket retaining bolts, on the side the strut and spring assembly was installed (right-hand side shown).

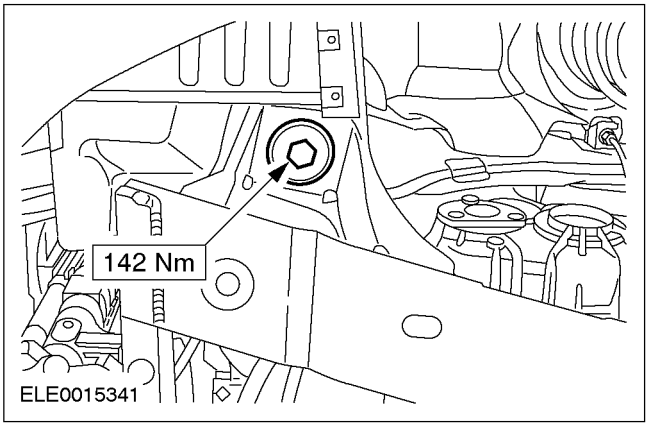


9. Tighten the subframe rear retaining bolt and the subframe bracket retaining bolts, on the opposite side (left-hand side shown).



10. ⚠ CAUTION: While tightening the subframe retaining bolts, make sure the subframe does not move.

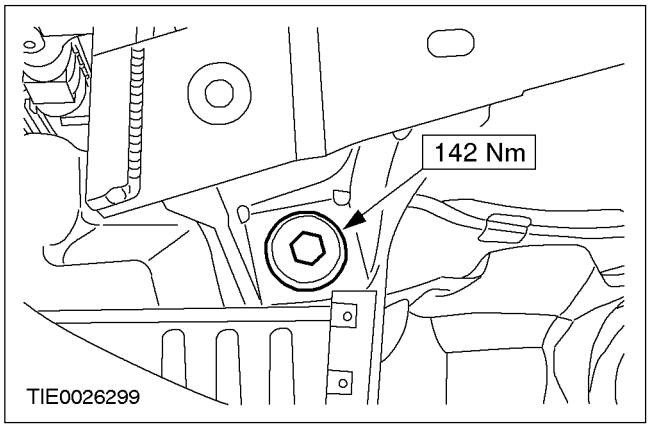
Install the subframe front retaining bolt, on the side the strut and spring assembly was installed (right-hand side shown).



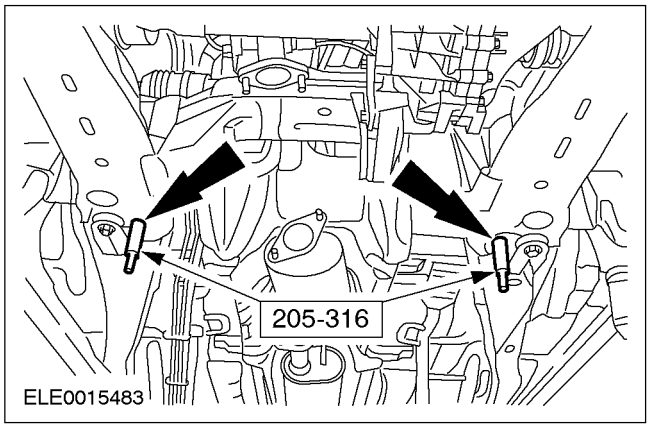
REMOVAL AND INSTALLATION (Continued)

11. Tighten the subframe front retaining bolt, on the opposite side (left-hand side shown).

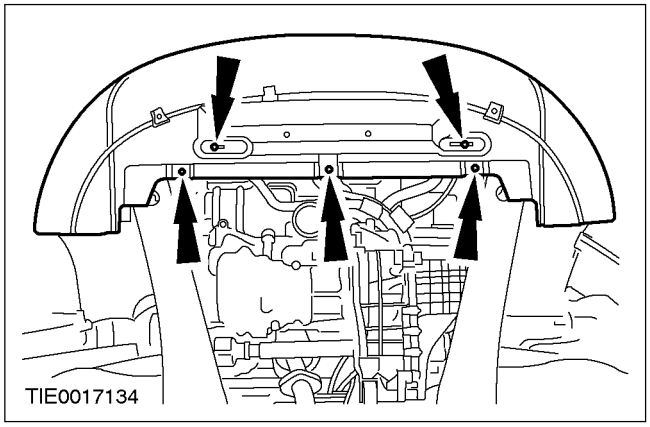
- Lower and remove the transmission jack.



12. Remove the special tools.

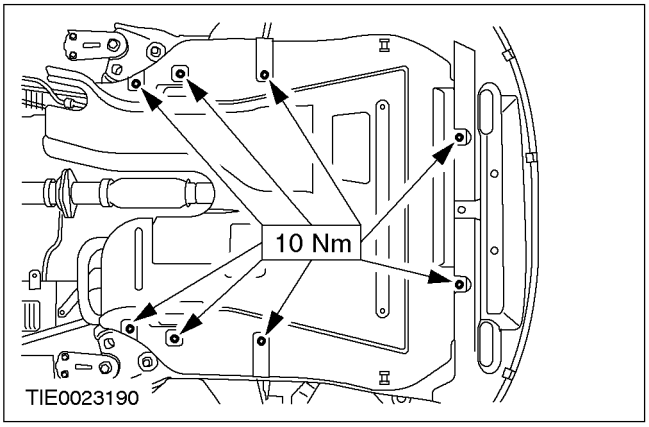


13. Attach the splash shield to the subframe.



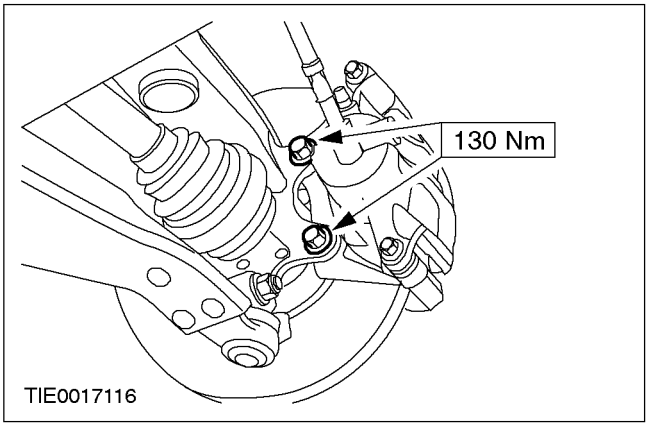
Vehicles with diesel engine

14. Install the engine undershield.



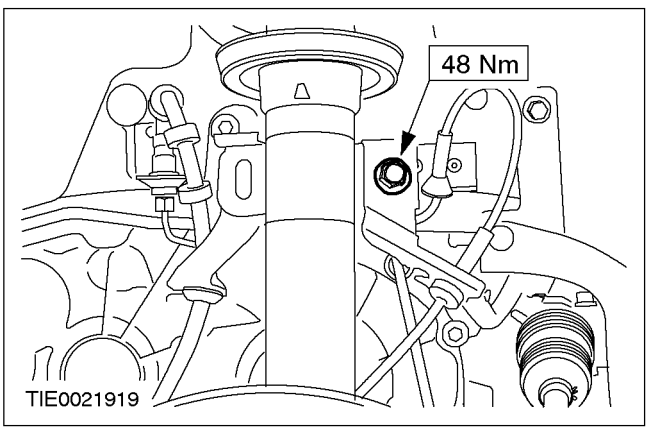
All vehicles

15. Attach the brake caliper and anchor plate to the wheel knuckle.



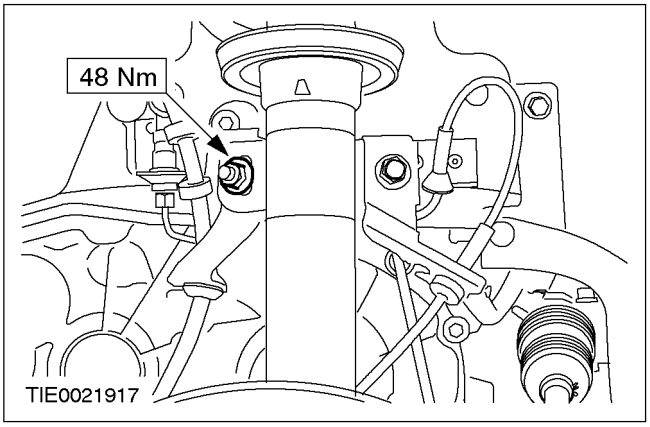
16. NOTE: Use a 5 mm Allen key to prevent the ball joint from rotating.

Attach the stabilizer bar connecting link to the suspension strut.



REMOVAL AND INSTALLATION (Continued)

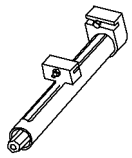
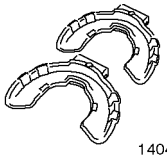
17. **Attach the brake hose support bracket to the suspension strut.**



18. **Install the wheel and tire. For additional information, refer to Section 204-04.**

DISASSEMBLY AND ASSEMBLY

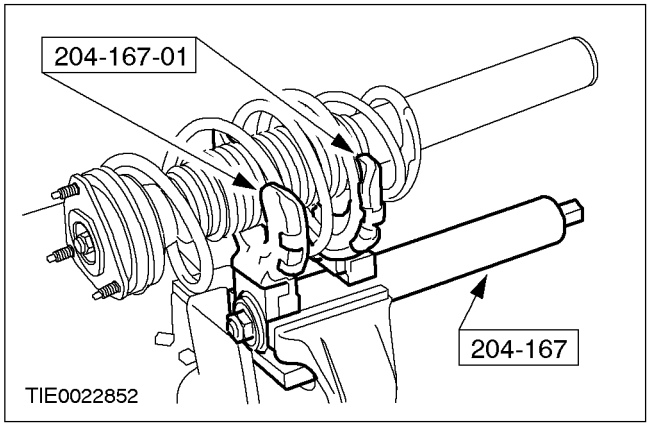
Strut and Spring Assembly (14 783 4)

Special Tool(s)	
 14042	Compressor, Coil Spring 204-167 (14-042)
 1404201	Adaptors for 204-167 204-167-01 (14-042-01)

Disassembly

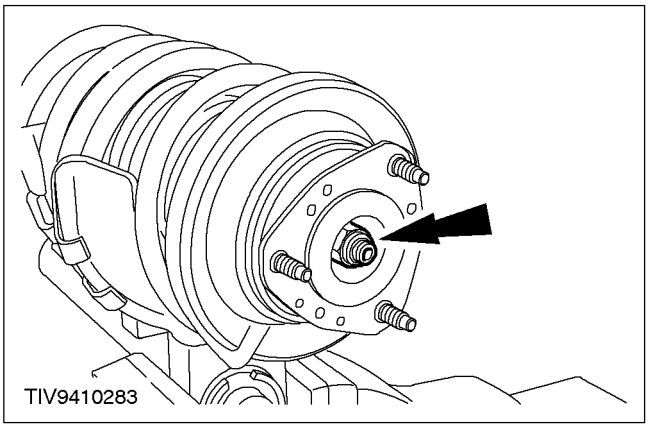
1. **WARNING: The spring is under extreme tension; care must be taken at all times. Failure to follow this instruction may result in personal injury.**

   Using the special tools, compress the spring.



2. **CAUTION: Use an Allen key to prevent the piston rod from rotating.**

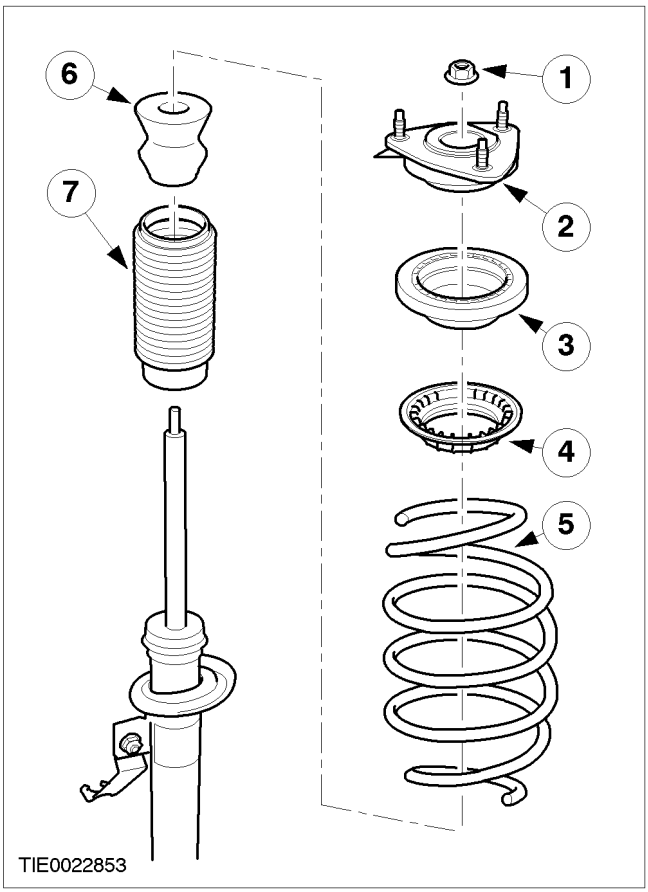
   Loosen the thrust bearing retaining nut.



DISASSEMBLY AND ASSEMBLY (Continued)

3. Disassemble the strut and spring assembly.

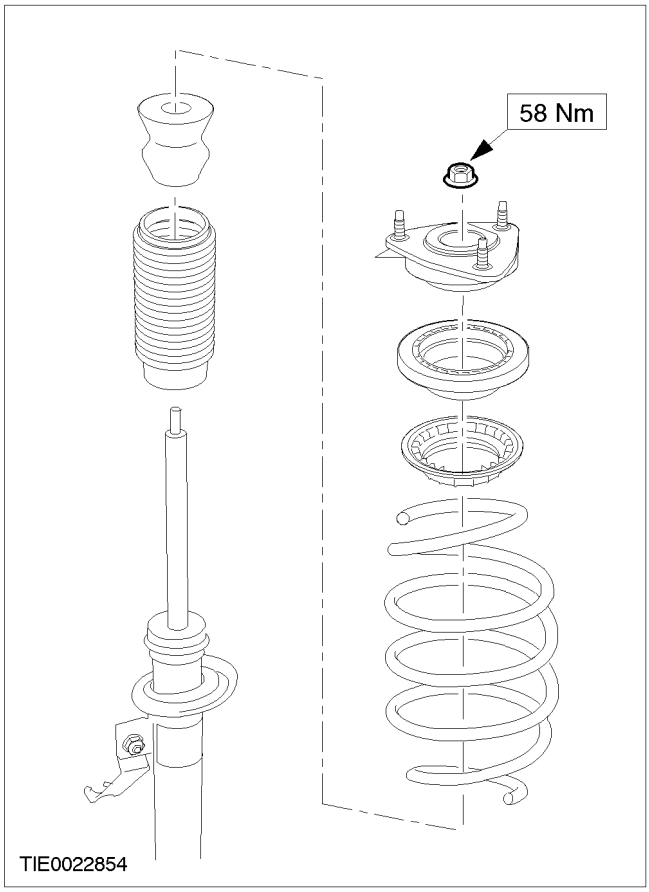
1. Remove the thrust bearing retaining nut.
2. Remove the top mount.
3. Remove the thrust bearing.
4. Remove the spring seat.
5. Remove the spring.
6. Remove the bump stop.
7. Remove the boot.



Assembly

1. CAUTION: The ends of the spring must locate correctly in the spring seats.

To assemble, reverse the disassembly procedure.



SECTION 204-02 Rear Suspension

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

SPECIFICATIONS

Specifications 204-02-2

DESCRIPTION AND OPERATION

Rear Suspension 204-02-3

DIAGNOSIS AND TESTING

Rear Suspension 204-02-4

REMOVAL AND INSTALLATION

Wheel Hub ..... (15 373 0) 204-02-5
Front Lower Arm — 4-Door/5-Door ..... (15 690 0) 204-02-7
Rear Lower Arm — 4-Door/5-Door ..... (15 693 0) 204-02-11
Rear Lower Arm — Wagon ..... (15 693 0) 204-02-13
Tie Bar — 4-Door/5-Door ..... (15 765 0) 204-02-16
Wheel Knuckle — 4-Door/5-Door 204-02-18
Wheel Knuckle — Wagon 204-02-19
Shock Absorber — Wagon ..... (15 791 0) 204-02-22
Strut and Spring Assembly — 4-Door/5-Door ..... (15 781 0) 204-02-23
Spring — Wagon ..... (15 621 0) 204-02-24
Crossmember — 4-Door/5-Door 204-02-25
Crossmember — Wagon 204-02-33

DISASSEMBLY AND ASSEMBLY

Strut and Spring Assembly 204-02-35

SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Stabilizer bar connecting link retaining nuts	48	35	–
Stabilizer bar clamp retaining bolts	25	18	–
Stabilizer bar connecting link to lower arm retaining nut (wagon)	48	35	–
Crossmember retaining bolts	120	89	–
Upper arm to wheel knuckle retaining bolt (Wagon)	120	89	–
Upper arm to crossmember retaining bolt (Wagon)	84	62	–
Front lower arm to crossmember retaining nut	103	76	–
Front lower arm to wheel knuckle retaining bolt (Wagon)	84	62	–
Front lower arm to wheel knuckle retaining bolt (4-door and 5-door)	120	89	–
Rear lower arm to wheel knuckle retaining bolt (Wagon)	84	62	–
Rear lower arm to wheel knuckle retaining bolt (4-door and 5-door)	120	89	–
Rear lower arm to crossmember cam retaining nut	103	76	–
Wheel speed sensor retaining bolt	7	–	62
Brake caliper anchor plate retaining bolt	80	59	–
Wheel knuckle pinch bolt	85	63	–
Wheel hub retaining bolts	70	52	–
Wheel knuckle to bracket retaining nut (Wagon)	103	76	–
Wheel knuckle bracket retaining bolts (Wagon)	120	89	–
Tie-bar to wheel knuckle retaining bolt (4-door and 5-door)	103	76	–
Tie-bar to bracket retaining nut	103	76	–
Tie-bar bracket retaining bolts	120	89	–
Strut and spring assembly retaining bolts	25	18	–
Strut and spring assembly thrust bearing retaining nut	58	43	–
Shock absorber upper mounting retaining bolt (Wagon)	84	62	–
Shock absorber lower mounting retaining bolt (Wagon)	120	89	–
Catalytic converter to front muffler pipe nuts	46	34	–
Exhaust flexible pipe to front muffler pipe nuts	46	34	–

DESCRIPTION AND OPERATION

Rear Suspension

Information not available at this time

DIAGNOSIS AND TESTING

Rear Suspension

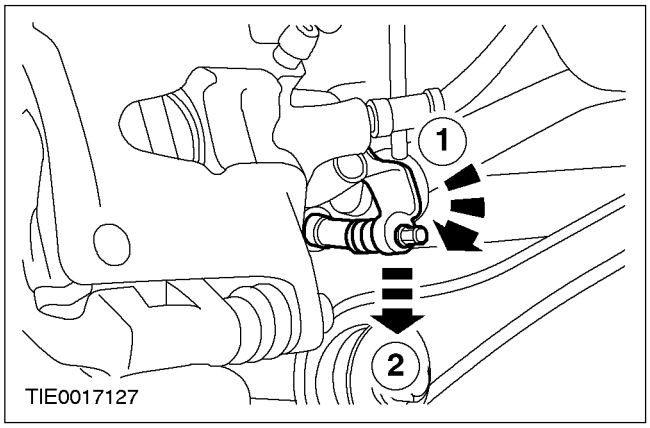
REFER to Section 204-00.

REMOVAL AND INSTALLATION

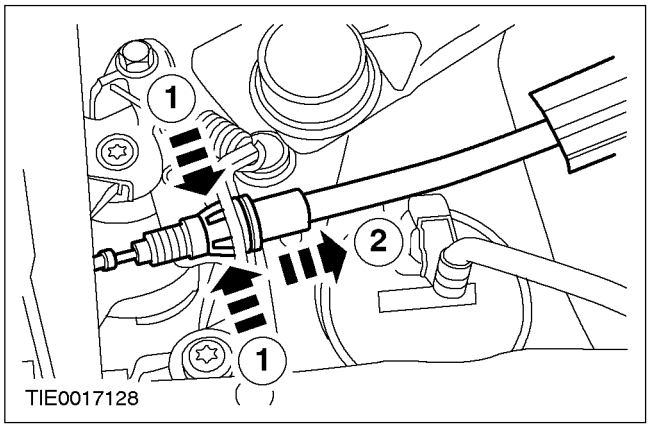
Wheel Hub (15 373 0)

Removal

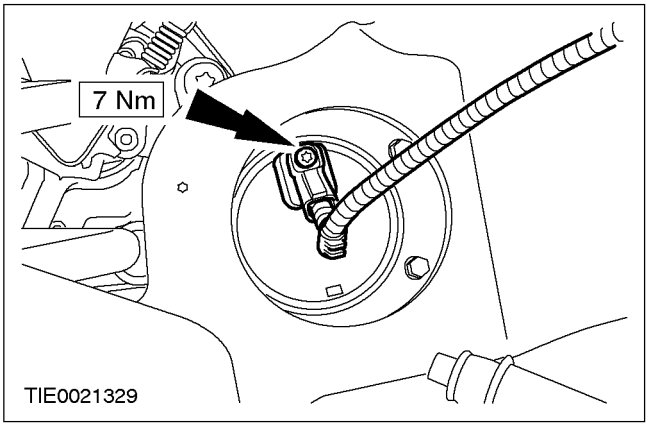
1. **Remove the wheel and tire. For additional information, refer to Section 204-04.**
2. **Detach the parking brake cable from the brake caliper lever.**
   1. Push the caliper lever.
   2. Detach the parking brake cable.



3. **Detach the parking brake cable from the brake caliper.**
   1. Depress the locking tangs.
   2. Detach the cable from the brake caliper.

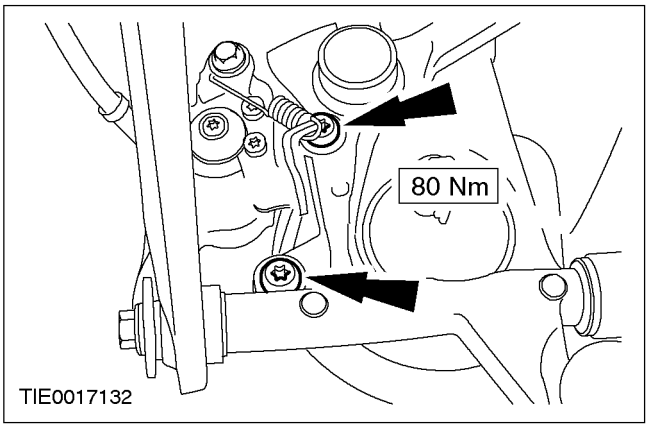


4. **Detach the rear wheel speed sensor from the wheel hub.**

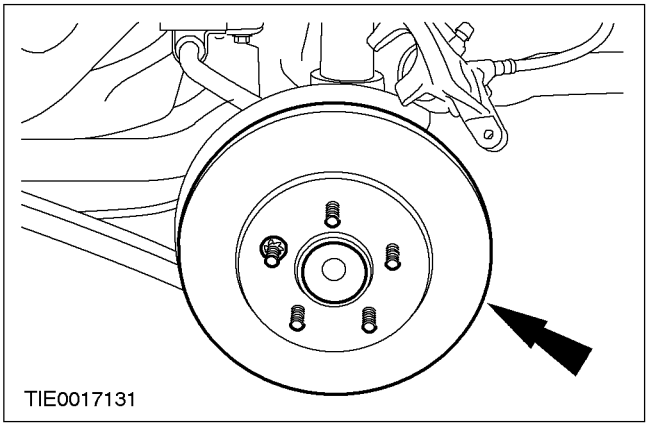


5. **CAUTION: Suspend the brake caliper and anchor plate to prevent load being placed on the brake hose.**

   Detach the brake caliper and anchor plate from the wheel knuckle.

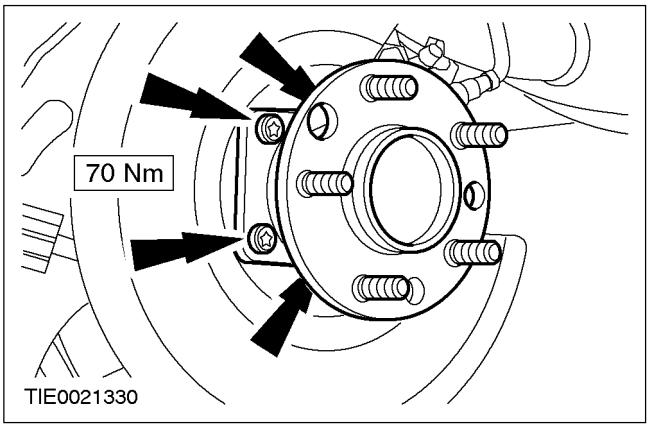


6. **Remove the brake disc.**



REMOVAL AND INSTALLATION (Continued)

7. Remove the wheel hub.

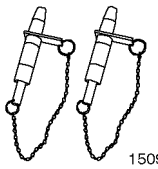


Installation

1. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

Front Lower Arm — 4-Door/5-Door (15 690 0)

Special Tool(s)	
 15097A	Alignment Pins, Subframe 205-316 (15-097A)

General Equipment
Transmission jack
Axle stand

Removal

All vehicles

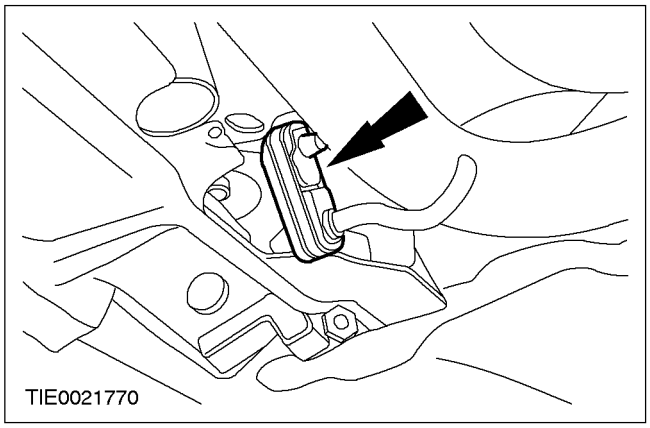
1. **Remove the wheel and tire. For additional information, refer to Section 204-04.**

Vehicles with xenon headlamps

2. **Remove the headlamp leveling sensor. For additional information, refer to Section 417-01.**

All vehicles

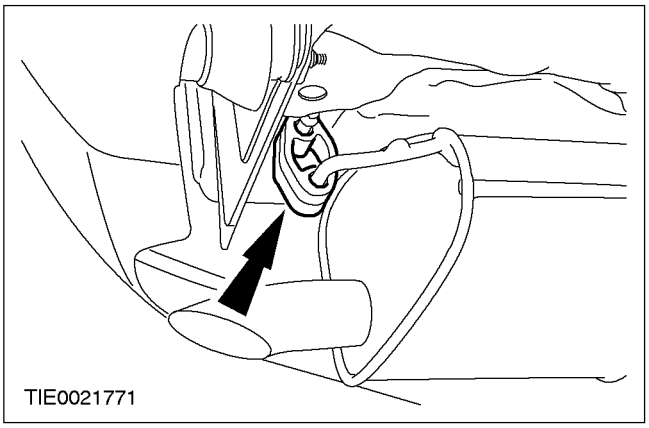
3. **Detach the exhaust system from the intermediate exhaust hanger insulator.**



Vehicles with 1.8L, 2.0L or diesel engine

4. **NOTE:** Support the front and rear muffler assembly with a suitable axle stand.

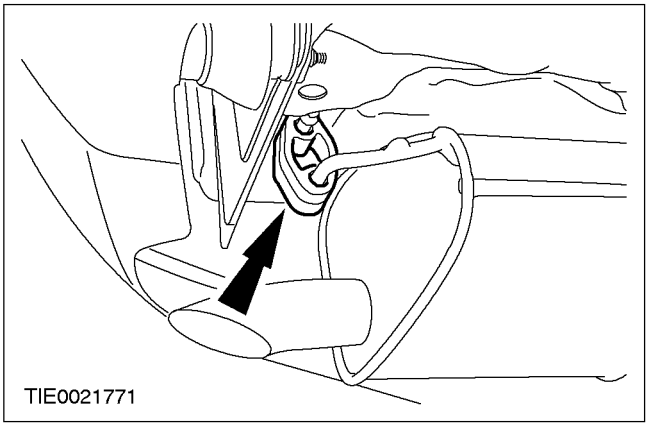
   Detach the exhaust system from the rear exhaust hanger insulator.



Vehicles with 2.5L engine

5. **NOTE:** Support the front and rear muffler assembly with a suitable axle stand.

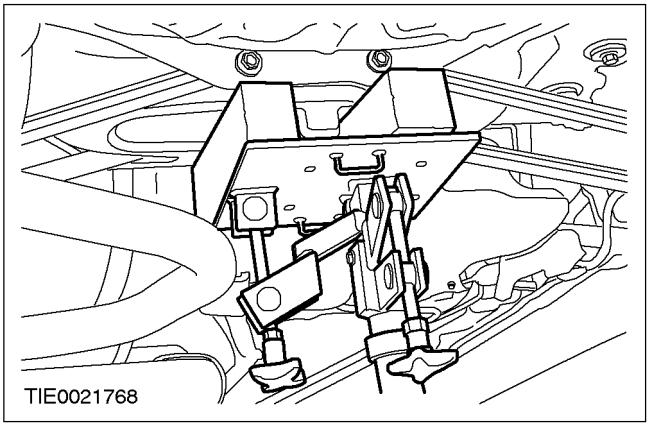
   Detach the exhaust system from both rear exhaust hanger insulators (left-hand shown, right-hand similar).



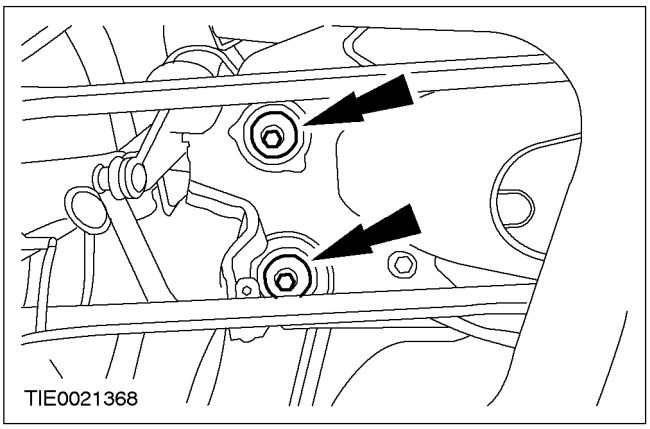
REMOVAL AND INSTALLATION (Continued)

All vehicles

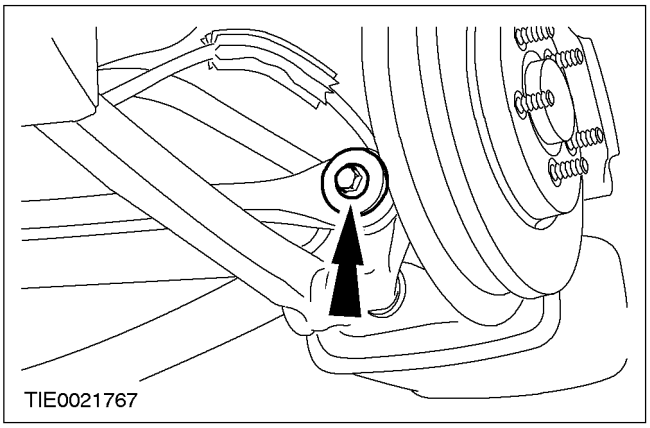
6. **Using suitable wooden blocks and a suitable transmission jack, support the crossmember.**



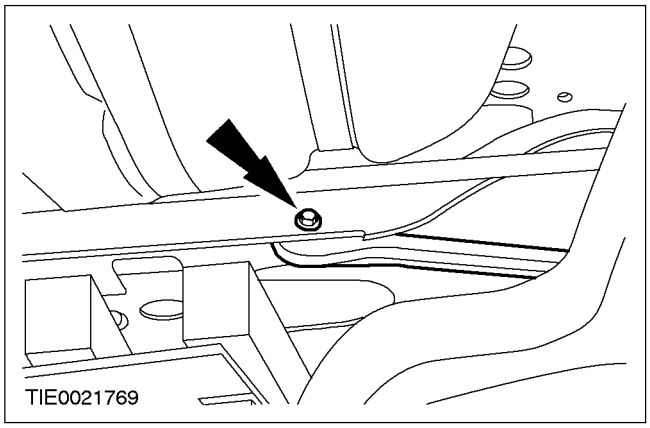
7. **Remove the crossmember retaining bolts (two bolts each side).**



8. **Lower the crossmember to gain access to the front lower arm retaining nut and bolt.**
9. **Detach the front lower arm from the wheel knuckle.**



10. **Remove the front lower arm.**



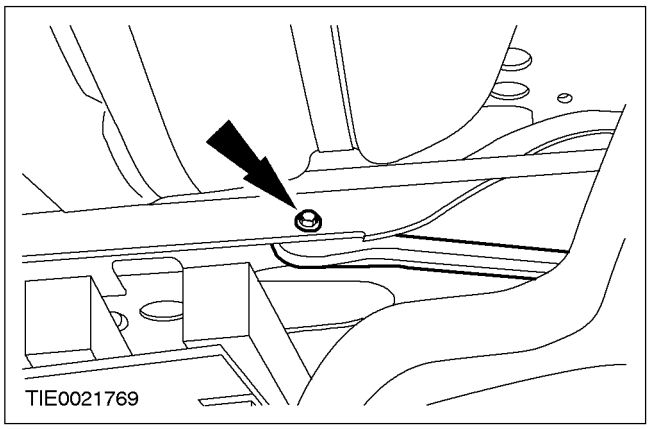
Installation

All vehicles

NOTE: Final tightening of the rear suspension components should be carried out when the vehicle weight is on the road wheels.

1. **NOTE:** Do not fully tighten the front lower arm retaining nut and bolt at this stage.

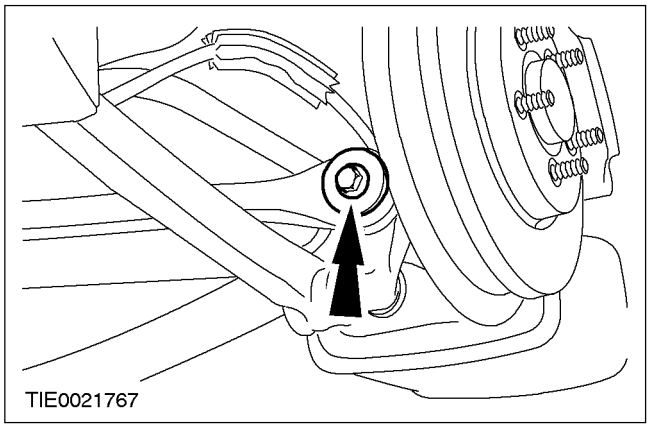
   Install the front lower arm.



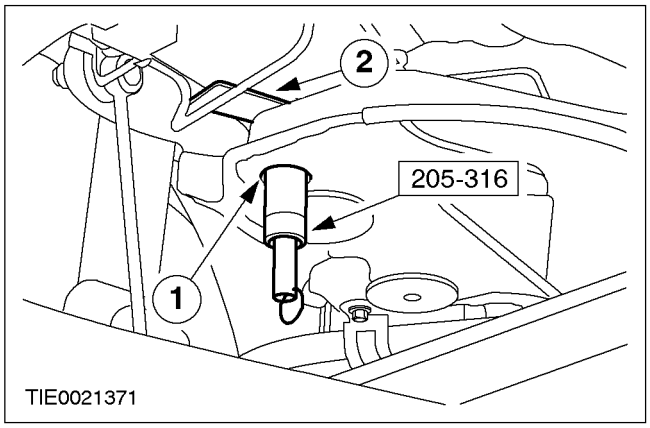
REMOVAL AND INSTALLATION (Continued)

2. **NOTE:** Do not fully tighten the front lower arm retaining bolt at this stage.

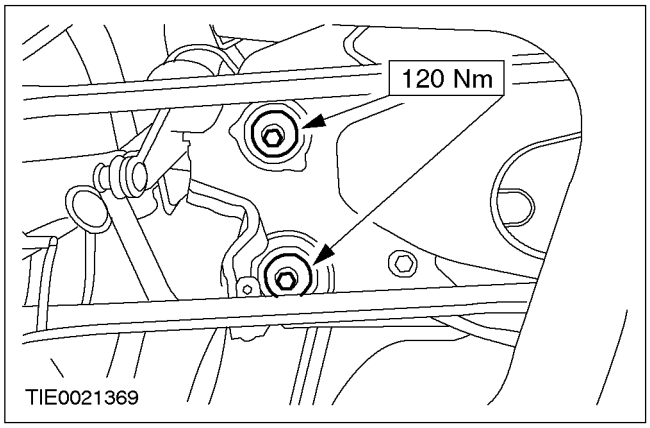
   Attach the front lower arm to the wheel knuckle.



3. **Using the special tool, align the crossmember.**
   1. Insert the alignment pins through the crossmember alignment holes.
   2. Slide the locking plate into the groove and tighten the alignment pin sleeve.

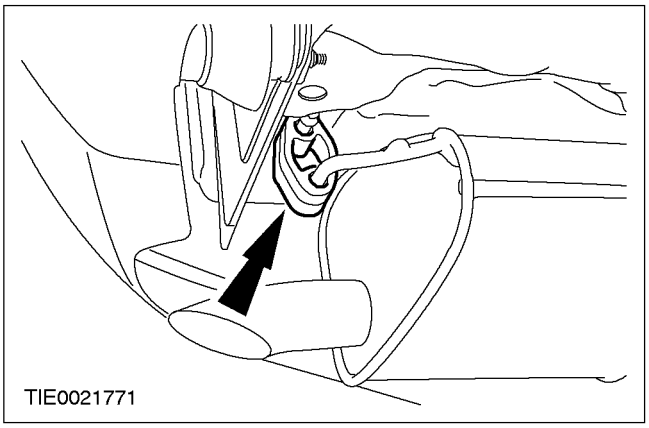


4. **Install the crossmember (two bolts each side).**



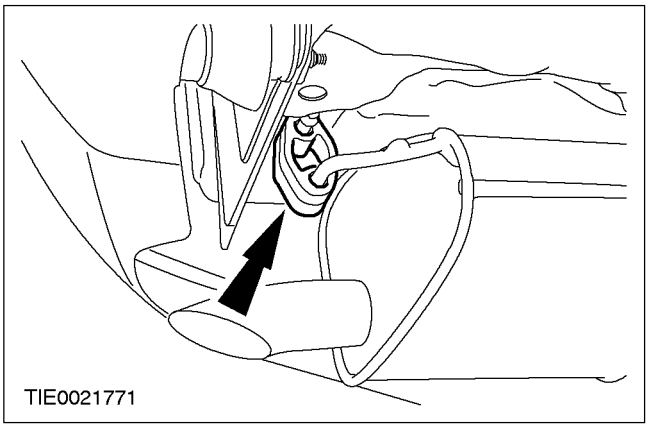
Vehicles with 1.8L, 2.0L or diesel engine

5. **Attach the exhaust system to the rear exhaust hanger insulator.**



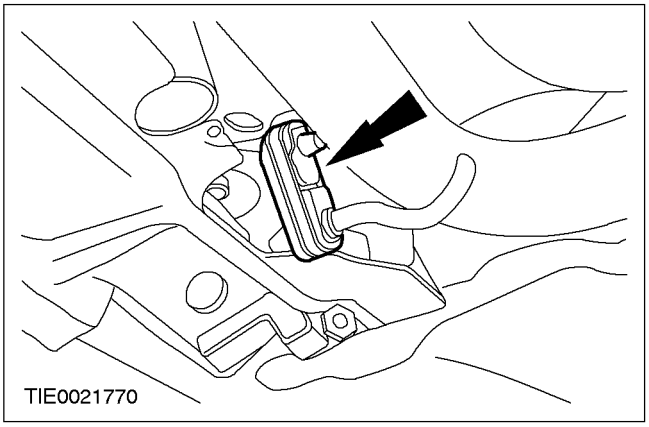
Vehicles with 2.5L engine

6. **Attach the exhaust system to both rear exhaust hanger insulators (left-hand shown, right-hand similar).**



All vehicles

7. **Attach the exhaust system to the intermediate exhaust hanger insulator.**



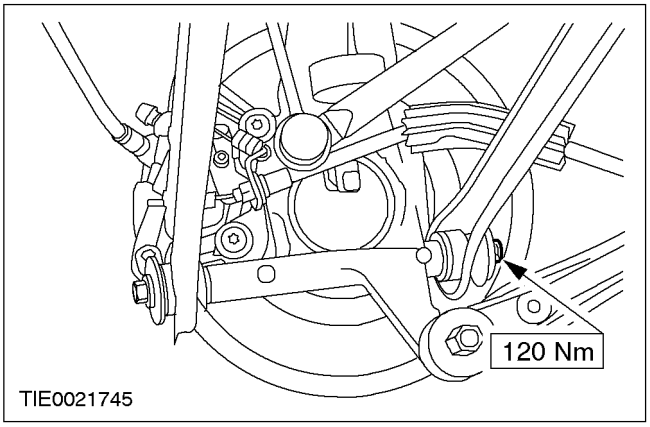
REMOVAL AND INSTALLATION (Continued)

Vehicles with xenon headlamps

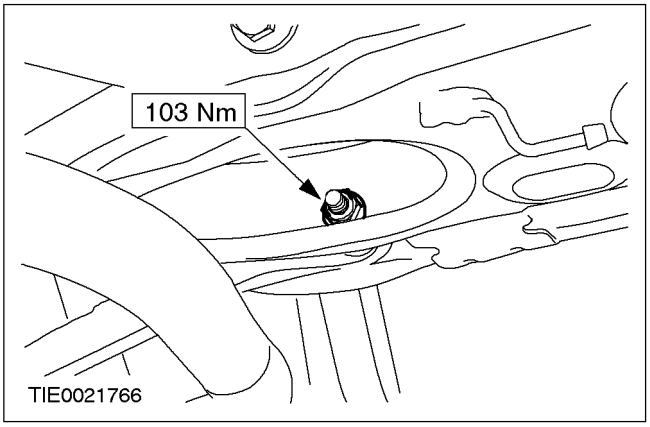
8. **Install the headlamp leveling sensor. For additional information, refer to Section 417-01.**

All vehicles

9. **Install the wheel and tire. For additional information, refer to Section 204-04.**
10. **Tighten the front lower arm to wheel knuckle retaining bolt.**



11. **Tighten the front lower arm to cross-member retaining nut.**



Vehicles with xenon headlamps

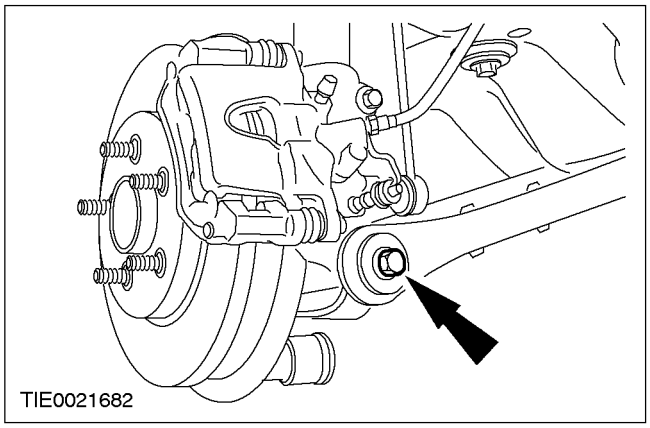
12. **Initialize the headlamp leveling system using WDS.**

REMOVAL AND INSTALLATION

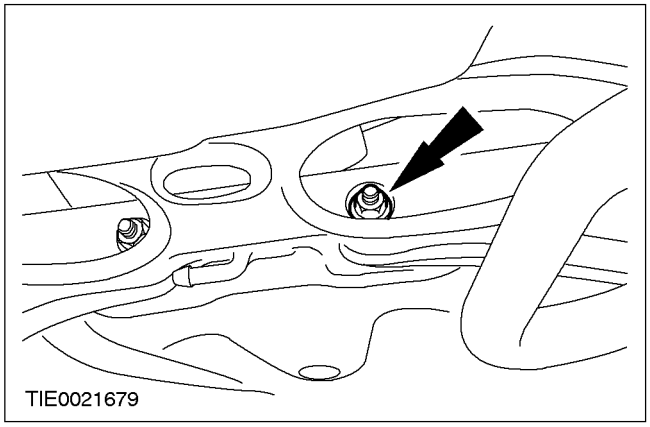
Rear Lower Arm — 4-Door/5-Door (15 693 0)

Removal

1. **Remove the wheel and tire. For additional information, refer to Section 204-04.**
2. **Detach the rear lower arm from the wheel knuckle.**



3. **Remove the rear lower arm.**

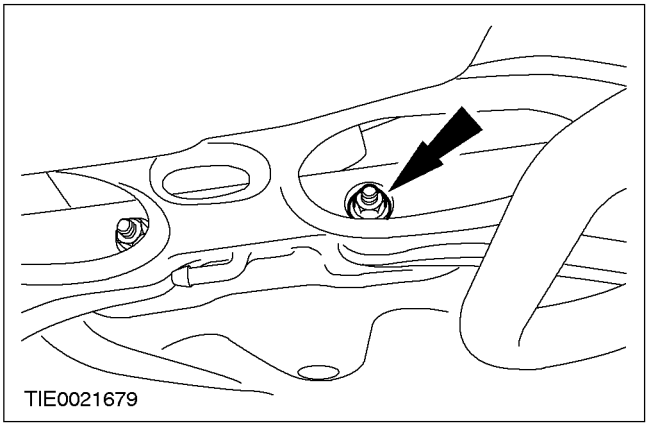


Installation

NOTE: Final tightening of the rear suspension components should be carried out when the vehicle weight is on the road wheels.

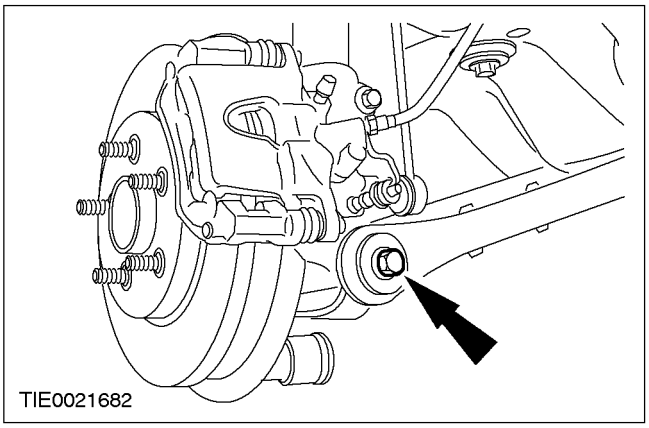
1. **NOTE:** Do not fully tighten the rear lower arm adjustment cam nut at this stage.

   Attach the rear lower arm to the cross-member.



2. **NOTE:** Do not fully tighten the rear lower arm to wheel knuckle retaining bolt at this stage.

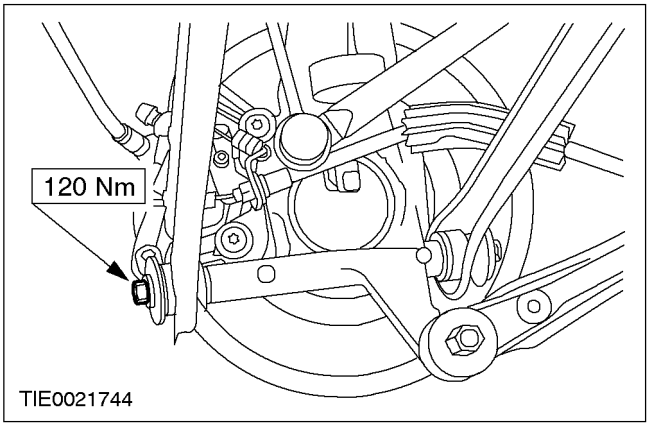
   Install the rear lower arm.



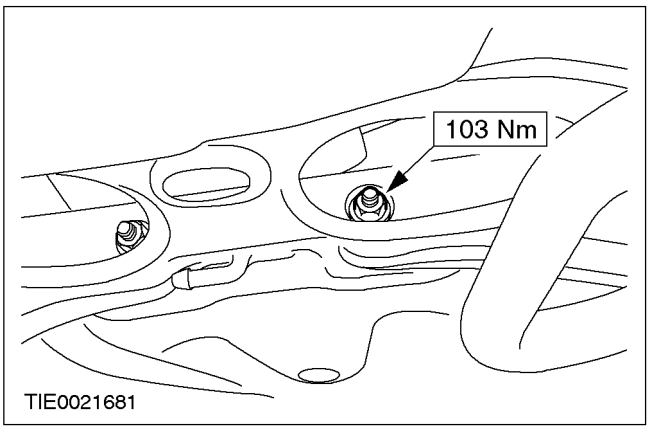
3. **Install the wheel and tire. For additional information, refer to Section 204-04.**

REMOVAL AND INSTALLATION (Continued)

4. **Tighten the rear lower arm to wheel knuckle retaining bolt.**



5. **Check the toe setting and adjust as necessary. For additional information, refer to Section 204-00.**
6. **Tighten the rear lower arm adjustment cam nut.**



REMOVAL AND INSTALLATION

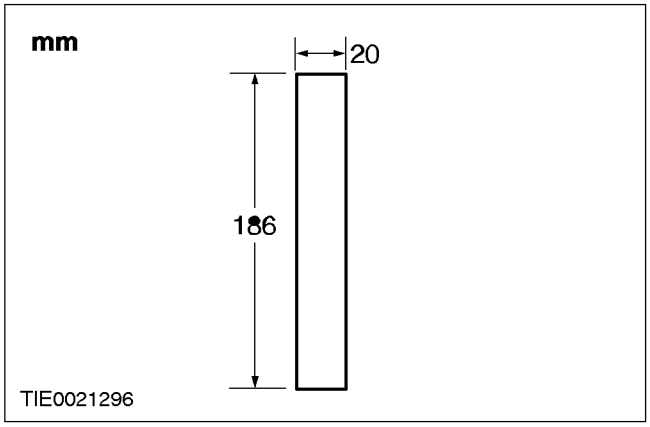
Rear Lower Arm — Wagon (15 693 0)

General Equipment
Transmission jack

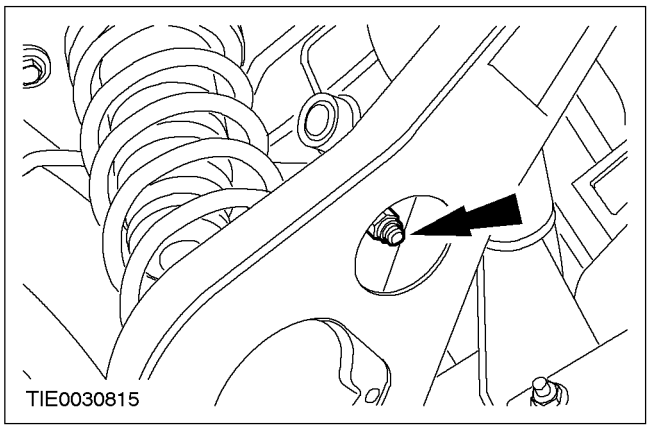
Removal

All vehicles

1. **Remove the wheel and tire. For additional information, refer to Section 204-04.**
2. **Fabricate a 20 mm wide by 186 mm long spacer.**



3. **Detach the stabilizer bar from the rear lower arm.**

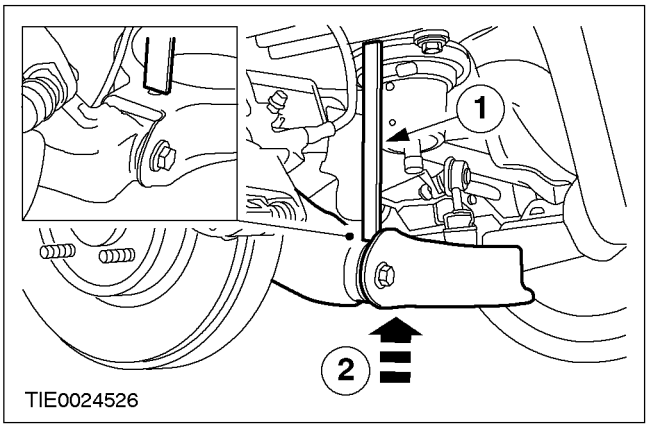


4. **Remove the spring.** **For additional information, refer to Spring-Wagon in this section.**

5. **NOTE:** The spacer must be positioned exactly as shown.

   Using a suitable transmission jack, raise the rear lower arm to the suspension design height setting.

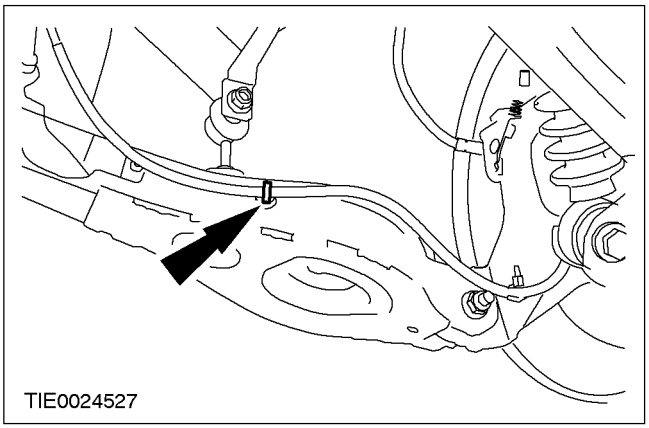
   1. Position the spacer.
   2. Raise the rear lower arm.



Vehicles with xenon headlamps

6. **NOTE:** The headlamp leveling sensor wiring harness is attached to the left-hand rear lower arm.

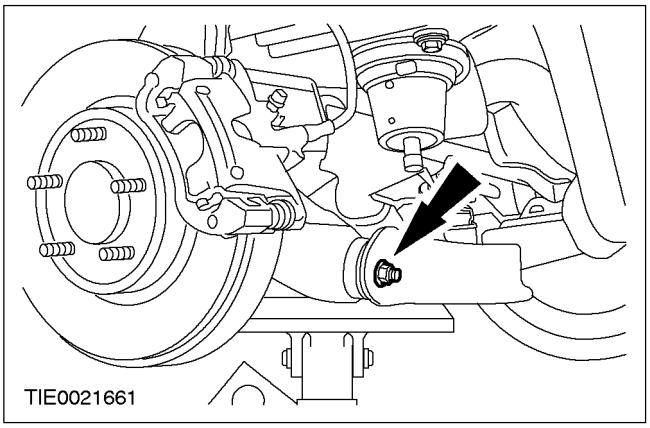
   Detach the headlamp leveling sensor wiring harness from the rear lower arm.



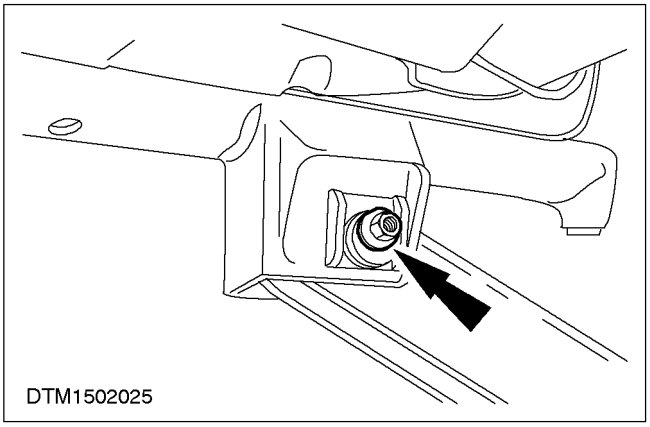
REMOVAL AND INSTALLATION (Continued)

All vehicles

7. **Detach the rear lower arm from the wheel knuckle.**



8. **Remove the rear lower arm.**



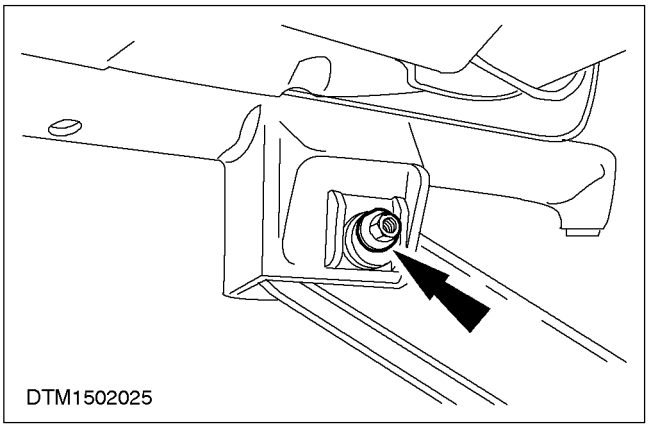
Installation

All vehicles

NOTE: Final tightening of the rear suspension components should be carried out when the vehicle weight is on the road wheels.

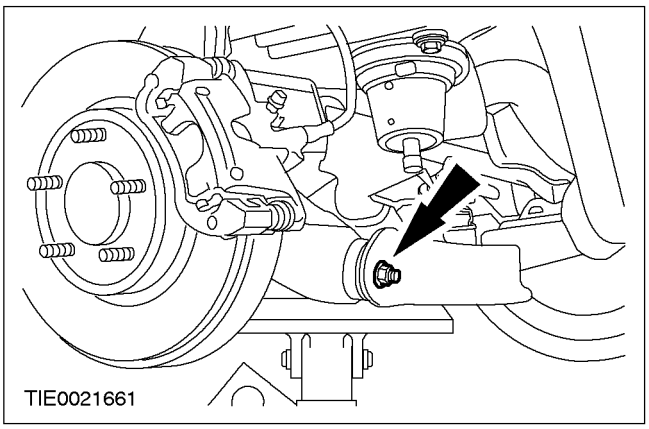
1. **NOTE:** Do not fully tighten the rear lower arm adjustment cam nut at this stage.

   Attach the rear lower arm to the cross-member.



2. **NOTE:** Do not fully tighten the rear lower arm to wheel knuckle retaining bolt at this stage.

   Install the rear lower arm.

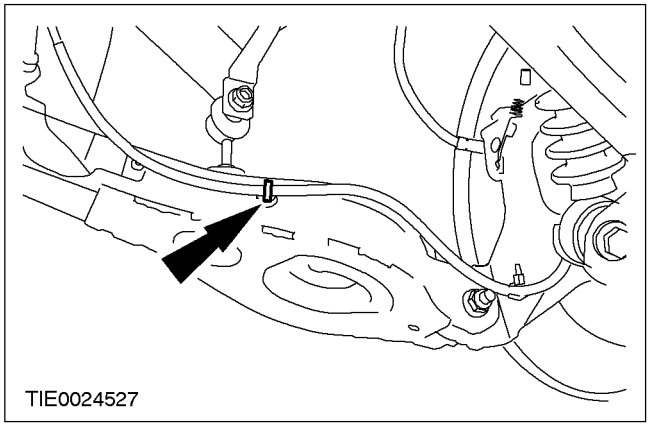


REMOVAL AND INSTALLATION (Continued)

Vehicles with xenon headlamps

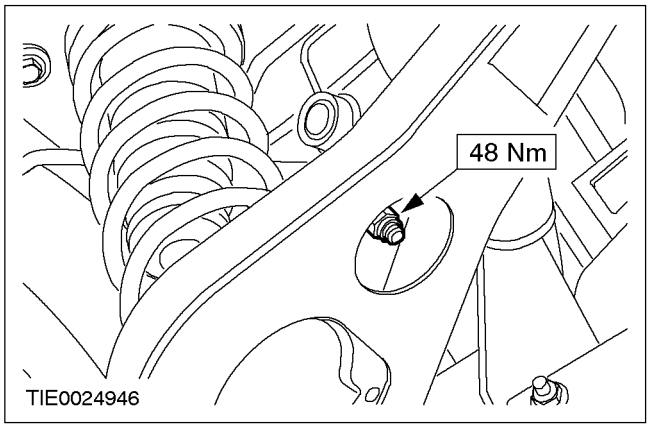
3. **NOTE:** The headlamp leveling sensor wiring harness is attached to the left-hand rear lower arm.

   Attach the headlamp leveling sensor wiring harness to the rear lower arm.

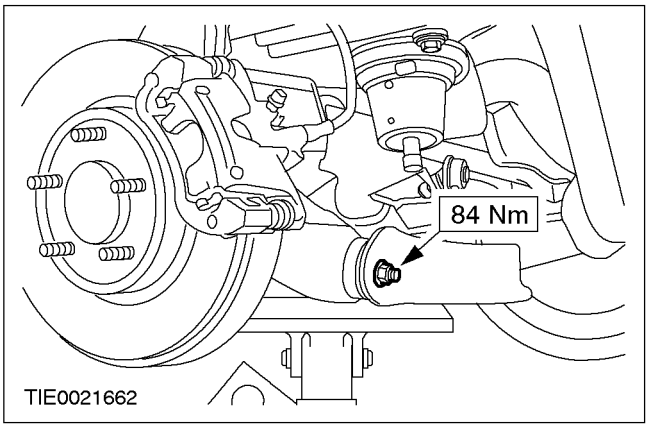


All vehicles

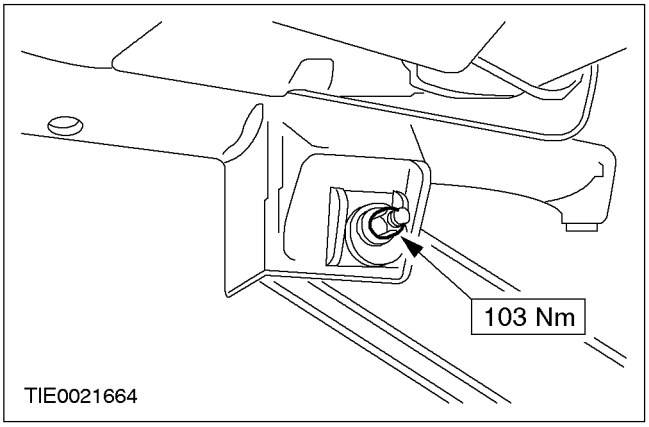
4. **Lower the suspension from the design height setting.**
5. **Install the spring.** **For additional information, refer to Spring-Wagon in this section.**
6. **Attach the stabilizer bar to the rear lower arm.**



7. **Install the wheel and tire. For additional information, refer to Section 204-02.**
8. **Tighten the rear lower arm to wheel knuckle retaining bolt (wheel and tire shown removed for clarity).**



9. **Check the toe setting and adjust as necessary. For additional information, refer to Section 204-00.**
10. **Tighten the rear lower arm adjustment cam nut.**



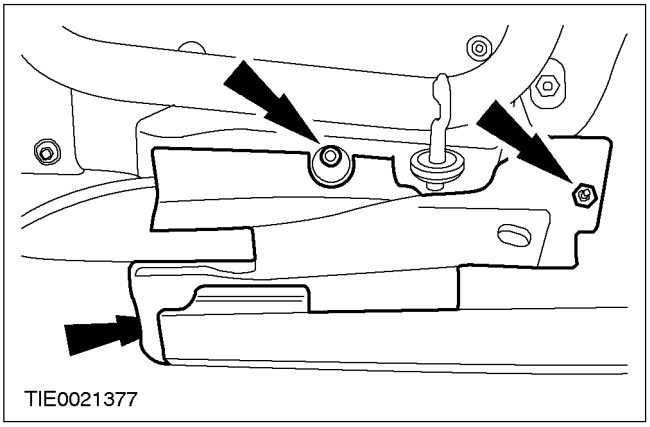
REMOVAL AND INSTALLATION

Tie Bar — 4-Door/5-Door (15 765 0)

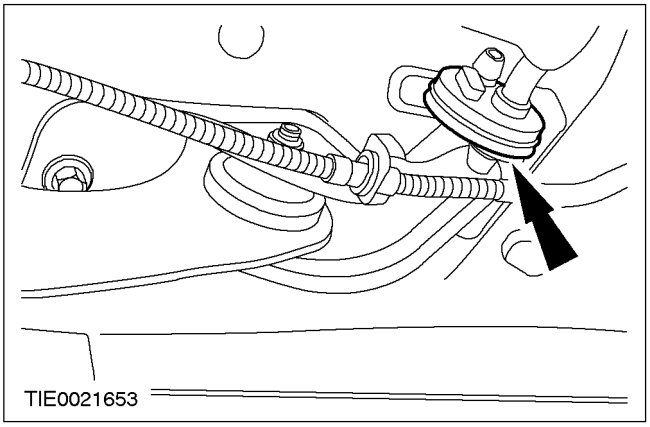
Removal

All vehicles

1. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
2. **Remove the tie bar bracket cover.**



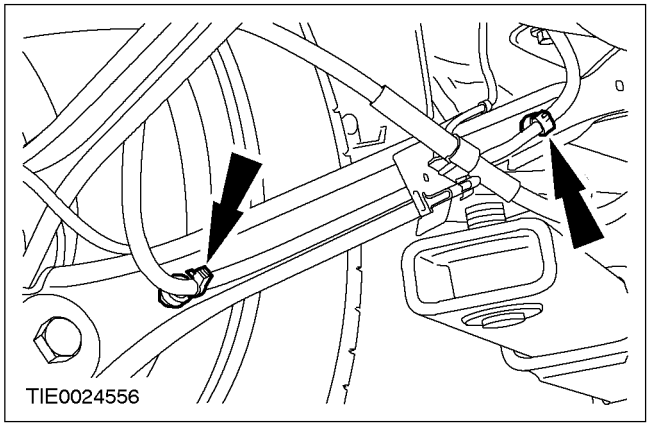
3. **Detach the intermediate exhaust hanger insulator from the tie bar (if equipped).**



Vehicles with xenon headlamps

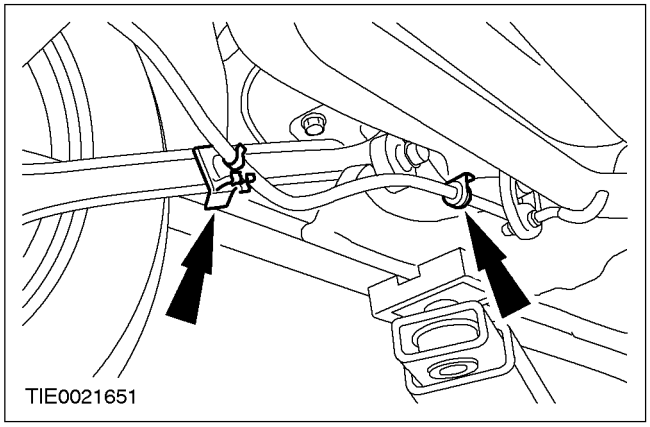
4. **NOTE:** The headlamp leveling sensor wiring harness is attached to the left-hand tie bar.

   Detach the headlamp leveling sensor wiring harness from the tie bar.



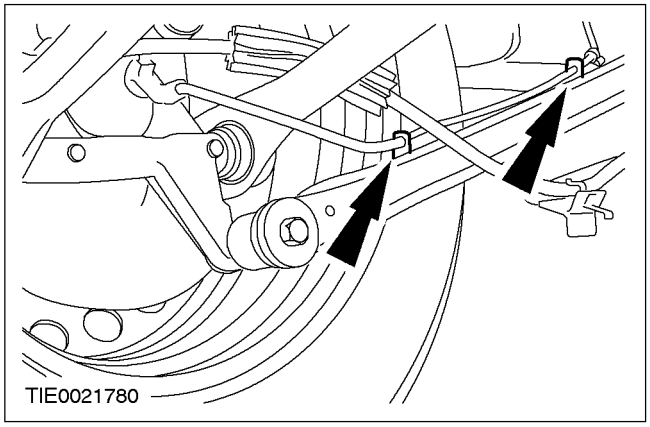
All vehicles

5. **Detach the parking brake cable from the tie bar.**

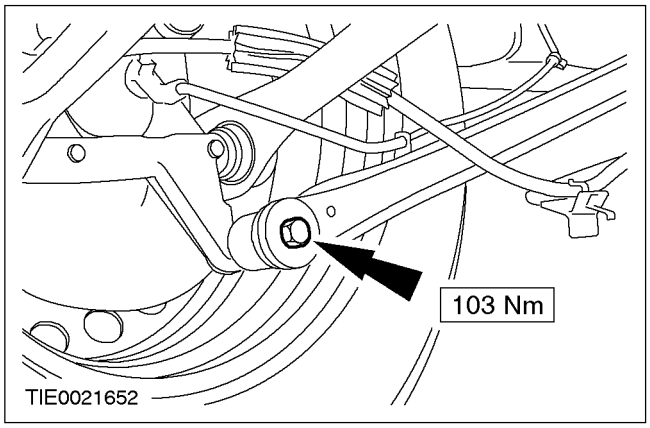


REMOVAL AND INSTALLATION (Continued)

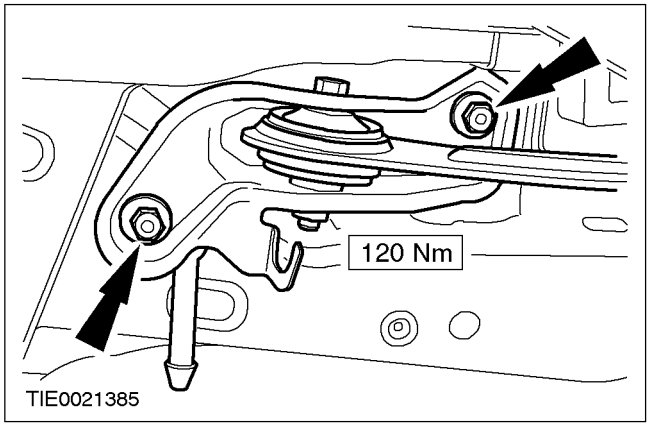
6. Detach the rear wheel speed sensor wiring harness from the tie bar.



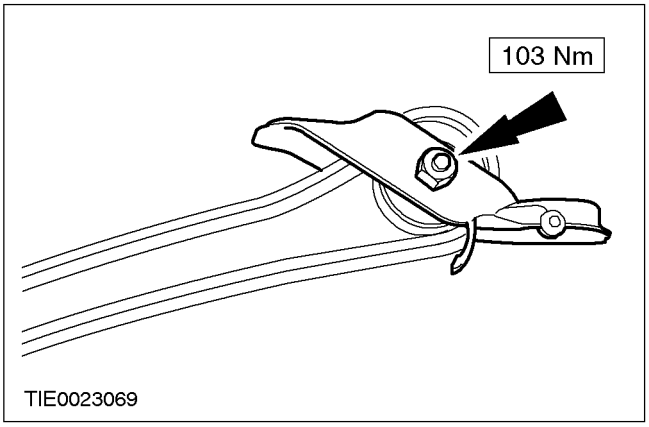
7. Detach the tie bar from the wheel knuckle.



8. Remove the tie bar.



9. Remove the tie bar bracket from the tie bar.



Installation

1. NOTE: Final tightening of the rear suspension components should be carried out when the vehicle weight is on the road wheels.

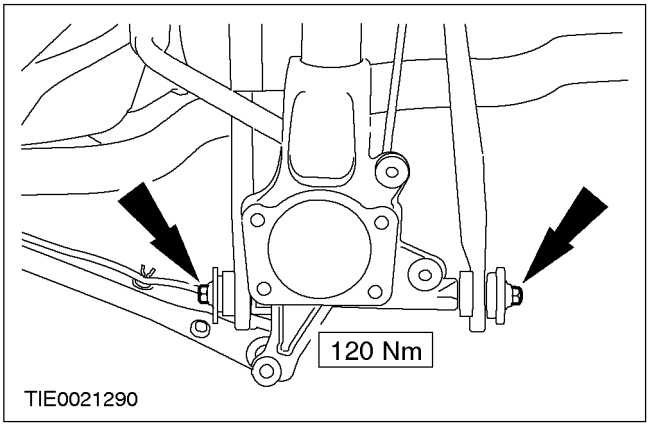
To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

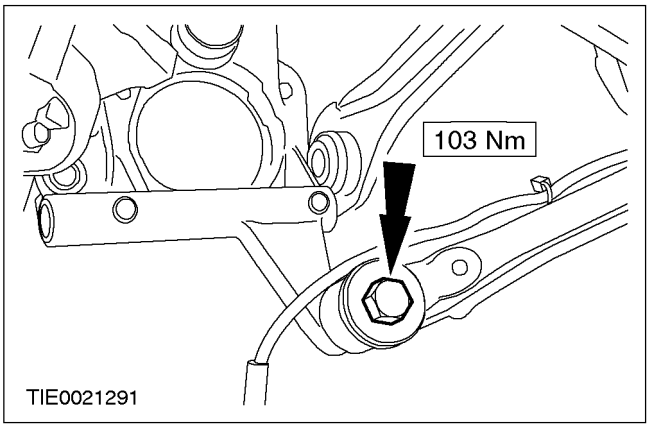
Wheel Knuckle — 4-Door/5-Door

Removal

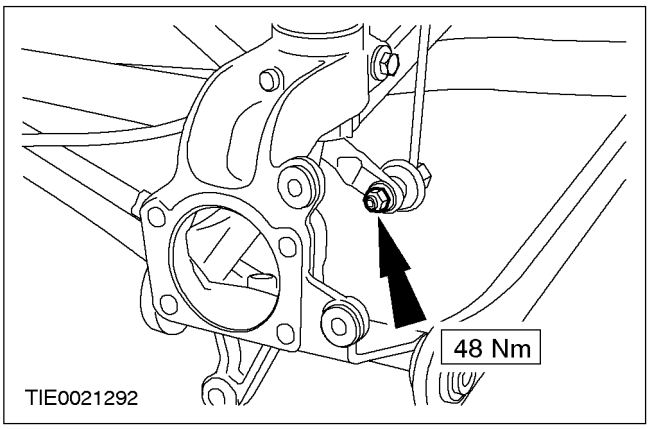
1. **Remove the wheel hub.** **For additional information, refer to Wheel Hub in this section.**
2. **Detach the front and rear lower arms from the wheel knuckle.**



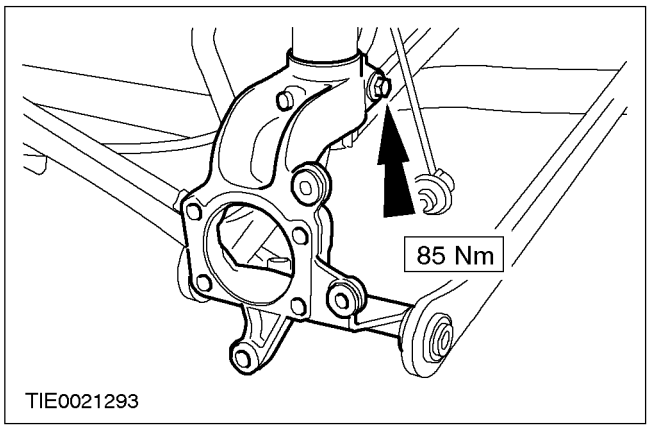
3. **Detach the tie bar from the wheel knuckle**



4. **Detach the stabilizer bar connecting link from the stabilizer bar.**



5. **Remove the wheel knuckle.**



Installation

1. **NOTE:** Final tightening of the rear suspension components should be carried out when the vehicle weight is on the road wheels.

   To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

Wheel Knuckle — Wagon

General Equipment
Transmission jack

Removal

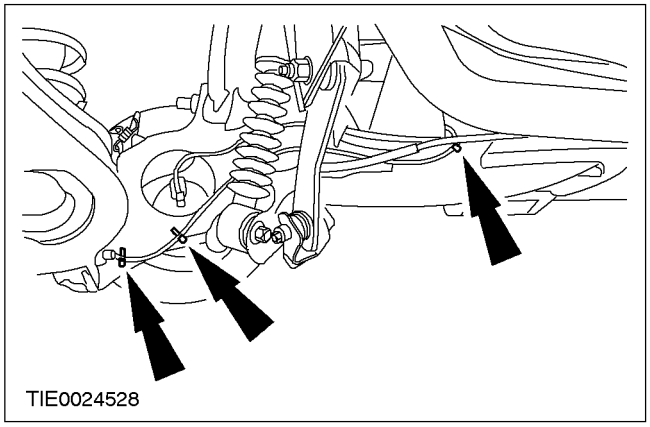
All vehicles

1. **Remove the wheel hub.** **For additional information, refer to Wheel Hub in this section.**

Vehicles with xenon headlamps

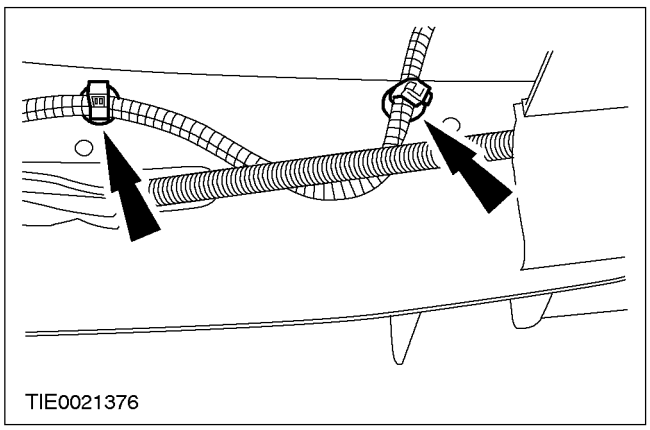
2. **NOTE:** The headlamp leveling sensor wiring harness is attached to the left-hand wheel knuckle.

   Detach the headlamp leveling sensor wiring harness from the wheel knuckle.

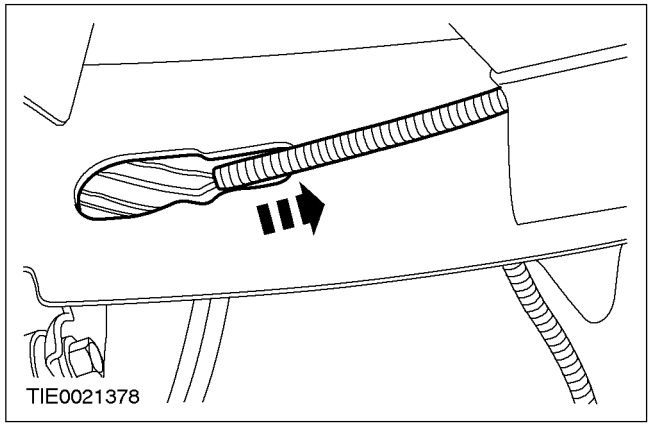


All vehicles

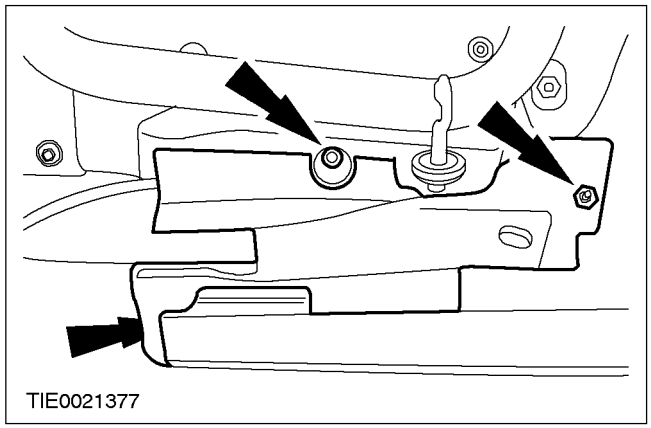
3. **Detach the wheel speed sensor wiring harness from the wheel knuckle.**



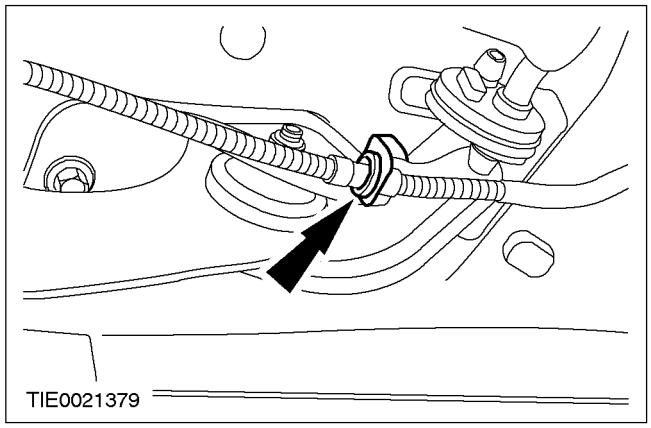
4. **Pull the parking brake cable through the wheel knuckle.**



5. **Remove the wheel knuckle bracket cover.**

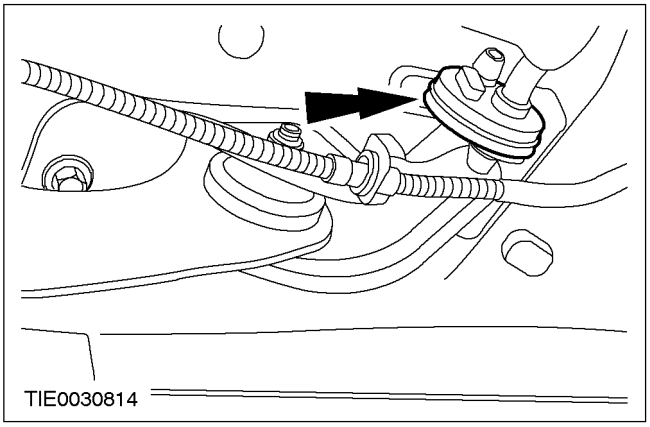


6. **Detach the parking brake cable from the wheel knuckle.**

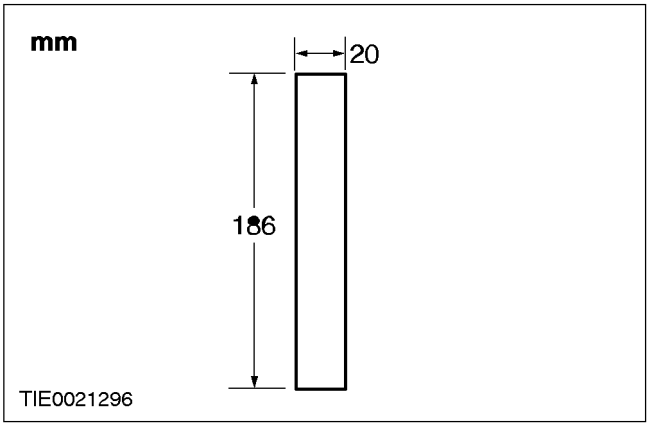


REMOVAL AND INSTALLATION (Continued)

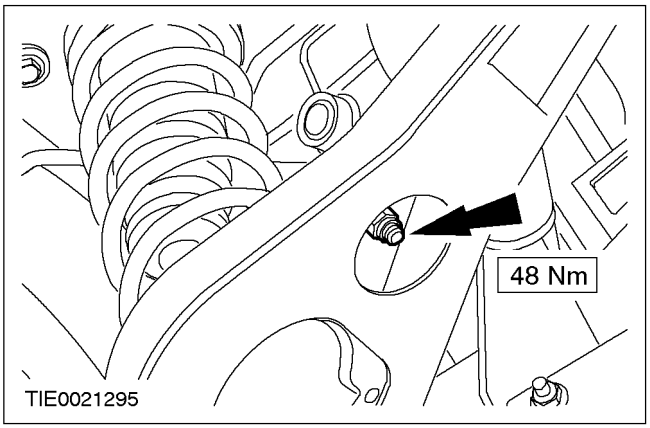
7. **Detach the exhaust hanger insulator from the wheel knuckle (if equipped).**



8. **Fabricate a 20 mm wide by 186 mm long spacer.**



9. **Detach the stabilizer bar from the rear lower arm.**

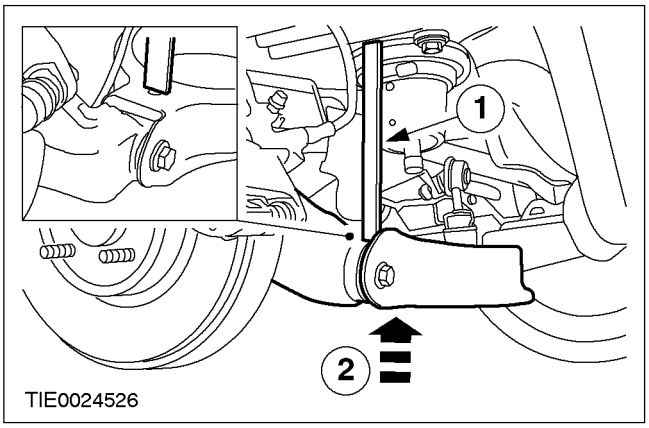


10. **Remove the spring.** **For additional information, refer to Spring-Wagon in this section.**

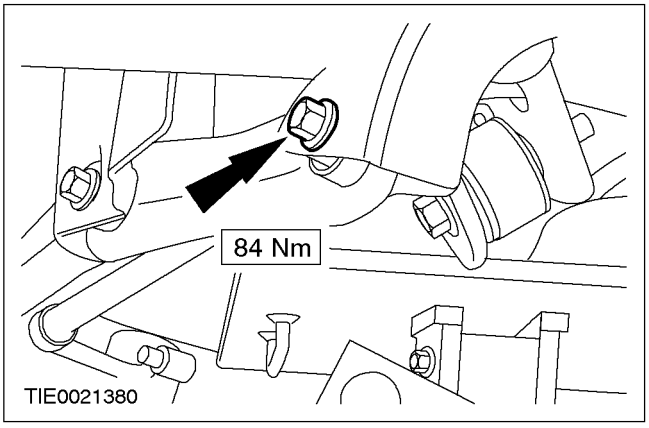
11. **NOTE:** The spacer must be positioned exactly as shown.

Using a suitable transmission jack, raise the rear lower arm to the suspension design height setting.

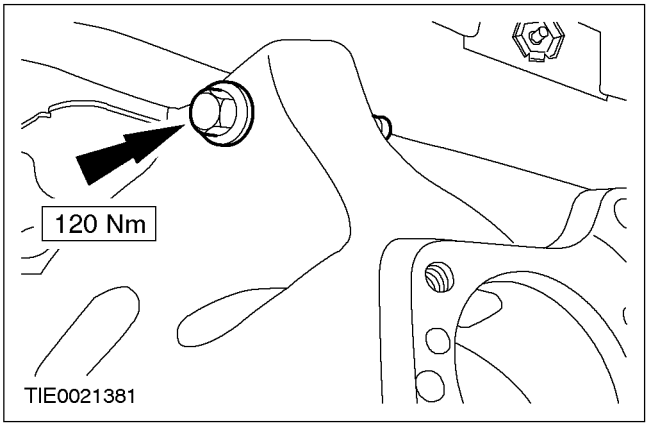
1. Position the spacer.
2. Raise the rear lower arm.



12. **Detach the front lower arm from the wheel knuckle.**

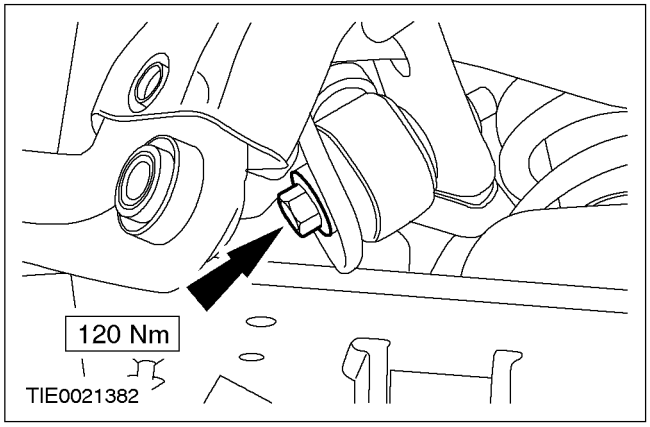


13. **Detach the upper arm from the wheel knuckle.**

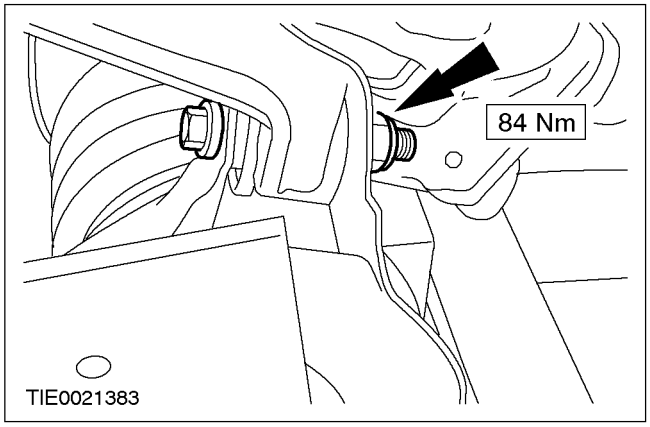


REMOVAL AND INSTALLATION (Continued)

14. **Detach the shock absorber from the wheel knuckle.**

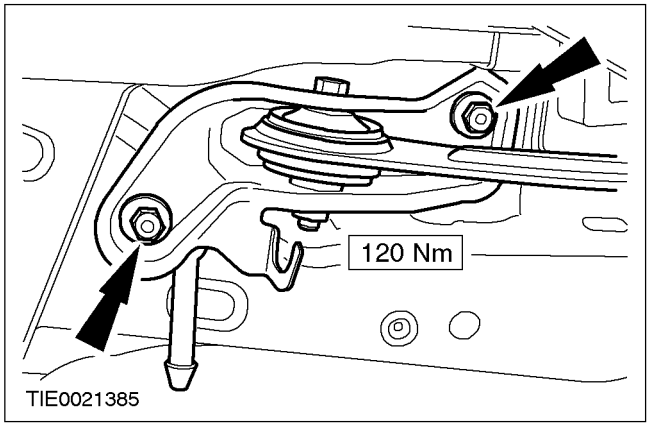


15. **Detach the rear lower arm from the wheel knuckle.**

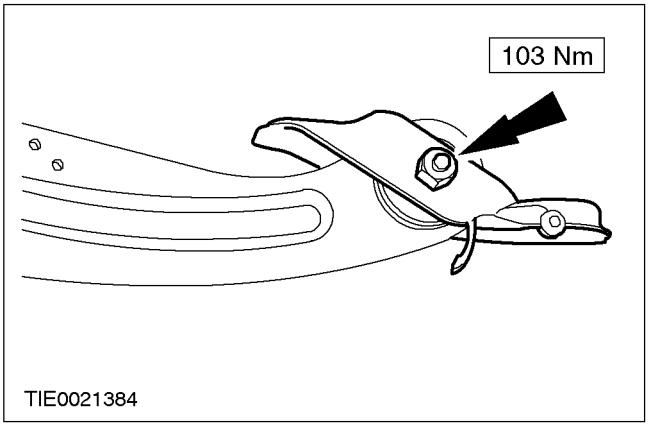


16. **CAUTION: With the aid of another technician, support the wheel knuckle.**

Remove the wheel knuckle.



17. **Remove the wheel knuckle bracket from the wheel knuckle.**



Installation

1. **NOTE:** Final tightening of the rear suspension components should be carried out when the vehicle weight is on the road wheels.

To install, reverse the removal procedure.

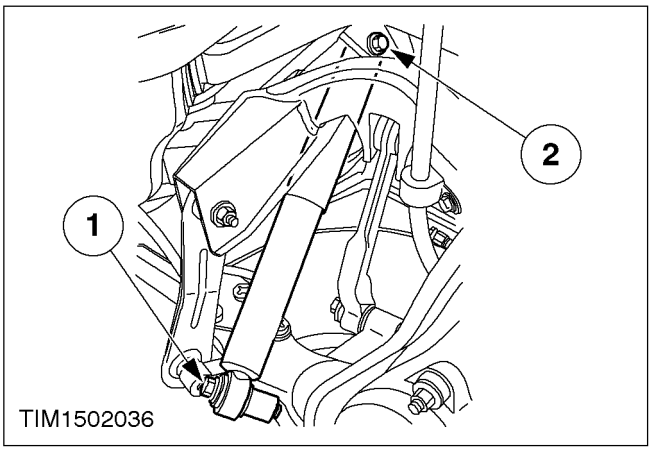
REMOVAL AND INSTALLATION

Shock Absorber — Wagon (15 791 0)

General Equipment
Transmission jack

Removal

1. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
2. **Using a suitable transmission jack, support the lower arm.**
3. **Remove the shock absorber.**
   1. Remove the lower mounting bolt.
   2. Remove the upper mounting bolt.

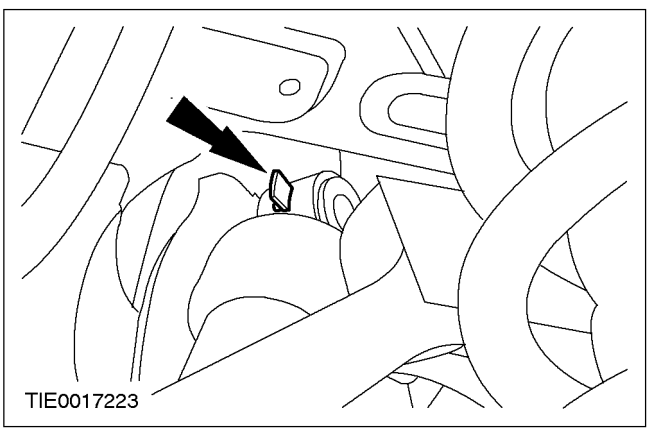


Installation

Vehicle with load levelling shock absorbers

1. **NOTE:** Make sure the tab on the shock absorber top mount is pointing outwards.

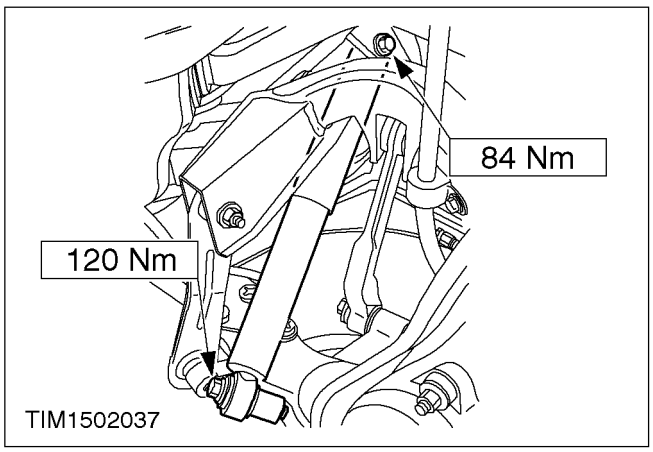
   Install the shock absorber.



All vehicles

2. **NOTE:** Final tightening of the shock absorber should be carried out when the vehicle weight is on the road wheels.

   Install the shock absorber.



3. **Lower vehicle.**

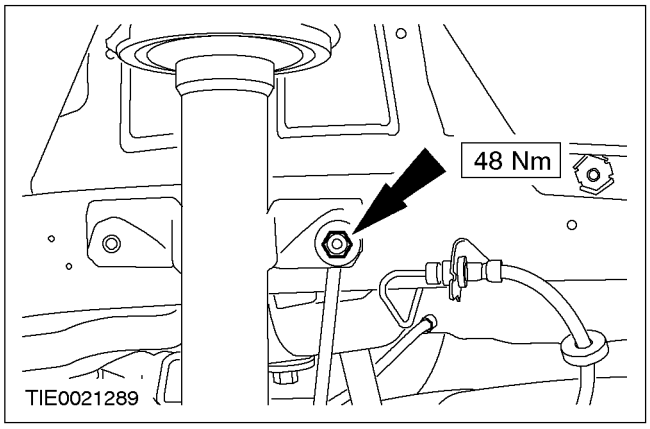
REMOVAL AND INSTALLATION

Strut and Spring Assembly — 4-Door/5-Door (15 781 0)

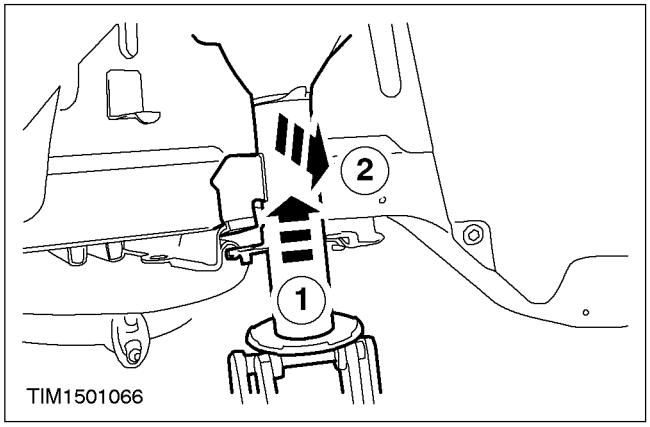
General Equipment
Trolley jack

Removal

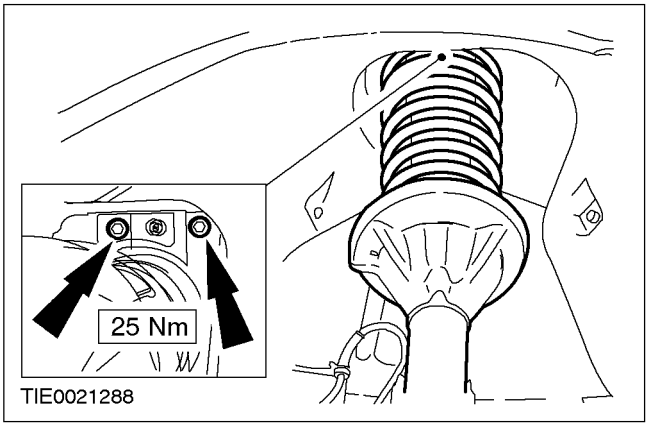
1. **Remove the wheel knuckle.** **For additional information, refer to Wheel Knuckle in this section.**
2. **Detach the stabilizer bar connecting link from the suspension strut.**



3. **Using a suitable trolley jack, detach the suspension strut from the crossmember ledge.**
   1. Raise the suspension strut.
   2. Move the suspension strut away from the crossmember ledge and lower the suspension strut.



4. **Remove the strut and spring assembly.**

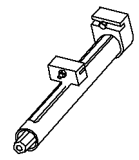
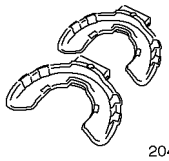


Installation

1. **To install, reverse the removal procedure.**

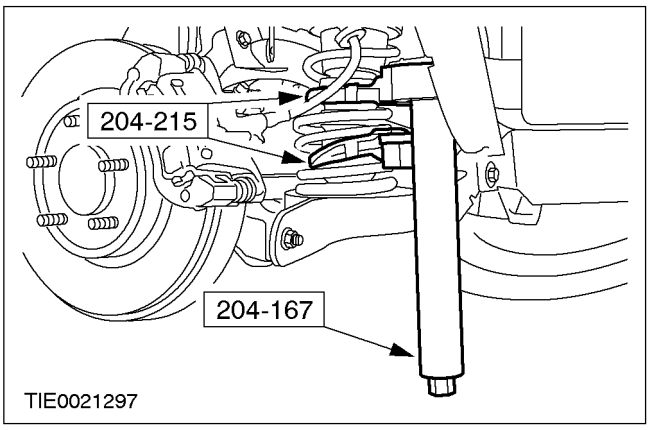
REMOVAL AND INSTALLATION

Spring — Wagon (15 621 0)

Special Tool(s)	
 14042	Compressor, Coil Spring 204-167 (14-042)
 204215	Adapters for 204-167 204-215 (15-111)

Removal

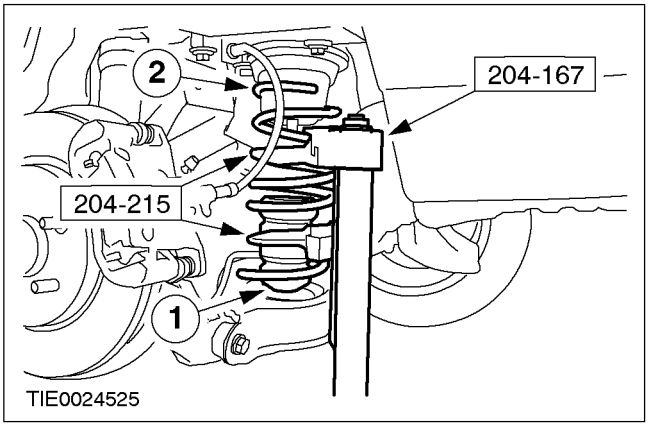
1. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
2. **Using the special tools, compress the spring (wheel and tire removed for clarity).**



3. **WARNING: As the spring is under extreme tension care must be taken at all times. Failure to follow this instruction may result in personal injury.**

   Remove the spring (wheel and tire removed for clarity).

   1. Detach the bump stop from the crossmember.
   2. Remove the spring and bump stop.

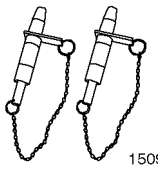


Installation

1. **To install, reverse the removal procedure.**

REMOVAL AND INSTALLATION

Crossmember — 4-Door/5-Door

Special Tool(s)	
 15097A	Alignment Pins, Subframe 205-316 (15-097-A)

General Equipment
Trolley jack
Transmission jack
Securing strap

Name	Specification
Anti-seize grease	SAM-1C107-A

Removal

All vehicles

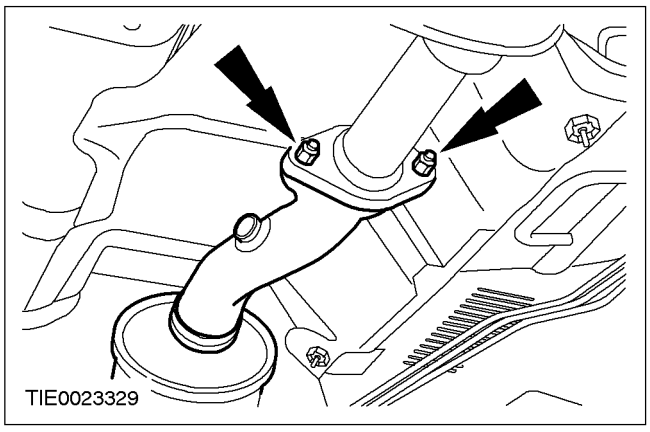
1. **Remove the wheels and tires. For additional information, refer to Section 204-04.**

Vehicles with xenon headlamps

2. **Remove the headlamp leveling sensor. For additional information, refer to Section 417-01.**

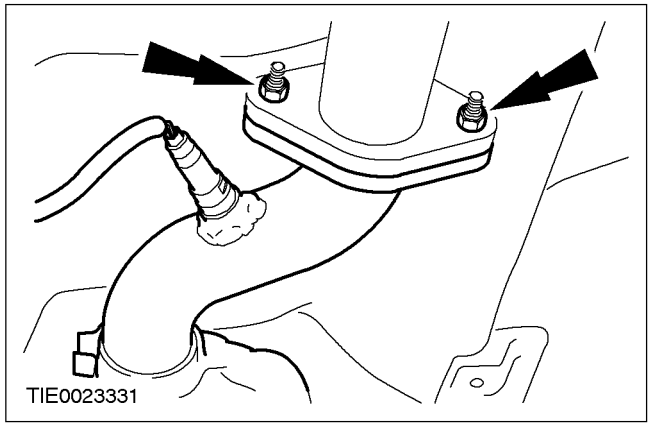
Vehicles with 1.8L or 2.0L engine

3. **Detach the catalytic converter from the front muffler pipe.**
   - Discard the gasket and nuts.



Vehicles with 2.5L engine

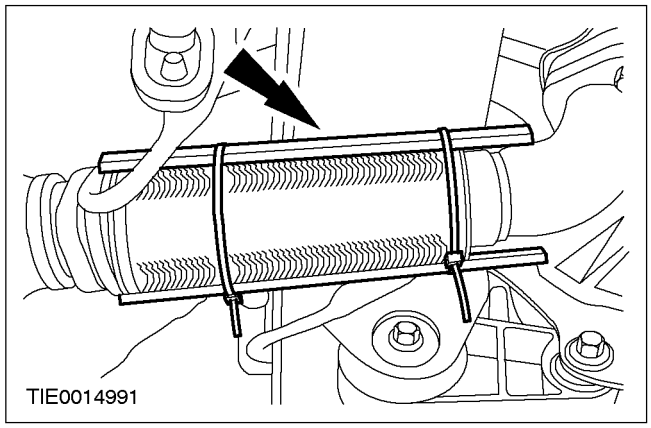
4. **Detach the catalytic converter from the front muffler pipe.**
   - Discard the gasket and nuts.



Vehicles with diesel engine

5. **CAUTION: Over bending of the exhaust flexible pipe may cause damage resulting in failure.**

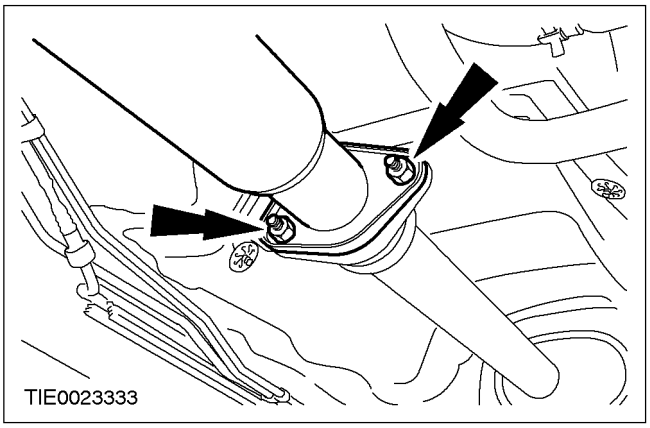
   Support the exhaust flexible pipe with a support wrap or suitable splint.



REMOVAL AND INSTALLATION (Continued)

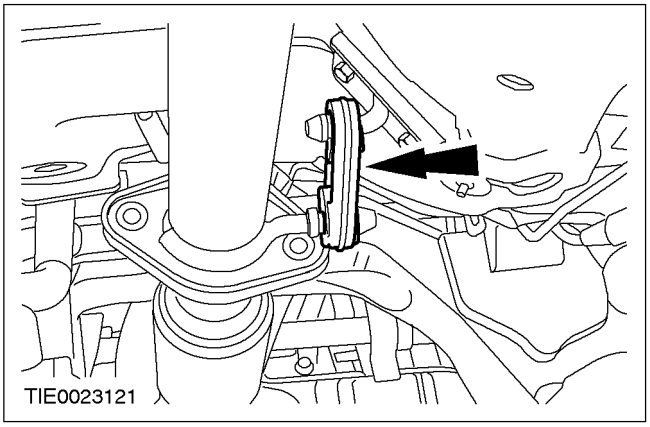
6. Detach the exhaust flexible pipe from the front muffler pipe.

- Discard the sealing ring and nuts.



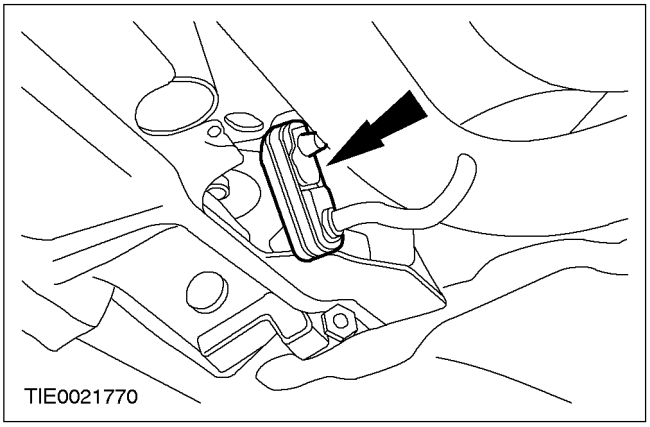
All vehicles

7. Detach the front and rear muffler assembly from the front exhaust hanger insulator.



8. NOTE: Support the front and rear muffler with a suitable axle stand.

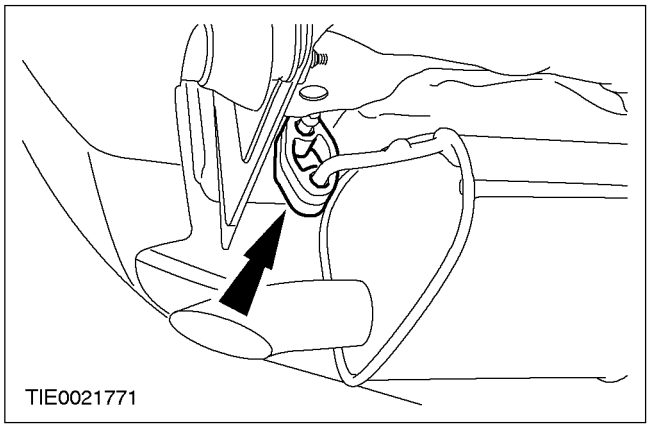
Detach the front and rear muffler assembly from the intermediate exhaust hanger insulator.



Vehicles with 1.8L, 2.0L or diesel engine

9. Remove the front and rear muffler assembly.

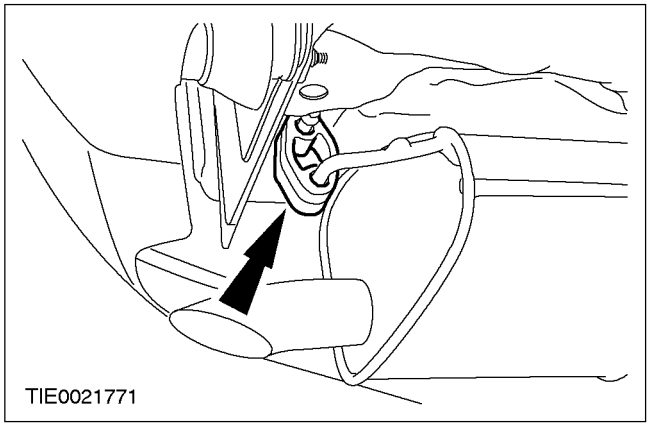
- Detach the muffler from the rear exhaust hanger insulator.



Vehicles with 2.5L engine

10. Remove the front and rear muffler assembly.

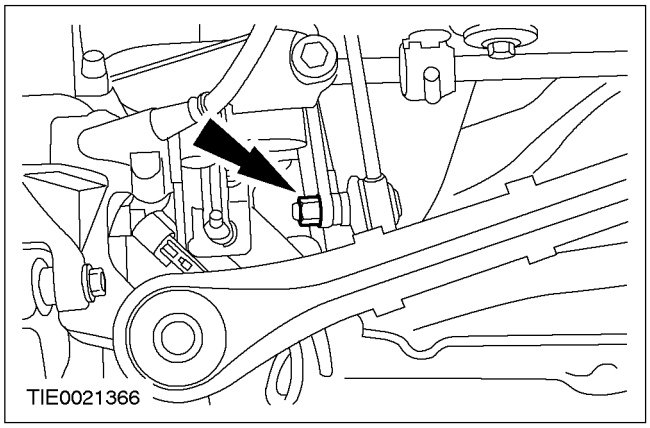
- Detach the rear mufflers from the rear exhaust hanger insulators (left-hand side shown).



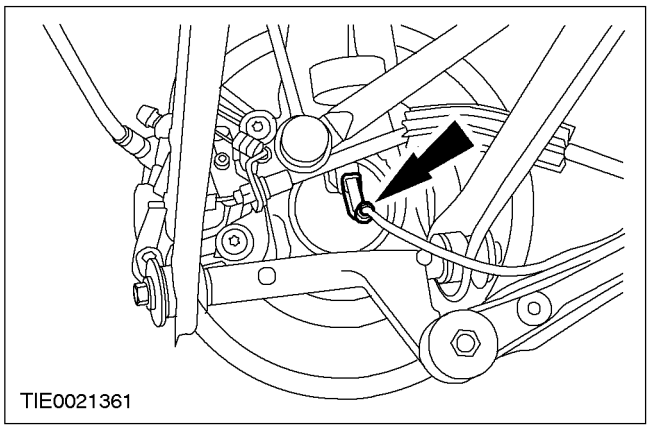
REMOVAL AND INSTALLATION (Continued)

All vehicles

11. Detach the stabilizer bar connecting link from the stabilizer bar on both sides.

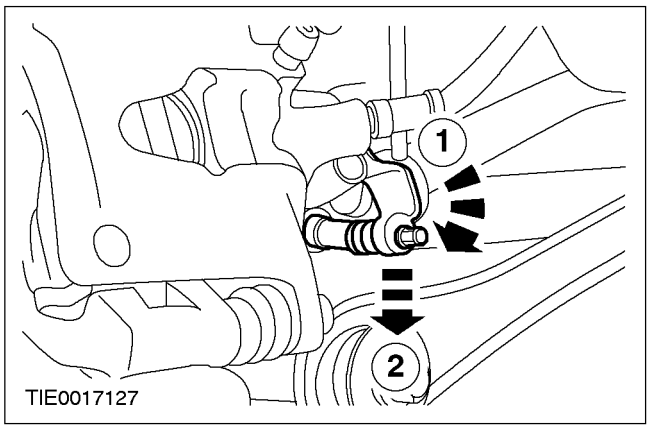


12. Disconnect the rear wheel speed sensor electrical connector from the rear wheel speed sensor on both sides.



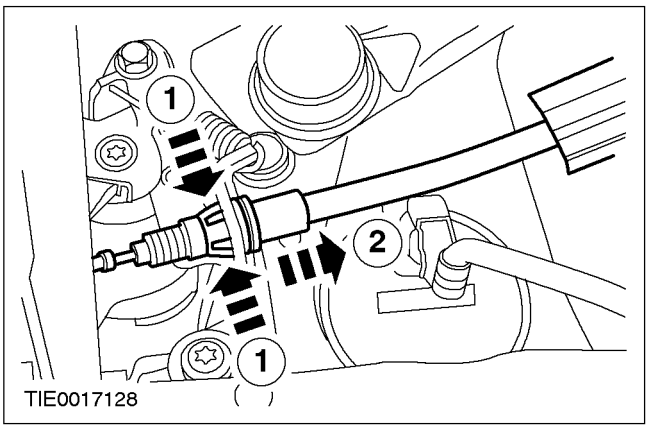
13. Detach the parking brake cable from the brake caliper lever on both sides.

1. Push the caliper lever.
2. Detach the parking brake cable.



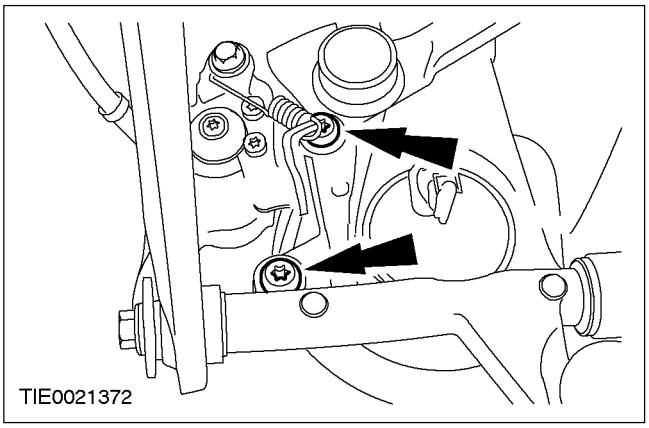
14. Detach the parking brake cable from the brake caliper on both sides.

1. Depress the locking tangs.
2. Detach the brake cable from the brake caliper.

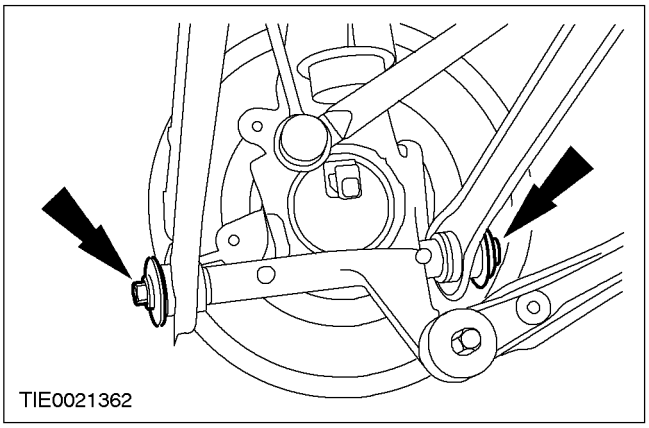


15. ⚠ CAUTION: Suspend the brake caliper and anchor plate to prevent load being placed on the brake hoses.

Detach the brake caliper and anchor plate from the wheel knuckle on both sides.

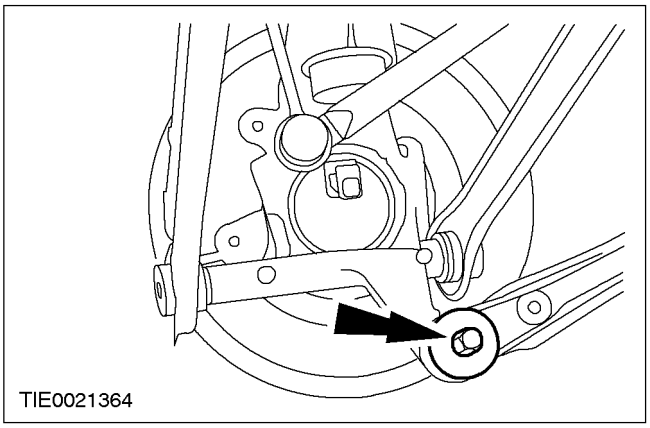


16. Detach the front and rear lower arm from the wheel knuckle on both sides.



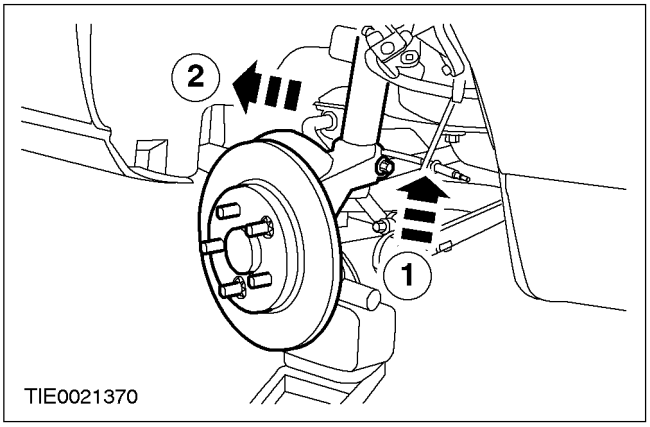
REMOVAL AND INSTALLATION (Continued)

17. Detach the tie-bar from the wheel knuckle on both sides.



18. Using a suitable trolley jack, detach the suspension strut from the crossmember ledge on both sides.

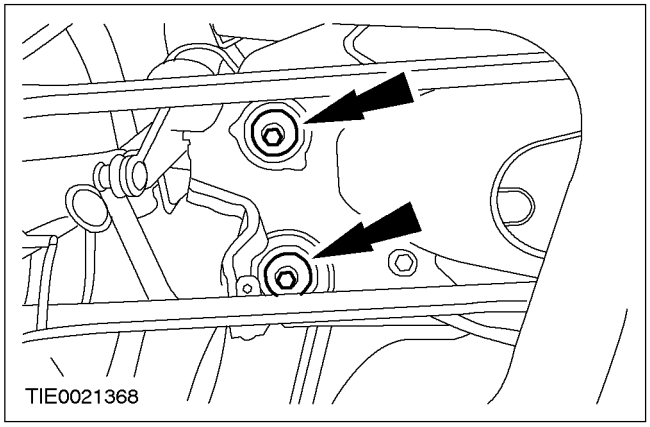
1. Raise the suspension strut.
2. Move the suspension strut away from the crossmember ledge and lower the suspension strut.



19. ⚠ WARNING: Make sure the crossmember is secured to the transmission jack. Failure to follow this instruction may result in personal injury.

Using a suitable securing strap, secure the crossmember to the transmission jack.

20. Remove the crossmember (two bolts each side).



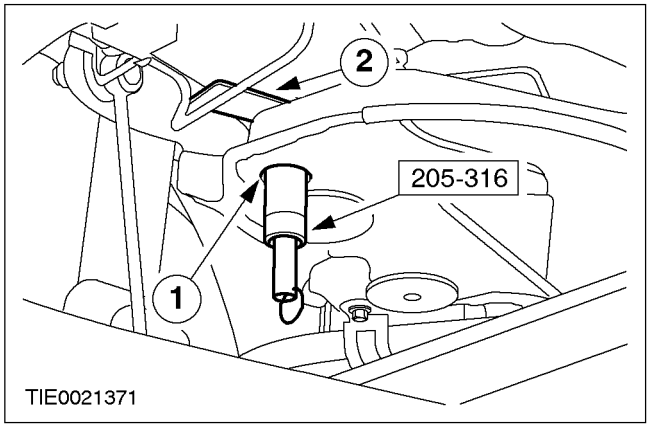
Installation

All vehicles

NOTE: Final tightening of the rear suspension components should be carried out when the vehicle weight is on the road wheels.

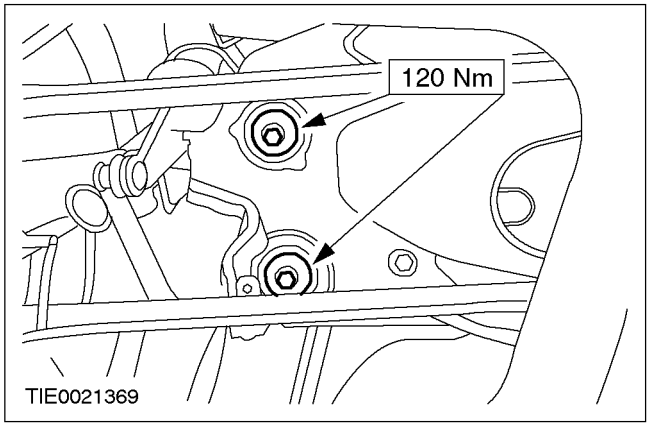
1. Using the special tools, align the crossmember.

1. Install the special tools.
2. Install the locking plates and tighten the sleeve.



REMOVAL AND INSTALLATION (Continued)

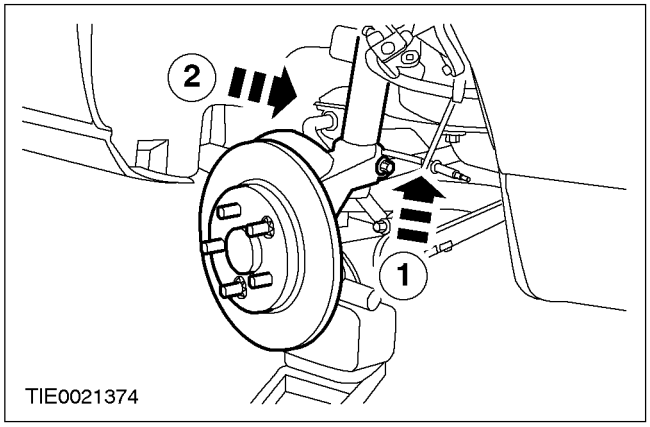
2. Install the crossmember (two bolts each side).



3. Remove the securing straps and the transmission jack.

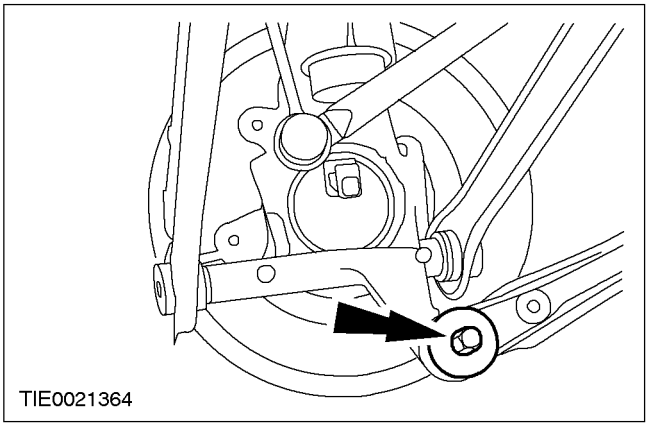
4. Using a suitable trolley jack jack, attach the suspension strut to the crossmember ledge on both sides.

1. Raise the suspension strut.
2. Move the suspension strut towards the crossmember ledge and lower the suspension strut onto the ledge.



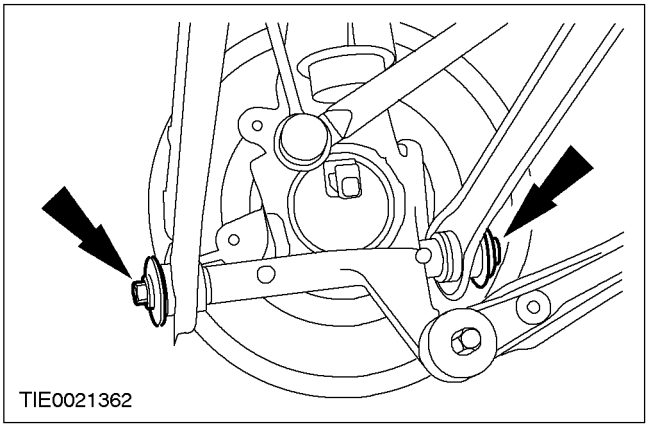
5. NOTE: Do not fully tighten the tie-bar retaining bolts at this stage.

Attach the tie-bar to the wheel knuckle on both sides.

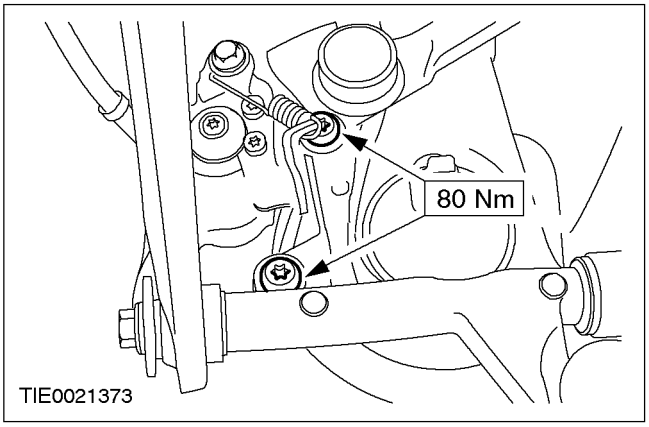


6. NOTE: Do not fully tighten the front and rear lower arm retaining bolts at this stage.

Attach the front and rear lower arms to the wheel knuckle on both sides.

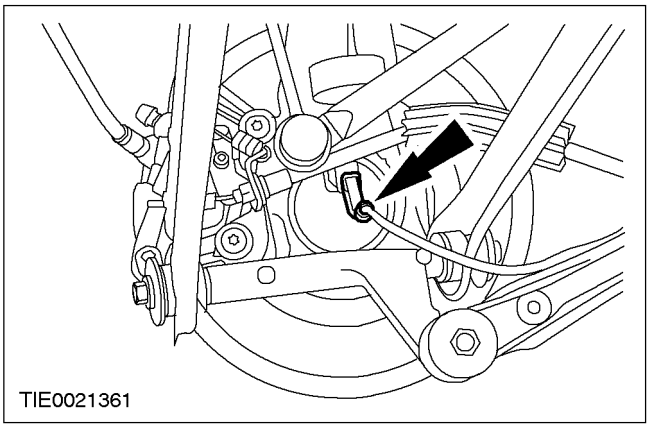


7. Attach the brake caliper and anchor plate to the wheel knuckle on both sides.

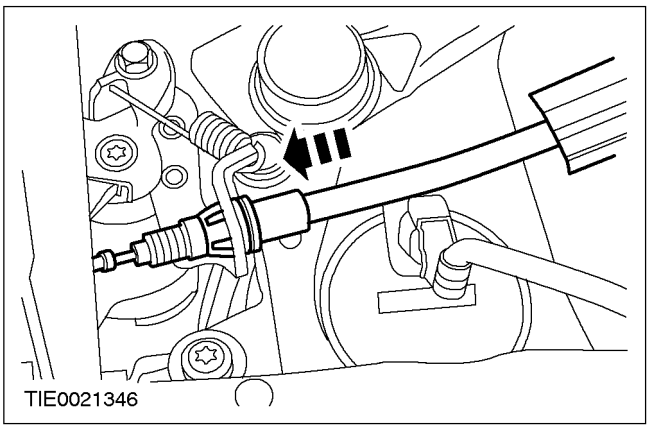


REMOVAL AND INSTALLATION (Continued)

8. Connect the rear wheel speed sensor electrical connector to the rear wheel speed sensor on both sides.

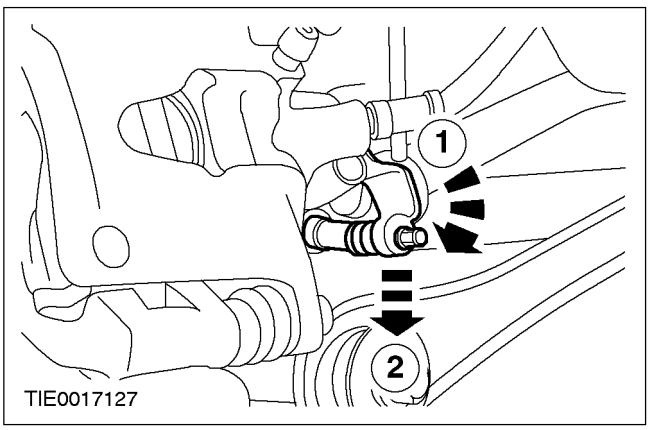


9. Attach the parking brake cable to the brake caliper on both sides.

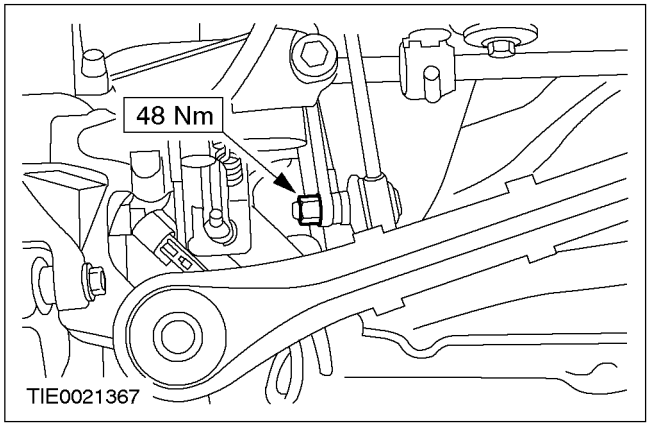


10. Attach the parking brake cable to the brake caliper lever on both sides.

1. Push the caliper lever.
2. Attach the parking brake cable.



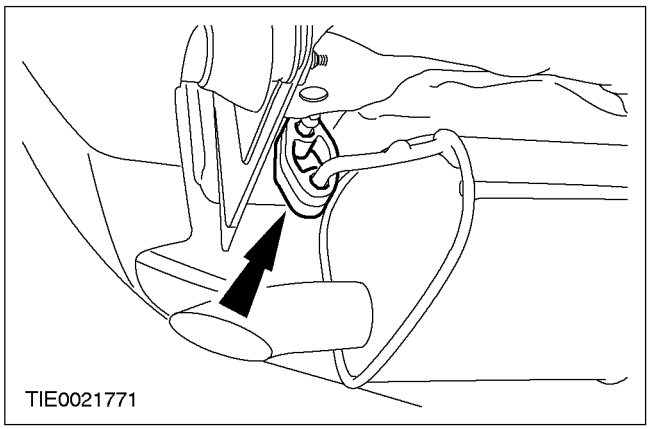
11. Attach the stabilizer bar connecting link to the stabilizer bar on both sides.



Vehicles with 2.5L engine

12. Install the front and rear muffler assembly.

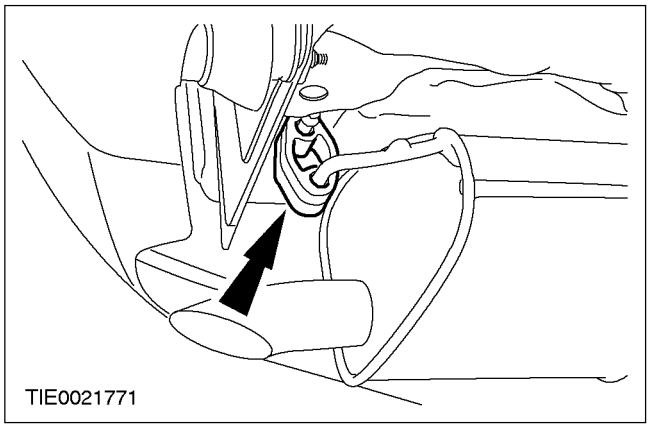
- Attach the rear mufflers to the rear exhaust hanger insulators (left-hand side shown).



Vehicles with 1.8L, 2.0L or diesel engine

13. Install the front and rear muffler assembly.

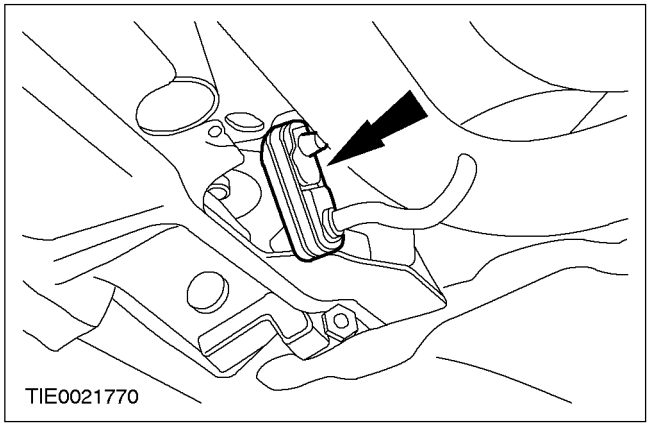
- Attach the muffler to the rear exhaust hanger insulator.



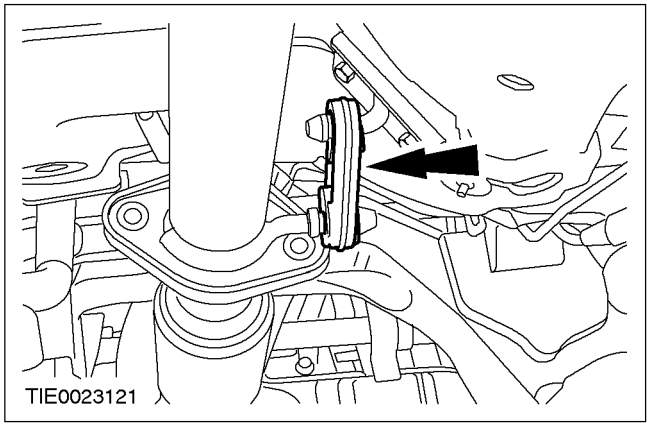
REMOVAL AND INSTALLATION (Continued)

All vehicles

14. Attach the front and rear muffler assembly to the intermediate exhaust hanger insulator.



15. Attach the front and rear muffler assembly to the front exhaust hanger insulator.

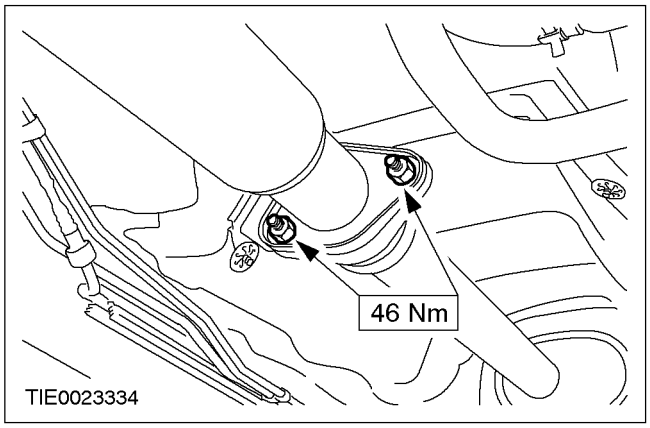


Vehicles with diesel engine

16. NOTE: Coat the front muffler pipe studs with anti-seize grease.

NOTE: Install a new sealing ring and nuts.

Attach the exhaust flexible pipe to the front muffler pipe.



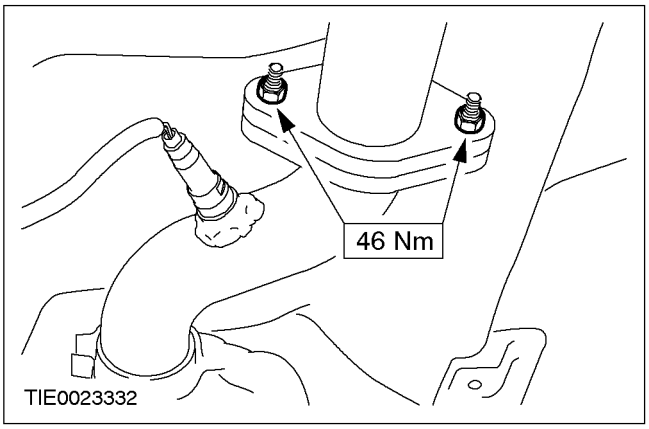
17. Remove the exhaust wrap or splint.

Vehicles with 2.5L engine

18. NOTE: Coat the catalytic converter studs with anti-seize grease.

NOTE: Install a new gasket and nuts.

Attach the catalytic converter to the front muffler pipe.

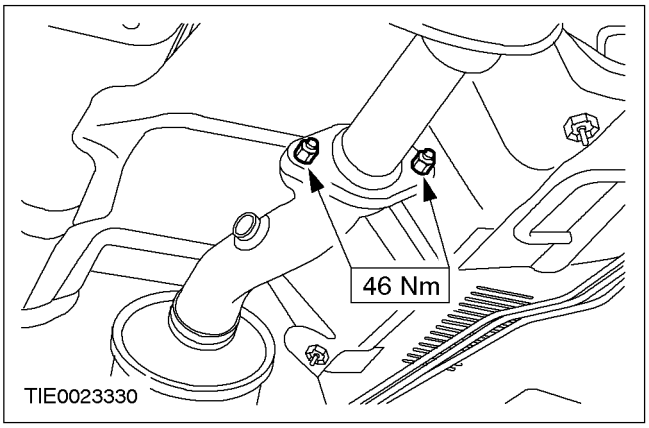


Vehicles with 1.8L or 2.0L engine

19. NOTE: Coat the catalytic converter studs with anti-seize grease.

NOTE: Install a new gasket and nuts.

Attach the catalytic converter to the front muffler pipe.



Vehicles with xenon headlamps

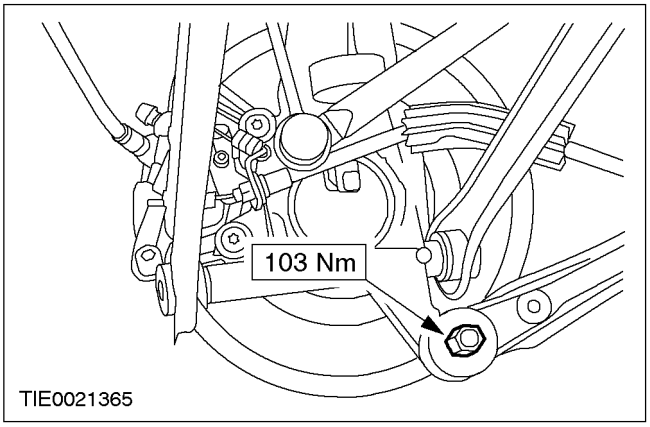
20. Install the headlamp leveling sensor. For additional information, refer to Section 417-01.

All vehicles

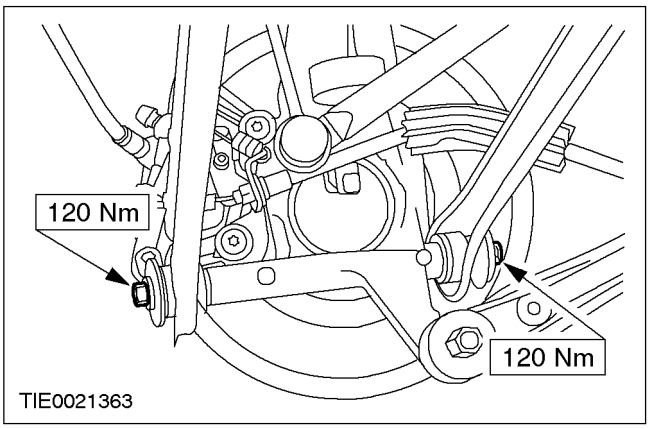
21. Install the wheels and tires. For additional information, refer to Section 204-04.

REMOVAL AND INSTALLATION (Continued)

22. Tighten the tie-bar to wheel knuckle retaining bolt on both sides.



23. Tighten the front and rear lower arm to wheel knuckle retaining bolts on both sides.



24. Check the toe setting and adjust as necessary. For additional information, refer to Section 204-00.

Vehicles with xenon headlamps

25. Initialize the headlamp leveling system using WDS.

REMOVAL AND INSTALLATION

Crossmember — Wagon

General Equipment
Transmission jack
Securing strap

Removal

All vehicles

1. **Remove the wheel knuckles. For additional information, refer to Wheel Knuckle-Wagon in this section.**

Vehicles with xenon headlamps

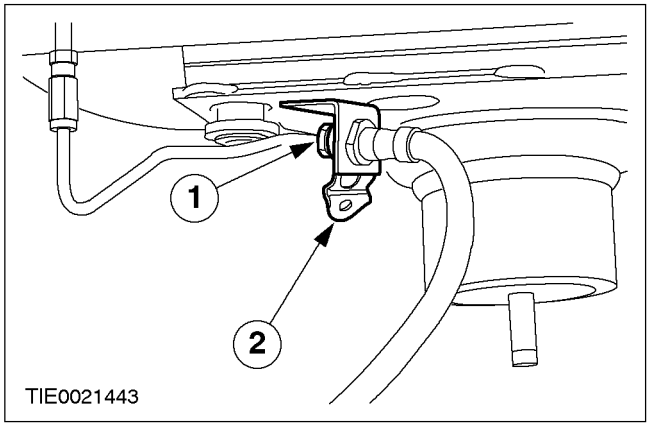
2. **Remove the headlamp leveling sensor. For additional information, refer to Section 417-01.**

All vehicles

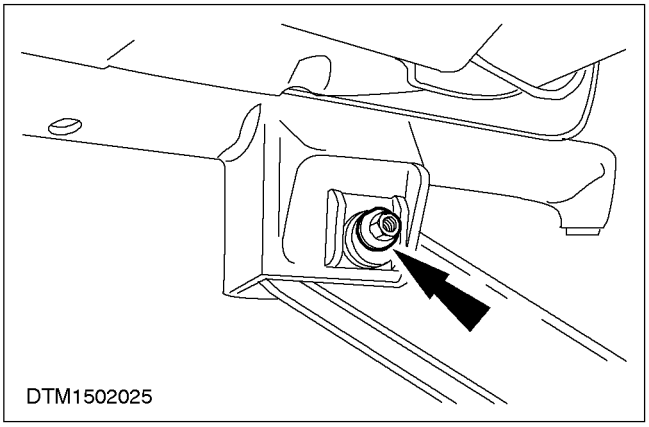
3. **CAUTION: Cap the brake tubes to prevent fluid loss or dirt ingress.**

   Remove the brake caliper and anchor plate assemblies.

   1. Disconnect the brake tube unions.
   2. Remove the brake hose retaining clips.



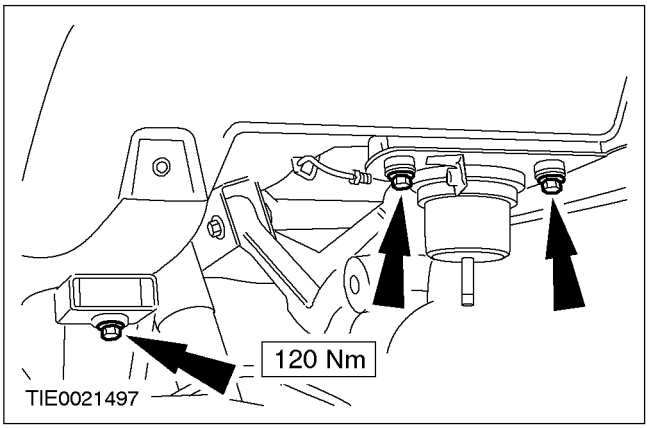
4. **Remove the rear lower arms.**



5. **WARNING: Make sure the crossmember is secured to the transmission jack. Failure to follow this instruction may result in personal injury.**

   Using a suitable securing strap, secure the crossmember to the transmission jack.

6. **Remove the crossmember (three bolts each side).**



Installation

All vehicles

1. **NOTE:** Final tightening of the rear suspension components should be carried out when the vehicle weight is on the road wheels.

   To install, reverse the removal procedure.

2. **Bleed the brake system. For additional information, refer to Section 206-00.**

REMOVAL AND INSTALLATION (Continued)

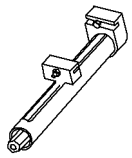
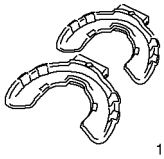
3. **Check the toe setting and adjust as necessary. For additional information, refer to Section 204-00.**

Vehicles with xenon headlamps

4. **Initialize the headlamp leveling system using WDS.**

DISASSEMBLY AND ASSEMBLY

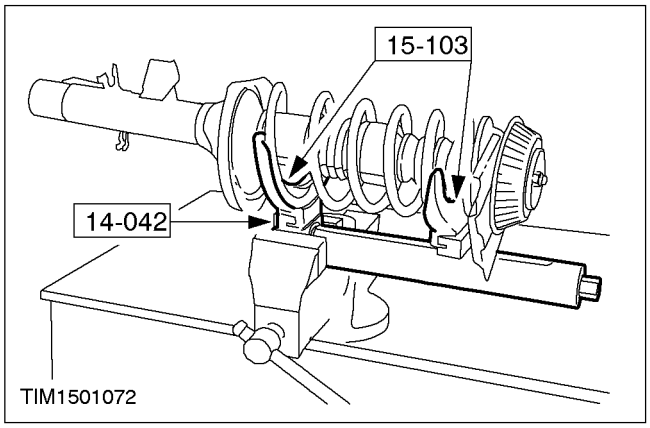
Strut and Spring Assembly

Special Tool(s)	
 14042	Spring compressor 14-042
 15103	Adaptors for 14-042 15-103

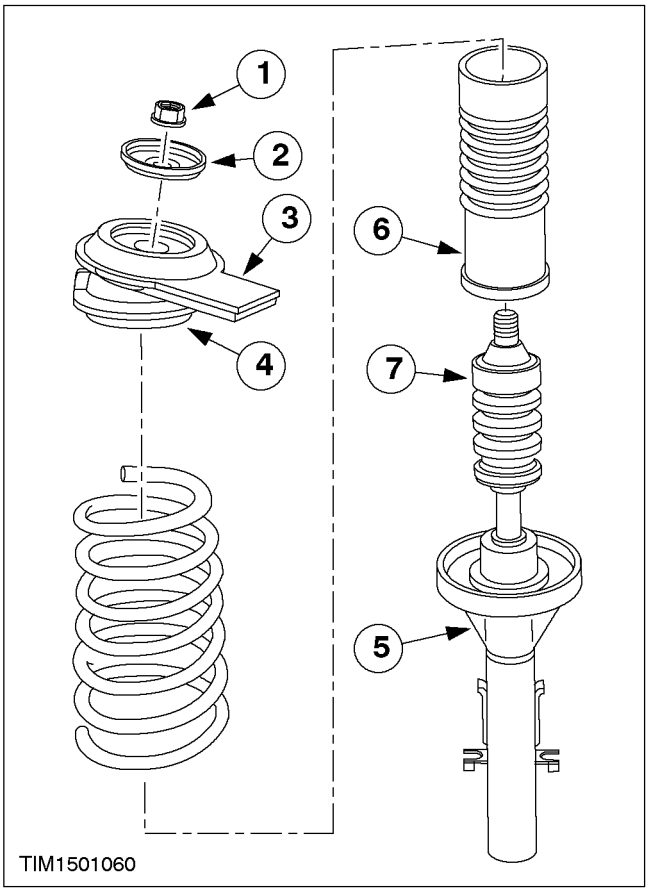
Disassembly

1. **WARNING: As the spring is under extreme tension care should be taken at all times.**

   Compress the spring.



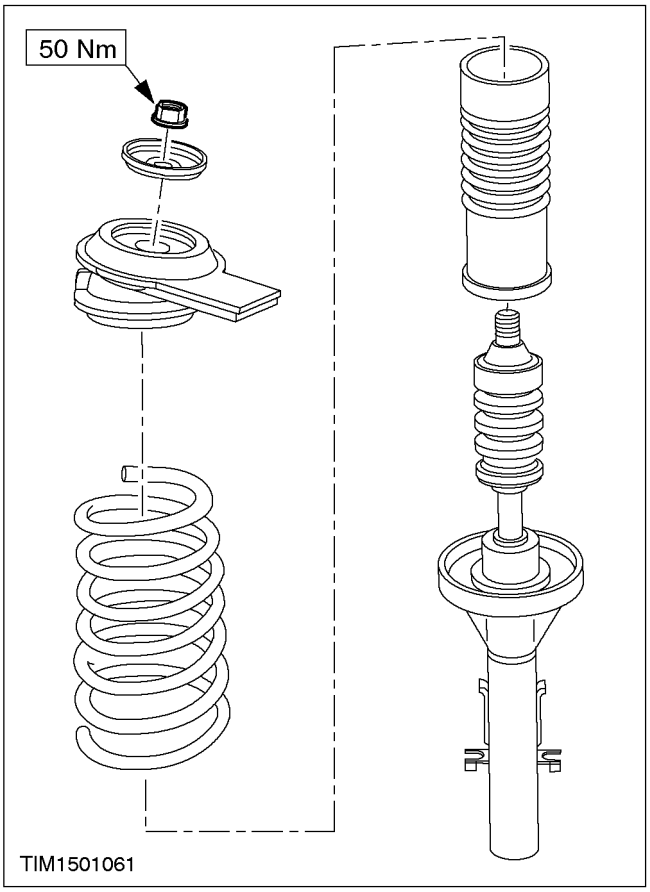
2. **Disassemble the suspension unit.**
   1. Remove the top mount nut.
   2. Remove the retaining cup.
   3. Remove the top mount.
   4. Remove the spring seat.
   5. Remove the suspension unit.
   6. Remove the gaiter.
   7. Remove the bump stop.



DISASSEMBLY AND ASSEMBLY (Continued)

Assembly

1. Install the components in reverse order.



SECTION 204-04 Wheels and Tires

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

SPECIFICATIONS

Specifications 204-04-2

DIAGNOSIS AND TESTING

Wheels and Tires..... 204-04-3
Inspection and Verification 204-04-3
Symptom Chart 204-04-4

REMOVAL AND INSTALLATION

Wheel and Tire 204-04-7

SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Wheel nuts	85	63	-

DIAGNOSIS AND TESTING

Wheels and Tires

Inspection and Verification

To maximize tire performance, inspect the tires for signs of incorrect inflation and uneven wear which may indicate a need for balancing, rotation or suspension alignment. Tires should also be checked frequently for cuts, stone bruises, abrasions, blisters, and for objects that may have become embedded in the tread. More frequent inspections are recommended when rapid or extreme temperature changes occur or when road surfaces are rough or occasionally littered with foreign material.

As a further visible check of tire condition, tread wear indicators are molded into the bottom of the tread grooves. When these indicator bands become visible, new tires must be installed.

Tire Wear Diagnosis

Uneven wear is usually caused by either excessive camber or excessive toe on tires.

Sometimes incorrect toe settings or worn struts will cause severe `cupping' or `scalloped' tire wear on non-driven wheels.

Severely incorrect toe settings will also cause other unusual wear patterns.

Tire Vibration Diagnosis

A tire vibration diagnostic procedure always begins with a road test. The road test and customer interview (if available) will provide much of the information needed to find the source of a vibration.

During the road test, drive the vehicle on a road that is smooth and free of undulations. If vibration is apparent, note and record the following:

- the speed at which the vibration occurs.
- what type of vibration occurs in each speed range.
  - mechanical or audible
- how the vibration is affected by changes in the following:
  - engine torque
  - vehicle speed
  - engine speed
- type of vibration - sensitivity: torque sensitive, vehicle speed sensitive or engine speed sensitive.

The following explanations help isolate the source of the vibration.

Torque Sensitive

This means that the condition can be improved or made worse by accelerating, decelerating, coasting, maintaining a steady vehicle speed or applying engine torque.

Vehicle Speed Sensitive

This means that the vibration always occurs at the same vehicle speed and is not affected by engine torque, engine speed or the transmission gear selected.

Engine Speed Sensitive

This means that the vibration occurs at varying vehicle speeds when a different transmission gear is selected. It can sometimes be isolated by increasing or decreasing engine speed with the transmission in NEUTRAL or by stall testing with the transmission in gear. If the condition is engine speed sensitive, the cause is probably not related to the tires.

If the road test indicates that there is tire whine, but no shake or vibration, the noise originates with the contact between the tire and the road surface.

A thumping noise usually means that the tire is flat or has soft spots making a noise as they slap the roadway. Tire whine can be distinguished from axle noise. Tire whine remains the same over a range of speeds.

A complete road test procedure is described in Section 100-04. REFER to Section 100-04.

DIAGNOSIS AND TESTING

Symptom Chart

Condition	Possible Sources	Action
•Tires show excess wear on edge of tread	•Tires under-inflated.	•ADJUST the tire pressure.
	•Vehicle overloaded.	•CORRECT as necessary.
	•Incorrect wheel alignment.	•ADJUST the wheel alignment.
•Tires show excess wear in center of tread	•Tires over-inflated.	•ADJUST the tire pressure.
•Other excessive tire wear concerns	•Incorrect tire pressure.	•ADJUST the tire pressure.
	•Tires need rotating.	•ROTATE the tires.
	•Incorrect wheel alignment.	•ADJUST the wheel alignment.
	•Vehicle overloaded.	•CORRECT as necessary.
	•Loose or leaking front strut and spring assembly.	•TIGHTEN or INSTALL new suspension components as necessary. REFER to Section 204-01.
	•Wheel bearings worn.	•INSTALL new wheel bearings as necessary. REFER to Section 204-01 / 204-02.
	•Suspension components, bushings and ball joints.	•CHECK or INSTALL new suspension components as necessary.
	•Excessive lateral or radial runout of wheel or tire.	•CHECK the wheel and tire radial runout. REFER to Section 204-00.
•Wheel mounting is difficult	•Incorrect application or mismatched parts, including wheel studs and nuts.	•FOLLOW manufacturers specifications.
•Wheel rust or corrosion	•Poor maintenance.	•CLEAN and PROTECT with paint.
•Wobble or shimmy affecting wheel runout	•Damaged wheel.	•INSPECT wheel rims for damage. INSTALL new parts as necessary.
	•Front wheel bearing.	•CHECK or INSTALL new wheel bearings as necessary. REFER to Section 204-01.
•Excessive vehicle vibration, rough steering	•Suspension components.	•CHECK or INSTALL new parts. REFER to Section 204-00.
•Vehicle vibrations from wheels and tires	•Incorrect tire pressure.	•ADJUST the tire pressure.
	•Wheel or tire imbalance.	•BALANCE the tire and wheel assembly.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
	•Uneven tire wear.	•INSTALL a new tire(s) as necessary.
	•Brake disc imbalance.	•CHECK the brake disc for foreign material.
	•Water in tires.	•REMOVE the water.
	•Bent wheel.	•INSTALL a new wheel. Attempts to straighten a wheel can cause fractures in the wheel and weaken the wheels strength.
	•Incorrectly seated tire bead.	•SPIN the wheel on the vehicle. EXAMINE the area where the tire and the wheel meet. If that section of the tire appears to waver while being rotated, the tire bead may not be correctly seated on the wheel. REMOVE the tire and CLEAN the bead seat areas on both wheel and tire.
	•Radial runout of wheel or tire.	•Using a suitable dial indicator gauge and holding fixture, CHECK the radial runout of both the wheel and the tire. REFER to Section 204-00.
	•Wheel stud, wheel nut or enlarged stud holes.	•CHECK or INSTALL new parts as necessary.
	•Foreign material between wheel mounting face and hub mounting surface.	•CLEAN mounting surfaces.
	•Lateral runout of wheel or tire.	•Using a suitable dial indicator gauge and holding fixture, CHECK the radial runout of both the wheel and the tire. REFER to Section 204-00.
	•Front wheel bearing.	•CHECK or INSTALL a new wheel bearing as necessary. REFER to Section 204-01.
•Cracks develop in rim base back (rim bead seat)	•Overloading or abusive use.	•INSTALL a new wheel. CHECK loading and operating conditions. AVOID over inflation of tires. CHECK the specifications for the rim load capacity, working load, tire size, ply rating and tire construction.
	•Incorrect use of tools.	•CHECK mounting, demounting, and maintenance procedures.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
•Damaged wheel studs	•Sliding wheel across wheel studs during assembly.	•INSTALL new wheel studs as necessary. INSTALL a new wheel as necessary.
•Loose brake drum	•Wheel studs too long.	•INSTALL new wheel studs of the correct length as necessary.
•Broken wheel studs	•Loose wheel nuts.	•INSTALL new wheel studs and nuts. TIGHTEN to specification.
	•Overloading.	•INSTALL new wheel studs. TIGHTEN to specification. Compare actual load against vehicle load ratings.
•Stripped wheel stud threads	•Excessive tightening.	•INSTALL new wheel studs and nuts. TIGHTEN to specification.
•Rust streaks from the wheel stud holes in the wheel	•Wheel nuts.	•CHECK complete assembly. If parts are damaged INSTALL new parts. TIGHTEN to specification.
•Damaged wheel nuts	•Wheel assembly.	•INSTALL new wheel nuts. TIGHTEN to specification.
	•Over tightened wheel nuts.	•FOLLOW correct tightening procedure.
•Seized wheel nuts	•Corrosion.	•CAUTION: Do not permit lubricant to get on cone sets of stud holes or on cone angle of wheel nuts. If corrosion is slight, wire brush away. If corrosion is excessive, INSTALL new wheel studs and nuts. If the condition persists, LUBRICATE the first three threads of each wheel stud with a graphite-based lubricant.
	•Overloading	•REDUCE weight.

REMOVAL AND INSTALLATION

Wheel and Tire

Removal

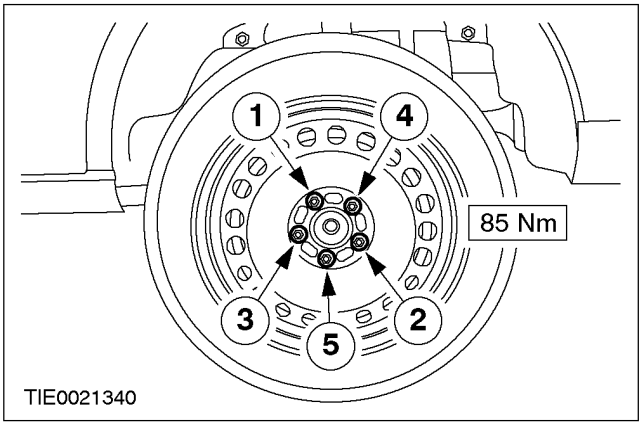
CAUTION: Do not use heat to loosen a seized wheel nut. Heat may damage the wheel and wheel hub.

1. **Loosen the wheel nuts.**
2. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
3. **Remove the wheel and tire.**

Installation

1. **WARNING: Remove any corrosion or dirt from the mounting surfaces of the wheel, wheel hub or brake disc. Corrosion or dirt on the mounting surfaces may cause the wheel nuts to loosen and the wheel to come off while the vehicle is in motion. Failure to follow this instruction may result in personal injury.**

   Clean the wheel hub and mounting surfaces.
2. **Install the wheel and tire.**
3. **Lower the vehicle.**
4. **Tighten the wheel nuts in the sequence shown.**



SECTION 205-04 Front Drive Halfshafts

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

Specifications 205-04-2

DESCRIPTION AND OPERATION

Front Drive Halfshafts 205-04-3
Working principle of the halfshafts 205-04-9
Handling halfshafts 205-04-9
Wheel balancing, front 205-04-9
Raising the vehicle 205-04-9
Towing the vehicle 205-04-9
Underbody protection and corrosion prevention 205-04-9

DIAGNOSIS AND TESTING

Front Drive Halfshafts 205-04-11
Inspection and Verification 205-04-11
Symptom Chart – Front Drive Halfshafts 205-04-11

REMOVAL AND INSTALLATION

Halfshaft LH ..... (14 320 0) 205-04-12
Halfshaft RH ..... (14 321 0) 205-04-23
Intermediate Shaft 205-04-34
Constant Velocity (CV) Joint Boot 205-04-38

SPECIFICATIONS

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Grease, outer constant velocity (CV) joint	XS4C-M1C230-AA
Grease, inner CV joint	WSD-M1C230-A

Constant Velocity (CV) Joint Boot Capacities

Description	
Grease, outer CV joint	55
Grease, inner CV joint (vehicles with 1.8L or 2.0L engine)	155
Grease, inner CV joint (vehicles with 2.5L engine)	165
Grease, inner CV joint (vehicles with 2.0L diesel engine)	165

Torque Specifications

Description	Nm	lb-ft	lb-in
Intermediate shaft center bearing retaining nuts Intermediate shaft center bearing to cylinder block bracket retaining bolts (vehicles with 1.8L or 2.0L engine)	25 48	18 35	– –
Stabilizer bar connecting link to suspension strut retaining nut	48	35	–
Suspension top mount thrust bearing retaining nut	59	44	–
Hub retaining nut	290	214	–
Boot clamps	21	15	–
Engine undershield retaining bolts	10	–	89
Subframe retaining bolts	142	–	105
Subframe bracket retaining bolts	10	–	89
Lower arm to wheel knuckle pinch nut and bolt	83	61	–

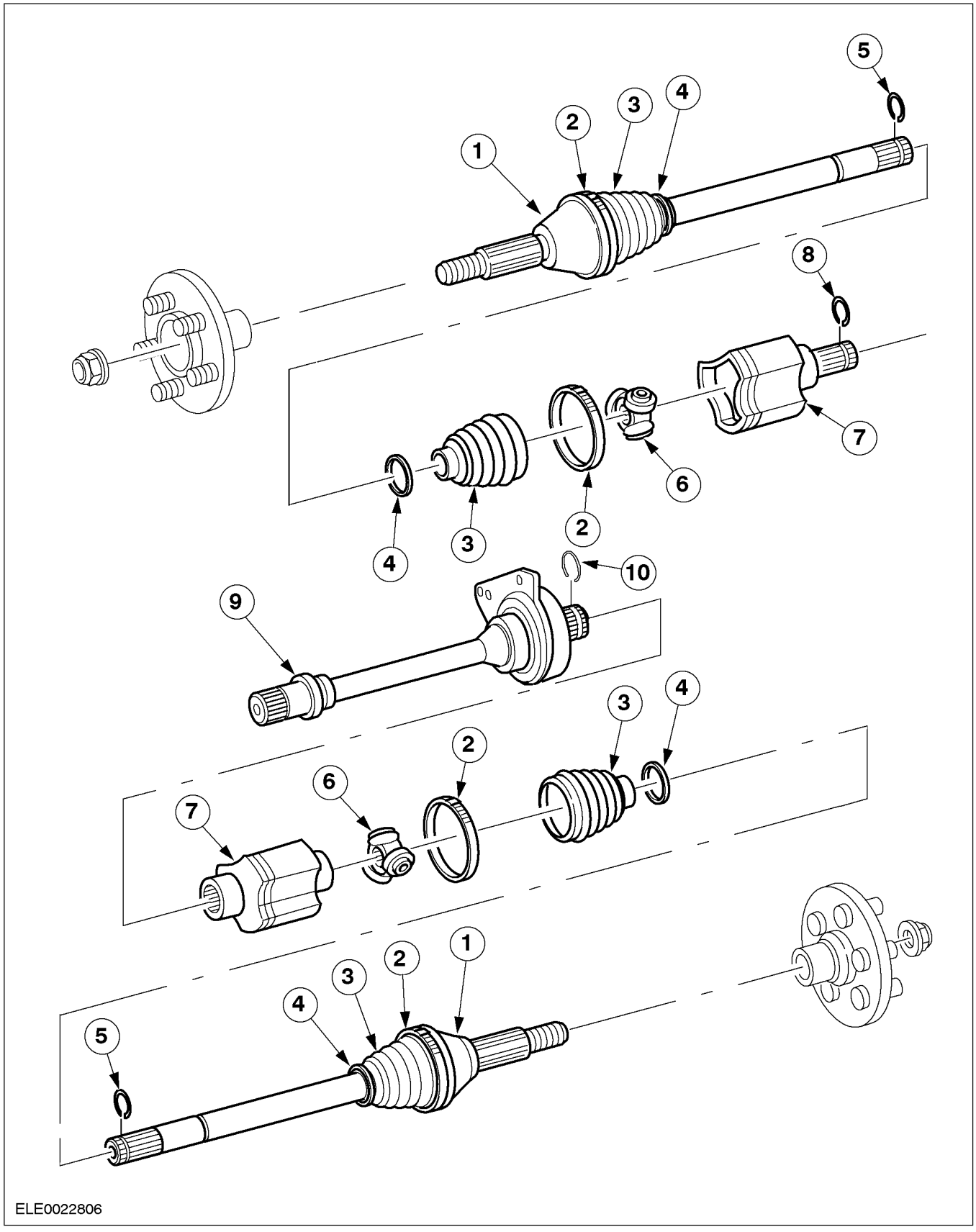
DESCRIPTION AND OPERATION

Front Drive Halfshafts

- The halfshafts have constant velocity (CV) joints at both ends to provide smooth drive to the road wheels.
- The inner CV joints are sliding joints.
- The outer CV joints are fixed ball joints.
- The left-hand halfshaft CV joint is secured in the differential with a snap ring.
- The intermediate shaft (right-hand side) is secured in the differential by the intermediate shaft center bearing.
- The right-hand halfshaft is secured on the intermediate shaft with a snap ring.
- The outer CV joints are attached to the wheel hubs.

DESCRIPTION AND OPERATION

Exploded view of the halfshaft (vehicles with 2.5L engine)



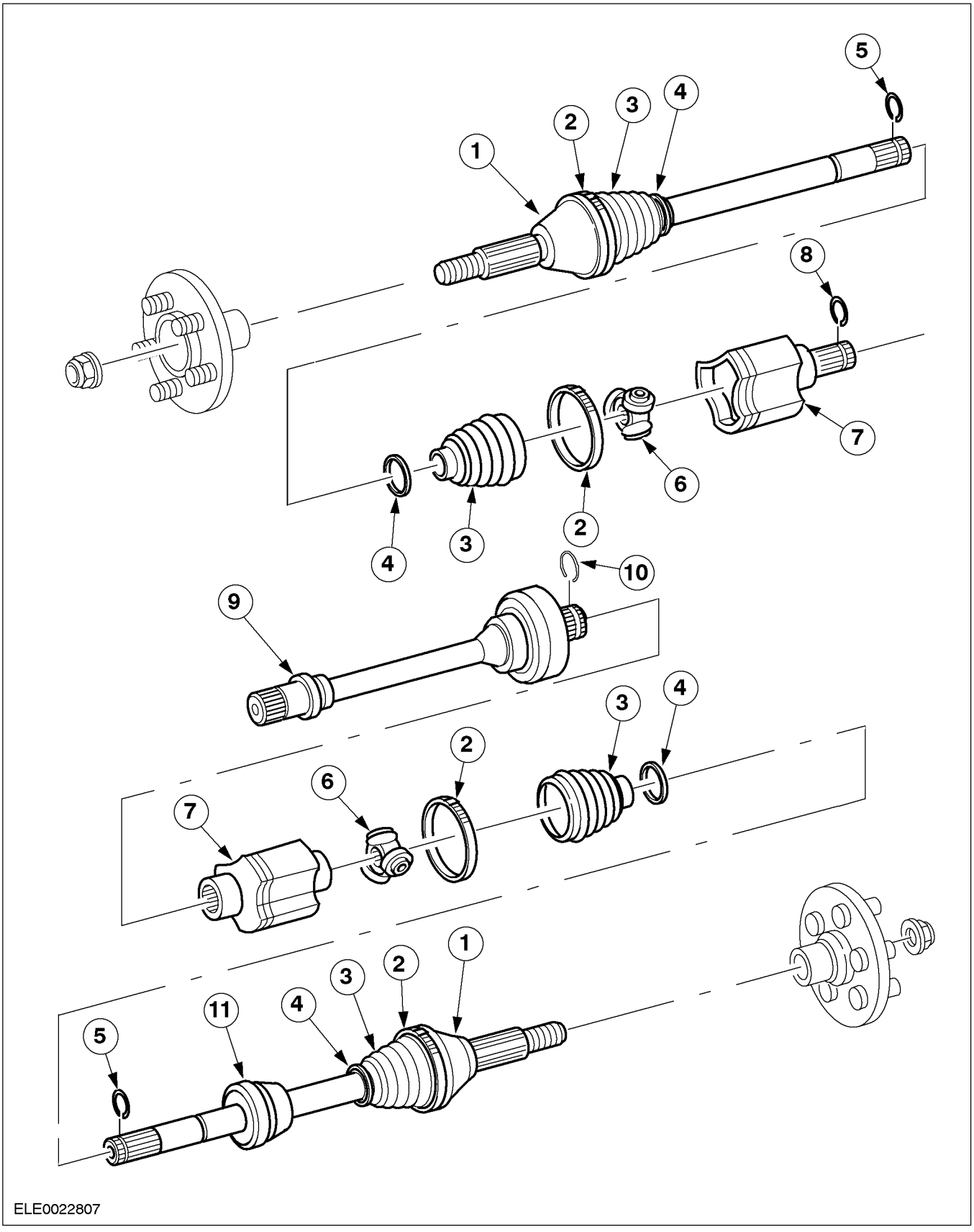
DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1	-	Solid halfshaft with fixed outer CV joint
2	-	Boot retaining clamp (large)
3	-	CV joint boot
4	-	Boot retaining clamp (small)
5	-	Circlip - spider
6	-	Inner CV joint bearing

Item	Part Number	Description
7	-	Inner CV joint housing
8	-	Snap ring - stub shaft
9	-	Solid intermediate shaft with intermediate shaft center bearing
10	-	Snap ring - intermediate shaft

DESCRIPTION AND OPERATION

Exploded view of the halfshaft (vehicles with 2.0L diesel engine)



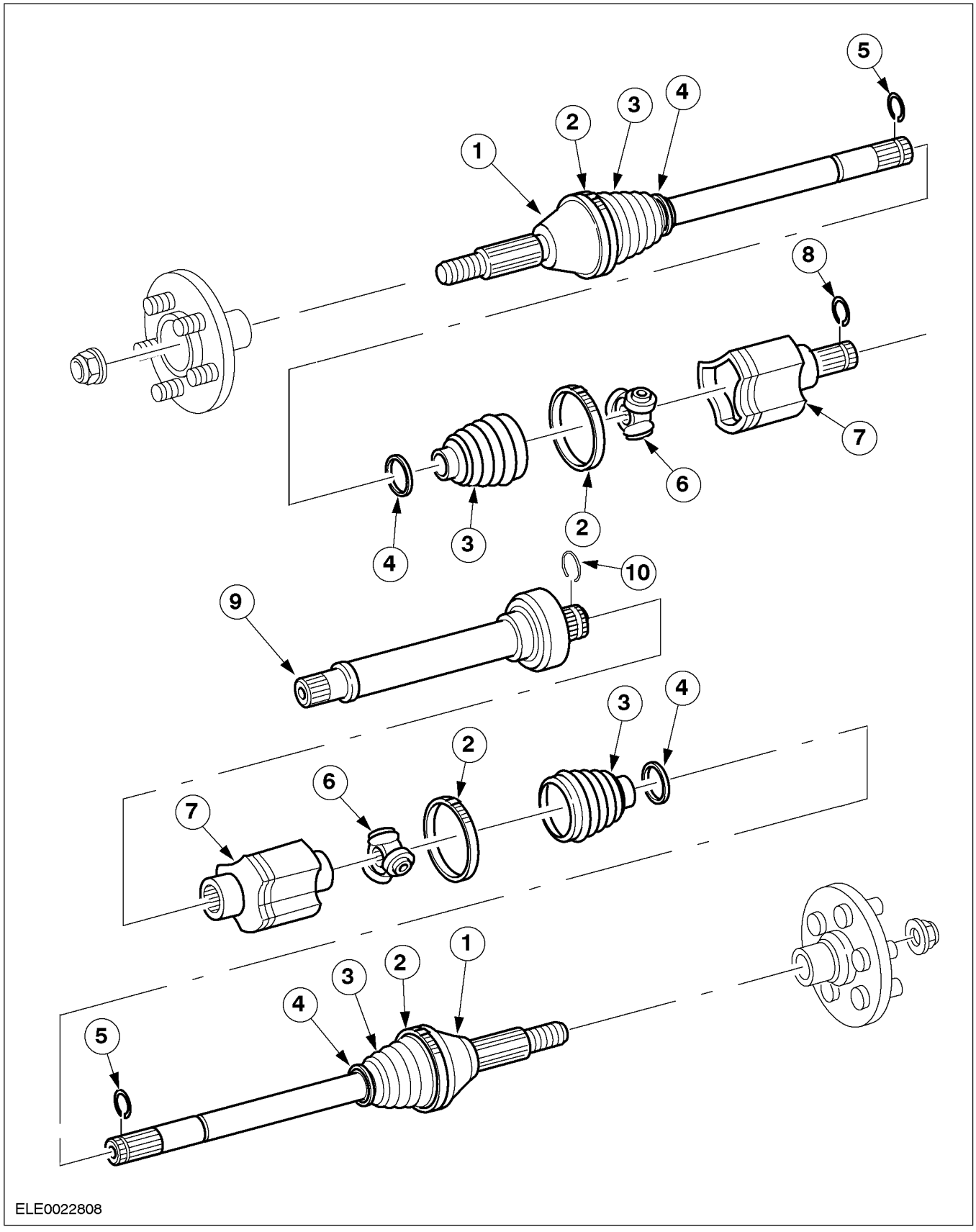
DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1	-	Solid halfshaft with fixed outer CV joint
2	-	Boot retaining clamp (large)
3	-	CV joint boot
4	-	Boot retaining clamp (small)
5	-	Circlip - spider
6	-	Inner CV joint bearing

Item	Part Number	Description
7	-	Inner CV joint housing
8	-	Snap ring - stub shaft
9	-	Solid intermediate shaft with intermediate shaft center bearing
10	-	Snap ring - intermediate shaft
11	-	Dynamic absorber

DESCRIPTION AND OPERATION

Exploded view of the halfshaft (vehicles with 1.8 or 2.0L engine)



DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1	-	Tubular halfshaft with fixed outer CV joint
2	-	Boot retaining clamp (large)
3	-	CV joint boot
4	-	Boot retaining clamp (small)
5	-	Circlip - spider
6	-	Inner CV joint bearing
7	-	Inner CV joint housing
8	-	Snap ring - stub shaft
9	-	Tubular intermediate shaft with intermediate shaft center bearing
10	-	Snap ring - intermediate shaft

Working principle of the halfshafts

- The halfshafts transmit torque from the engine to the wheels.
- In order to allow vertical movement of the wheels and engine, the halfshafts operate at varying lengths and angles.
- The tripode joints allow for changes in halfshaft length during axial movements.

Handling halfshafts

CAUTION: The inner constant velocity (CV) joint must not be bent at more than 18 degrees, the outer CV joint must not be bent at more than 45 degrees.

NOTE: Do not place the tripode joint under tension.

If removing/installing and disassembling/assembling the halfshafts, the following points should be observed:

- Check polished surfaces and splines for damage.
- Do not allow the boots to come into contact with sharp edges, the engine or the exhaust system.
- Do not drop the halfshaft as this can damage the inside of the CV joint boots without showing any signs of damage on the outside.
- Do not use halfshafts as levering tools for the installation of other components. The halfshafts must always hang freely.
- The tripode joint can be damaged by impact from outside the joint housing.

Wheel balancing, front

CAUTION: Using a portable wheel balancing unit when the vehicle is lifted completely off the ground will result in damage to the tripode joints or boots, as the joint is bent at a greater angle than its normal operating range. This results in overheating of the joint.

To use a portable balancing unit position a trolley jack under the suspension arm opposite the wheel which is being balanced. This prevents the joint from being bent too much when the vehicle is raised.

Where possible, wheels should be removed for balancing, and balanced using a stationary wheel balancing unit.

Raising the vehicle

CAUTION: Never use the CV joints or halfshafts as jacking points.

Towing the vehicle

NOTE: Do not attach the tow rope to the halfshaft.

Underbody protection and corrosion prevention

NOTE: The boots should be covered during application of underbody protection or corrosion prevention.

DESCRIPTION AND OPERATION (Continued)

Foreign matter on the boots can cause premature ageing of the material. Foreign matter on the halfshafts can cause imbalance.

DIAGNOSIS AND TESTING

Front Drive Halfshafts

(if possible) before proceeding to the next step.

Inspection and Verification

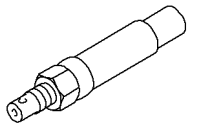
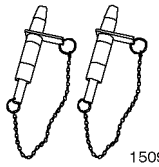
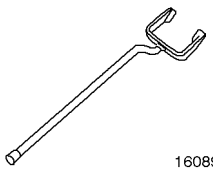
1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause

Symptom Chart – Front Drive Halfshafts

Condition	Possible Sources	Action
•Clicking, Popping or Grinding Noises While Turning	•Inadequate or contaminated lubricant in the inner/outer front drive halfshaft constant velocity (CV) joint.	•INSPECT, CLEAN and LUBRICATE as necessary.
	•Another component contacting front drive halfshaft assembly. •Wheel bearings, brakes, suspension or steering components.	•INSPECT and REPAIR as necessary. •INSPECT and REPAIR as necessary. REFER to Section 204-00 / 206-00 / 211-00.
•Vibration at Highway Speeds	•Out of balance front wheels or tires. •Out-of-round tires. •Incorrectly seated outer constant velocity (CV) joint in front wheel hub.	•REPAIR or INSTALL new as necessary. REFER to Section 204-04. •REPAIR or INSTALL new as necessary. REFER to Section 204-04. •REPAIR or INSTALL new as necessary. REFER to Halfshaft Disassemblv and Assembly in this section.
•Shudder Vibration During Acceleration.	•Excessively high CV joint operating angles caused by incorrect ride height. •Excessively worn or damaged inner/outer front drive halfshaft constant velocity (CV) joint.	•CHECK ride height, VERIFY correct spring rate and CHECK items under Halfshaft Joint Pullout. REPAIR or INSTALL new as necessary. •INSPECT and INSTALL new as necessary.
•Halfshaft Joint Pullout	•Outer front drive halfshaft retainer circlip missing or not correctly seated differential side. •Engine/transaxle assembly misalignment. •Frame rail or strut tower out of position or damaged. •Front suspension components worn or damaged.	•INSPECT and REPAIR or INSTALL new as necessary. •CHECK engine mounts for damage or wear. REPAIR or INSTALL new as necessary. •CHECK underbody dimensions. •CHECK for worn bushings or bent components (front stabilizer bar, front suspension lower arm). REPAIR or INSTALL new as necessary.

REMOVAL AND INSTALLATION

Halfshaft LH (14 320 0)

Special Tool(s)	
 14041	Installer, Halfshaft 204-161 (14-041)
 15097A	Alignment Pins, Subframe 205-316 (15-097A)
 16089	Remover, Halfshaft 308-256 (16-089)

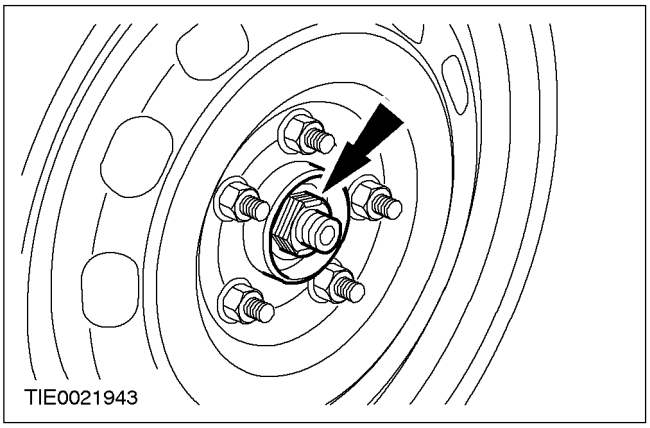
General Equipment
Three leg puller
Transmission jack

Removal

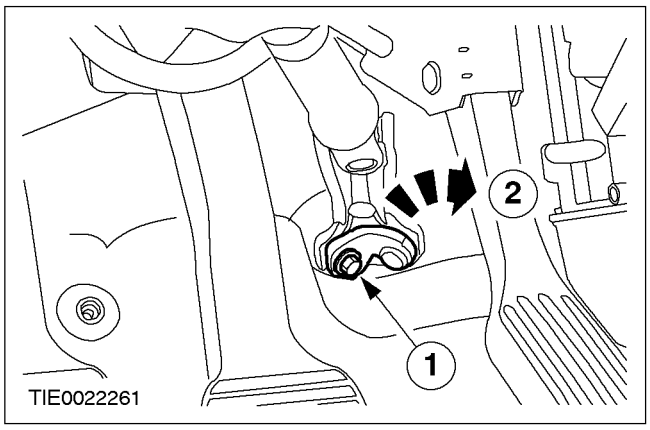
All vehicles

1. **CAUTION: Use a socket to loosen the wheel hub retaining nut to prevent damage.**

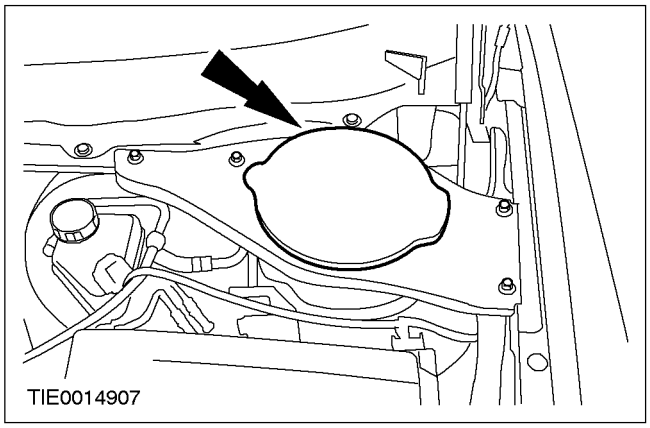
   Loosen the wheel hub retaining nut.



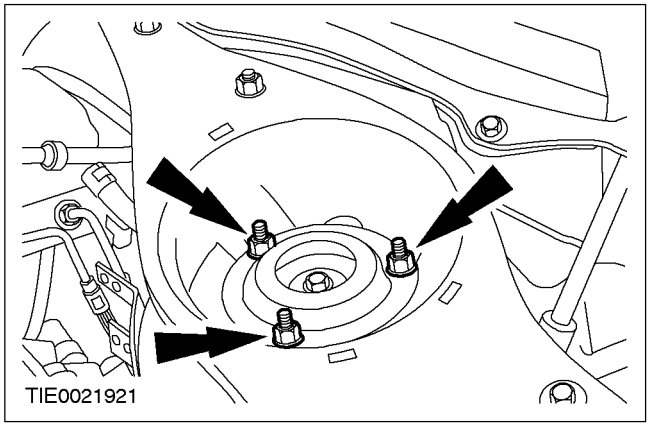
2. **Detach the steering column shaft from the steering column flexible coupling.**
   1. Remove the retaining bolt.
   2. Rotate the clamp plate.
   - Discard the bolt.



3. **Remove the suspension strut and spring assembly top mount brace cover.**
   - Release the clips.

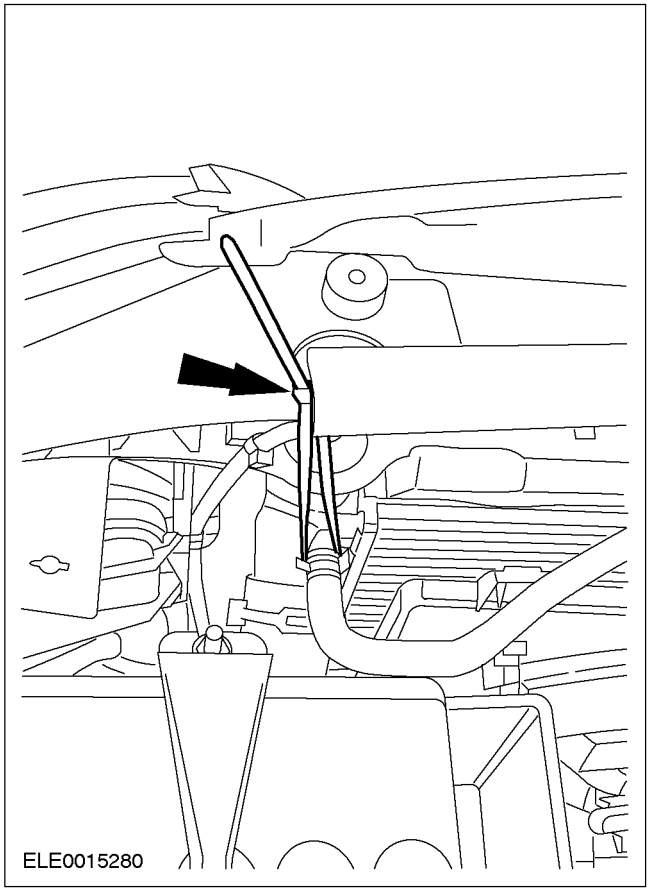


4. **Loosen the strut and spring assembly top mount retaining nuts by four turns.**



REMOVAL AND INSTALLATION (Continued)

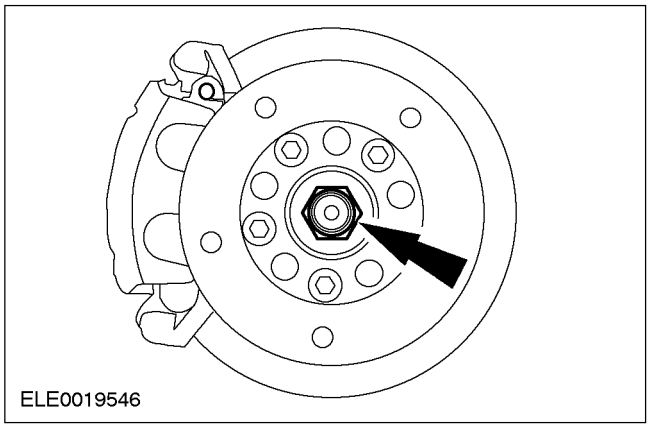
5. Using cable ties, support the radiator on both sides.



6. Remove the wheel and tire. For additional information, refer to Section 204-04.

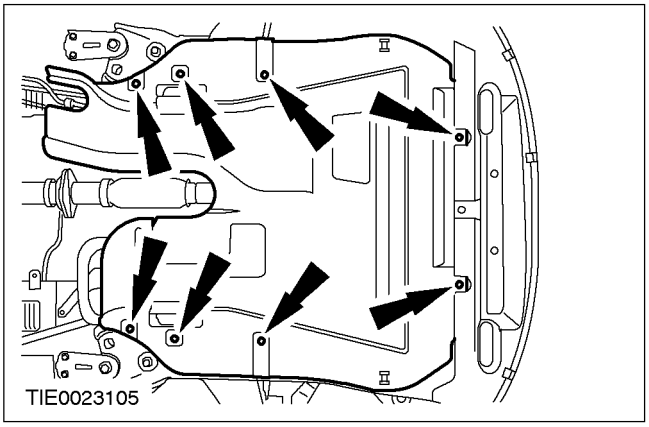
7. CAUTION: The wheel hub retaining nut can be reused four times, mark the retaining nut.

Remove the wheel hub retaining nut.



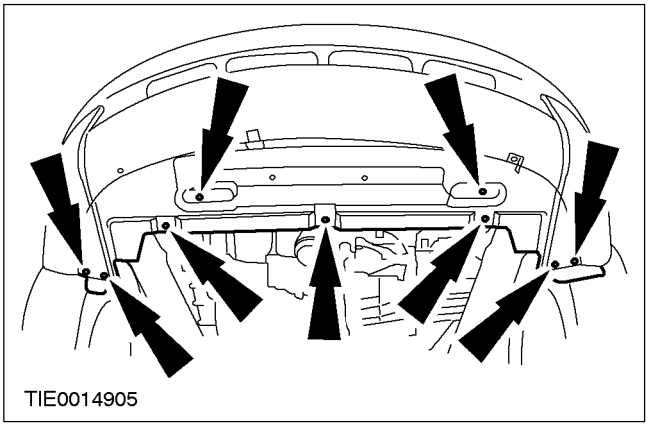
Vehicles with diesel engine

8. Remove the engine undershield.



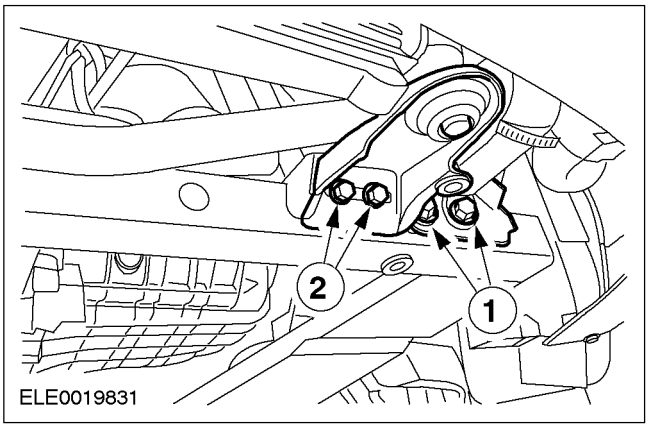
All vehicles

9. Remove the splash shield.



10. Remove the radiator support brackets.

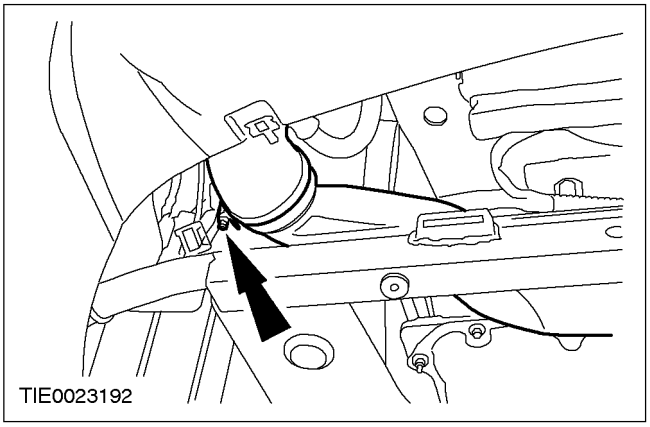
1. Remove the hose bracket.
2. Remove both radiator support brackets.



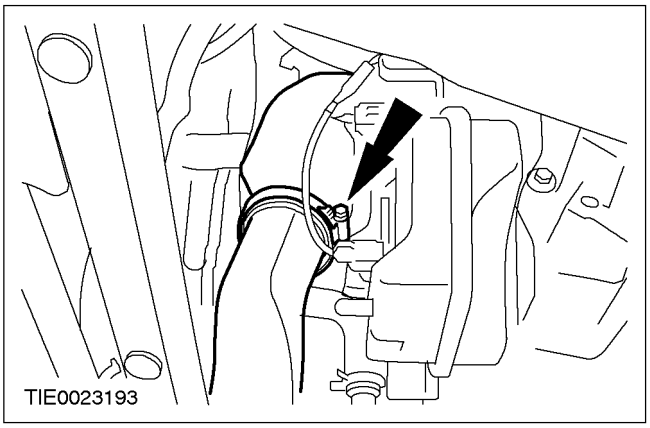
REMOVAL AND INSTALLATION (Continued)

Vehicles with diesel engine

11. Detach the air intake hose.

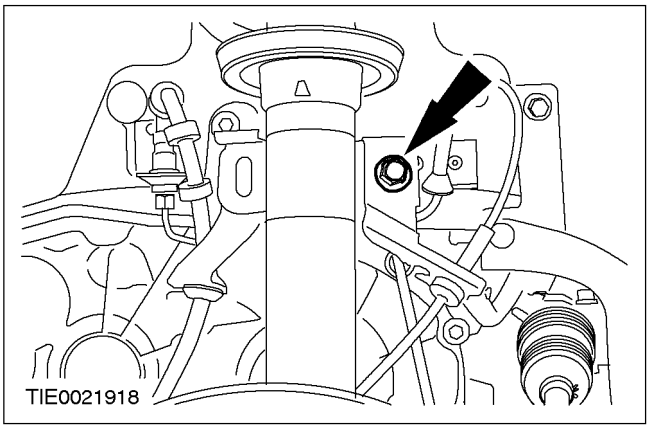


12. Detach the turbocharger outlet hose.



All vehicles

13. Detach the stabilizer bar connecting link from the suspension strut.



Vehicles with 1.8L, 2.0L or diesel engine

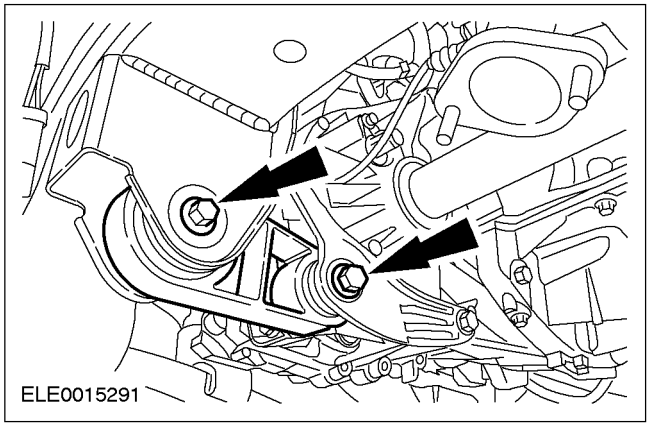
14. Remove the exhaust flexible pipe. For additional information, refer to Section 309-00.

Vehicles with 2.5L engine

15. Remove the exhaust dual converter y-pipe. For additional information, refer to Section 309-00.

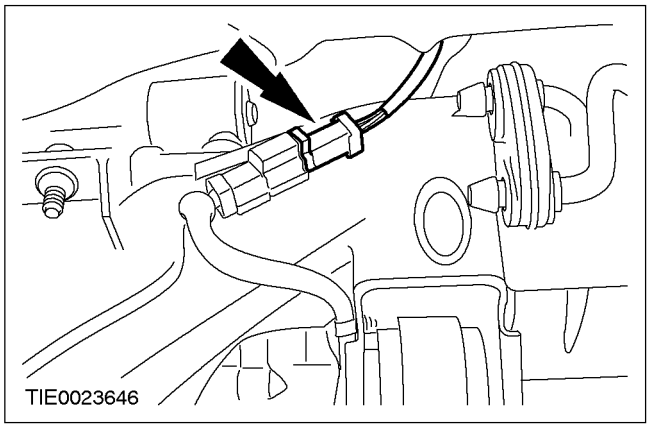
All vehicles

16. Remove the engine rear support insulator.

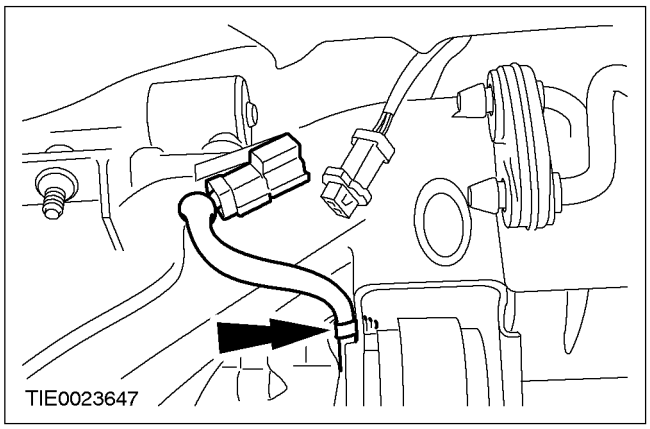


All except vehicles with diesel engine

17. Disconnect the catalyst monitor sensor electrical connector.



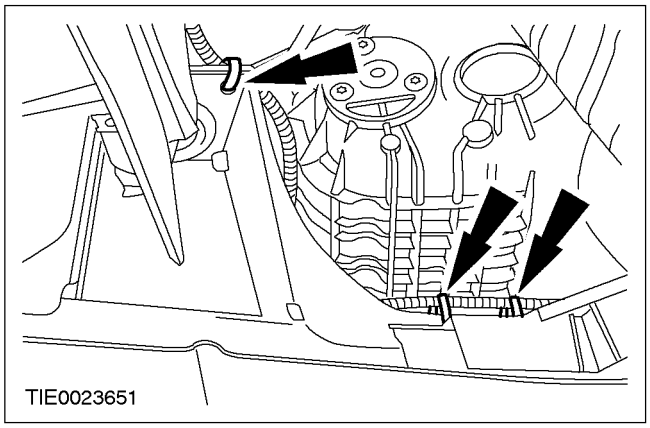
18. Detach the catalyst monitor sensor wiring harness from the subframe.



REMOVAL AND INSTALLATION (Continued)

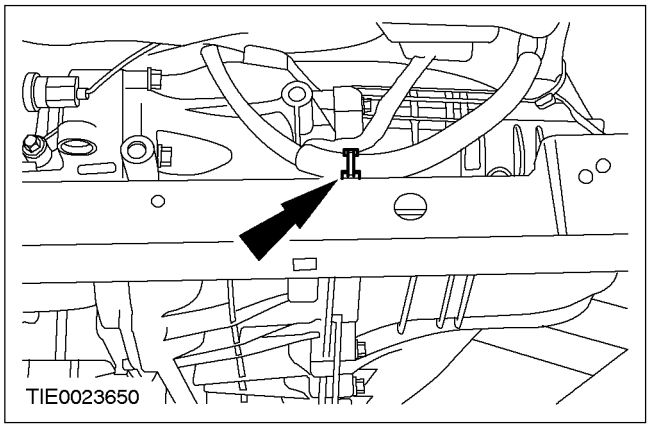
Vehicles with xenon headlamps

19. Detach the headlamp leveling sensor wiring harness from the subframe.

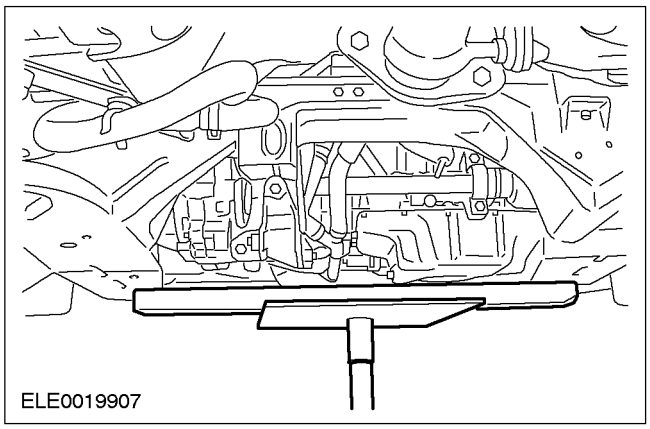


All vehicles

20. Detach the radiator cooling fan wiring harness from the subframe.

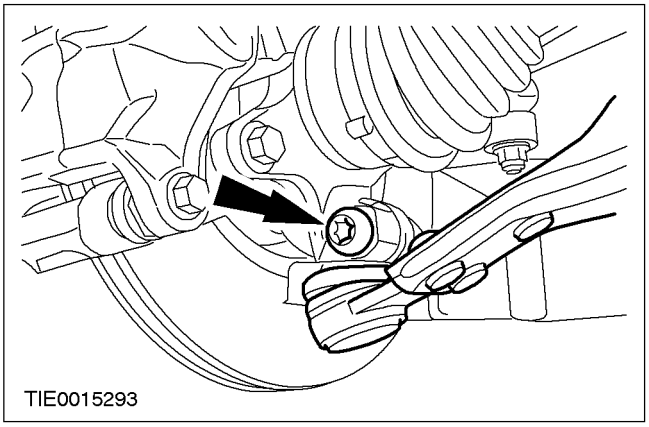


21. Using two suitable wooden blocks and a suitable transmission jack, support the subframe.

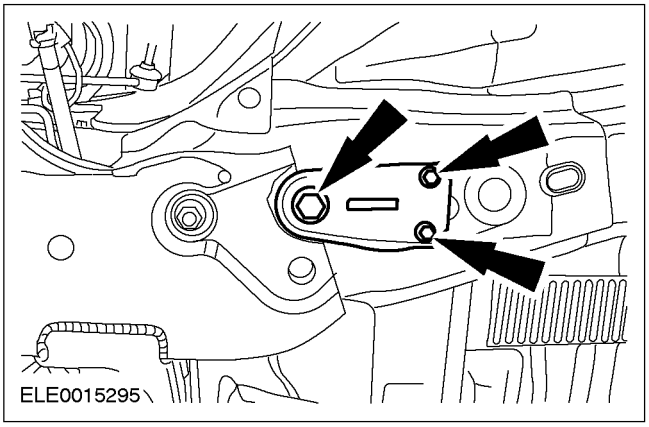


22. ⚠ CAUTION: Do not pull down the lower arm, to prevent the lower arm hydro-bushing from damage.

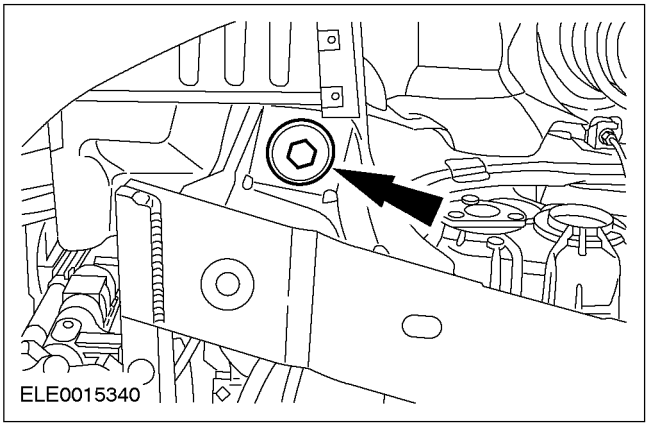
Remove the lower arm ball joint retaining nut and bolt.



23. Remove the subframe rear retaining bolts and the subframe bracket retaining bolts on both sides.



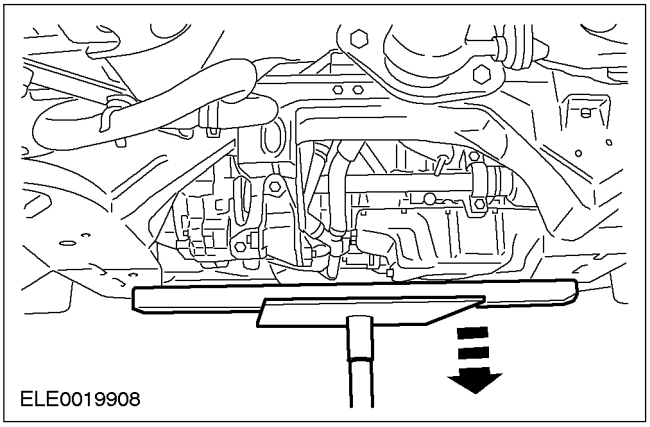
24. Remove the subframe front retaining bolts on both sides.



REMOVAL AND INSTALLATION (Continued)

25. **CAUTION: Lower the subframe uniformly, to prevent the lower arm hydro-bushing from damage.**

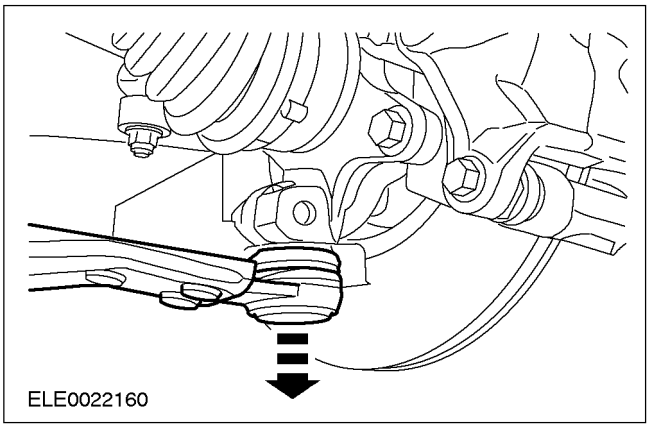
    Using the transmission jack, lower the subframe approximately 150 mm.



26. **CAUTION: Protect the ball joint seal using a soft cloth to prevent damage.**

    Detach the lower arm ball joint from the wheel knuckle.

    - Remove the heat shield.



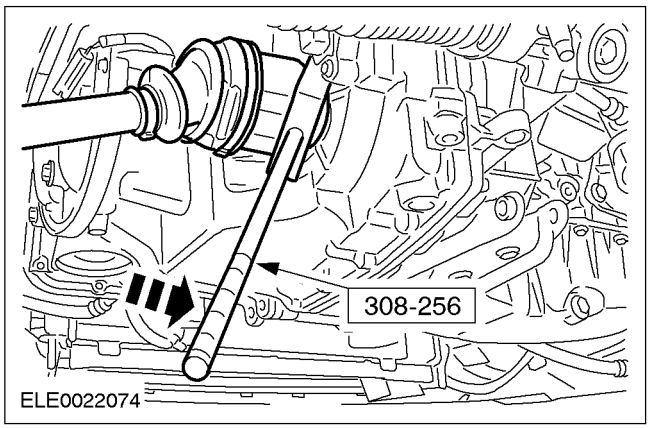
27. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

CAUTION: Do not damage the halfshaft oil seal.

NOTE: Plug the transaxle to prevent oil loss or dirt ingress.

Using the special tool, detach the halfshaft from the transaxle and secure it to one side.

- Allow the oil to drain into a suitable container.
- Remove and discard the snap ring.



28. **Using a suitable three leg puller, detach the halfshaft from the wheel hub and remove the halfshaft.**

REMOVAL AND INSTALLATION (Continued)

Installation

All vehicles

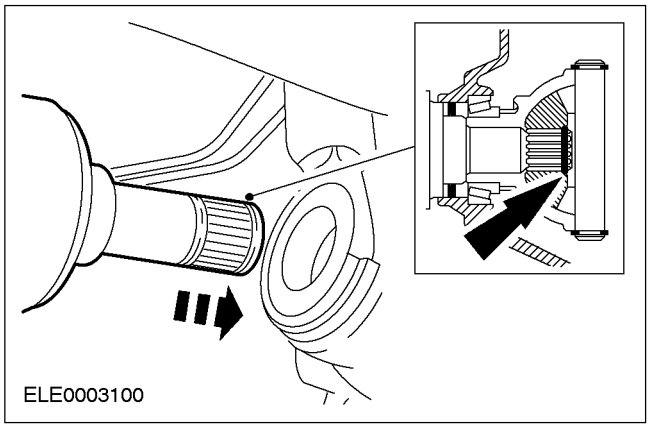
1. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

CAUTION: Do not damage the halfshaft oil seal.

CAUTION: Make sure the snap ring is correctly seated.

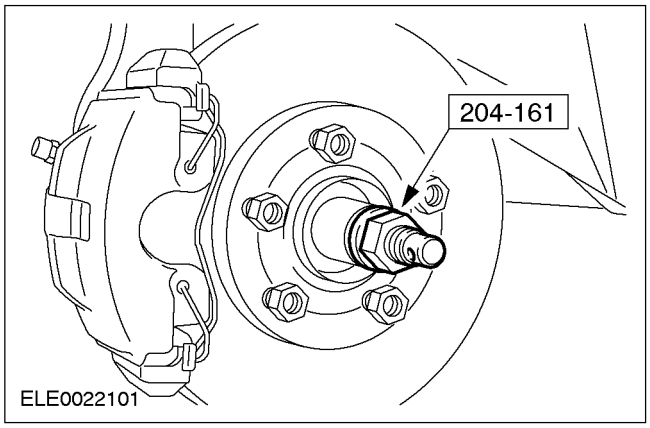
NOTE: Install a new snap ring.

Attach the left-hand halfshaft to the transaxle.



2. **CAUTION: Make sure the halfshaft is completely installed into the wheel hub.**

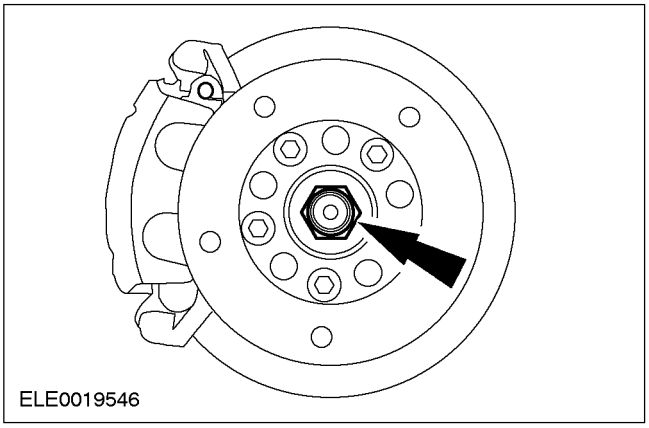
Using the special tool, install the halfshaft.



3. **CAUTION: The wheel hub retaining nut can be reused four times, inspect the markings on the retaining nut and install a new retaining nut if necessary.**

NOTE: Do not fully tighten the retaining nut at this stage.

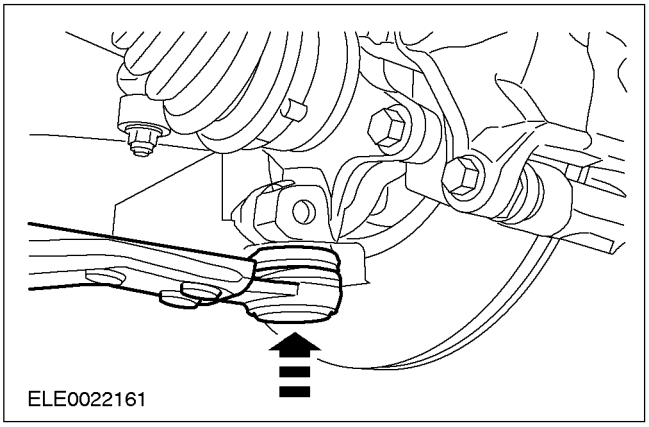
Install the wheel hub retaining nut.



4. **CAUTION: Make sure the heat shield is installed to prevent damage to the ball joint.**

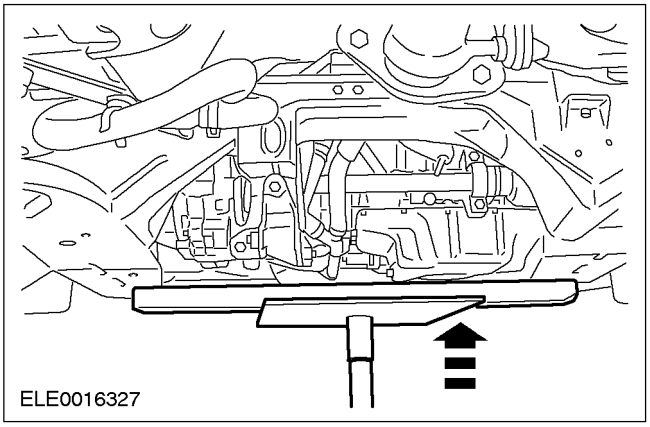
Attach the lower arm to the wheel knuckle on both sides.

- Install the heat shield.



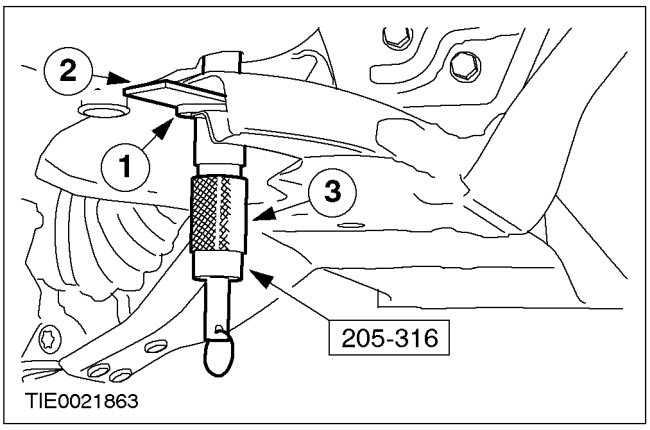
REMOVAL AND INSTALLATION (Continued)

5. Using the transmission jack, position the subframe.



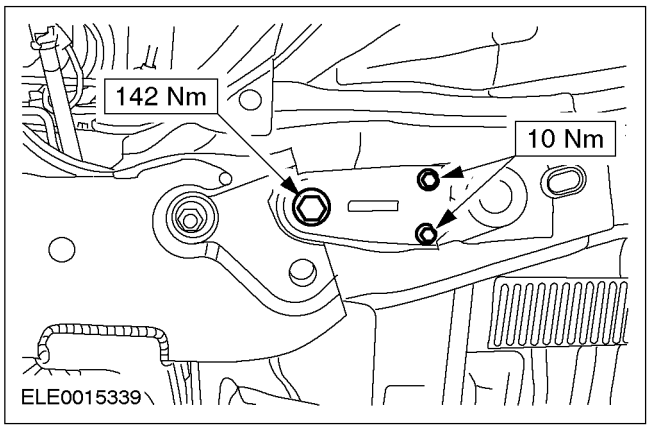
6. Using the special tool and a suitable washer, align the subframe.

1. Insert the washer with inside diameter 22 mm, outside diameter 44 mm and height 5 mm, into the subframe above the lower alignment hole.
2. Insert the alignment pin through the subframe alignment holes and the washer.
3. Slide the locking plates on top of the washer and into the groove of the tool and tighten the alignment pin sleeve.



7. ⚠ CAUTION: While tightening the subframe retaining bolts, make sure the subframe does not move.

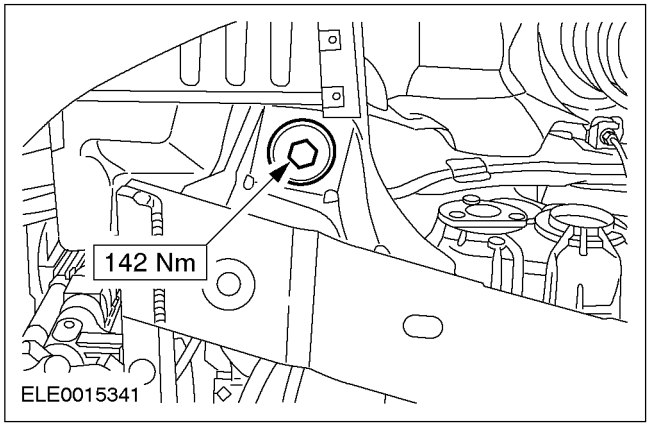
Install the subframe rear retaining bolts and the subframe bracket retaining bolts on both sides.



8. ⚠ CAUTION: While tightening the subframe retaining bolts, make sure the subframe does not move.

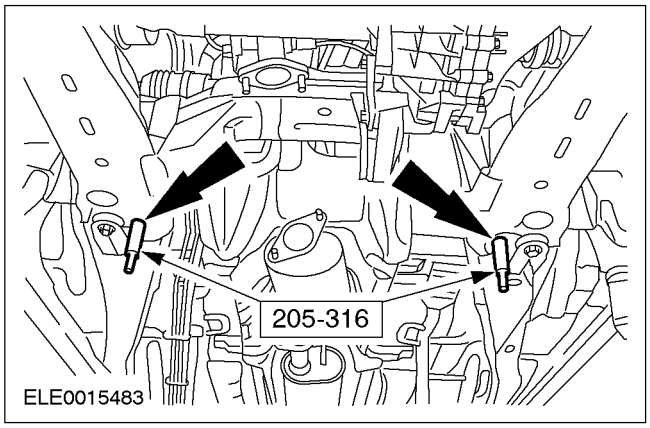
Install the subframe front retaining bolts.

- Lower and remove the transmission jack.



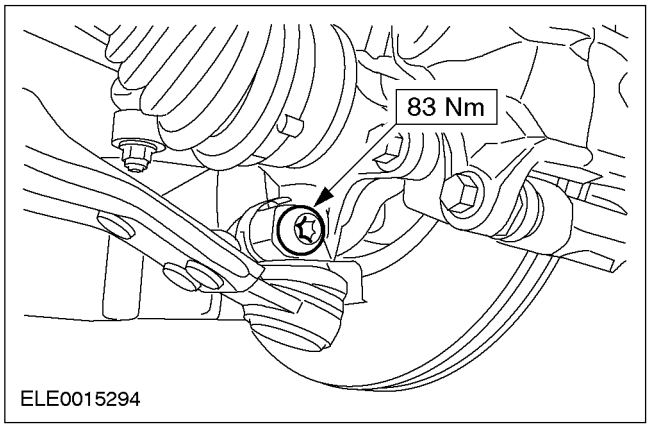
REMOVAL AND INSTALLATION (Continued)

9. Remove the special tools.

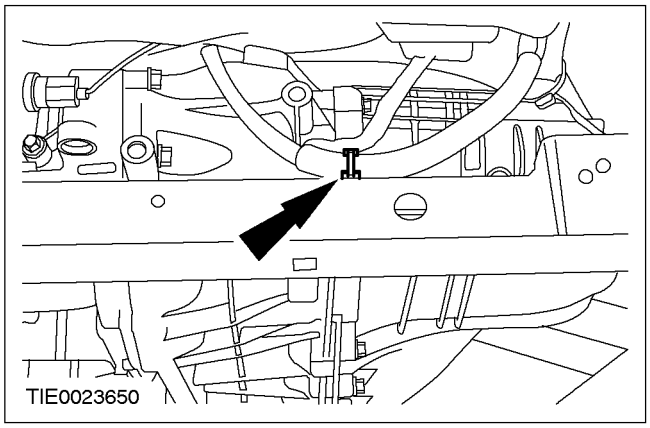


10. ⚠ WARNING: Install a new self-locking nut.

Install the lower arm joint pinch bolt from the rear, the retaining nut from the front.

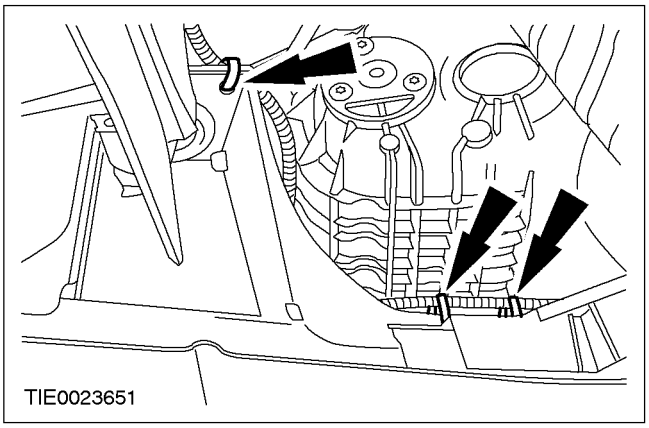


11. Attach the radiator cooling fan wiring harness to the subframe.



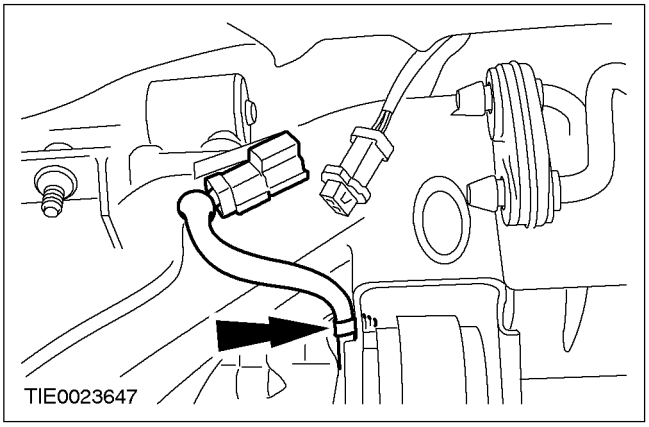
Vehicles with xenon headlamps

12. Attach the headlamp leveling sensor wiring harness to the subframe.

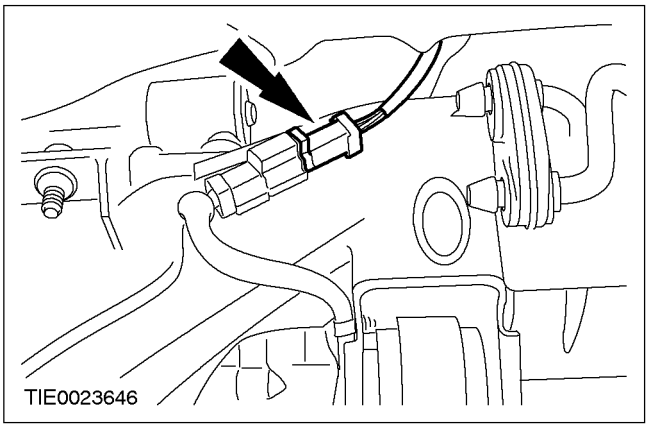


All except vehicles with diesel engine

13. Attach the catalyst monitor sensor wiring harness to the subframe.



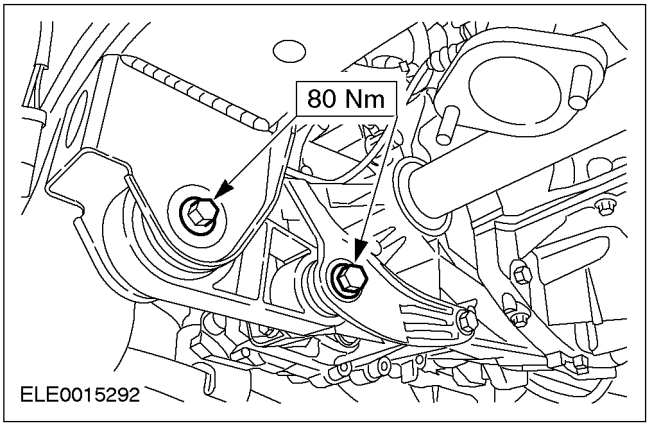
14. Connect the catalyst monitor sensor electrical connector.



REMOVAL AND INSTALLATION (Continued)

All vehicles

15. Install the engine rear support insulator.



Vehicles with 1.8L, 2.0L or diesel engine

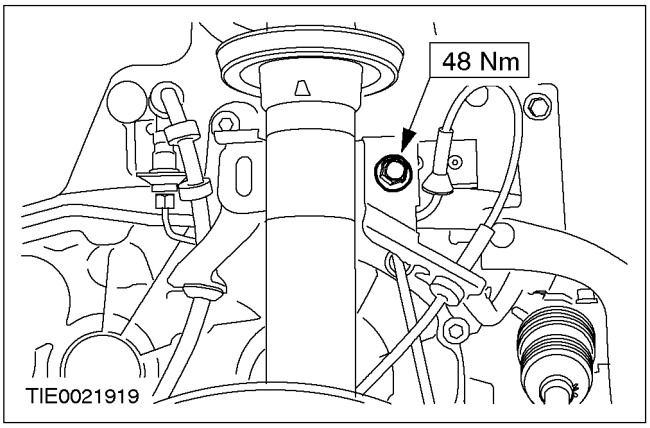
16. Install the exhaust flexible pipe. For additional information, refer to Section 309-00.

Vehicles with 2.5L engine

17. Install the exhaust dual converter y-pipe. For additional information, refer to Section 309-00.

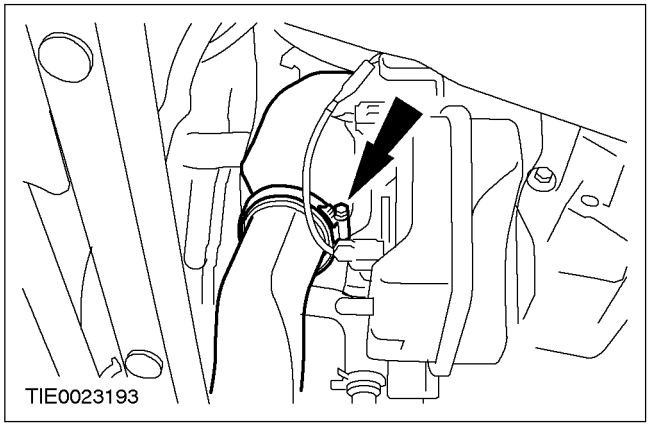
All vehicles

18. Attach the stabilizer bar connecting link to the suspension strut.

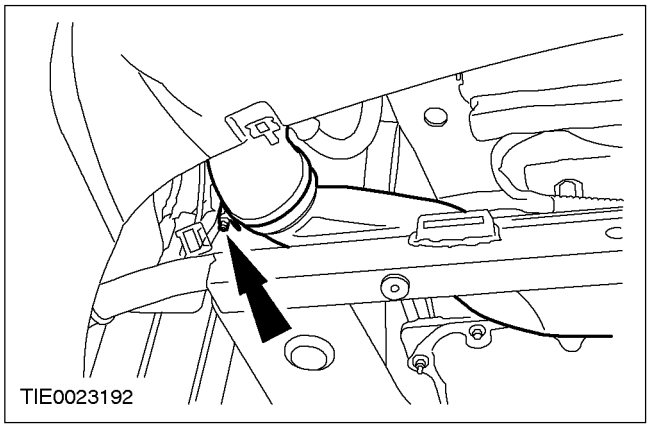


Vehicles with diesel engine

19. Attach the turbocharger outlet hose.



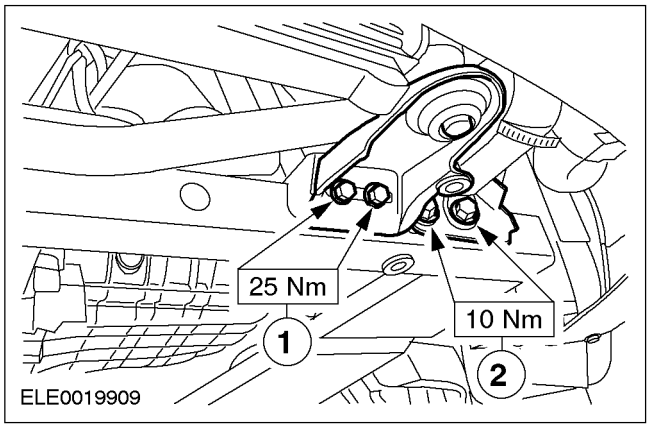
20. Attach the air intake hose.



All vehicles

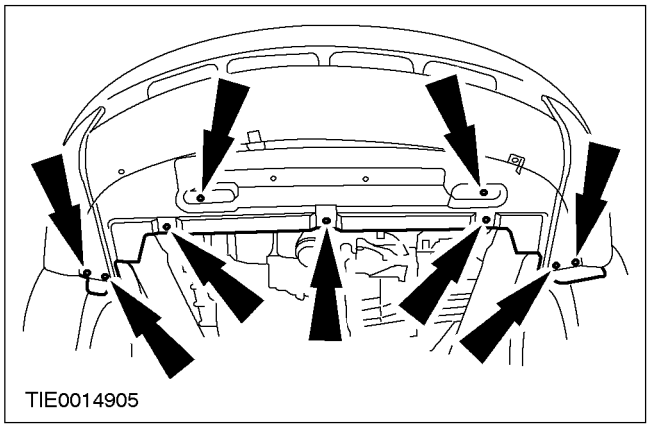
21. Install the radiator support brackets.

1. Install both radiator supports brackets.
2. Install the hose brackets.



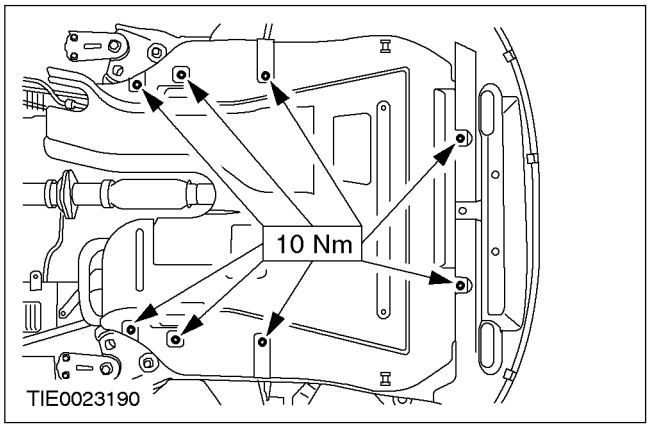
REMOVAL AND INSTALLATION (Continued)

22. Install the splash shield.



Vehicles with diesel engine

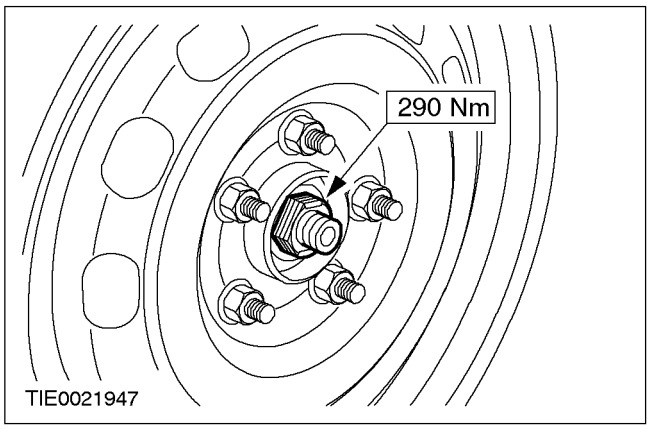
23. Install the engine undershield.



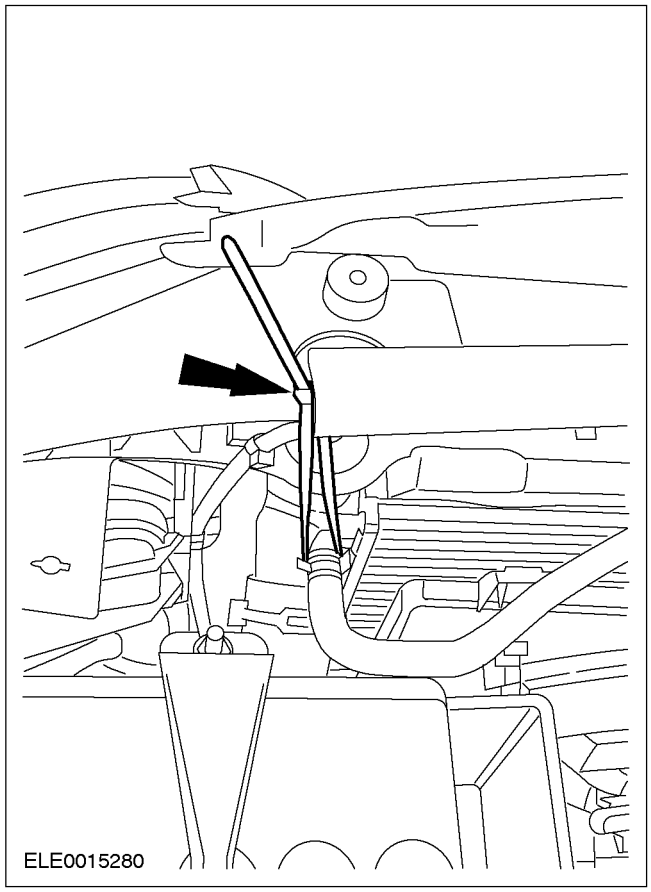
All vehicles

24. Install the front wheel and tire. For additional information, refer to Section 204-04.

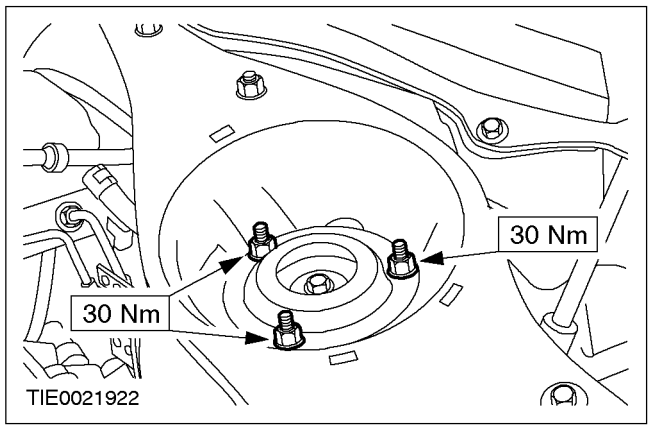
25. Tighten the wheel hub retaining nut.



26. Remove the cable ties.

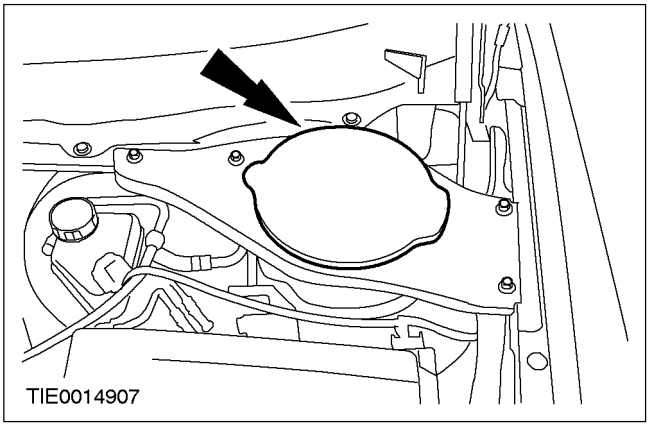


27. Tighten the strut and spring assembly top mount retaining nuts.



REMOVAL AND INSTALLATION (Continued)

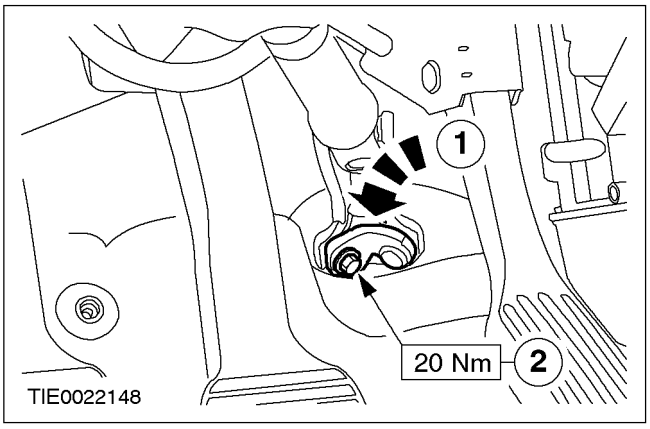
28. Install the suspension strut and spring assembly top mount brace cover.



29. ⚠ WARNING: Install a new steering column to steering column flexible coupling retaining bolt. Failure to follow this instruction may result in personal injury.

Connect the steering column shaft to the steering column flexible coupling.

1. Rotate the clamp plate.
2. Install the retaining bolt.



Vehicles with automatic transaxle

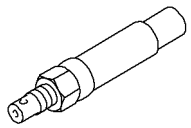
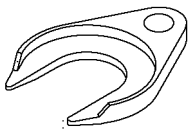
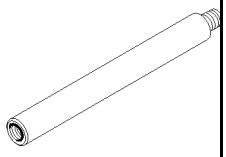
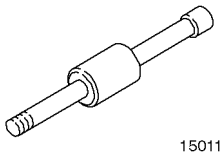
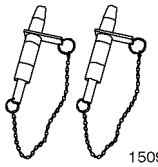
30. Refill the transaxle. For additional information, refer to Section 307-01A / 307-01B.

Vehicles with manual transaxle

31. Check the transmission fluid level and top up with manual transmission fluid, if necessary.

REMOVAL AND INSTALLATION

Halfshaft RH (14 321 0)

Special Tool(s)	
 14041	Installer, Halfshaft 204-161 (14-041)
 16092	Remover, Halfshaft 204-226 (16-092)
 16-092-	Adapter for 204-226 204-226-01 (16-092-01)
 15011	Slide Hammer 205-047 (15-011)
 15097A	Alignment Pins, Subframe 205-316 (15-097A)

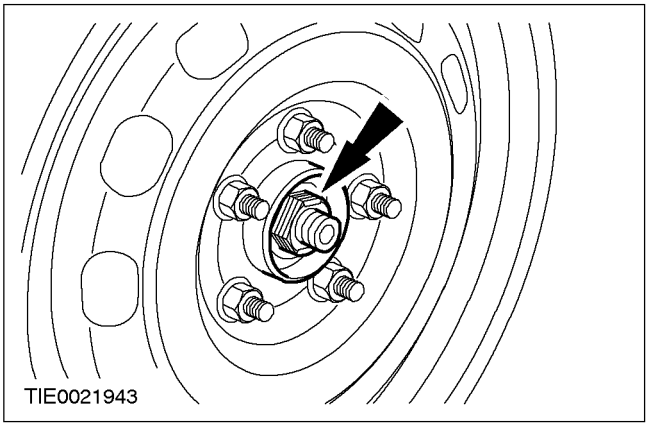
General Equipment
Three leg puller
Transmission jack

Removal

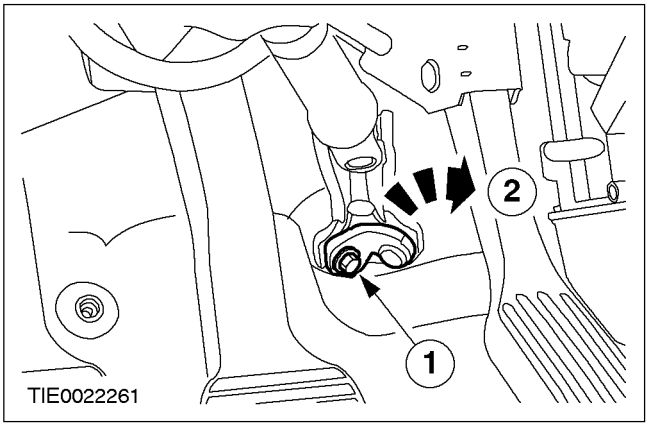
All vehicles

1. **CAUTION: Use a socket to loosen the wheel hub retaining nut to prevent damage.**

   Loosen the wheel hub retaining nut.



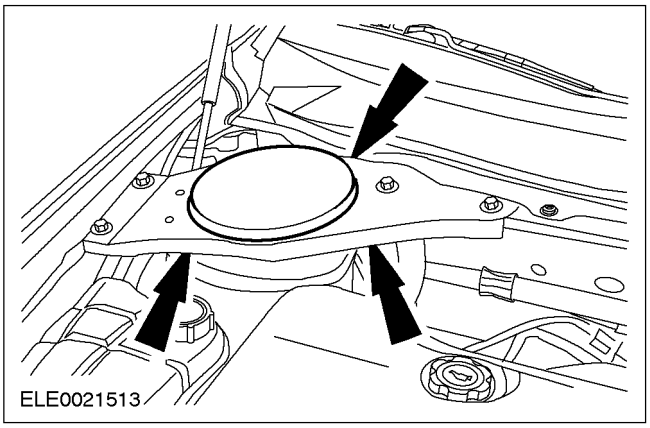
2. **Detach the steering column shaft from the steering column flexible coupling.**
   1. Remove the retaining bolt.
   2. Rotate the clamp plate.
   - Discard the bolt.



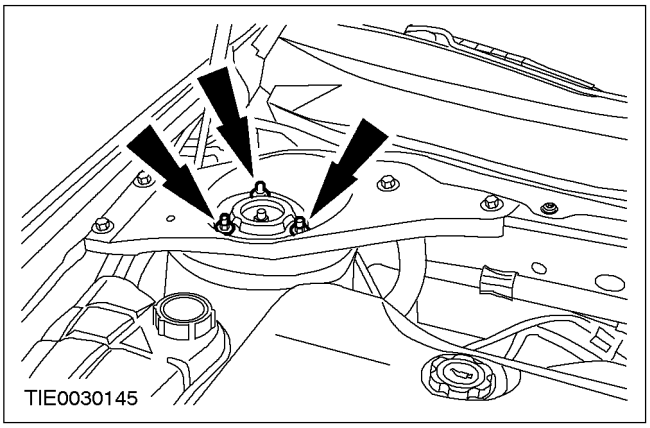
REMOVAL AND INSTALLATION (Continued)

3. Remove the suspension strut and spring assembly top mount brace cover.

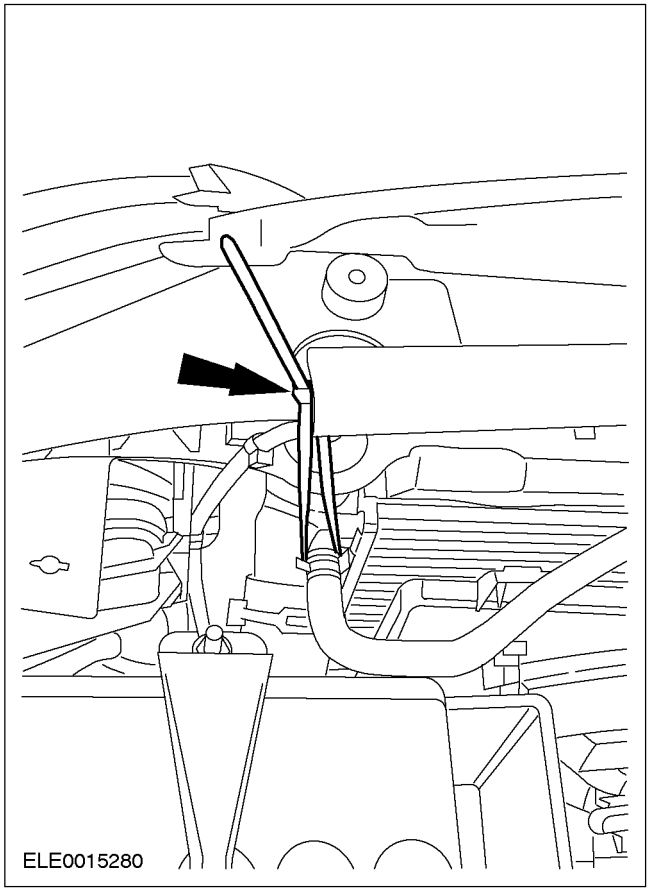
- Release the clips.



4. Loosen the strut and spring assembly top mount retaining nuts by four turns.



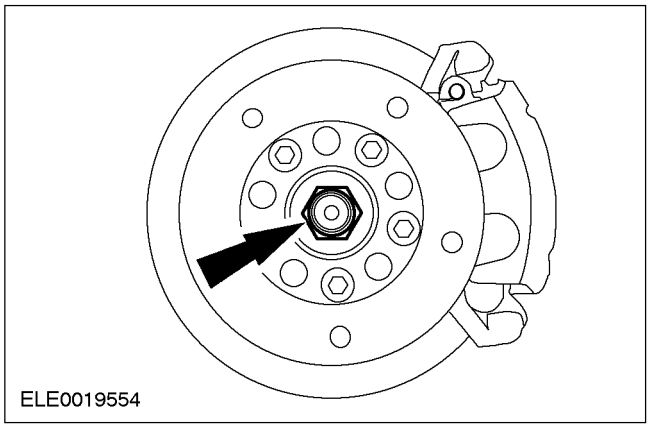
5. Using cable ties, support the radiator on both sides.



6. Remove the wheel and tire. For additional information, refer to Section 204-04.

7. ⚠ CAUTION: The wheel hub retaining nut can be reused four times, mark the retaining nut.

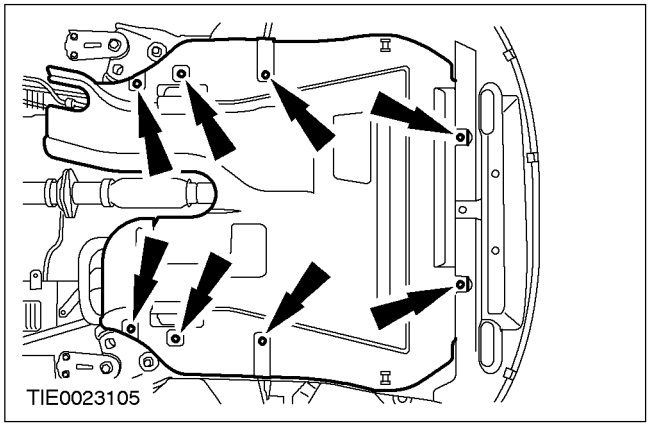
Remove the wheel hub retaining nut.



REMOVAL AND INSTALLATION (Continued)

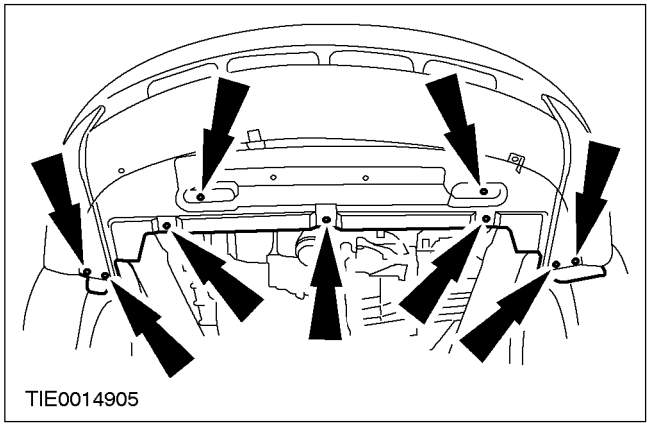
Vehicles with diesel engine

8. Remove the engine undershield.



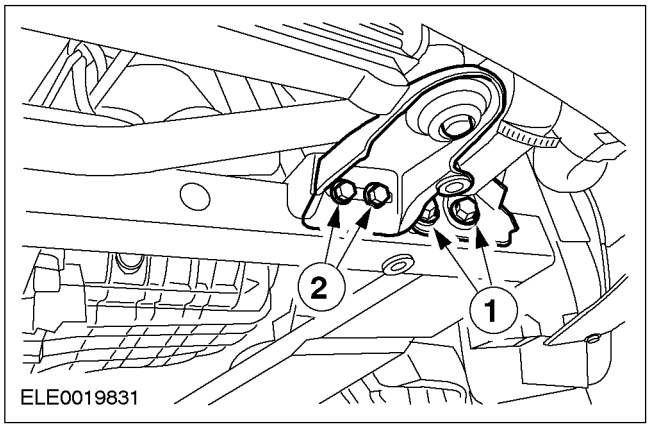
All vehicles

9. Remove the splash shield.



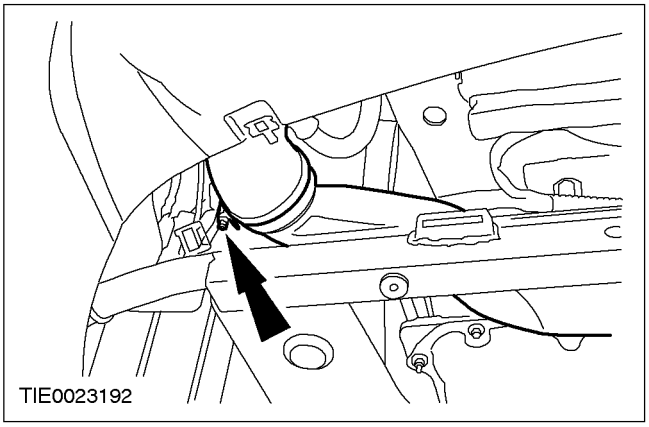
10. Remove the radiator support brackets.

1. Remove the hose bracket.
2. Remove both radiator support brackets.

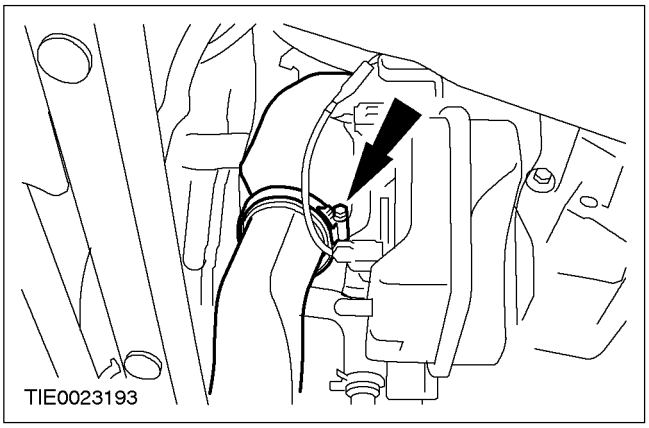


Vehicles with diesel engine

11. Detach the air intake hose.

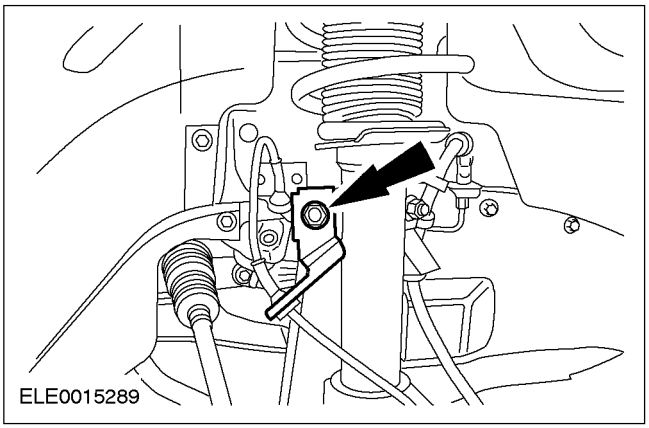


12. Detach the turbocharger outlet hose.



All vehicles

13. Detach the stabilizer bar connecting link from the suspension strut on both sides.



Vehicles with 1.8L, 2.0L or diesel engine

14. Remove the exhaust flexible pipe. For additional information, refer to Section 309-00.

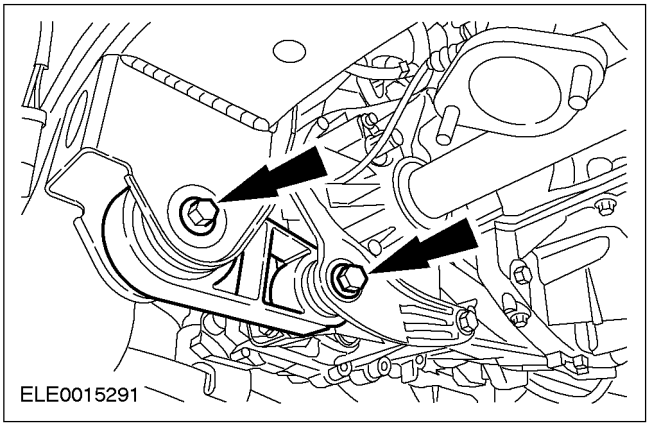
REMOVAL AND INSTALLATION (Continued)

Vehicles with 2.5L engine

15. **Remove the exhaust dual converter y-pipe. For additional information, refer to Section 309-00.**

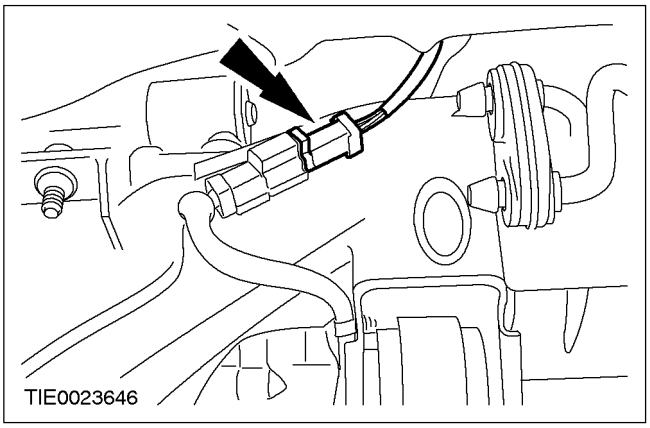
All vehicles

16. **Remove the engine rear support insulator.**

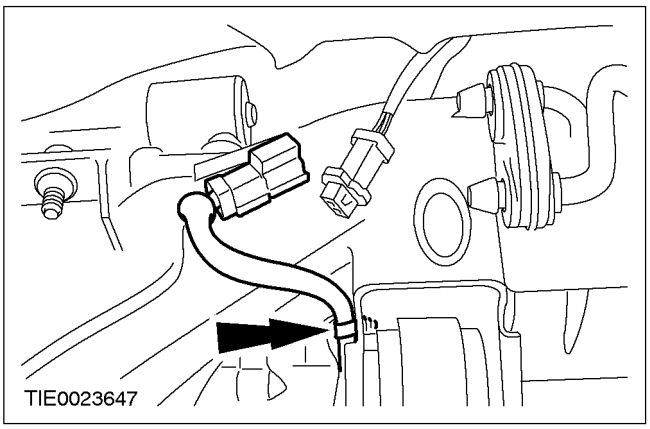


All except vehicles with diesel engine

17. **Disconnect the catalyst monitor sensor electrical connector.**

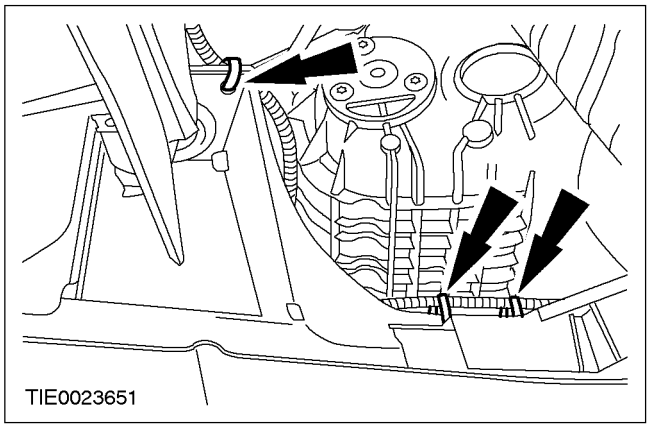


18. **Detach the catalyst monitor sensor wiring harness from the subframe.**



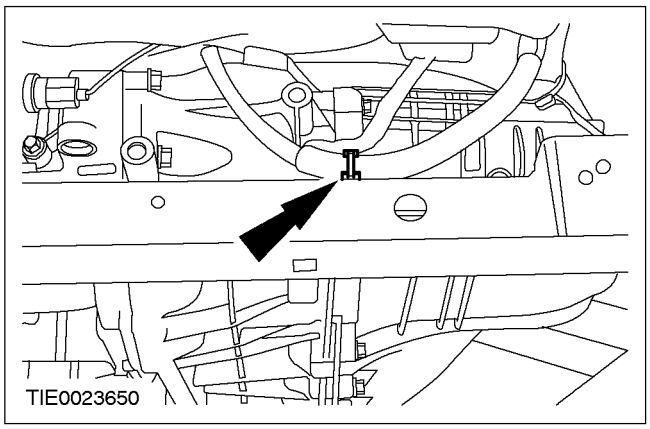
Vehicles with xenon headlamps

19. **Detach the headlamp leveling sensor wiring harness from the subframe.**

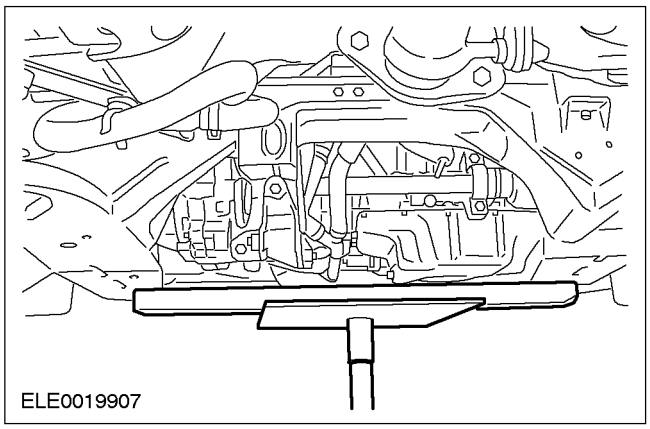


All vehicles

20. **Detach the radiator cooling fan wiring harness from the subframe.**



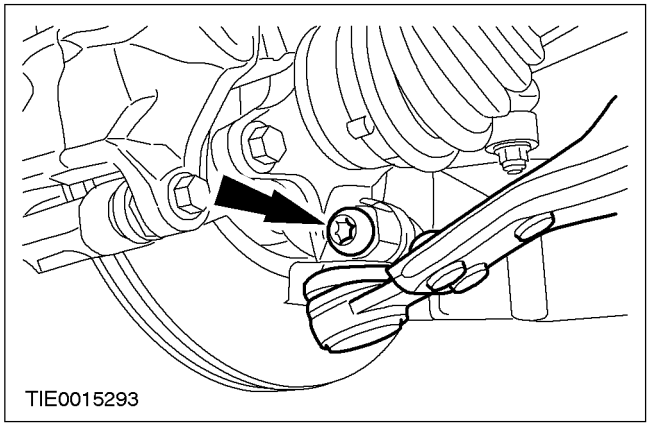
21. **Using two suitable wooden blocks and a suitable transmission jack, support the subframe.**



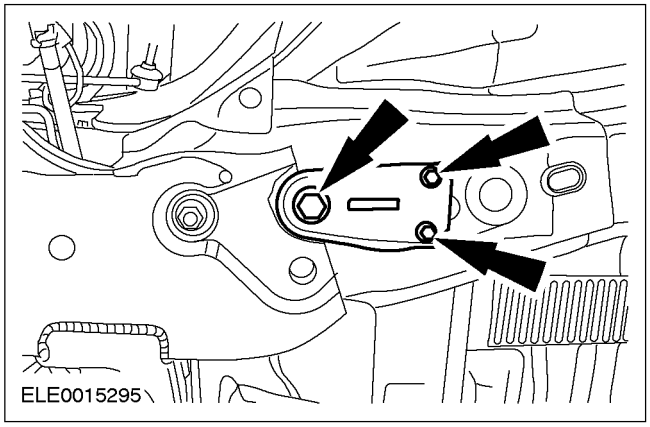
REMOVAL AND INSTALLATION (Continued)

22. **CAUTION: Do not pull down the lower arm, to prevent the lower arm hydro-bushing from damage.**

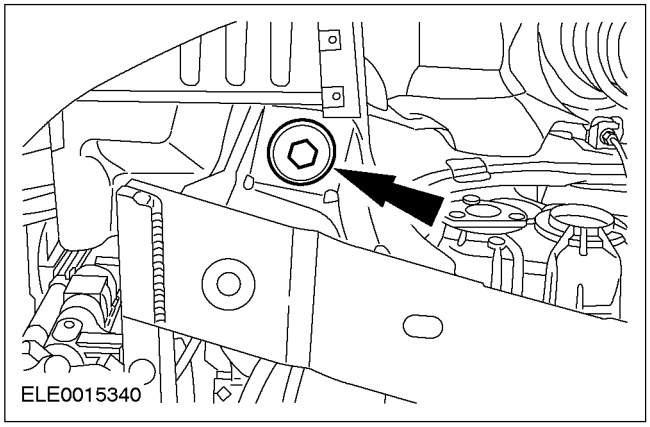
    Remove the lower arm ball joint retaining nut and bolt.



23. **Remove the subframe rear retaining bolts and the subframe bracket retaining bolts on both sides.**

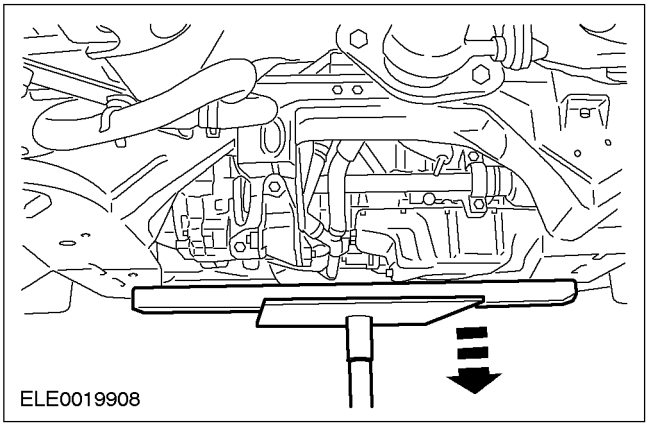


24. **Remove the subframe front retaining bolts on both sides.**



25. **CAUTION: Lower the subframe uniformly, to prevent the lower arm hydro-bushing from damage.**

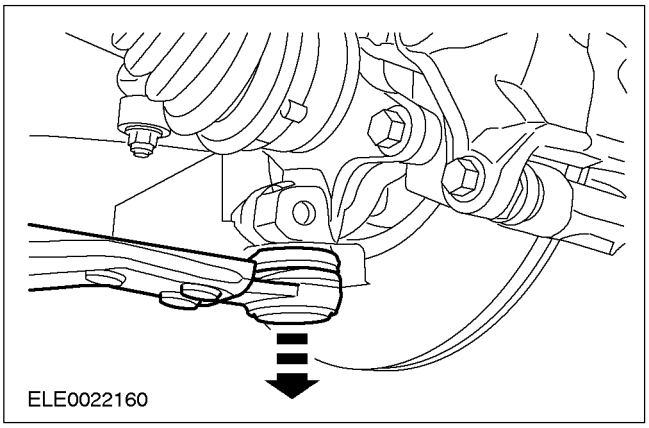
    Using the transmission jack, lower the subframe approximately 150 mm.



26. **CAUTION: Protect the ball joint seal using a soft cloth to prevent damage.**

    Detach the lower arm ball joint from the wheel knuckle.

    - Remove the heat shield.

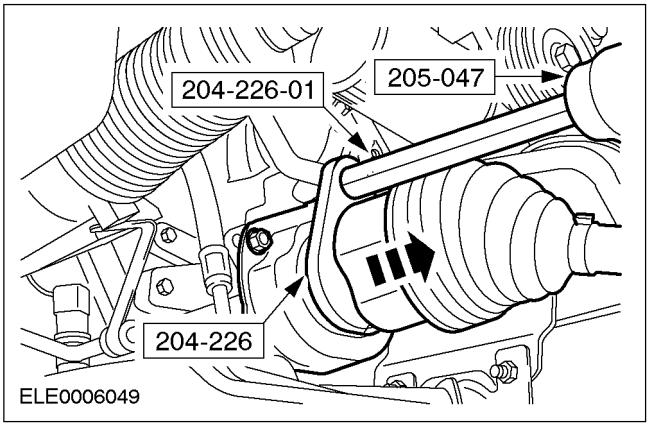


REMOVAL AND INSTALLATION (Continued)

27. CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.

Using the special tools, detach the halfshaft from the intermediate shaft and secure it to one side (vehicles with 2.5L engine shown).

- Remove and discard the snap ring.



28. Using a suitable three leg puller, detach the halfshaft from the wheel hub and remove the halfshaft.

Installation

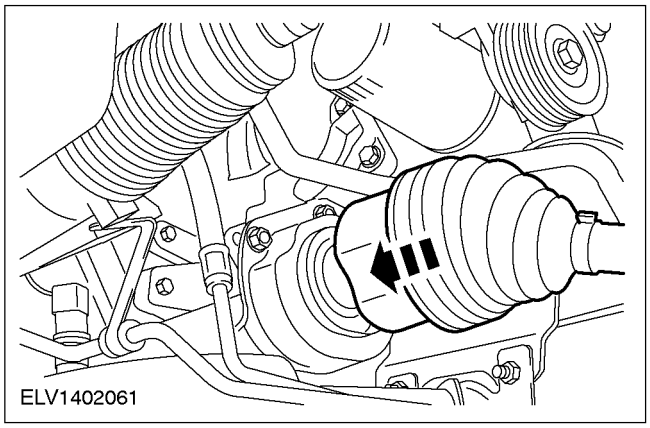
All vehicles

1. CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.

CAUTION: Make sure the snap ring is correctly seated.

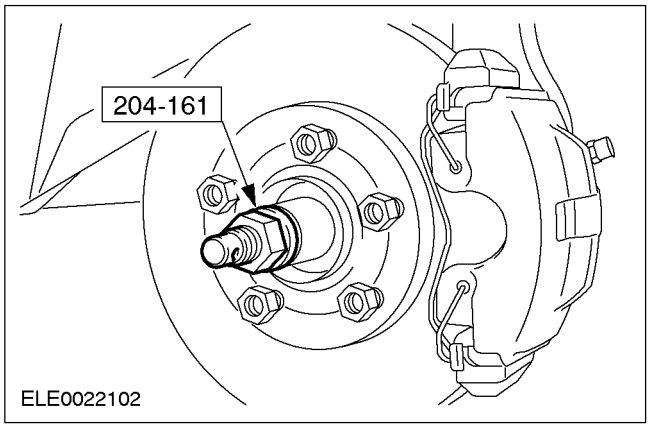
NOTE: Install a new snap ring.

Attach the halfshaft to the intermediate shaft (vehicles with 2.5L engine shown).



2. CAUTION: Make sure the wheel hub is completely installed into the wheel hub.

Using the special tool, install the halfshaft.

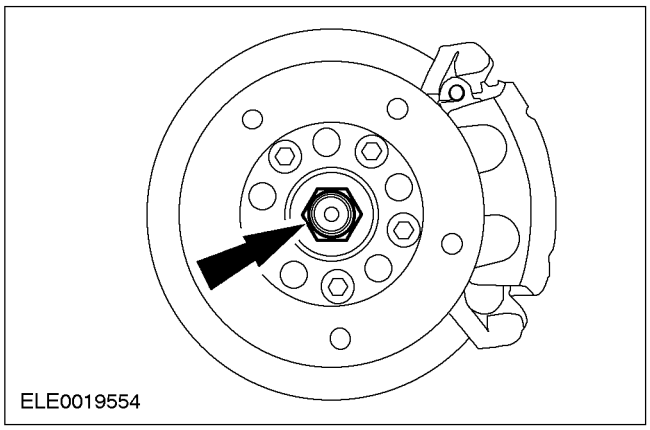


REMOVAL AND INSTALLATION (Continued)

3. **CAUTION: The wheel hub retaining nut can be reused four times, inspect the markings on the retaining nut and install a new retaining nut if necessary.**

NOTE: Do not fully tighten the retaining nut at this stage.

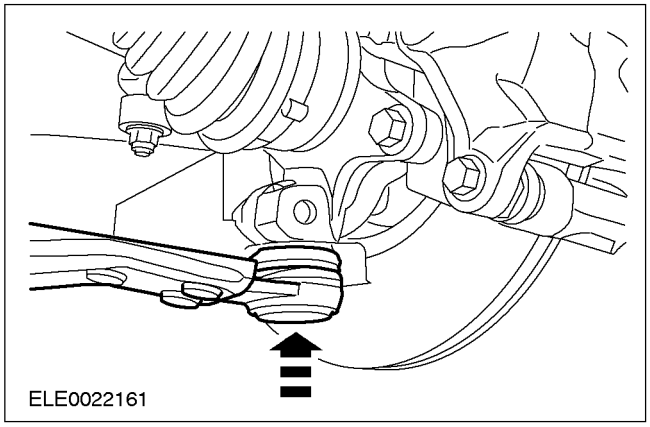
Install the retaining nut.



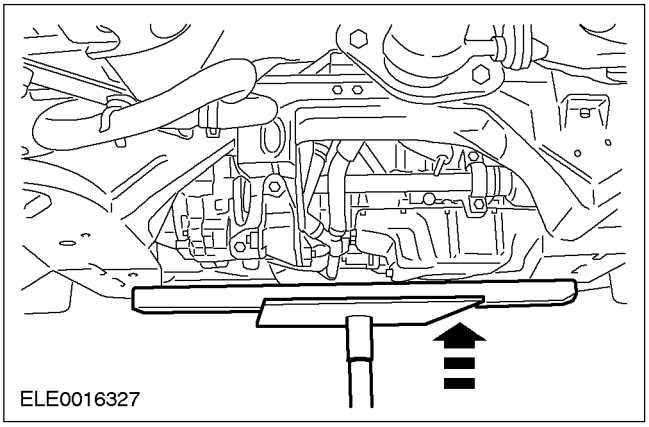
4. **CAUTION: Make sure the heat shield is installed to prevent damage to the ball joint.**

Attach the lower arm to the wheel knuckle on both sides.

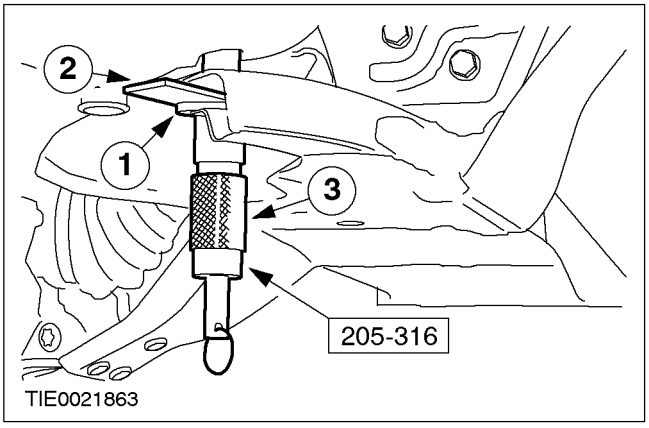
- Install the heat shield.



5. **Using the transmission jack, position the subframe.**



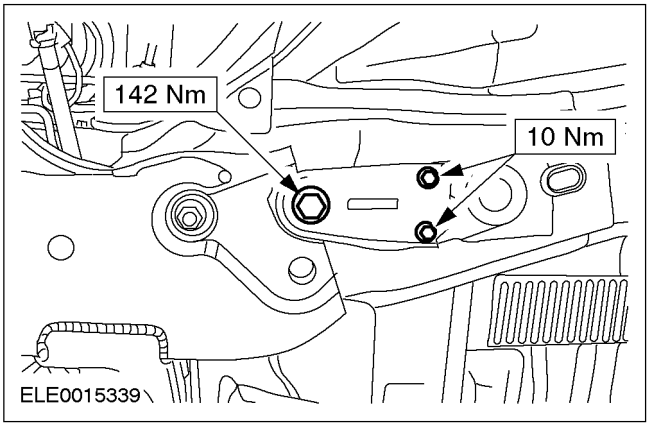
6. **Using the special tools and a suitable washer, align the subframe.**
   1. Insert the washer, with inside diameter 22 mm, outside diameter 44 mm and height 5 mm, into the subframe above the lower alignment hole.
   2. Insert the alignment pin through the subframe alignment holes and the washer.
   3. Slide the locking plates on top of the washer and into the groove of the tool and tighten the alignment pin sleeve.



REMOVAL AND INSTALLATION (Continued)

7. **CAUTION: While tightening the subframe retaining bolts, make sure the subframe does not move.**

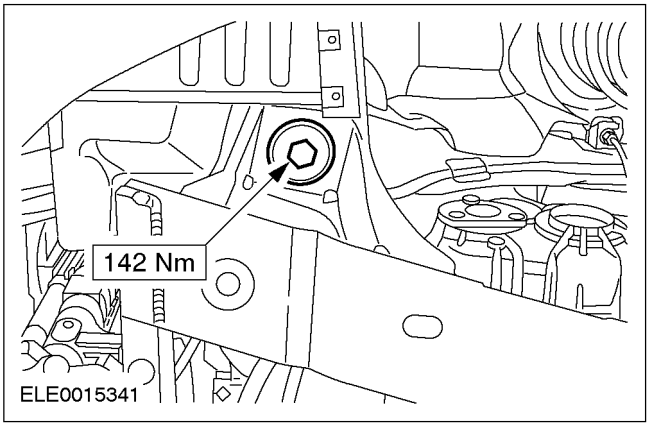
   Install the subframe rear retaining bolts and the subframe bracket retaining bolts on both sides.



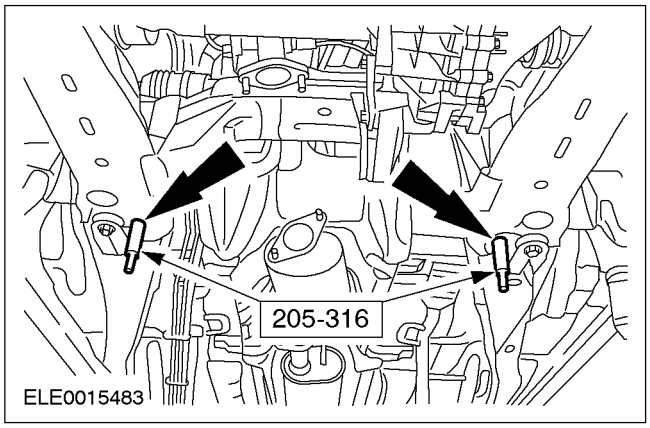
8. **CAUTION: While tightening the subframe retaining bolts, make sure the subframe does not move.**

   Install the subframe front retaining bolts.

   • Lower and remove the transmission jack.

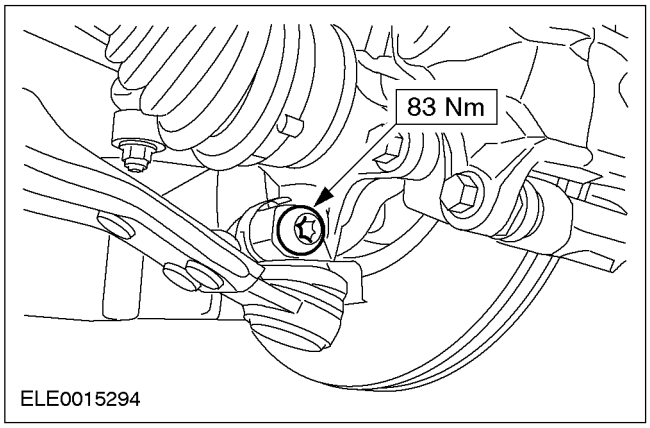


9. **Remove the special tools.**

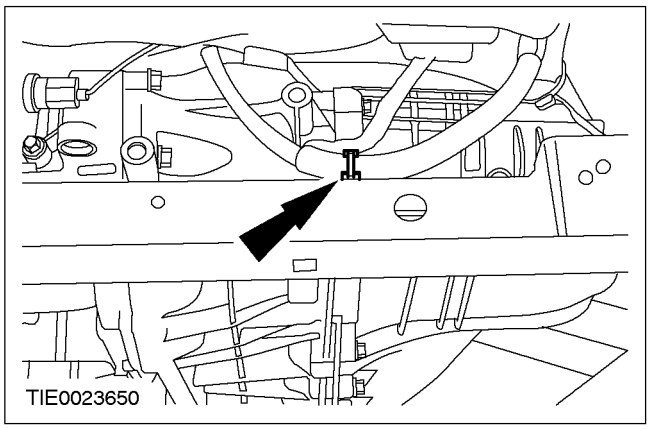


10. **WARNING: Install a new self-locking nut.**

    Install the lower arm ball joint pinch bolt from the rear, the retaining nut from the front.



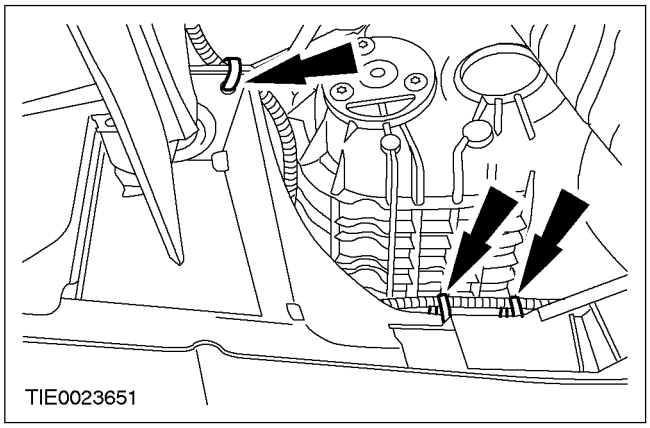
11. **Attach the radiator cooling fan wiring harness to the subframe.**



REMOVAL AND INSTALLATION (Continued)

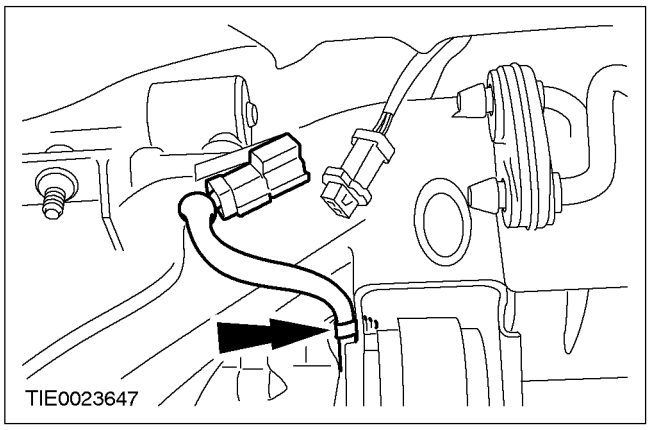
Vehicles with xenon headlamps

12. Attach the headlamp leveling sensor wiring harness to the subframe.

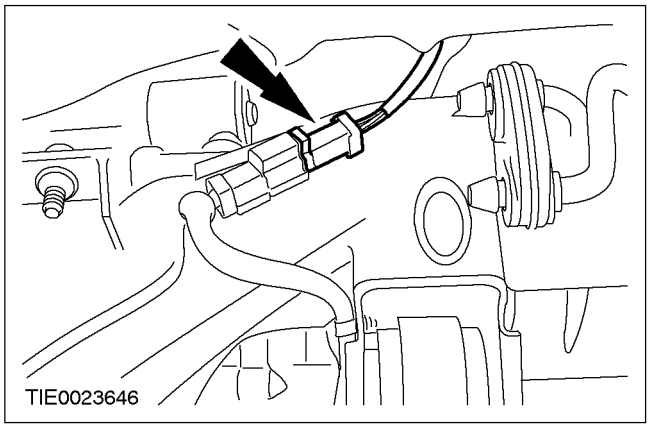


All except vehicles with diesel engine

13. Attach the catalyst monitor sensor wiring harness to the subframe.

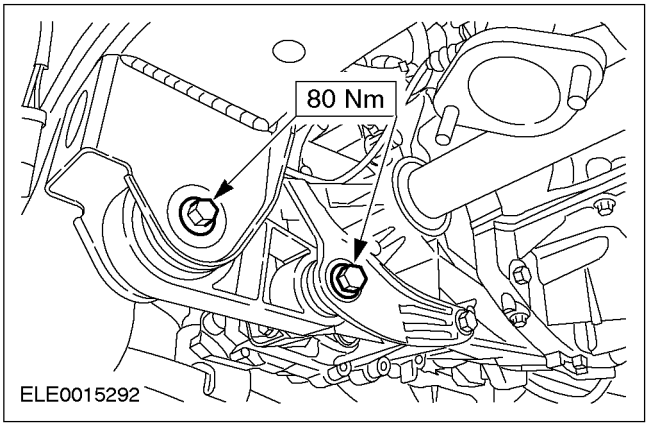


14. Connect the catalyst monitor sensor electrical connector.



All vehicles

15. Install the engine rear support insulator.



Vehicles with 1.8L, 2.0L or diesel engine

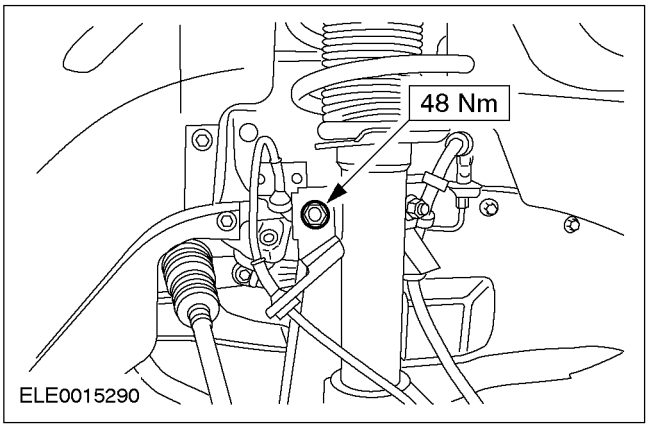
16. Install the exhaust flexible pipe. For additional information, refer to Section 309-00.

Vehicles with 2.5L engine

17. Install the exhaust dual converter y-pipe. For additional information, refer to Section 309-00.

All vehicles

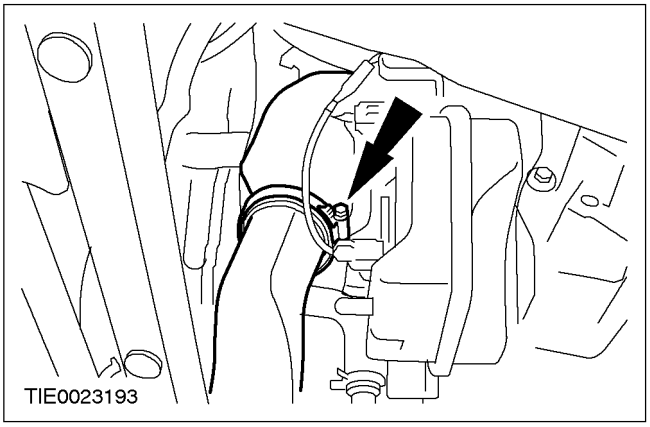
18. Attach the stabilizer bar connecting link to the suspension strut on both sides.



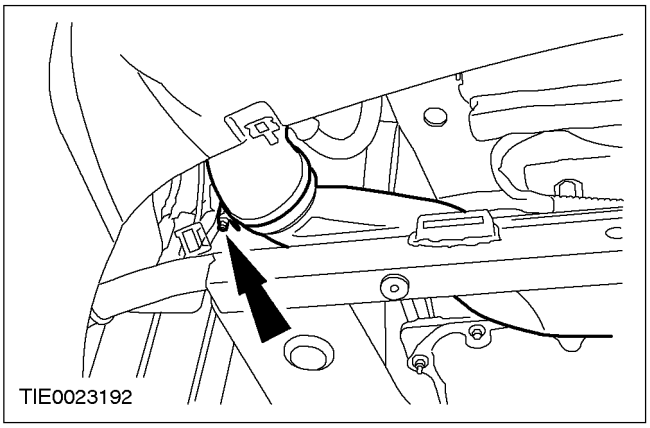
REMOVAL AND INSTALLATION (Continued)

Vehicles with diesel engine

19. Attach the turbocharger outlet hose.



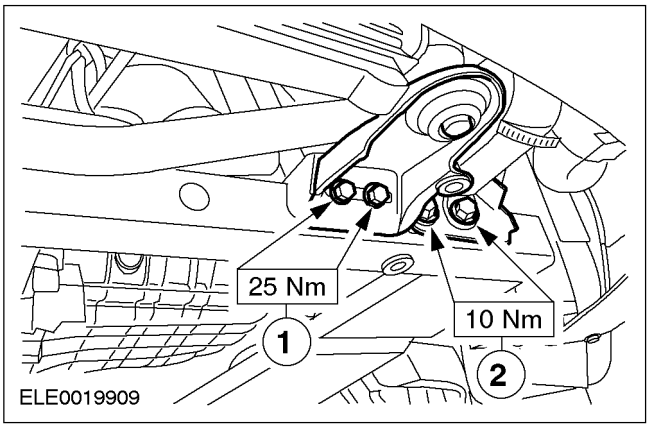
20. Attach the air intake hose.



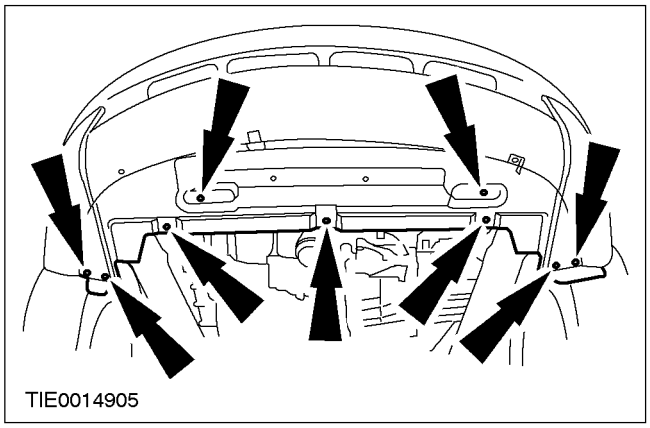
All vehicles

21. Install the radiator support brackets.

1. Install both radiator support brackets.
2. Install the hose bracket.

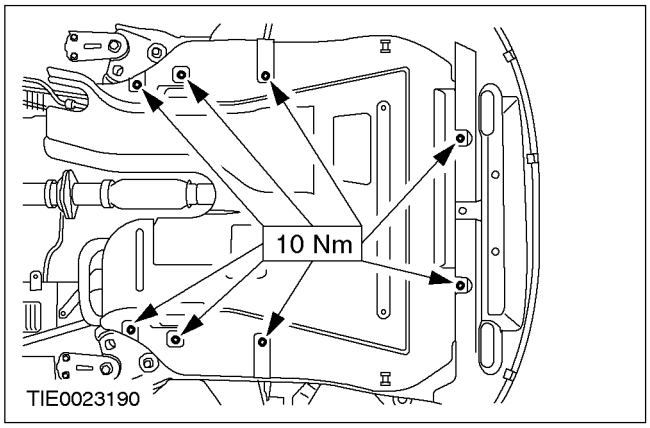


22. Install the splash shield.



Vehicles with diesel engine

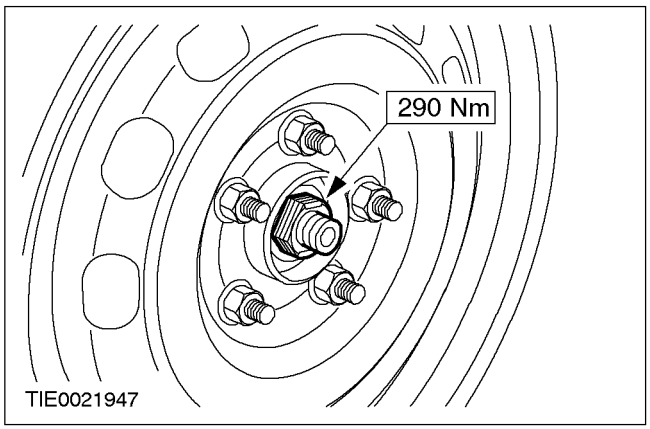
23. Install the engine undershield.



All vehicles

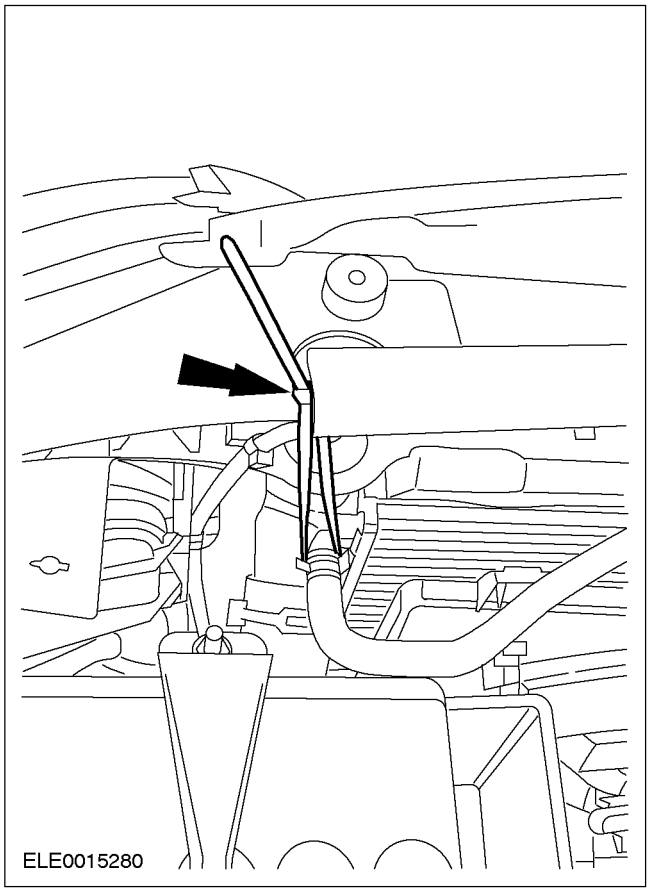
24. Install the wheel and tire. For additional information, refer to Section 204-04.

25. Tighten the wheel hub retaining nut.

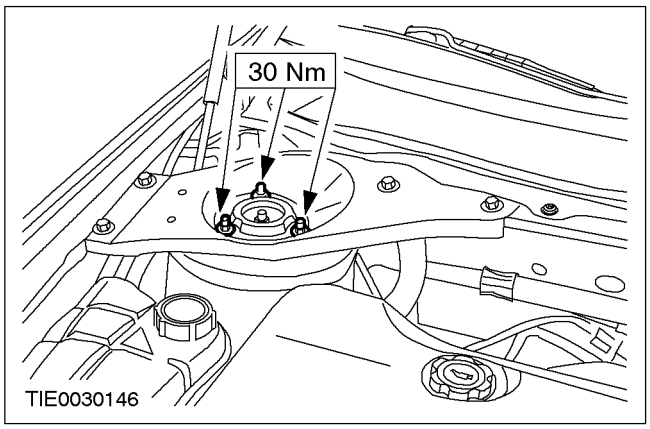


REMOVAL AND INSTALLATION (Continued)

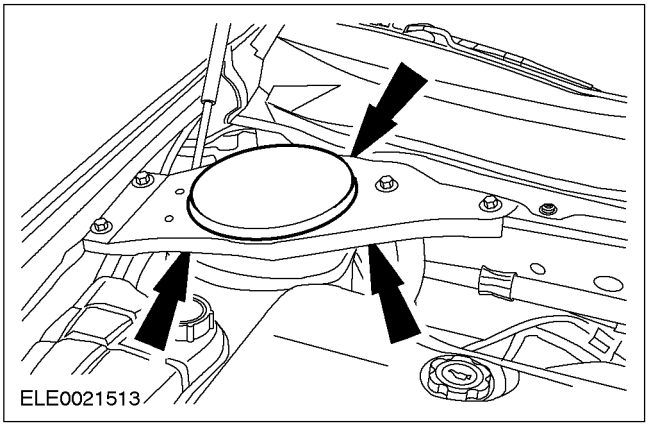
26. Remove the cable ties.



27. Tighten the strut and spring assembly top mount retaining nuts.



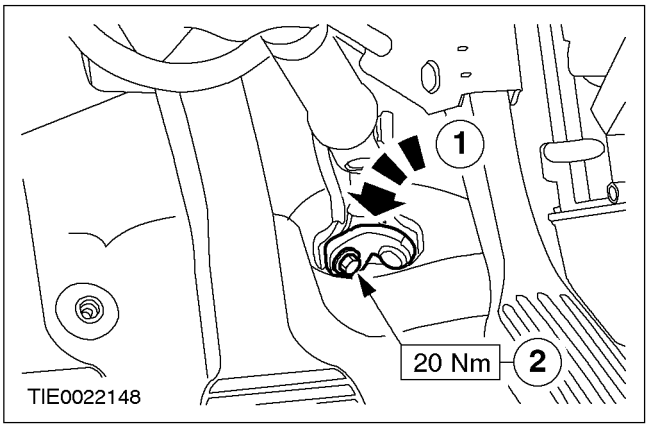
28. Install the suspension strut and spring assembly top mount brace cover.



29. ⚠ WARNING: Install a new steering column to steering column flexible coupling retaining bolt. Failure to follow this instruction may result in personal injury.

Connect the steering column shaft to the steering column flexible coupling.

1. Rotate the clamp plate.
2. Install the retaining bolt.



Vehicles with automatic transaxle

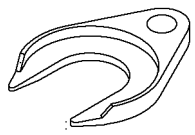
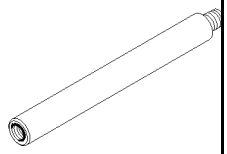
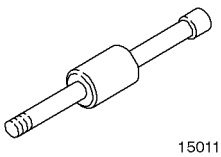
30. Refill the transaxle. For additional information, refer to Section 307-01A / 307-01B.

Vehicles with manual transaxle

31. Check the transmission fluid level and top up with manual transmission fluid, if necessary.

REMOVAL AND INSTALLATION

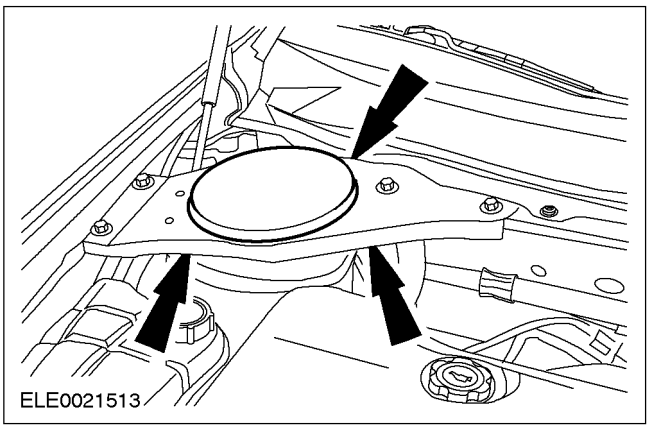
Intermediate Shaft

Special Tool(s)	
 16092	Remover, Halfshaft 204-226 (16-092)
 16-092	Adapter for 204-226 204-226-01 (16-092-01)
 15011	Slide hammer 205-047 (15-011)

Removal

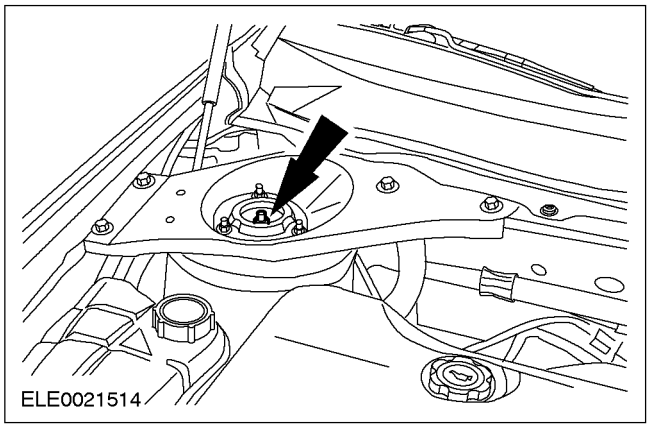
All vehicles

1. **Remove the right-hand suspension strut and spring assembly top mount brace cover.**
   - Release the clips.

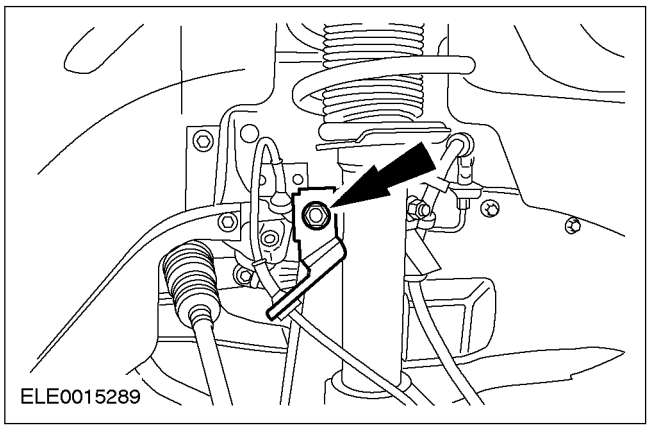


2. **CAUTION: Use an Allen key to prevent the piston rod from rotating.**

   Loosen the right-hand top mount nut by five turns.



3. **Detach the right-hand stabiliser connecting link from the suspension strut.**



4. **Remove the right-hand wheel and tire. For additional information, refer to Section 204-04.**
5. **NOTE:** The lower arm remains installed.

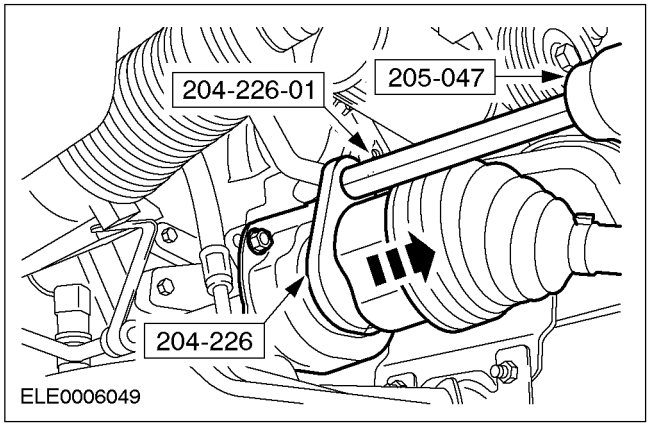
   Detach the right-hand lower arm ball joint from the wheel knuckle. For additional information, refer to Section 204-01.

REMOVAL AND INSTALLATION (Continued)

6. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent at more than 45 degrees.**

Using the special tools, detach the right-hand halfshaft from the intermediate shaft and secure it to one side (vehicles with 2.5L engine shown).

- Remove and discard the snap ring.



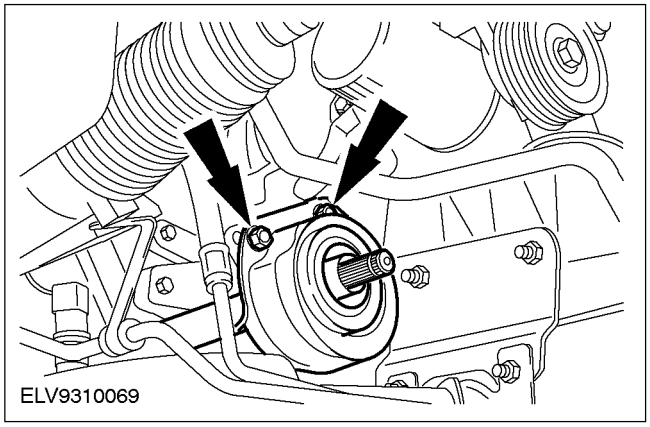
Vehicles with 2.5L engine

7. **CAUTION: Do not damage the halfshaft oil seal.**

NOTE: Plug the transaxle to prevent oil loss and dirt ingress.

Remove the intermediate shaft.

- Remove and discard the center bearing locknuts.
- Allow the oil to drain into a suitable container.



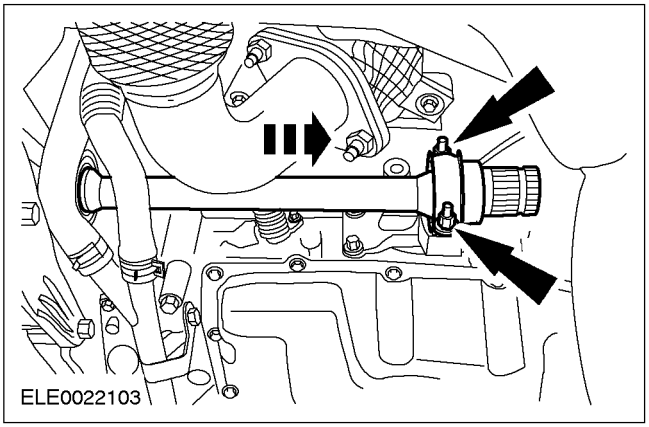
Vehicles with 2.0L diesel engine

8. **CAUTION: Do not damage the halfshaft oil seal.**

NOTE: Plug the transaxle to prevent oil loss or dirt ingress.

Remove the intermediate shaft.

- Remove and discard the center bearing cap and locknuts.
- Allow the oil to drain into a suitable container.



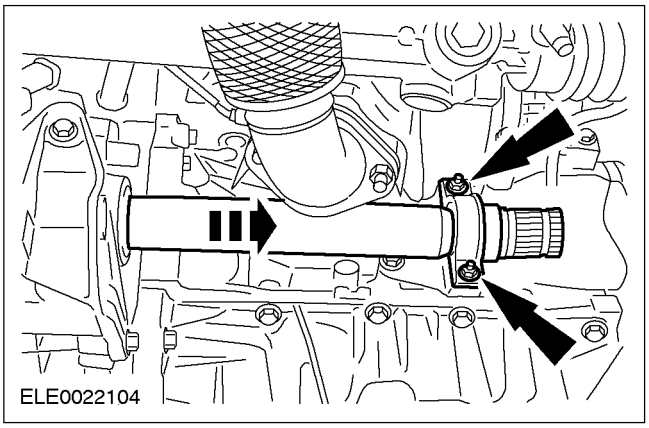
Vehicles with 1.8L or 2.0L engine

9. **CAUTION: Do not damage the halfshaft oil seal.**

NOTE: Plug the transaxle to prevent oil loss or dirt ingress.

Remove the intermediate shaft.

- Remove and discard the center bearing cap and locknuts.
- Allow the oil to drain into a suitable container.



REMOVAL AND INSTALLATION (Continued)

Installation

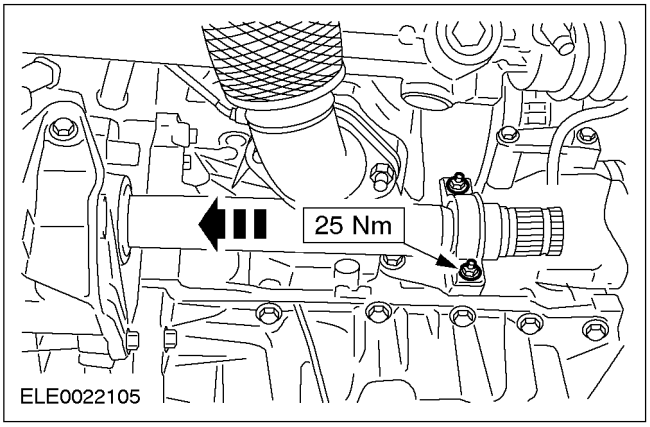
All Vehicles

1. CAUTION: Do not damage the halfshaft oil seal.

NOTE: Install a new halfshaft center bearing cap and locknuts.

Install the intermediate shaft.

- Install the center bearing cap.



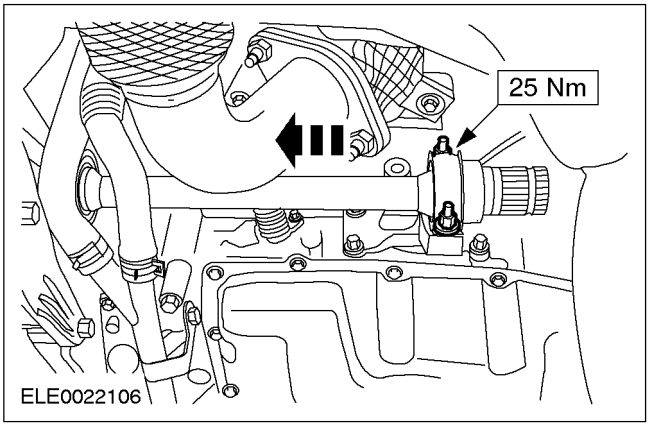
Vehicles with 2.0L diesel engine

2. CAUTION: Do not damage the damage the halfshaft oil seal.

NOTE: Install a new halfshaft center bearing cap and locknuts.

Install the intermediate shaft.

- Install the center bearing cap.



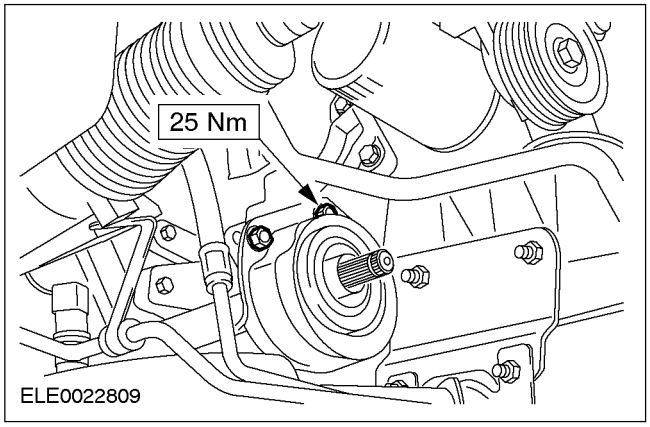
Vehicles with 2.5L engine

3. CAUTION: Do not damage the halfshaft oil seal.

NOTE: Install new halfshaft center bearing locknuts.

Install the intermediate shaft.

- Install the locknuts.



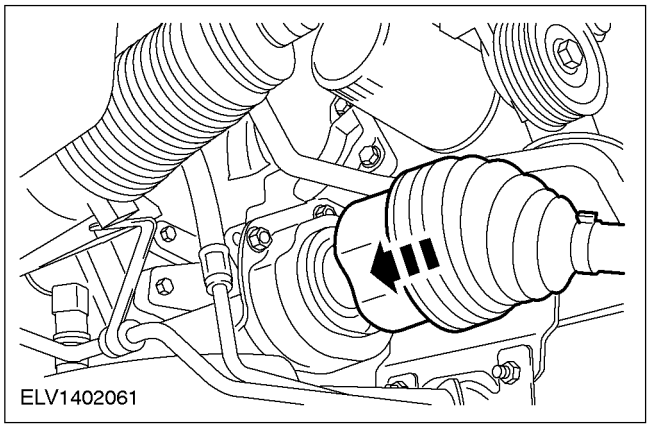
All vehicles

4. CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent at more than 45 degrees.

CAUTION: Make sure the snap ring is correctly seated.

NOTE: Install a new snap ring.

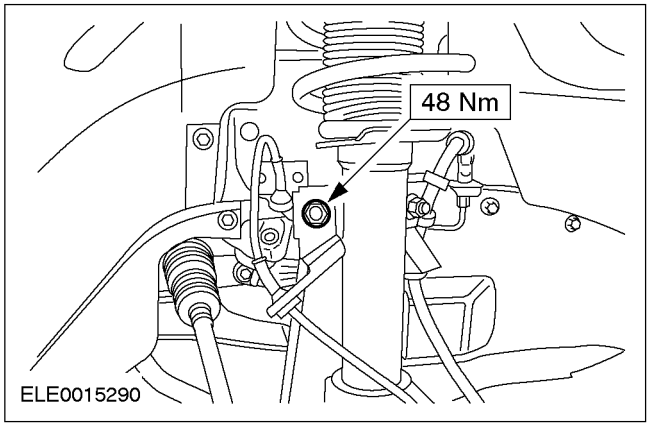
Attach the right-hand halfshaft to the intermediate shaft (vehicles with 2.5L engine shown).



5. Attach the right-hand lower arm ball joint to the wheel knuckle. For additional information, refer to Section 204-01.

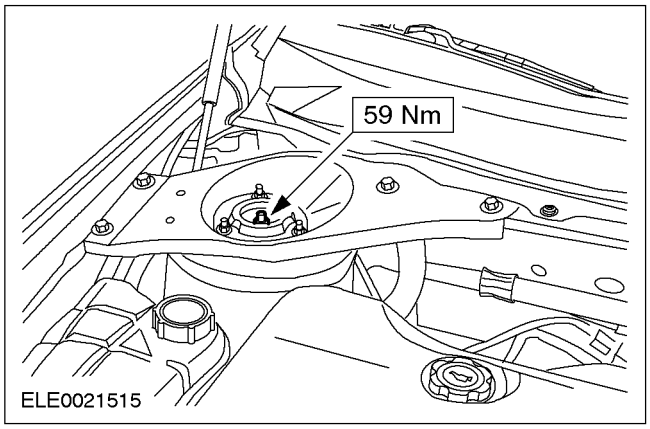
REMOVAL AND INSTALLATION (Continued)

6. **Attach the right-hand stabiliser connecting link to the suspension strut.**

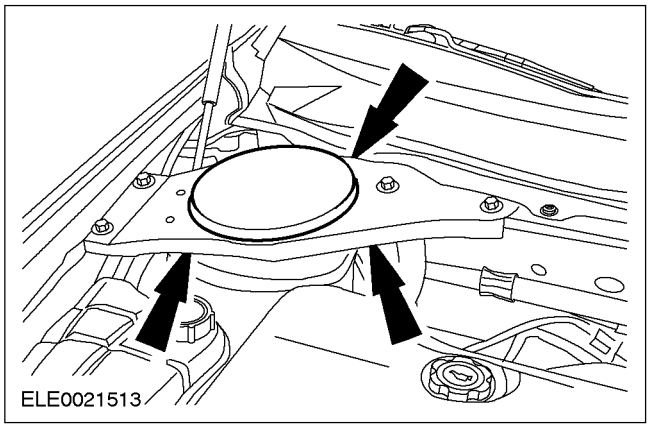


7. **Install the right-hand wheel and tire. For additional information, refer to Section 204-04.**
8. **CAUTION: Use an Allen key to prevent the piston rod from rotating.**

   Tighten the right-hand top mount nut.



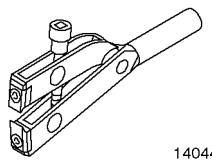
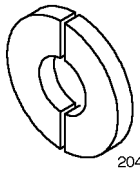
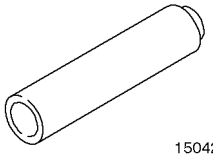
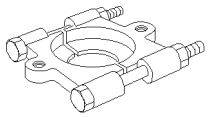
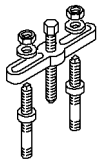
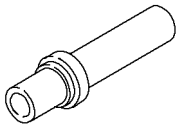
9. **Install the right-hand suspension strut and spring assembly top mount brace cover.**



10. **Check the transaxle fluid level and top up with manual transmission fluid if necessary.**

REMOVAL AND INSTALLATION

Constant Velocity (CV) Joint Boot

Special Tool(s)	
 14044	Clamping Tool, Boot Retaining Clamp 204-169 (14-044)
 204346	Remover/Installer, Vibration Damper Halfshaft 204-346 (14-068)
 15042	Installer, Drive Pinion Bearing 205-068 (15-042)
 TI15091	Remover, Bearing/Gear 205-310 (15-091)
 15092	Remover, Bearing/Gear 205-311 (15-092)
 16016	Installer, Transmission Extension Housing Bushing/Seal 308-046 (16-016)

Name	Specification
Grease	XS4C-M1C230-AA
Grease	WSD-M1C230-A

Removal

All Vehicles

1. **Remove the halfshaft.** **For additional information, refer to Halfshaft LH / Halfshaft RH in this section.**

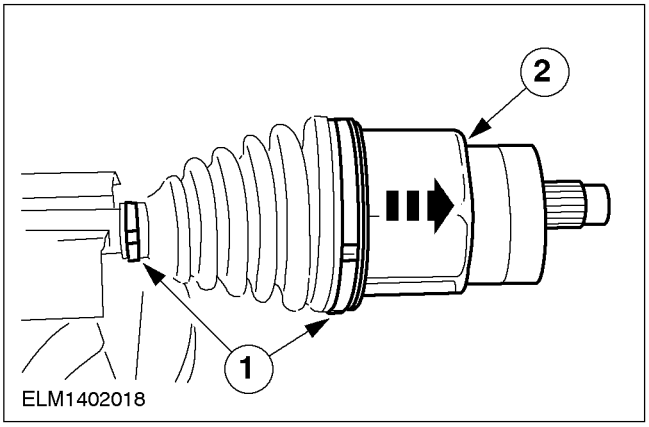
2. **CAUTION: The inner constant velocity (CV) joint must not be bent more than 18 degrees. The outer CV joint must not be bent more than 45 degrees.**

CAUTION: The outer CV joint is a press fit. Do not disassemble.

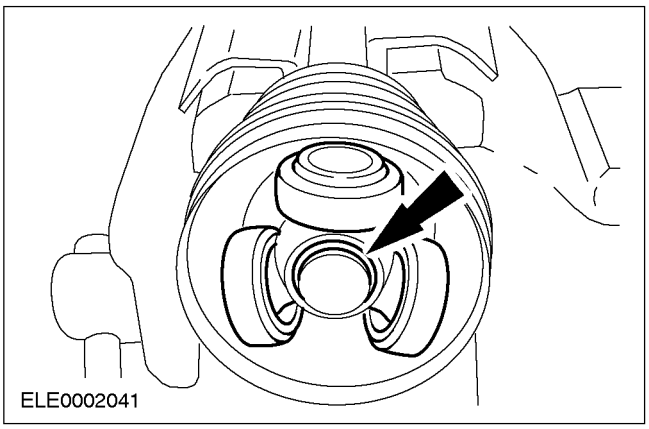
CAUTION: Use vise jaw protectors.

Clamp the halfshaft in a vise.

3. **Detach the inner CV joint housing from the halfshaft.**
   1. Remove and discard the inner CV joint boot retaining clamps.
   2. Remove the inner CV joint housing and discard the grease filling.



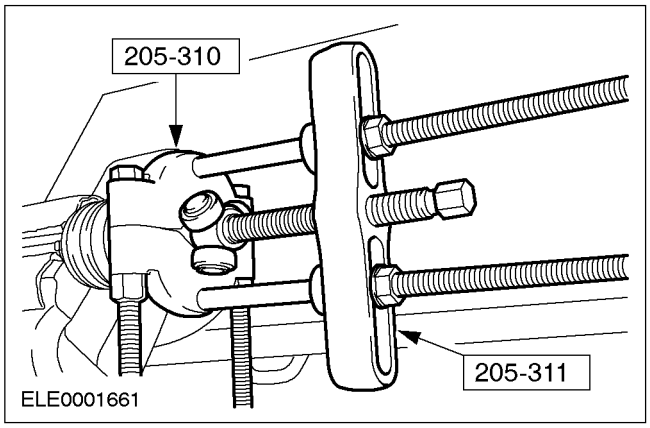
4. **Remove the spider circlip.**



REMOVAL AND INSTALLATION (Continued)

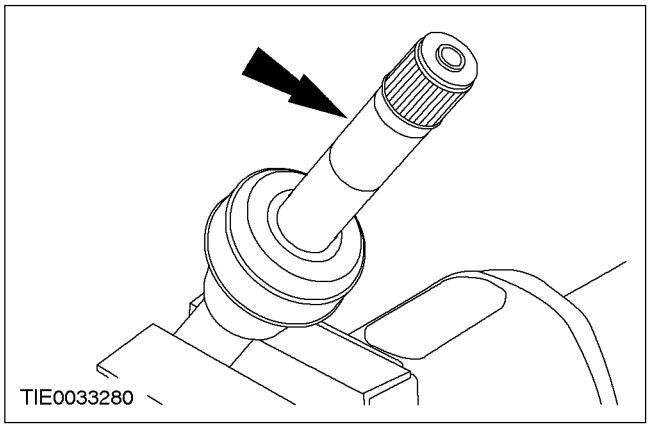
5. Using the special tools, remove the CV joint spider.

- Discard the inner CV joint boot.

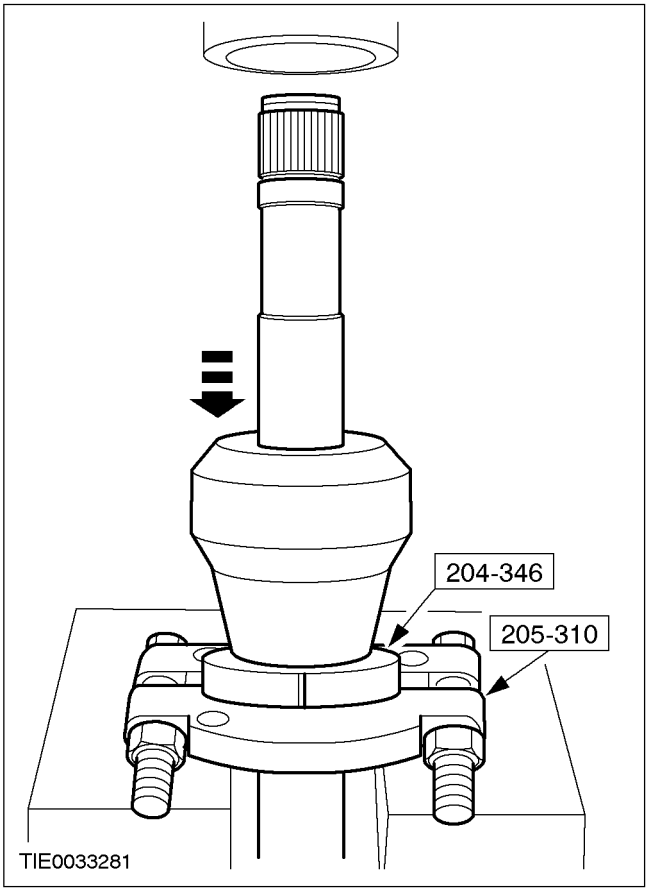


Vehicles with 2.0L diesel engine

6. Clean the halfshaft mating faces.

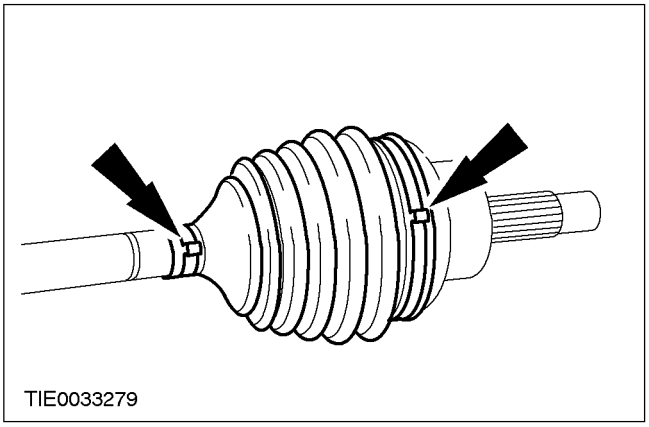


7. Using the special tools, remove the dynamic absorber.



8. NOTE: Mark the halfshaft where the outer CV joint boot is located.

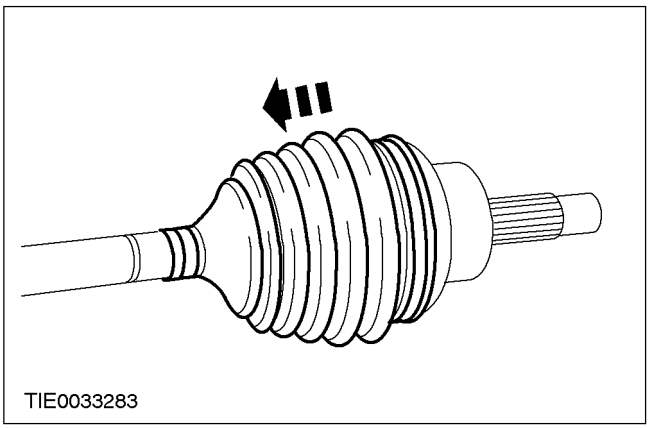
Remove and discard the outer CV joint boot retaining clamps.



REMOVAL AND INSTALLATION (Continued)

9. Remove the outer CV joint boot.

- Pull the boot inwards over the halfshaft.

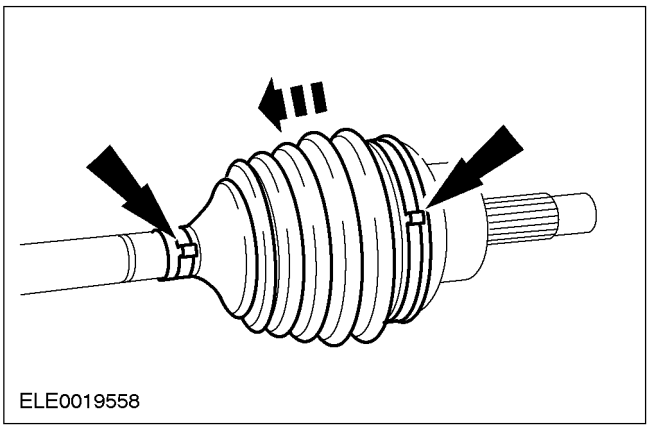

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All vehicles except 2.0L diesel engine

10. CAUTION: The outer CV joint is a press fit. Do not disassemble.

Remove the outer CV joint boot.

- Discard the outer CV joint boot and retaining clamps.


ELE0019558

Installation

All Vehicles

CAUTION: The inner CV joint must not be bent more than 18 degrees. The outer CV joint must not be bent more than 45 degrees.

1. CAUTION: Use vise jaw protectors.

Clamp the halfshaft in a vise.

2. Pack the outer CV joint with grease.

Vehicles with 2.0L diesel engine

3. CAUTION: Make sure that the amount of grease in the CV joint does not exceed 120 grams.

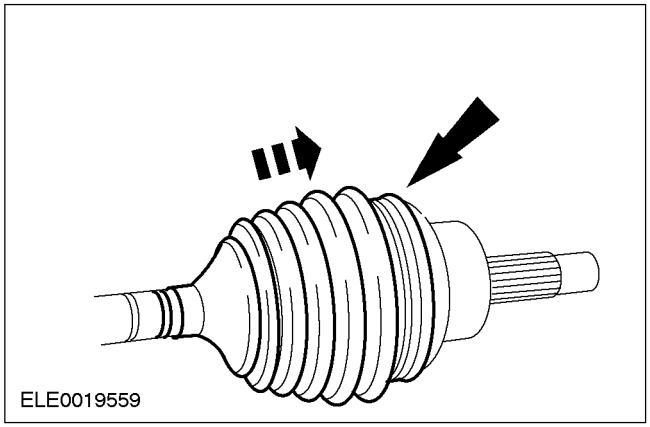
Apply grease to the outer CV joint.

4. NOTE: Install a new outer CV joint boot.

NOTE: Make sure that the outer CV joint boot is installed at the marks on the halfshaft.

Install the outer CV joint boot.

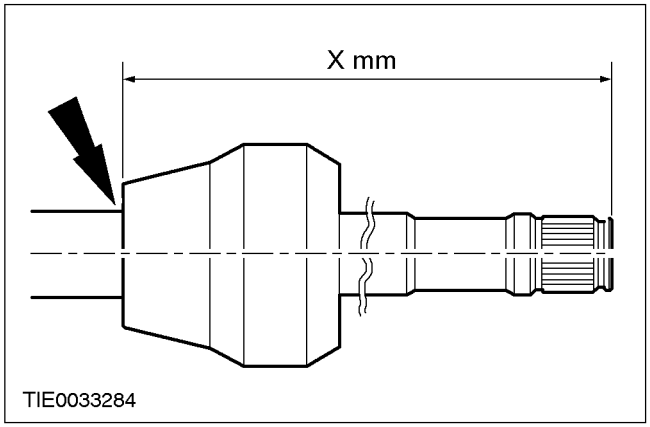
- Use a suitable screwdriver under the boot to allow air to escape.


ELE0019559

5. NOTE: Measure the length of the absorber (e.g. 70 mm) and add X = 125±1 mm to the resulting measurement.

Mark the installation position of the dynamic absorber.

- Example: 70 mm + 125±1 mm = 195±1 mm



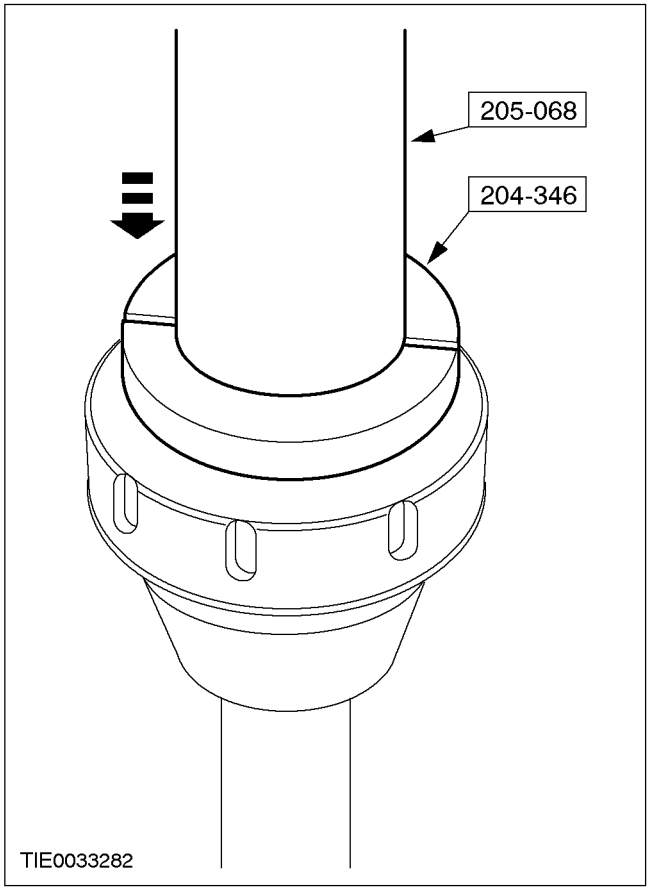
TIE0033284

REMOVAL AND INSTALLATION (Continued)

6. **CAUTION: Do not exceed a pressing force more than 10 kN. Failure to follow this instruction may result in damage to the outer CV joint.**

CAUTION: Make sure that the dynamic absorber and the halfshaft mating faces are free of oil and grease.

Using the special tool and a suitable tube, install the dynamic absorber to the marked position.



Vehicles with 1.8L or 2.0L engine

7. **CAUTION: Make sure that the amount of grease in the CV joint does not exceed 100 grams.**

Apply grease to the outer CV joint.

Vehicles with 2.5L engine

8. **CAUTION: Make sure that the amount of grease in the CV joint does not exceed 115 grams.**

Apply grease to the outer CV joint.

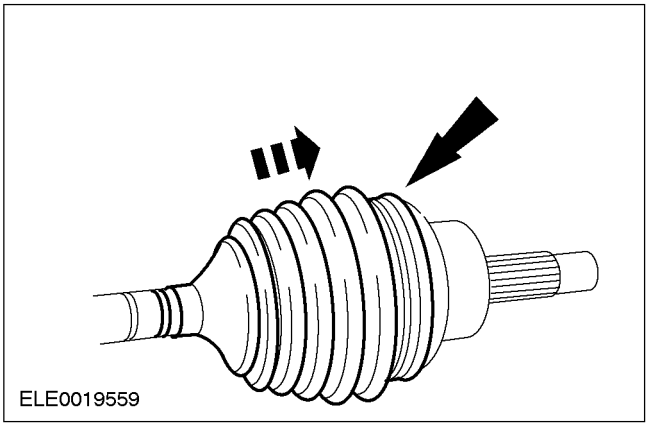
All vehicles except 2.0L diesel engine

9. **NOTE:** Install a new outer CV joint boot.

NOTE: Make sure that the outer CV joint boot is installed at the marks on the halfshaft.

Install the outer CV joint boot.

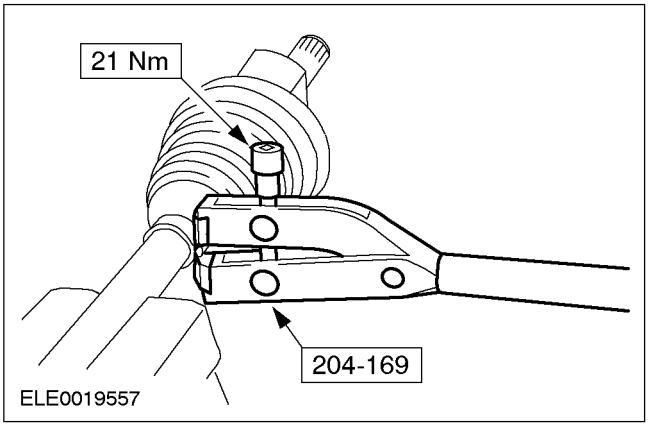
- Use a suitable screwdriver under the boot to allow air to escape.



All vehicles

10. **NOTE:** Install a new outer CV joint boot retaining clamp.

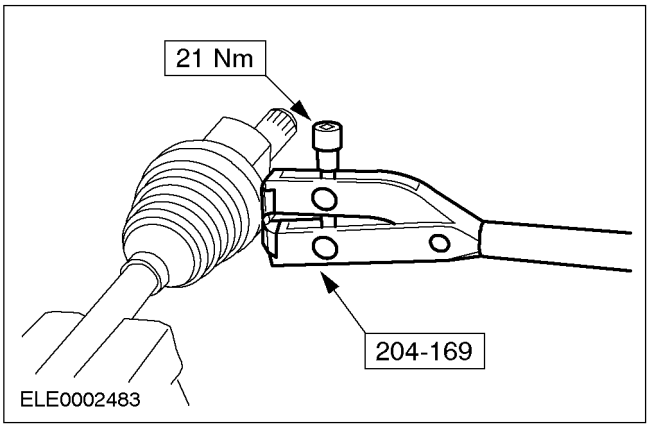
Using the special tool, install the CV joint boot inner retaining clamp.



REMOVAL AND INSTALLATION (Continued)

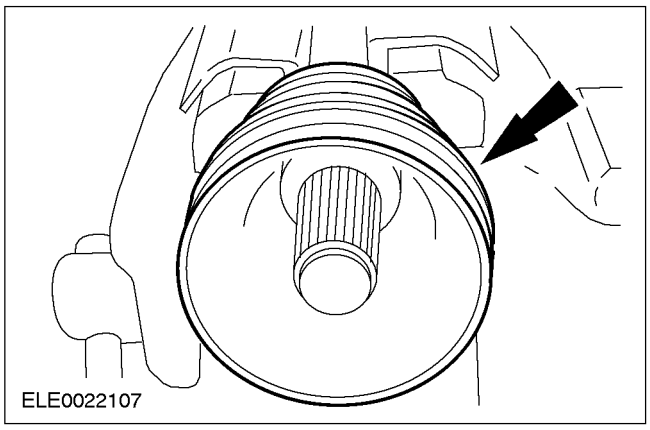
11. NOTE: Install a new outer CV joint boot retaining clamp.

Using the special tool, install the CV joint boot outer retaining clamp.



12. NOTE: Install a new inner CV joint boot.

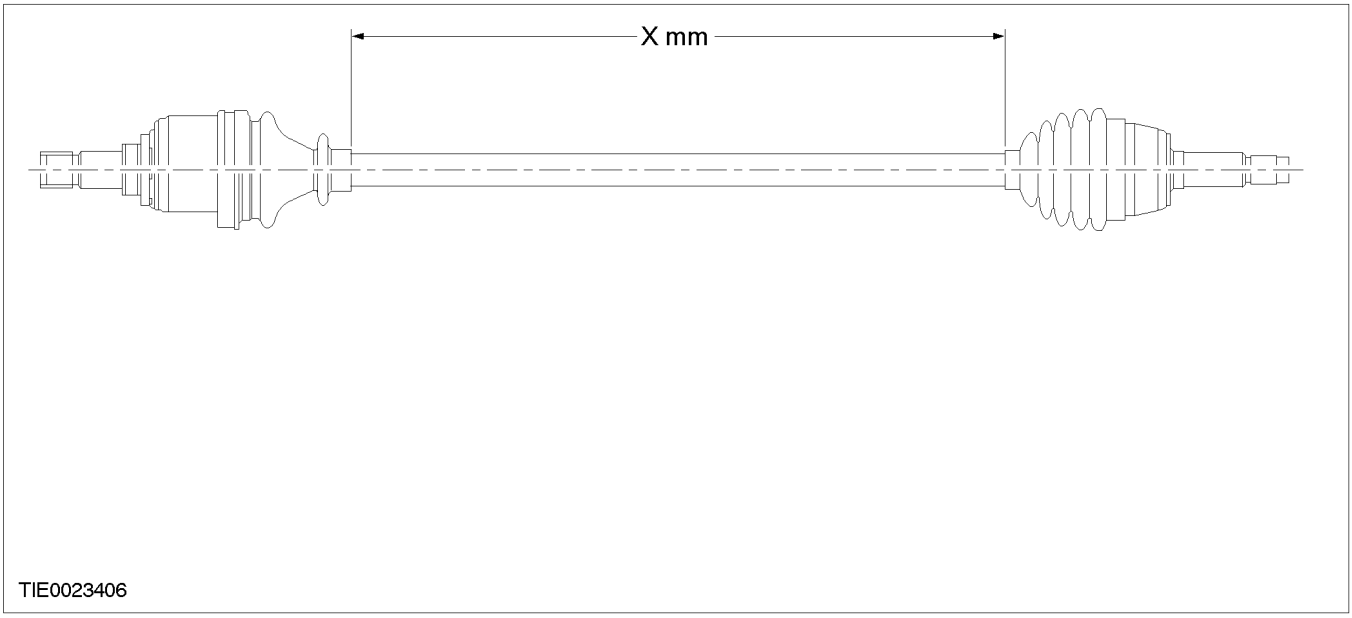
Install the inner CV joint boot.



13. NOTE: To obtain the correct inner CV joint boot installation position, make sure that the distance between the inner and outer CV joint boot is as indicated.

Align the inner CV joint boot.

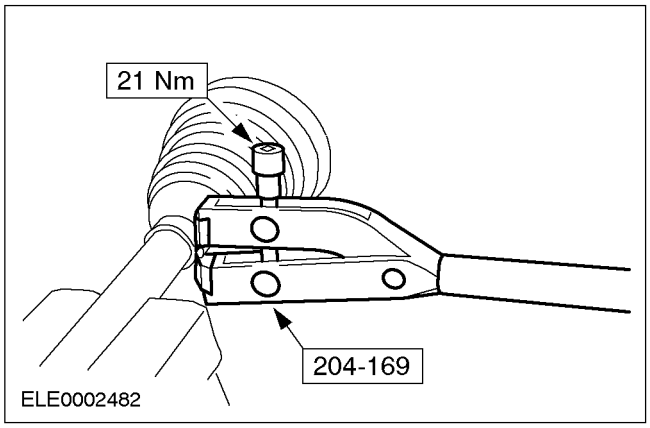
- X = 180 mm (halfshafts, vehicles with 1.8L or 2.0L engine).
- X = 160 mm (left-hand halfshaft, vehicles with 2.0L engine and automatic transaxle).
- X = 165.5 mm (halfshafts, vehicles with 2.5L or diesel engine).



REMOVAL AND INSTALLATION

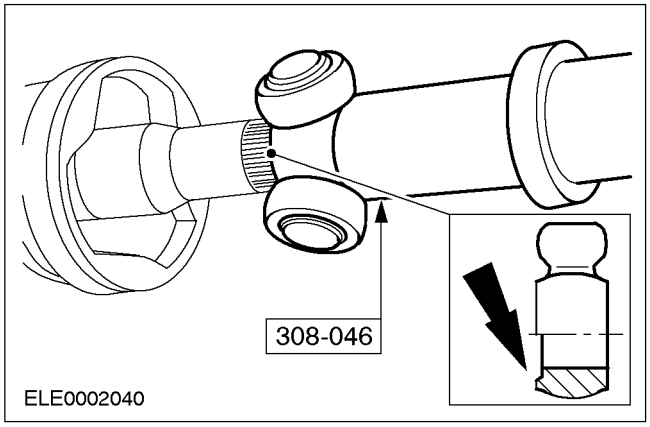
14. NOTE: Install a new inner CV joint boot retaining clamp.

Using the special tool, install the CV joint boot inner retaining clamp.

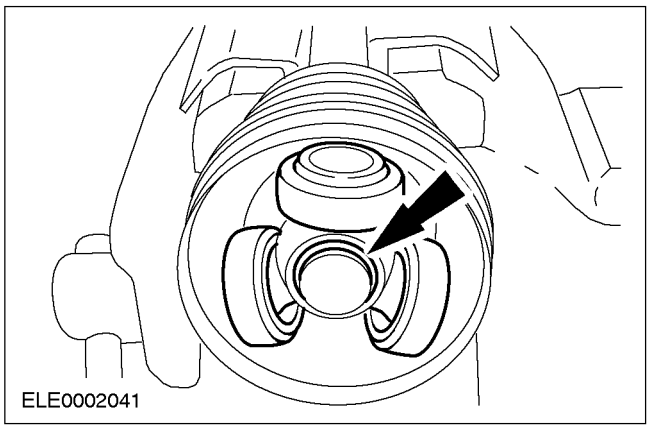


15. CAUTION: Make sure that the CV joint bearings are not damaged.

Using the special tool, install the CV joint spider.



16. Install the spider circlip.



Vehicles with 1.8L or 2.0L engine

17. CAUTION: Make sure that the amount of grease in the CV joint does not exceed 155 grams.

Apply grease to the inner CV joint.

Vehicles with 2.5L engine

18. CAUTION: Make sure that the amount of grease in the CV joint does not exceed 165 grams.

Apply grease to the inner CV joint.

Vehicles with 2.0L diesel engine

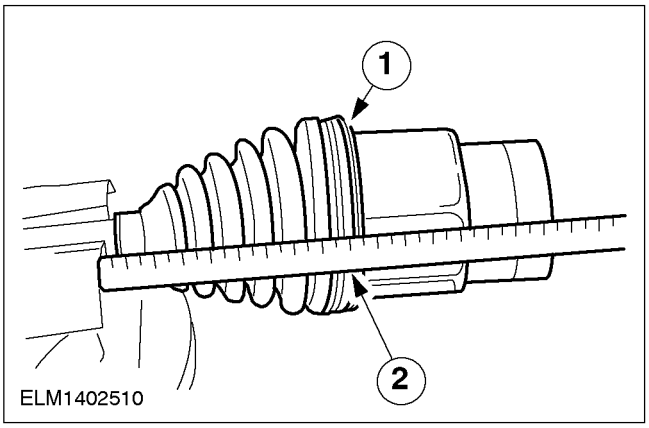
19. CAUTION: Make sure that the amount of grease in the CV joint does not exceed 165 grams.

Apply grease to the inner CV joint.

All vehicles

20. Attach the inner CV joint housing to the halfshaft.

1. Use a suitable screwdriver under the CV joint boot to allow air to escape.
2. Install the CV joint housing and pull it backwards 20 mm.

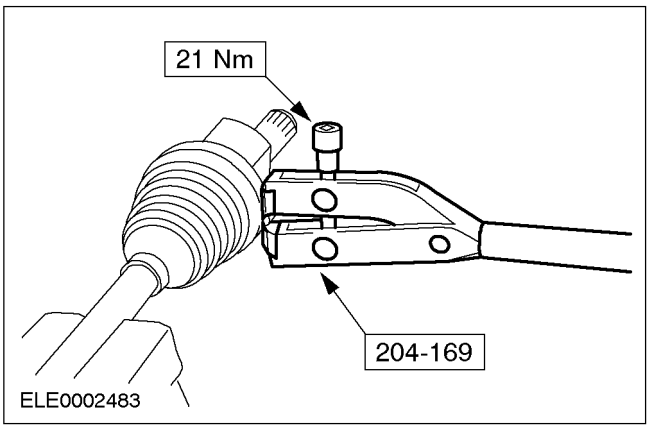


REMOVAL AND INSTALLATION (Continued)

21. NOTE: Install a new inner CV joint boot retaining clamp.

NOTE: Do not move the inner CV joint housing. Make sure that the CV joint boot is clamped at the measured position.

Using the special tool, install the CV joint boot outer retaining clamp.



22. Install the halfshaft. **For additional information, refer to Halfshaft LH / Halfshaft RH in this section.**

SECTION 206-00 Brake System - General Information

VEHICLE APPLICATION: 2003.0 Mondeo

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DESCRIPTION AND OPERATION

Brake System 206-00-2

DIAGNOSIS AND TESTING

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Inspection and Verification 206-00-3
Road Test 206-00-3
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GENERAL PROCEDURES

Brake System Bleeding ..... (12 141 0) 206-00-13

DESCRIPTION AND OPERATION

Brake System

NOTE: Brake friction materials inherently generate noise and heat in order to dissipate energy. As a result, occasional squeal is possible. This condition may be amplified by severe operating conditions, such as cold, heat, rain, snow, salt and mud.

The braking system is of a diagonally split, dual circuit design featuring front and rear disc brakes. Vehicles with steel wheels are equipped with standard brake discs and vehicles with alloy wheels are equipped with anti-corrosion coated brake discs.

The hydraulic system has separate circuits for each pair of diagonally opposed wheels (left front, right rear and right front, left rear). The front brake caliper is of a single sliding piston design which makes sure that equal effort is applied through both brake pads.

The anti-lock brake system (ABS) is controlled by the hydraulic control unit (HCU), incorporated within the hydraulic system, and only operates when the wheel speed sensors detect the onset of wheel lock up.

The parking brake control operates the rear brakes through a cable system. The parking brake cable features automatic adjustment using a ratchet and pawl mechanism on the parking brake control assembly.

The brake master cylinder is of a tandem design and is linked to a brake booster which reduces the brake pedal effort. The tandem design will make sure that in the event of one brake circuit failing the other will remain fully operational.

The brake master cylinder and brake booster are located on the left-hand side of the engine compartment. On right-hand drive vehicles they are connected to the brake pedal via a brake pedal cross shaft. On left-hand drive vehicles the brake booster actuating rod is connected directly to the brake pedal.

The brake booster vacuum on vehicles with diesel engine is provide by a camshaft driven vacuum pump.

The emergency brake assist (EBA) system incorporates a hydraulic mechanism in the brake master cylinder allowing controlled additional assistance to brake pedal effort in emergency braking situations. This allows maximum braking capability with a reduced brake pedal effort during critical situations.

DIAGNOSIS AND TESTING

Brake System

Principles of Operation

The brake system operates by transferring effort applied to the brake pedal by the driver to the brakes at each wheel.

The braking effort is distributed to each wheel, using an hydraulic system. The system is assisted using a vacuum brake booster that reduces pedal effort and increases hydraulic pressure. The parking brake operates on the rear wheels and is applied using a hand operated control.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
• Tire pressure • Wheels and tires • Fluid leak from brake line(s) • Fluid level • Fluid contamination

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Road Test

Carry out a road test to compare actual vehicle braking performance with the performance standards expected by the driver. The ability of the test driver to make valid comparison and detect performance deficiencies will depend on experience.

The driver should have a thorough knowledge of brake system operation and accepted general performance guidelines to make good comparisons and detect performance concerns.

An experienced brake technician will always establish a route that will be used for all brake diagnosis road tests. The roads selected will be reasonably smooth and level. Gravel or bumpy roads are not suitable because the surface does not allow the tires to grip the road equally. Crowned roads should be avoided because of the large amount of weight shifted to the low set of wheels on this type of road. Once the route is established and consistently used, the road surface variable can be eliminated from the test results.

Before a road test, obtain a complete description of the customer concerns or suspected condition. From the description, the technician's experience will allow the technician to match possible causes with symptoms. Certain components will be tagged as possible suspects while other will be eliminated by the evidence. More importantly, the customer description can reveal unsafe conditions which should be checked or corrected before the road test. The description will also help form the basic approach to the road test by narrowing the concern to specific components, vehicle speed or conditions.

Begin the road test with a general brake performance check. Keeping the description of the concern in mind, test the brakes at different vehicle speeds using both light and heavy pedal pressure. To determine if the concern is in the front or rear braking system, use the brake pedal and then use the parking brake control. If the condition (pull, vibration, isolation) occurs only with the parking brake, the concern is in the rear brake system.

Avoid locking the brakes and sliding the tires. Locked brakes and sliding tires do not indicate brake efficiency. A heavily braked and turning wheel will stop the vehicle in a shorter distance than locked brakes.

If the concern becomes evident during this check, verify it fits the description given before the road test. If the concern is not evident, attempt to duplicate the condition using the information from the description.

If a concern exists, use the Symptom Chart in order to isolate it to a specific sub-system and condition description. From this description, a list of possible sources can be used to further narrow the cause to a specific component or condition.

DIAGNOSIS AND TESTING

Symptom Chart

Condition	Possible Sources	Action
•The brakes pull or drift	•Wheel alignment angles.	•CHECK the wheel alignment angles. REFER to Section 204-00.
	•Brake pads.	•CHECK and INSTALL new components as necessary. REFER to Section 206-03 / 206-04.
	•Brake disc.	•CHECK and INSTALL new components as necessary. REFER to Section 206-03 / 206-04.
	•Brake caliper.	•CHECK and INSTALL new components as necessary. REFER to Section 206-03 / 206-04.
•The red brake warning indicator is always on	•Brake fluid level sensor.	•REFER to WDS.
	•Parking brake control.	•RELEASE and ADJUST the parking brake. REFER to Section 206-05.
	•Excessively worn brake pads.	•CHECK and INSTALL new components as necessary. REFER to Section 206-03 / 206-04.
	•Brake master cylinder primary piston cup.	•INSTALL a new brake master cylinder. REFER to Section 206-06.
•Vibration when brakes are applied	•Brake pads.	•CHECK and INSTALL new components as necessary. REFER to Section 206-03 / 206-04.
	•Brake caliper.	•CHECK and INSTALL new components as necessary. REFER to Section 206-03 / 206-04.
	•Brake disc.	•CHECK and INSTALL new components as necessary. REFER to Section 206-03 / 206-04.
•The pedal goes down fast	•Air in system.	•BLEED the system. REFER to Section 206-00.
	•Brake master cylinder	•Carry out the brake master cylinder component test in this section.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
	•Brake disc.	•CHECK and INSTALL new components as necessary. REFER to Section 206-03 / 206-04.
	•Brake pads.	•CHECK and INSTALL new components as necessary. REFER to Section 206-03 / 206-04.
•The pedal eases down slowly	•Brake caliper	•CHECK and INSTALL new components as necessary. CHECK and INSTALL new components as necessary. REFER to Section 206-03 / 206-04.
	•Brake master cylinder.	•Carry out the brake master cylinder component test in this section.
•The pedal is low or feels spongy	•Air in system.	•Bleed the system. REFER to Section 206-00.
	•Brake pads.	•CHECK and INSTALL new components as necessary. REFER to Section 206-03 / 206-04.
	•Brake booster	•CARRY out the brake booster component test in this section.
•Brake lockup during light brake pedal force	•Brake pads.	•CHECK and INSTALL new components as necessary. REFER to Section 206-03 / 206-04.
	•Brake disc.	•CHECK and INSTALL new components as necessary. REFER to Section 206-03 / 206-04.
	•Brake booster.	•CARRY out the brake booster component test in this section.
•Excessive/erratic brake pedal travel	•Insufficient grease on sliding parts.	•APPLY grease where necessary.
	•Brake pads.	•CHECK and INSTALL new components as necessary. REFER to Section 206-03 / 206-04.
	•Brake disc.	•CHECK and INSTALL new components as necessary. REFER to Section 206-03 / 206-04.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
	•Wheel bearing.	•CHECK or INSTALL a new wheel bearing. REFER to Section 204-01.
	•Brake pedal.	• GO to Pinpoint Test A
•Brake drag	•Brake booster.	•Carry out the brake booster component test in this section.
	•Brake caliper.	•CHECK and INSTALL new components as necessary. REFER to Section 206-03 / 206-04.
	•Stability assist system (if equipped)	•REFER to WDS.
	•Brake pedal.	• GO to Pinpoint Test B
•Slow or incomplete brake pedal return	•Stability assist system (if equipped)	•REFER to WDS.
	•Brake master cylinder.	•Carry out the brake master cylinder component test in this section.
	•Brake pedal.	• GO to Pinpoint Test C

Pinpoint Tests

PINPOINT TEST A: EXCESSIVE/ERRATIC BRAKE PEDAL TRAVEL

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK FOR BRAKE PEDAL RETURN	
	1 Run the engine at fast idle whilst making several brake applications. 2 Pull the brake pedal upwards. 3 Release the brake pedal and measure the distance from the rubber to the floor. 4 Make a hard brake application. 5 Release the brake pedal and measure the distance from brake pedal rubber to the floor. The brake pedal should return to its original position. • Does the brake pedal return to its original position? → **Yes** Vehicle is OK. → **No** GO to **A2**
A2: CHECK FOR BRAKE PEDAL BINDING	
	1 Check the brake pedal to make sure it is operating freely. • Is the brake pedal operating freely?

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** INSTALL a new brake booster. REFER to Section 206-07. TEST the system for normal operation. → **No** REPAIR or INSTALL new brake pedal and bracket. TEST the system for normal operation.

PINPOINT TEST B: BRAKES DRAG

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK FOR BRAKE PEDAL RETURN	
	1 Run the engine at fast idle whilst making several brake applications 2 Pull the brake pedal upwards. 3 Release the brake pedal and measure the distance from the rubber to the floor. 4 Make a hard brake application. 5 Release the brake pedal and measure the distance from brake pedal rubber to the floor. The brake pedal should return to its original position. • Does the brake pedal return to its original position? → **Yes** Vehicle is OK. → **No** GO to **B2**
B2: CHECK FOR BRAKE PEDAL BINDING	
	1 Check the brake pedal to make sure it is operating freely. • Is the brake pedal operating freely? → **Yes** INSTALL a new brake booster. REFER to Section 206-07. TEST the system for normal operation. → **No** REPAIR or INSTALL new brake pedal and bracket. TEST the system for normal operation.

PINPOINT TEST C: SLOW OR INCOMPLETE BRAKE PEDAL RETURN

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK FOR BRAKE PEDAL RETURN	
	1 Run the engine at fast idle whilst making several brake applications. 2 Pull the brake pedal upwards. 3 Release the brake pedal and measure the distance from the rubber to the floor. 4 Make a hard brake application.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	5 Release the brake pedal and measure the distance from brake pedal rubber to the floor. The brake pedal should return to its original position. • Does the brake pedal return to its original position? → **Yes** Vehicle is OK. → **No** GO to **C2**
C2: CHECK FOR BRAKE PEDAL BINDING	
	1 Check the brake pedal to make sure it is operating freely. • Is the brake pedal operating freely? → **Yes** INSTALL a new brake booster. REFER to Section 206-07. TEST the system for normal operation. → **No** REPAIR or INSTALL new brake pedal and bracket. TEST the system for normal operation.

DIAGNOSIS AND TESTING

Component Tests

Brake Booster

1. Inspect all hoses and connections. All unused vacuum connectors should be capped. Hoses and their connections should be correctly secured and in good condition with no holes and no collapsed areas. Inspect the brake booster check valve for damage.
2. Check the hydraulic brake system for leaks or low fluid.
3. With the transmission in PARK (automatic transmission), stop the engine and operate the parking brake. Operate the brake pedal several times to exhaust all vacuum in the system.
4. With the engine turned OFF and all vacuum in the system exhausted operate the brake pedal and hold it down. Start the engine. If the vacuum system is operating, the brake pedal will tend to move downward under constant foot pressure. If no motion is felt, the vacuum booster system is not functioning.
5. Remove the vacuum hose from the brake booster. Manifold vacuum should be available at the brake booster end of the hose with the engine at idle speed and the transmission in PARK or NEUTRAL. Make sure that all unused vacuum outlets are correctly capped, hose connectors are correctly secured and vacuum hoses are in good condition. When it is established that manifold vacuum is available to the brake booster, connect the vacuum hose to the brake booster and repeat Step 3. If no downward movement of the brake pedal is felt, the vacuum booster system is not functioning.
6. Run the engine for a minimum of 10 seconds at fast idle. Stop the engine and let the vehicle stand for 10 minutes. Then, operate the brake pedal with approximately 98N (20 lb) of force. The pedal feel (brake applications) should be the same as noted with the engine running. If the brake pedal feels hard (no power assist), install a new check valve and then repeat the testing. If the brake pedal still feels hard, install a new brake booster. If the brake pedal movement feels spongy, bleed the brake system. Refer to General Procedures.

Brake Master Cylinder

Usually, the first and strongest indicator of anything wrong in the brake system is a feeling through the brake pedal. In diagnosing the condition of the brake master cylinder, check brake pedal feel as evidence of a brake concern.

Check for brake warning indicator illumination and the brake fluid level in the brake fluid reservoir.

Normal Conditions

The following conditions are considered normal and are not indications that the brake master cylinder is in need of repair.

1. New brake systems are not designed to produce as hard a pedal effort as in the past. Complaints of light pedal efforts should be compared to pedal efforts of another vehicle, same model and year.
2. During normal operation of the brake master cylinder, the brake fluid level in the reservoir will rise during brake application and fall during release. The net brake fluid level (after brake application and release) will remain unchanged.
3. A trace of brake fluid exists on the brake booster shell below the master cylinder mounting flange. This results from the normal lubricating action of the master cylinder bore end seal.
4. Brake fluid level will fall with brake pad wear.

Abnormal Conditions

Changes in brake pedal feel or travel are indicators that something could be wrong in the brake system. The diagnostic procedure and techniques are brake pedal feel, brake warning indicator illumination and low brake fluid level as indicators in diagnosing brake system concerns. The following condition are considered abnormal and indicate that the brake master cylinder is in need of repair.

DIAGNOSIS AND TESTING (Continued)

1. Brake pedal goes down fast. This could be caused by an external or internal leak.
2. Brake pedal eases down slowly. This could be caused by an external or internal leak.
3. Brake pedal is low or feels spongy. This condition may be caused by no fluid in the brake master cylinder reservoir, brake fluid reservoir cap vent holes blocked or air in the hydraulic system.
4. Brake pedal effort is excessive. This may be caused by a bind or obstruction in pedal or linkage, blocked fluid control valve or insufficient brake booster vacuum.
5. Rear brakes lock up during light pedal force. This may be caused by grease or fluid on brake pads, damaged brake pads and linings, incorrectly adjusted parking brakes, damaged or contaminated brake pressure control valve.
6. Brake pedal effort is erratic. This condition could be caused by the brake booster being in operative, extreme brake caliper piston knock back or incorrectly installed brake pads.
7. Brake warning indicators is always ON. This may be caused by low fluid level, ignition wire routing too close to the fluid level indicator, or float assembly damage.

Bypass Condition Test

1. Check the brake fluid level in the brake fluid reservoir. Fill the brake fluid reservoir to the MAX mark if low or empty.
2. Observe the brake fluid level in the brake fluid reservoir. If after several brake applications, the brake fluid level remains the same, measure the wheel turning torque required to rotate the wheels with rearward with brakes applied as follows:

Place the transmission in NEUTRAL and raise and support the vehicle. REFER to Section 100-02.

With the aid of another technician, operate the brakes with a minimum of 445N (100 lb) and hold for approximately 15 seconds. With the brakes still applied, exert torque on the front wheels to 10.1 Nm (75 lbf.ft). If either wheel rotates, install a new brake master cylinder.

Non-Pressure Leaks

Any empty brake fluid reservoir condition may be the result of two types of non-pressure external leaks.

Type 1: An external leak may occur at the brake fluid reservoir cap because of incorrect positioning of the gasket and cap.

Reposition the gasket and cap.

Type 2: An external leak may occur at the brake fluid reservoir mounting seals. Repair such a leak by installing new seals.

DIAGNOSIS AND TESTING

Emergency Brake Assist (EBA)

Principles of Operation

All critical braking situations are immediately detected by the hydraulic mechanism incorporated in the brake master cylinder that is sensitive to the effect and speed of application of the brake pedal.

When activated, this has an immediate affect on the pressure distribution in the brake master cylinder and allows for the generation of high pressure braking levels with a reduced brake pedal effort. The brake system pressure is modulated by slightly releasing the brake pedal. When the brake pedal pressure is reduced below its threshold value, the EBA system is deactivated.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
• Tire pressures • Wheels and tires • Brake line damage • Fluid leaks • Fluid level • Fluid contamination

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Condition	Possible Sources	Action
•The emergency brake assist (EBA) is inoperative	•Brake assist valve.	•CARRY OUT the emergency brake assist (EBA) function tests in this section.

Function Tests

Static Diagnosis

To simulate normal braking:

1. Run the engine for 30 seconds.
2. Depress the brake pedal slowly with maximum pedal effort to just beyond the pressure point and hold.
3. Hold the brake pedal in this position for a minimum of 10 seconds.
4. Release the brake pedal by half of the pedal travel and pulsate the pedal.
5. If the resistance in the brake pedal is low (the pedal feels soft), then the system has switched to EBA mode and is operating correctly. This condition is considered normal and does not indicate that the brake master cylinder is in need of renewal.

Dynamic Diagnosis

To simulate an emergency braking situation:

1. Carry out a road test at a speed of 40-50 km/h (25-30 mph).
2. Simulate an emergency braking situation using a low pedal force (wait at least 30 seconds before repeating the test).
3. The anti-lock brake system (ABS) will be activated with the aid of the EBA.
4. The brake pedal can modulate the brake system pressure.
5. If the resistance in the brake pedal is low (the pedal feels soft), then the system has switched to EBA mode and is operating correctly. This condition is considered normal

DIAGNOSIS AND TESTING (Continued)

and does not indicate that the brake master cylinder is in need of renewal.

If only the static diagnosis was successful, then the brake pedal was not depressed rapidly enough during the dynamic diagnosis. If both the static and dynamic diagnosis were unsuccessful, check that the brake booster is operating correctly before installing a new EBA brake master cylinder. REFER to Section 206-06.

GENERAL PROCEDURES

Brake System Bleeding (12 141 0)

Bleeding

Vehicles with anti-lock brakes

1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**

All Vehicles

WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with the eyes. Wash hands thoroughly after handling. If brake fluid contacts the eyes, flush the eyes for 15 minutes with cold running water. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately. Failure to follow these instructions may result in personal injury.

CAUTION: If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

NOTE: Make sure that the vehicle is standing on a level surface.

NOTE: The system consists of separate circuits for each front and diagonally opposite rear wheel. Each circuit can be bled independently.

2. **CAUTION: The brake fluid reservoir must remain full with new, clean brake fluid at all times during bleeding.**

   Install the bleed tube to the bleed nipple.
3. **Immerse the end of the bleed tube in a bleed jar containing a small quantity of approved brake fluid.**
4. **Position the bleed jar base at least 300 mm above the bleed nipple to maintain fluid pressure and prevent air leaking past the threads of the bleed nipple.**
5. **Loosen the bleed nipple by one-half turn.**
6. **Operate the brake pedal fully (pumping brake fluid and air into the bleed jar) and allow the brake pedal to return to the rest position.**
7. **Fill the brake fluid reservoir.**
8. **Continue operating the brake pedal until air-free fluid is being pumped into the bleed jar.**
9. **With the brake pedal fully depressed tighten the bleed nipple.**
10. **CAUTION: Make sure the bleed nipple cap is installed after bleeding the brake line(s). This will prevent corrosion to the bleed nipple. Failure to follow this instruction may result in the bleed nipple becoming seized.**

    Repeat the procedure for the remaining brake lines.

SECTION 206-03 Front Disc Brake

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

Specifications 206-03-2

DESCRIPTION AND OPERATION

Front Disc Brake..... 206-03-3

DIAGNOSIS AND TESTING

Front Disc Brake..... 206-03-4

SPECIFICATIONS

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Super DOT 4 brake fluid	ESD-M6C57-A
High temperature grease	ESE-M12A4-A

Front Disc Brake Specification

	mm	inches
Brake disc diameter	300	11.81
New brake disc nominal thickness	24	0.945
Worn brake disc discard thickness*	22.0	0.866
Maximum brake disc thickness variation	0.015	0.0006
Worn brake pad discard thickness*	1.5	0.06

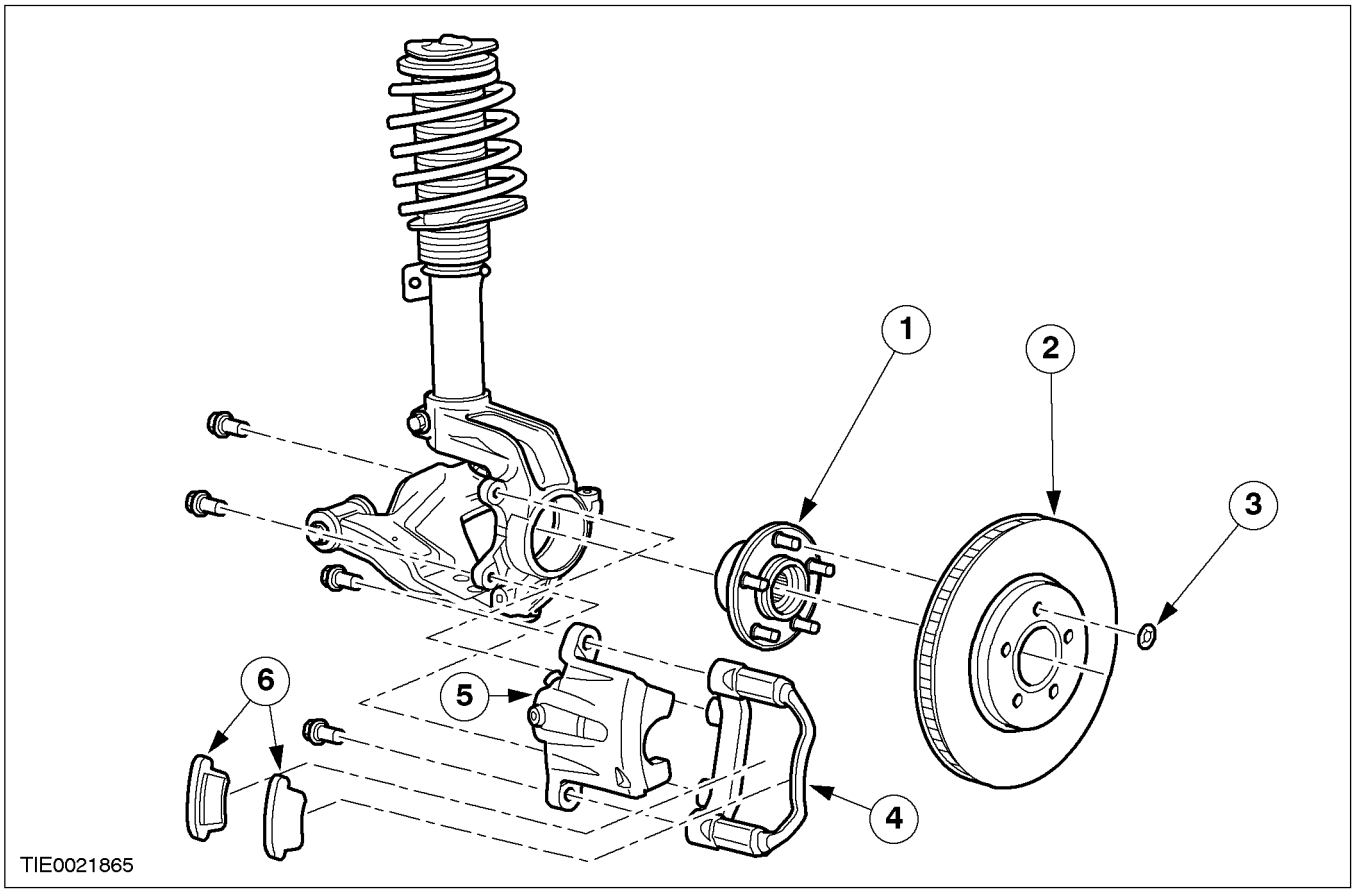
* When the discard thickness has been reached, install a new brake disc/brake pads.

Torque Specifications

Description	Nm	lb-ft	lb-in
Brake caliper anchor plate retaining bolts	130	96	–
Brake caliper retaining bolts	30	22	–
Brake hose to brake caliper union	10	7	89

DESCRIPTION AND OPERATION

Front Disc Brake



Item	Part Number	Description
1		Wheel hub
2		Brake disc
3		Brake disc retaining washer
4		Brake caliper anchor plate
5		Brake caliper
6		Brake pads

Brake Disc

Vehicles with steel wheels are equipped with standard brake discs and vehicles with alloy wheels are equipped with anti-corrosion coated brake discs.

DIAGNOSIS AND TESTING

Front Disc Brake

REFER to Section 206-00.

SECTION 206-04 Rear Disc Brake

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

Specifications 206-04-2

DESCRIPTION AND OPERATION

Rear Disc Brake 206-04-3

DIAGNOSIS AND TESTING

Rear Disc Brake 206-04-4

REMOVAL AND INSTALLATION

Brake Pads..... (12 238 0) 206-04-5

SPECIFICATIONS

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Super DOT 4 brake fluid	ESD-M6C57-A
High temperature grease	ESE-M12A4-A

Rear Disc Brake Specification

Description	mm	inches
Brake disc diameter	280	11.02
New brake disc nominal thickness	12	0.472
Worn brake disc discard thickness*	10.2	0.401
Maximum brake disc thickness variation	0.015	0.0006
Worn brake pad discard thickness*	1.5	0.059

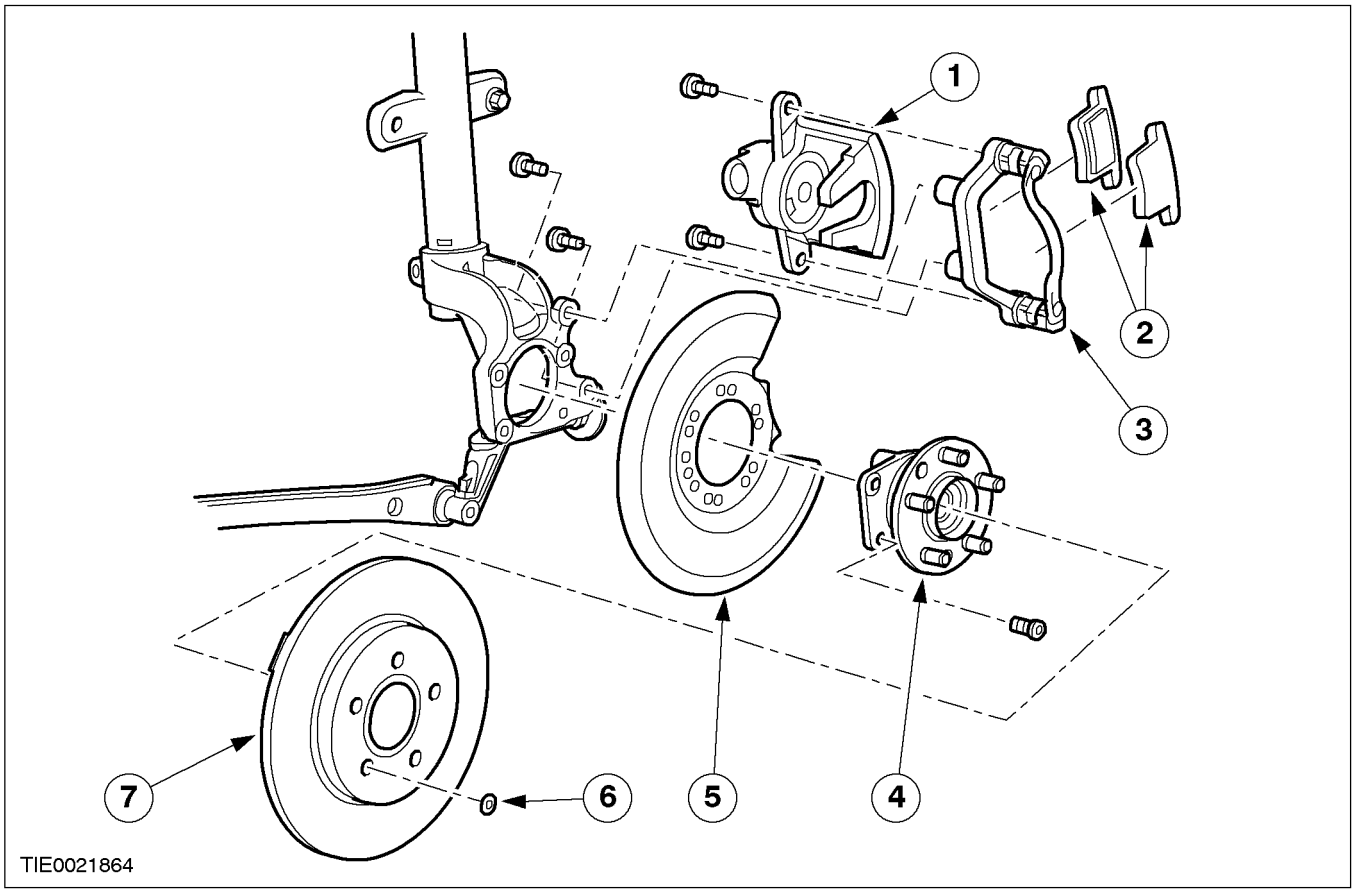
* When the discard thickness has been reached, install a new brake disc/brake pads.

Torque Specifications

Description	Nm	lb-ft	lb-in
Brake caliper anchor plate retaining bolts	80	59	–
Brake caliper retaining bolts	30	22	–
Brake hose to brake caliper union	10	7	89
Wheel spindle retaining bolts	90	66	–

DESCRIPTION AND OPERATION

Rear Disc Brake



Item	Part Number	Description
1		Brake caliper
2		Brake pads
3		Brake caliper anchor plate
4		Wheel hub
5		Brake disc shield
6		Brake disc retaining washer
7		Brake disc

Brake Disc

Vehicles with steel wheels are equipped with standard brake discs and vehicles with alloy wheels are equipped with anti-corrosion coated brake discs.

DIAGNOSIS AND TESTING

Rear Disc Brake

REFER to Section 206-00.

REMOVAL AND INSTALLATION

Brake Pads (12 238 0)

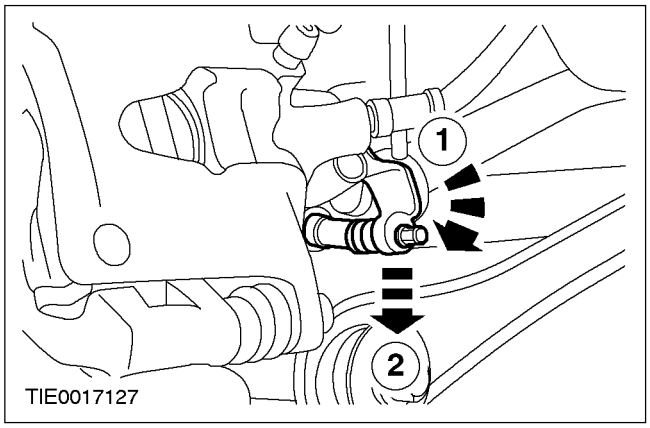
Name	Specification
Super DOT 4 brake fluid	ESD-M6C57-A
High temperature grease	ESE-M12A4-A

Removal

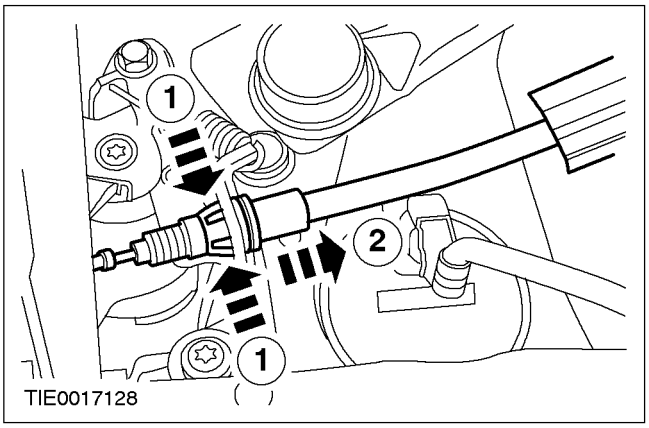
All vehicles

CAUTION: If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

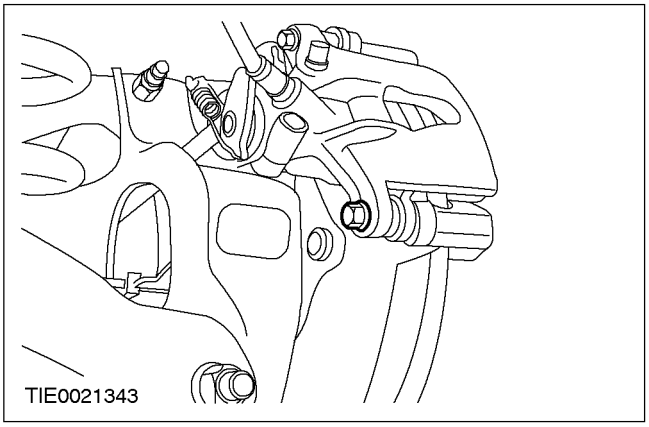
1. **Remove the wheel and tire. For additional information, refer to Section 204-04.**
2. **Detach the parking brake cable from the brake caliper lever.**
   1. Push the caliper lever.
   2. Detach the parking brake cable.



3. **Detach the parking brake cable from the brake caliper.**
   1. Depress the locking tangs.
   2. Detach the cable from the brake caliper.



4. **Remove the brake caliper lower retaining bolt.**



REMOVAL AND INSTALLATION (Continued)

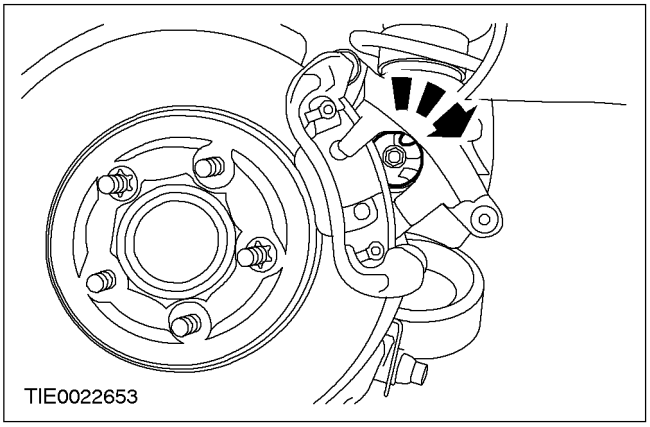
Wagon

5. **CAUTION: When the brake caliper piston is retracted into the piston housing, brake fluid will be displaced into the brake fluid reservoir.**

CAUTION: Support the brake caliper against the brake pad and disc assembly during brake caliper piston retraction.

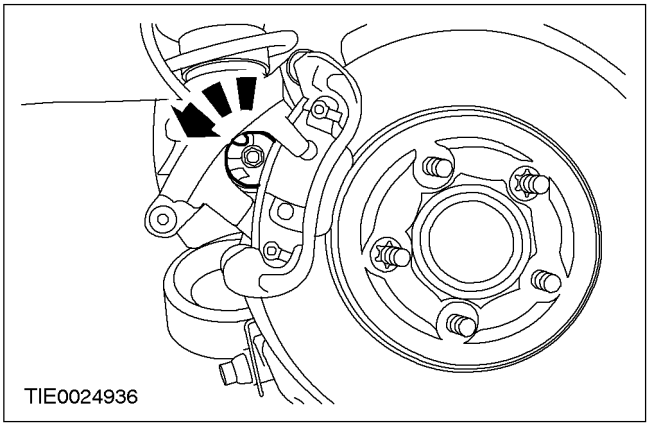
NOTE: To retract the left-hand brake caliper piston, the piston must be rotated clockwise whilst applying pressure.

Using a suitable Allen key, retract the brake caliper piston.



6. **NOTE:** To retract the right-hand brake caliper piston, the piston must be rotated counterclockwise whilst applying pressure.

Using a suitable Allen key, retract the brake caliper piston.



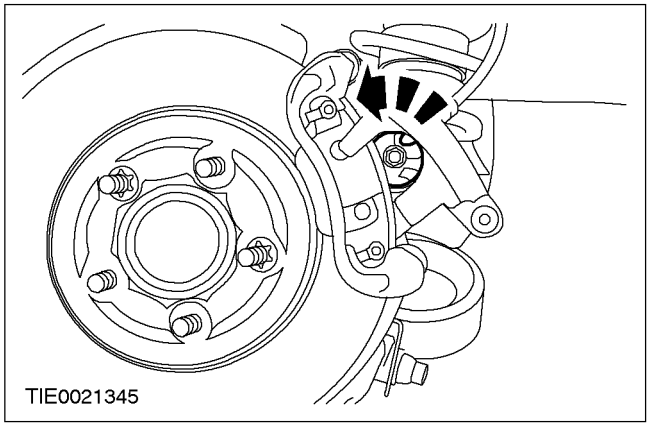
4-door and 5-door

7. **CAUTION: When the brake caliper piston is retracted into the piston housing, brake fluid will be displaced into the brake fluid reservoir.**

CAUTION: Support the brake caliper against the brake pad and disc assembly during brake caliper piston retraction.

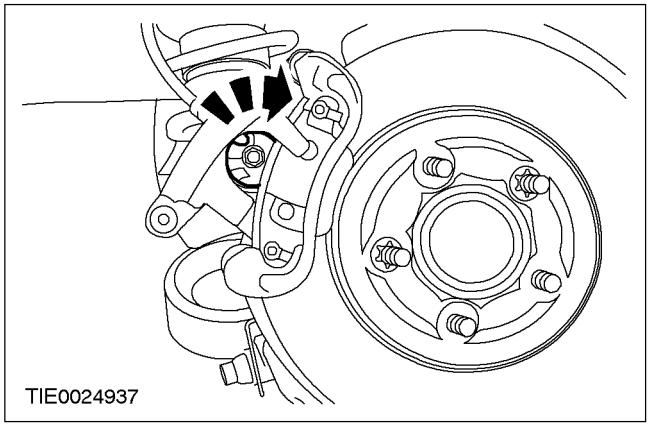
NOTE: To retract the left-hand brake caliper piston, the piston must be rotated counterclockwise whilst applying pressure.

Using a suitable Allen key, retract the brake caliper piston.



8. **NOTE:** To retract the right-hand brake caliper piston, the piston must be rotated clockwise whilst applying pressure.

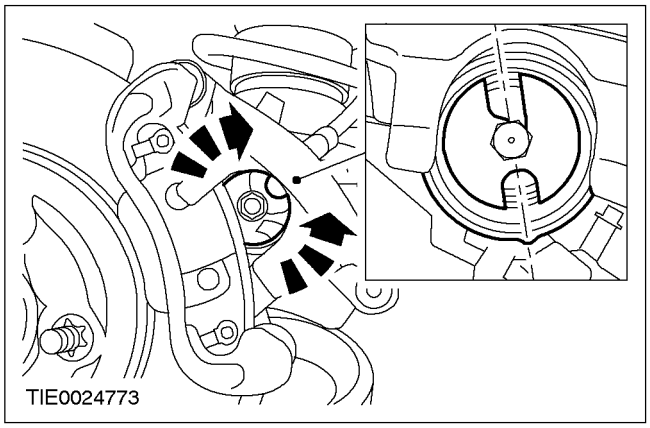
Using a suitable Allen key, retract the brake caliper piston.



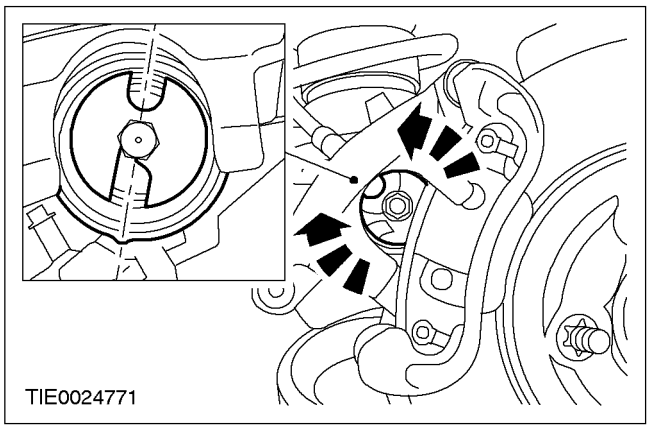
REMOVAL AND INSTALLATION (Continued)

All vehicles

9. Centralize the indent on the left hand brake caliper piston.

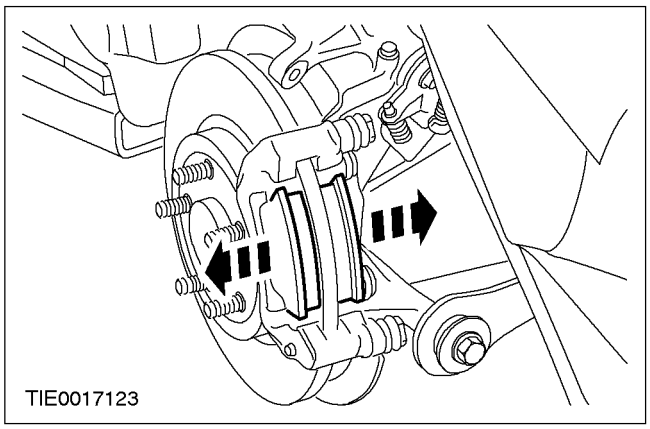


10. Centralize the indent on the right hand brake caliper piston.



11. NOTE: Rotate the brake caliper upwards.

Remove the brake pads (caliper shown removed for clarity)

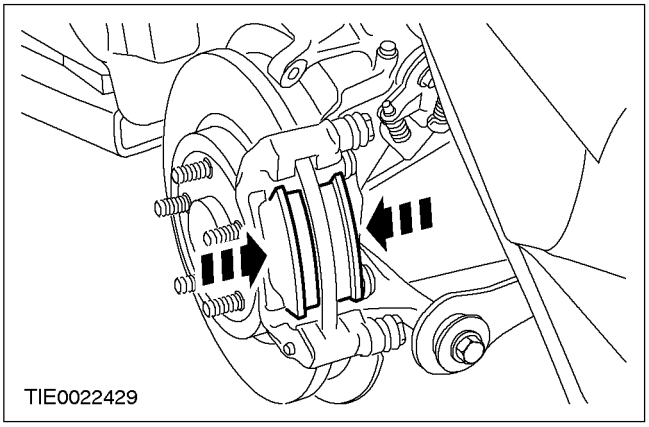


Installation

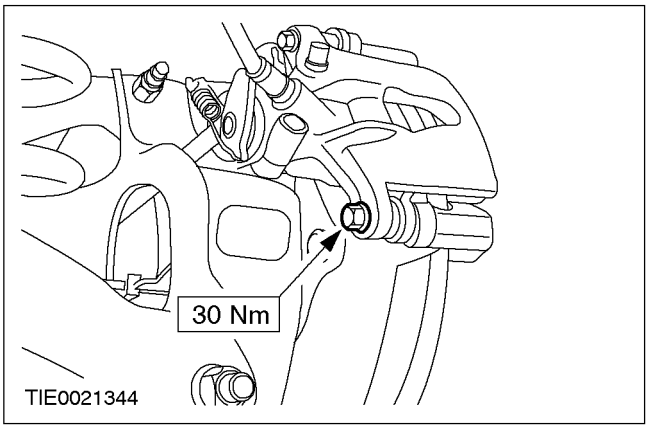
All vehicles

1. Install the brake pads (caliper shown removed for clarity).

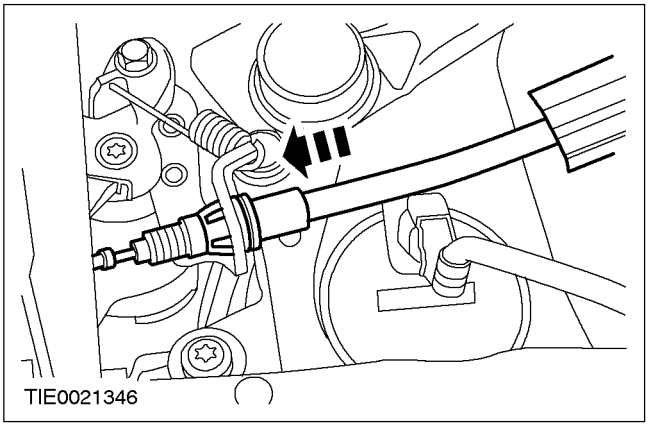
- Apply high temperature grease to the brake pad contact points



2. Install the brake caliper lower retaining bolt.



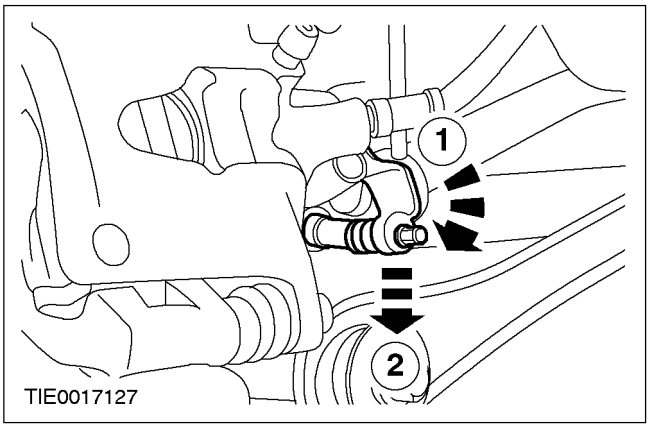
3. Attach the parking brake cable to the brake caliper.



REMOVAL AND INSTALLATION (Continued)

4. Attach the parking brake cable to the brake caliper lever.

1. Push the caliper lever.
2. Attach the cable to the lever.



5. Install the wheel and tire. For additional information, refer to Section 204-04.

6. Depress the brake pedal, check the fluid level in the brake fluid reservoir and top up if necessary with brake fluid.

SECTION 206-05 Parking Brake and Actuation

VEHICLE APPLICATION: 2003.0 Mondeo

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Parking Brake 206-05-3

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Parking Brake 206-05-4
Inspection and Verification 206-05-4
Symptom Chart 206-05-4
Pinpoint Tests 206-05-4

REMOVAL AND INSTALLATION

Parking Brake Control ..... (12 664 0) 206-05-6
Parking Brake Cable ..... (12 675 0) 206-05-12

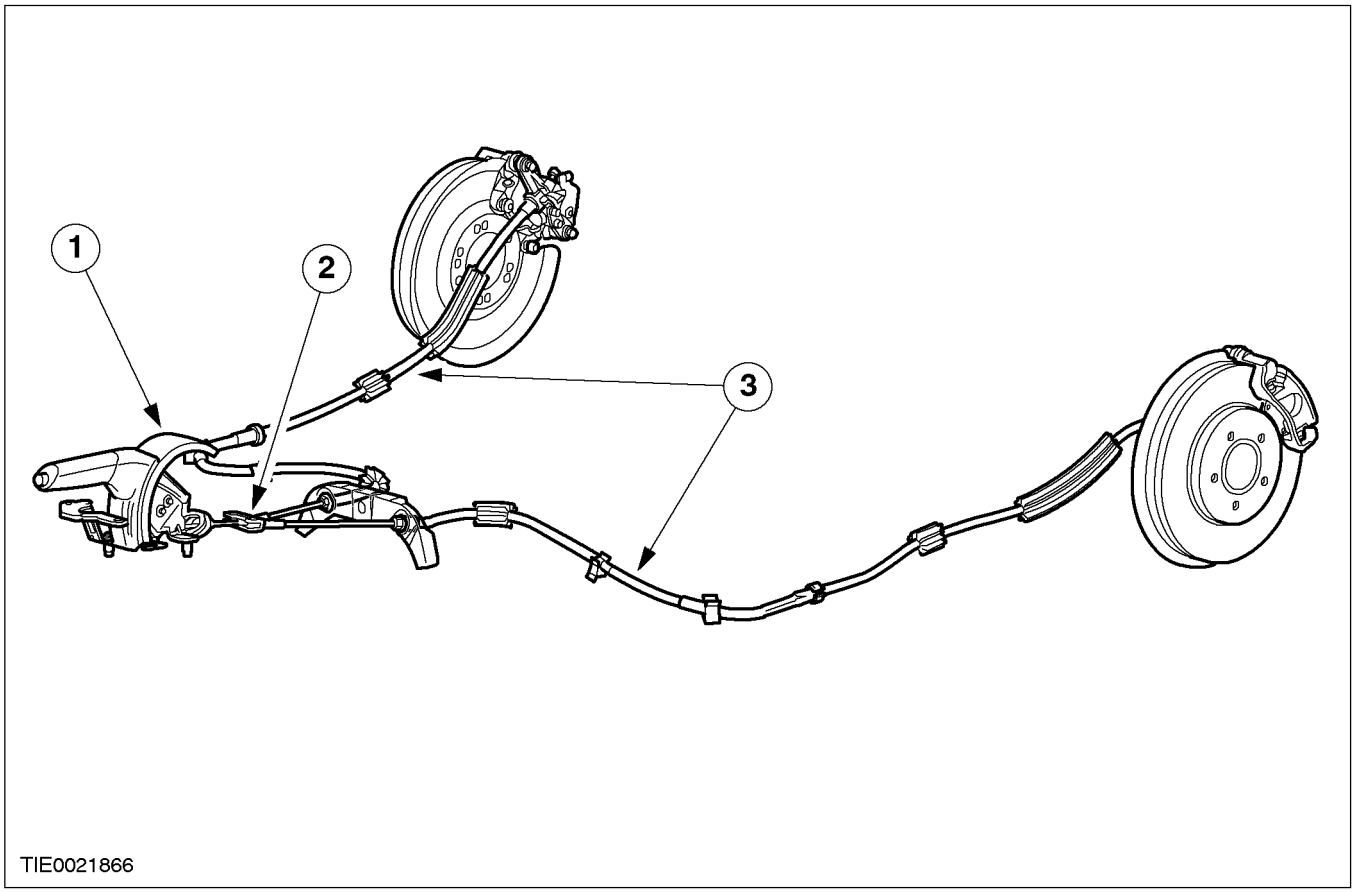
SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Parking brake control retaining nuts	20	15	–

DESCRIPTION AND OPERATION

Parking Brake



Item	Part Number	Description
1		Parking brake control
2		Equalizer
3		Parking brake cables

DIAGNOSIS AND TESTING

Parking Brake

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Parking brake control. • Parking brake cable(s)	• Parking brake warning circuit.

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Condition	Possible Sources	Action
•The parking brake will not apply	•Parking brake control. •Parking brake cable(s).	• GO to Pinpoint Test A.
•The parking brake will not release	•Parking brake control. •Parking brake cable(s).	• GO to Pinpoint Test B.

Pinpoint Tests

PINPOINT TEST A: THE PARKING BRAKE WILL NOT APPLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK THE PARKING BRAKE CABLE ADJUSTMENT	
	1 Carry out the parking brake cable adjustment procedure. REFER to Parking Brake Cable Adjustment in this section. • Does the parking brake now engage correctly? → **Yes** Parking brake is OK. → **No** GO to **A2**
A2: CHECK THE PARKING BRAKE CABLE(S)	
	1 Inspect the parking brake cable(s) for damage, rust or fraying. • Are the parking brake cable(s) OK? → **Yes** GO to **A3** → **No** REPAIR or INSTALL new cables as necessary. REFER to Parking Brake Cable in this section. TEST the system for normal operation.
A3: CHECK THE BRAKE PADS	
	1 Check the brake pads for excessive wear.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Are the brake pads OK? → **Yes** INSPECT for other causes such as loose parking brake control or other brake system components. REFER to Section 206-04 / 206-05. TEST the system for normal operation. → **No** INSTALL new brake pads. REFER to Section 206-04.TEST the system for normal operation.

PINPOINT TEST B: THE PARKING BRAKE WILL NOT RELEASE

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK THE PARKING BRAKE CONTROL	
	1 Release the parking brake control by pulling upwards on the control lever and pushing the release button. • Did the parking brake release? → **Yes** GO to **B2** → **No** INSTALL a new parking brake control. REFER to Parking Brake Control in this section. TEST the system for normal operation.
B2: CHECK THE PARKING BRAKE CABLE(S)	
	1 Raise and Support the vehicle on a free-wheel lift. REFER to Section 100-02. 2 Loosen the parking brake cable tension at the parking brake equalizer. 3 Rotate the rear wheels by hand. • Did the rear wheels turn freely? → **Yes** INSPECT other brake system components, REPAIR or INSTALL new components as necessary. REFER to Section 206-04 / 206-05. TEST the system for normal operation. → **No** INSTALL new parking brake cables. REFER to Parking Brake Cable in this section. TEST the system for normal operation.

REMOVAL AND INSTALLATION

Parking Brake Control (12 664 0)

Name	Specification
Anti-seize grease	SAM-1C107A

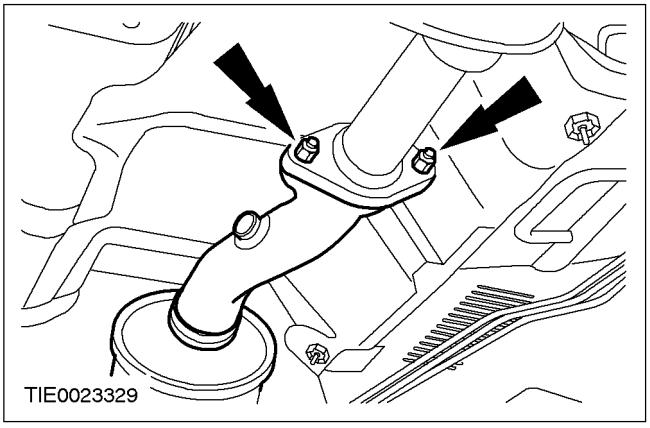
Removal

All vehicles

1. **Release the parking brake.**
2. **Raise and support the vehicle. For additional information, refer to Section 100-02.**

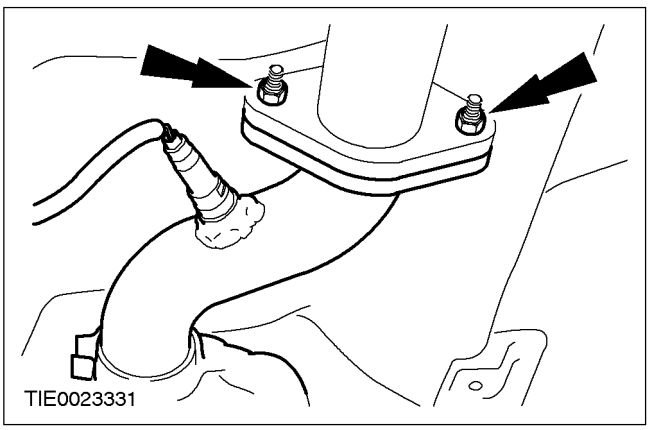
Vehicles with 1.8L or 2.0L engine

3. **Detach the catalytic converter from the front muffler pipe.**
   - Discard the gasket and nuts.



Vehicles with 2.5L engine

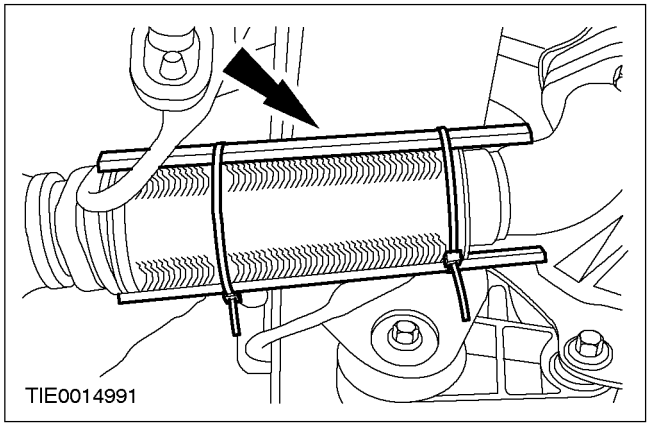
4. **Detach the catalytic converter from the front muffler pipe.**
   - Discard the gasket and nuts.



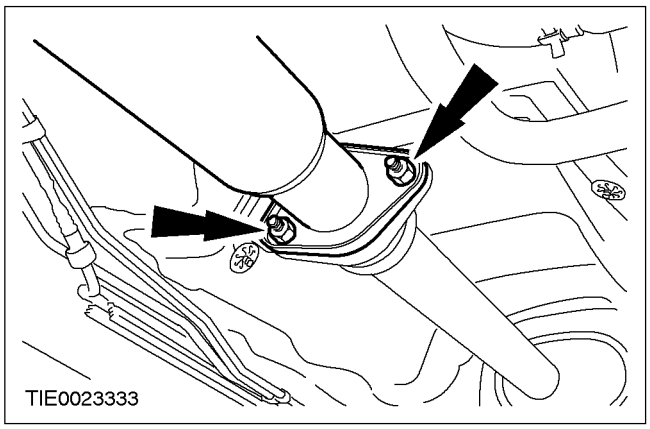
Vehicles with diesel engine

5. **CAUTION: Over bending of the exhaust flexible pipe may cause damage resulting in failure.**

   Support the exhaust flexible pipe with a support wrap or suitable splint.



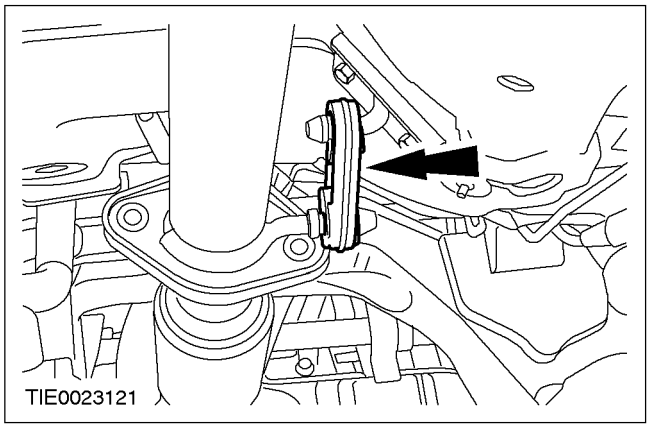
6. **Detach the exhaust flexible pipe from the front muffler pipe.**
   - Discard the sealing ring and nuts.



REMOVAL AND INSTALLATION (Continued)

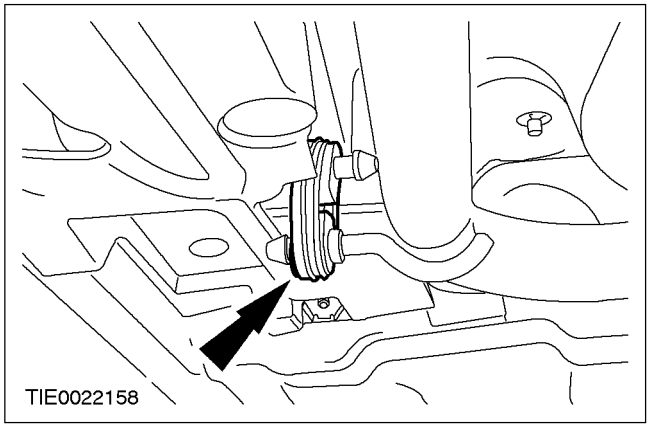
All vehicles

7. Detach the front and rear muffler assembly from the front exhaust hanger insulator.



8. NOTE: Support the front and rear muffler with a suitable axle stand.

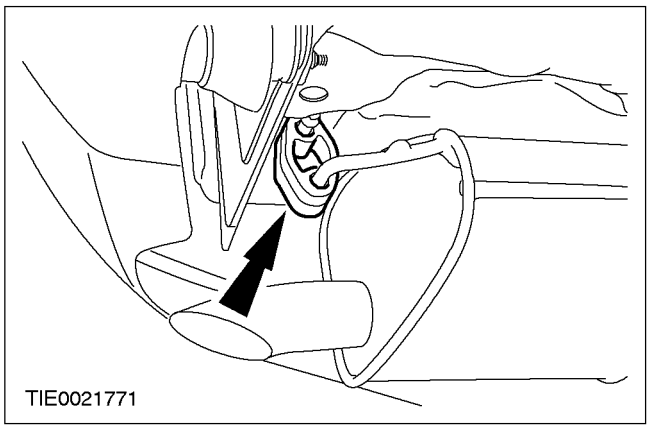
Detach the front and rear muffler assembly from the intermediate exhaust hanger insulator.



Vehicles with 1.8L, 2.0L or diesel engine

9. Remove the front and rear muffler assembly.

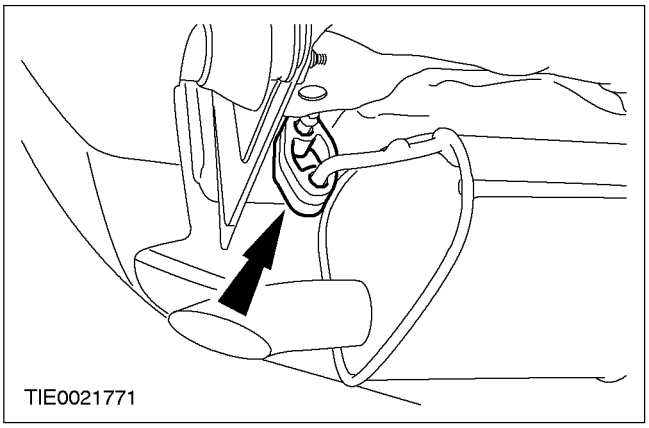
- Detach the muffler from the rear exhaust hanger insulator.



Vehicles with 2.5L engine

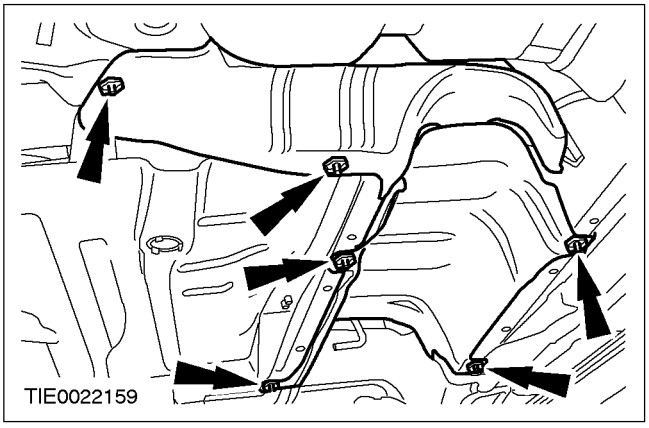
10. Remove the front and rear muffler assembly.

- Detach the rear mufflers from the rear exhaust hanger insulators (left-hand shown, right-hand similar).

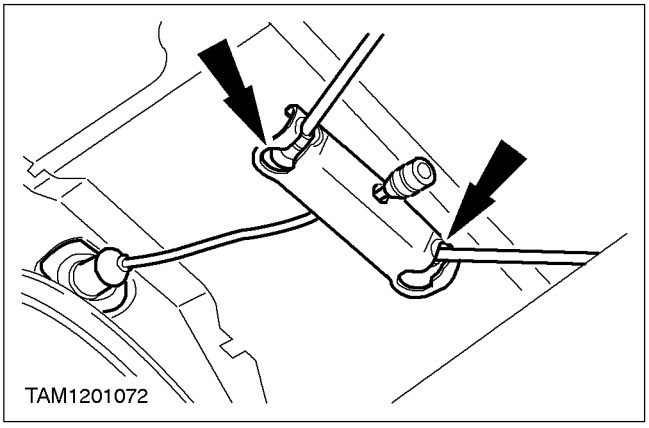


All vehicles

11. Remove the exhaust heat shield.

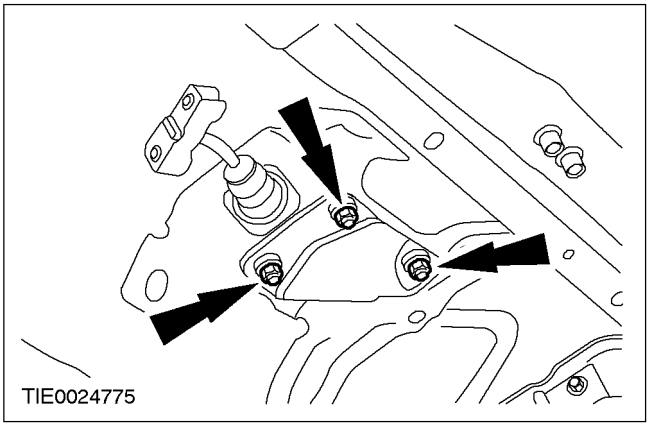


12. Disconnect the parking brake cables from the equalizer.



REMOVAL AND INSTALLATION (Continued)

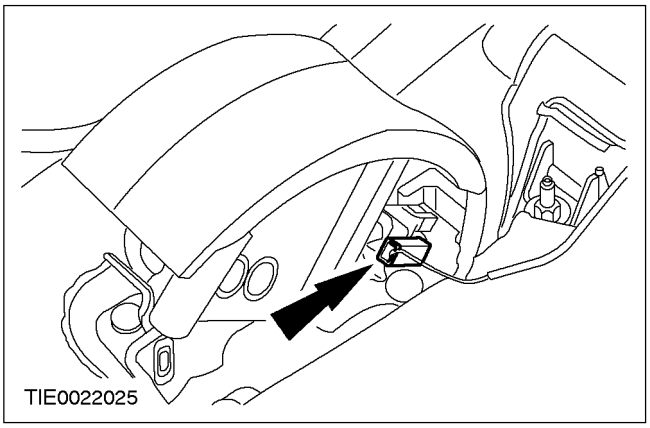
13. Detach the parking brake control from the underside of the floor pan.



14. Lower the vehicle.

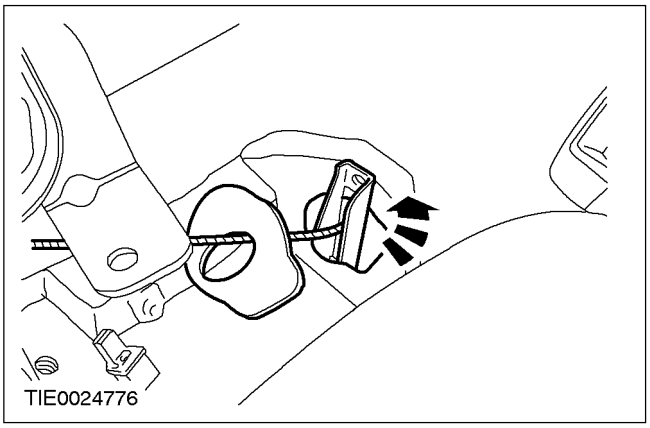
15. Remove the floor console. For additional information, refer to Section 501-12.

16. Disconnect the parking brake warning indicator switch electrical connector.



17. Remove the parking brake control.

- Pull the parking brake cable and equalizer through the opening in the floor pan.

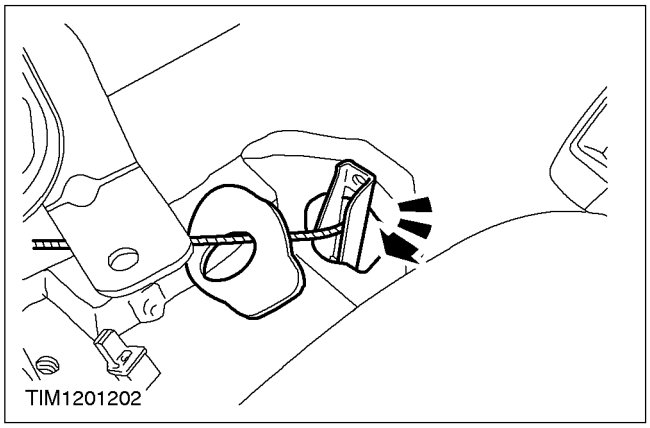


Installation

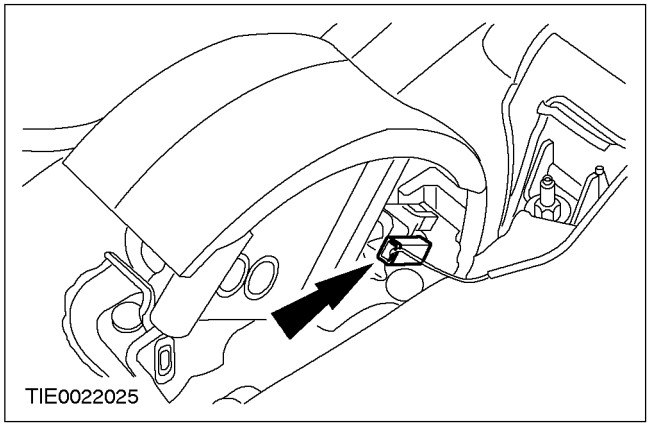
All vehicles

1. Install the parking brake control.

- Pass the parking brake cable and equalizer through the opening in the floor pan.



2. Connect the parking brake warning indicator switch electrical connector.

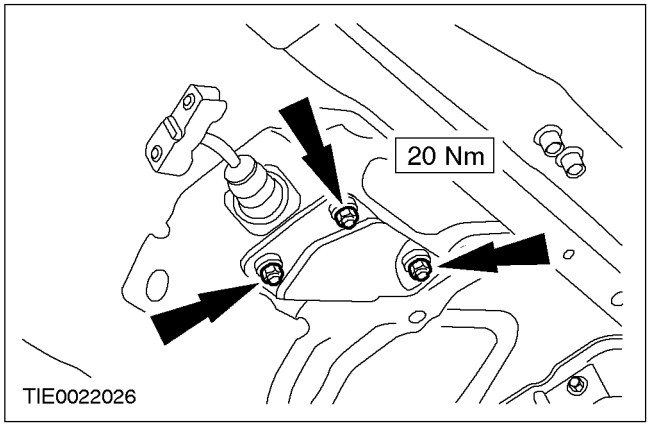


3. Install the floor console. For additional information, refer to Section 501-12.

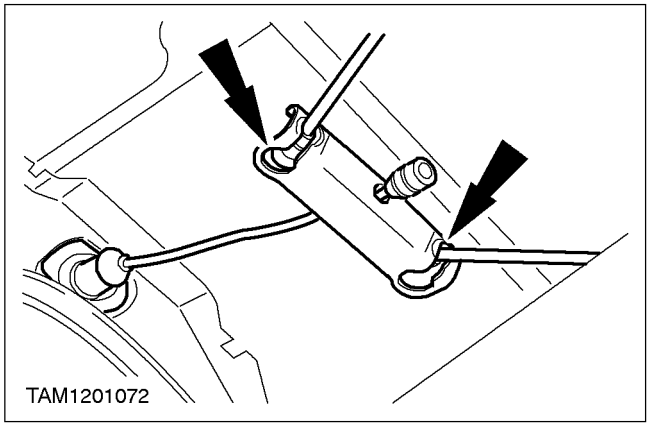
4. Raise and support the vehicle. For additional information, refer to Section 100-02.

REMOVAL AND INSTALLATION (Continued)

5. Attach the parking brake control to the underside of the floor pan.



6. Connect the parking brake cables to the equalizer.

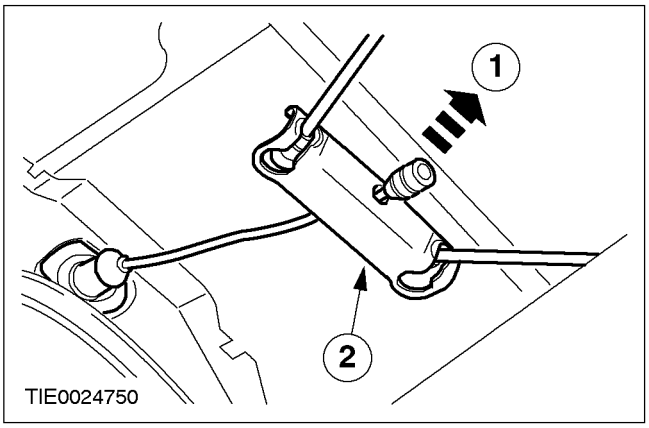


7. NOTE: To aid installation, the parking brake control self adjuster mechanism is locked out by a small clock spring.

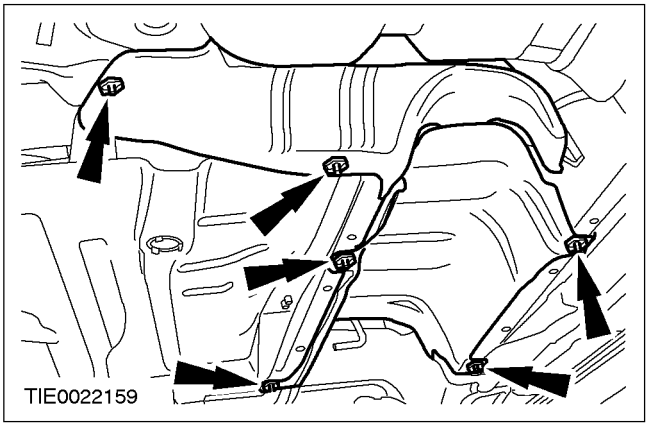
NOTE: Make sure the parking brake control lever is in the fully released position.

Release the parking brake control self adjusting mechanism clock spring.

1. Sharply pull the equalizer rearwards.
2. Release the equalizer.



8. Install the exhaust heat shield.

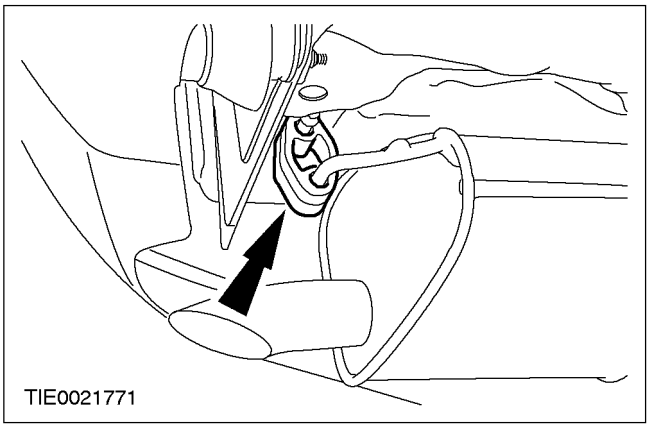


REMOVAL AND INSTALLATION (Continued)

Vehicles with 2.5L engine

9. Install the front and rear muffler assembly.

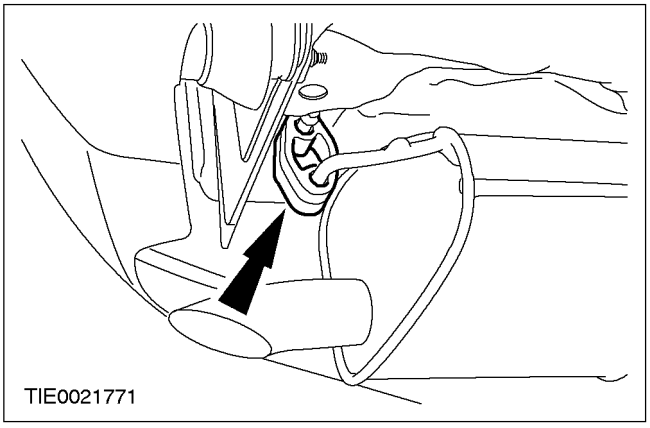
- Attach the rear mufflers to the rear exhaust hanger insulators (left-hand shown, right-hand similar).



Vehicles with 1.8L, 2.0L or diesel engine

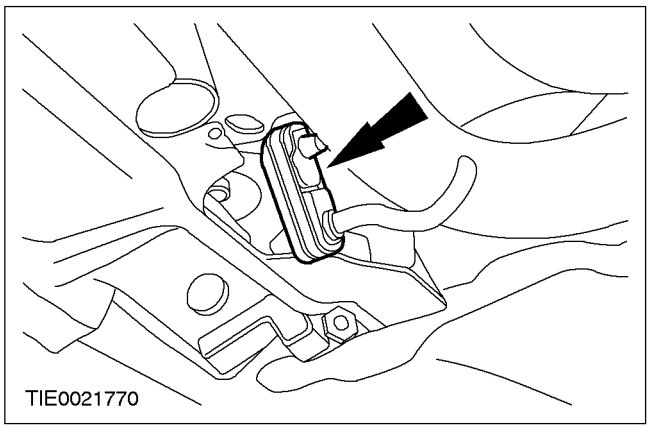
10. Install the front and rear muffler assembly.

- Attach the muffler to the rear exhaust hanger insulator.

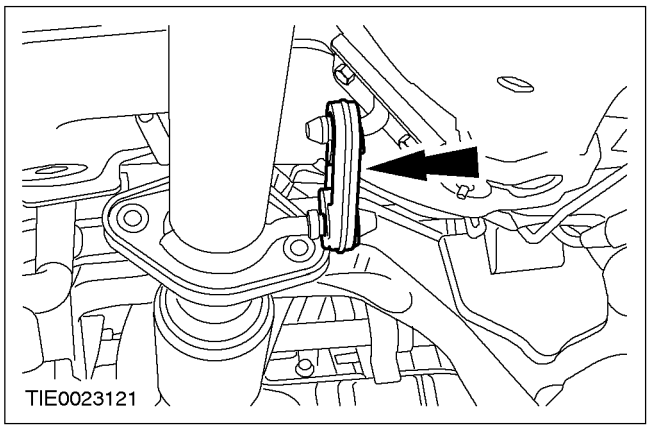


All vehicles

11. Attach the front and rear muffler assembly to the intermediate exhaust hanger insulator.



12. Attach the front and rear muffler assembly to the front exhaust hanger insulator.

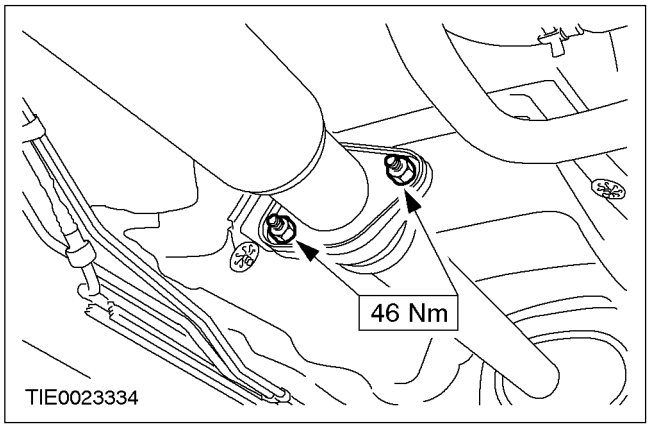


Vehicles with diesel engine

13. NOTE: Coat the front muffler pipe studs with anti-seize grease.

NOTE: Install new sealing ring and nuts.

Attach the exhaust flexible pipe to the front muffler pipe.



REMOVAL AND INSTALLATION (Continued)

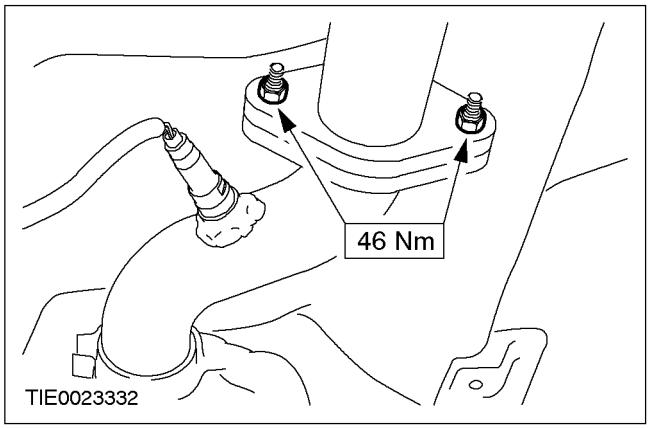
14. **Remove the exhaust wrap or splint.**

Vehicles with 2.5L engine

15. **NOTE:** Coat the catalytic converter studs with anti-seize grease.

NOTE: Install new gasket and nuts.

Attach the catalytic converter to the front muffler pipe.

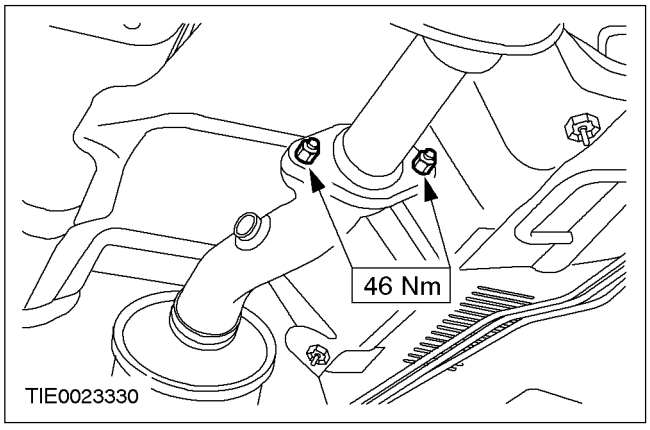


Vehicles with 1.8L or 2.0L engine

16. **NOTE:** Coat the catalytic converter studs with anti-seize grease.

NOTE: Install new gasket and nuts.

Attach the catalytic converter to the front muffler pipe.



All vehicles

17. **Lower the vehicle.**
18. **Adjust the parking brake cable.**

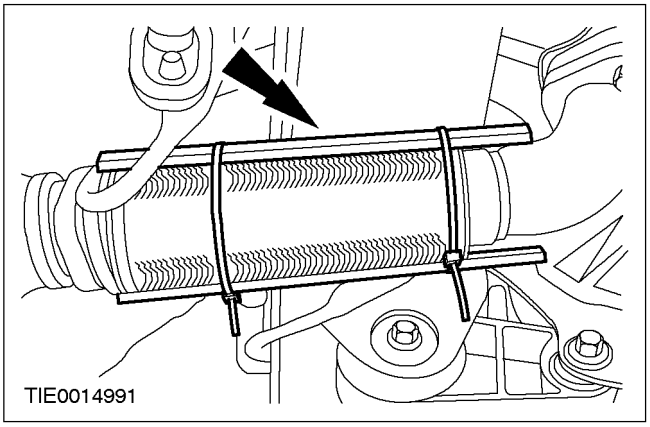
REMOVAL AND INSTALLATION

Parking Brake Cable (12 675 0)

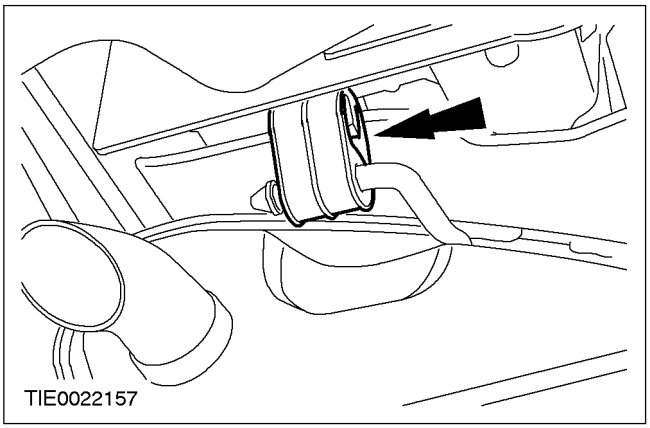
Removal

1. **Release the parking brake.**
2. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
3. **CAUTION: Over bending of the exhaust flexible pipe may cause damage resulting in failure.**

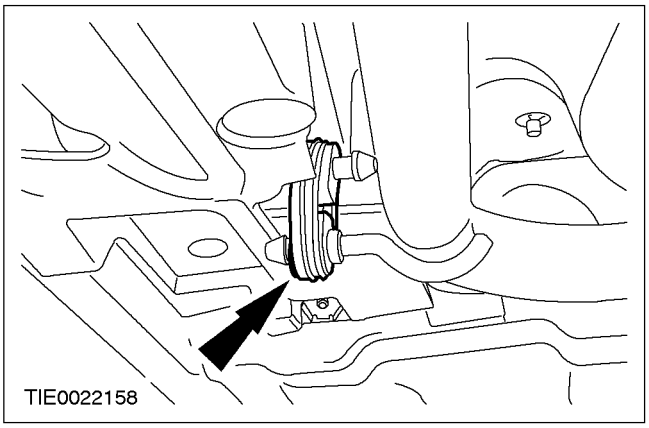
   Support the exhaust flexible pipe with a support wrap or suitable splint.



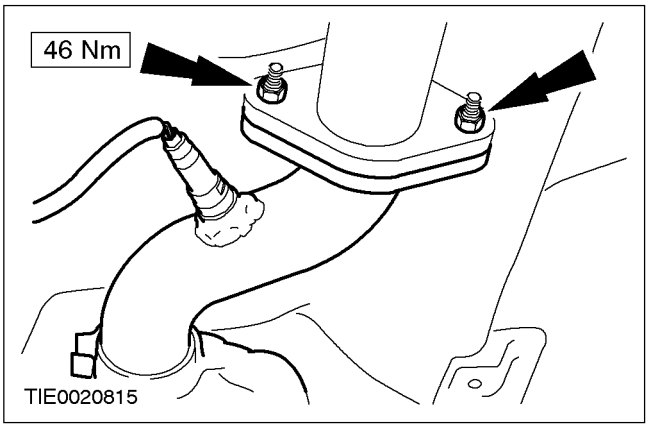
4. **Detach the muffler and tailpipe assembly from the chassis.**



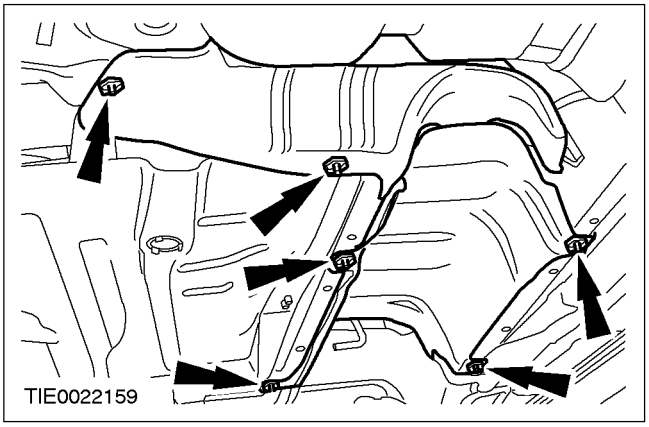
5. **Detach the muffler and tailpipe assembly from the chassis.**



6. **Remove the muffler and tailpipe assembly.**
   - Discard the gasket and nuts.

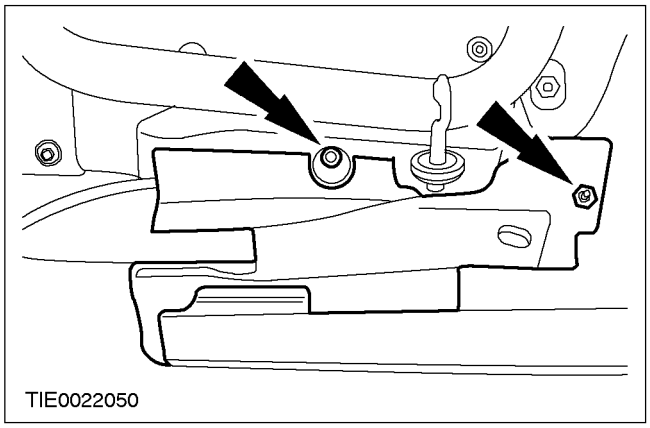


7. **Remove the exhaust heat shield.**



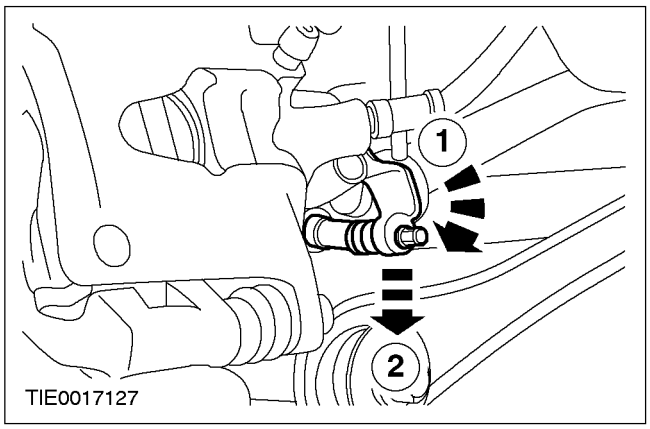
REMOVAL AND INSTALLATION (Continued)

8. Detach the tie bar bracket cover.



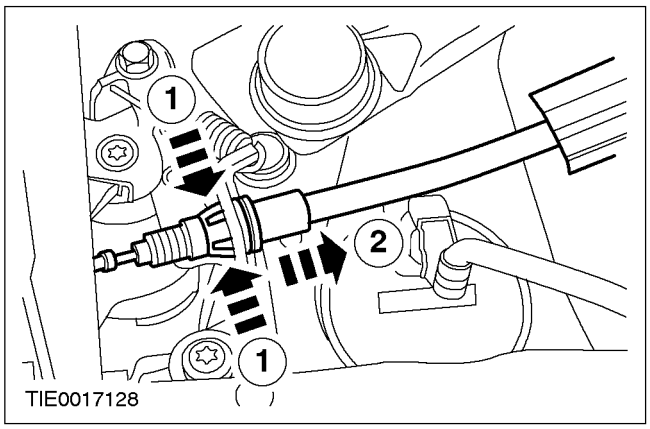
9. Detach the parking brake cable from the brake caliper lever.

1. Push the caliper lever.
2. Detach the parking brake lever.

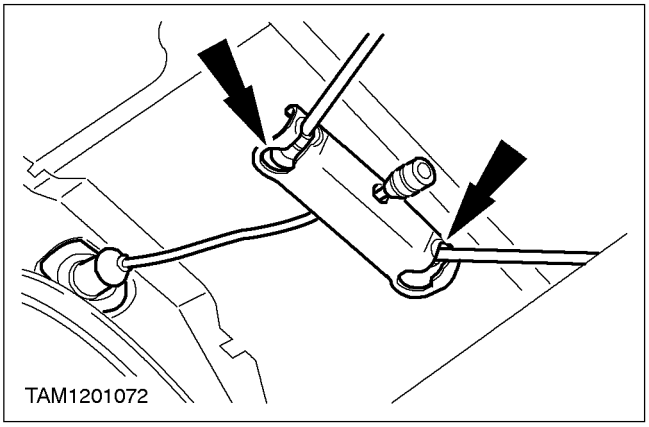


10. Detach the parking brake cable from the brake caliper.

1. Depress the locking tangs.
2. Detach the cable from the brake caliper.

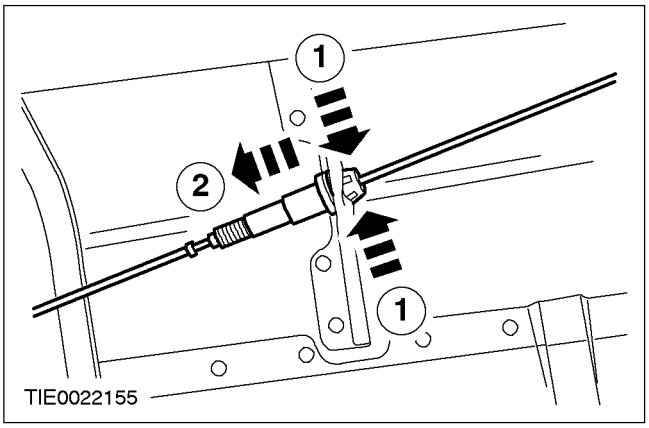


11. Remove the brake cable from the equalizer

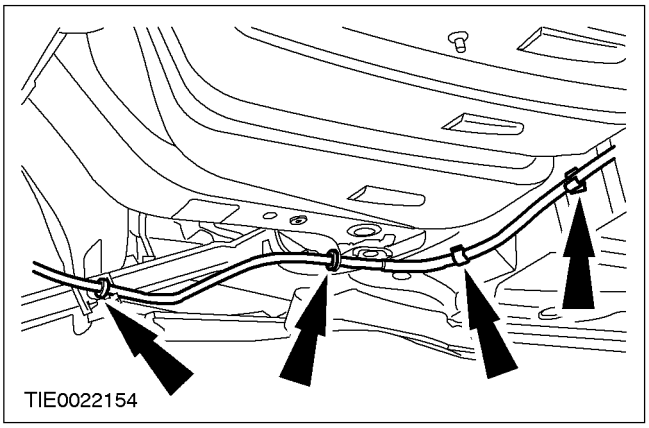


12. Detach the parking brake cable from the chassis.

1. Depress the locking tangs.
2. Detach the cable from the chassis.



13. Remove the parking brake cable.



Installation

1. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION (Continued)

2. To adjust the parking brake cable, operate the parking brake control several times.

SECTION 206-06 Hydraulic Brake Actuation

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

SPECIFICATIONS

Specifications 206-06-2

DESCRIPTION AND OPERATION

Hydraulic Brake Actuation 206-06-3

DIAGNOSIS AND TESTING

Hydraulic Brake Actuation 206-06-5

REMOVAL AND INSTALLATION

Brake Pedal and Bracket 206-06-6
Brake Master Cylinder ..... (12 343 0) 206-06-9
Brake Pedal Cross-Shaft ..... (12 338 0) 206-06-11
Brake Pedal Control Switch 206-06-13

SPECIFICATIONS

Lubricants, Fluids, Sealers and Adhesives

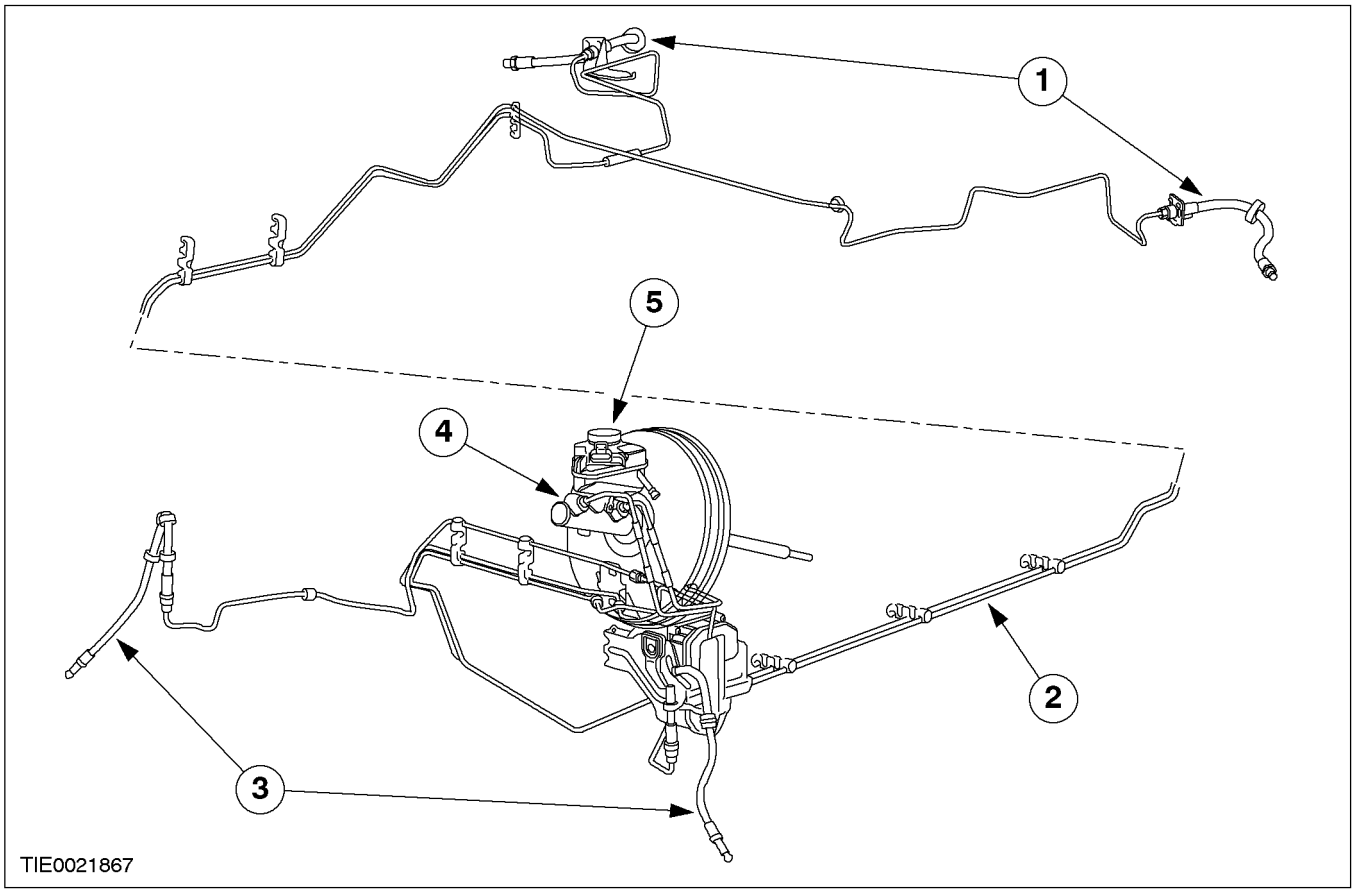
Item	Specification
Super DOT 4 brake fluid	ESD-M6C57-A

Torque Specifications

Description	Nm	lb-ft	lb-in
Brake master cylinder retaining nuts	20	15	–
Brake tube to brake master cylinder union	20	15	–
Brake pedal bracket retaining nuts	25	18	–
Brake booster retaining nuts	20	15	–

DESCRIPTION AND OPERATION

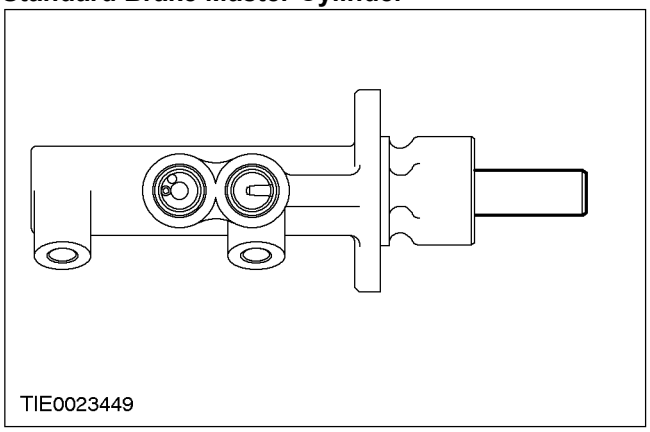
Hydraulic Brake Actuation



Item	Part Number	Description
1		Rear brake hoses
2		Brake hydraulic tubes

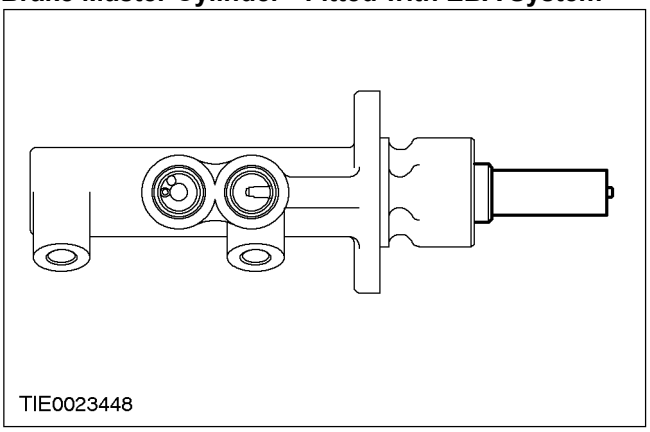
Item	Part Number	Description
3		Front brake hoses
4		Brake master cylinder
5		Brake fluid reservoir

Standard Brake Master Cylinder



DESCRIPTION AND OPERATION (Continued)

Brake Master Cylinder - Fitted with EBA System



DIAGNOSIS AND TESTING

Hydraulic Brake Actuation

REFER to Section 206-00.

REMOVAL AND INSTALLATION

Brake Pedal and Bracket

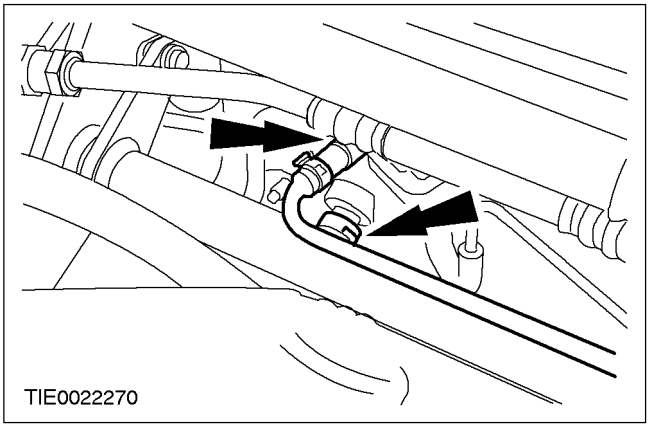
Removal

Vehicles with manual transaxle

1. **CAUTION: If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.**

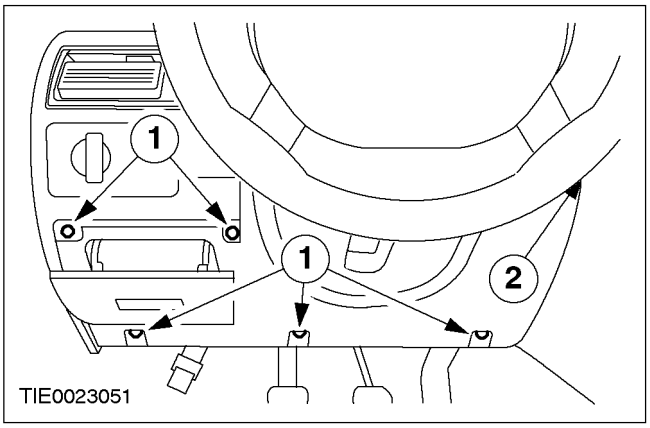
NOTE: Cap the clutch hydraulic pipes to prevent fluid loss or dirt ingress.

Disconnect the clutch hydraulic pipes from the clutch master cylinder.

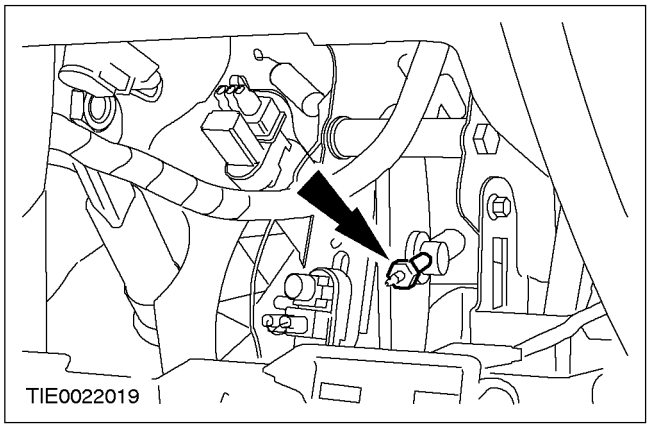


All vehicles

2. **Remove the instrument panel lower panel.**
   1. Remove the retaining screws.
   2. Release the retaining clip.



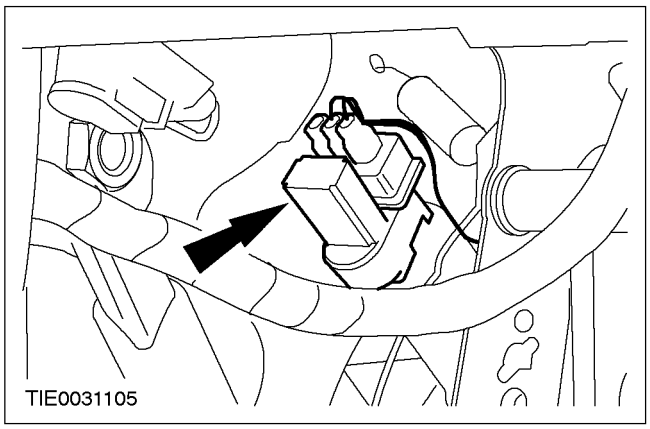
3. **Detach the brake booster actuating rod from the brake pedal.**



4. **Remove the brake pedal position (BPP) switch. For additional information, refer to Brake Pedal Control Switch in this section.**

Vehicles with manual transaxle

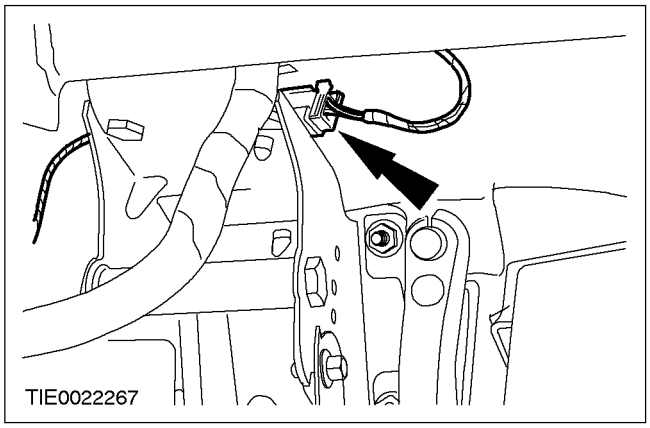
5. **Detach the clutch pedal position switch from the brake pedal bracket.**



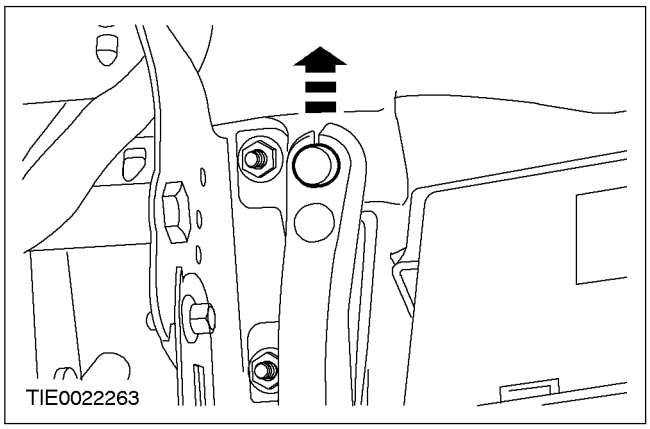
REMOVAL AND INSTALLATION (Continued)

All vehicles

6. Detach the BPP switch electrical harness from the brake pedal bracket.

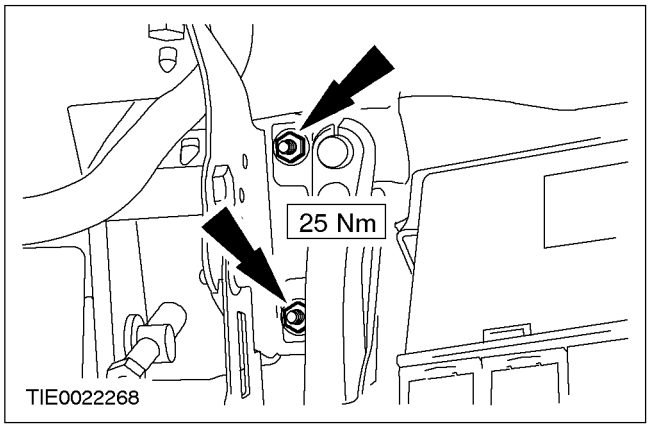


7. Detach the accelerator cable from the accelerator pedal.

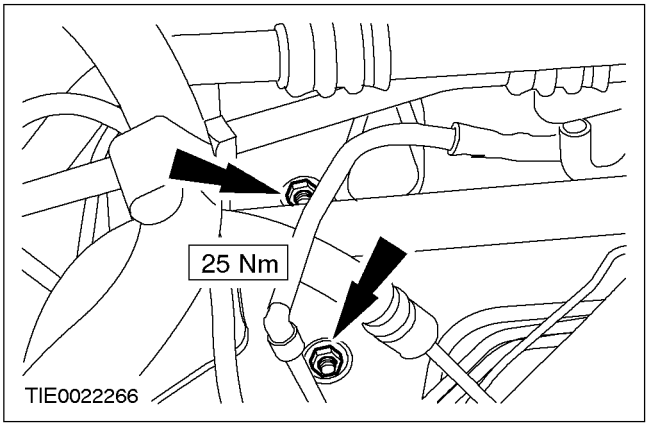


Right-hand drive vehicles

8. Remove the brake pedal bracket retaining nuts from inside the vehicle.

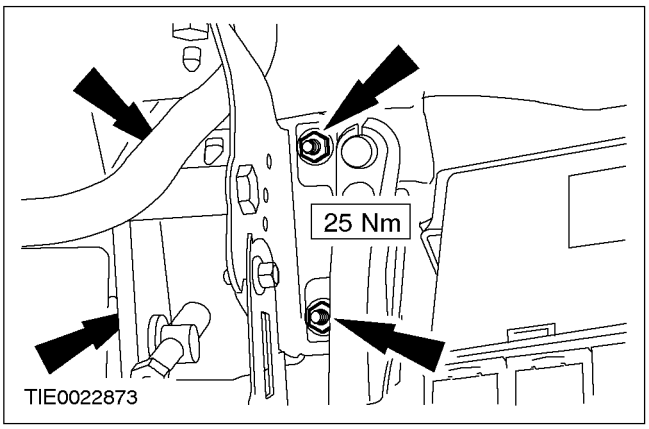


9. Remove the brake pedal bracket retaining nuts from the engine compartment.



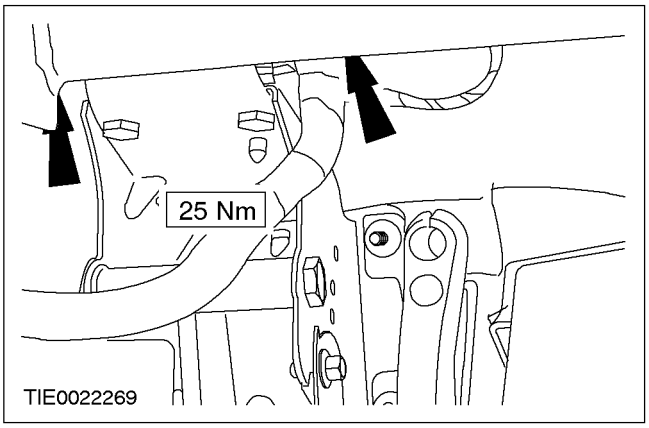
Left-hand drive vehicles

10. Detach the brake pedal bracket from the floor pan.



All vehicles

11. Remove the brake pedal and bracket.



REMOVAL AND INSTALLATION (Continued)

Installation

1. **NOTE:** Install a new BPP switch retaining clip.

   To install, reverse the removal procedure.
2. **Bleed the clutch system.**

REMOVAL AND INSTALLATION

Brake Master Cylinder (12 343 0)

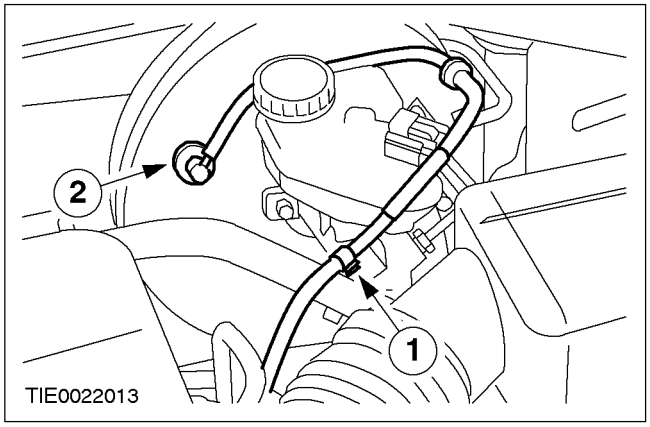
Removal

All vehicles

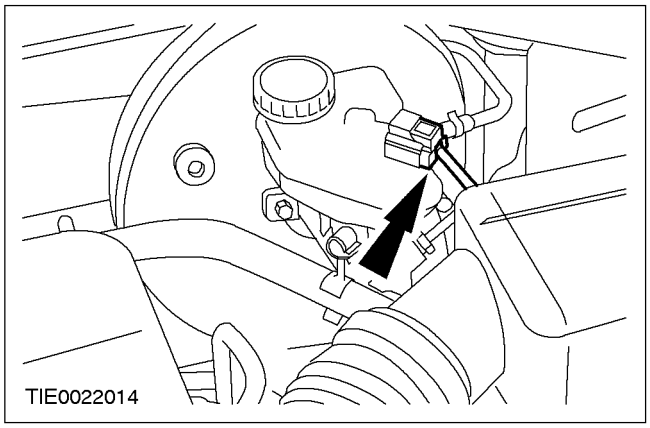
CAUTION: If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

1. Disconnect the brake vacuum pipe from the brake booster.

1. Unclip the brake vacuum pipe.
2. Disconnect the brake vacuum pipe.



2. Disconnect the low brake fluid warning indicator switch electrical connector.



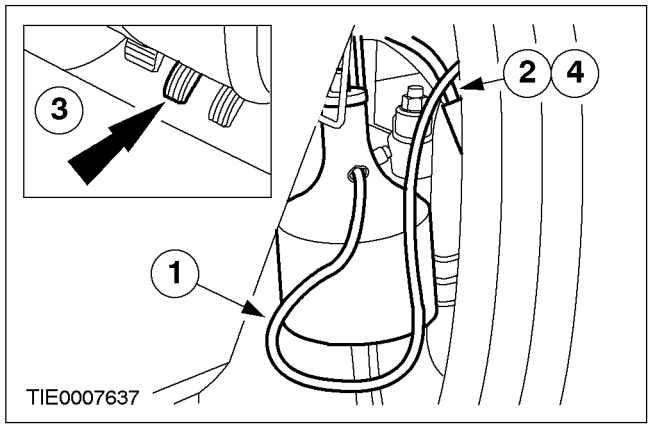
3. CAUTION: The brake fluid reservoir cap must not become contaminated.

Remove the brake fluid reservoir cap.

4. NOTE: It will be necessary to carry out this step on both sides in order to completely drain the brake fluid reservoir.

Drain the brake fluid reservoir.

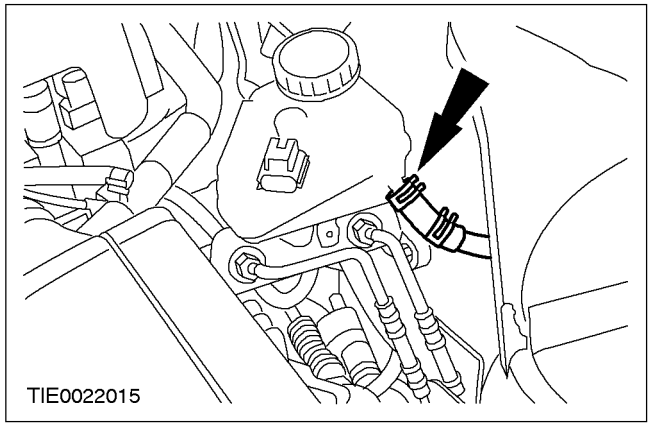
1. Connect one end of a suitable piece of clear plastic pipe to the bleed nipple and place the other end into a suitable container.
2. Loosen the bleed nipple.
3. Depress the brake pedal until all of the brake fluid is drained from the brake fluid reservoir.
4. Tighten the bleed nipple.



Vehicle with manual transaxle

5. CAUTION: Cap the clutch master cylinder hose to prevent fluid loss or dirt ingress.

Disconnect the clutch master cylinder hose from the brake fluid reservoir.

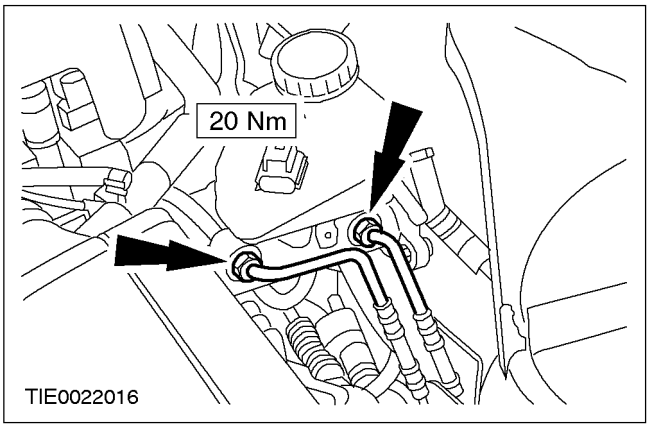


REMOVAL AND INSTALLATION (Continued)

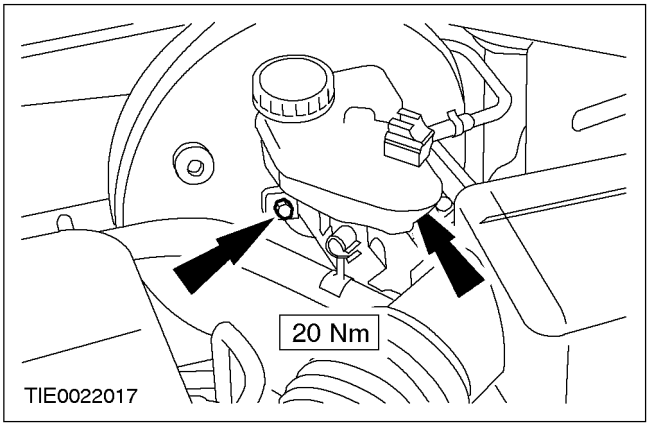
All vehicles

6. **CAUTION: Cap the brake tubes to prevent fliud loss or dirt ingress.**

   Disconnect the brake tubes from the brake master cylinder.



7. **Remove the brake master cylinder and brake fluid reservoir assembly.**



Installation

WARNING: Do not install a standard brake master cylinder to a vehicle equiped with Emergency Brake Assist. Failure to follow this instruction may result in personal injury.

CAUTION: Make sure the brake master cylinder vacuum seal is correctly positioned before installation.

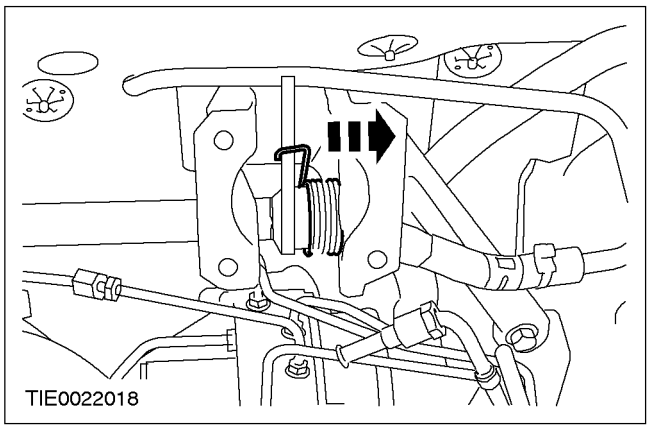
1. **To install, reverse the removal procedure.**
2. **Bleed the brake system. For additional information, refer to Section 206-00.**

REMOVAL AND INSTALLATION

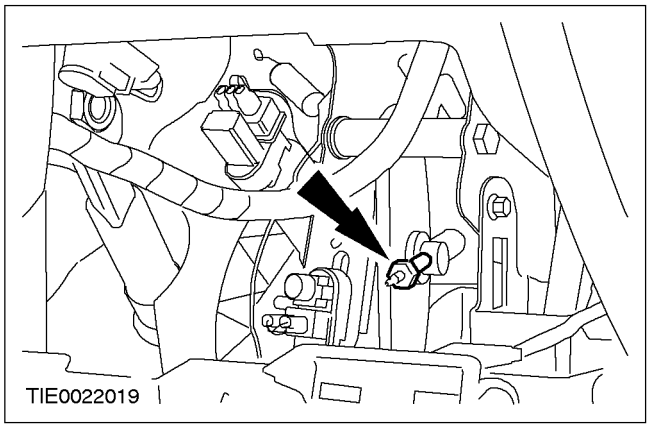
Brake Pedal Cross-Shaft (12 338 0)

Removal

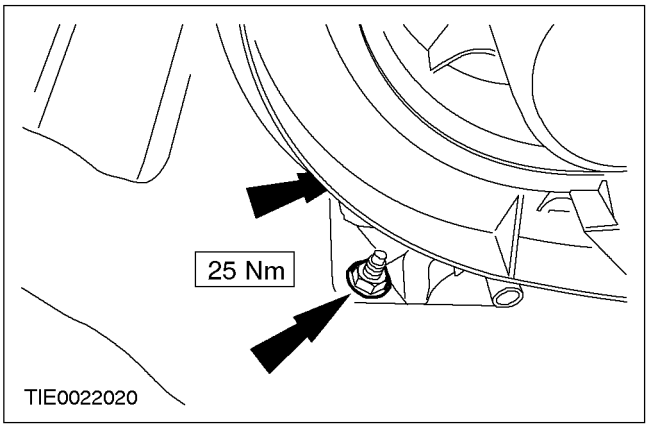
1. **Remove the brake booster. For additional information, refer to Section 206-07.**
2. **De-tension the brake pedal cross shaft return spring.**
   - Unclip the spring.



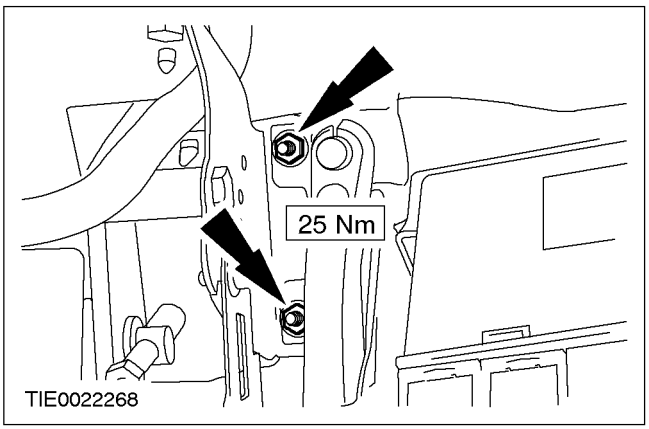
3. **Remove the brake booster actuator rod retaining nut.**



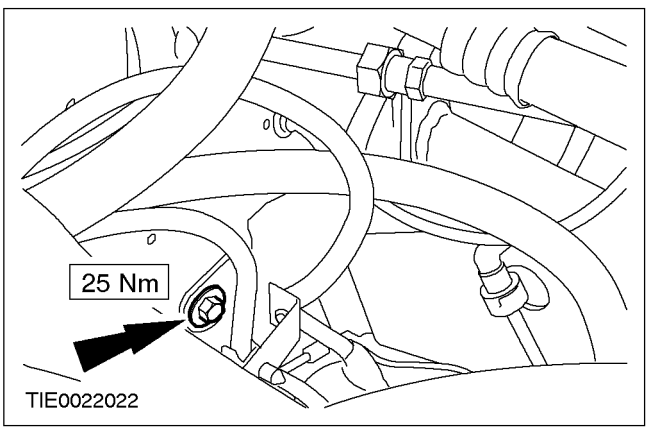
4. **Loosen the brake booster bracket retaining nuts.**



5. **Remove the brake pedal bracket retaining nuts.**

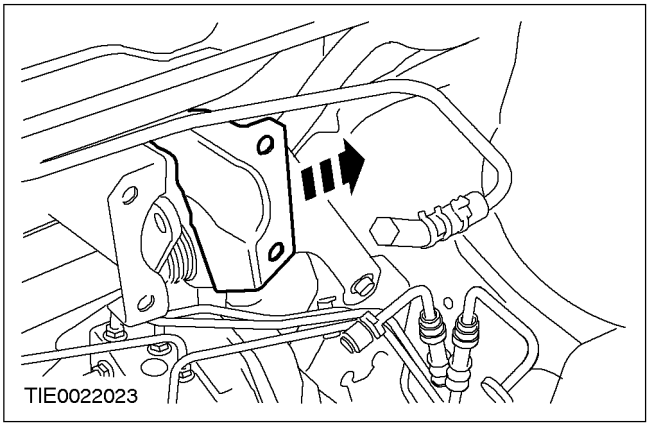


6. **Remove the brake pedal cross shaft bracket retaining nut.**



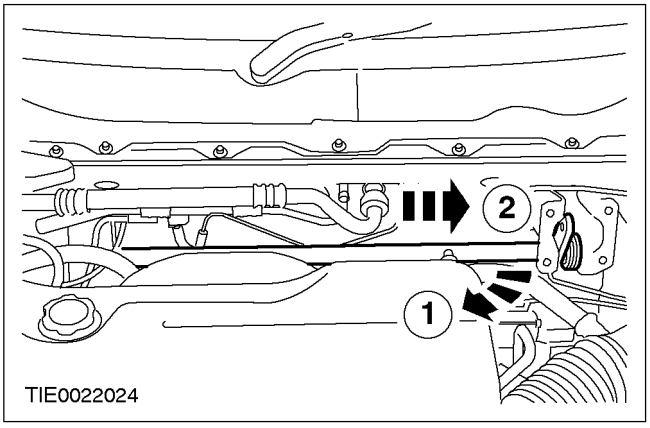
REMOVAL AND INSTALLATION (Continued)

7. Position the brake booster bracket to one side.



8. Remove the brake pedal cross shaft.

1. Move the cross shaft to the right.
2. Pull the cross shaft forward



Installation

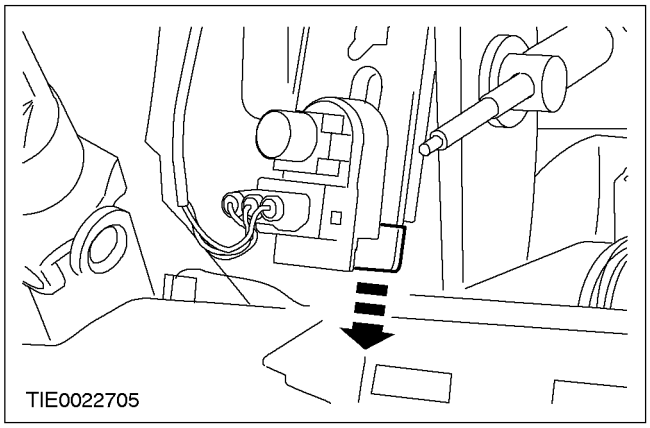
1. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

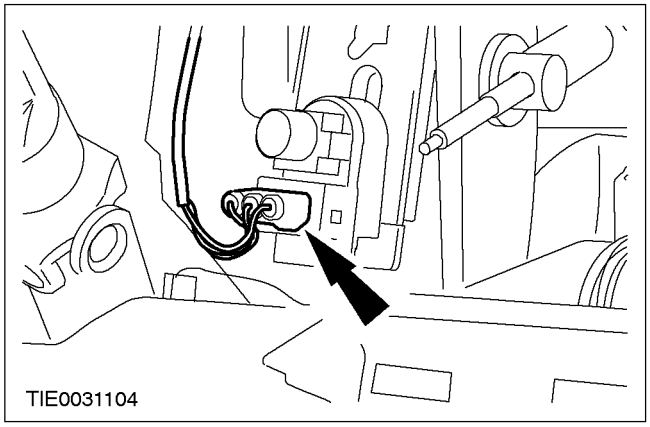
Brake Pedal Control Switch

Removal

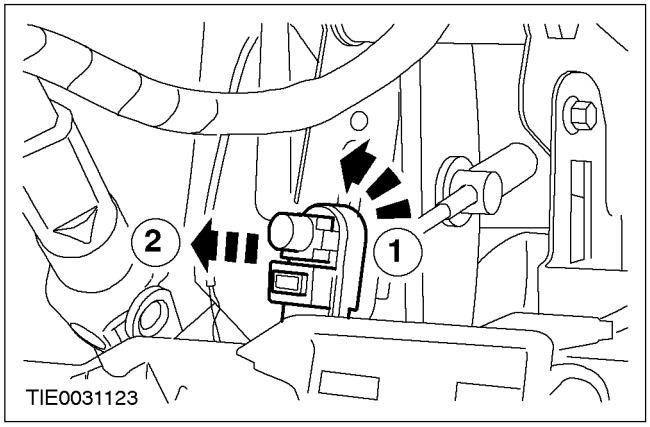
1. **Remove and discard the brake pedal position (BPP) switch retaining clip.**



2. **Disconnect the BPP switch electrical connector.**



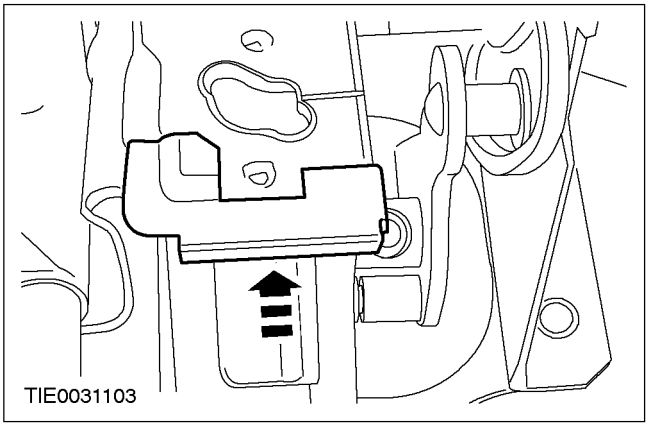
3. **Remove the BPP switch.**
   1. Unlock the switch.
   2. Remove the switch.



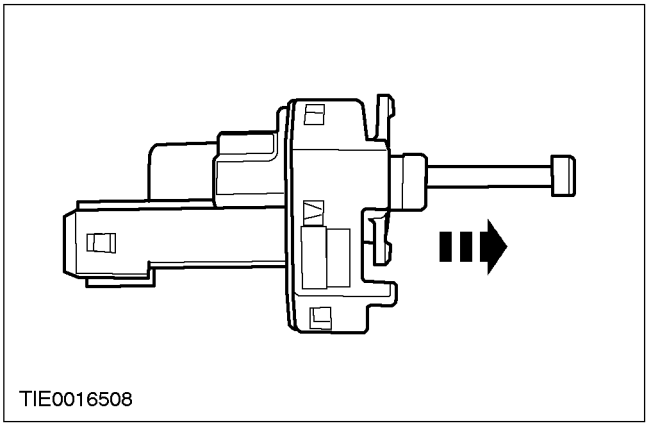
Installation

1. **⚠ CAUTION: Make sure the BPP switch retaining clip is correctly positioned before installation.**

   Install a new BPP switch retaining clip.



2. **Set the BPP switch.**
   - Pull the switch plunger out to its full extent.



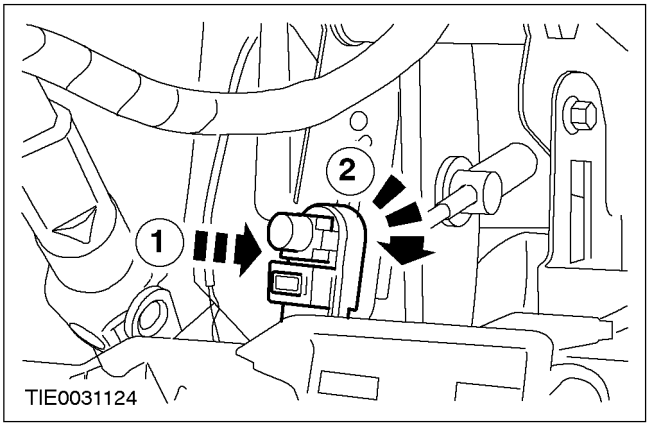
3. **Depress the brake pedal and hold it in the depressed position.**

REMOVAL AND INSTALLATION (Continued)

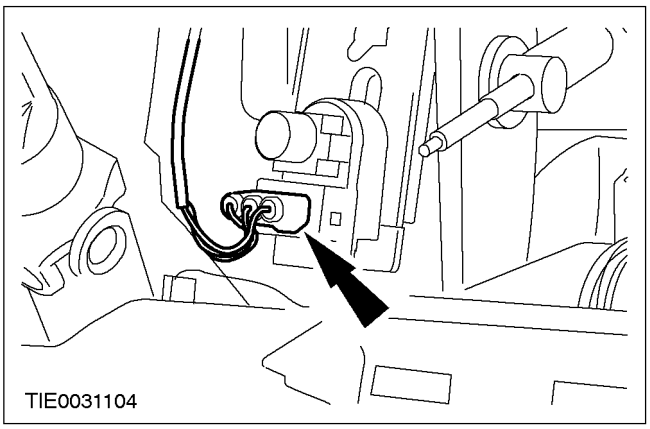
4. **⚠ CAUTION: The BPP switch is automatically adjusted during installation.**

   Install the BPP switch.

   1. Install the switch.
   2. Lock the switch in position.



5. **Release the brake pedal.**
6. **Connect the BPP switch electrical connector.**



SECTION 206-07 Power Brake Actuation

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

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Brake Booster 206-07-3
Right-hand drive shown 206-07-3

DIAGNOSIS AND TESTING

Power Brake System 206-07-4

REMOVAL AND INSTALLATION

Brake Booster ..... (12 451 0) 206-07-5
Brake Vacuum Pump ..... (12 414 0) 206-07-7

SPECIFICATIONS

Torque Specifications

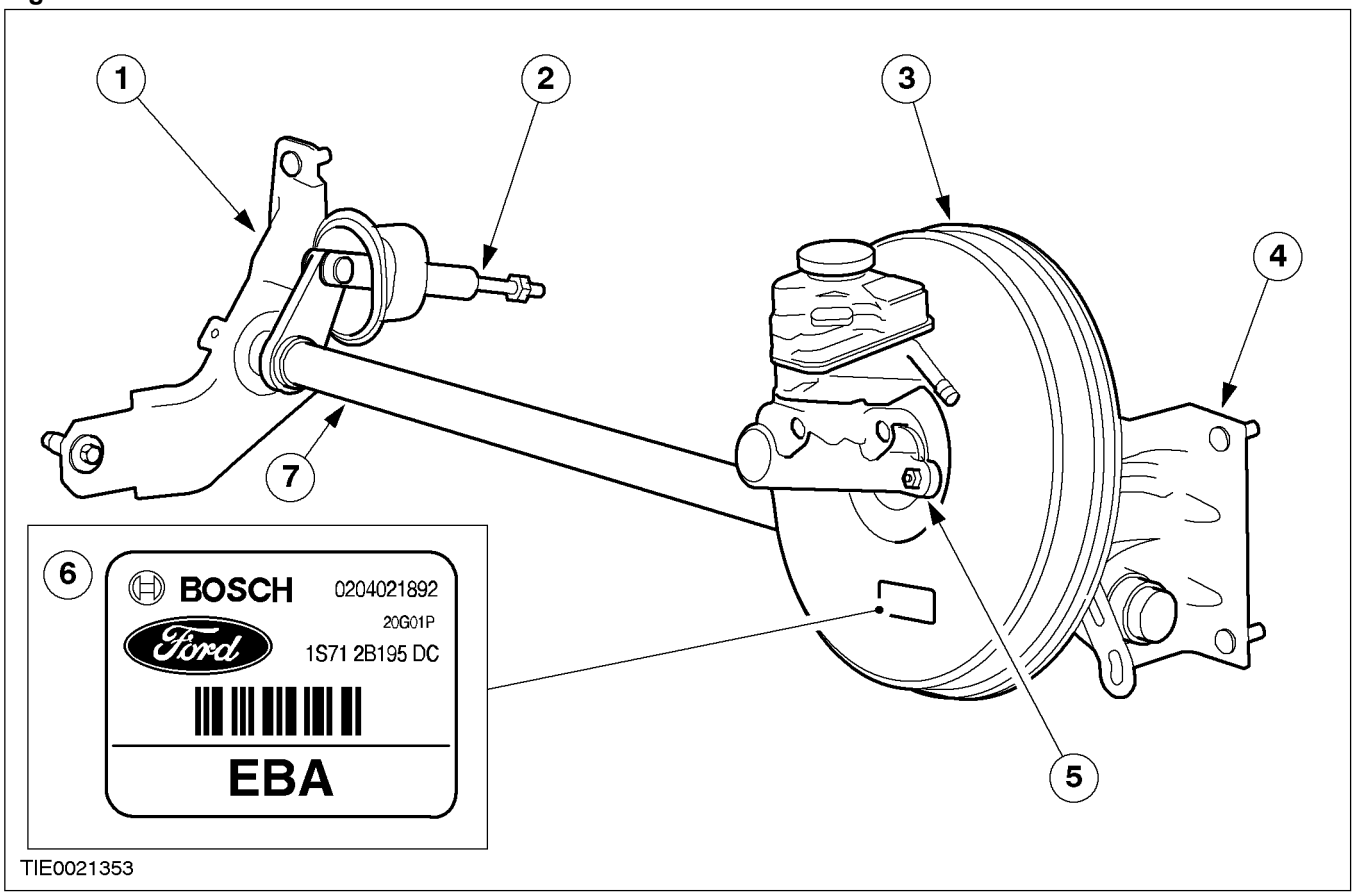
Description	Nm	lb-ft	lb-in
Brake booster retaining nuts	20	15	–
Brake pedal bracket retaining nuts	25	18	–
Cross-shaft bracket retaining nuts	25	18	–

DESCRIPTION AND OPERATION

Brake Booster

WARNING: Do not install a standard brake master cylinder to a vehicle equipped with Emergency Brake Assist. Failure to follow this instruction may result in personal injury.

Right-hand drive shown



Item	Part Number	Description
1		Cross shaft support bracket
2		Brake booster actuation rod
3		Brake booster
4		Brake booster support bracket
5		Brake master cylinder
6		Label (vehicles equipped with emergency brake assist)

Item	Part Number	Description
7		Cross shaft

DIAGNOSIS AND TESTING

Power Brake System

REFER to Section 206-00.

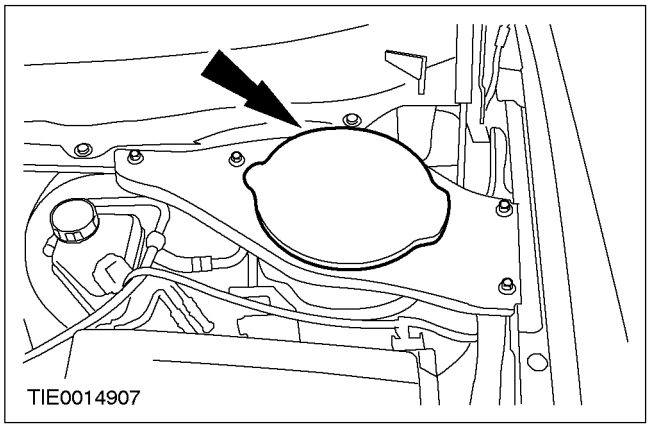
REMOVAL AND INSTALLATION

Brake Booster (12 451 0)

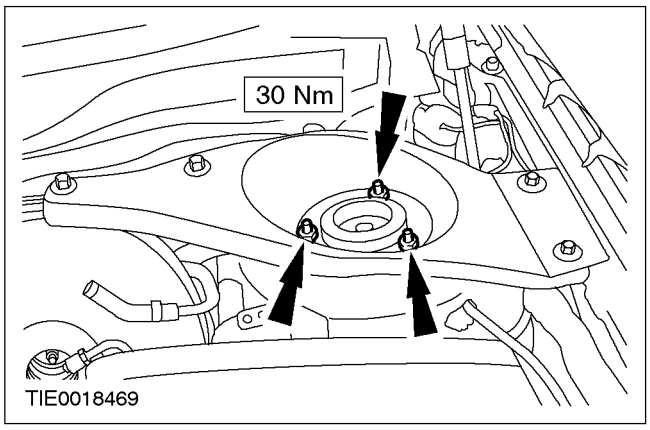
Removal

All vehicles

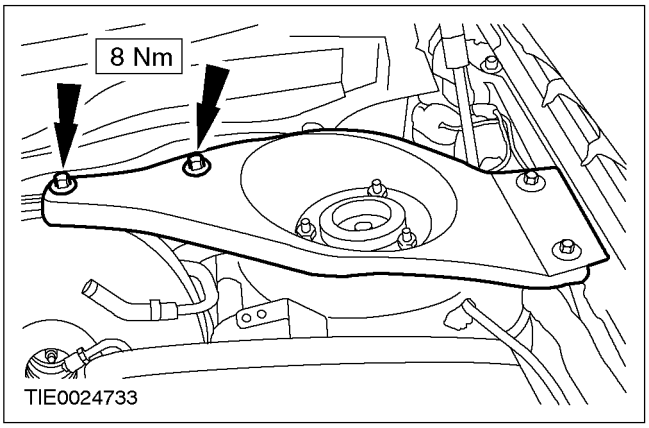
1. **Remove the brake master cylinder. For additional information, refer to Section 206-06.**
2. **Remove the strut and spring assembly top mount brace cover.**



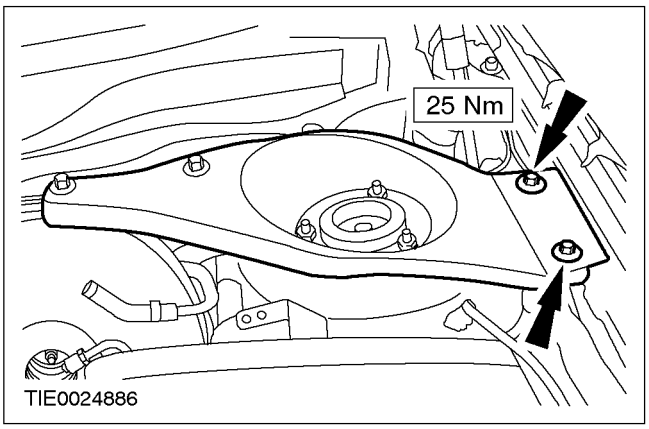
3. **Detach the strut and spring assembly top mount from the strut and spring assembly top mount brace.**



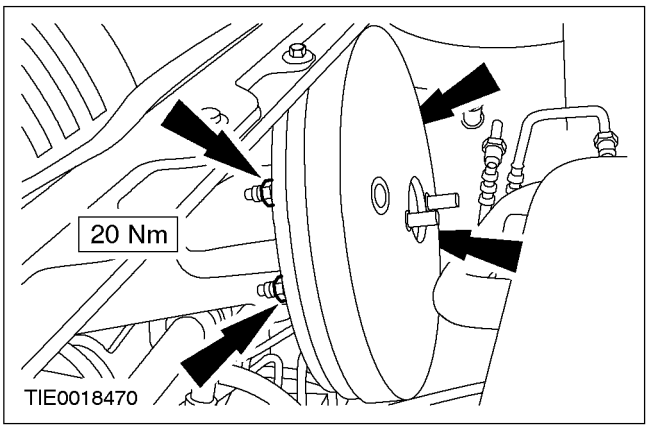
4. **Detach the strut and spring assembly top mount brace from the cowl.**



5. **Remove the strut and spring assembly top mount brace.**



6. **Detach the brake booster from the brake booster bracket.**

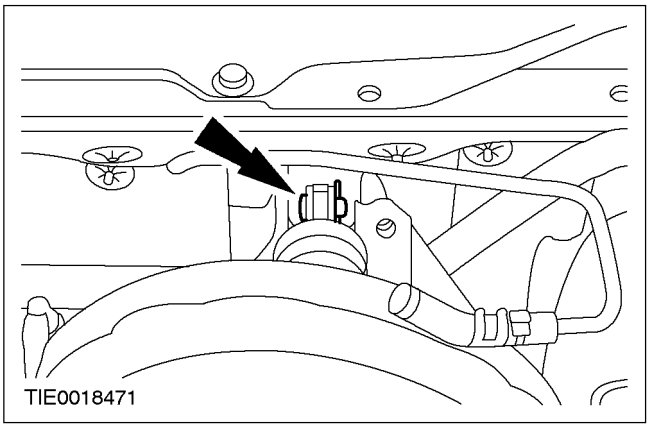


REMOVAL AND INSTALLATION (Continued)

Right-hand drive vehicles

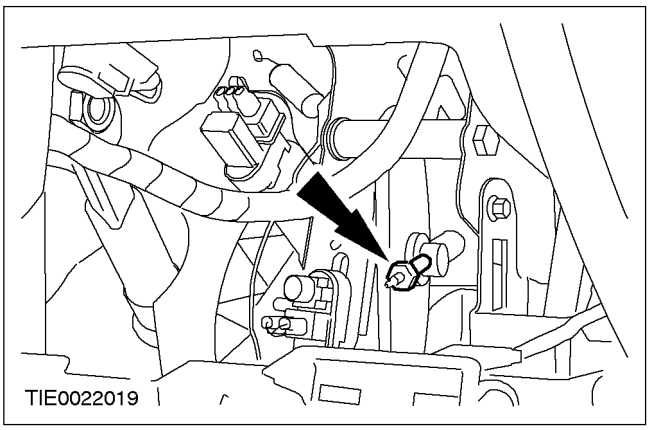
7. Detach the brake booster from the brake pedal cross shaft.

- Remove the pin.

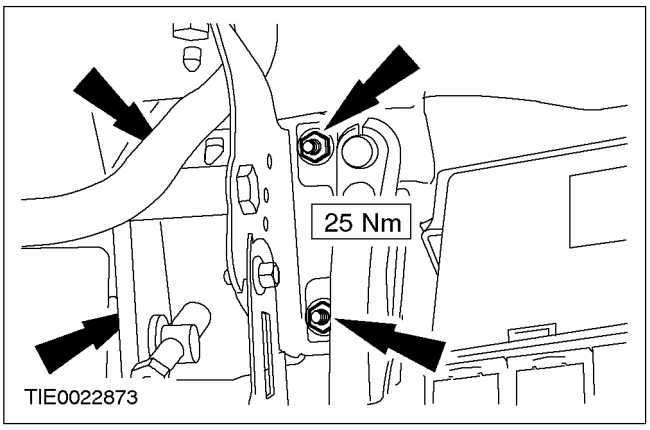


Left-hand drive vehicles

8. Remove the brake booster actuator retaining clip.



9. Remove the brake booster retaining nuts.



All vehicles

10. Remove the brake booster.

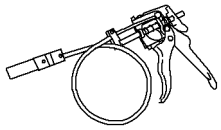
Installation

1. **WARNING: Do not install a normal brake booster to a vehicle fitted with Emergency Brake Assist. Failure to follow this instruction may cause personal injury.**

To install, reverse the removal procedure.

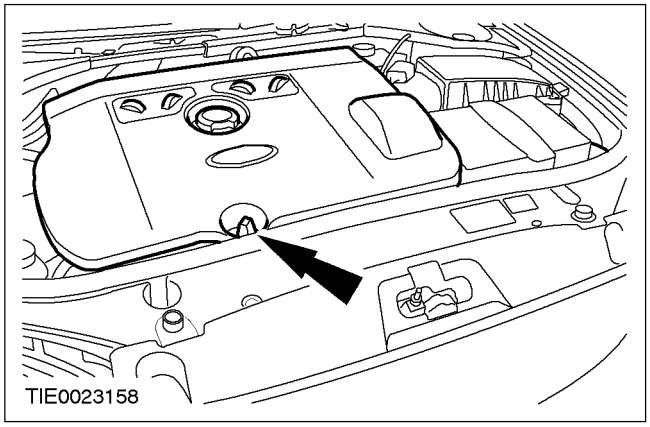
REMOVAL AND INSTALLATION

Brake Vacuum Pump (12 414 0)

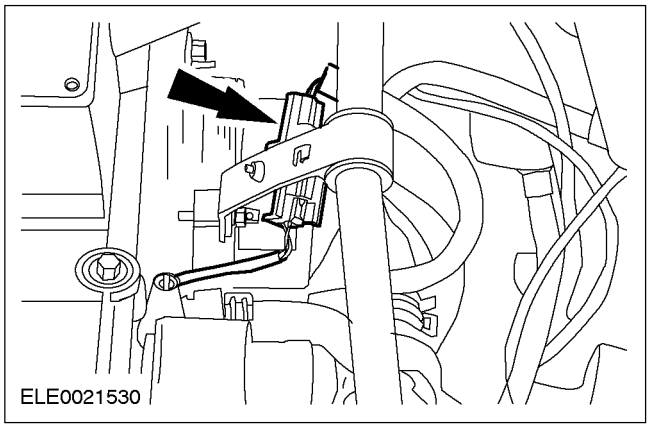
Special Tool(s)	
 24003	Remover/Install, Cooling Hose Clamp 303-097 (24-003)

Removal

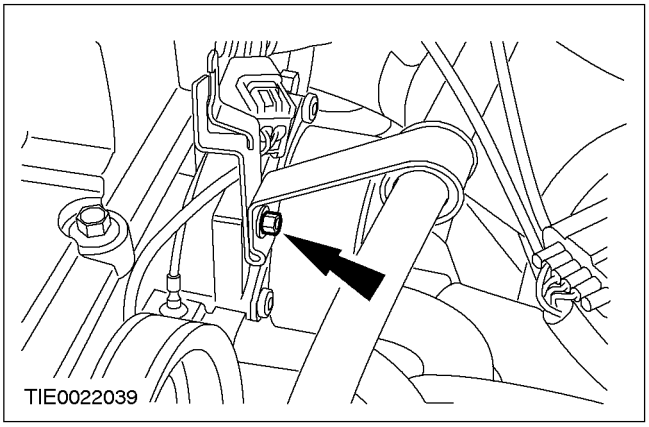
1. **Remove the engine upper cover**


TIE0023158

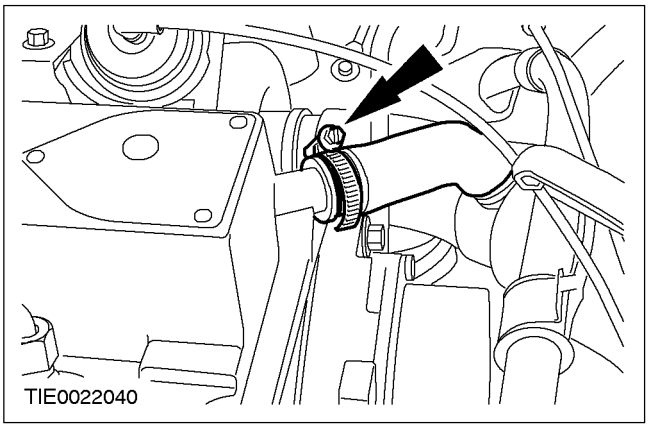
2. **Drain the cooling system. For additional information, refer to Section 303-03.**
3. **Disconnect and unclip the cylinder head temperature (CHT) sensor electrical connector from the power steering line support bracket.**


ELE0021530

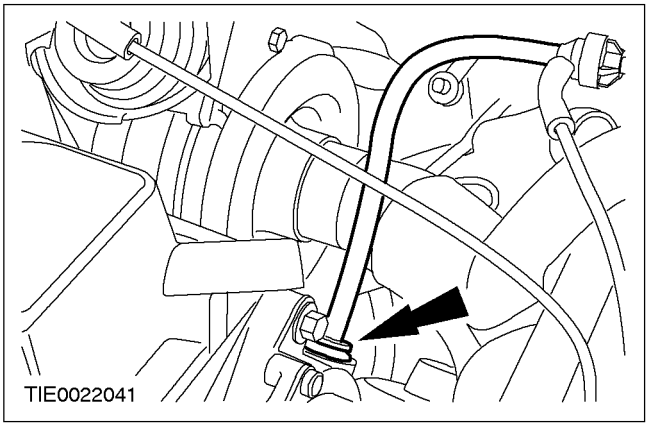
4. **Detach the power steering line support bracket from the brake vacuum pump.**


TIE0022039

5. **Disconnect the positive crankcase ventilation (PCV) hose from the valve cover.**

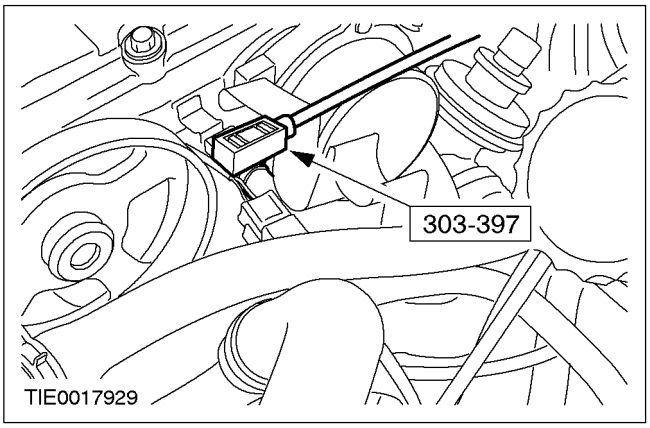

TIE0022040

6. **Disconnect the vacuum hose from the brake vacuum pump.**

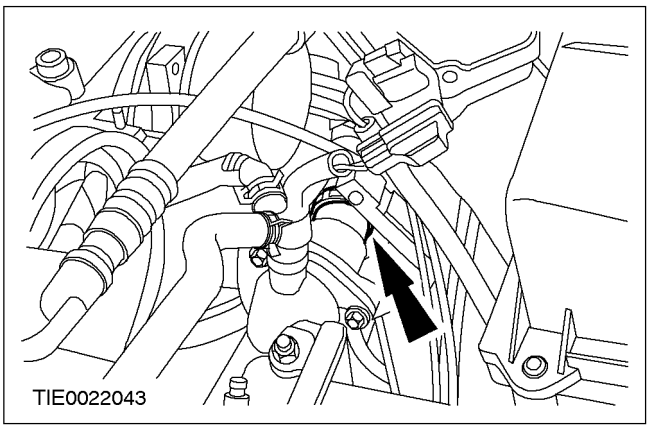

TIE0022041

REMOVAL AND INSTALLATION (Continued)

7. Using the special tool, disconnect the coolant expansion tank hose from the brake vacuum pump.

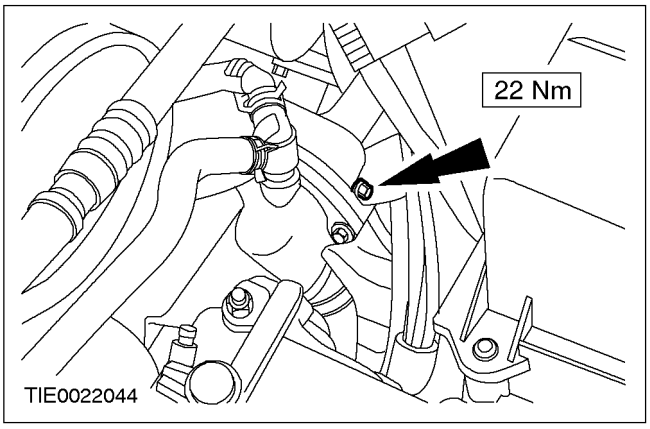


8. Disconnect the exhaust gas recirculation (EGR) cooler coolant hose from the thermostat housing.



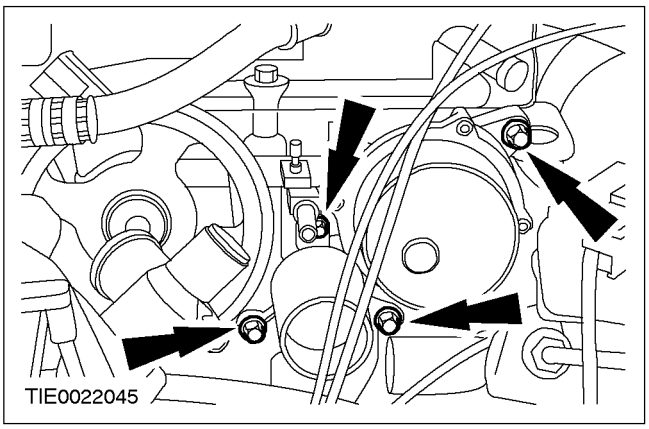
9. Detach the thermostat housing from the brake vacuum pump.

- Discard the O-ring seal.



10. Remove the brake vacuum pump.

- Discard the gasket.



Installation

1. ⚠ CAUTION: Make sure the drive coupling is aligned with the camshaft coupling.

NOTE: Install a new brake vacuum pump gasket.

NOTE: Install a new thermostat housing O-ring seal.

To install, reverse the removal procedure.

SECTION 206-09A Anti-Lock Control

VEHICLE APPLICATION: 2003.0 Mondeo

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Anti-Lock Control 206-09-4
Inspection and Verification 206-09-4

REMOVAL AND INSTALLATION

Hydraulic Control Unit (HCU) 206-09-5

SPECIFICATIONS

Lubricants, Fluids, Sealers and Adhesives

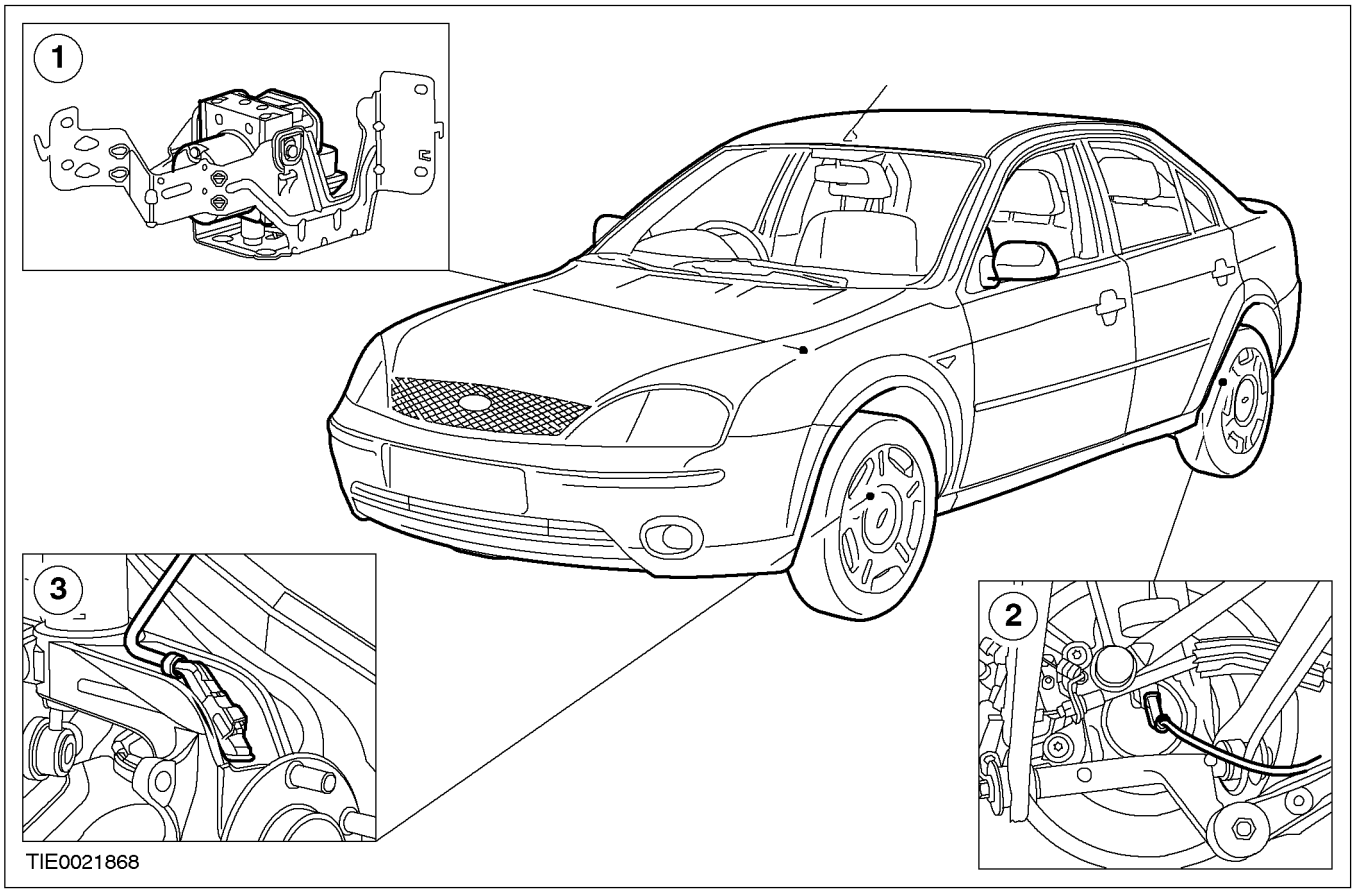
Item	Specification
Super DOT 4 brake fluid	ESD-M6C57-A

Torque Specifications

Description	Nm	lb-ft	lb-in
Hydraulic control unit (HCU) support bracket retaining nuts	25	18	-
Brake tube to HCU union	15	11	-
Brake tube in-line unions	17	13	-
Front wheel speed sensor retaining bolt	5	4	44

DESCRIPTION AND OPERATION

Anti-Lock Control



Item	Part Number	Description
1		Hydraulic control unit (HCU)
2		Rear wheel speed sensor
3		Front wheel speed sensor

DIAGNOSIS AND TESTING

Anti-Lock Control

Refer to Wiring Diagrams Section 206-09A for schematic and connector information.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Wheel speed sensor(s) • Wheel speed sensor ring(s)	• Fuse(s) • Electrical connector(s) • Wiring harness(s).

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to WDS.

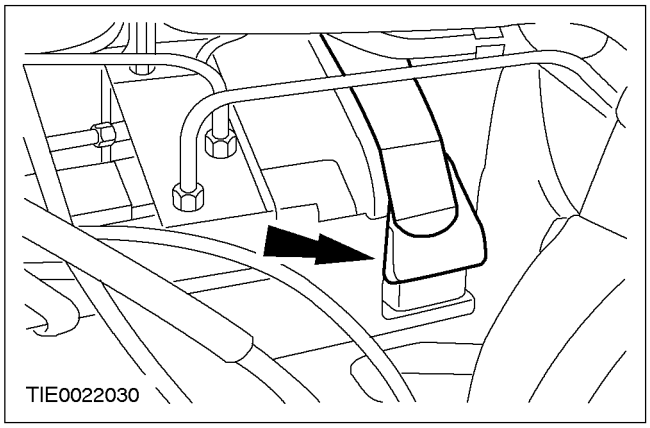
REMOVAL AND INSTALLATION

Hydraulic Control Unit (HCU)

Removal

CAUTION: If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

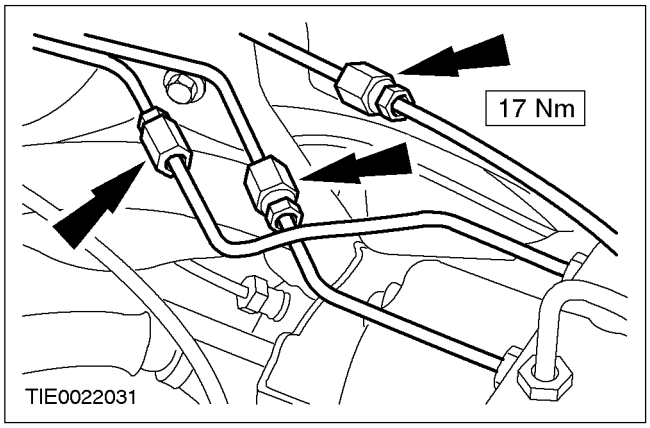
1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Remove the air cleaner.**
3. **Remove the brake booster. For additional information, refer to Section 206-07.**
4. **Disconnect the HCU electrical connector.**



5. **CAUTION: Cap the brake tubes to prevent fluid loss or dirt ingress.**

NOTE: Make a note of the position of the brake tubes to aid installation.

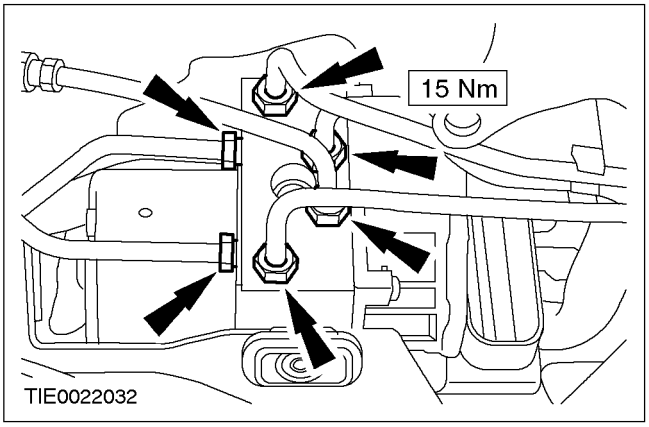
Disconnect the in-line brake tube unions.



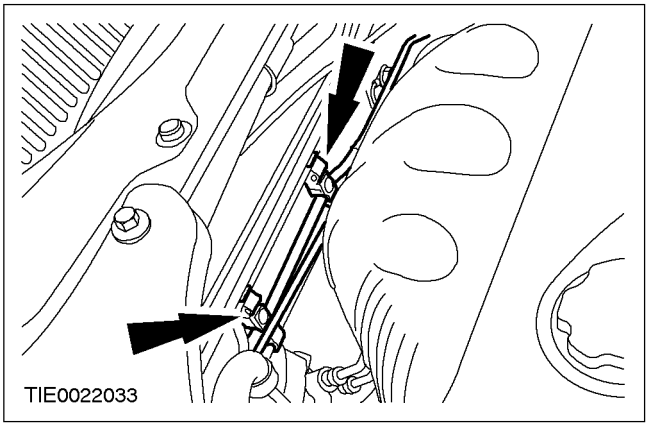
6. **CAUTION: Cap the brake tubes to prevent fluid loss or dirt ingress.**

NOTE: Make a note of the position of the brake tubes to aid installation.

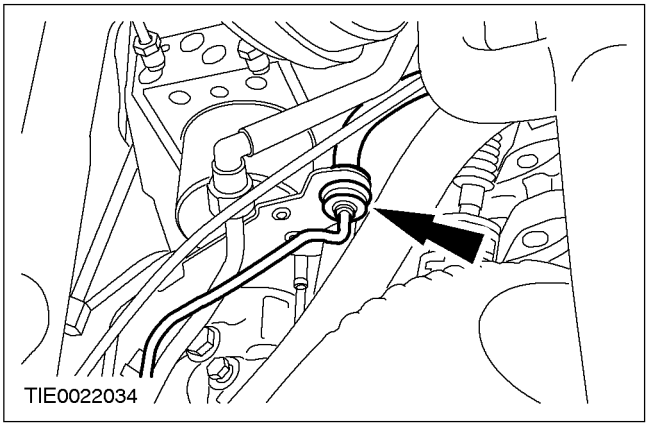
Disconnect the brake tubes from the HCU.



7. **Detach the brake and fuel tubes from the bulkhead.**

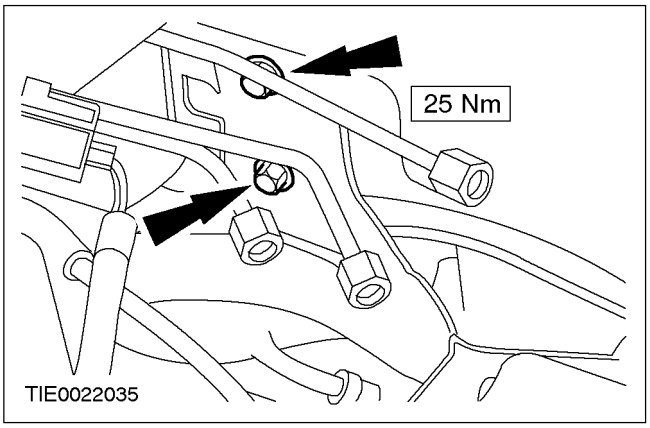


8. **Detach the clutch master cylinder hose from the support bracket.**

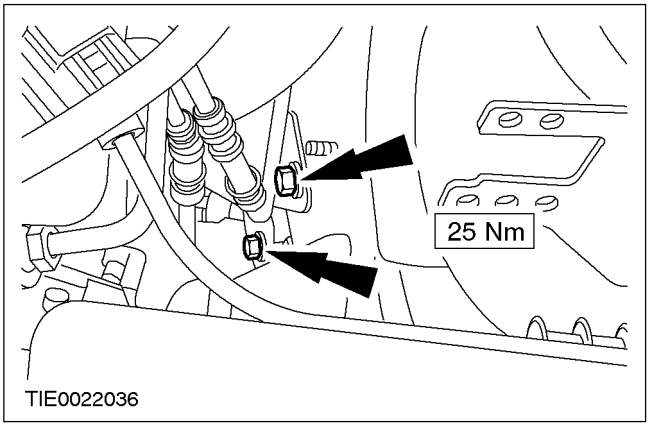


REMOVAL AND INSTALLATION (Continued)

9. Remove the HCU support bracket retaining nuts.



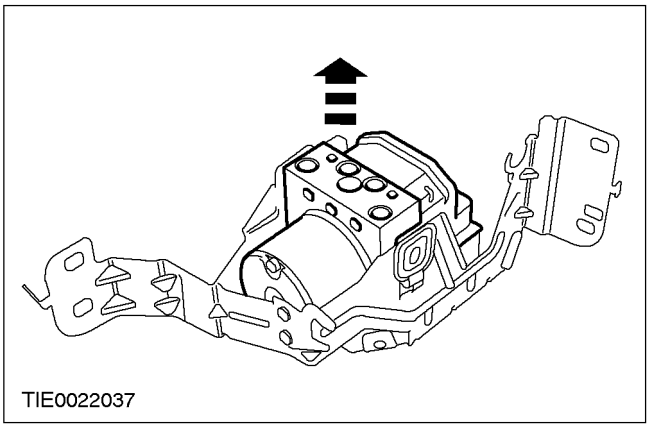
10. Remove the HCU and support bracket assembly.



11. NOTE: Make a note of the position of the insulator pad to aid installation.

Detach the HCU from the support bracket.

- Remove the HCU side clip.



Installation

1. NOTE: Make sure the insulator pad is correctly positioned on the bottom of the HCU before installation.

To install, reverse the removal procedure.

SECTION 206-09B Anti-Lock Control - Stability Assist

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

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DIAGNOSIS AND TESTING

Anti-Lock Control - Stability Assist 206-09-4

REMOVAL AND INSTALLATION

Steering Wheel Rotation Sensor..... 206-09-5
Yaw Rate Sensor..... 206-09-7

SPECIFICATIONS

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Super DOT 4 brake fluid	ESD-M6C57-A

Torque Specifications

Description	Nm	lb-ft	lb-in
Hydraulic control unit (HCU) support bracket retaining nuts	25	18	–
Brake tube to HCU union	20	15	–
Front wheel speed sensor retaining bolt	5	4	44
Yaw rate sensor	6	4	53

DESCRIPTION AND OPERATION

Anti-Lock Control - Stability Assist

The stability assist adds a further function known as Electronic Stability Program (ESP) to the Anti-lock Brakes (ABS) and Traction Control System (TCS). Whereas the ABS/TCS function controls wheel slip during braking and acceleration (longitudinal dynamics), the active yaw control stabilizes the vehicle about its vertical axis.

Sensors measure the position of the steering wheel, the pressure in the brake master cylinder, the yaw velocity (Yaw rate) and the acceleration transverse to the vehicle (Lateral acceleration). This makes it possible to compare the driver's intention with the momentary vehicle behaviour so that in the event of the vehicle becoming unstable the stability assist system can initiate the appropriate corrective action.

The stability assist recognizes critical driving conditions, such as panic reactions in dangerous situations and stabilizes the vehicle by individually braking each wheel and engine control intervention without the need to a actuate the brake or the accelerator pedal.

DIAGNOSIS AND TESTING

Anti-Lock Control - Stability Assist

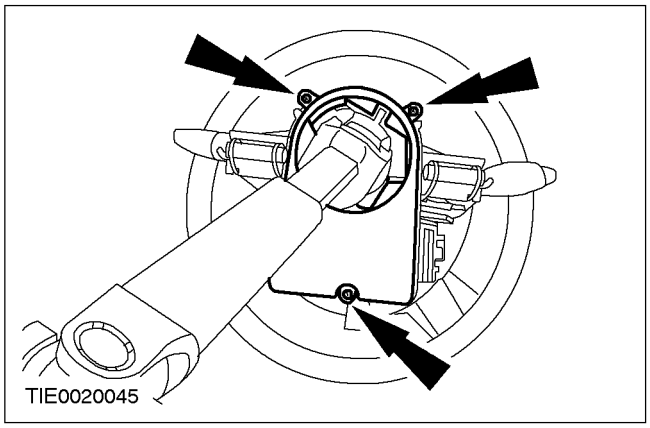
REFER to Section 206-09A / 206-09B.

REMOVAL AND INSTALLATION

Steering Wheel Rotation Sensor

Removal

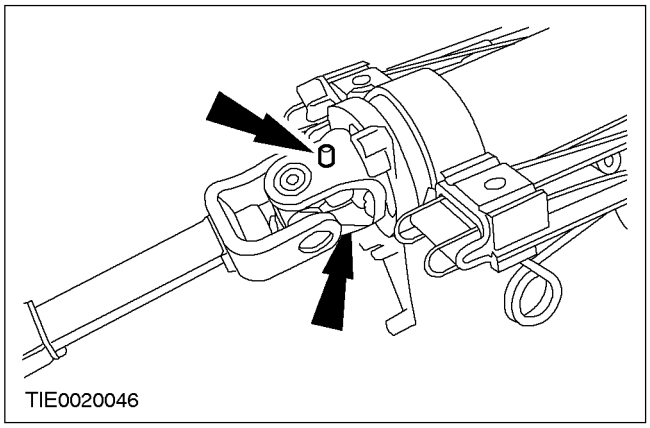
1. **Remove the steering column. For additional information, refer to Section 211-04.**
2. **Remove the steering wheel rotation sensor.**



Installation

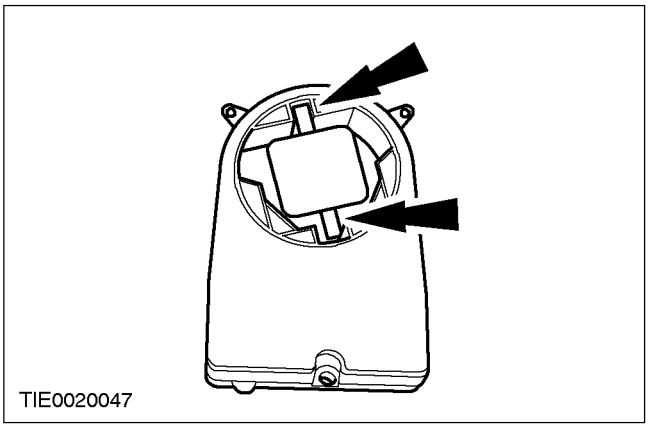
1. **WARNING: Make sure that the steering wheel rotation sensor drive pins are not damaged, loose or worn. Failure to follow this instruction, may result in personal injury.**

   Check the steering wheel rotation sensor drive pins.



2. **WARNING: Make sure the steering wheel rotation sensor drive pins are correctly located in the sensor hub. Failure to follow this instruction, may result in personal injury.**

   Check the steering wheel rotation sensor drive pin to sensor hub for excessive free-play.

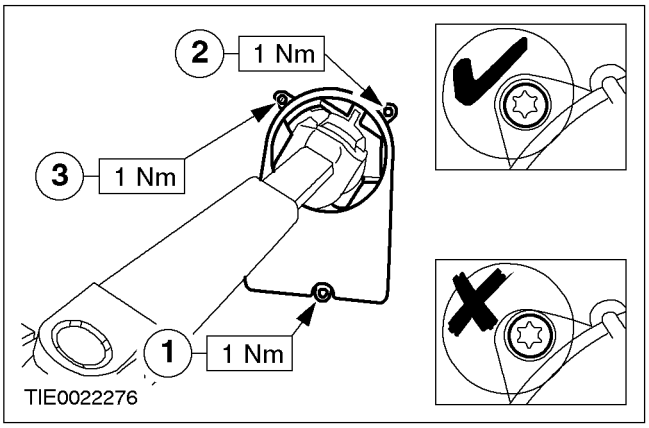


3. **WARNING: Do not use excessive force when installing the steering wheel rotation sensor. Failure to follow this instruction may result in personal injury.**

WARNING: Do not use a damaged steering wheel rotation sensor. Failure to follow this instruction may result in personal injury.

Install the steering wheel rotation sensor.

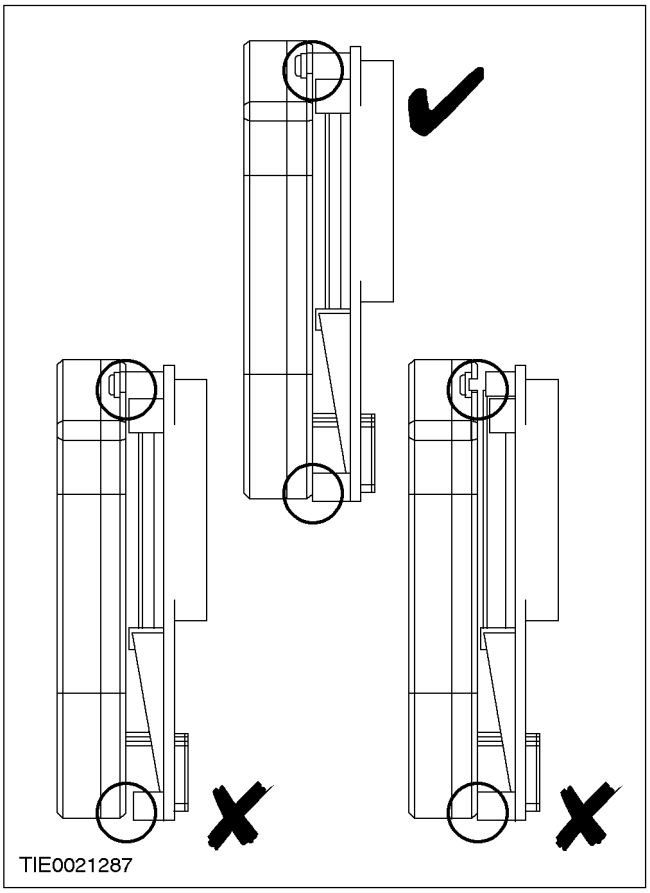
- Tighten the screws in the sequence shown.



REMOVAL AND INSTALLATION (Continued)

4. **WARNING: Make sure that the steering wheel rotation sensor is correctly fitted to the support bracket. Failure to follow this instruction, may result in personal injury.**

   Check the vertical alignment of the steering wheel rotation sensor.



5. **Install the steering column. For additional information, refer to Section 211-04.**

REMOVAL AND INSTALLATION

Yaw Rate Sensor

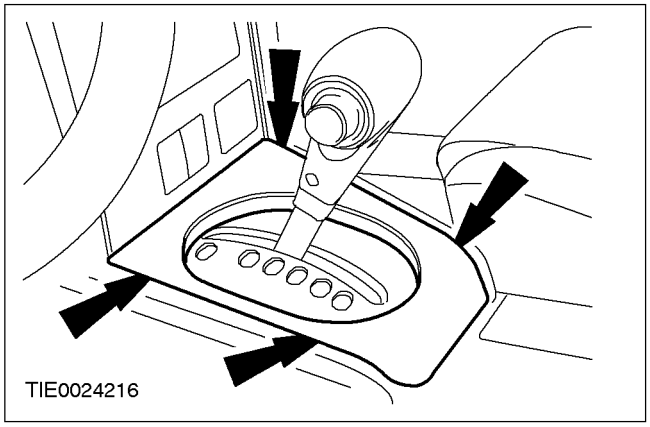
Removal

All vehicles

1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**

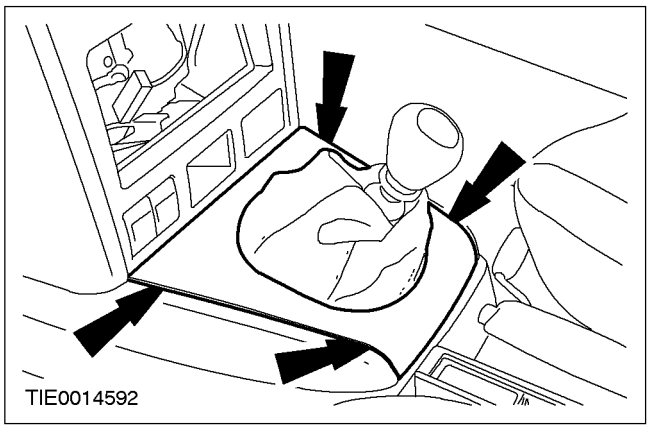
Vehicles with automatic transaxle

2. **Remove the automatic transaxle selector lever trim panel.**

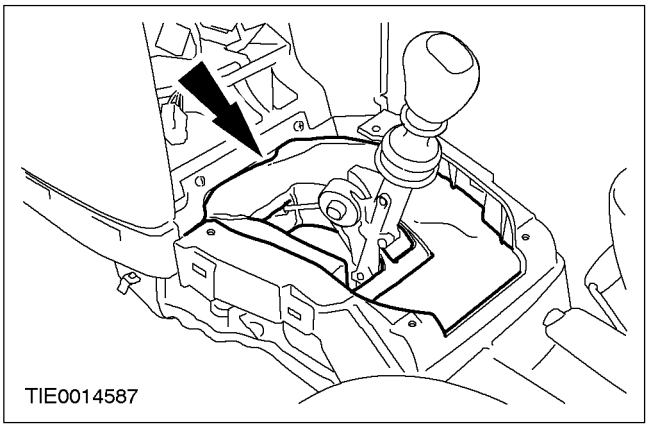


Vehicles with manual transaxle

3. **Remove the gearshift lever boot.**

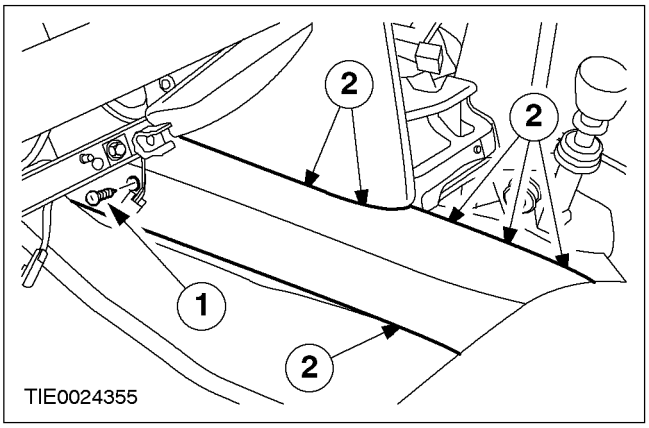


4. **Remove the insulation pad.**

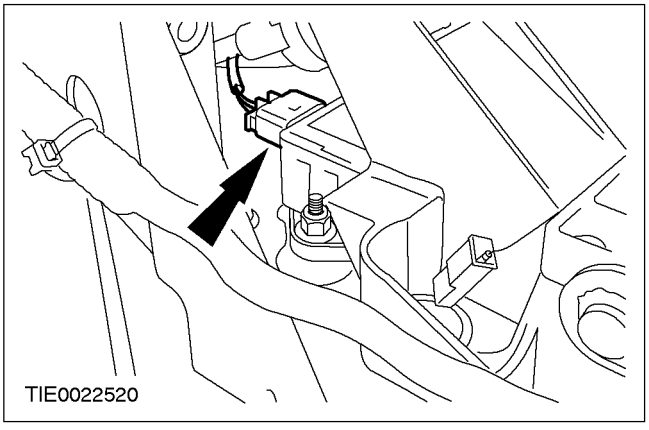


All vehicles

5. **Remove the floor console side trim panels.**
   1. Remove the retaining screw.
   2. Detach the retaining clips.

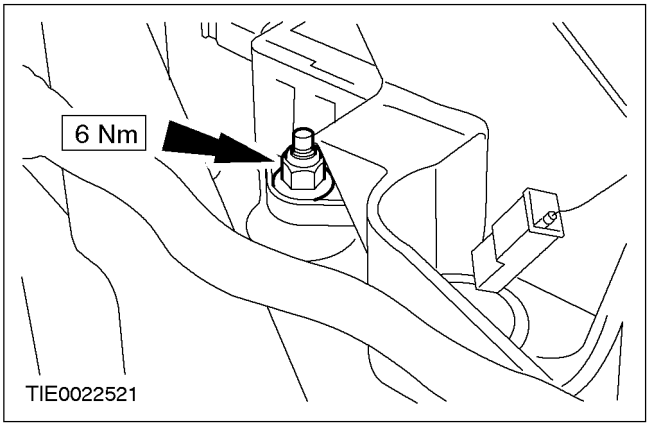


6. **Disconnect the yaw rate sensor electrical connector.**



REMOVAL AND INSTALLATION (Continued)

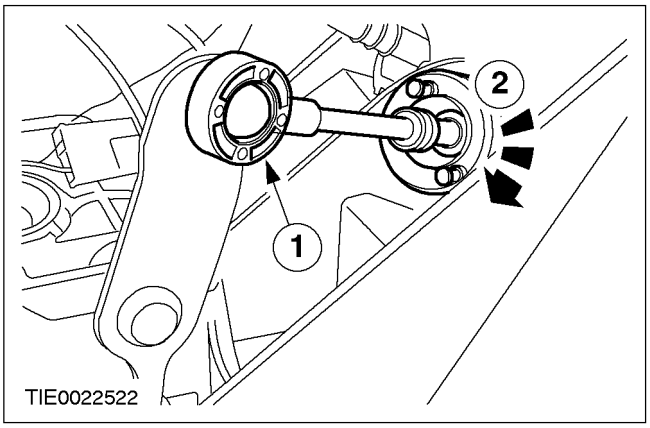
7. Remove the yaw rate sensor left-hand retaining nut.



Vehicles with manual transaxle

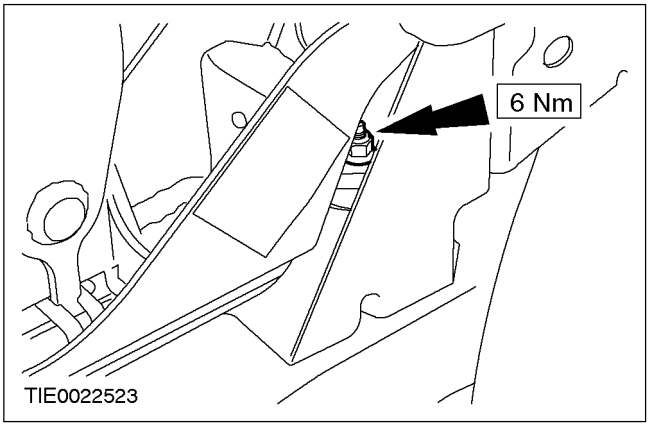
8. Disconnect the gear linkage and position to one side.

1. Detach the gear linkage from the ball joint.
2. Rotate the linkage through 90°.



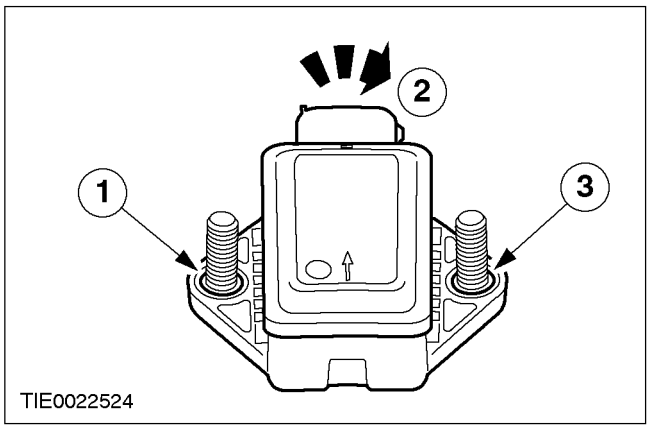
All vehicles

9. Remove the yaw rate sensor right-hand retaining nut.



10. Remove the yaw rate sensor.

1. Raise the yaw rate sensor off the locating stud.
2. Rotate the yaw rate sensor.
3. Remove the yaw rate sensor.



Installation

1. WARNING: Do not use a damaged yaw rate sensor. Failure to follow this instruction may result in personal injury.

WARNING: Install the yaw rate sensor with the direction arrow pointing towards the front of the vehicle. Failure to follow this instruction may result in personal injury.

CAUTION: The yaw rate sensor will be damaged if dropped.

To install, reverse the removal procedure.

SECTION 211-00 Steering System - General Information

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

Specifications 211-00-2

DESCRIPTION AND OPERATION

Steering System 211-00-3

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Inspection and Verification 211-00-8
Symptom Chart 211-00-8
Component Tests 211-00-13

GENERAL PROCEDURES

Power Steering System Flushing — 1.8L/2.0L ..... (13 001 0) 211-00-14
Power Steering System Flushing — 2.5L ..... (13 001 0) 211-00-17
Power Steering System Bleeding ..... (13 416 1) 211-00-20
Power Steering System Filling ..... (13 002 0) 211-00-21

SPECIFICATIONS

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Power Steering Fluid	WSA-M2C195-A
Anti-seize Grease	SAM 1C9107A

Steering Wheel Alignment

	Degrees
Maximum allowable steering wheel mis-alignment	+/-3

Steering Gear

	mm
Steering gear rack travel	73.3

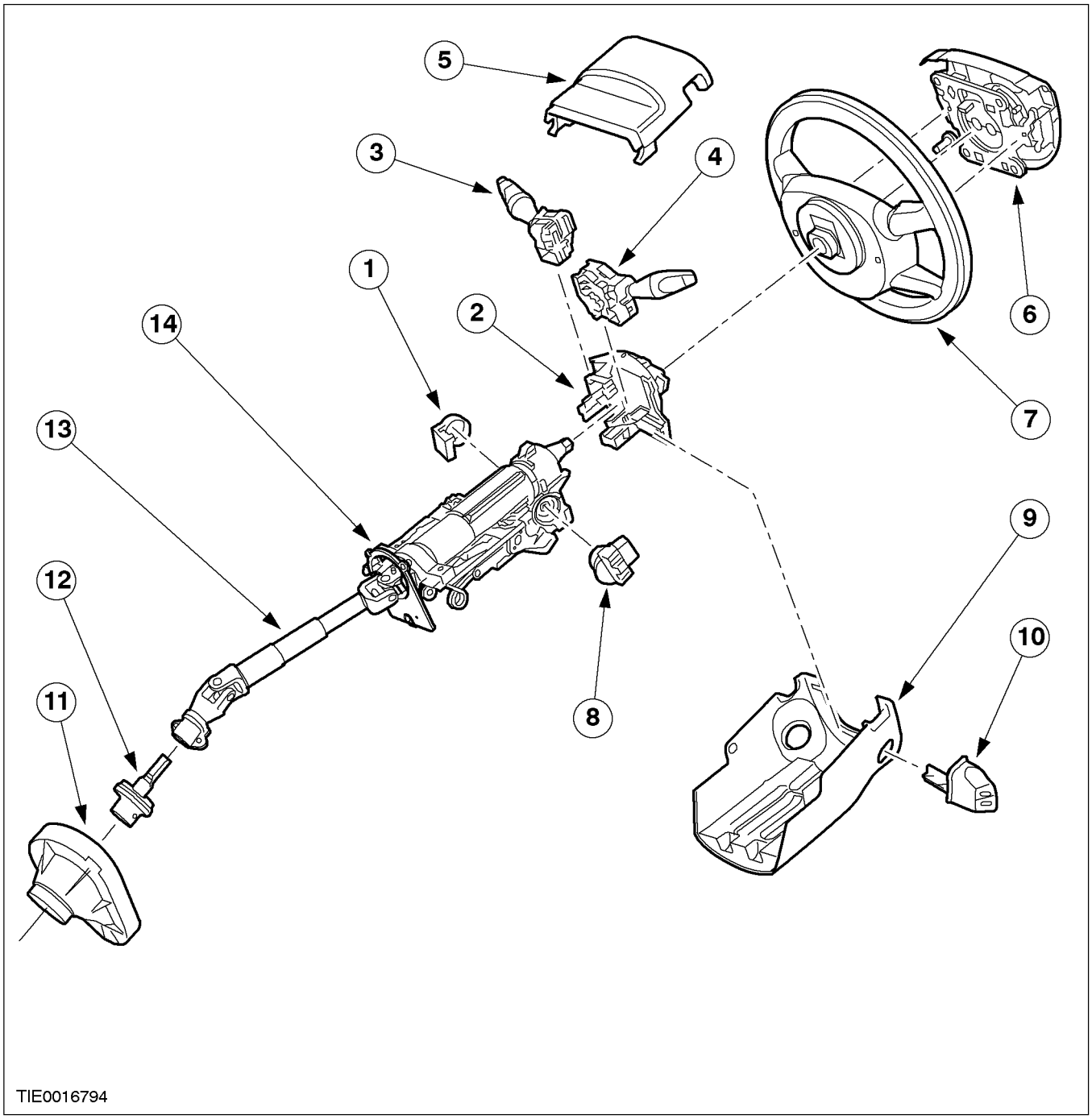
Turning Circle

	Metres
Turning circle	11,1

DESCRIPTION AND OPERATION

Steering System

All vehicles



Item	Part Number	Description
1		Passive anti-theft system (PATS) transceiver
2		Clockspring

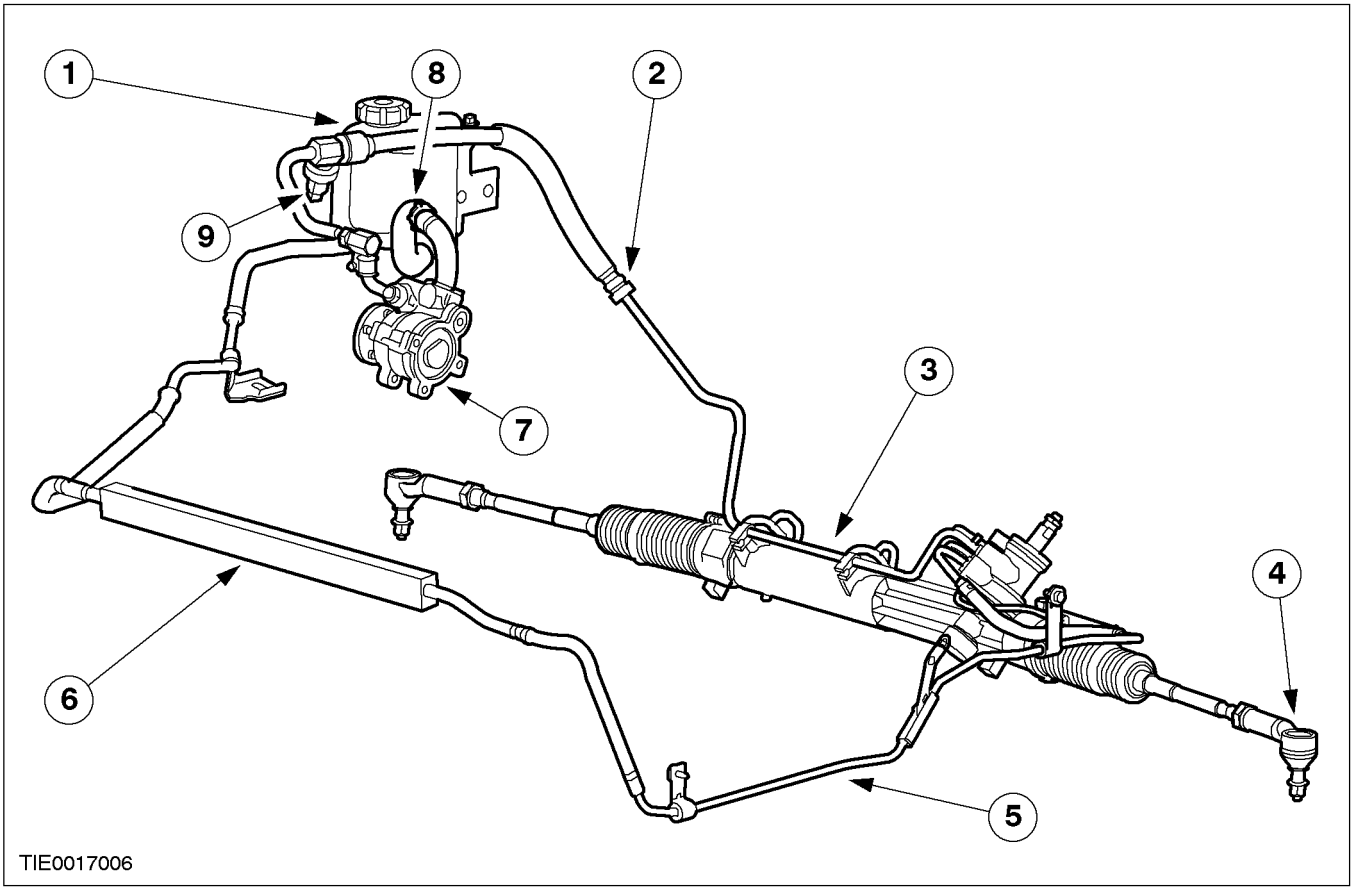
Item	Part Number	Description
3		Windshield wiper switch/washer switch
4		Turn signal lamp switch

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
5		Steering column upper shroud
6		Driver air bag module
7		Steering wheel
8		Ignition switch
9		Steering column lower shroud
10		Audio control switch

Item	Part Number	Description
11		Steering gear to bulkhead seal
12		Steering column flexible coupling
13		Steering column
14		Steering wheel rotation sensor

Vehicles with 2.5L engine



Item	Part Number	Description
1		Power steering fluid reservoir
2		Power steering pump to steering gear pressure line
3		Steering gear
4		Tie-rod end

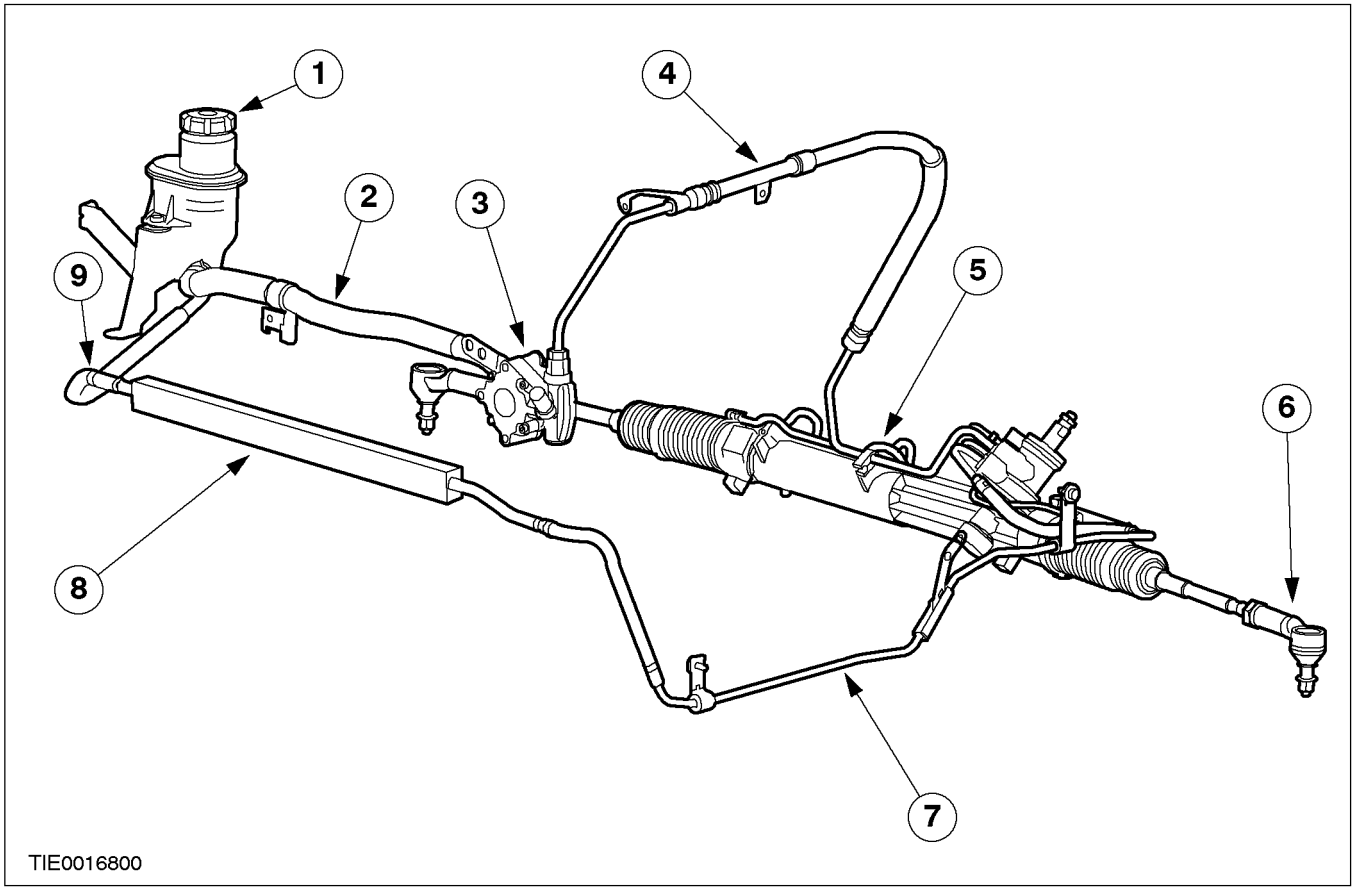
Item	Part Number	Description
5		Steering gear to power steering fluid cooler return hose
6		Power steering fluid cooler
7		Power steering pump

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
8		Power steering fluid reservoir to power steering pump hose

Item	Part Number	Description
9		Power steering pressure (PSP) switch

Vehicles with Diesel engine

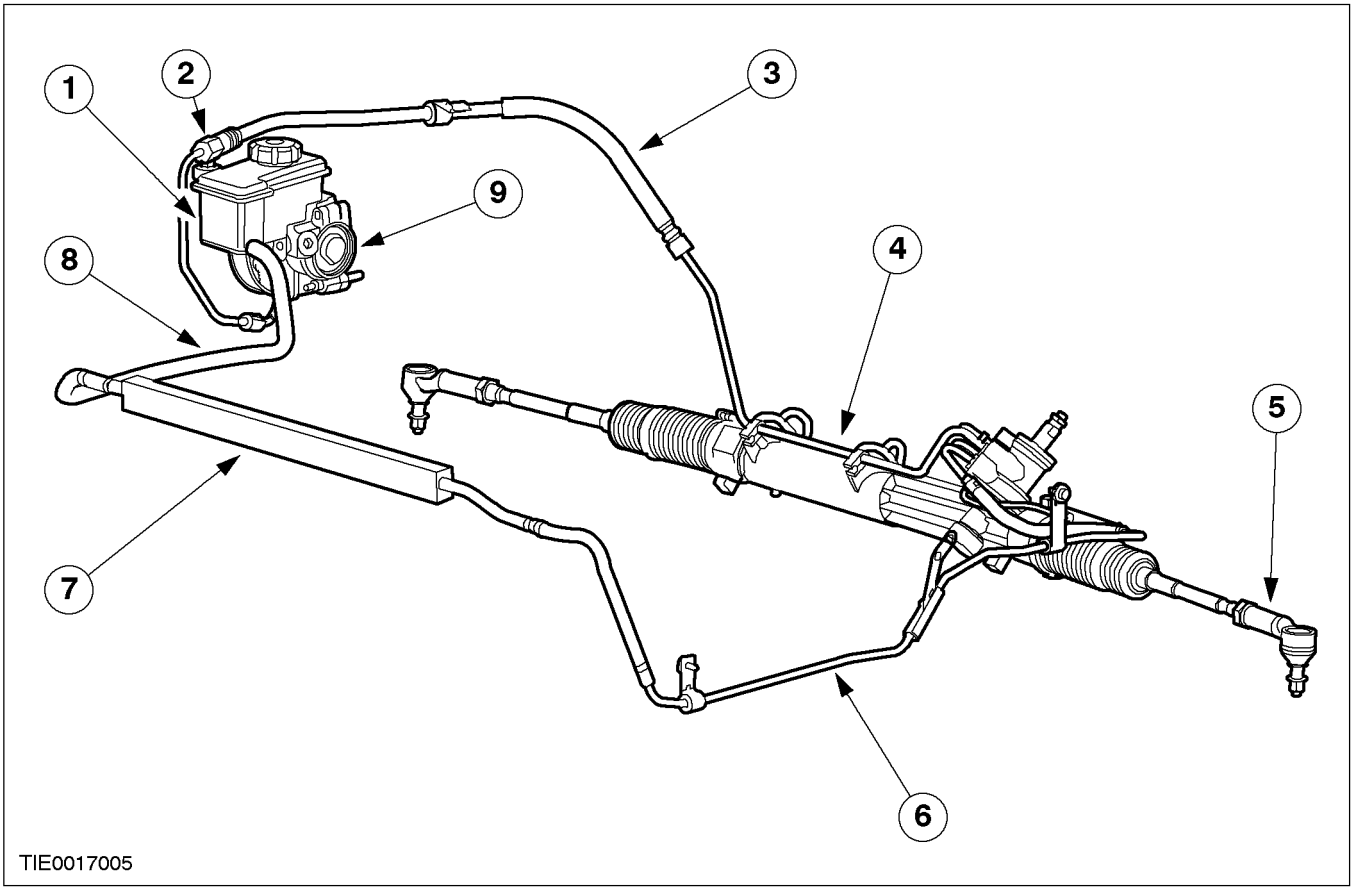


Item	Part Number	Description
1		Power steering fluid reservoir
2		Power steering fluid reservoir to power steering pump hose
3		Power steering pump
4		Power steering pump to steering gear pressure line

Item	Part Number	Description
5		Steering gear
6		Tie-rod end
7		Steering gear to power steering fluid cooler return hose
8		Power steering fluid cooler
9		Power steering fluid cooler to power steering fluid reservoir hose

DESCRIPTION AND OPERATION

Vehicles with 1.8L and 2.0L engine



Item	Part Number	Description
1		Power steering fluid reservoir
2		Power steering pressure (PSP) switch
3		Power steering pump to steering gear pressure line
4		Steering gear
5		Tie-rod end
6		Steering gear to fluid cooler return hose
7		Power steering fluid cooler
8		Power steering fluid reservoir to power steering pump hose
9		Power steering pump

Vehicles with 1.8L or 2.0L engine

The power steering pump has the fluid reservoir mounted directly on the pump. The power steering pump is mounted directly on the engine without any intermediate bracket.

Vehicles with diesel engine

Have a power steering pump which is mounted directly on the water pump. This pump has been designed as a tandem pump, one shaft drives both the power steering pump and the water pump.

Vehicles with 2.5L engine

The power steering pump, is the same as previous models fitted with 2.5L engine.

All vehicles

The steering column is adjustable for height and reach as standard. Vehicles with Electronic Stability Program (ESP), have a steering column installed on which there is a steering wheel rotation sensor. No repairs may be made to the mechanical part of the steering column. The

DESCRIPTION AND OPERATION (Continued)

complete steering column must be changed if it is damaged.

DIAGNOSIS AND TESTING

Steering System

General Equipment
Spring scale

Inspection and Verification

1. Verify the customer concern by driving the vehicle.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Incorrect tire pressure, loose wheels – Loose tie-rod ends, inner ball joints – Loose strut and spring assemblies or ball joints – Loose steering column shaft universal joints – Loose pinch bolts on steering column shaft flexible coupling – Loose steering gear assembly – Incorrect accessory drive belt tension – Binding or misaligned steering column, pump, steering gear – Incorrect power steering pump – Incorrect fluid level – Hose leak or line restrictions	– Power steering pressure (PSP) switch – Wiring harness – Circuit

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Condition	Possible Sources	Action
•Condition where the vehicle wanders side-to-side on the road, when it is driven straight ahead while the steering wheel is held in a firm position.	•Incorrect tire size or pressure.	•CHECK for correct tire sizes and adjust tire pressures. REFER to Section 204-04.
	•Vehicle is unevenly loaded or overloaded.	•ADJUST the load.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
	•Loose or worn tie-rods or tie-rod ends.	•INSTALL a new steering gear or tie-rod end as necessary. REFER to Section 211-02 / 211-03.
	•Steering gear bolts loose or damaged.	•TIGHTEN or INSTALL new bolts.
	•Loose or worn suspension ball joint(s).	•INSTALL a new suspension ball joint assembly. REFER to Section 204-01.
	•Steering column shaft flexible coupling to pinion shaft bolt loose.	•TIGHTEN the pinion shaft bolts. •TIGHTEN the steering column shaft flexible coupling. REFER to Section 211-04.
	•Steering column shaft flexible coupling joints loose or worn.	•INSTALL a new steering column shaft flexible coupling. REFER to Section 211-04.
	•Incorrect toe adjustment.	•ADJUST as necessary. REFER to Section 204-00.
	•Loose or worn rear suspension.	•TIGHTEN loose, or INSTALL new rear suspension components. REFER to Section 204-02.
•Vehicle tends to pull to one side when driven on a level surface.	•Incorrect tire pressure.	•ADJUST the tire pressure. REFER to Section 204-04.
	•Incorrect tire size or different tire/tread type.	•INSTALL a new tire as necessary. REFER to Section 204-04.
	•Vehicle is unevenly or excessively loaded.	•ADJUST the load evenly.
	•Incorrect toe adjustment.	•ADJUST as necessary. REFER to Section 204-00.
	•Damaged front suspension components.	•INSTALL new front suspension component as necessary. REFER to Section 204-01.
	•Damaged rear suspension components.	•INSTALL new rear suspension components as necessary. REFER to Section 204-02.
	•Check front and rear brakes for correct operation.	•ADJUST as necessary. REFER to Section 206-00.
	•Check for bent rear suspension components and for damaged or sagging coil springs in the front or the rear suspension.	•INSTALL new rear suspension components as necessary. REFER to Section 204-00. •INSTALL new rear suspension components as necessary. REFER to Section 204-02.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
	•Check the rear suspension for loose or worn suspension components or rear suspension bolts.	•INSTALL new rear suspension components as necessary. REFER to Section 204-02. •TIGHTEN all bolts. REFER to Section 204-02.
•Feedback (whining or knocking noises in the steering gear) – condition where roughness is felt in the steering wheel by the driver when the vehicle is driven over rough surfaces.	•Steering gear input shaft coupling joints.	•INSTALL a new flexible coupling as necessary. REFER to Section 211-04.
	•Loose/worn tie-rods.	•INSTALL a new steering gear as necessary. REFER to Section 211-02.
	•Steering gear bolts loose or damaged.	•TIGHTEN or INSTALL new retaining bolts as necessary. REFER to Section 211-02.
	•Steering column shaft to flexible coupling pinch bolt loose.	•TIGHTEN the bolt. REFER to Section 211-04.
	•Loose suspension bushing, bolts or ball joints.	•TIGHTEN or INSTALL new bolts or ball joint as necessary. REFER to Section 204-01.
	•Steering column shaft in bad condition.	•INSTALL a new steering column as necessary. REFER to Section 211-04.
•Steering fails to return to center, following a turn, without manual effort from the driver. In addition, when the driver returns the steering wheel to center, it may have a sticky or catchy feel.	•Incorrect tire pressure.	•ADJUST tire pressures. REFER to Section 204-04.
	•Incorrect tire size or incorrect type.	•INSTALL a new tire as necessary. REFER to Section 204-04.
	•Misaligned steering column tube or column shroud rubbing steering wheel.	•ALIGN the steering column tube. REFER to Section 211-04.
	•Steering column shaft flexible coupling, universal joints binding.	•INSTALL a new flexible coupling. REFER to Section 211-04.
	•Steering column shaft floor seal may be torn.	•INSTALL a new floor seal as necessary. REFER to Section 211-04.
	•Binding or damage to tie-rods.	•INSTALL a new steering gear as necessary. REFER to Section 211-02.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
	•Damaged or worn front suspension components.	•INSTALL new front suspension components as necessary. REFER to Section 204-01.
	•Incorrect toe adjustment.	•ADJUST as necessary. REFER to Section 204-00.
	•Column bearing binding.	•INSTALL a new steering column. REFER to Section 211-04.
	•Fluid contamination.	•FLUSH the power steering system. REFER to Power Steering System Flushing in this section.
•Heavy steering efforts while turning corners and during parking manoeuvres	•Low power steering pump fluid.	•FILL as necessary and check for system leaks. REFER to Power Steering System Filling in this section.
	•Incorrect accessory drive belt tension.	•CHECK the accessory drive belt tension. REFER to Section 303-05.
	•Hose or cooler external leak.	•REPAIR or INSTALL a new hose or cooler as necessary.
	•Incorrect engine idle speed.	•REFER to the Powertrain Control Emissions Diagnosis (PC/ED) manual.
	•Power steering pump pulley loose or warped.	•INSTALL a new power steering pump pulley. REFER to Section 211-02.
	•Hose or cooler line restriction.	•CLEAN or INSTALL a new hose or cooler as necessary.
	•Fluid contamination.	•INSPECT system for foreign objects, contamination. FLUSH the power steering system. REFER to Power Steering System Flushing in this section.
	•Fluid aeration.	•BLEED the system. REFER to Power Steering System Bleeding in this section.
	•PSP switch open circuit.	•TEST or INSTALL a new PSP switch as necessary. REFER to Section 303-14.
•Fluid leakage	•Overfilled system.	•CORRECT the fluid level as necessary.
	•Component leak.	•LOCATE the suspect component, and repair as necessary.
•Accessory drive belt squeal (particularly at full steering wheel travel and stand still parking)	•Check accessory drive belt for correct tension or glazing.	•INSTALL a new accessory drive belt as necessary. REFER to Section 303-05.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
•Chirp noise in steering pump	•Loose or worn accessory drive belt.	•INSTALL a new accessory drive belt. REFER to Section 303-05.
•Power steering pump noisy	•Low fluid level and possible leak.	•FILL to the specified level. PURGE the air from the system. REFER to Power Steering System Purging in this section.
	•Power steering pump.	•CHECK for leaks. Repair as necessary. •INSTALL a new power steering pump as necessary. REFER to Section 211-02.
•Swish type noise	•Fluid flow into the bypass valve of the pump valve housing with fluid temperature below 54°C (130°F).	•Normal noise.
•Whine type noise	•Aerated fluid, air leak in system.	•PURGE the air from the system. REFER to Power Steering System Purging in this section.
	•Check valve cover O-ring seal.	•INSTALL a new power steering pump as necessary. REFER to Section 211-02.
•Power steering pump or reservoir leaks	•Excessive fluid fill.	•CORRECT the fluid level as necessary.
	•Fluid cap missing, loose, damaged or missing O-ring seal.	•INSTALL a new fluid cap or O-ring seal, as necessary.
	•Loose or damaged hose fittings.	•INSTALL a new hose fitting as necessary.
	•Leakage at shaft seal: •Seal damage. •Rotor shaft damage, such as grooving or scratches. •Shaft bush or bushing worn.	•INSTALL a new power steering pump. REFER to Section 211-02.
	•Inlet tube.	•INSTALL a new power steering pump. REFER to Section 211-02.
	•Housing porosity.	•INSTALL a new power steering pump. REFER to Section 211-02.
	•Loose outlet fitting nut or plug valve.	•TIGHTEN as necessary.
	•Outlet fitting, nut or plug damaged.	•INSTALL a new power steering pump. REFER to Section 211-02.

DIAGNOSIS AND TESTING

Component Tests

Steering Linkage

CAUTION: Boots must be handled carefully to avoid damage. Use new steering gear boot clamps when installing boots.

Inspect the boots for cuts, deterioration, twisting or distortion. Check the steering gear boots to make sure they are tight. Install new boots or clamps as necessary.

1. With the wheels in the straight ahead position, gently turn the steering wheel to the left and right to check free play.
2. Free play should be between 0 and 6 mm (0 and 0.25 inch) at the steering wheel rim. If the free play exceeds this limit, either the steering joints are worn or the backlash of the rack and pinion steering gear is excessive.
3. Backlash cannot be adjusted, install a new steering gear. REFER to Section 211-02.
4. Grasp the steering wheel firmly and move it up and down and to the left and right without turning the wheel, to check for column bearing wear, steering column shaft joint play, steering wheel or steering column looseness. REFER to Section 211-04.

Turning Effort Test

NOTE: Before carrying out this test, make sure the toe adjustment and tire pressures are correct. REFER to Section 204-00.

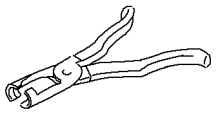
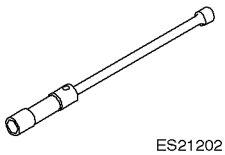
1. Park the vehicle on a dry, even surface and apply the parking brake.
2. Start the engine and turn the steering wheel from lock to lock several times until the power steering fluid has reached a temperature of 74°-79°C (165°-175°F).
3. With the steering in the straight ahead position, attach the spring scale to the steering wheel rim. Measure the effort required to turn the steering wheel one complete revolution in each direction, compare the result with the specifications listed in this section.

Tie-Rod Articulation Torques

1. Detach both tie-rod ends from the wheel knuckles. REFER to Section 211-03.
2. Attach the spring scale to a tie-rod end, pull on the spring scale in line with the steering gear and measure the effort required to move the tie-rod.
3. No free play is allowed. If the force required to move the tie-rod is greater than listed in the specifications in this section, install a new steering gear. REFER to Section 211-02.

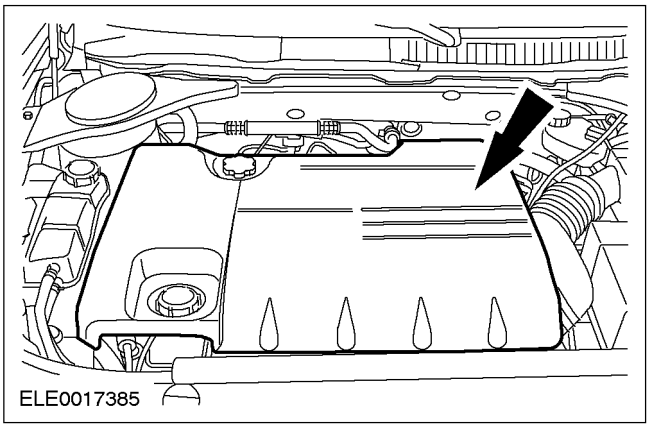
GENERAL PROCEDURES

Power Steering System Flushing — 1.8L/2.0L (13 001 0)

Special Tool(s)	
 PZ21211	Pliers, Valve Stem Oil seal 303-508 (21-211)
 ES21202	Socket,Spark Plug 303-499 (21-202)

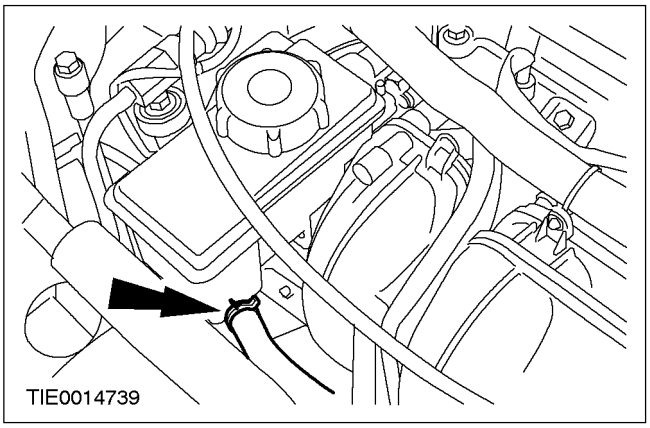
Name	Specification
Power Steering Fluid	WSA-M2C195-A

1. **Remove the engine upper cover.**

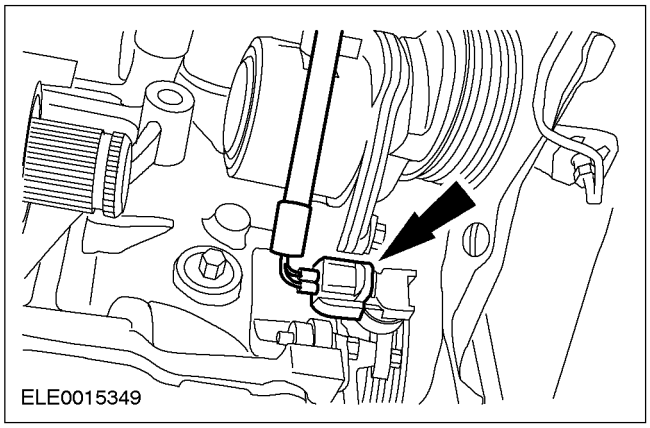

ELE0017385

2. **NOTE:** Using a suitable blanking cap, cap the power steering fluid reservoir.

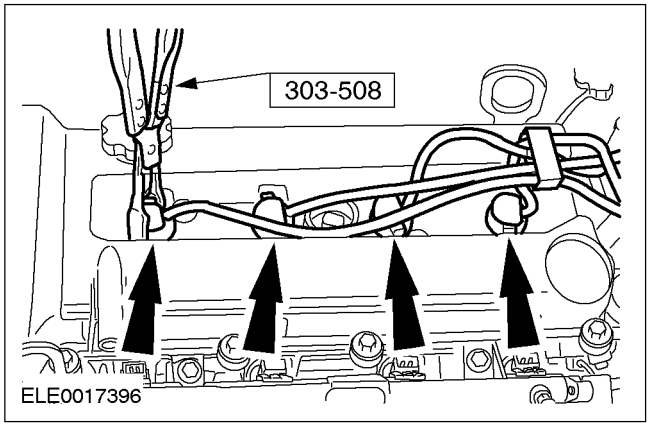
   Disconnect the power steering fluid cooler return line from the power steering fluid reservoir.


TIE0014739

3. **Place the end of the power steering fluid cooler return line into a suitable container.**
4. **Disconnect the crankshaft position (CKP) sensor electrical connector.**

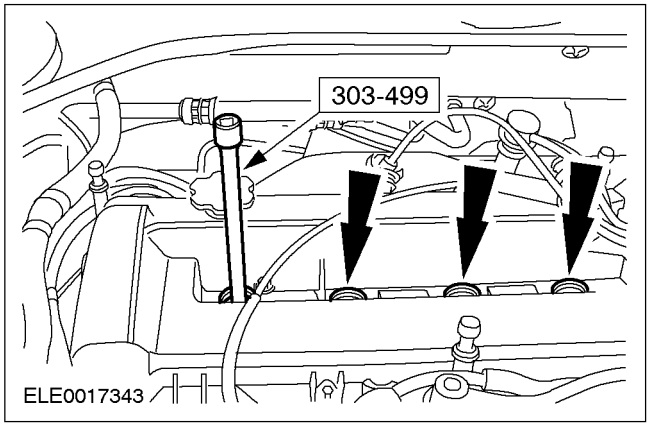

ELE0015349

5. **Using the special tool, disconnect the spark plug wires from the spark plugs.**



ELE0017396

6. **Using the special tool, remove the spark plugs.**



ELE0017343

GENERAL PROCEDURES (Continued)

7. **NOTE:** The vehicle must be raised with the wheels clear of the floor to allow the steering wheel to be rotated from lock to lock.

   Raise and support the vehicle. For additional information, refer to Section 100-02.

8. **NOTE:** When filling the power steering fluid reservoir, make sure the power steering fluid is clean and not agitated prior to use. The fluid should be poured slowly into the reservoir to minimize the possibility of aeration. The fluid level should be checked with the fluid cold.

   Fill the power steering fluid reservoir to the MAX mark with power steering fluid.

9. **CAUTION: Do not continuously crank the engine for more than 30 seconds, as damage to the starter motor may result.**

NOTE: When flushing the power steering system, make sure that the power steering fluid in the reservoir does not fall below the minimum mark.

While cranking the engine for no more than 30 seconds turn the steering wheel from lock to lock.

- With the aid of another technician add 1 liter of clean power steering fluid.

10. **Wait 60 seconds to allow the starter motor to cool.**

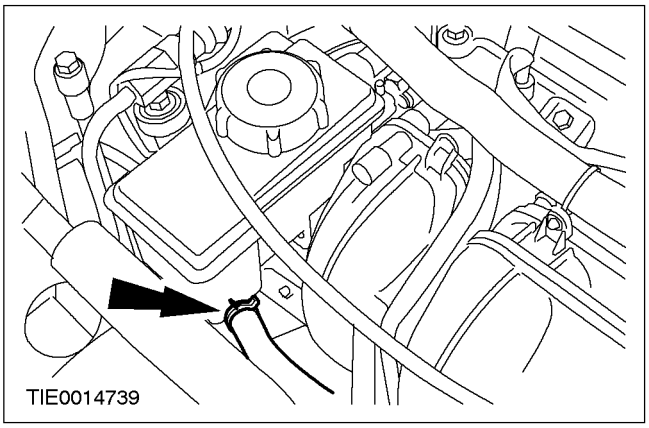
11. **CAUTION: Do not continuously crank the engine for more than 30 seconds, as damage to the starter motor may result.**

NOTE: When flushing the power steering system, make sure that the power steering fluid in the reservoir does not fall below the minimum mark.

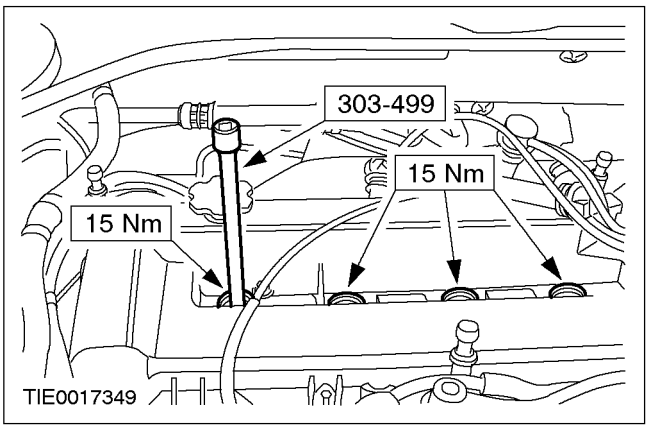
While cranking the engine for a further 30 seconds turn the steering wheel from lock to lock.

- With the aid of another technician add a further 1 liter of clean power steering fluid.

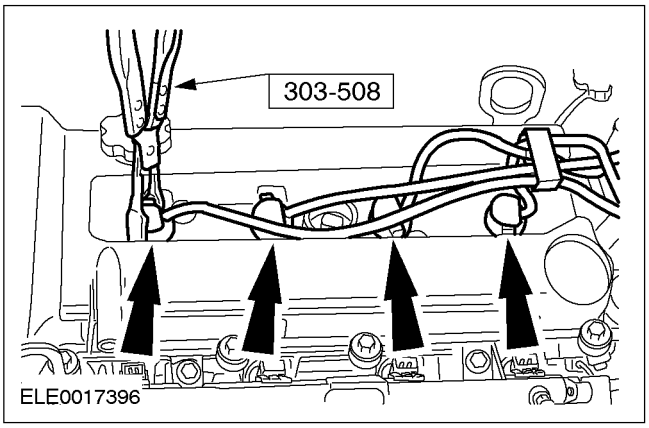
12. **When all the fluid has been used, turn the ignition switch to the OFF position.**
13. **Lower the vehicle.**
14. **Remove the blanking cap from the power steering fluid reservoir and connect the power steering fluid cooler return line.**



15. **Using the special tool, install the spark plugs.**

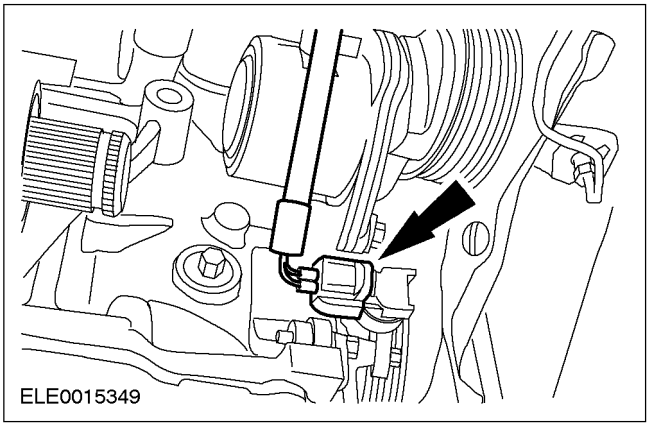


16. **Using the special tool, connect the spark plug wires to the spark plugs.**

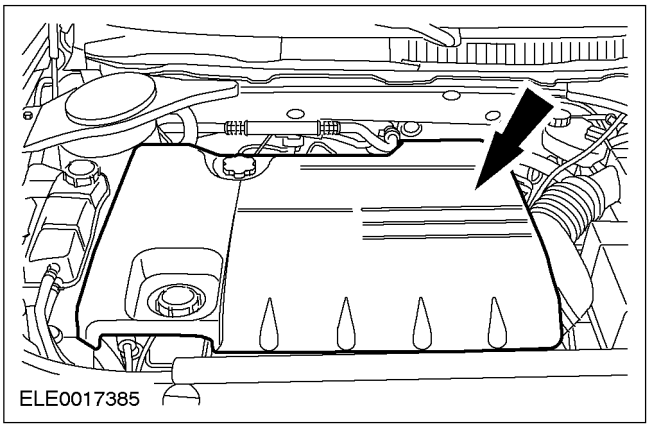


GENERAL PROCEDURES (Continued)

17. Connect the CKP sensor electrical connector.



18. Install the engine upper cover.



19. NOTE: When filling the power steering fluid reservoir, make sure the power steering fluid is clean and not agitated prior to use. The fluid should be poured slowly into the reservoir to minimize the possibility of aeration. The fluid level should be checked with the fluid cold.

Fill the power steering fluid reservoir to the MAX mark with power steering fluid.

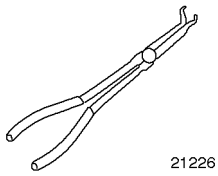
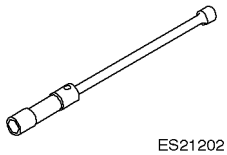
20. Start the engine and slowly turn the steering wheel from lock to lock.

21. Switch OFF the engine.

22. Check the fluid level. Fill up as necessary.

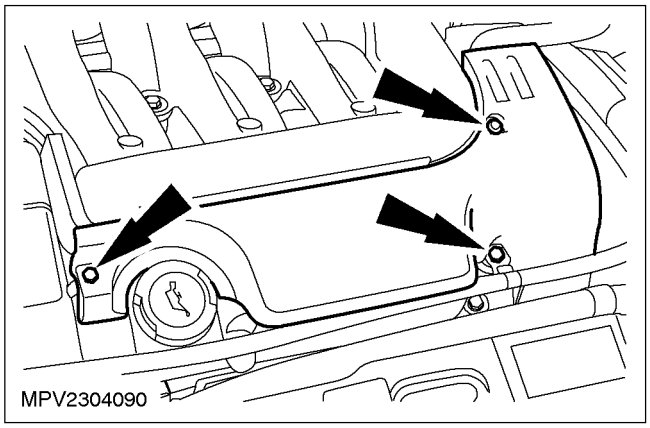
GENERAL PROCEDURES

Power Steering System Flushing — 2.5L (13 001 0)

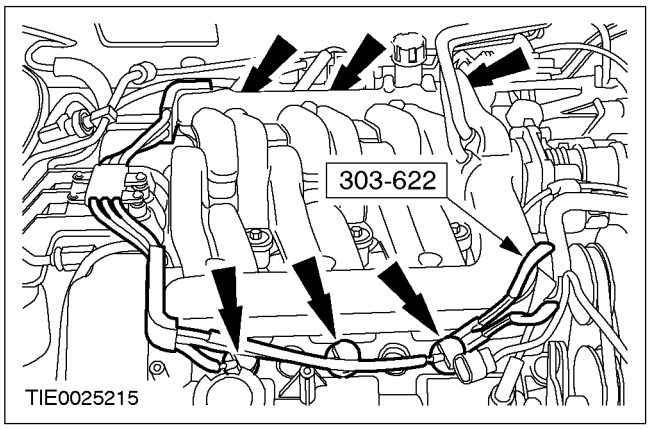
Special Tool(s)	
 21226	Pliers,Spark Plug Connector 303-622 (21-226)
 ES21202	Socket,Spark Plug 303-499 (21-202)

Name	Specification
Power Steering Fluid	WSA-M2C195-A

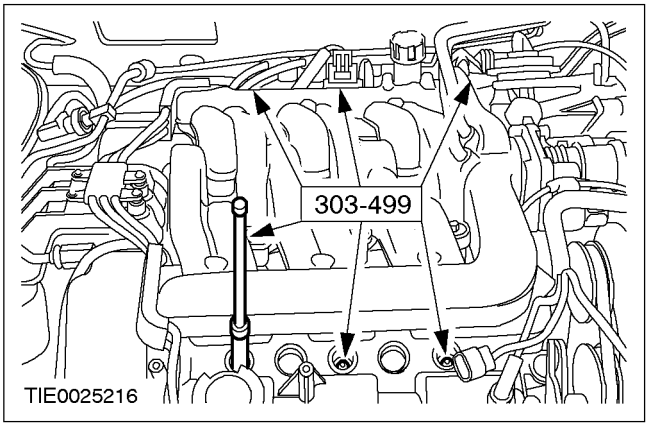
1. Remove the engine upper cover.



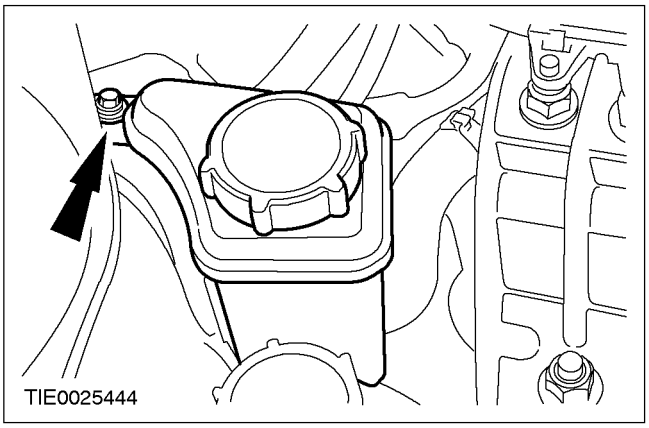
2. Using the special tool, disconnect the spark plug wires from the spark plugs.



3. Using the special tool, remove the spark plugs.

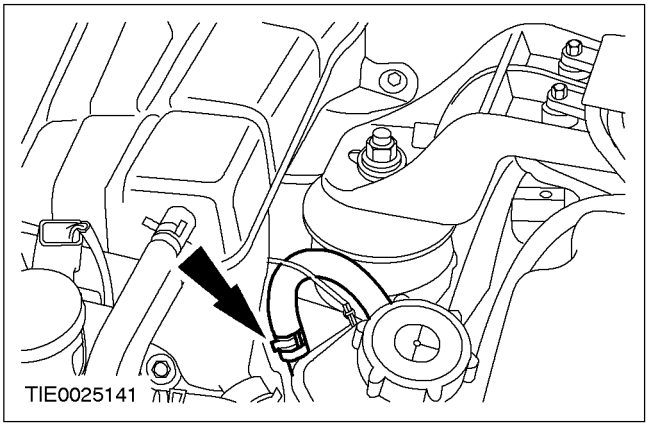


4. Detach the power steering fluid reservoir from the wheelhouse assembly.



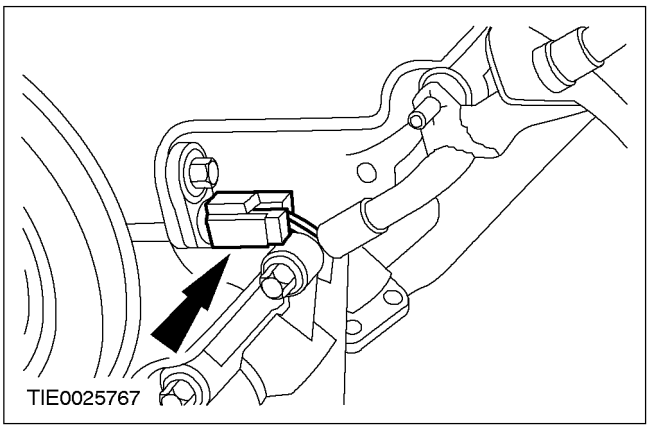
5. NOTE: Using a suitable blanking cap, cap the power steering fluid reservoir.

Disconnect the power steering fluid cooler return line from the power steering fluid reservoir.



GENERAL PROCEDURES (Continued)

6. **Place the end of the power steering fluid cooler return line into a suitable container.**
7. **Disconnect the crankshaft position (CKP) sensor electrical connector.**



8. **NOTE:** The vehicle must be raised with the wheels clear of the floor to allow the steering wheel to be rotated from lock to lock.

   Raise and support the vehicle. For additional information, refer to Section 100-02.
9. **NOTE:** When filling the power steering fluid reservoir, make sure the power steering fluid is clean and not agitated prior to use. The fluid should be poured slowly into the reservoir to minimize the possibility of aeration. The fluid level should be checked with the fluid cold.

   Fill the power steering fluid reservoir to the MAX mark with power steering fluid.
10. **CAUTION: Do not continuously crank the engine for more than 30 seconds, as damage to the starter motor may result.**

NOTE: When flushing the power steering system, make sure that the power steering fluid in the reservoir does not fall below the minimum mark.

While cranking the engine for no more than 30 seconds turn the steering wheel from lock to lock.

- With the aid of another technician add 1 liter of clean power steering fluid.

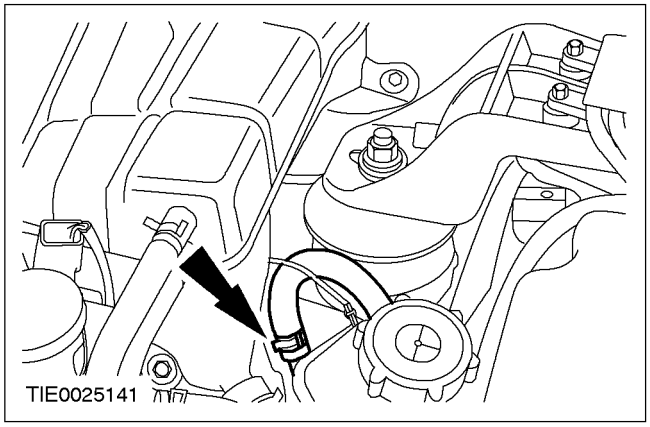
11. **Wait 60 seconds to allow the starter motor to cool.**
12. **CAUTION: Do not continuously crank the engine for more than 30 seconds, as damage to the starter motor may result.**

NOTE: When flushing the power steering system, make sure that the power steering fluid in the reservoir does not fall below the minimum mark.

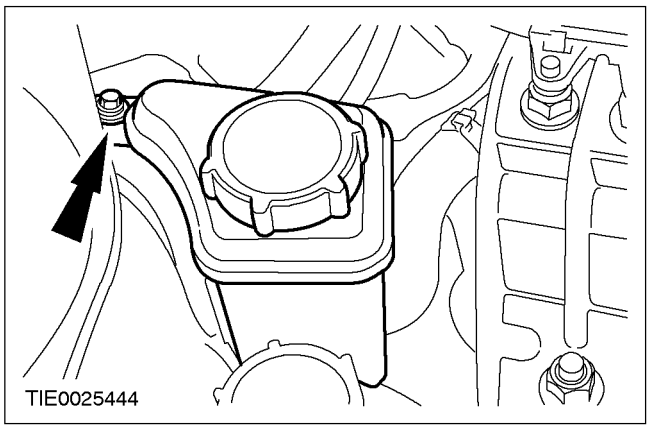
While cranking the engine for a further 30 seconds turn the steering wheel from lock to lock.

- With the aid of another technician add a further 1 liter of clean power steering fluid.

13. **When all the fluid has been used, turn the ignition switch to the OFF position.**
14. **Lower the vehicle.**
15. **Remove the blanking cap from the power steering fluid reservoir and connect the power steering fluid cooler return line.**

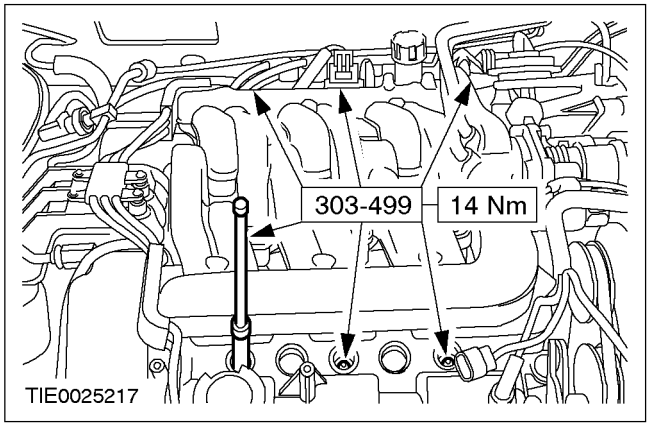


16. **Attach the power steering fluid reservoir to the wheelhouse assembly.**

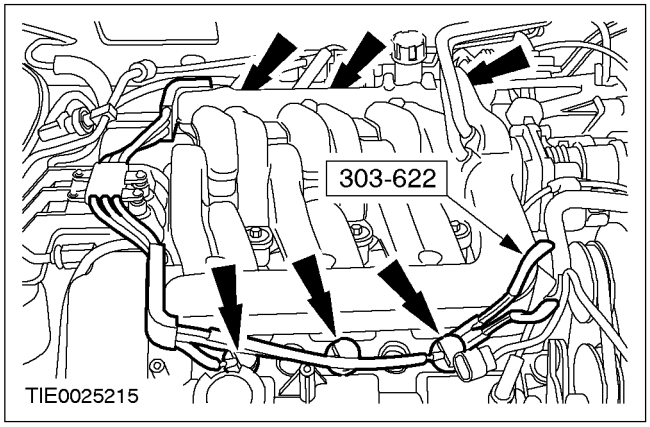


GENERAL PROCEDURES (Continued)

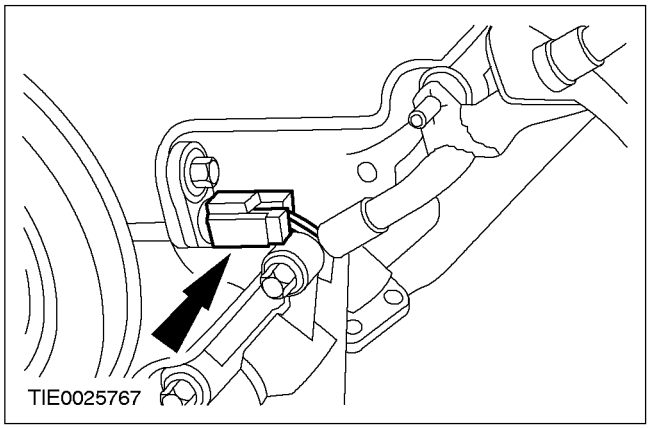
17. **Using the special tool, install the spark plugs.**



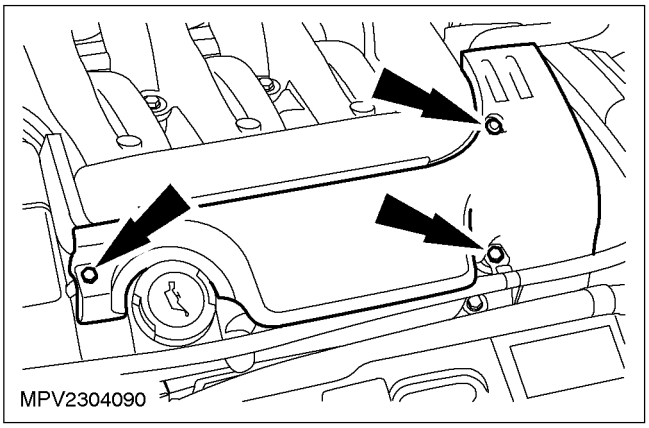
18. **Using the special tool,connect the spark plug wires to the spark plugs.**



19. **Connect the CKP sensor electrical connector.**



20. **Install the engine upper cover.**



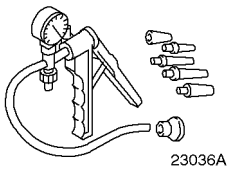
21. **NOTE:** When filling the power steering fluid reservoir, make sure the power steering fluid is clean and not agitated prior to use. The fluid should be poured slowly into the reservoir to minimize the possibility of aeration. The fluid level should be checked with the fluid cold.

    Fill the power steering fluid reservoir to the MAX mark with power steering fluid.

22. **Start the engine and slowly turn the steering wheel from lock to lock.**
23. **Switch OFF the engine.**
24. **Check the fluid level. Fill up as necessary.**

GENERAL PROCEDURES

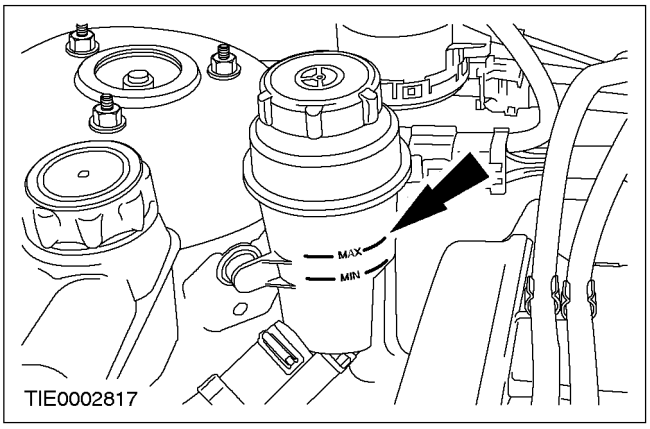
Power Steering System Bleeding (13 416 1)

Special Tool(s)	
 13016	Adaptor, Power Steering Bleeding 211 - 189 (13 - 016)
 23036A	Hand Vacuum/Pressure Pump 416 - D001 (23 - 036A)

Bleeding

1. **NOTE:** When filling the reservoir, make sure the power steering fluid is clean and not agitated prior to use. The fluid should be poured slowly into the reservoir to minimize the possibility of aeration. The fluid level should be checked with the fluid cold.

   Fill the reservoir to the MAX mark.



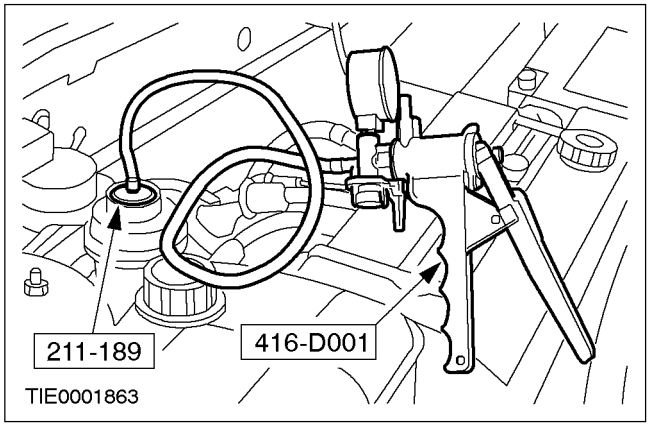
2. **NOTE:** Make sure that the fluid in the reservoir does not fall below the MIN mark, as air could enter the system.

   Start the engine and slowly turn the steering wheel from lock to lock.

3. **Switch OFF the engine and examine the hose connections, steering gear boots, valve body and pump for external leaks.**
4. **Check the fluid level. Fill up as necessary.**
5. **NOTE:** When bleeding the system the vacuum will decrease. Maintain a sufficient vacuum of 51 kPa (15 in - Hg), using the hand vacuum/pressure pump. If the vacuum decreases by more than 7 kPa (2 in - Hg) in 5 minutes, the system should be checked for leaks.

   Using the special tools, bleed the system.

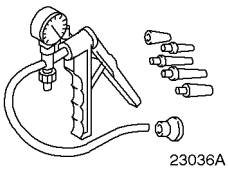
   - Start the engine and slowly turn the steering wheel from lock to lock once; then turn the steering wheel to the right, just off the stop.
   - Switch OFF the engine and using the hand vacuum/pressure pump apply a vacuum of 51 kPa (15 in - Hg). Maintain the vacuum until the air is evacuated from the system (minimum of five minutes).
   - Release the vacuum at the hand vacuum/ pressure pump.
   - Repeat the bleed procedure, turning the steering wheel to the left, just off the stop.



6. **Remove the hand vacuum/pressure pump and stopper. Fill the reservoir if necessary.**
7. **Start the engine, turn the steering wheel from lock to lock. If excessive noise is apparent, repeat the bleed procedure.**
8. **If the noise level is still unacceptable, leave the vehicle standing overnight then repeat the bleed procedure.**

GENERAL PROCEDURES

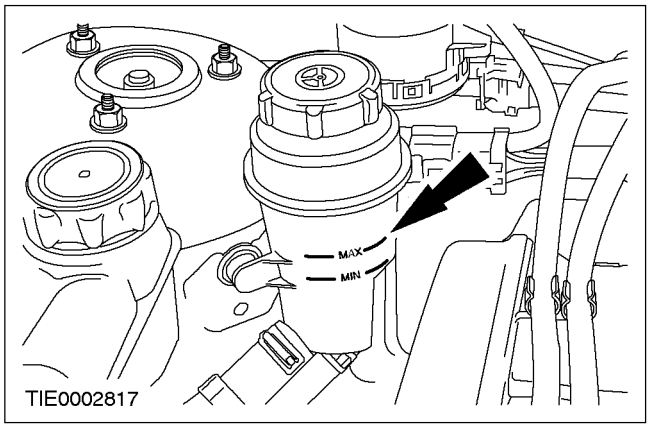
Power Steering System Filling (13 002 0)

Special Tool(s)	
 13016	Adaptor, Power Steering Bleeding 211 - 189 (13 - 016)
 23036A	Hand Vacuum/Pressure Pump 416 - D001 (23 - 036A)

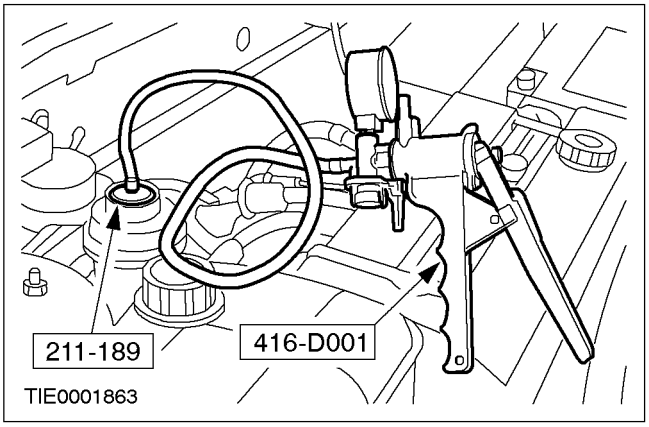
Refill

1. **NOTE:** When filling the reservoir, make sure the power steering fluid is clean and not agitated prior to use. The fluid should be poured slowly into the reservoir to minimize the possibility of aeration. The fluid level should be checked with the fluid cold.

   Fill the reservoir to the MAX mark.



2. **Using the special tools, apply a vacuum of 84 - 101 kPa (25 - 30 in - Hg) for 30 seconds.**



3. **Observe the vacuum gauge reading.**
   - If the vacuum decreases by more than 7 kPa (2 in - Hg) in 5 minutes, the system should be checked for leaks.
4. **Remove the hand vacuum/pressure pump and stopper. Fill the reservoir to the MAX mark is necessary.**

SECTION 211-02 Power Steering

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

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Power Steering 211-02-3

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Power Steering 211-02-6

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Power Steering Pump — 1.8L/2.0L ..... (13 434 0) 211-02-7
Power Steering Pump — 2.5L ..... (13 434 0) 211-02-11
Power Steering Pump Pulley — 1.8L/2.0L ..... (13 425 0) 211-02-15
Steering Gear ..... (13 116 0) 211-02-16

SPECIFICATIONS

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Power Steering Fluid	WSA-M2C195-A
Anti-seize grease	SAM 1C 9107A

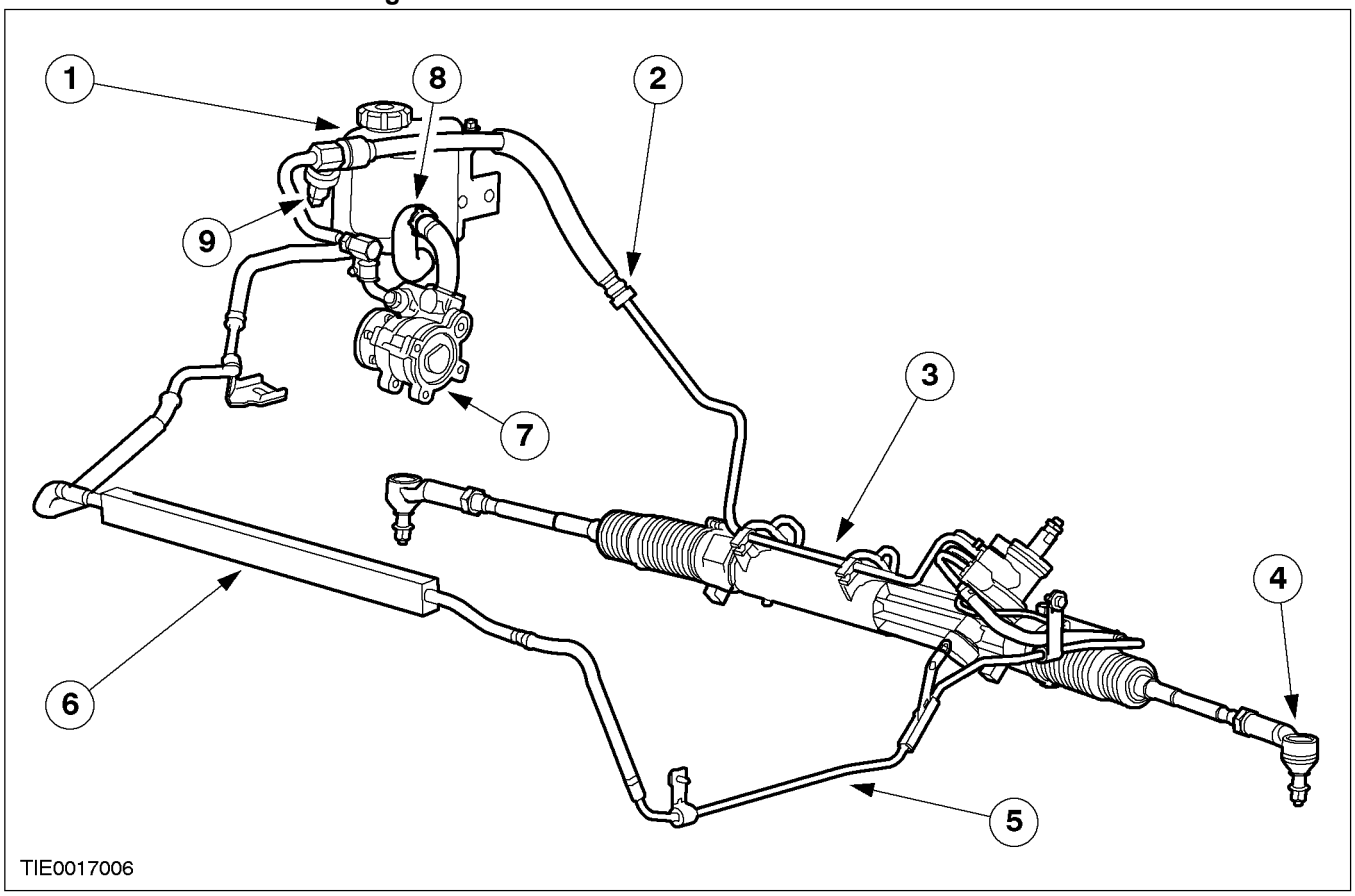
Torque Specifications

Description	Nm	lb-ft	lb-in
Steering gear mounting bolts	130	96	-
Power steering line to steering gear screw	23	17	-
Front sub-frame retaining bolts	142	105	-
Roll restrictor retaining bolt	80	59	-
Steering column shaft to flexible coupling bolt	20	15	-
Flexible coupling to steering gear pinion bolt	25	18	-
Front sub-frame assembly rear retaining bolt support bracket bolts	10	7	-
Tie-rod end retaining nut	40	30	-
Power steering pump retaining bolts — vehicles with 2.5L engine	48	35	-
Power steering pump plate retaining bolts — vehicles with 2.5L engine	25	18	-
Power steering pump plate retaining nuts — vehicles with 2.5L engine	10	7	-
Power steering pump pulley retaining bolts — vehicles with 2.5L engine	25	18	-
Power steering line to power steering pump union — vehicles with 2.5L engine	17	13	-
Engine front mounting retaining bolts — vehicles with 2.5L engine	83	61	-
Power steering pump retaining bolts — vehicles with 1.8L or 2.0L engine	18	13	-
Power steering line to power steering pump support bracket nut — vehicles with 1.8L or 2.0L engine	8	6	-
Power steering line to power steering pump union — vehicles with 1.8L or 2.0L engine	65	48	-
Power steering fluid reservoir retaining bolts — vehicles with 1.8L or 2.0L engine	9	7	-
Power steering pump retaining bolts — vehicles with diesel engine	23	17	-
Power steering pump pulley retaining bolts — vehicles with diesel engine	10	7	-
Power steering line to power steering pump union — vehicles with diesel engine	23	17	-
Exhaust pipe flexible coupling retaining bolts	46	34	-
Tie-rod end locknut	40	30	-
Tie-rod to steering gear	110	81	-

DESCRIPTION AND OPERATION

Power Steering

Vehicles with 2.5L and 3.0L engine

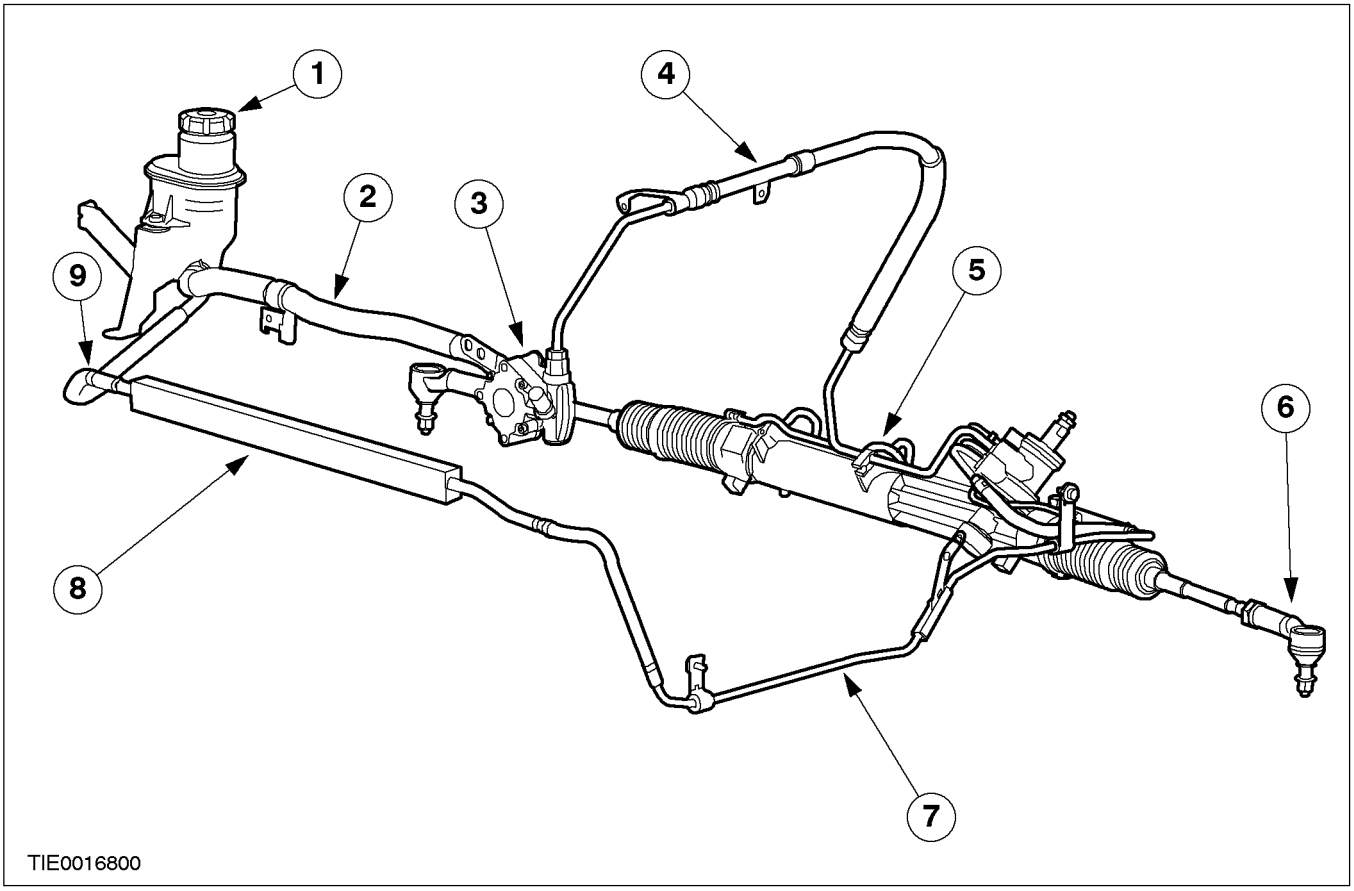


Item	Description
1	Power steering fluid reservoir
2	Power steering pump to steering gear pressure line
3	Steering gear
4	Tie-rod end
5	Steering gear to fluid cooler return hose

Item	Description
6	Power steering fluid cooler
7	Power steering pump
8	Power steering fluid reservoir to power steering pump hose
9	Power steering pressure (PSP) switch

DESCRIPTION AND OPERATION

Vehicles with diesel engine

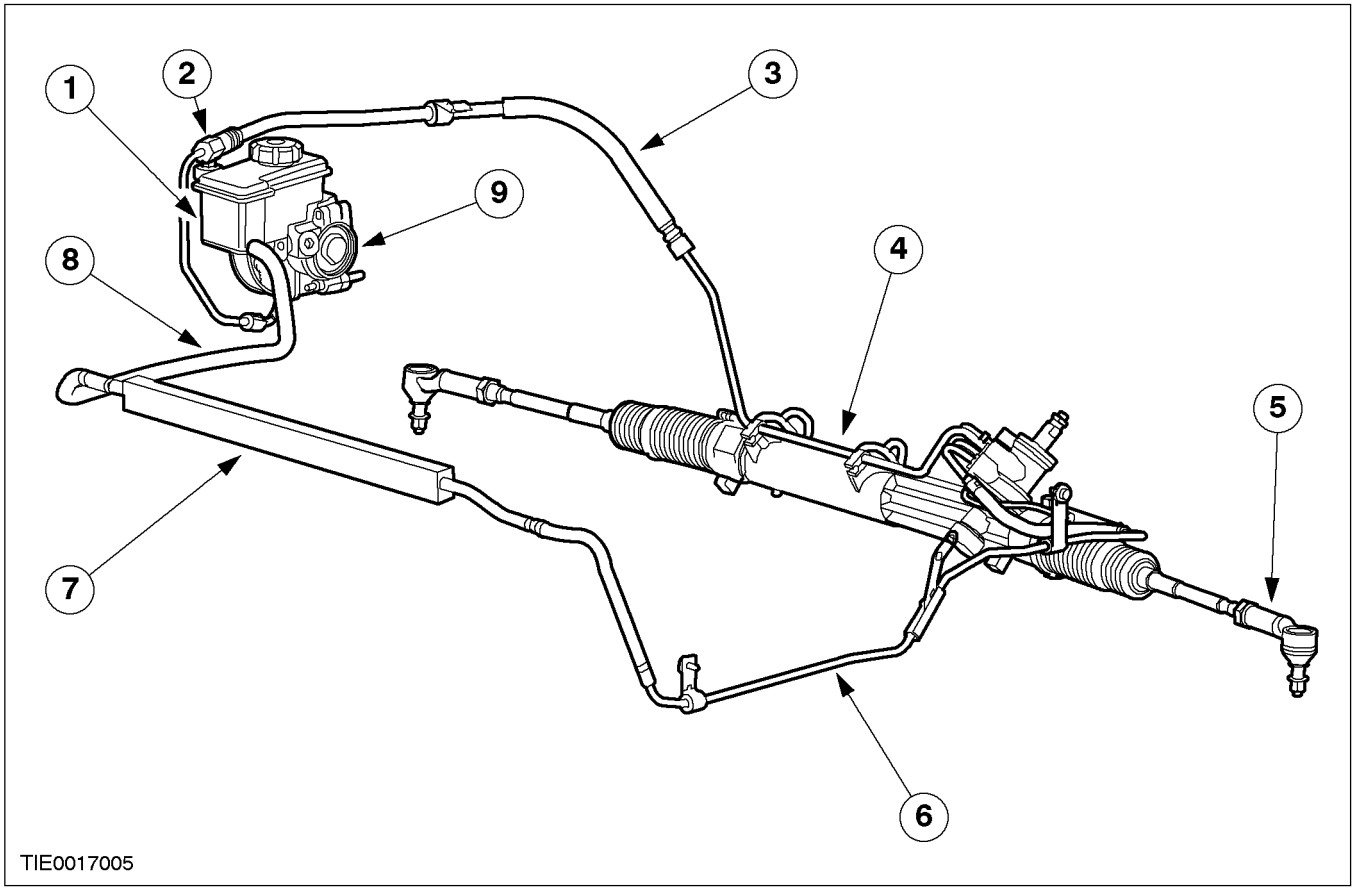


Item	Description
1	Power steering fluid reservoir
2	Power steering fluid reservoir to power steering pump hose
3	Steering pump
4	Power steering pump to steering gear pressure line

Item	Description
5	Steering gear
6	Tie-rod end
7	Steering gear to fluid cooler return hose
8	Power steering fluid cooler
9	Power steering fluid cooler to power steering fluid reservoir hose

DESCRIPTION AND OPERATION

Vehicles with 1.8L and 2.0L engine



Item	Description
1	Power steering fluid reservoir
2	Power steering pressure (PSP) switch
3	Power steering pump to steering gear pressure line
4	Steering gear
5	Tie-rod end
6	Steering gear to fluid cooler return hose
7	Power steering fluid cooler
8	Power steering fluid reservoir to power steering pump hose
9	Power steering pump

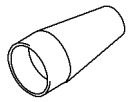
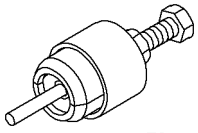
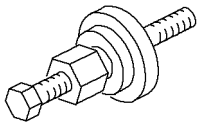
DIAGNOSIS AND TESTING

Power Steering

REFER to Section 211-00.

REMOVAL AND INSTALLATION

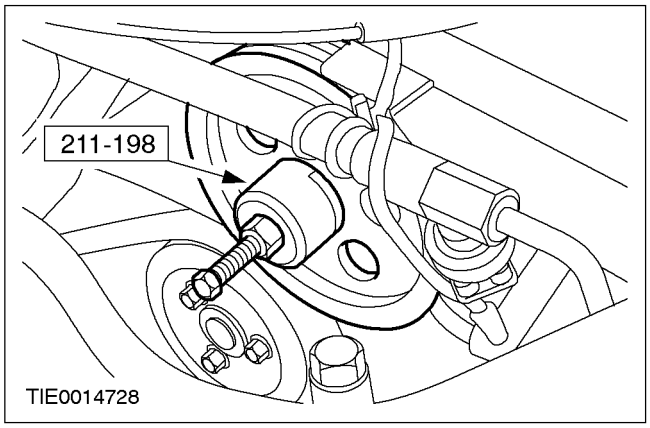
Power Steering Pump — 1.8L/2.0L (13 434 0)

Special Tool(s)	
 13015	Expander, Teflon Seal 211-188 (13-015)
 ES13021	Remover, Power Steering Pump Pulley 211-198 (13-021)
 21192	Installer, Camshaft Pulley 303-458 (21-192)

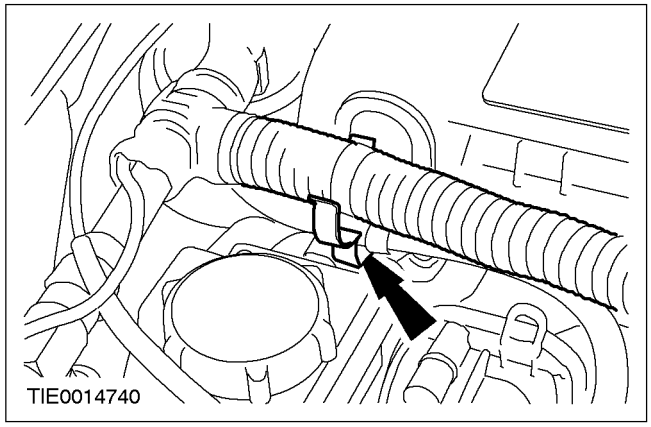
Removal

1. **Remove the accessory drive belt. For additional information, refer to Section 303-05.**
2. **NOTE:** When installing a new power steering pump, a new power steering pump pulley must be installed.

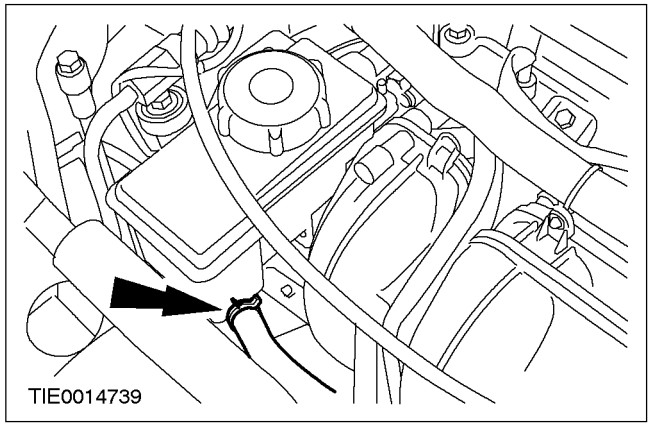
   Using the special tool, remove the power steering pump pulley.



3. **Remove the engine wiring harness support bracket.**



4. **Disconnect the power steering hose from the power steering fluid reservoir.**
   - Allow the fluid to drain into a suitable container.

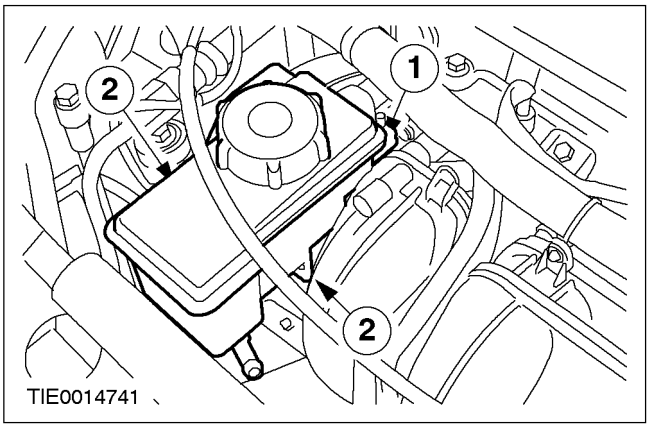


REMOVAL AND INSTALLATION (Continued)

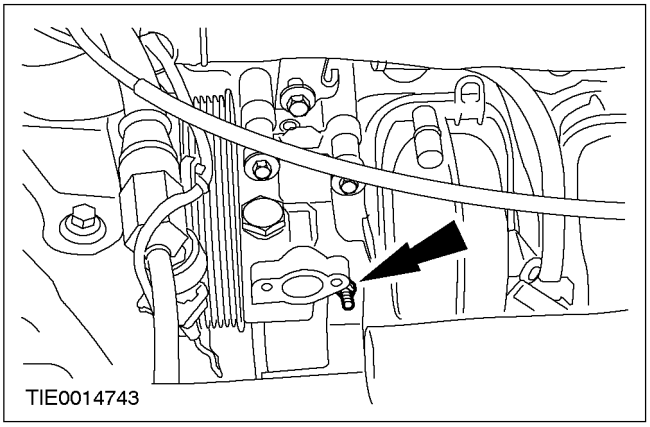
5. NOTE: The power steering fluid reservoir contains a filter. If the power steering fluid is contaminated the power steering fluid reservoir must be renewed.

Remove the power steering fluid reservoir.

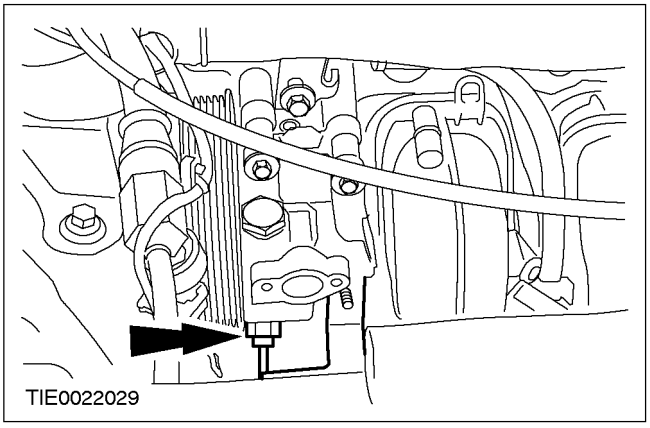
1. Remove the rear retaining stud.
2. Remove the front retaining bolts.
   - Discard the O-ring seals.



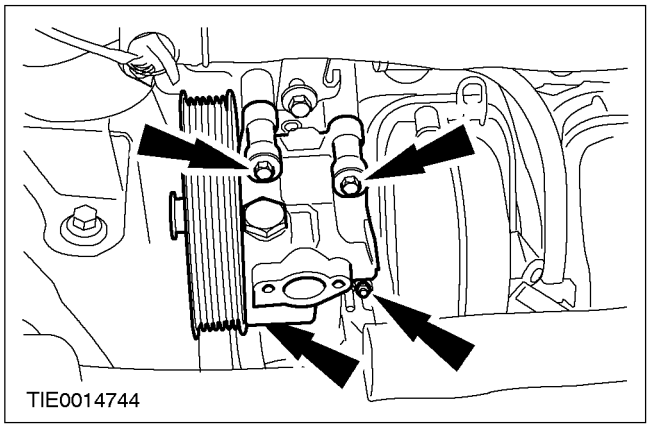
6. Remove the power steering line support retaining nut.



7. Disconnect the power steering line from the power steering pump.



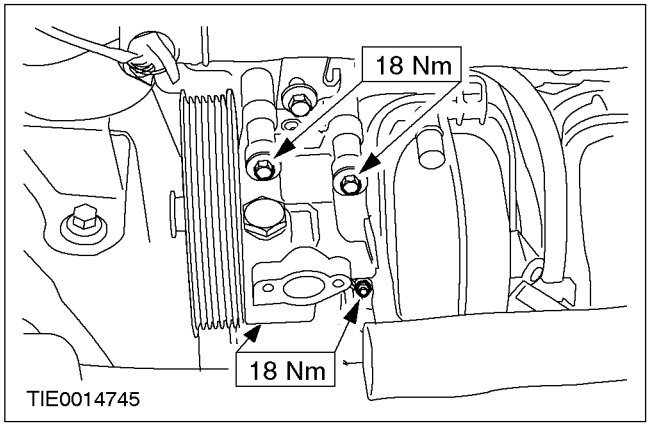
8. Remove the power steering pump.



Installation

1. NOTE: If installing a new power steering pump, the unions supplied with the new pump should be removed and retained for further use.

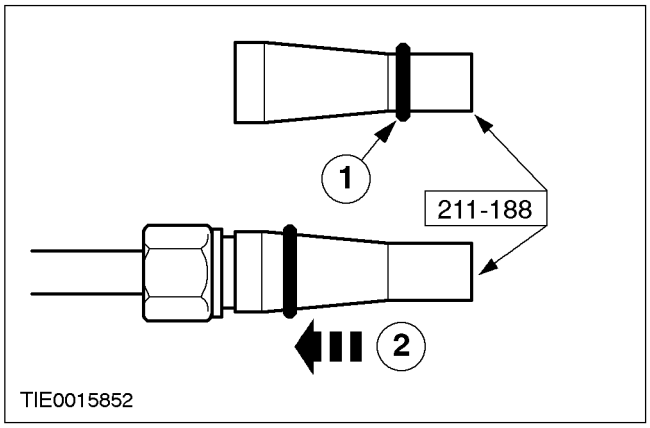
Install the power steering pump.



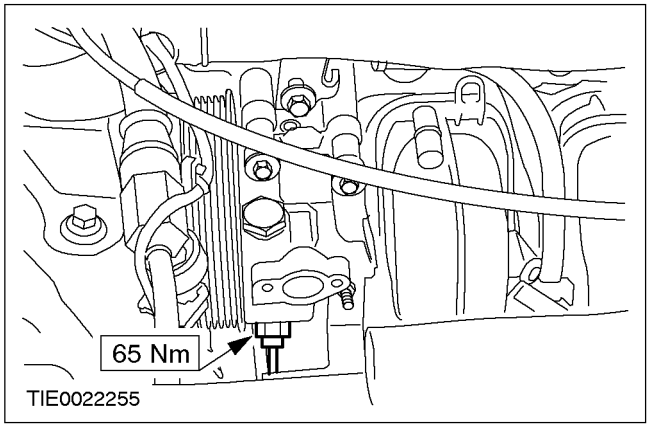
REMOVAL AND INSTALLATION (Continued)

2. Using the special tool, install a new O-ring seal onto the power steering line to power steering pump union.

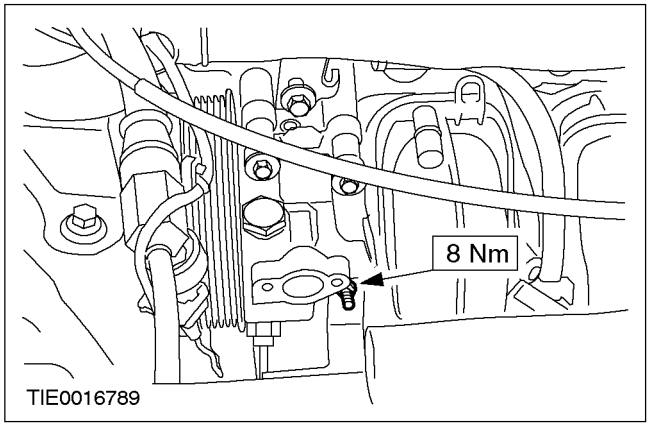
1. Push the O-ring seal onto the special tool.
2. Locate the special tool onto the union and install the O-ring seal.



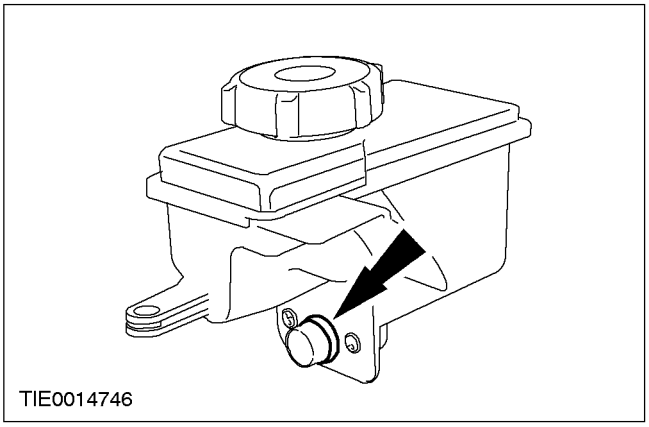
3. Connect the power steering line to the power steering pump.



4. Install the power steering line support retaining nut.

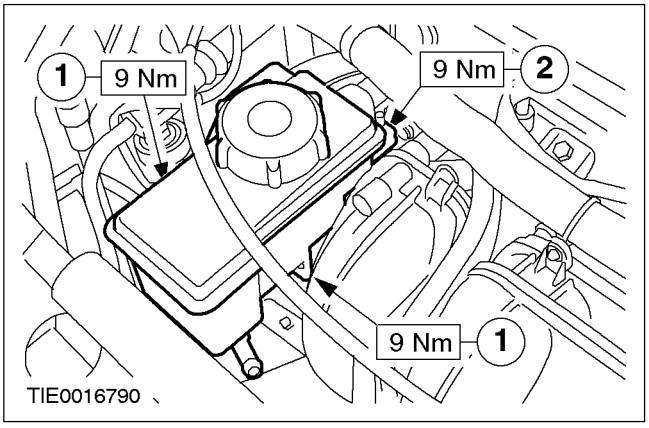


5. Install new O-ring seals to the power steering fluid reservoir.

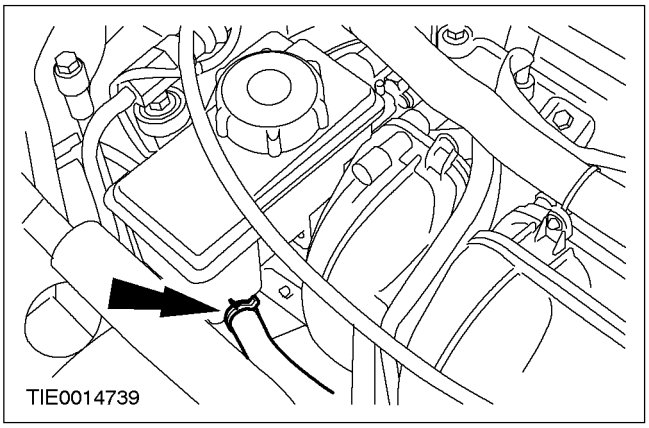


6. Install the power steering fluid reservoir.

1. Install the front retaining bolts.
2. Install the rear retaining stud.

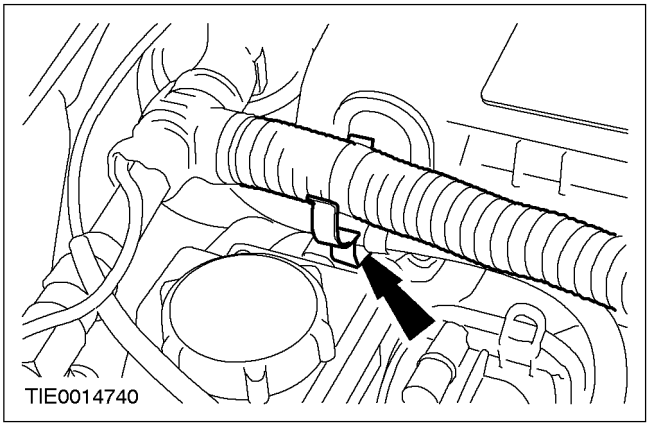


7. Connect the power steering hose to the power steering fluid reservoir.



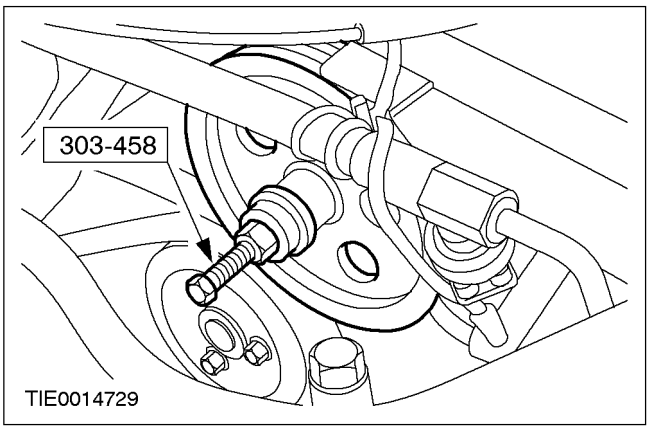
REMOVAL AND INSTALLATION (Continued)

8. **Install the engine wiring harness support bracket.**



9. **NOTE:** When installing a new power steering pump, install a new power steering pump pulley.

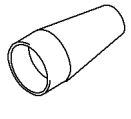
   Using the special tool, install the new power steering pump pulley flush with the end of the power steering pump shaft.



10. **Install the accessory drive belt. For additional information, refer to Section 303-05.**
11. **Fill and bleed the power steering system. For additional information, refer to Section 211-00.**

REMOVAL AND INSTALLATION

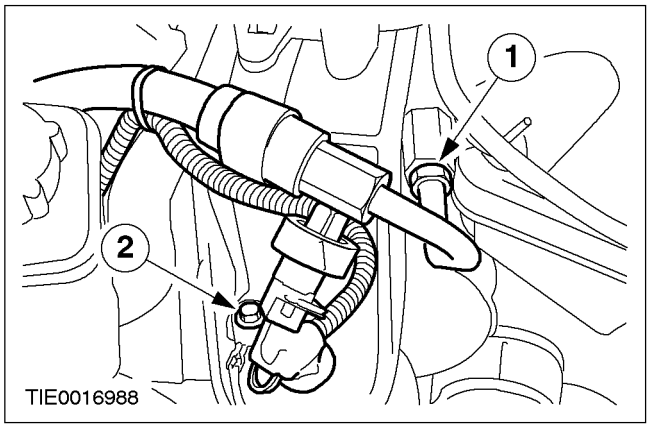
Power Steering Pump — 2.5L (13 434 0)

Special Tool(s)	
 13015	Expander, Teflon Seal 211-188 (13-015)

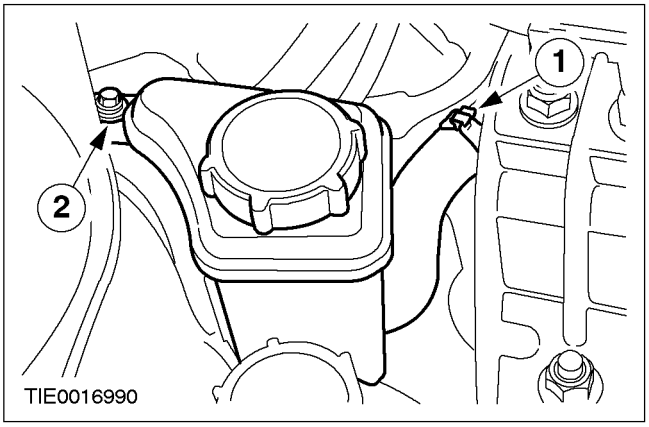
General Equipment
Trolley jack

Removal

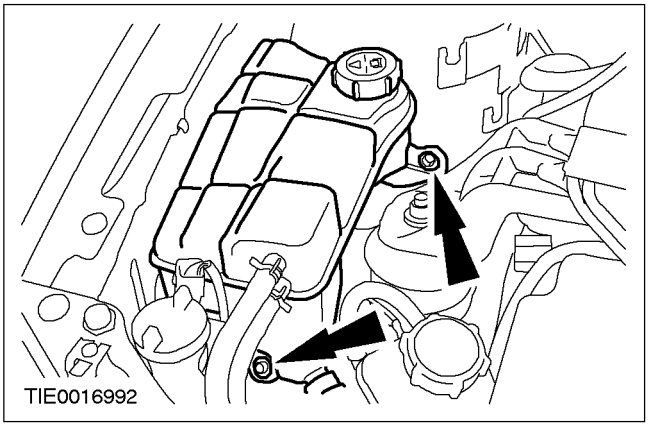
1. **Remove the accessory drive belt. For additional information, refer to Section 303-05.**
2. **Disconnect the power steering line from the power steering pump.**
   1. Disconnect the power steering line.
   2. Remove the support bracket retaining bolt.
   - Allow the fluid to drain into a suitable container.



3. **Detach the power steering fluid reservoir from the wheelhouse and position to one side.**
   1. Disconnect the power steering hose from the power steering pump.
   2. Remove the retaining bolt.
   - Allow the fluid to drain into a suitable container.

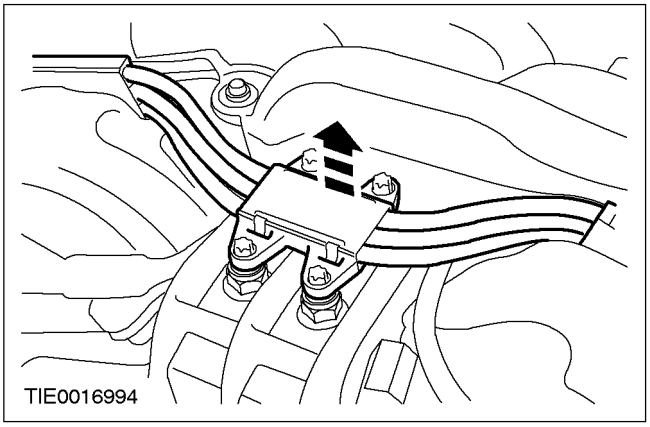


4. **Detach the coolant expansion tank from the wheelhouse and position to one side.**

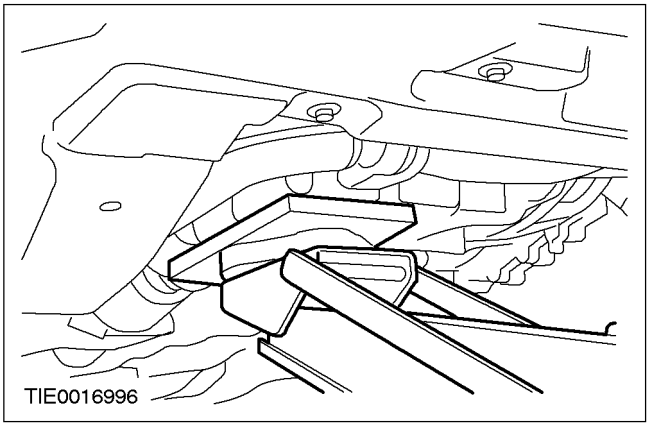


REMOVAL AND INSTALLATION (Continued)

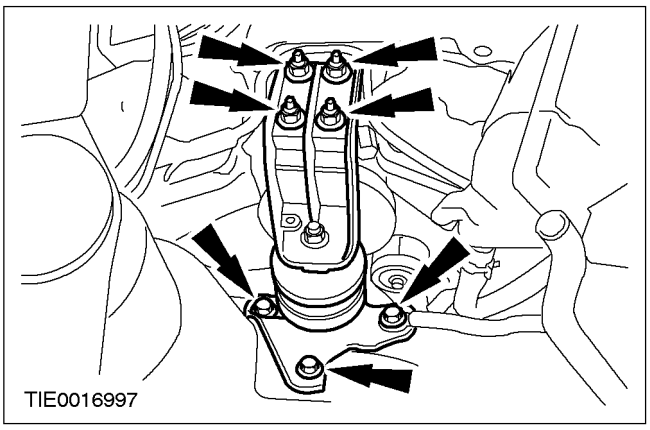
5. Detach the spark plug leads from the engine front mount.



6. Using a suitable trolley jack and wooden block, support the engine.

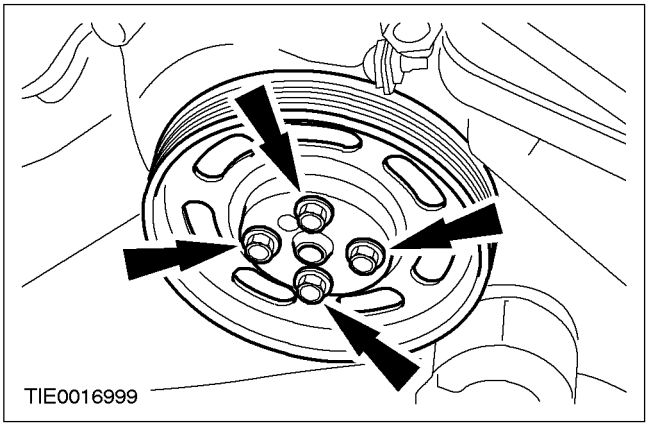


7. Remove the engine front mount.



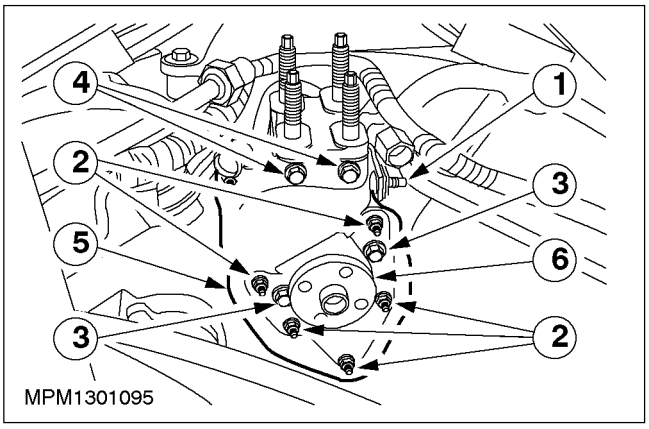
8. NOTE: Use a 8 mm Allen key to prevent the power steering pump pulley from rotating.

Remove the power steering pump pulley.



9. Remove the power steering pump.

1. Remove the power steering pump bracket retaining bolt.
2. Remove the retaining plate nuts.
3. Remove the retaining plate bolts.
4. Remove the power steering pump retaining bolts.
5. Remove the retaining plate.
6. Remove the pump.

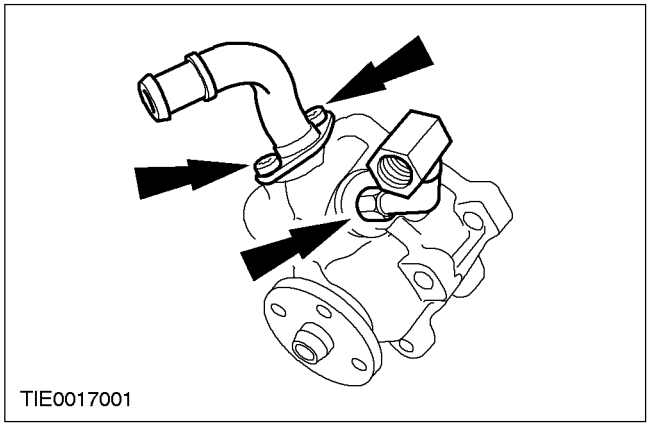


REMOVAL AND INSTALLATION (Continued)

10. NOTE: When installing a new power steering pump the power steering hose and power steering line unions should be removed.

Remove the power steering hose and power steering line unions.

- Remove and discard the O-ring seals.

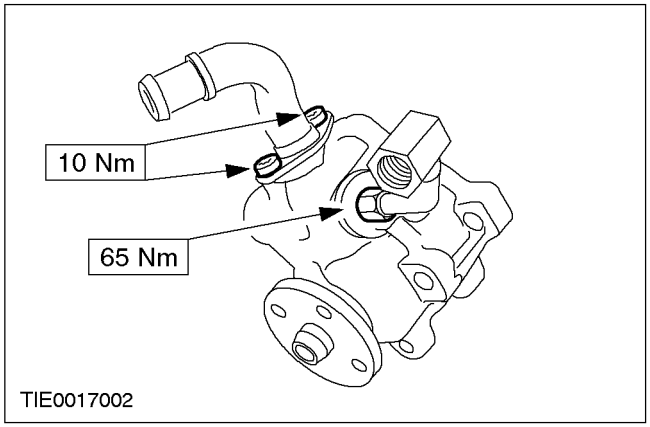


Installation

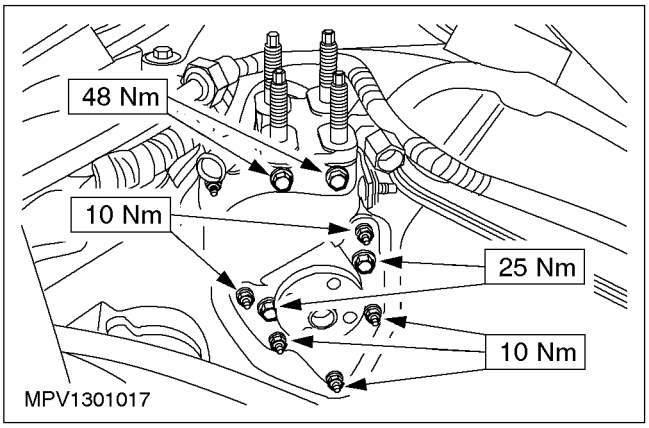
1. NOTE: When installing a new power steering pump, install the power steering hose and power steering line unions.

NOTE: Install new O-ring seals.

Install the power steering hose and power steering line unions.

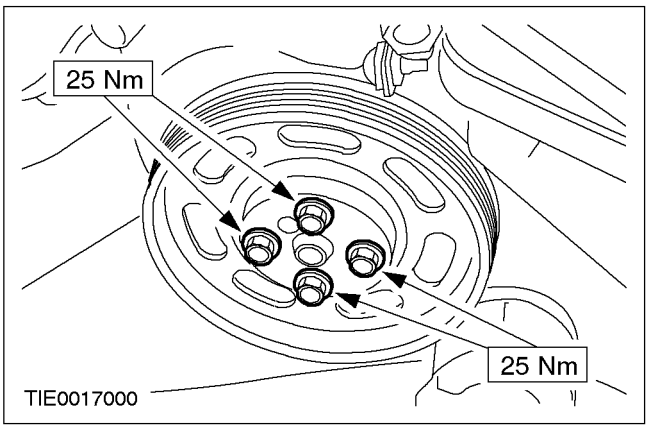


2. Install the power steering pump.



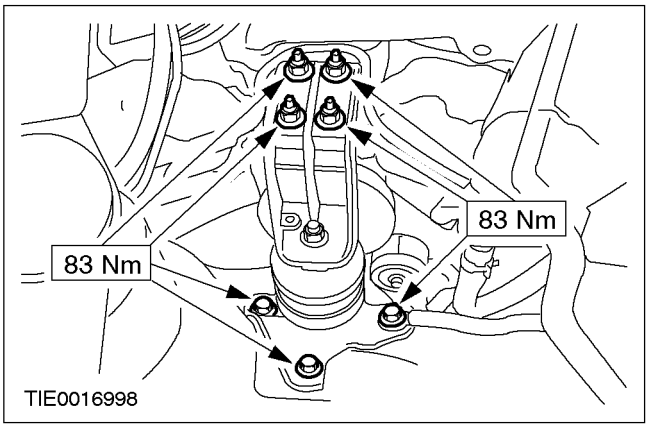
3. NOTE: Use a 8 mm Allen key to prevent the power steering pump pulley from rotating.

Install the power steering pump pulley.



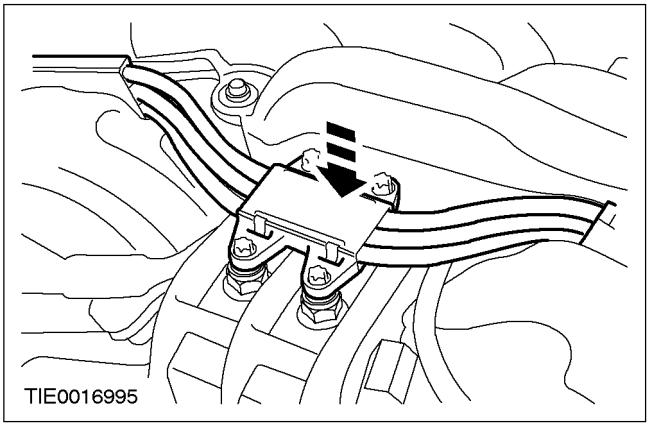
4. Install the accessory drive belt. For additional information, refer to Section 303-05.

5. Install the engine front mount.

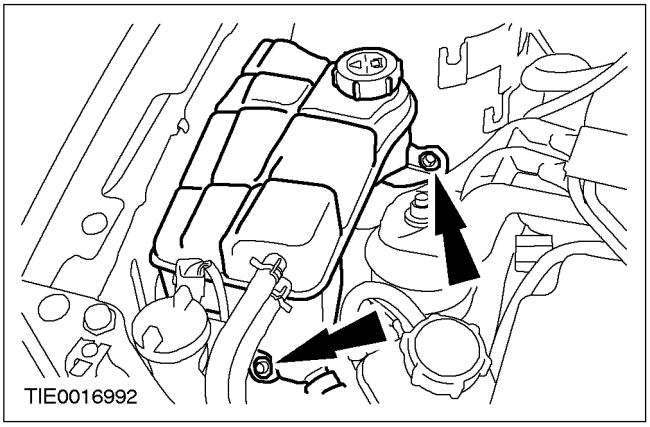


REMOVAL AND INSTALLATION (Continued)

6. Attach the spark plug leads to the engine front mount.

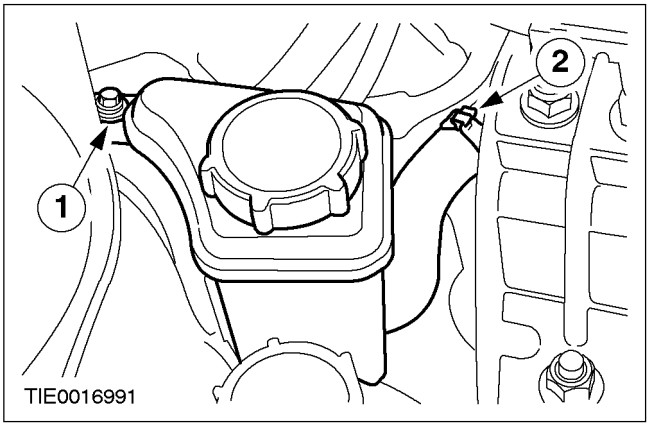


7. Attach the coolant expansion tank to the wheelhouse.



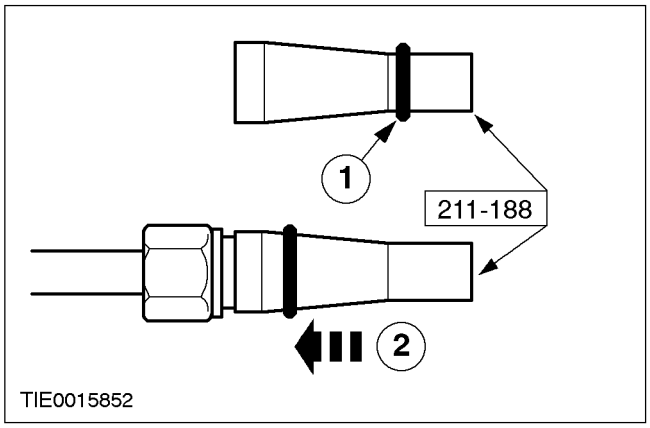
8. Attach the power steering fluid reservoir to the wheelhouse.

1. Install the retaining bolt.
2. Connect the power steering hose to the power steering pump.



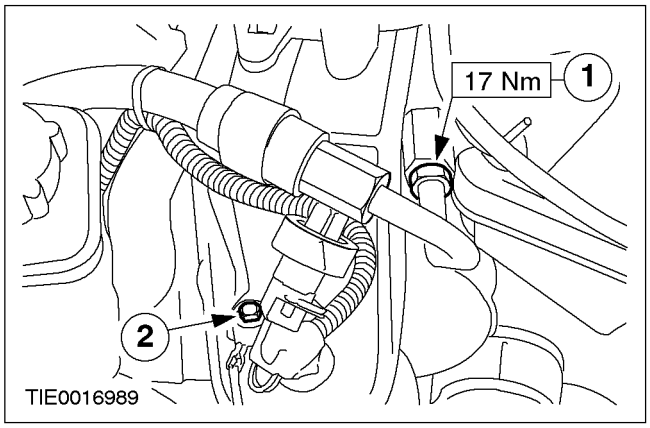
9. Using the special tool, install a new O-ring seal onto the power steering line to power steering pump union.

1. Push the O-ring seal onto the special tool.
2. Locate the special tool onto the union and install the O-ring seal.



10. Connect the power steering line to the power steering pump.

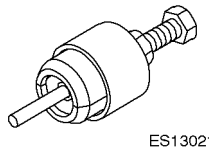
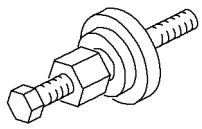
1. Connect the power steering line.
2. Install the support bracket retaining bolt.



11. Fill and bleed the power steering system. For additional information, refer to Section 211-00.

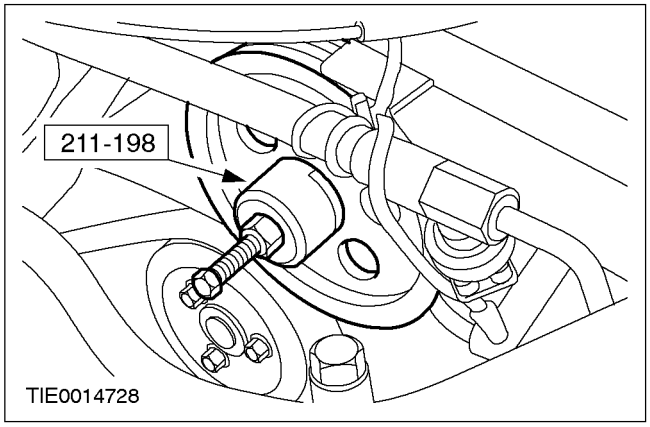
REMOVAL AND INSTALLATION

Power Steering Pump Pulley — 1.8L/2.0L (13 425 0)

Special Tool(s)	
 ES13021	Remover, Power Steering Pump Pulley 211-198 (13-021)
 21192	Installer, Camshaft Pulley 303-458 (21-192)

Removal

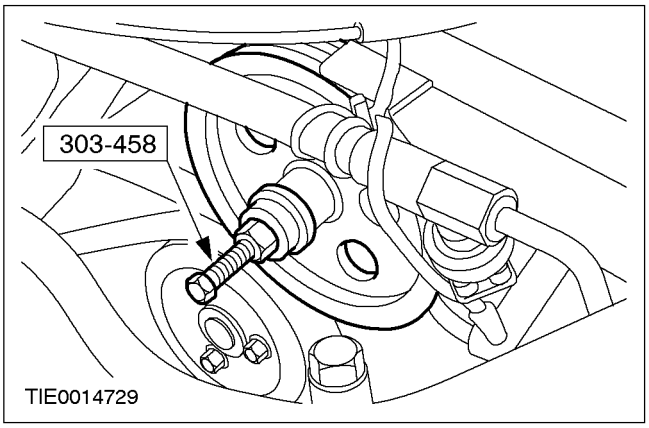
1. **Remove the accessory drive belt. For additional information, refer to Section 303-05.**
2. **Using the special tool, remove the power steering pump pulley.**



Installation

1. **NOTE:** Install the power steering pump pulley flush with the end of the power steering pump shaft.

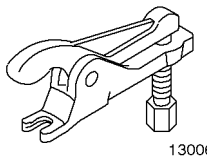
   Using the special tool, install the power steering pump pulley.



2. **Install the accessory drive belt. For additional information, refer to Section 303-05.**

REMOVAL AND INSTALLATION

Steering Gear (13 116 0)

Special Tool(s)	
 13006	Separator, Ball Joint 211-020 (13-006)

General Equipment
Transmission Jack

Name	Specification
Anti-seize grease	SAM-1C9107-A

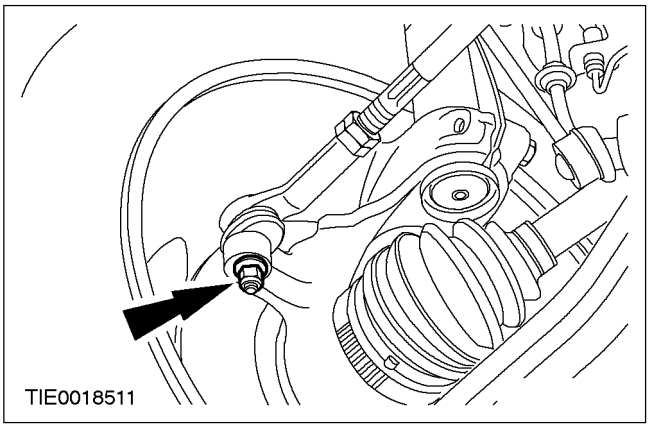
Removal

All vehicles

1. **Remove the steering column flexible coupling. For additional information, refer to Section 211-04.**
2. **CAUTION: Leave the tie-rod end retaining nuts in place to protect the ball joint studs.**

NOTE: Use a 5 mm Allen key to prevent the ball joint stud from rotating.

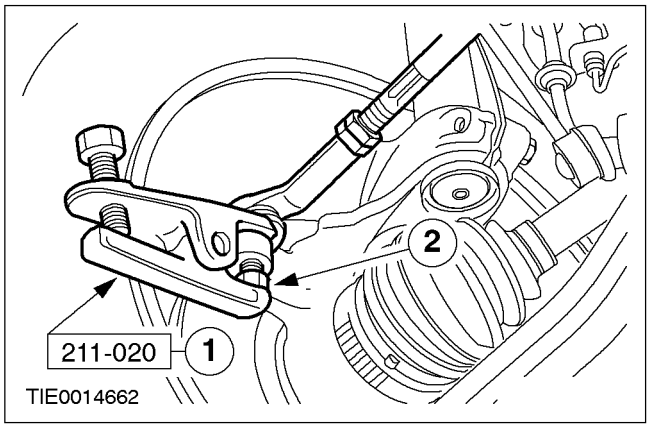
Loosen the left-hand and right-hand tie-rod end retaining nut (left-hand side shown).



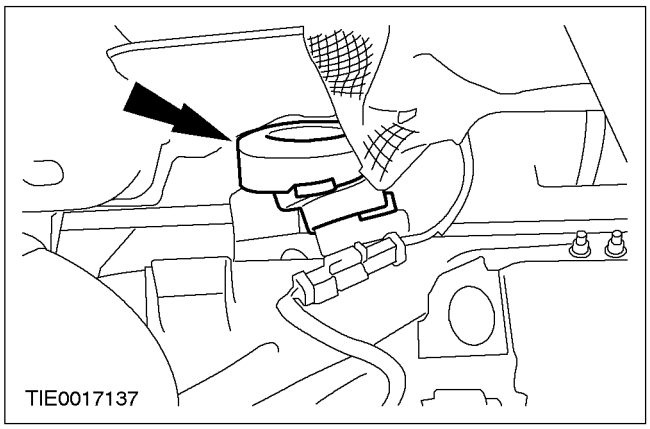
3. **CAUTION: Protect the ball joint seals using a soft cloth to prevent damage.**

Using the special tool, detach the left-hand and right-hand tie-rod end from the wheel knuckle (left-hand side shown).

1. Release the tie-rod ends.
2. Remove the tie-rod end retaining nuts.
   - Discard the nuts.



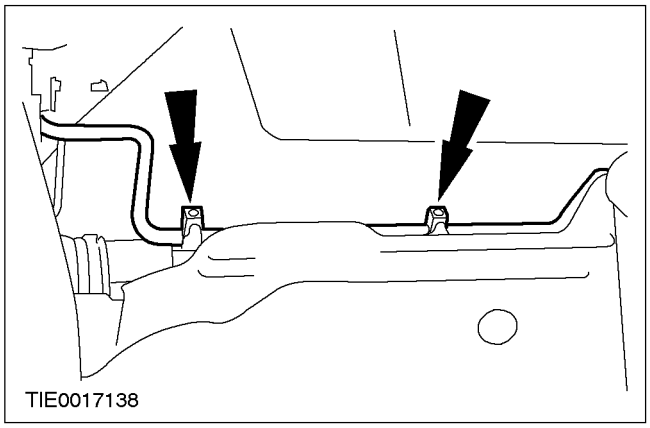
4. **Remove the steering gear bulkhead floor seal.**



REMOVAL AND INSTALLATION (Continued)

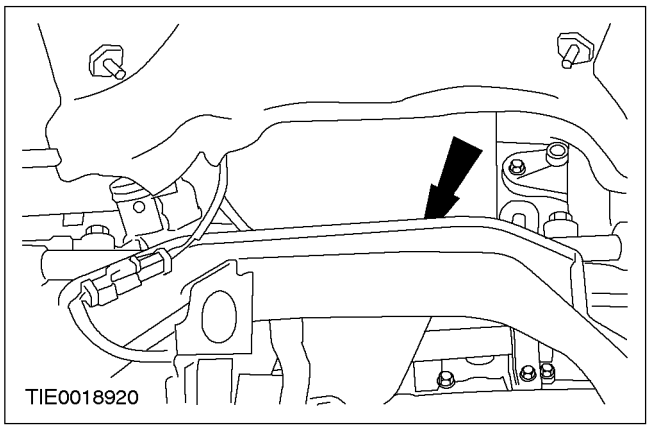
Vehicles with 2.5L engine

5. Detach the power steering lines from the steering gear.



Vehicles with 1.8L, 2.0L and diesel engine.

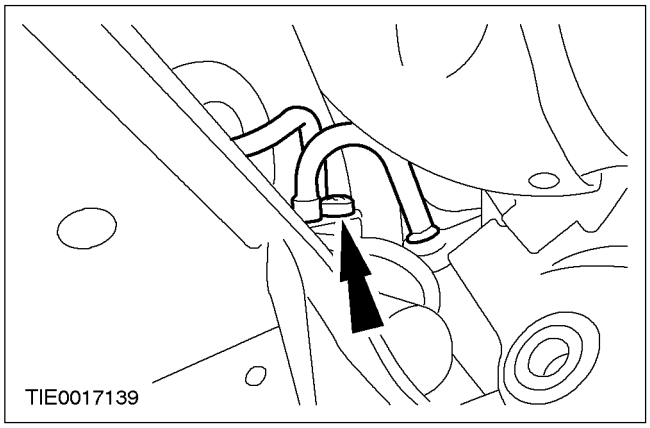
6. Detach the power steering lines from the steering gear.



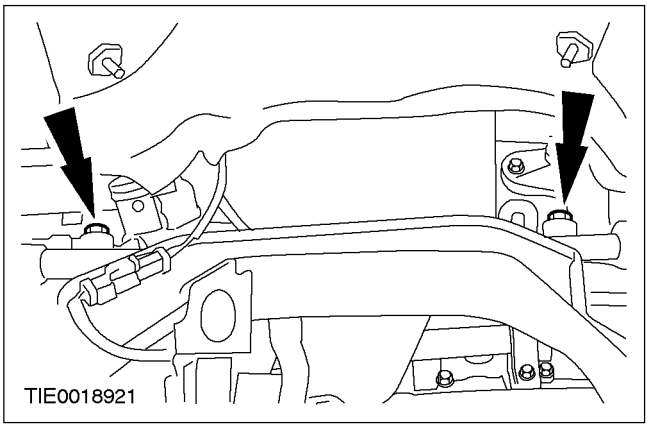
All vehicles

7. Detach the power steering lines from the steering gear valve body.

- Discard the retaining bolt.
- Discard the O-ring seals.

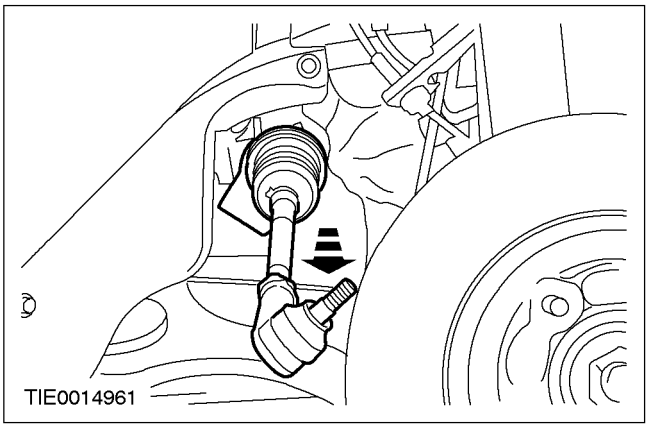


8. Remove the steering gear retaining bolts.



9. NOTE: Remove the steering gear through the wheel arch.

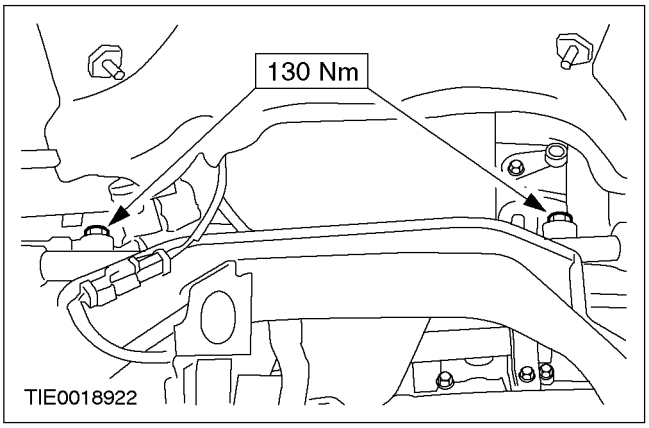
Remove the steering gear through the wheel arch.



Installation

All vehicles

1. Install the steering gear.

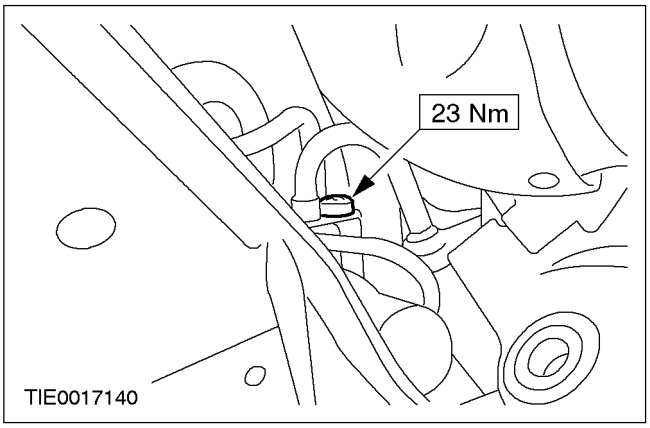


REMOVAL AND INSTALLATION (Continued)

2. ⚠ **WARNING: Install a new retaining bolt. Failure to follow this instruction may result in personal injury.**

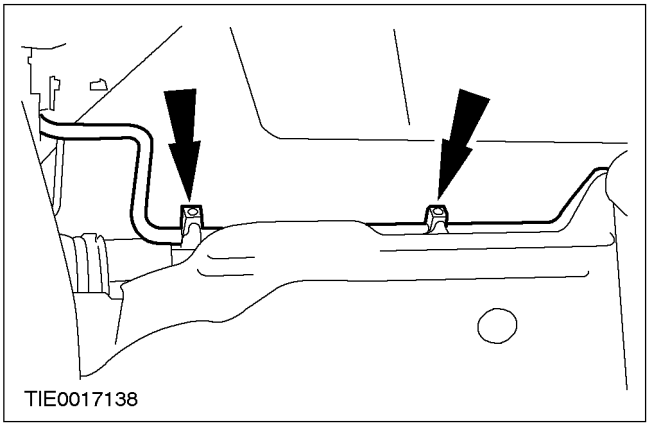
NOTE: Install new o-ring seals.

Attach the power steering lines to the steering gear valve body.



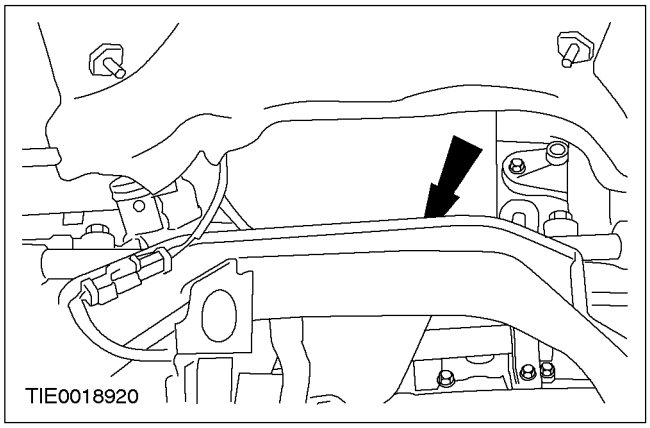
Vehicles with 2.5L engine

3. **Attach the power steering lines to the steering gear.**



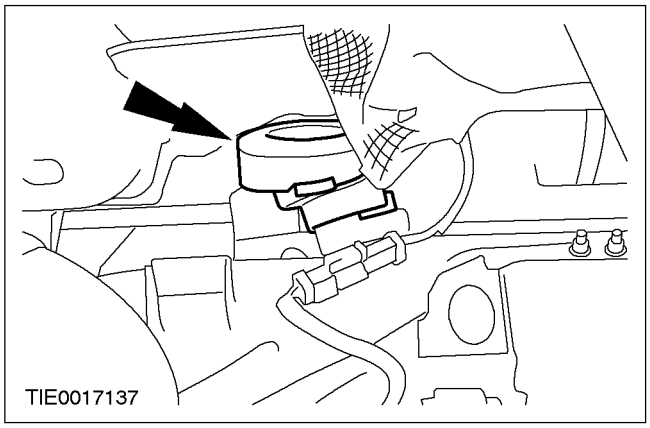
Vehicles with 1.8L, 2.0L and diesel engine

4. **Attach the power steering lines to the steering gear.**



All vehicles

5. **Install the steering gear bulkhead floor seal.**



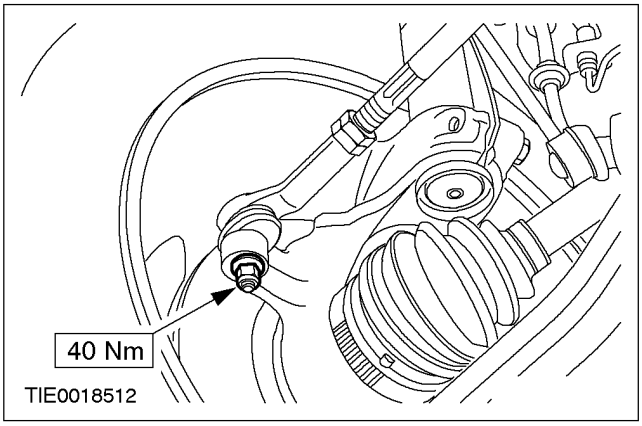
6. **Install the steering column flexible coupling. For additional information, refer to Section 211-04.**

REMOVAL AND INSTALLATION (Continued)

7. **WARNING: Install new tie-rod end retaining nuts. Failure to follow this instruction may result in personal injury.**

NOTE: Use a 5 mm Allen key to prevent the ball joint stud from rotating.

Attach the tie-rod end to the left-hand and right-hand wheel knuckle (left-hand side shown).



8. **Fill and bleed the power steering system. For additional information, refer to Section 211-00.**
9. **Adjust the front wheel alignment. For additional information, refer to Section 204-00.**

Vehicles with stability assist

10. **WARNING: The electronic stability program must be re-configured. Failure to follow this instruction, may result in personal injury.**

Configure the electronic stability program using WDS.

SECTION 211-03 Steering Linkage

VEHICLE APPLICATION: 2003.0 Mondeo

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Steering Linkage 211-03-3

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Tie-Rod End ..... (13 273 0) 211-03-8
Steering Gear Boot ..... (13 134 0) 211-03-10

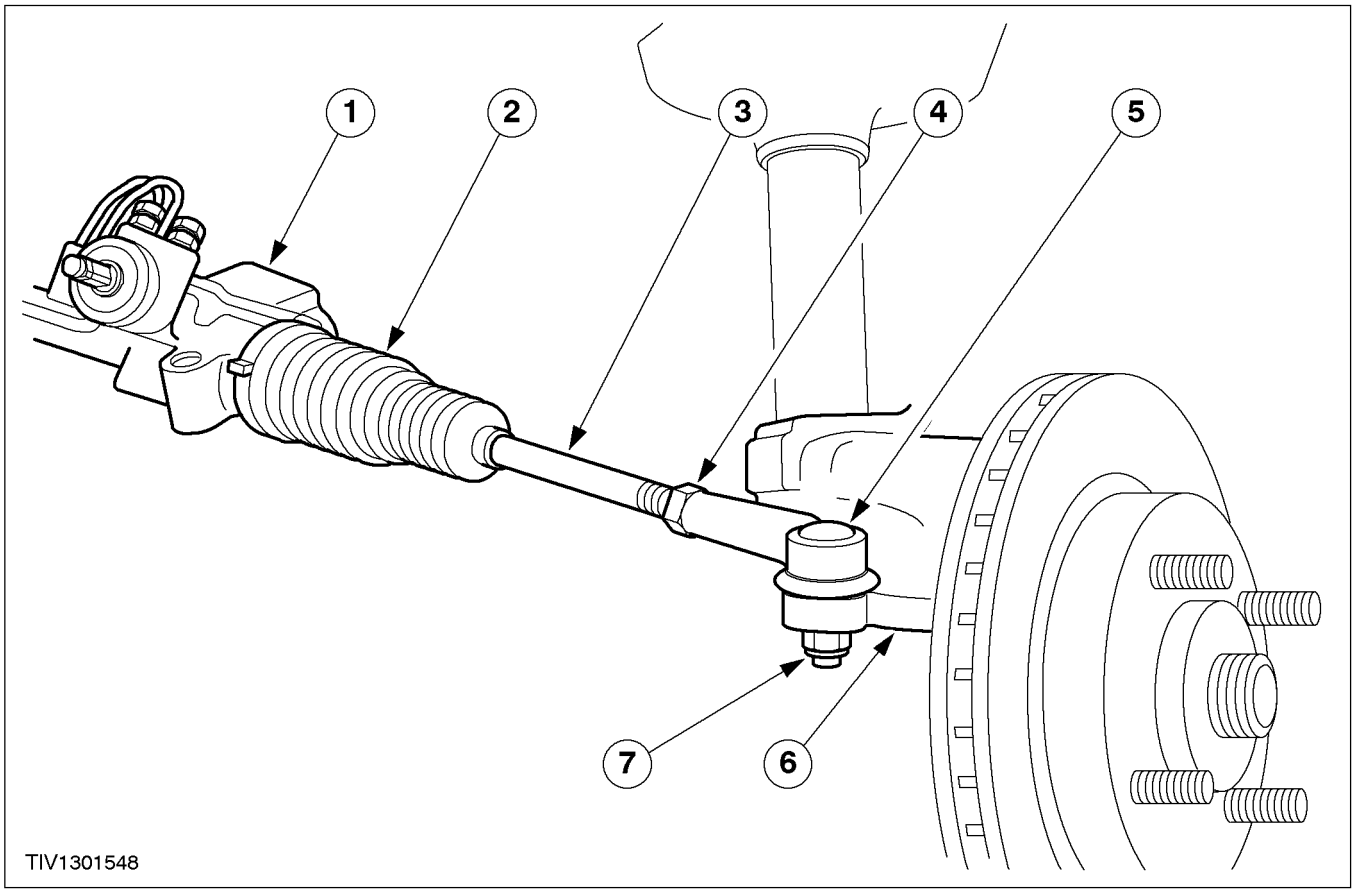
SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Tie-rod end retaining nut	40	30	-
Tie-rod end locknut	40	30	-
Tie-rod to steering gear	110	81	-

DESCRIPTION AND OPERATION

Steering Linkage



Item	Part Number	Description
1	-	Steering gear
2	-	Steering gear boot
3	-	Tie-rod
4	-	Tie-rod end locknut
5	-	Tie-rod end
6	-	Wheel knuckle
7	-	Tie-rod end retaining nut

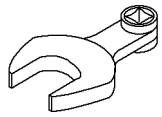
DIAGNOSIS AND TESTING

Steering Linkage

REFER to Section 211-00.

REMOVAL AND INSTALLATION

Tie-Rod (13 263 0)

Special Tool(s)	
 13025	Socket, Tie-Rod End, Steering Gear 211-245 (13-025)

General Equipment
Vice jaw protectors
Pincers

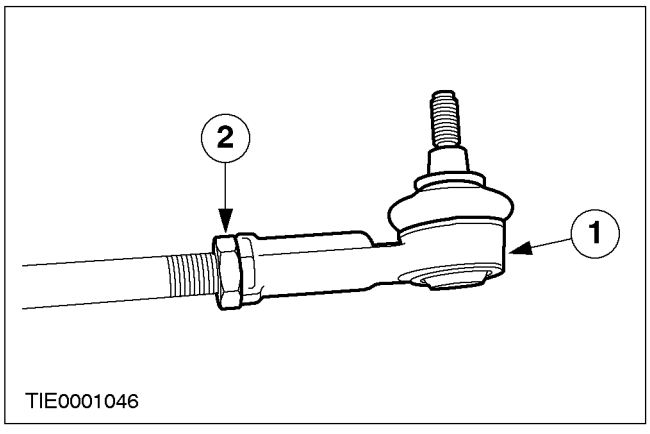
Name	Specification
Grease	ESB-M1C119-B

Removal

1. **Remove the steering gear. For additional information, refer to Section 211-02.**
2. **NOTE:** Make a note of the number of turns used to remove the tie-rod end.

   Remove the tie-rod end and the tie-rod end locknut.

   1. Remove the tie-rod end.
   2. Remove the tie-rod end locknut.

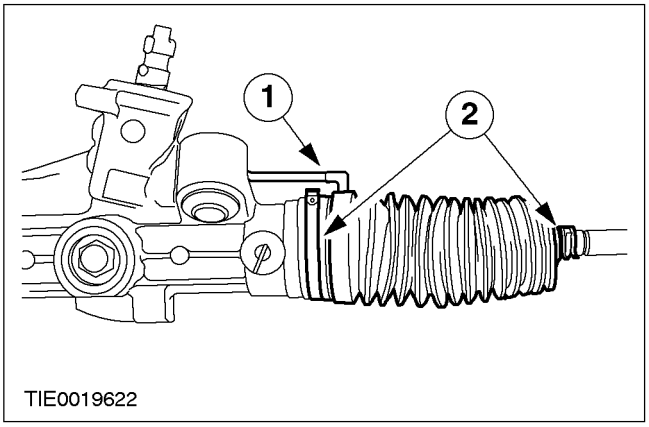


TIE0001046

3. **NOTE:** Make sure the tie-rod is clean before removing the steering gear boot.

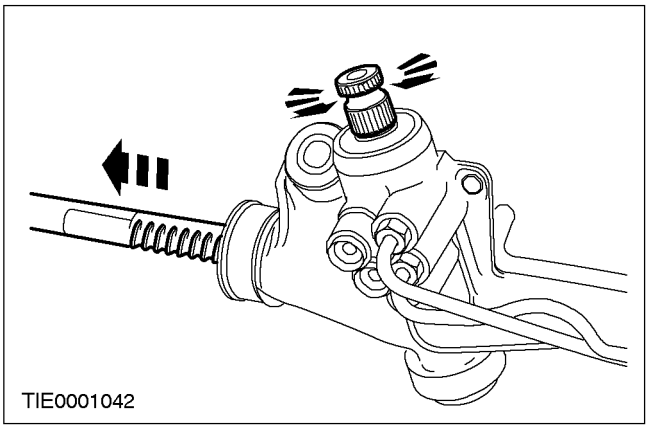
   Remove the steering gear boot.

   1. Detach the steering gear breather pipe from the steering gear boot.
   2. Remove the steering gear boot retaining clamps.
   - Discard the clamps.



TIE0019622

4. **Rotate the steering gear pinion to expose the rack.**


TIE0001042

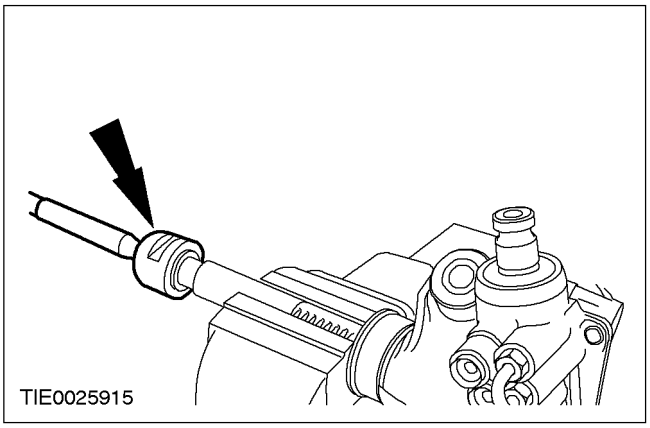
REMOVAL AND INSTALLATION (Continued)

5. **CAUTION: Do not clamp the steering rack on exposed hydraulic sealing surfaces.**

CAUTION: Make sure vise jaw protectors are used.

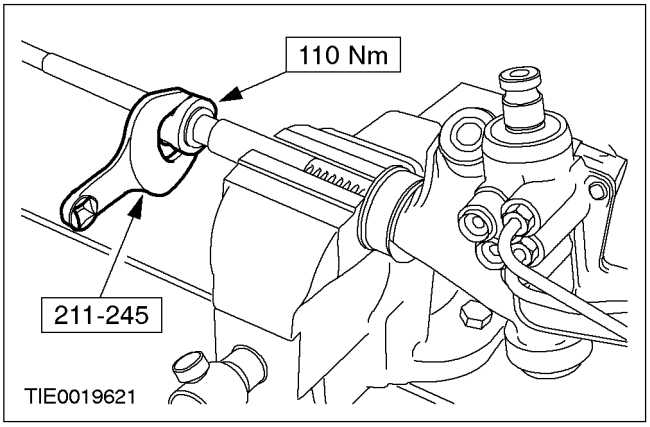
CAUTION: Clamp the steering rack in vise jaws. Do not clamp the steering gear body.

Secure the steering gear in a vice and using a suitable pipe wrench, remove the tie-rod.



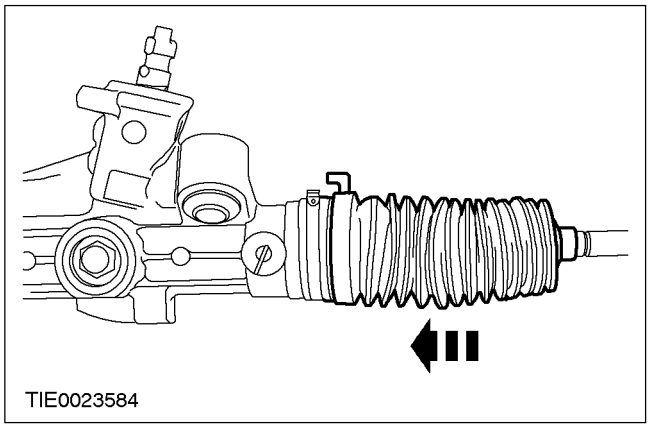
Installation

1. Using the special tool, install the tie-rod.



2. NOTE: Lubricate the steering gear boot.

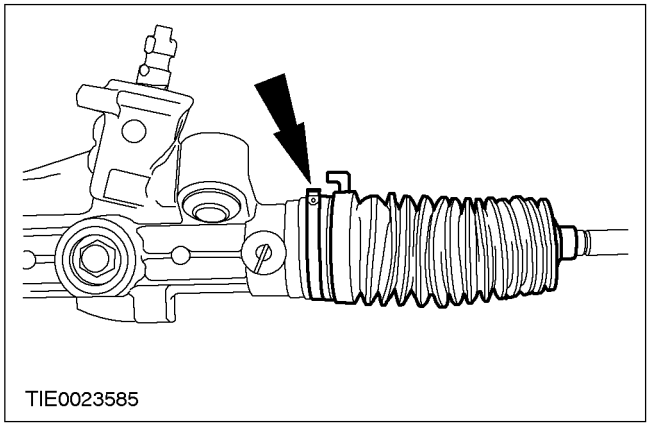
Install the steering gear boot.



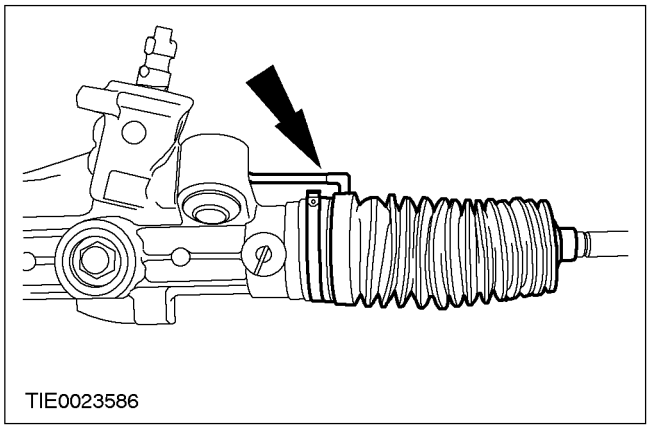
3. NOTE: Make sure the steering gear breather pipe connection is at the top.

NOTE: Install a new steering gear boot inner clamp.

Using a suitable pair of pincers, install the steering gear boot inner clamp.



4. Attach the steering gear breather pipe.

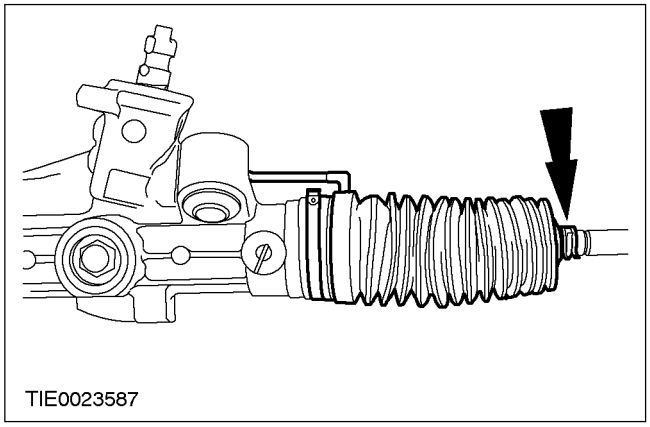


REMOVAL AND INSTALLATION (Continued)

5. **NOTE:** Make sure the steering gear boot outer clamp is located over the recess in the tie-rod.

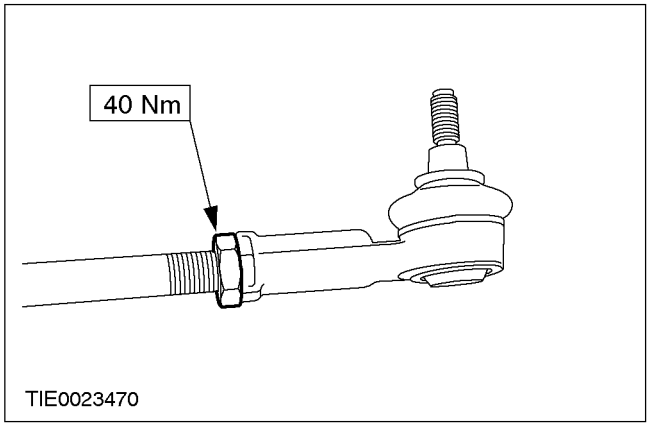
NOTE: Install a new steering gear boot outer clamp.

Using a suitable pair of pincers, install the steering gear boot outer clamp.



6. **NOTE:** Install the tie-rod end using the same number of turns used to remove it.

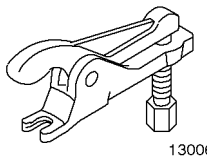
Install the tie-rod end and tie-rod end lock-nut.



7. **Install the steering gear. For additional information, refer to Section 211-02.**
8. **Adjust the front wheel alignment. For additional information, refer to Section 204-00.**

REMOVAL AND INSTALLATION

Tie-Rod End (13 273 0)

Special Tool(s)	
 13006	Separator, Ball Joint 211-020 (13-006)

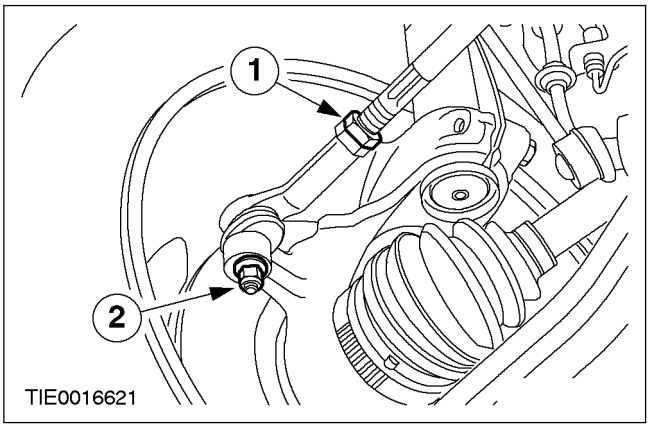
Removal

1. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
2. **CAUTION: Leave the tie-rod end retaining nut in place to protect the ball joint stud.**

NOTE: Use a 5 mm Allen key to prevent the ball joint stud from rotating.

Loosen the tie-rod end locknut and the tie-rod end retaining nut.

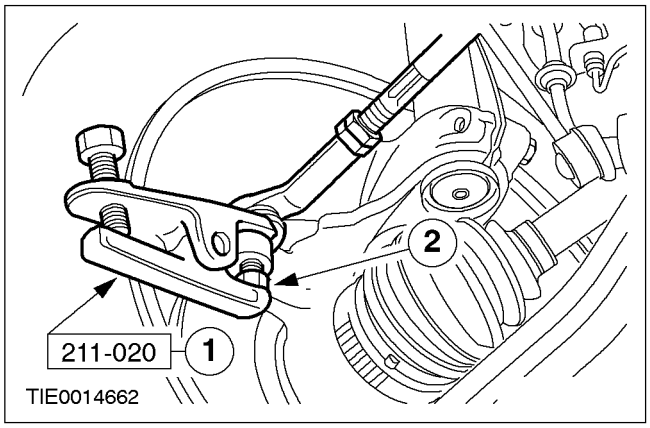
1. Loosen the locknut.
2. Loosen the retaining nut.



3. **CAUTION: Protect the ball joint seal using a soft cloth to prevent damage.**

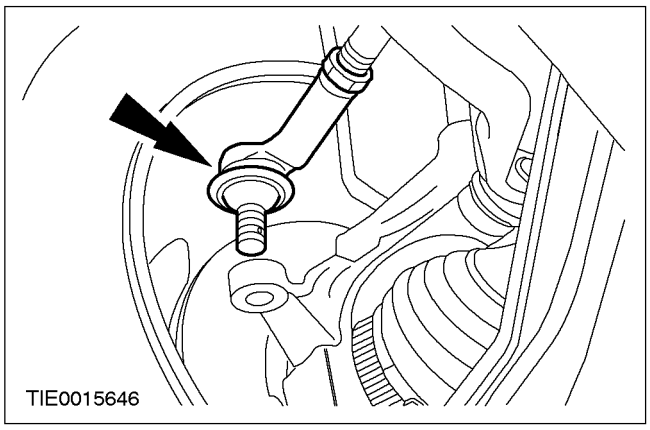
Using the special tool, detach the tie-rod end from the wheel knuckle.

1. Release the tie-rod end.
2. Remove the tie-rod end retaining nut.
- Discard the retaining nut.



4. **NOTE:** Make a note of the number of turns used to remove the tie-rod end.

Remove the tie-rod end.

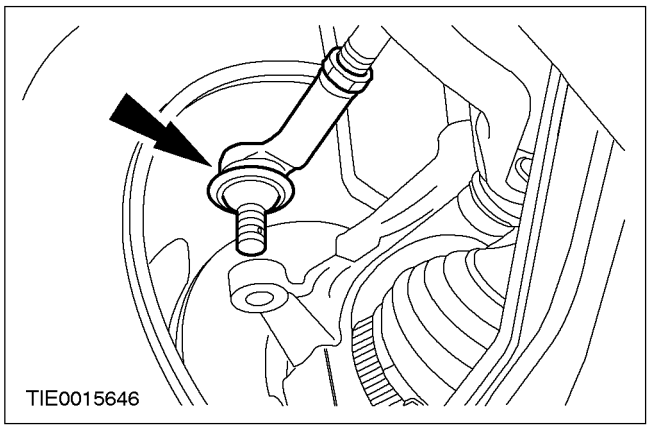


REMOVAL AND INSTALLATION (Continued)

Installation

1. **NOTE:** Install the tie-rod end using the same number of turns used to remove it.

   Install the tie-rod end.

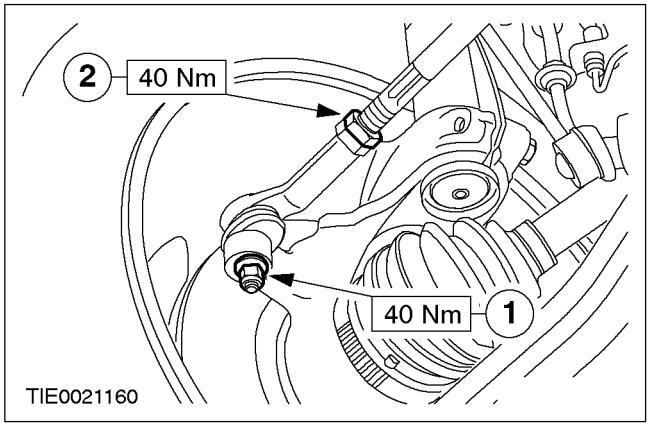


2. **WARNING: Install a new tie-rod end retaining nut. Failure to follow this instruction may result in personal injury.**

NOTE: Use a 5 mm Allen key to prevent the ball joint from rotating.

Tighten the tie-rod end locknut and the tie-rod end retaining nut.

1. Tighten the retaining nut.
2. Tighten the locknut.



3. **Lower the vehicle.**
4. **Check the toe setting and adjust as necessary. For additional information, refer to Section 204-00.**

REMOVAL AND INSTALLATION

Steering Gear Boot (13 134 0)

General Equipment
Pincers

Name	Specification
Grease	ESB-M1C119-B

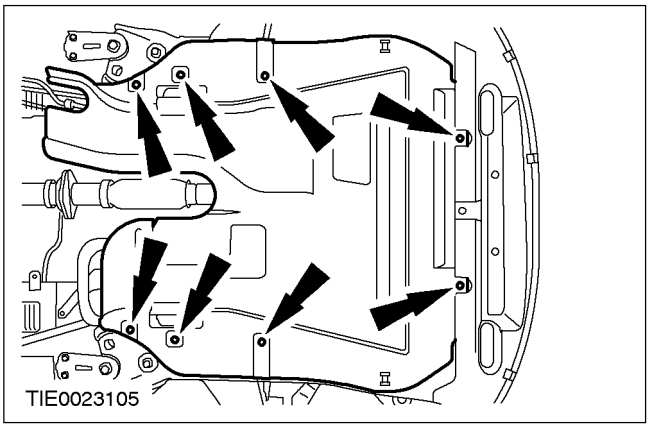
Removal

All vehicles

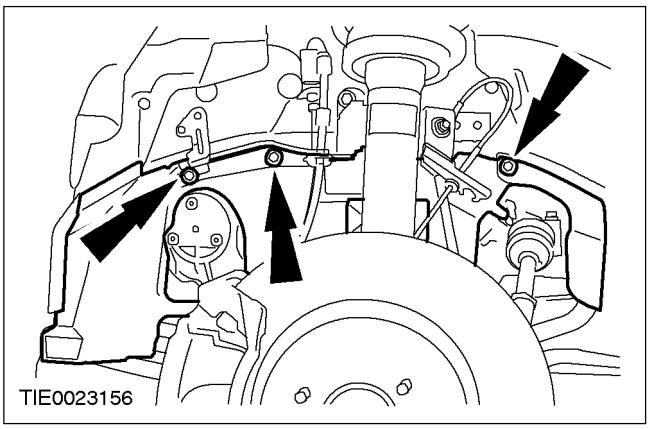
1. **Remove the tie-rod end.** **For additional information, refer to Tie-Rod End in this section.**

Vehicles with diesel engine

2. **Remove the engine undershield.**

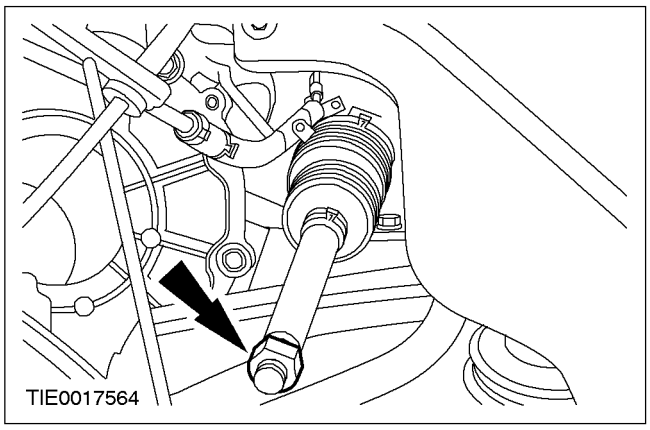


3. **Remove the splash shield (left-hand side only).**



All vehicles

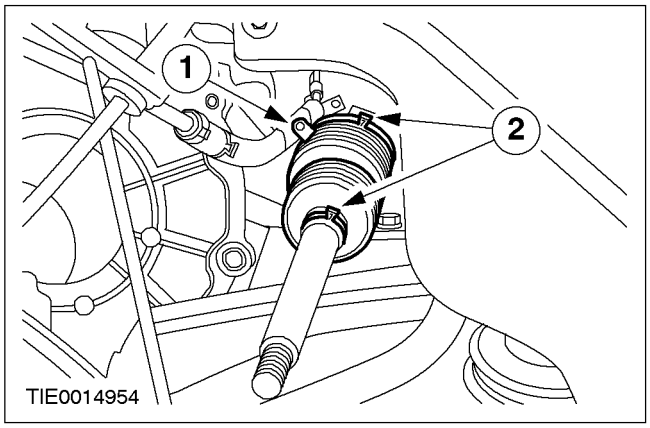
4. **Remove the tie-rod end locknut.**



5. **NOTE:** Make sure the tie-rod is clean before removing the steering gear boot.

Remove the steering gear boot.

1. Detach the steering gear breather pipe from the steering gear boot.
2. Remove the steering gear boot clamps.
   - Discard the clamps.



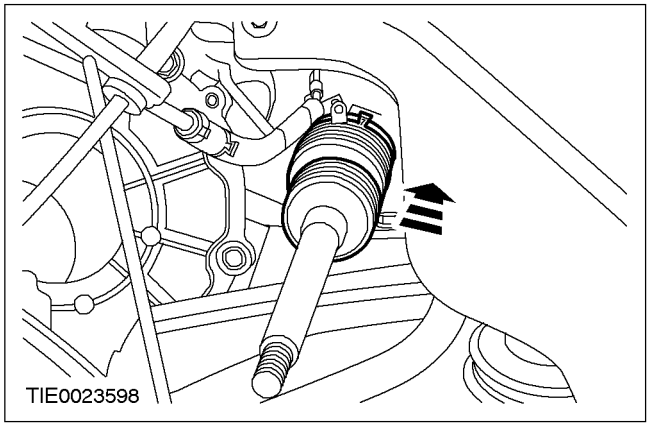
REMOVAL AND INSTALLATION (Continued)

Installation

All vehicles

1. NOTE: Lubricate the steering gear boot.

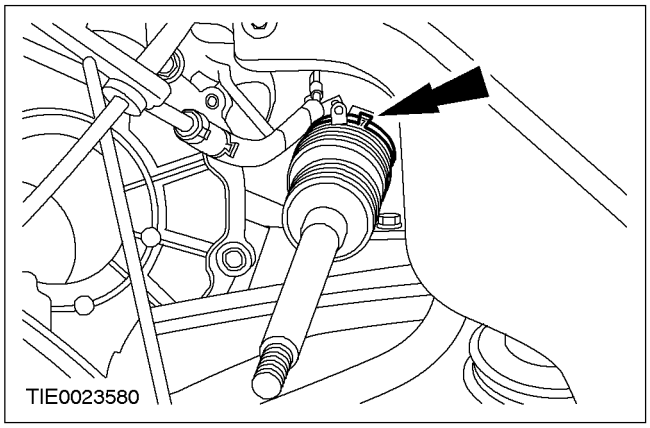
Install the steering gear boot.



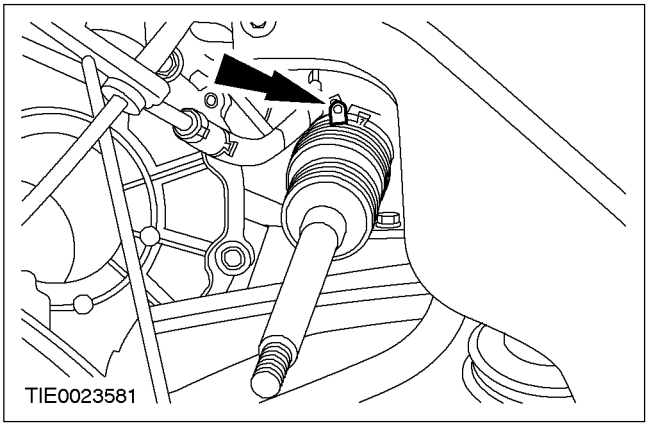
2. NOTE: Make sure the steering gear breather pipe connection is at the top.

NOTE: Install a new steering gear boot inner clamp.

Using a suitable pair of pincers, install the new steering gear boot inner clamp.



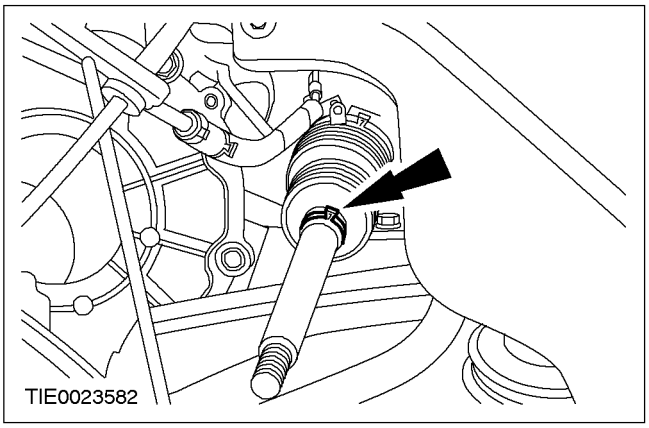
3. Attach the steering gear breather pipe to the steering gear boot.



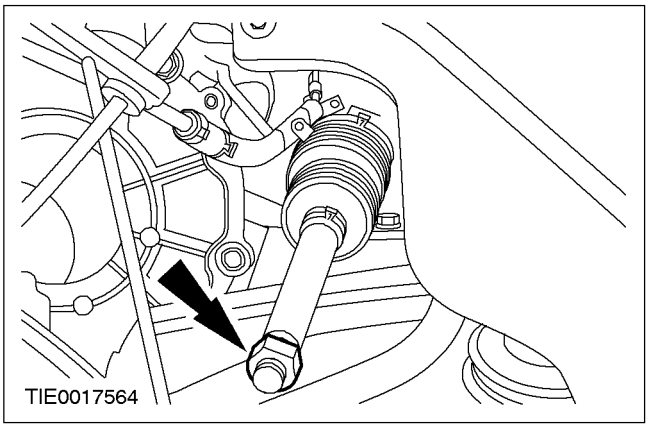
4. NOTE: Make sure the steering gear boot outer clamp is located over the recess in the tie-rod.

NOTE: Install a new steering gear boot outer clamp.

Using a suitable pair of pincers, install the steering gear boot outer clamp.



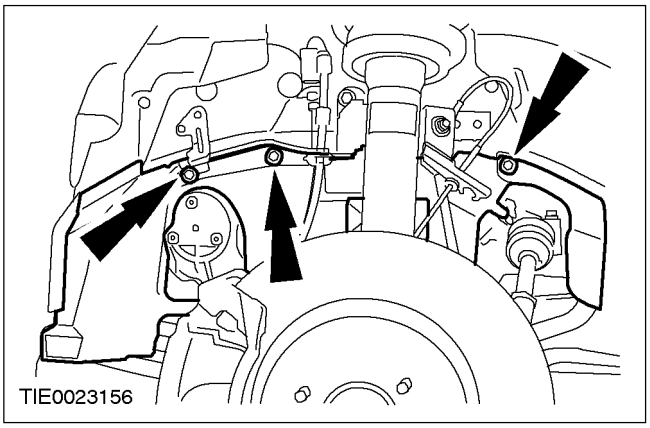
5. Install the tie-rod end locknut.



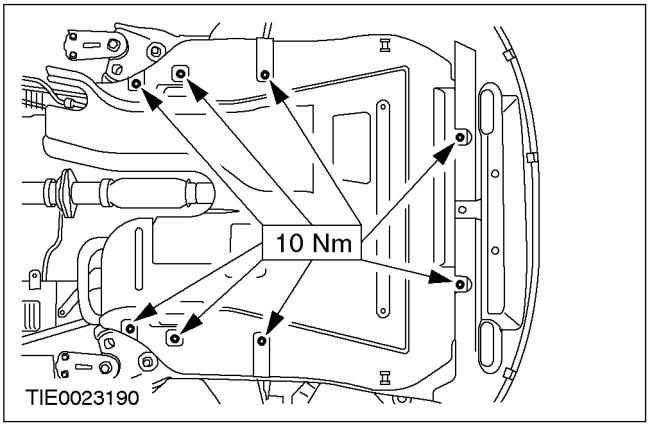
REMOVAL AND INSTALLATION (Continued)

Vehicles with diesel engine

6. **Install the splash shield (left-hand side only).**



7. **Install the engine undershield.**



All vehicles

8. **Install the tie-rod end.** **For additional information, refer to Tie-Rod End in this section.**

SECTION 211-04 Steering Column

VEHICLE APPLICATION: 2003.0 Mondeo

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Ignition Switch Lock Cylinder 211-04-7
Steering Column ..... (13 542 0) 211-04-9
Steering Column Flexible Coupling ..... (13 566 0) 211-04-15

DISASSEMBLY AND ASSEMBLY

Steering Column ..... (13 543 4) 211-04-24

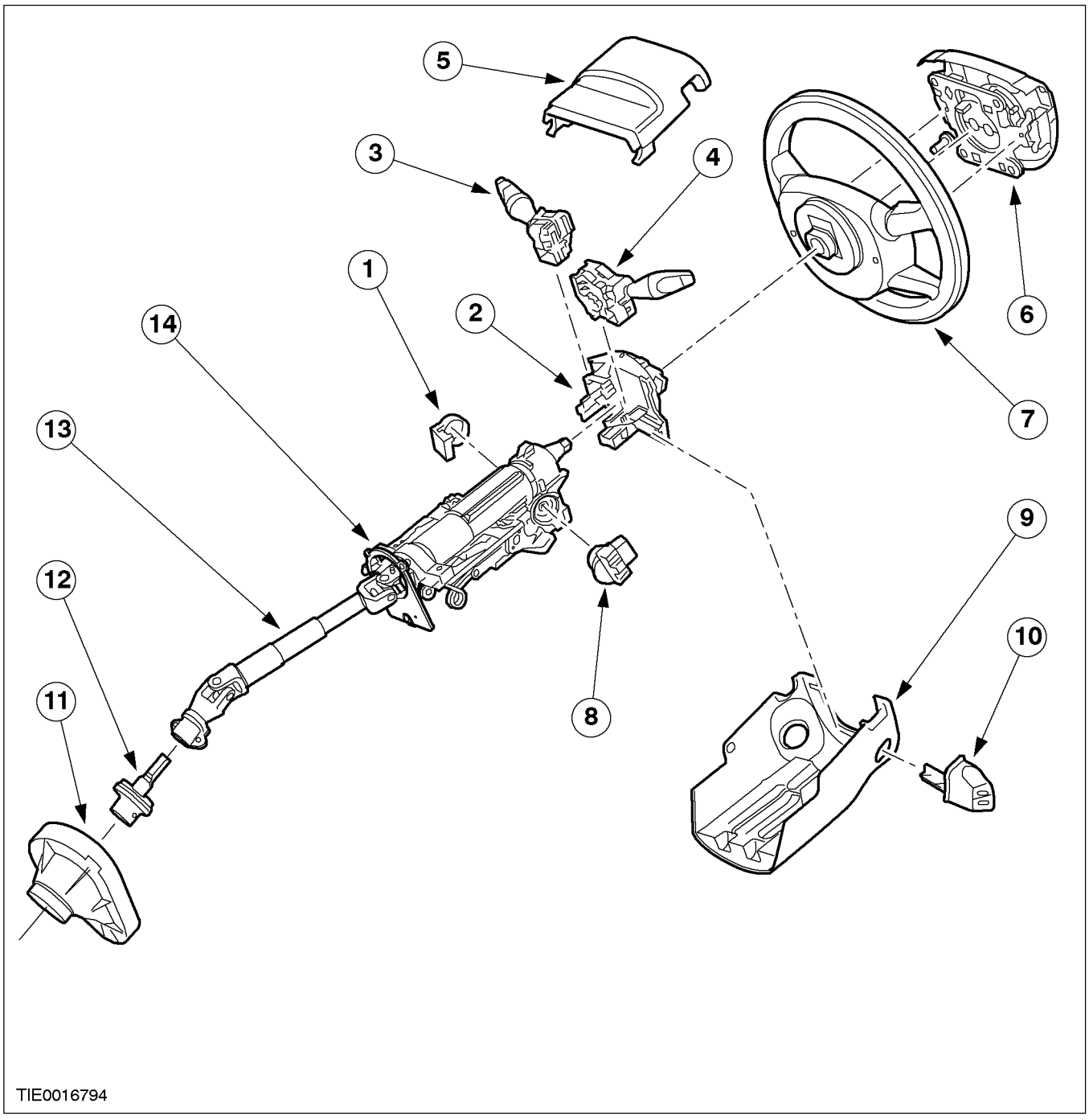
SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Steering wheel retaining bolt	45	33	-
Steering column retaining bolts	24	18	-
Steering wheel rotation sensor retaining screws	1	-	9
Driver air bag module retaining screws	5	-	44
Steering column shaft to flexible coupling bolt	20	15	-
Flexible coupling to steering gear pinion pinch bolt	25	18	-

DESCRIPTION AND OPERATION

Steering Column



Item	Part Number	Description
1	–	Passive anti–theft system (PATS) transceiver
2	–	Clockspring

Item	Part Number	Description
3	–	Windshield wiper/washer switch
4	–	Turn signal lamp switch

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
5	–	Steering column upper shroud
6	–	Driver air bag module
7	–	Steering wheel
8	–	Ignition switch
9	–	Steering column lower shroud
10	–	Audio control switch
11	–	Steering gear to bulkhead seal
12	–	Steering column flexible coupling
13	–	Steering column
14	–	Steering wheel rotation sensor

DIAGNOSIS AND TESTING

Steering Column

REFER to Section 211-00.

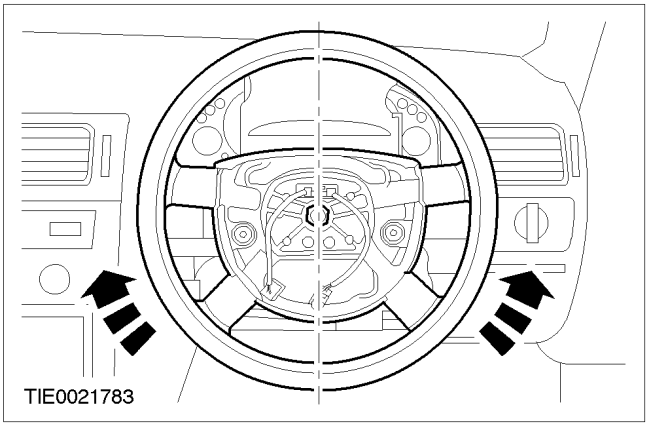
REMOVAL AND INSTALLATION

Steering Wheel (13 524 0)

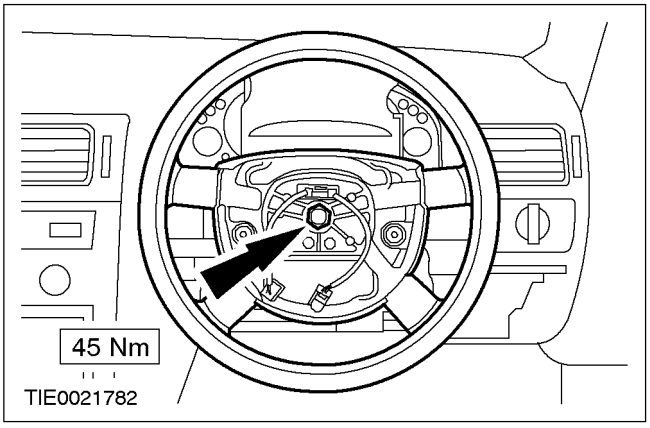
Removal

1. **Remove the driver air bag module. For additional information, refer to Section 501-20A / 501-20B.**
2. **NOTE:** Make sure the road wheels are in the straight ahead position.

   Centralize the steering and lock it in position.



3. **Remove the steering wheel.**



Installation

1. **To install, reverse the removal procedure.**

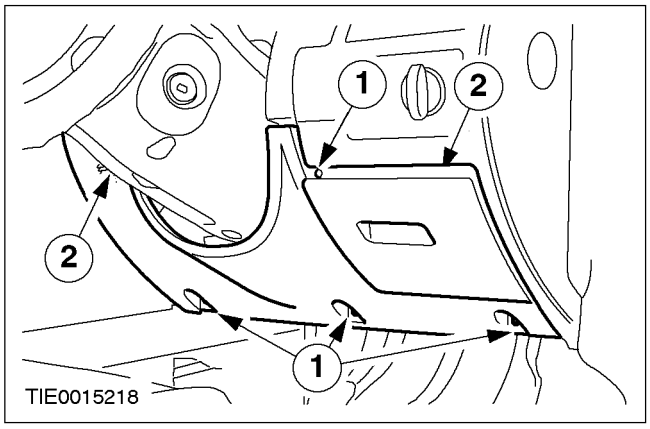
REMOVAL AND INSTALLATION

Ignition Switch Lock Cylinder

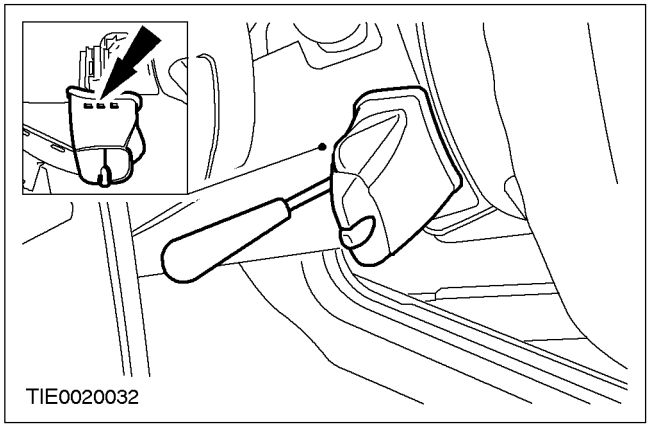
Removal

All vehicles

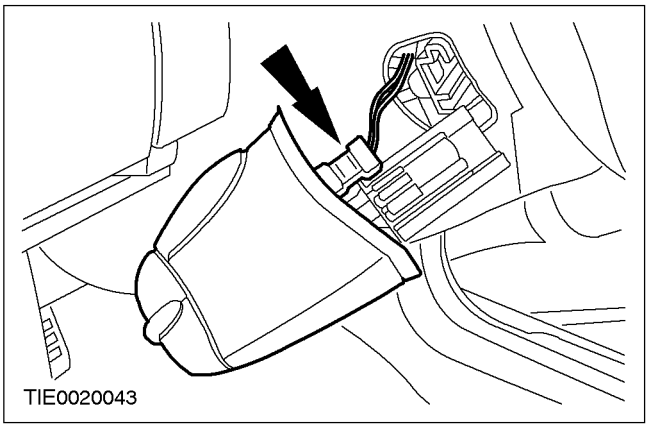
1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Remove the instrument panel lower panel.**
   1. Remove the retaining screws.
   2. Release the retaining clips.



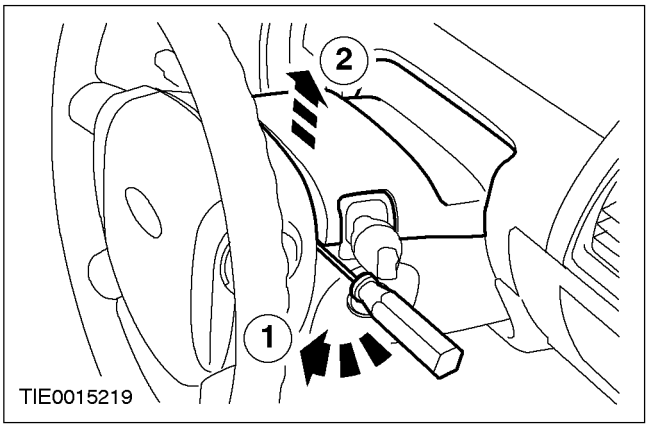
3. **Detach the audio control switch from the steering column lower shroud (if equipped).**
   - Using a thin bladed screwdriver, release the locking tang.



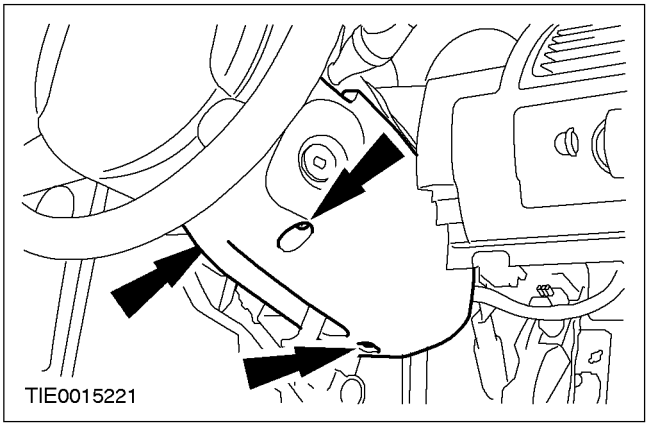
4. **Remove the audio control switch (if equipped).**
   - Disconnect the electrical connector.



5. **Detach the steering column upper shroud from the steering column lower shroud.**
   1. Using a thin bladed screwdriver, release the two clips (one each side).
   2. Detach the shroud.

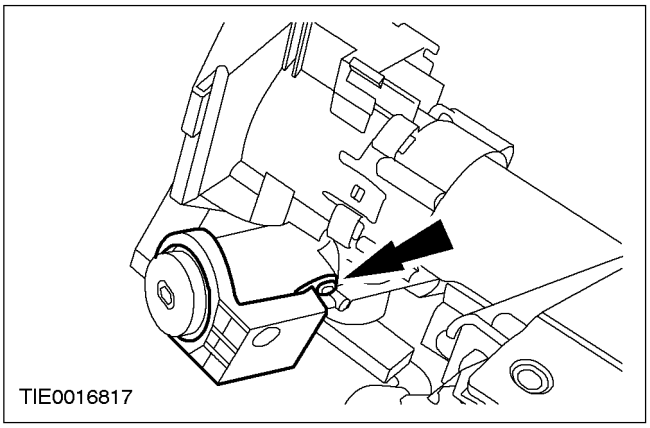


6. **Remove the steering column lower shroud.**



REMOVAL AND INSTALLATION (Continued)

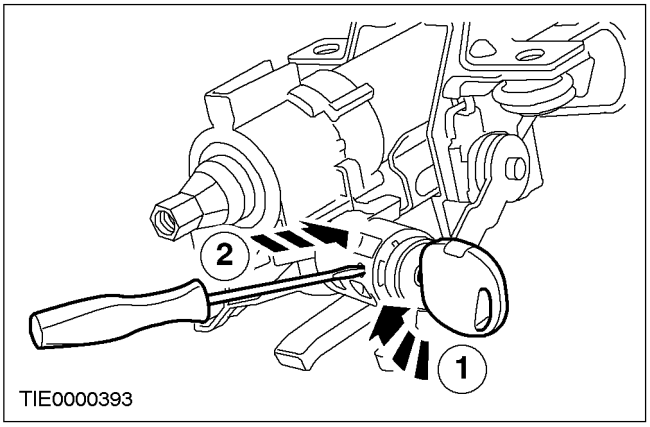
7. Remove the passive anti-theft (PATS) transceiver (steering wheel shown removed for clarity).



Left-hand drive vehicles

8. Remove the ignition lock cylinder (steering wheel shown removed for clarity).

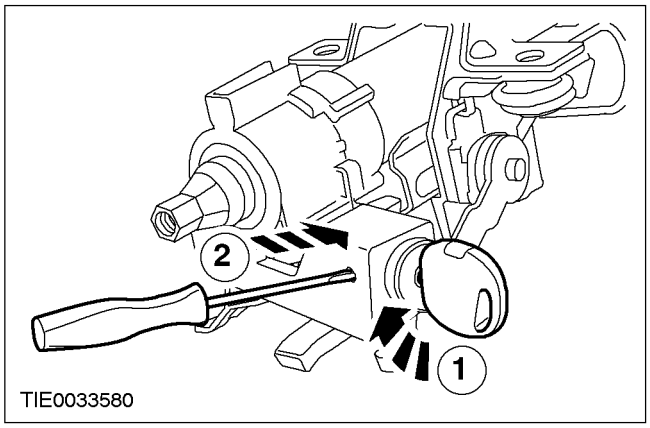
1. Insert and turn the ignition key to position I.
2. Using a thin bladed screwdriver, depress the detent.



Right-hand drive vehicles

9. Remove the ignition lock cylinder (steering wheel shown removed for clarity).

1. Insert and turn the ignition key to position I.
2. Using a thin bladed screwdriver, depress the detent.



Installation

1. **To install, reverse the removal procedure.**
2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

REMOVAL AND INSTALLATION

Steering Column (13 542 0)

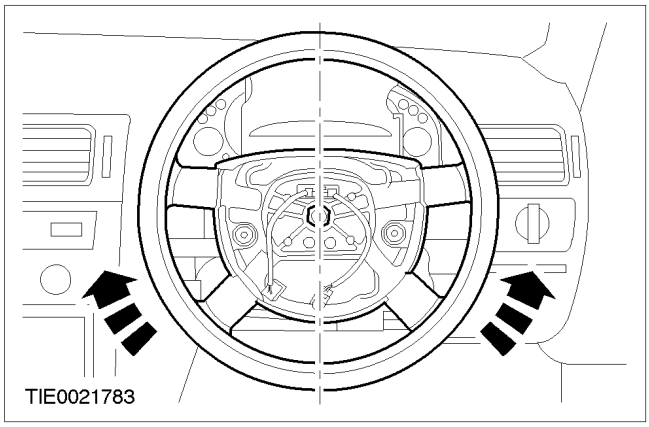
Name	Specification
Silicon Grease YS5J-M1C239-AA	

Removal

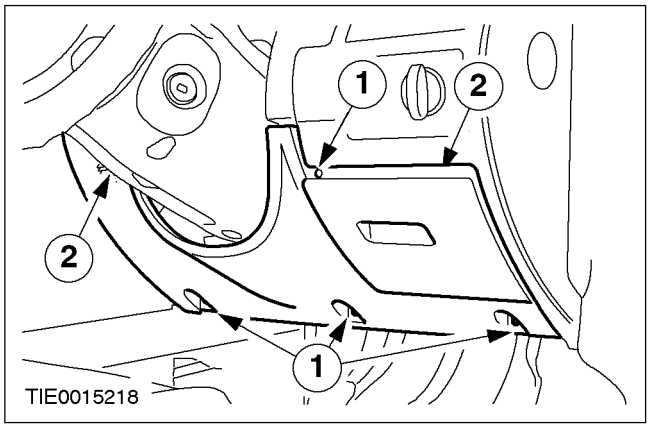
All vehicles

1. **Remove the driver air bag module. For additional information, refer to Section 501-20A / 501-20B.**
2. **NOTE:** Make sure the road wheels are in the straight ahead position.

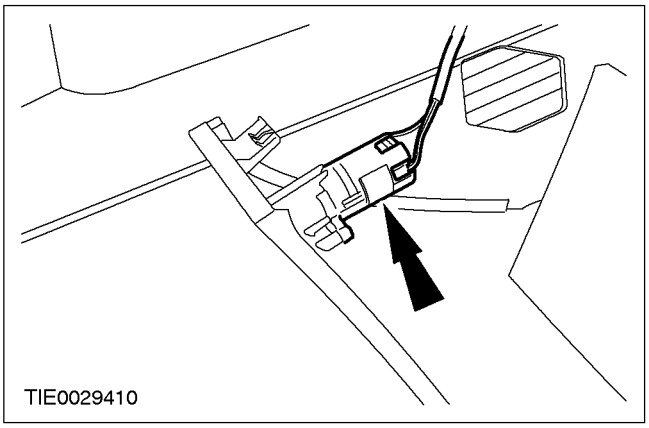
   Centralize the steering and lock it in position.



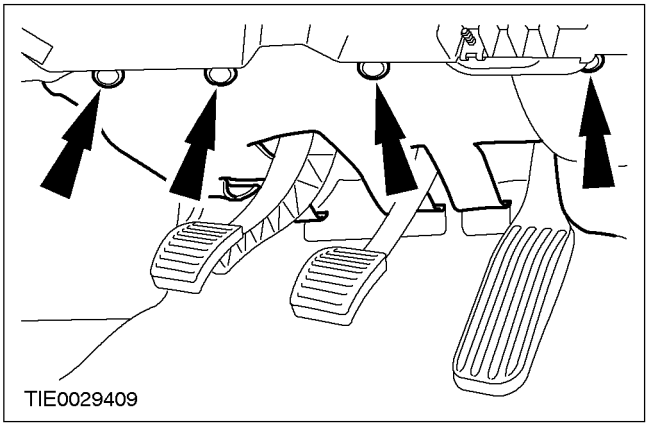
3. **Detach the instrument panel lower panel from the instrument panel.**
   1. Remove the retaining screws.
   2. Detach the retaining clips.



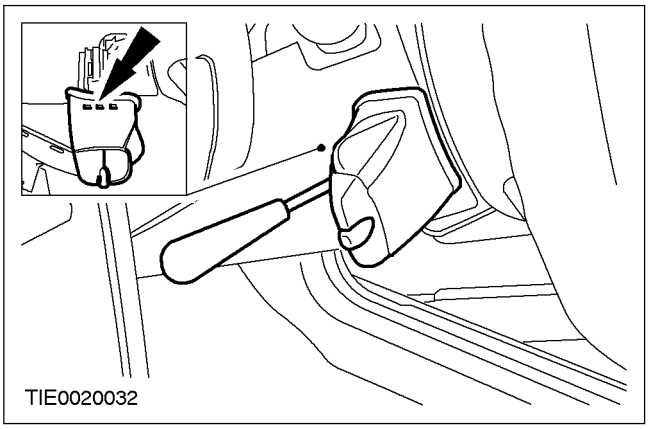
4. **Detach the electronic automated temperature control (EATC) sensor from the instrument panel lower panel (if equipped).**
   - Remove the instrument panel lower panel.



5. **Remove the insulation pad (if equipped).**



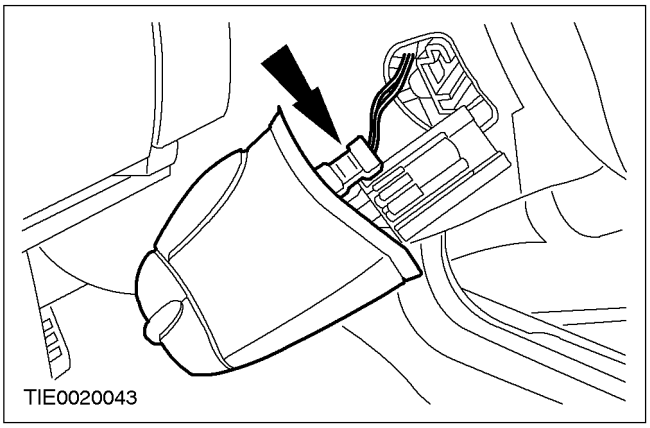
6. **Detach the audio control switch from the steering column lower shroud (if equipped).**
   - Using a thin bladed screwdriver, release the locking tang.



REMOVAL AND INSTALLATION (Continued)

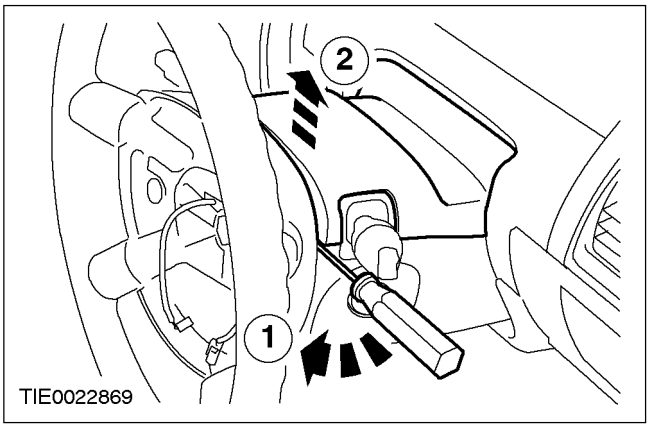
7. Remove the audio control switch (if equipped).

- Disconnect the electrical connector.

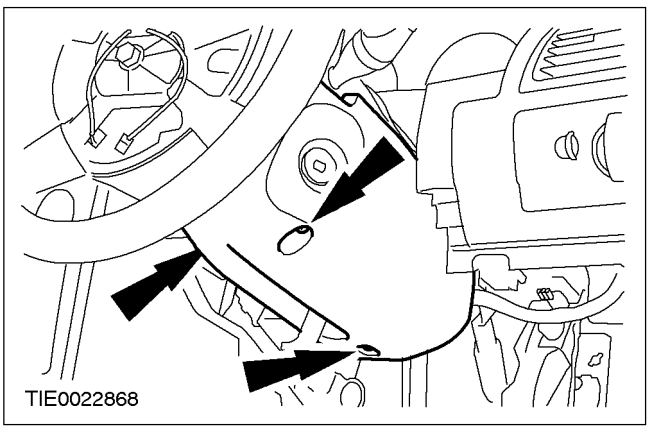


8. Detach the steering column upper shroud from the steering column lower shroud.

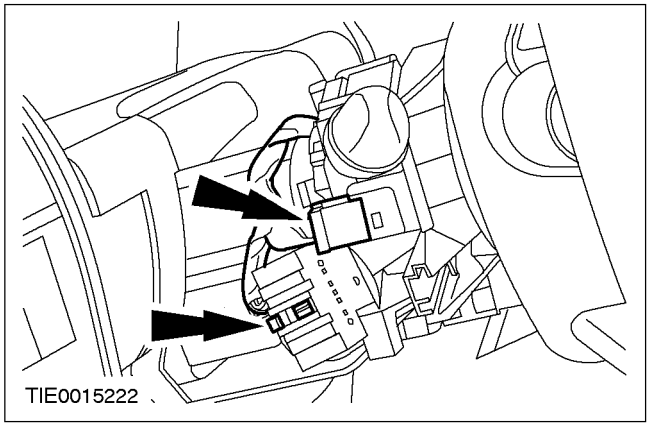
1. Using a thin bladed screwdriver, release the two retaining clips (one each side).
2. Detach the shroud.



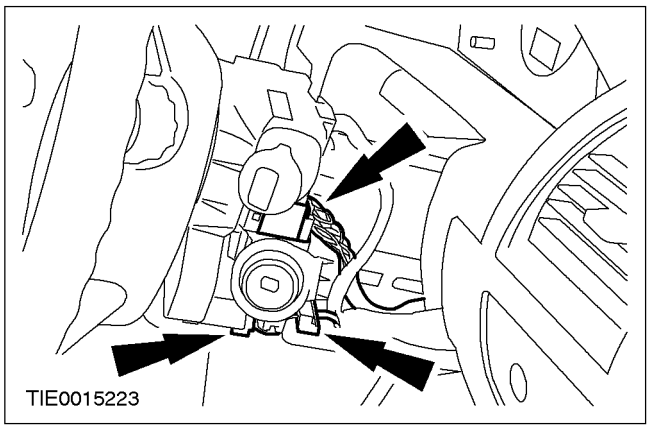
9. Remove the steering column lower shroud.



10. Disconnect the ignition switch and turn signal electrical connectors.

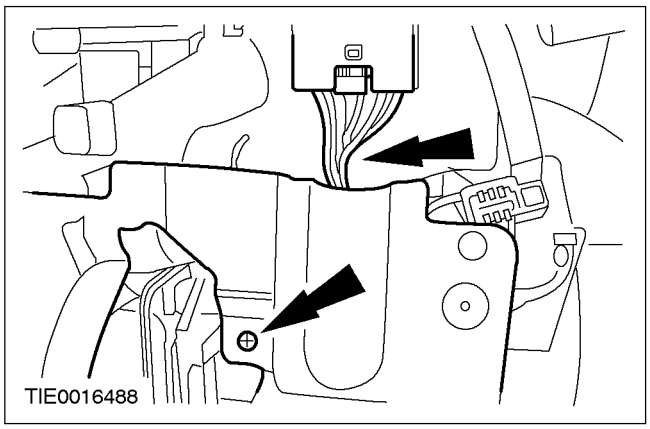


11. Disconnect the passive anti-theft system (PATS) transceiver, windshield wiper/washer switch and clockspring electrical connectors.



12. NOTE: Note the routing of the clockspring wiring harness, to aid installation.

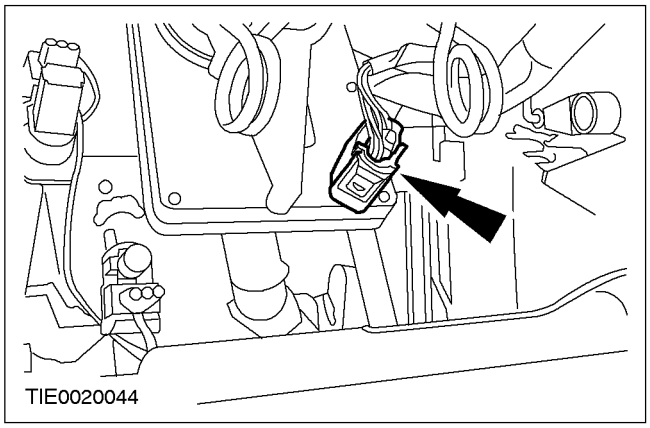
Detach the spreader plate from the steering column.



REMOVAL AND INSTALLATION (Continued)

Vehicles with stability assist

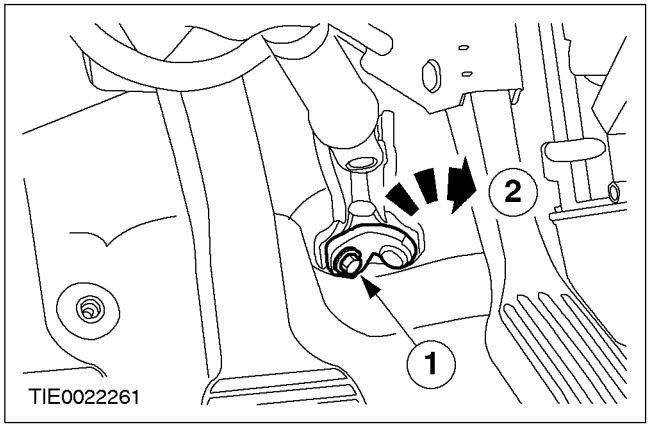
13. Disconnect the steering wheel rotation sensor electrical connector.



All vehicles

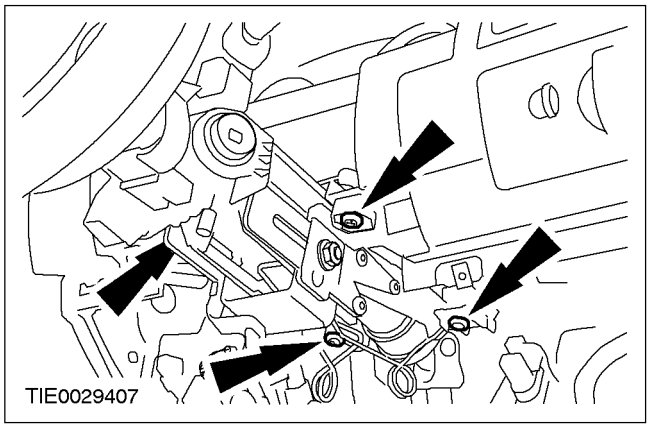
14. Detach the steering column shaft from the steering column flexible coupling.

1. Remove and discard the retaining bolt.
2. Rotate the clamp plate.



15. Remove the steering column.

- Discard the retaining bolts.



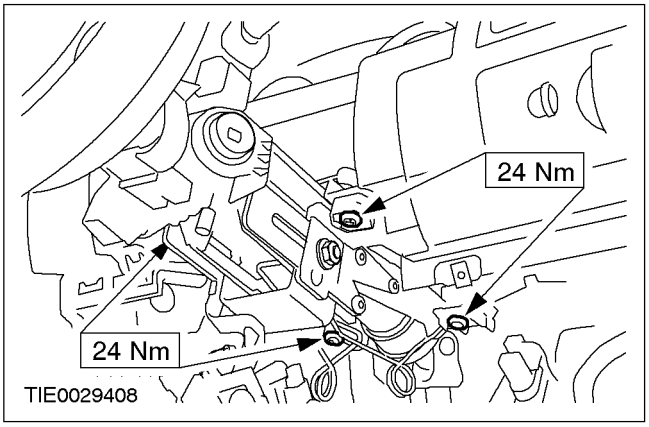
Installation

All vehicles

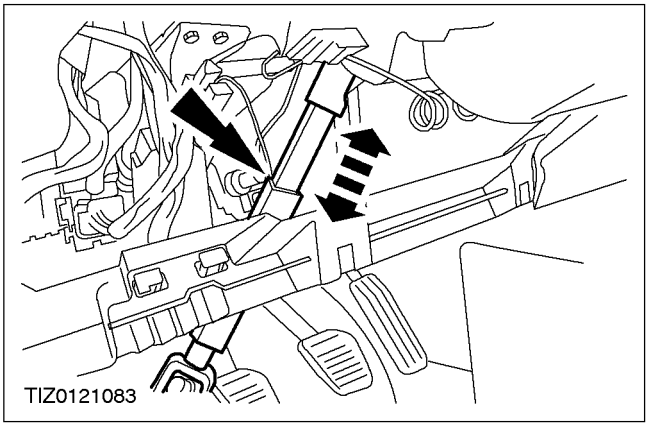
1. WARNING: Install new steering column retaining bolts. Failure to follow this instruction may result in personal injury.

WARNING: Make sure the steering column adjustment lever is in the locked position. Failure to follow this instruction may result in personal injury.

Install the steering column.

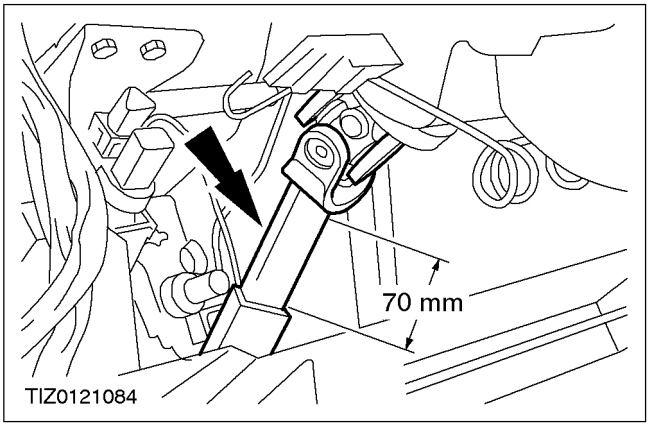


2. Apply silicon grease to the steering shaft compensator and fully extend and retract the steering column several times.



REMOVAL AND INSTALLATION (Continued)

3. Using a pre-prepared spacer, set the steering shaft compensator to 70 mm.



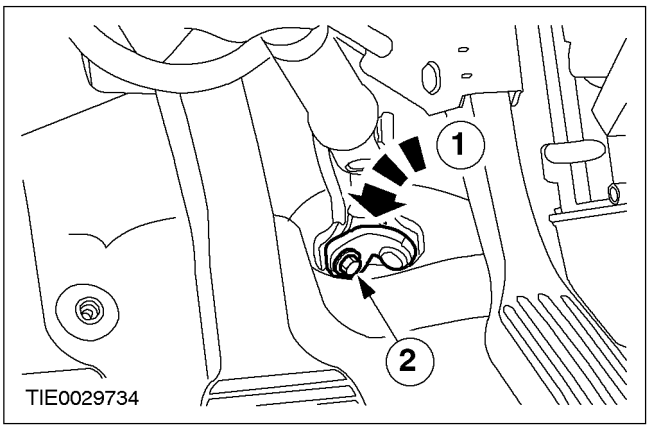
4. WARNING: Install a new steering column to steering column flexible coupling retaining bolt. Failure to follow this instruction may result in personal injury.

NOTE: Leave the spacer in position.

NOTE: Do not fully tighten the retaining bolt at this stage.

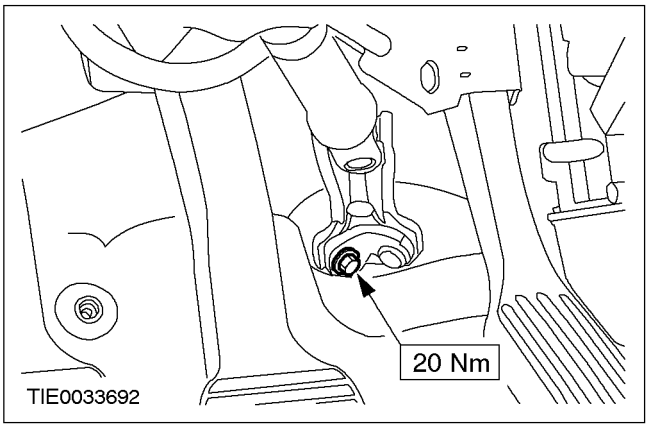
Attach the steering column shaft to the steering column flexible coupling.

1. Rotate the clamp plate.
2. Install the retaining bolt.



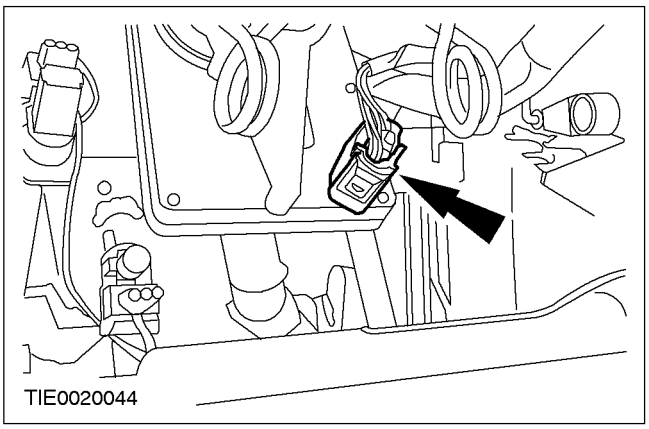
5. Check the steering shaft compensator and adjust if necessary.

6. Fully tighten the steering column shaft to the steering column flexible coupling retaining bolt.



Vehicles with stability assist

7. Connect the steering wheel rotation sensor electrical connector.

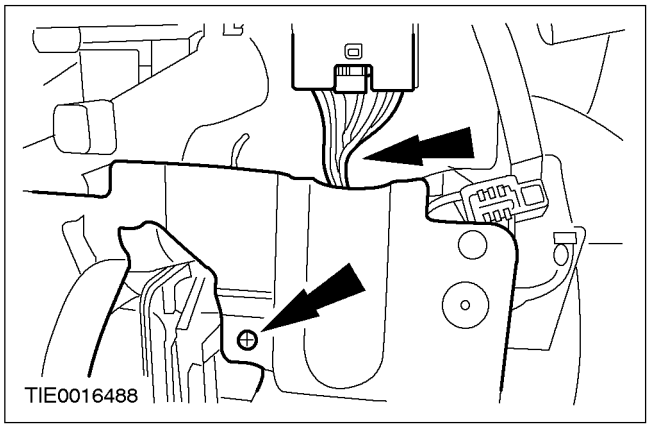


REMOVAL AND INSTALLATION (Continued)

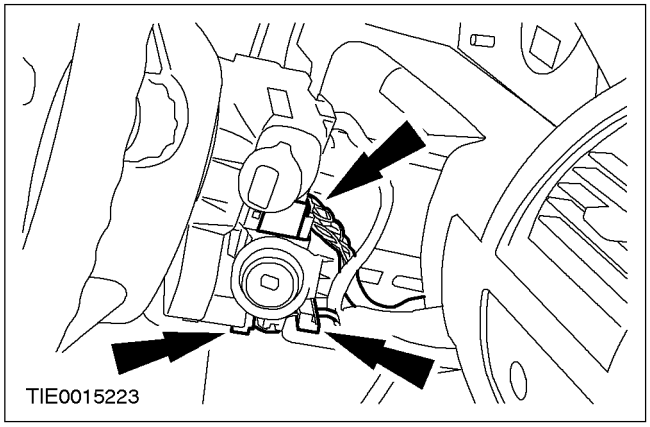
All vehicles

8. **CAUTION: Make sure that the clockspring wiring harness is routed down the spreader plate depression and, following the installation of the spreader plate, that the clockspring electrical connector is fully connected.**

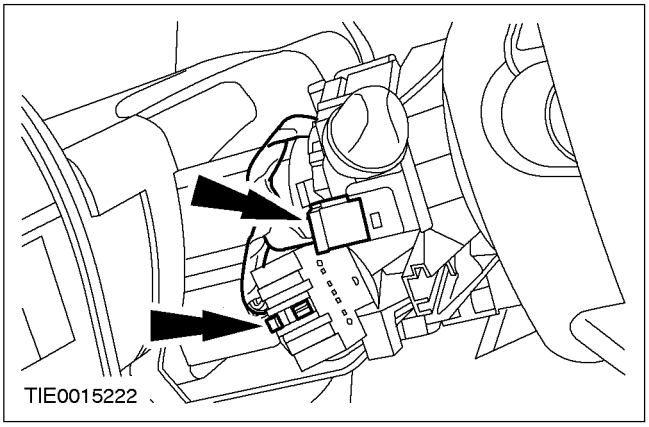
   Attach the spreader plate to the steering column.



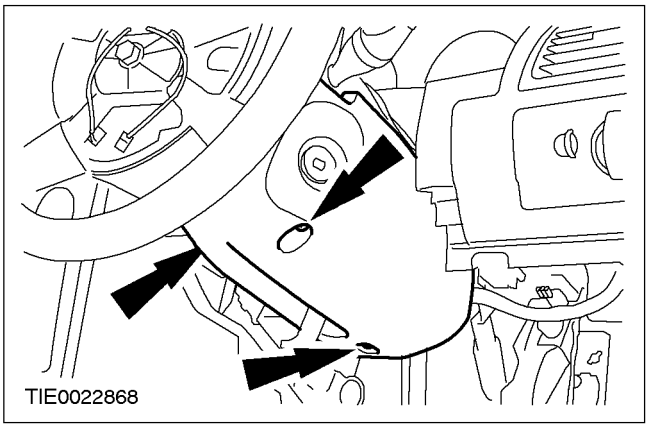
9. **Connect the passive anti-theft system (PATS) transceiver, windshield wiper/washer switch and clockspring electrical connectors.**



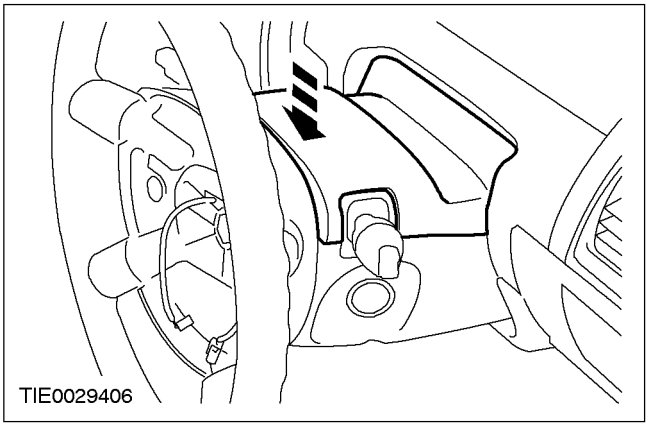
10. **Connect the ignition switch and turn signal electrical connectors.**



11. **Install the steering column lower shroud.**



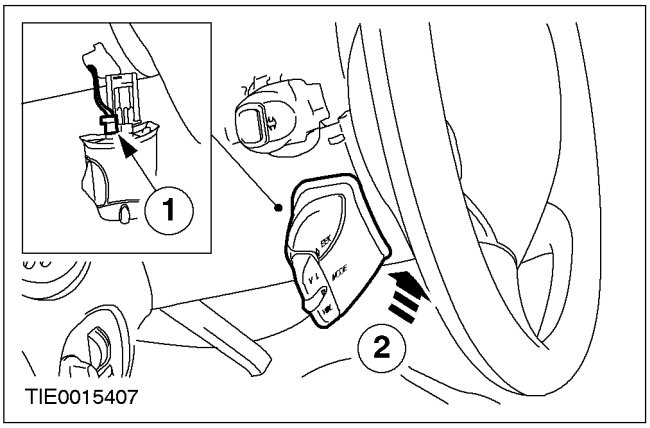
12. **Attach the steering column upper shroud to the steering column lower shroud.**



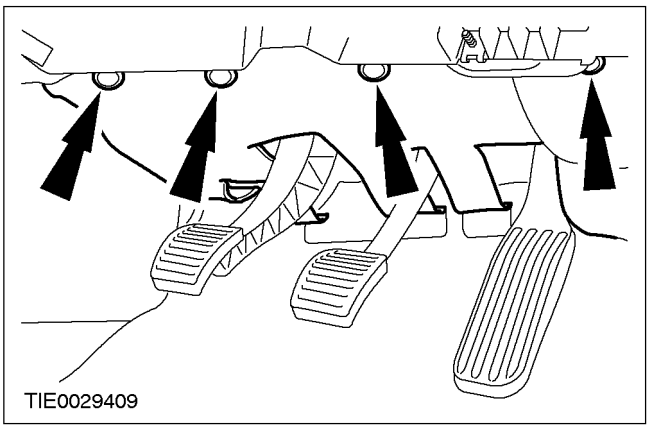
REMOVAL AND INSTALLATION (Continued)

13. Install the audio control switch (if equipped).

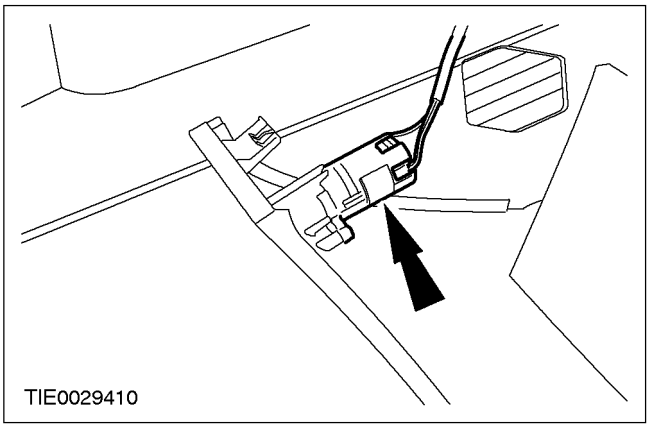
1. Connect the electrical connector.
2. Install the audio control switch



14. Install the insulation pad (if equipped).

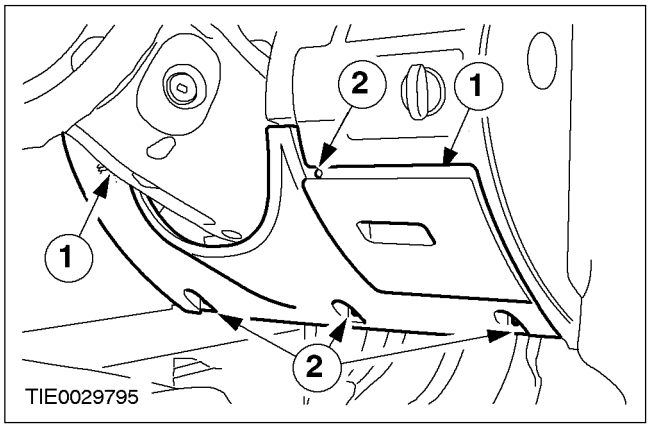


15. Attach the EATC sensor to the instrument panel lower panel (if equipped).



16. Attach the instrument panel lower panel to the instrument panel.

1. Attach the retaining clips.
2. Install the retaining screws.



17. Install the driver air bag module. For additional information, refer to Section 501-20A / 501-20B.

18. Initialize the door window motors. For additional information, refer to Section 501-11.

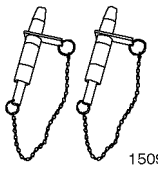
Vehicles with stability assist

19. ⚠ WARNING: The steering wheel rotation sensor must be re-configured following installation. Failure to follow this instruction may result in personal injury

Configure the steering wheel rotation sensor using WDS.

REMOVAL AND INSTALLATION

Steering Column Flexible Coupling (13 566 0)

Special Tool(s)	
 15097A	Alignment Pins, Subframe 205-316 (15-097A)

General Equipment
Transmission jack
Wooden block

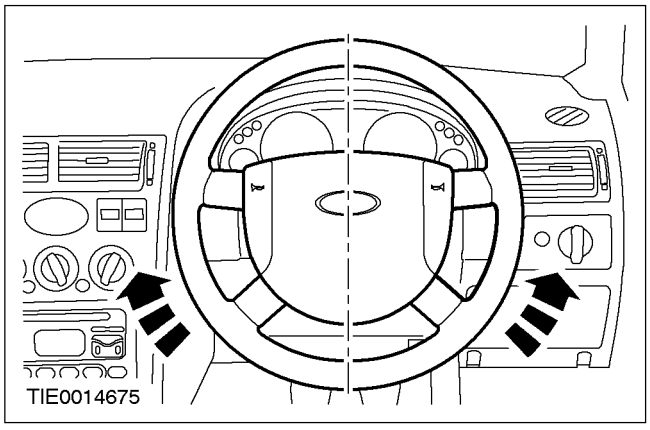
Name	Specification
Silicon Grease	YS5J-M1C239-AA

Removal

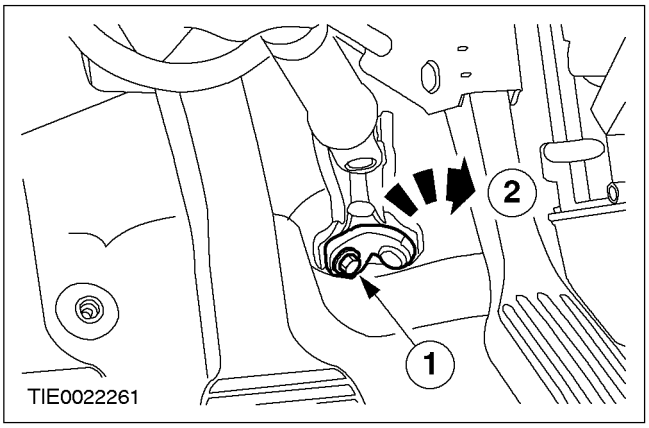
All vehicles

1. **NOTE:** Make sure the road wheels are in the straight ahead position.

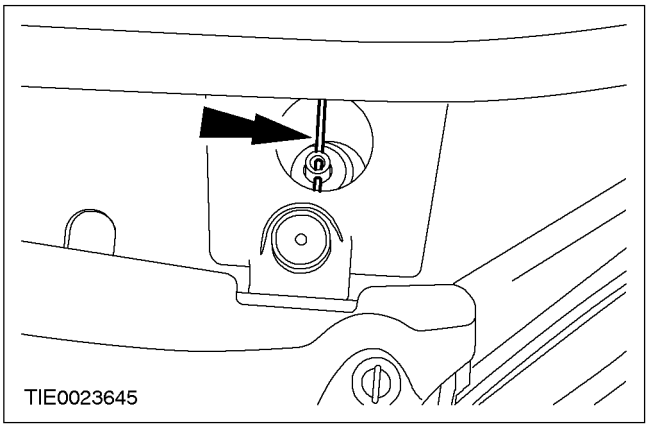
   Centralize the steering and lock it in position.



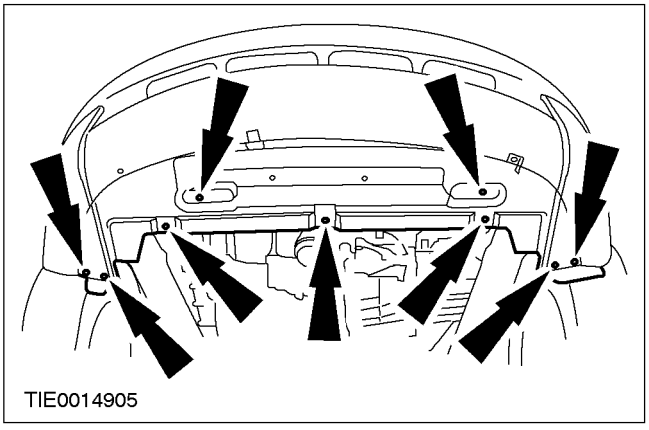
2. **Detach the steering column shaft from the steering column flexible coupling.**
   1. Remove the retaining bolt.
   2. Rotate the clamp plate.
   - Discard the retaining bolt.



3. **Using suitable pins, support the radiator on both sides.**



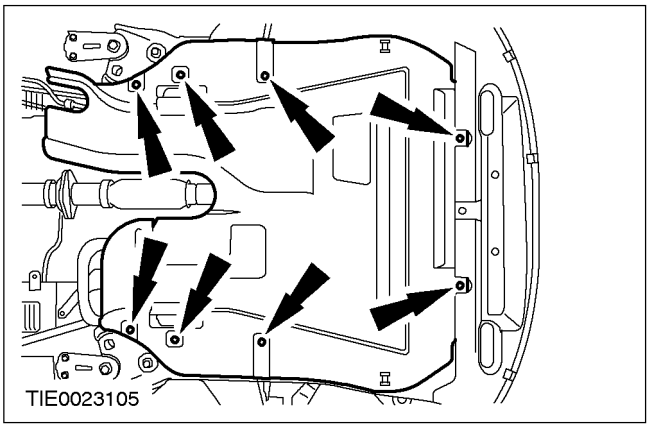
4. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
5. **Remove the splash shield.**



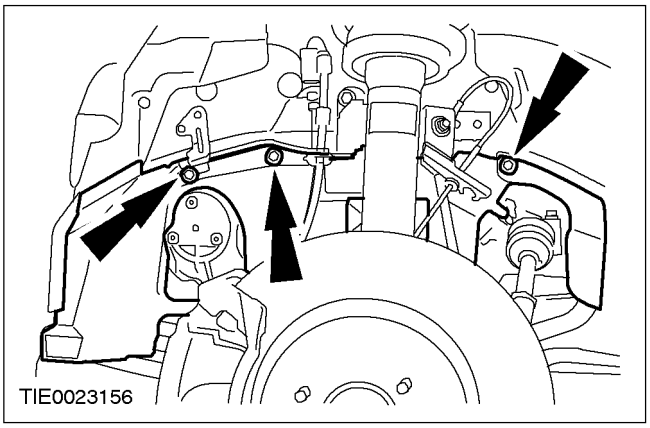
REMOVAL AND INSTALLATION (Continued)

Vehicles with diesel engine

6. Remove the engine undershield.



7. Remove the left-hand splash shield.



Vehicles with 1.8L, 2.0L or diesel engine

8. Remove the exhaust flexible pipe. For additional information, refer to Section 309-00.

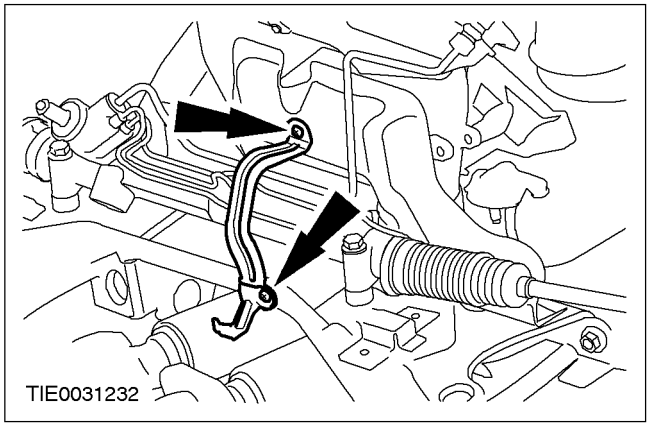
Vehicles with 2.5L engine

9. Remove the dual converter Y-pipe. For additional information, refer to Section 309-00.

Vehicles with 3.0L engine

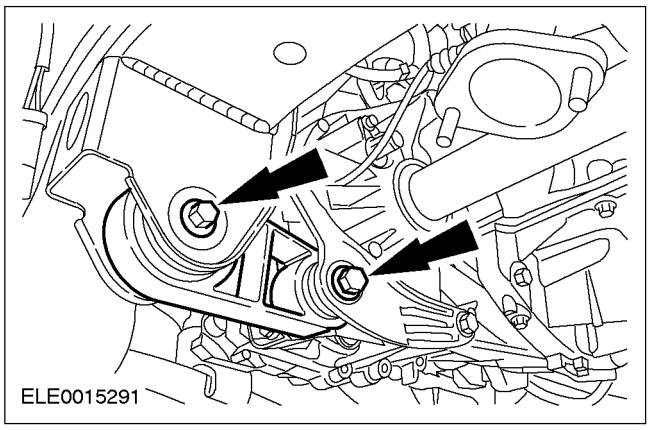
10. Remove the exhaust flexible pipes. For additional information, refer to Section 309-00.

11. Remove the exhaust heat shield support bracket.

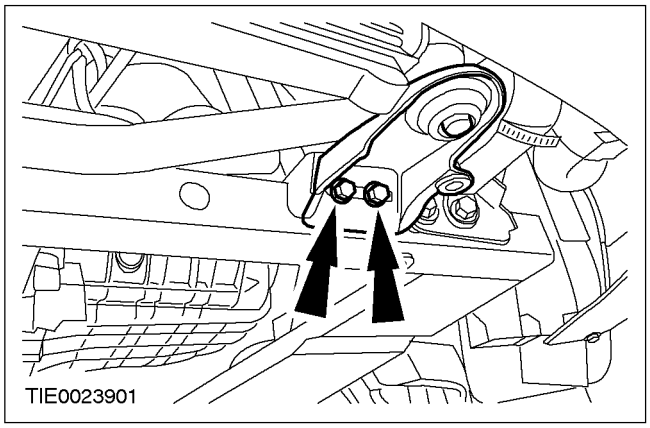


All vehicles

12. Remove the engine rear support insulator.

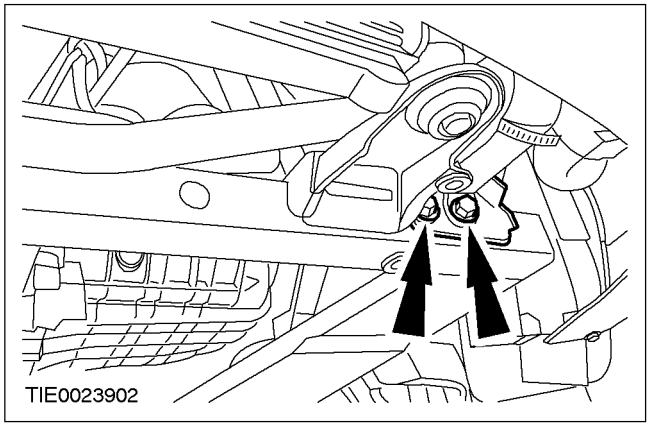


13. Remove the radiator support bracket retaining bolts on both sides.



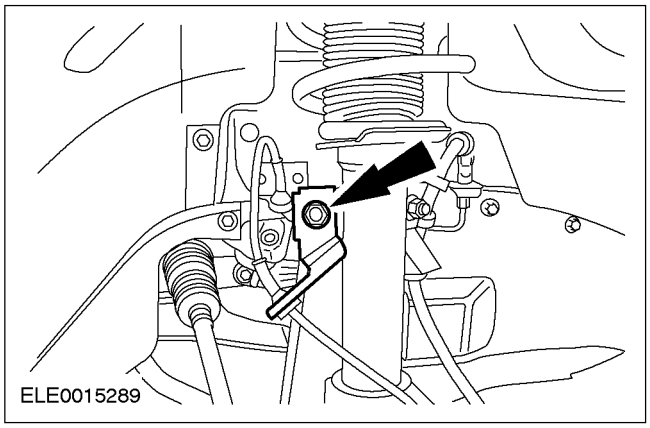
REMOVAL AND INSTALLATION (Continued)

14. **Remove the coolant hose support bracket.**

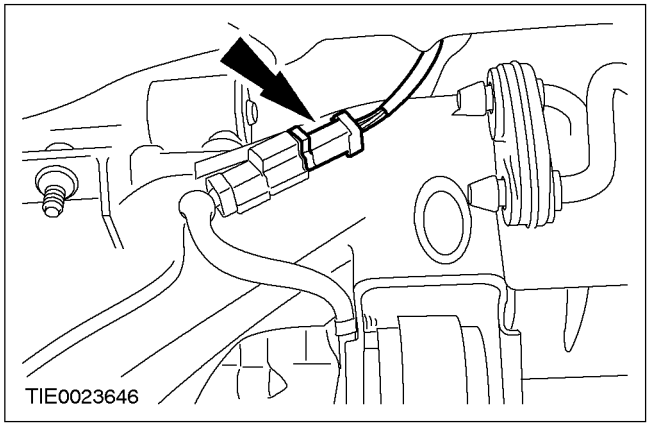


15. **NOTE:** Use a 5 mm Allen key to prevent the ball joint stud from rotating.

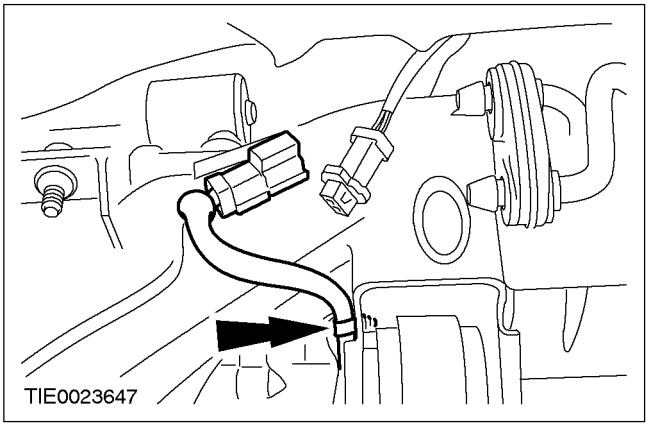
    Detach the stabilizer bar connecting link from the suspension strut on both sides.



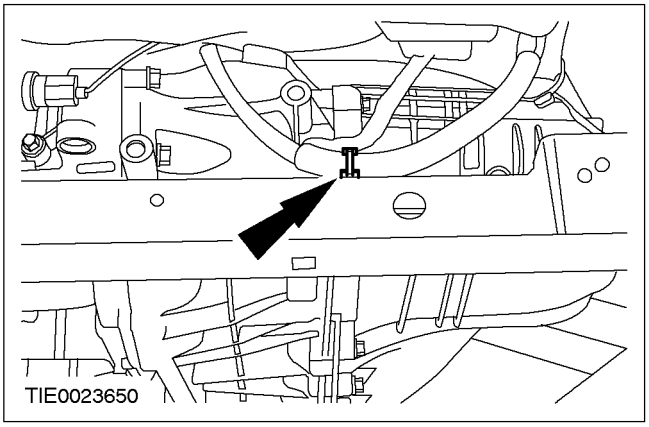
16. **Disconnect the catalyst monitor sensor electrical connector.**



17. **Detach the catalyst monitor sensor wiring harness from the subframe.**

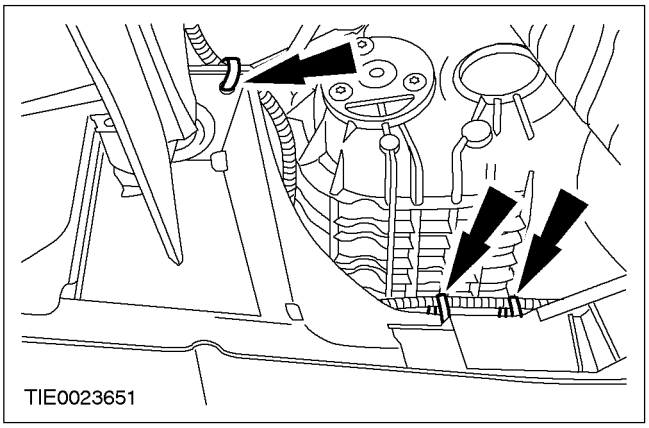


18. **Detach the radiator cooling fan wiring harness from the subframe.**



Vehicles with xenon headlamps

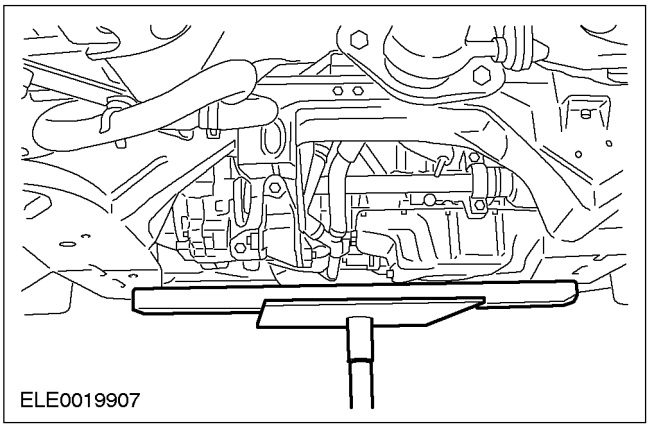
19. **Detach the headlamp leveling sensor wiring harness from the subframe.**



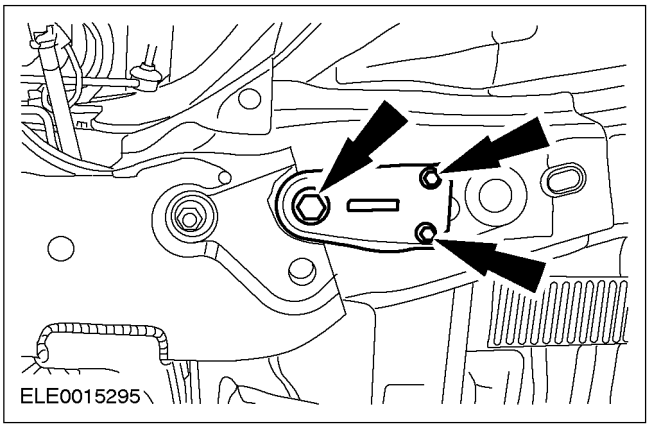
REMOVAL AND INSTALLATION (Continued)

All vehicles

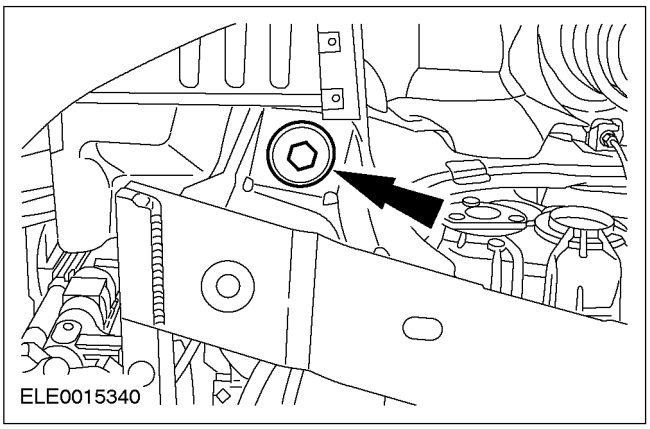
20. Using a suitable transmission jack and wooden blocks support the subframe.



21. Remove the subframe rear retaining bolts and the subframe rear bracket retaining bolts on both sides.

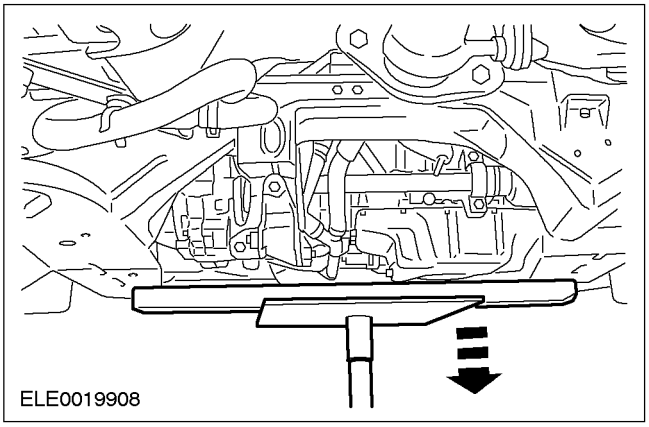


22. Remove the subframe front retaining bolts on both sides.



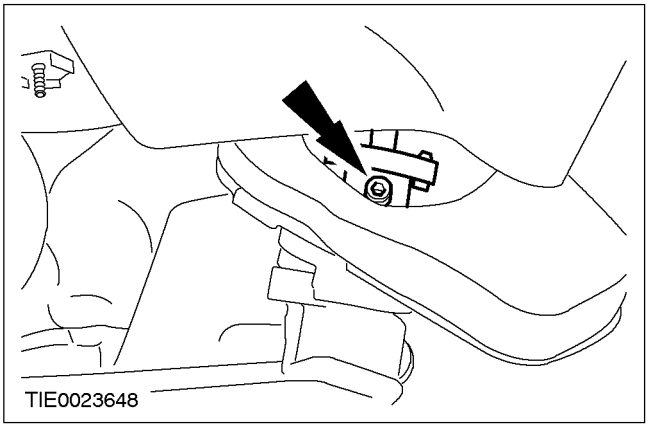
23. ⚠ CAUTION: Lower the subframe uniformly to prevent the lower arm hydro-bushings from damage.

Using the transmission jack, lower the subframe approximately 150 mm.



24. Remove the steering column flexible coupling.

- Discard the retaining bolt.



REMOVAL AND INSTALLATION (Continued)

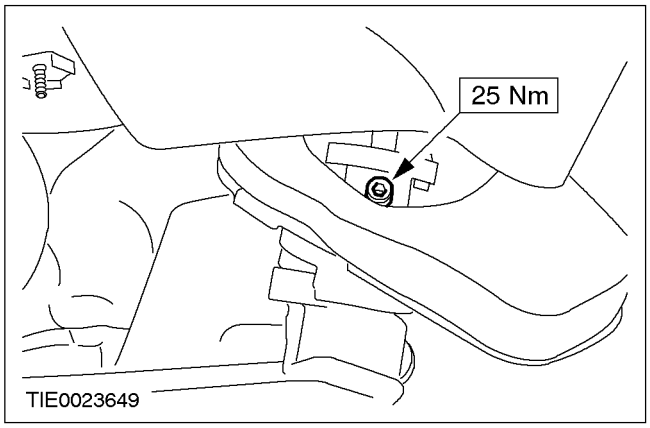
Installation

All vehicles

1. **WARNING: Make sure the steering column flexible coupling is located on the steering gear pinion shaft correctly. Failure to follow this instruction may result in personal injury.**

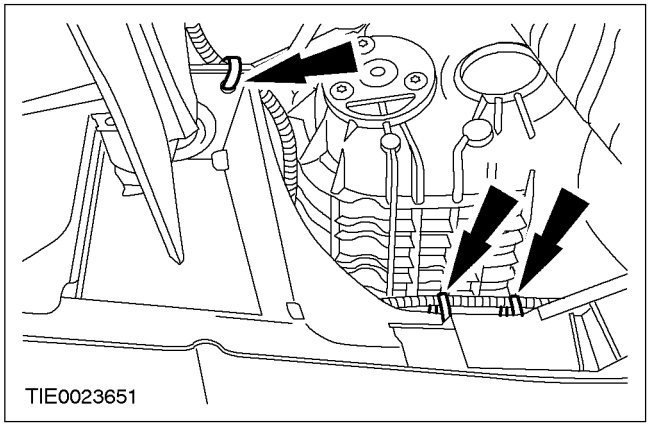
WARNING: Install a new steering column flexible coupling retaining bolt. Failure to follow this instruction may result in personal injury.

Install the steering column flexible coupling.



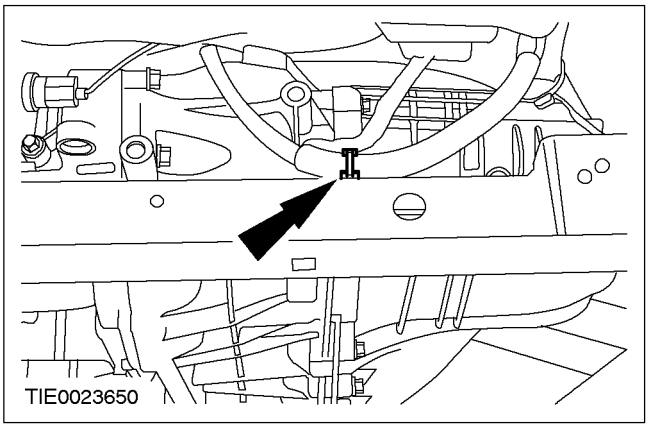
Vehicles with xenon headlamps

2. **Attach the headlamp leveling sensor wiring harness to the subframe.**

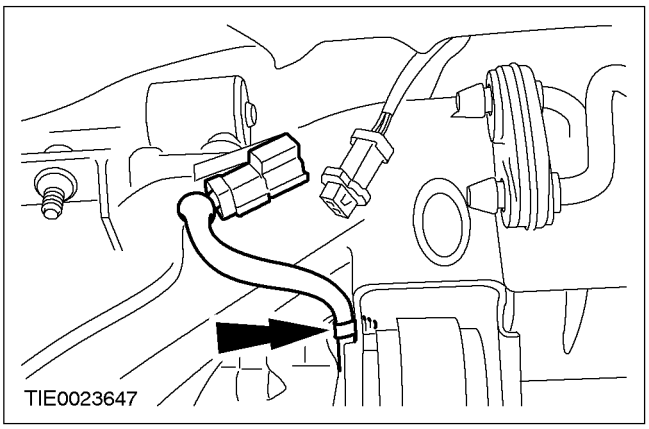


All vehicles

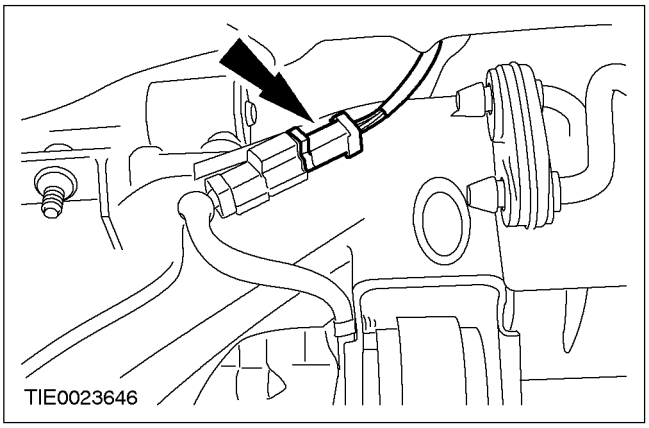
3. **Attach the radiator cooling fan wiring harness to the subframe.**



4. **Attach the catalyst monitor sensor wiring harness to the subframe.**



5. **Connect the catalyst monitor sensor electrical connector.**

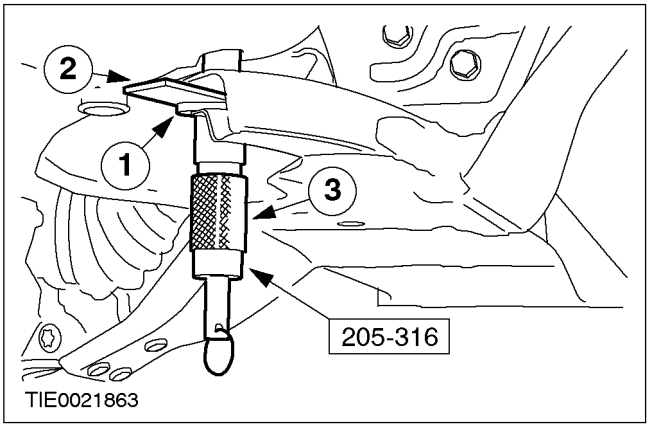


6. **Using the special tool and a suitable washer, align the subframe.**
   1. Insert the washer, with inside diameter 22 mm, outside diameter 44 mm and height 5

REMOVAL AND INSTALLATION (Continued)

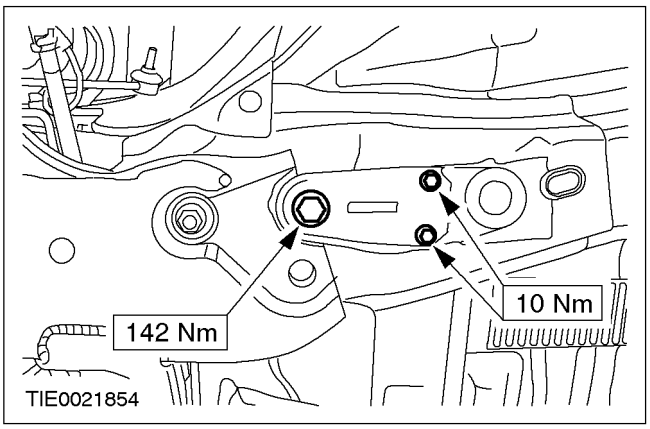
mm, into the subframe above the lower alignment hole.

2. Insert the alignment pins through the subframe and the washer.
3. Slide the locking plate on top of the washer and into the groove of the tool and tighten the alignment pin sleeve.



7. CAUTION: While tightening the subframe retaining bolts, make sure the subframe does not move.

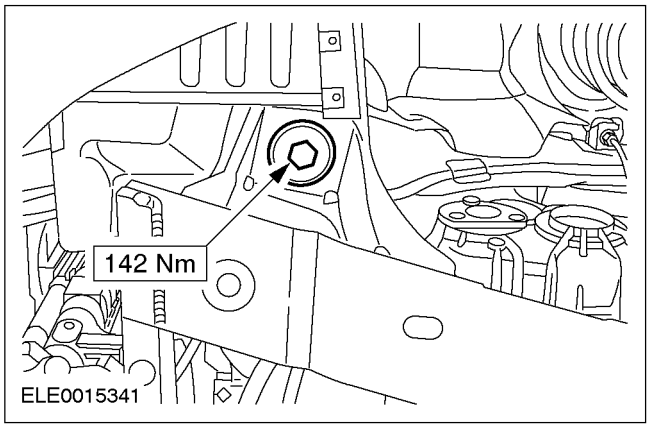
Install the subframe rear retaining bolts and the subframe bracket retaining bolts on both sides.



8. CAUTION: While tightening the subframe retaining bolts, make sure the subframe does not move.

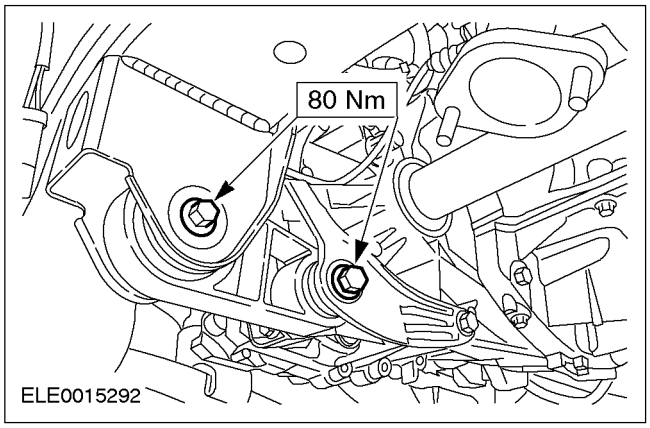
Install the subframe front retaining bolts on both sides.

- Lower and remove the transmission jack.



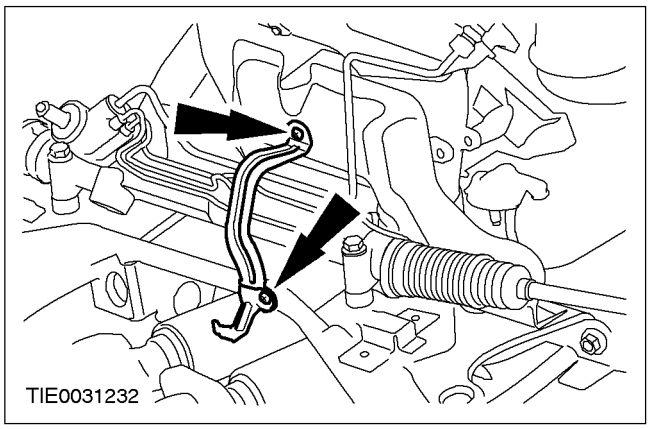
9. Remove the special tools.

10. Install the engine rear support insulator.



Vehicles with 3.0L engine

11. Install the exhaust heat shield support bracket.



REMOVAL AND INSTALLATION (Continued)

12. Install the exhaust flexible pipes. For additional information, refer to Section 309-00.

Vehicles with 1.8L, 2.0L or diesel engine

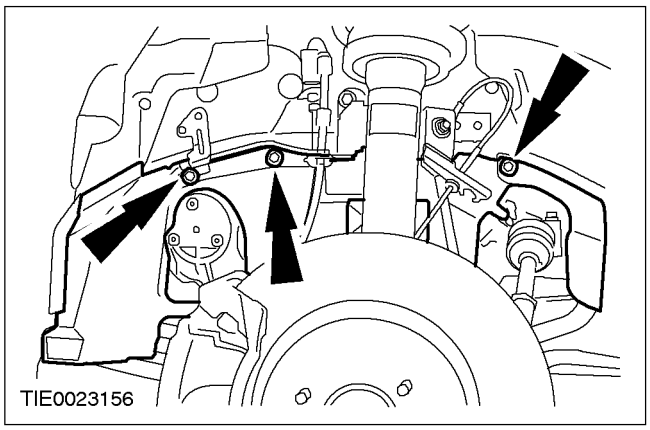
13. Install the exhaust flexible pipe. For additional information, refer to Section 309-00.

Vehicles with 2.5L engine

14. Install the dual converter Y-pipe. For additional information, refer to Section 309-00.

Vehicles with diesel engine

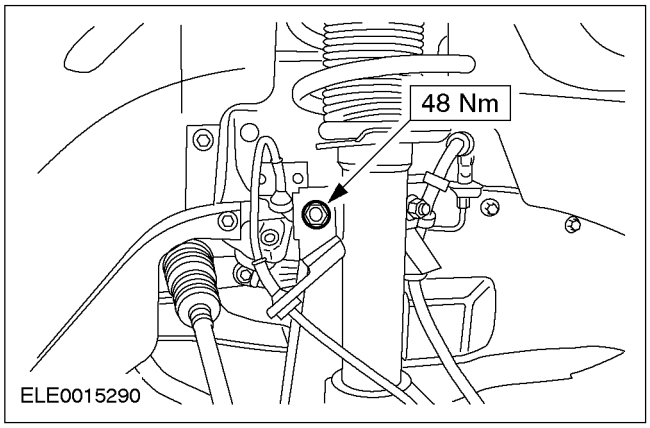
15. Install the left-hand splash shield.



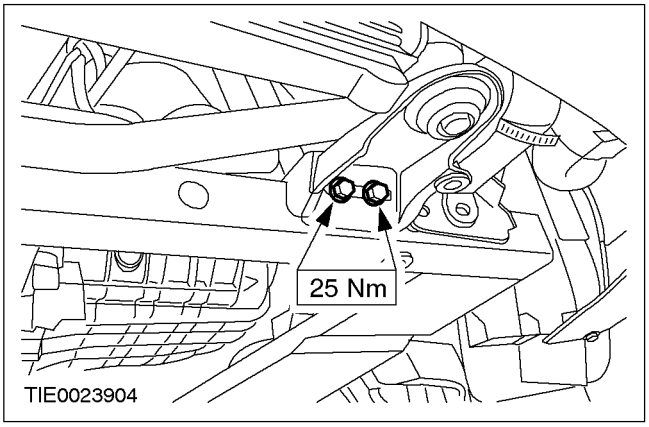
All vehicles

16. NOTE: Use a 5 mm Allen key to prevent the ball joint stud from rotating.

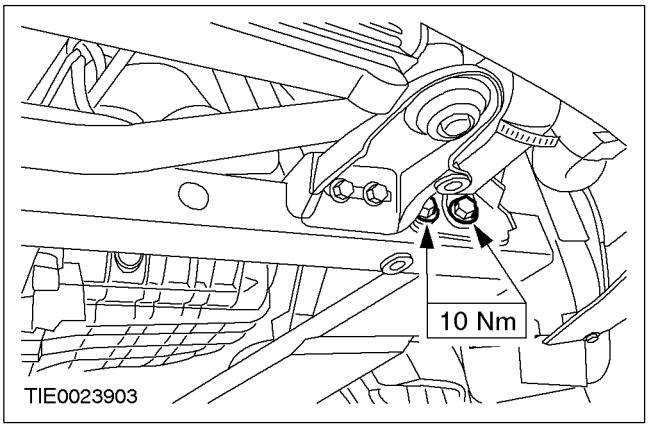
Attach the stabilizer bar connecting link to the suspension strut on both sides.



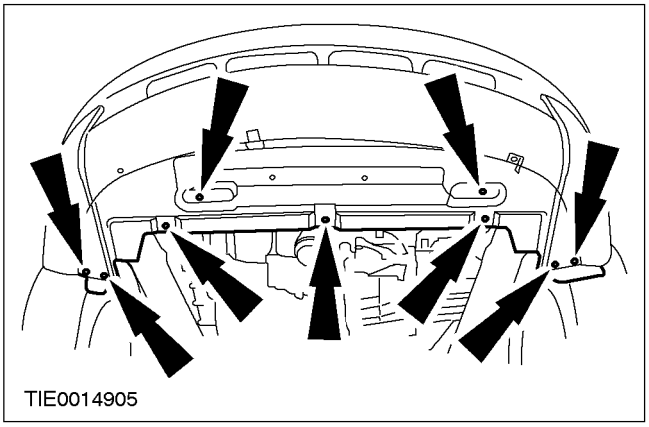
17. Install the radiator support brackets on both sides.



18. Install the coolant hose support bracket.



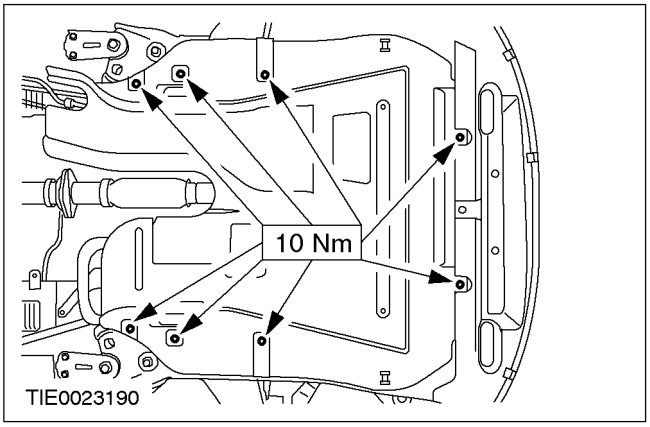
19. Install the splash shield.



REMOVAL AND INSTALLATION (Continued)

Vehicles with diesel engine

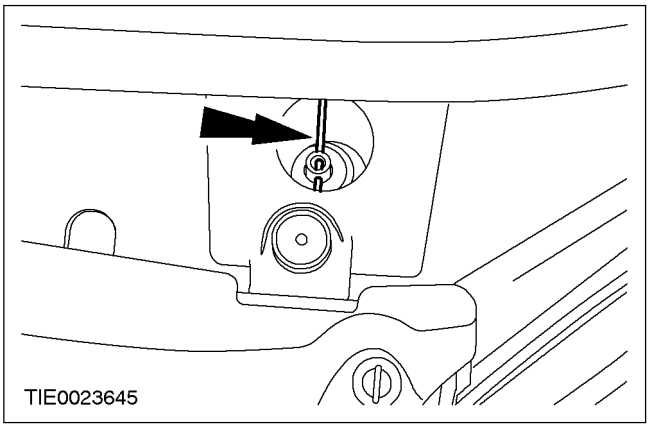
20. Install the engine undershield.



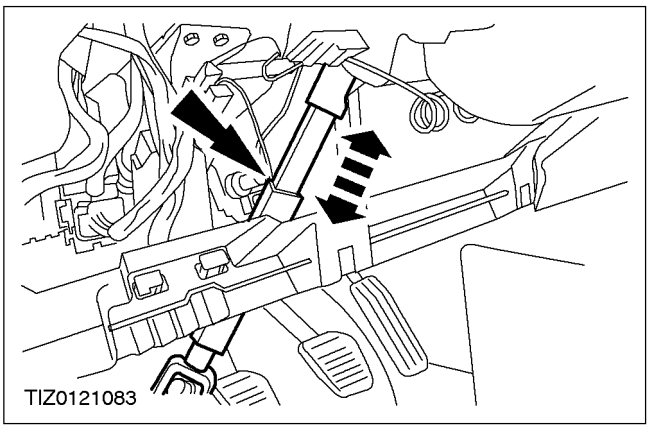
All vehicles

21. Lower the vehicle.

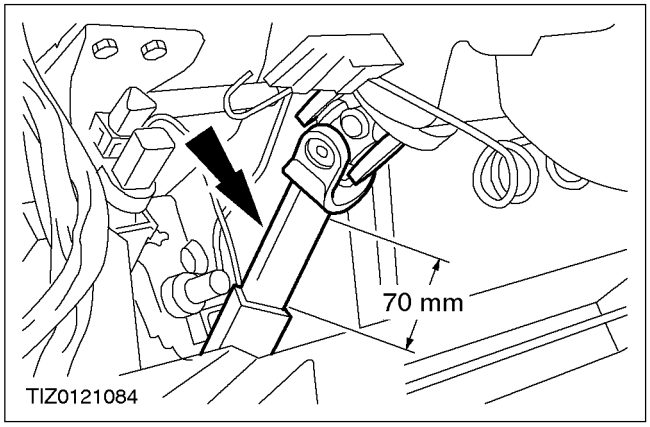
22. Remove the radiator support pins.



23. Apply silicon grease to the steering shaft compensator and fully extend and retract the steering column several times.



24. Using a pre-prepared spacer, set the steering shaft compensator to 70mm.



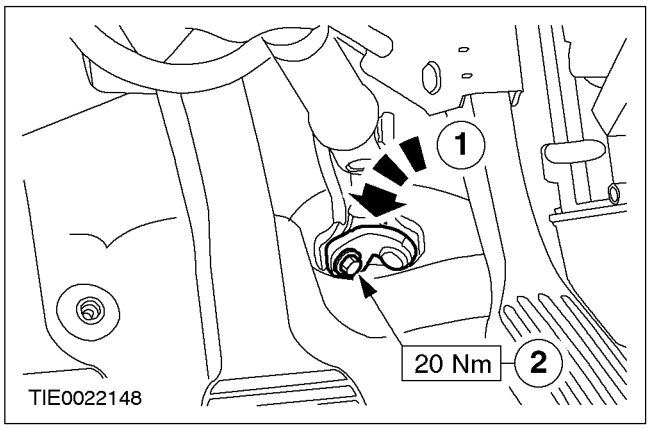
25. ⚠ WARNING: Install a new steering column to steering column flexible coupling bolt. Failure to follow this instruction may result in personal injury.

NOTE: Leave the spacer in position.

NOTE: Do not fully tighten the retaining bolt at this stage.

Attach the steering column shaft to the steering column flexible coupling.

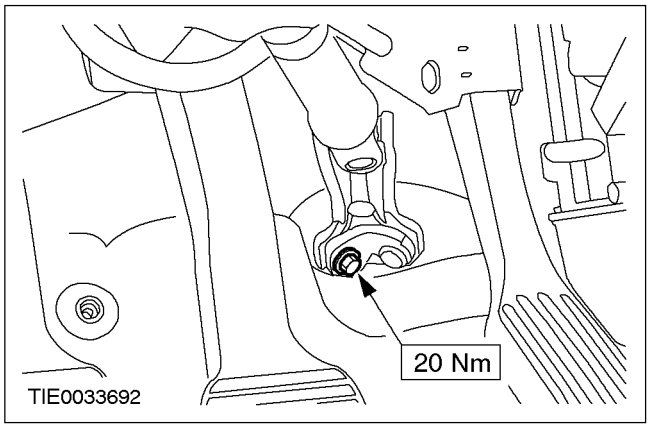
1. Rotate the clamp plate.
2. Install the retaining bolt.



26. Check the steering shaft compensator and adjust if necessary.

REMOVAL AND INSTALLATION (Continued)

27. **Fully tighten the steering column shaft to the steering column flexible coupling retaining bolt.**



Vehicles with stability assist

28. **WARNING: The electronic stability program must be re-configured. Failure to follow this instruction may result in personal injury.**

    Configure the electronic stability program using WDS.

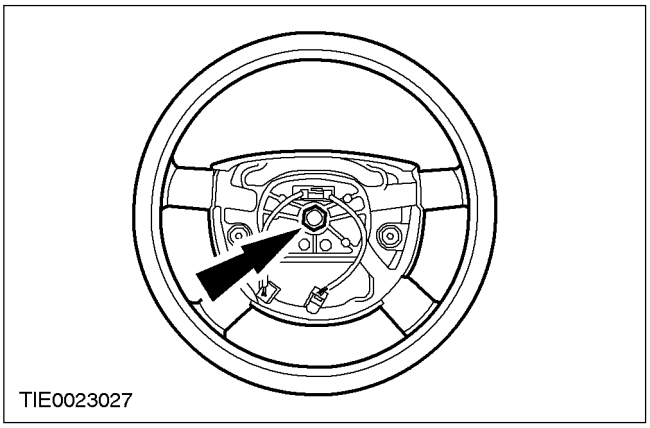
DISASSEMBLY AND ASSEMBLY

Steering Column (13 543 4)

Disassembly

All vehicles

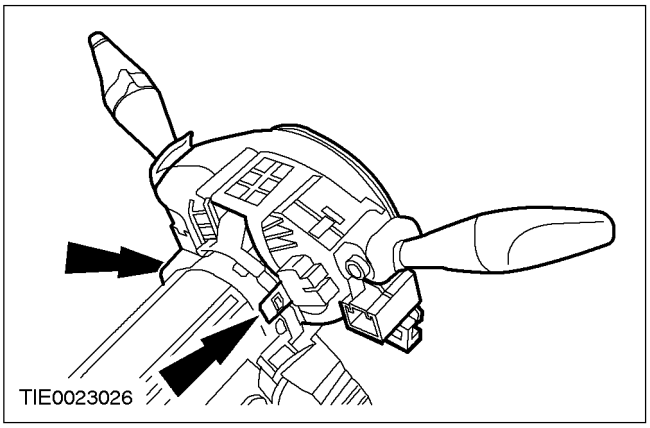
1. Remove the steering wheel.


TIE0023027

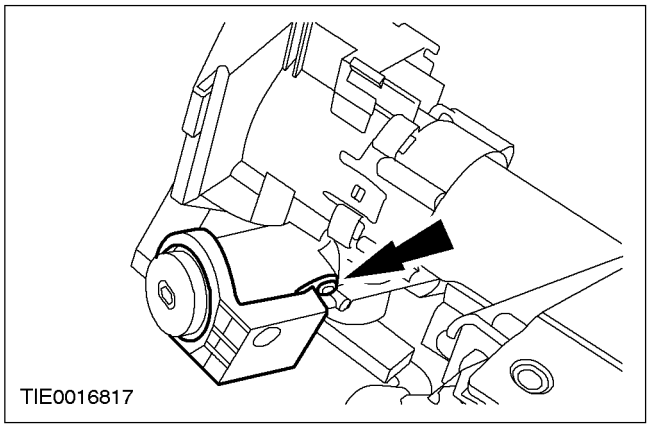
2. CAUTION: Make sure the clockspring is not allowed to rotate. Secure in the central position with a piece of suitable tape.

Remove the steering column multifunction switches and clockspring.

- Using a thin bladed screwdriver, release the two clips (one each side).

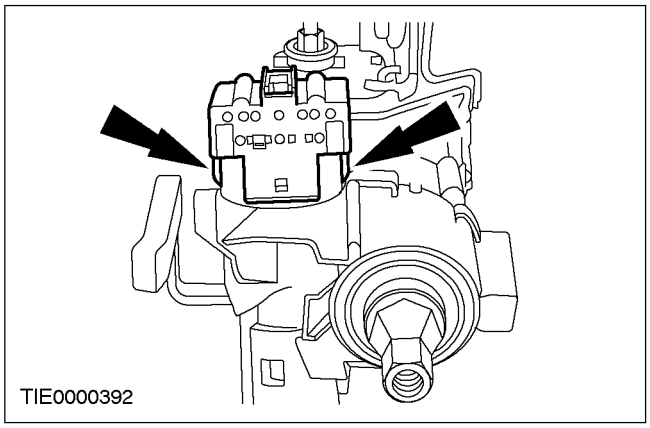

TIE0023026

3. Remove the passive anti-theft system (PATS) transceiver.


TIE0016817

4. Remove the ignition switch.

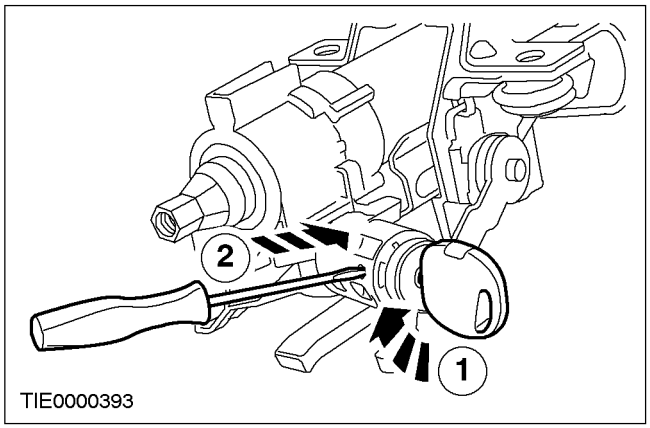
- Release the locking tangs.


TIE0000392

Left-hand drive vehicles

5. Remove the ignition lock cylinder.

1. Insert and turn the ignition key to position I.
2. Using a thin bladed screwdriver, depress the detent.



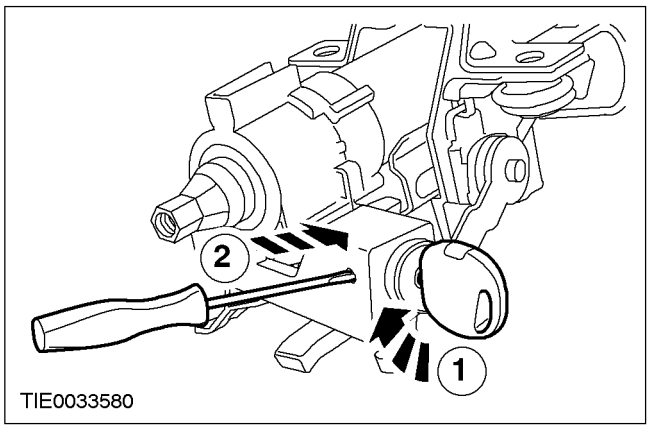
TIE0000393

DISASSEMBLY AND ASSEMBLY (Continued)

Right-hand drive vehicles

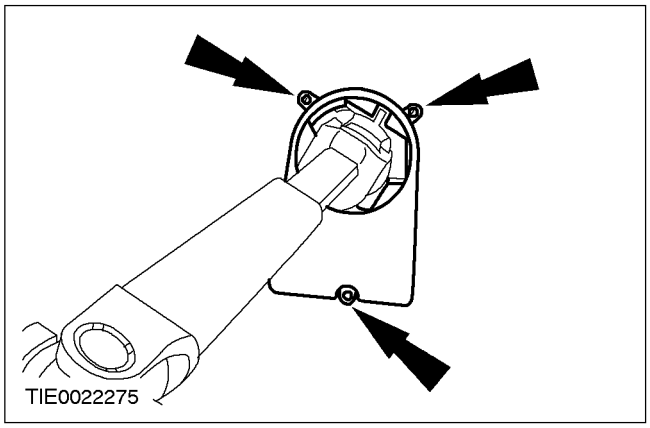
6. Remove the ignition lock cylinder.

1. Insert and turn the ignition key to position I.
2. Using a thin bladed screwdriver, depress the detent.



Vehicles with stability assist

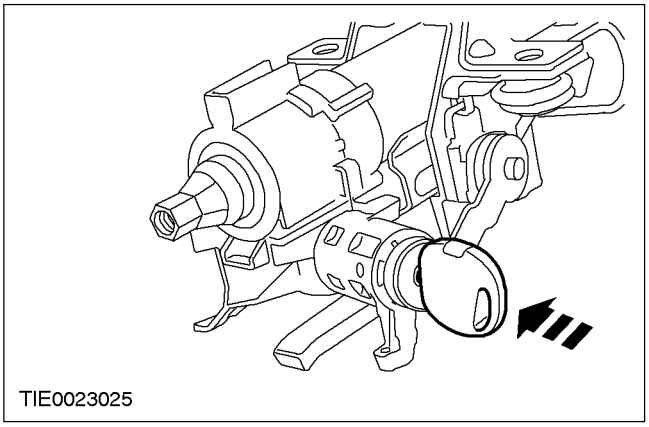
7. Remove the steering wheel rotation sensor.



Assembly

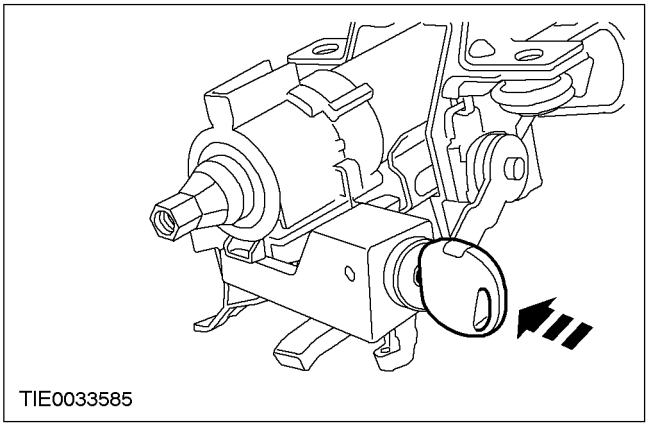
Left-hand drive vehicles

1. Install the ignition lock cylinder.



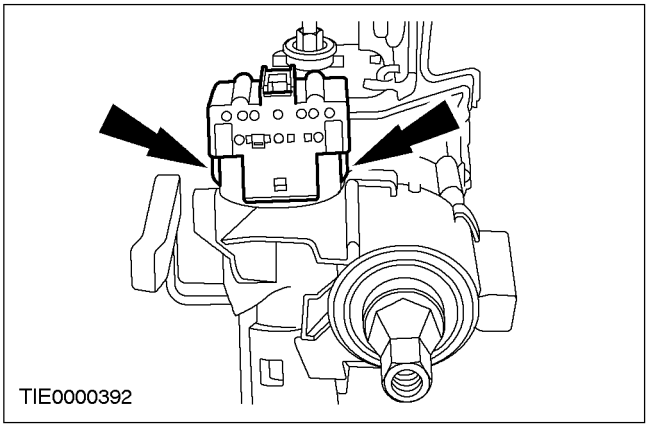
Right-hand drive vehicles

2. Install the ignition lock cylinder.



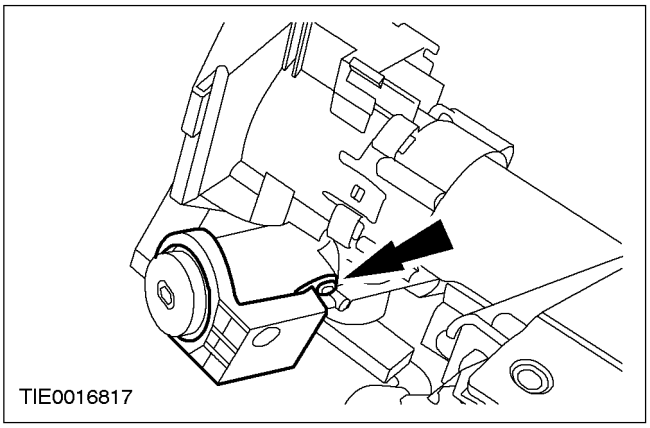
All vehicles

3. Install the ignition switch.

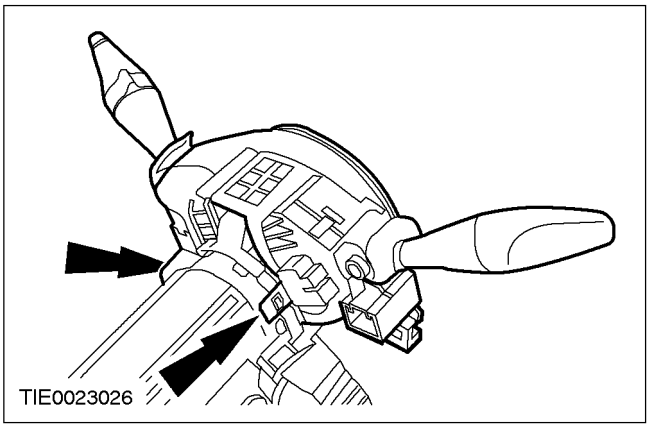


DISASSEMBLY AND ASSEMBLY (Continued)

4. Install the PATS transceiver.



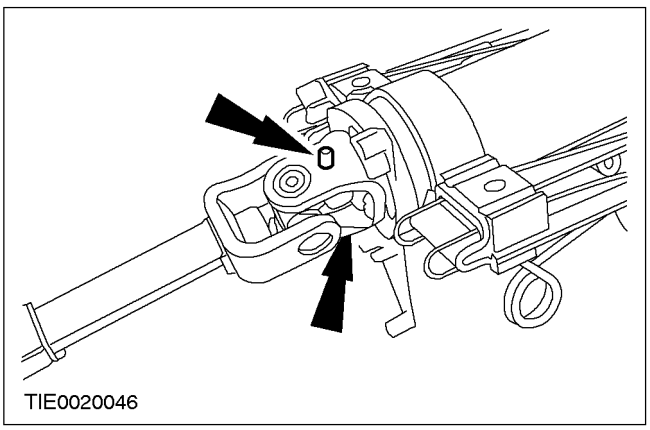
5. Install the steering column multifunction switches and clockspring.



Vehicles with stability assist

6. WARNING: Make sure that the steering wheel rotation sensor drive pins are not damaged loose or worn. Failure to follow this instruction, may result in personal injury.

Check the steering wheel rotation sensor drive pins for damage.

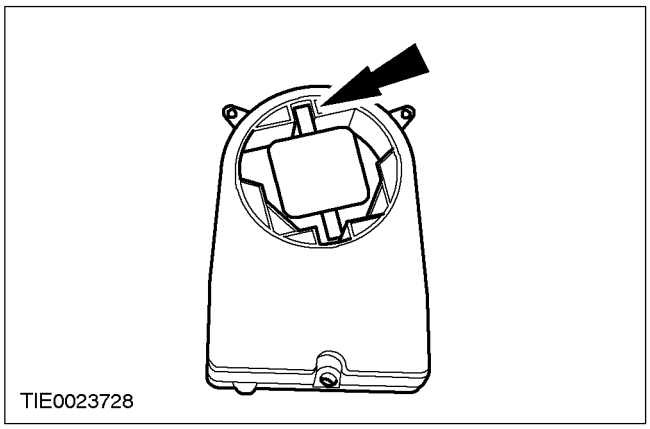


7. WARNING: Do not use excessive force when installing the steering wheel rotation sensor. Sensors that are damaged must not be used. Failure to follow this instruction may result in personal injury.

WARNING: Make sure that the steering wheel rotation sensor drive pin is correctly located in the sensor hub. Failure to follow this instruction, may result in personal injury.

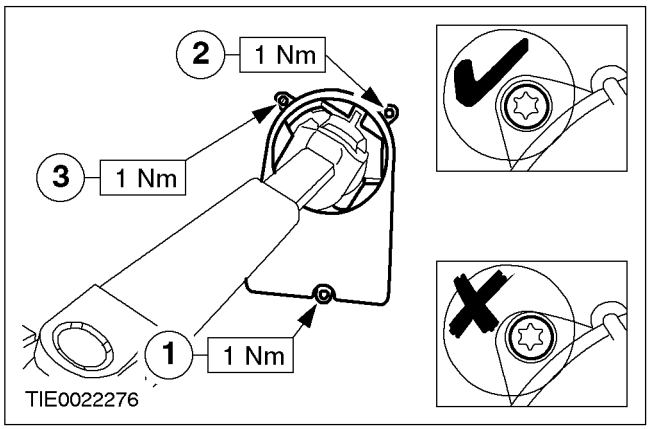
WARNING: Make sure that there is no freeplay between the sensor hub and drive pin. Failure to follow this instruction may result in personal injury.

Make sure the steering wheel rotation drive pin to sensor hub is a sliding fit.



8. Install the steering wheel rotation sensor.

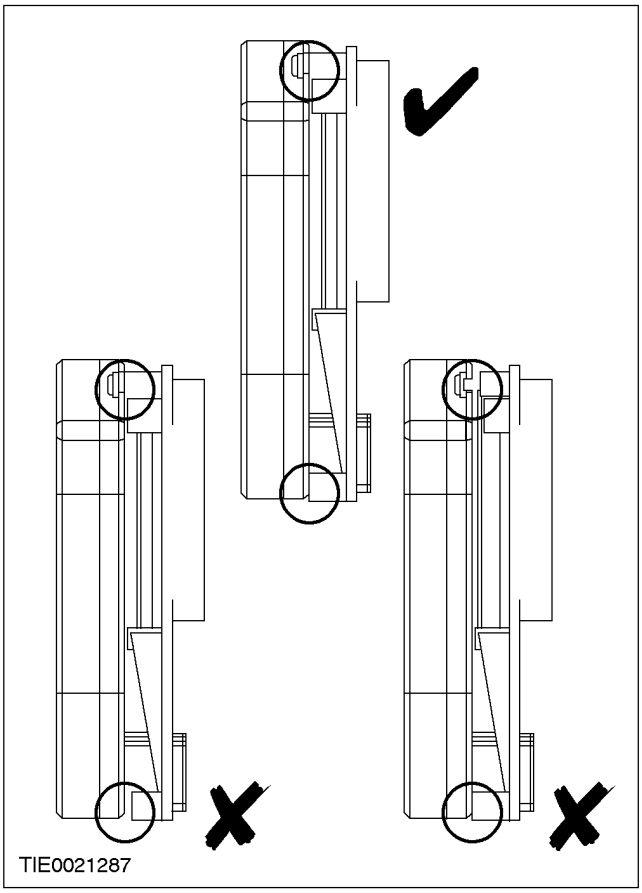
- Tighten the screws in the sequence shown.



DISASSEMBLY AND ASSEMBLY (Continued)

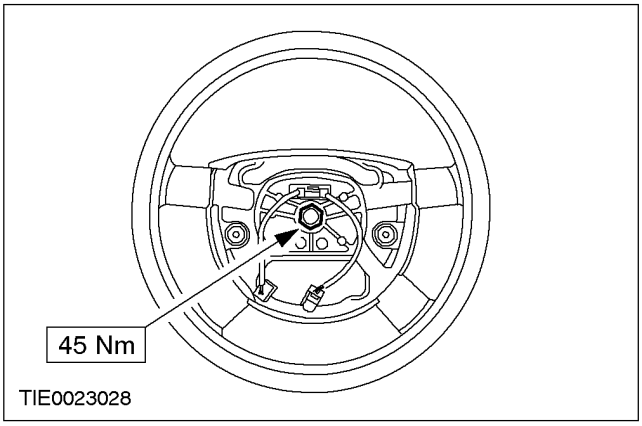
9. **WARNING: Make sure that the steering wheel rotation sensor is correctly fitted. Failure to follow this instruction, may result in personal injury.**

   Check the vertical alignment of the steering wheel rotation sensor to the support bracket.



All vehicles

10. **Remove the tape from the clockspring.**
11. **Install the steering wheel.**



Group

3

Powertrain

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Accessory Drive	303-05-1
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SECTION 303-00 Engine System - General Information

VEHICLE APPLICATION: 2003.0 Mondeo

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DIAGNOSIS AND TESTING

Engine

1. Verify the customer concern by operating the system
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Coolant leaks – Oil leaks – Fuel system leaks – Visibly damaged or worn parts – Loose or missing nuts or bolts	– Fuse(s) – Loose or corroded connector(s) – Control module – Damaged or worn switch(es)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Condition	Possible Sources	Action
•Loss of oil	•Oil leaks on components that are either coated in oil or have always oil leaks on ancillary components.	•Look for evidence of oil leaks on components. Use an ultraviolet (UV) leak tester if oil leak is not evident. Install new gaskets or components as required.
	•Internal or external leak at the oil cooler.	•Check the coolant expansion tank for oil film on the coolant surface. Install a new oil cooler or oil cooler gasket.
	•Leak at the crankshaft oil seal or incorrect front cover alignment.	•Install a new oil seal. •Align the front cover.
	•Leaks from oil carrying components or basic engine.	•Locate cracks in oil-carrying components of the basic engine by means of a UV leak test, and renew the relevant components or seals.
•Oil consumption	•Use of the wrong type of engine oil.	•Determine the last type of engine oil used (refer of the latest invoice of oil receipt) and compare with the specification. Change the engine oil.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
	•Faulty positive crankcase ventilation system. •Hoses or ventilation or breather valves are blocked. This causes excessive pressure in the crankcase which causes more oil to enter the combustion chamber. •Crankcase ventilation oil separator is faulty and engine oil can enter the combustion chamber through the intake manifold.	•Check if the crankcase ventilation system is operating correctly and repair as necessary. REFER to Section 303-08B.
	•Turbocharger seals (only diesel engines).	•Install a new turbocharger. REFER to Section 303-04A / 303-04B.
	•Damaged gaskets or mating surfaces. •Cylinder head gasket is damaged or mating face are warped. •Valve stem oil seals are worn and engine oil can enter the combustion chamber between the valve stem and the valve stem guide.	•Check the gaskets and mating surfaces for damage. •Remove the cylinder head. Check the mating faces, cylinder head gaskets and the evenness of the cylinder head and engine block mating faces. •Install new valve stem oil seals. Engine - 1.8L and 2.0L - REFER to Section 303-01A / 303-01B. Engine - 2.5L - Engine - 2.0L Diesel - Engine - 3.0L -
	•Piston ring or cylinder liner wear.	•Install new components as necessary.
	•Damaged cylinder liners or excessive clearance of engine components. •Pistons •Piston rings (clearance in groove and end gap) •Cylinder liners	•Check the running surfaces and clearances of the individual engine components, and renew if necessary. Renew the cylinder block if necessary. •Pistons •Piston rings •Cylinder liners
•Coolant consumption	•Cooling system components.	•REFER to Section 303-03.
	•Exhaust gas recirculation (EGR) cooler (only diesel engine).	•Install a new EGR cooler.
	•Oil cooler.	•Install a new oil cooler.
	•Damaged gaskets or warped mating faces.	•Check the cylinder head gasket for damage. Check the cylinder head for flatness.
	•Cracks or fractures in engine components surrounded by coolant, such as cylinder liners and cylinder head combustion chamber.	•Determine the damaged engine component and install a new component.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
•Engine will not crank	•Battery or cables.	•Check the battery, bracket and cables. REFER to Section 414-01.
	•Starter motor or cables.	•Check the starting system. REFER to Section 303-06.
•Engine cranks but will not start	•Fuel tank is empty.	•Check the fuel level.
	•Water in fuel (only diesel engine).	•Drain the water from the fuel system. REFER to Section 310-00.
	•Fuel filter blocked.	•Install a new fuel filter. REFER to Section 310-01.
	•Engine intake air system.	•Check the intake air system. REFER to Section 303-12.
	•Glow plug faulty.	•Check the glow plugs. Install new glow plugs as necessary. REFER to Section 303-07A / 303-07B.
	•Engine management system.	•Check the engine management system. REFER to Section 303-14.
	•Ignition system (petrol engines only).	•Check the ignition system. Engine - 1.8L and 2.0L - REFER to Section 303-07A / 303-07B. Engine 2.5L and 3.0L -
	•Incorrect valve timing.	•Check and adjust the valve timing. Engine - 1.8L and 2.0L - REFER to Section 303-01A / 303-01B. Engine - 2.5L - Engine - 2.0L Diesel - Engine 3.0L -
	•Broken or damaged timing chain or sprocket.	•Check the timing chain and sprockets. Install new components as necessary. Engine - 1.8L and 2.0L - REFER to Section 303-01A / 303-01B. Engine - 2.5L - Engine - 2.0L Diesel - Engine 3.0L -
•Very poor power output or fuel consumption too high or engine running rough	•Fuel system.	•Check the fuel system. Engine - 1.8L and 2.0L - REFER to Section 303-04A / 303-04B. Engine - 2.5L and 3.0L - Engine - 2.0L Diesel -
	•Engine intake air system.	•Check the intake air system. REFER to Section 303-12.
	•Exhaust system blocked.	•Check the exhaust system. REFER to Section 309-00.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
	•Engine management system.	•Check the engine management system. REFER to Section 303-14.
	•Fault in ignition system (petrol engines only).	•Check the ignition system. Engine 1.8L and 2.0L - REFER to Section 303-07A / 303-07B. Engine 2.5L and 3.0L -
	•Turbocharger (only diesel engine).	•Check the turbocharger. REFER to Section 303-04A / 303-04B.
	•Incorrect valve timing. Timing chain or timing sprocket damaged.	•Check and adjust valve timing. Install new components as necessary. Engine - 1.8L and 2.0L - REFER to Section 303-01A / 303-01B. Engine - 2.5L - Engine - 2.0L Diesel - Engine - 3.0L -
•Noisy running	•Engine auxiliary components loose or damaged.	•Check engine auxiliary components for damage or looseness. Check and adjust valve timing. Install new components as necessary. Engine - 1.8L and 2.0L - REFER to Section 303-01A / 303-01B. Engine - 2.5L - Engine - 2.0L Diesel - Engine - 3.0L -
•Noisy running, misfiring, backfiring or knocking	•Incorrect fuel	•Determine which type of fuel was the last put in the tank (note the country specific fuel specifications).
	•Water in fuel or fuel contaminated.	•Check the fuel system for water or other contamination.
	•Valve timing incorrect, timing chain or timing sprocket damaged.	•Check and adjust valve timing. Install new components as necessary. Engine - 1.8L and 2.0L - REFER to Section 303-01A / 303-01B. Engine - 2.5L - Engine - 2.0L Diesel - Engine - 3.0L -
•Noisy running or valve train noise	•Valve clearance too large due to faulty valve tappets or valve rocker arms.	•Install new hydraulic valve tappets. Engine - 1.8L and 2.0L - REFER to Section 303-01A / 303-01B. Engine - 2.5L - Engine - 2.0L Diesel - Engine - 3.0L -
	•Timing chain damaged.	•Install a new timing chain. Engine - 1.8L and 2.0L - REFER to Section 303-01A / 303-01B. Engine - 2.5L - Engine - 2.0L Diesel - Engine - 3.0L -

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
	•Timing chain incorrectly tensioned.	•Check the timing chain tension. Install a new tensioner, as necessary. Engine - 1.8L and 2.0L - REFER to Section 303-01A / 303-01B. Engine - 2.5L - Engine - 2.0L Diesel - Engine - 3.0L -
	•Timing chain guides worn of damaged.	•Check the timing chain guides. Install new guides as necessary. Engine - 1.8L and 2.0L - REFER to Section 303-01A / 303-01B. Engine - 2.5L - Engine - 2.0L Diesel - Engine - 3.0L -
•Noisy running or engine block	•Engine components – Pistons – Piston rings – Connecting rod large end, main bearing or thrust bearing journals – Connecting rods bent or damaged.	•Check the engine components for wear or damage. Make sure all components are within specification. Install new components as necessary. Engine - 1.8L and 2.0L - REFER to Section 303-01A / 303-01B. Engine - 2.5L - Engine - 2.0L Diesel - Engine - 3.0L -

Engine - Oil Leaks

NOTE: Before installing new gaskets or oil seals, make sure that the fault is clearly established.

If the oil leak cannot be identified clearly by a visual inspection, carry out an ultraviolet (UV) test:

Ultraviolet (UV) Testing

1. Clean the engine and transmission with a suitable cleaning fluid.
2. Pour a suitable UV testing fluid in accordance with the quantity specified by the manufacturer through the oil filler neck into the engine and install the oil filler cap.

⚠ WARNING: On manual transmissions put the transmission into Neutral. Failure to follow these instructions may result in personal injury.

3. Start the engine and let it run for about five minutes.
4. Switch off the engine.

NOTE: If no leak can be found, road test the vehicle under various loads and check the engine for leaks again.

5. Check the engine for oil leaks using a suitable UV lamp.
6. Rectify any leaks found and check the engine for oil leaks.

Measure the compression pressure (21 111 0)

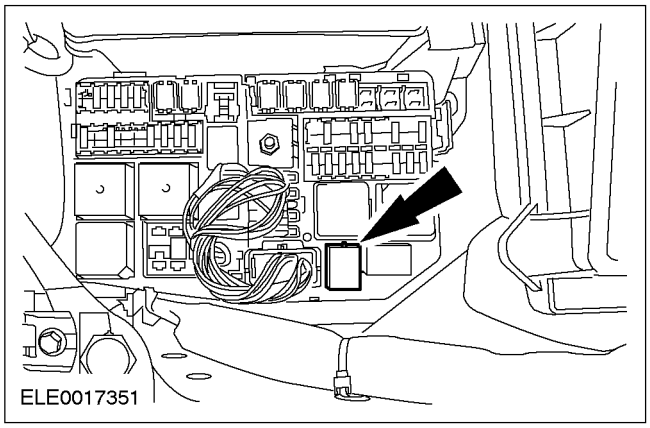
NOTE: The powertrain control module (PCM) receives an error message when the relay is removed or electrical components are disconnected. This error message must be deleted from the fault memory by connecting WDS after completing the measurement.

NOTE: Valve clearances must be set correctly before performing a compression test. Make sure engine is at the normal operating temperature.

NOTE: The varying design of compression checking devices and fluctuating starter motor speeds normally only allows to check if the compression is even in all cylinders.

DIAGNOSIS AND TESTING (Continued)

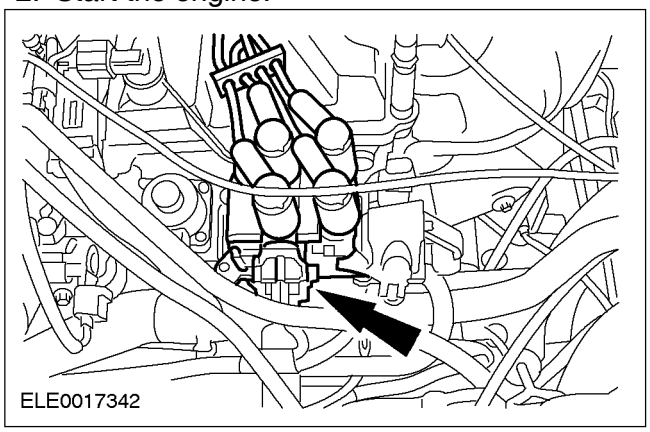
Measure the compression (Engine - 1.8L and 2.0L)



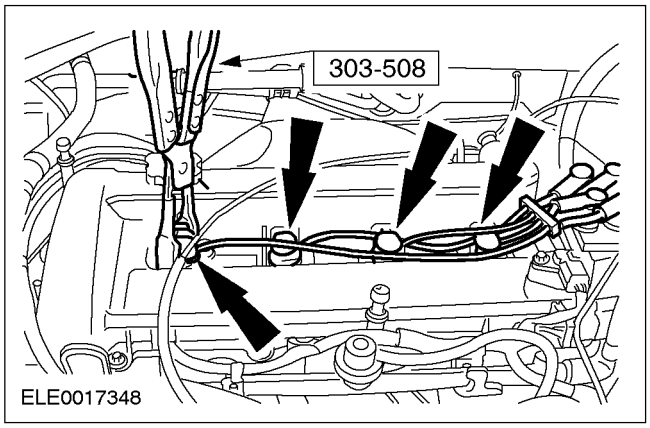
1. Open the central junction box (CJB) and remove the fuel pump relay.

NOTE: The engine will start, run for a few seconds and then stop.

2. Start the engine.

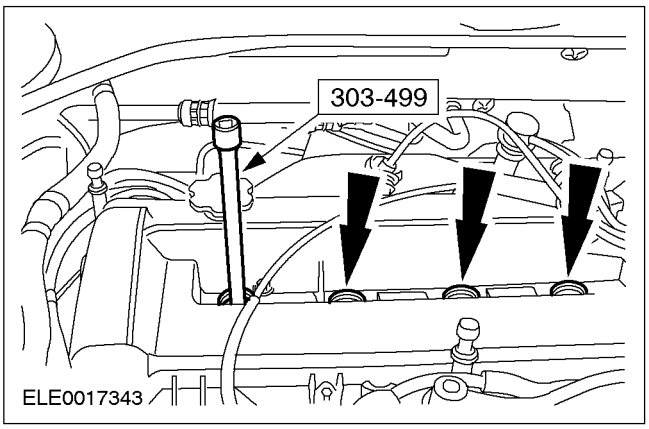


3. Disconnect the electronic ignition (EI) coil electrical connector from the EI coil.

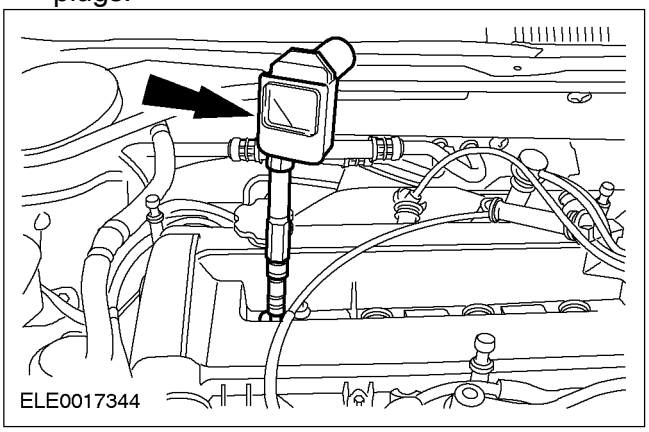


NOTE: Twist the spark plug connectors slightly before disconnecting them. Pull on the connector and not on the cable.

4. Using the special tool, remove the spark plug connectors.

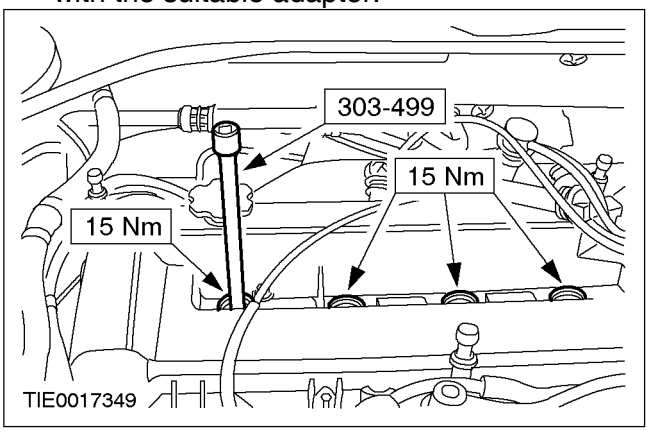


5. Using the special tool, remove the spark plugs.



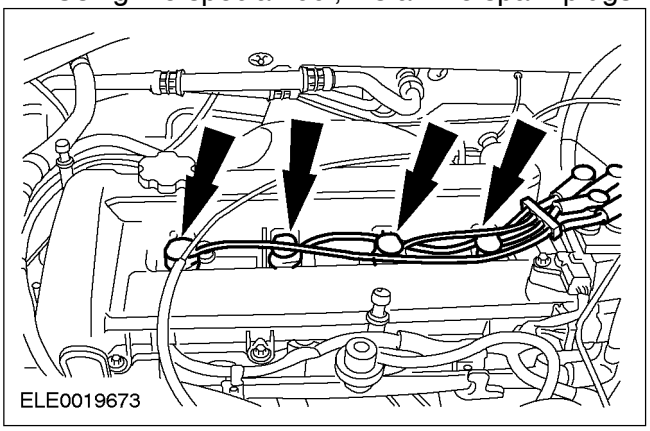
NOTE: Operate the starter motor with wide open throttle until the pointer on the measuring device stops rising.

6. Carry out the measurement in accordance with the instructions supplied with the measuring device on every cylinder using compression pressure recorder 623.000.101 with the suitable adapter.

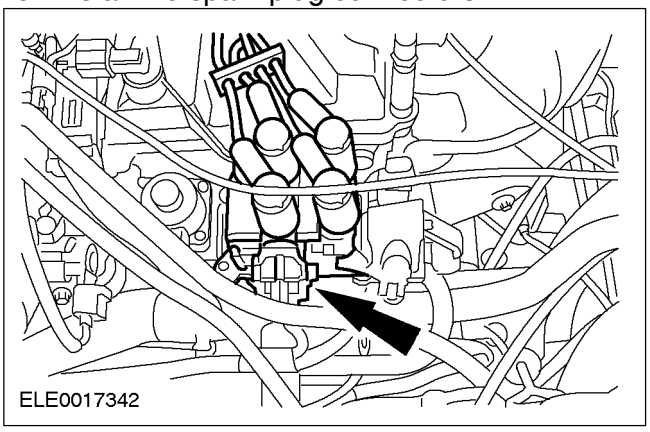


DIAGNOSIS AND TESTING (Continued)

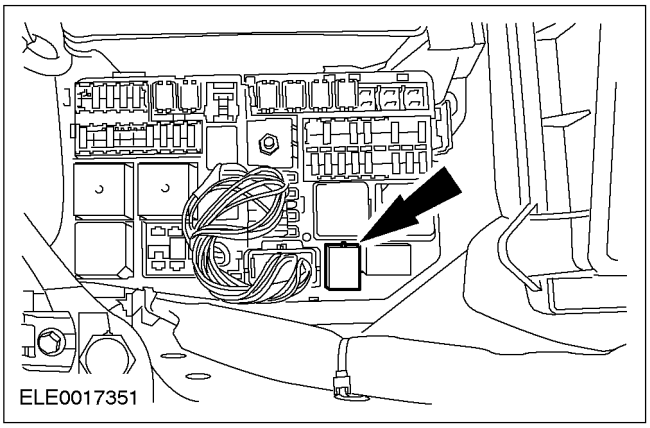
7. Using the special tool, install the spark plugs.



8. Install the spark plug connectors.

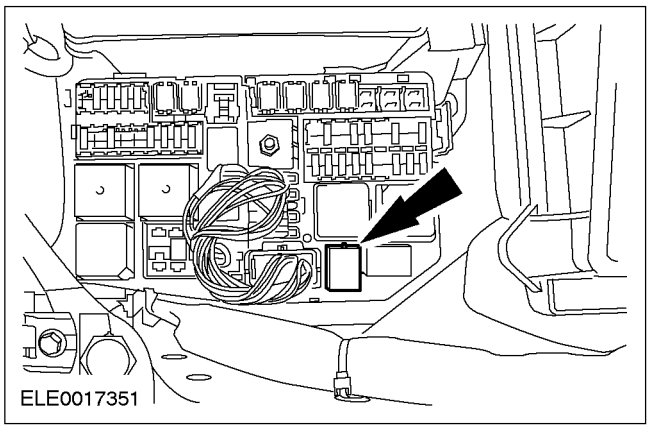


9. Connect the EI coil electrical connector to the EI coil.



10. Install the fuel pump relay.
11. Reset the PCM fault memory.

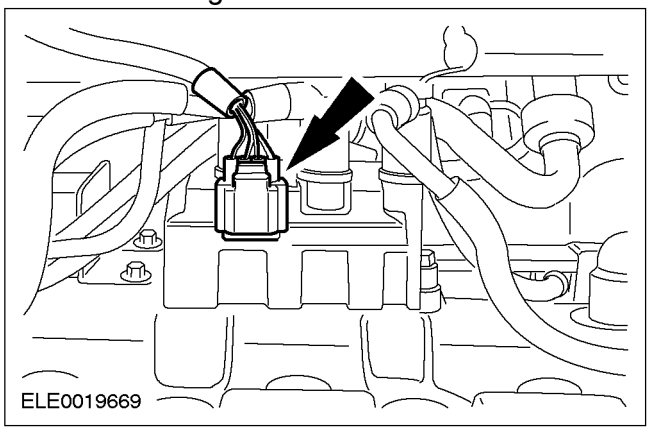
Measure the compression (Engine - 2.5L and 3.0L)



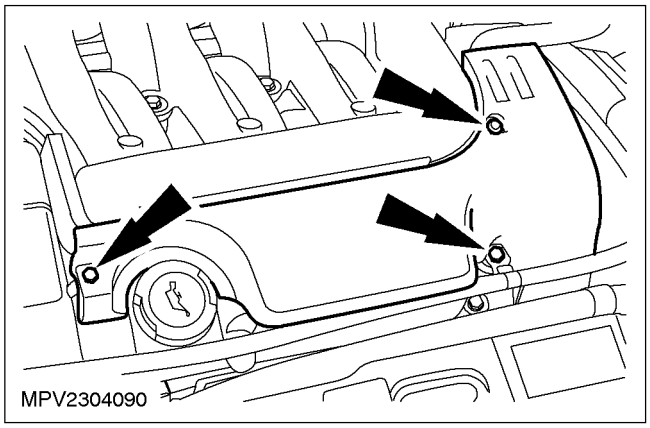
1. Open the central junction box (CJB) and remove the fuel pump relay.

NOTE: The engine will start, run for a few seconds and then stop.

2. Start the engine.

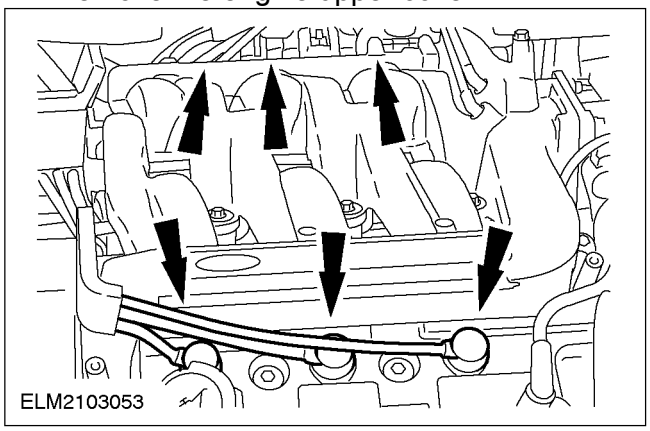


3. Disconnect the electronic ignition (EI) coil electrical connector from the EI coil.



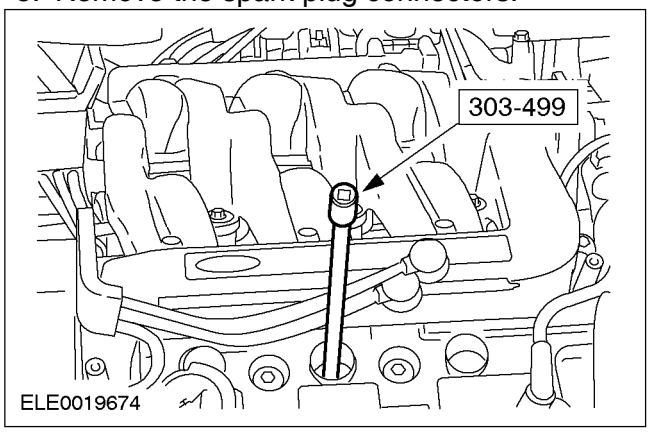
DIAGNOSIS AND TESTING (Continued)

4. Remove the engine upper cover.

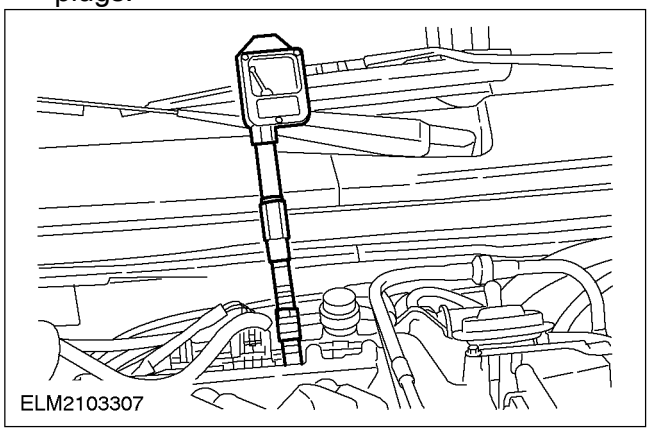


NOTE: Twist the spark plug connectors slightly before disconnecting them. Pull on the connector and not on the cable.

5. Remove the spark plug connectors.

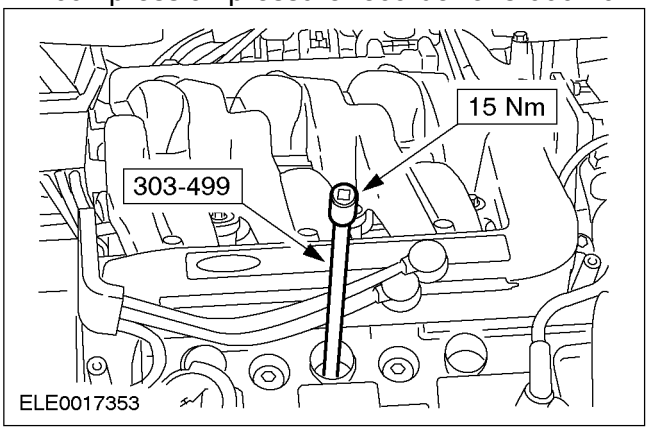


6. Using the special tool, remove the spark plugs.

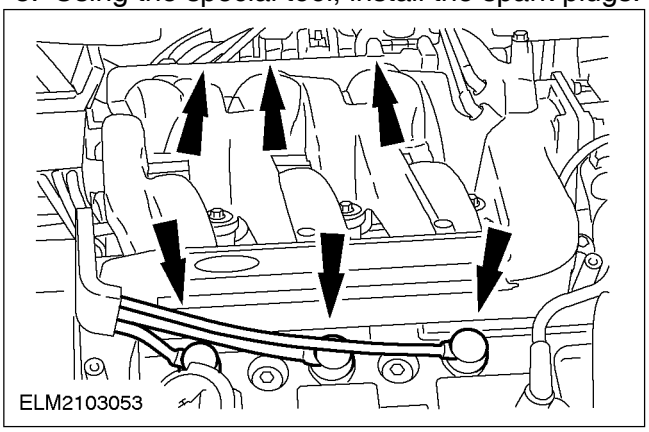


NOTE: Operate the starter motor with wide open throttle until the pointer on the measuring device stops rising.

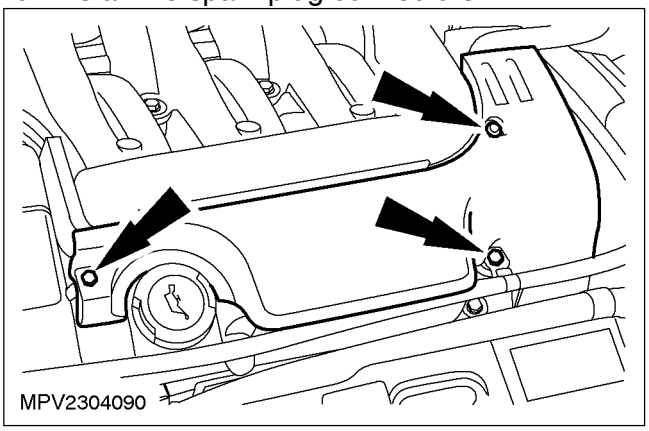
7. Carry out the measurement in accordance with the instructions supplied with the measuring device on every cylinder using compression pressure recorder 623.000.101.



8. Using the special tool, install the spark plugs.

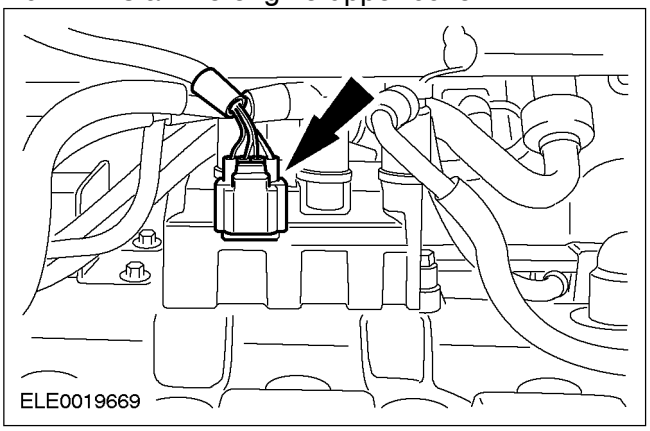


9. Install the spark plug connectors.

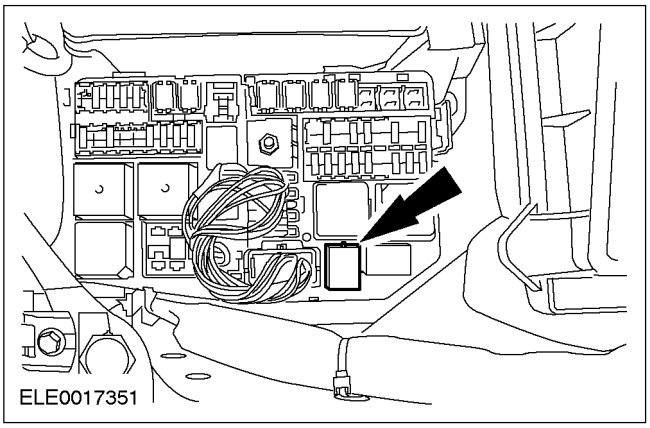


DIAGNOSIS AND TESTING (Continued)

10. Install the engine upper cover.

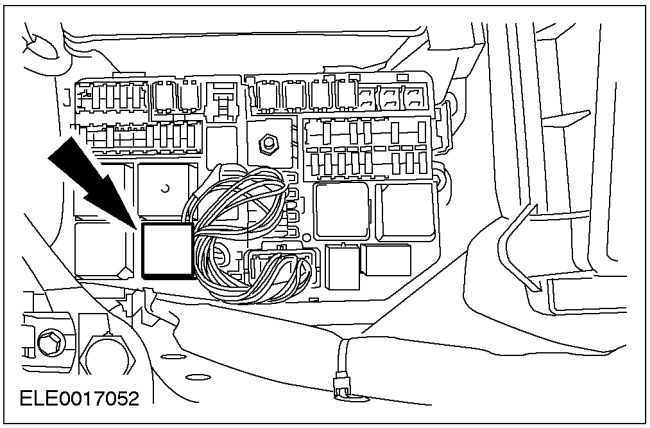


11. Connect the EI coil electrical connector to the EI coil.

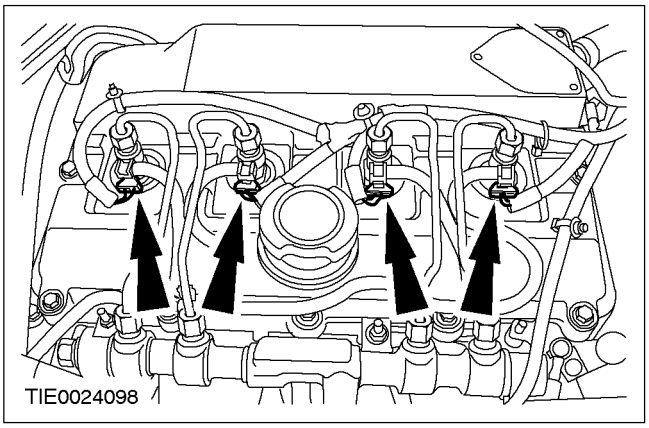


12. Install the fuel pump relay.
13. Reset the PCM fault memory.

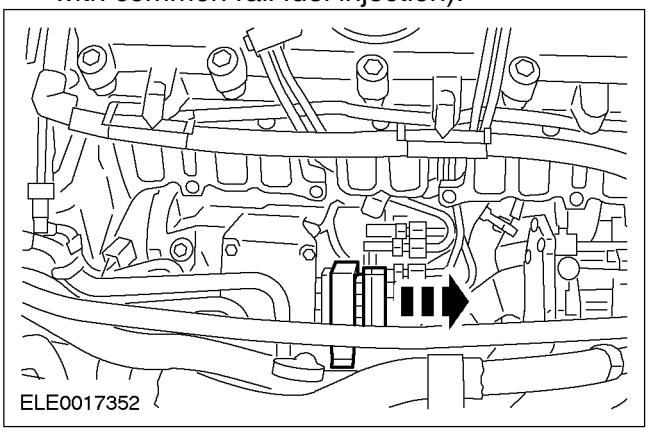
Measure the compression (Engine - 2.0L Diesel)



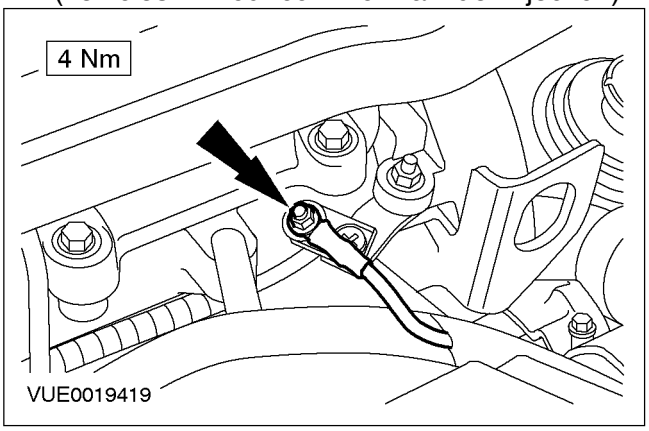
1. Open the central junction box (CJB) and remove the glow plug relay.
2. Remove the Intake Manifold. REFER to Section 303-01A / 303-01B.



3. Disconnect the fuel injector electrical connectors from the fuel injectors (vehicles with common rail fuel injection).

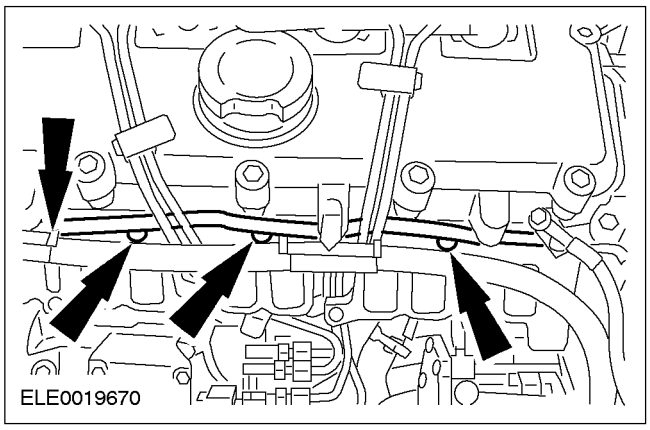


4. Disconnect the fuel injection pump electrical connector from the fuel injection pump (vehicles without common rail fuel injection).

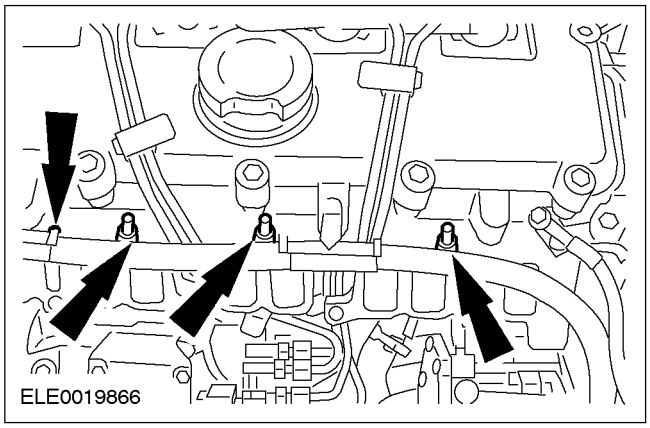


DIAGNOSIS AND TESTING (Continued)

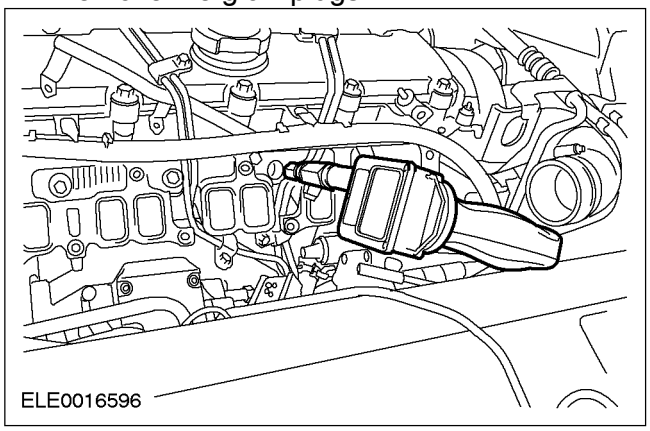
5. Disconnect the glow plug wire electrical connector.



6. Disconnect the glow plug electrical connector.



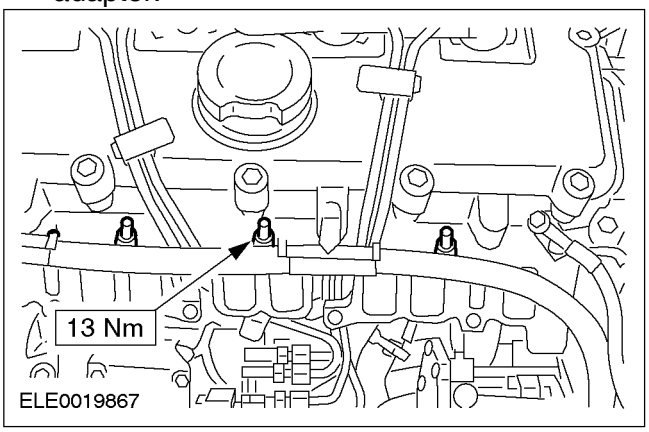
7. Remove the glow plugs.



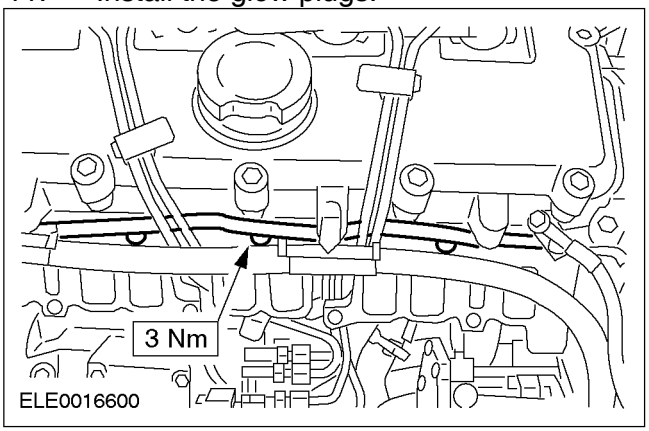
8. Install compression tester 623.002.1101 with adapter GV2168 into the glow plug bore.

NOTE: Crank the engine with the starter motor until the reading on the compression tester stops rising.

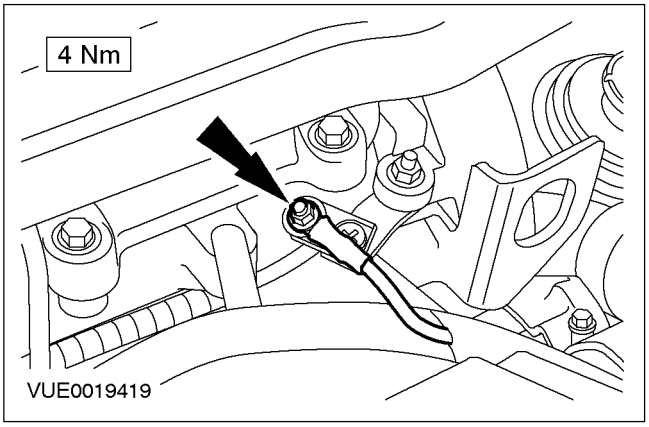
9. Carry out the measurement on all cylinders, following the measuring equipment manufacturer's instructions.
10. Detach the compression tester and adapter.



11. Install the glow plugs.

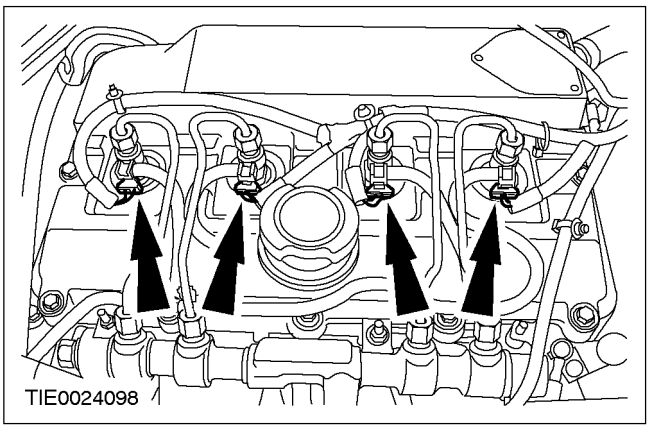


12. Connect the glow plug electrical connector.

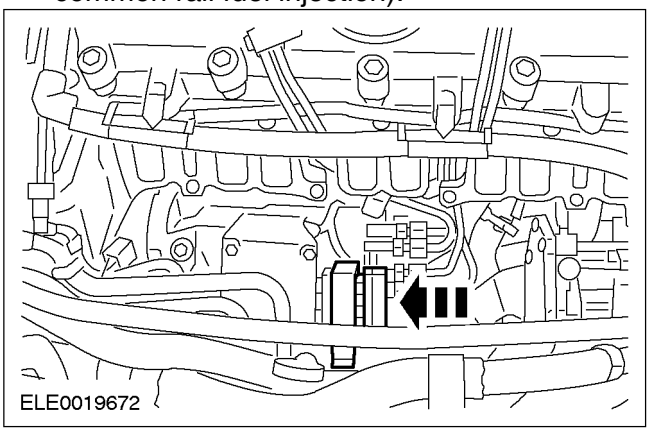


DIAGNOSIS AND TESTING (Continued)

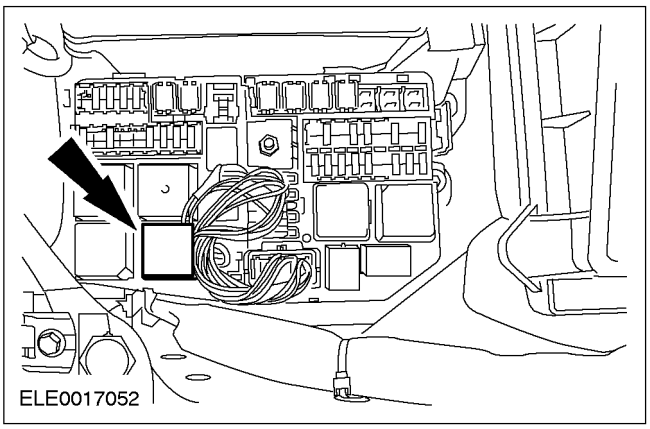
13. Connect the glow plug wire electrical connector.



14. Connect the fuel injector electrical connectors to the fuel injectors (vehicles with common rail fuel injection).



15. Connect the fuel injection pump electrical connector to the fuel injection pump (vehicles without common rail fuel injection).
16. Install the Intake Manifold. REFER to Section 303-01A / 303-01B.



17. Install the glow plug relay.
18. Reset the PCM fault memory.

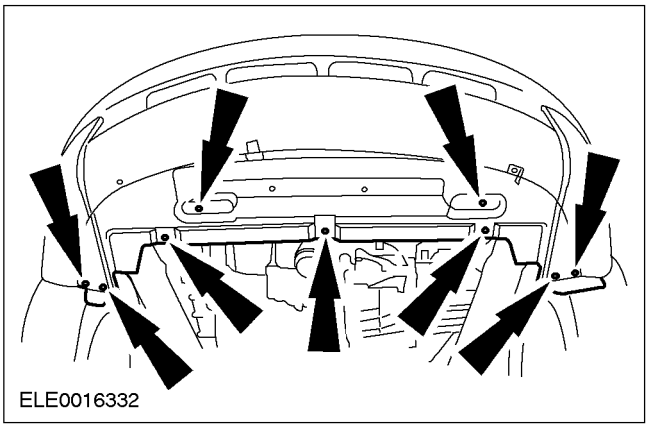
Oil Pressure - Measure (21 113 0)

The oil pressure depends on various factors (engine speed, oil temperature, oil viscosity, extent of oil filter contamination etc.).

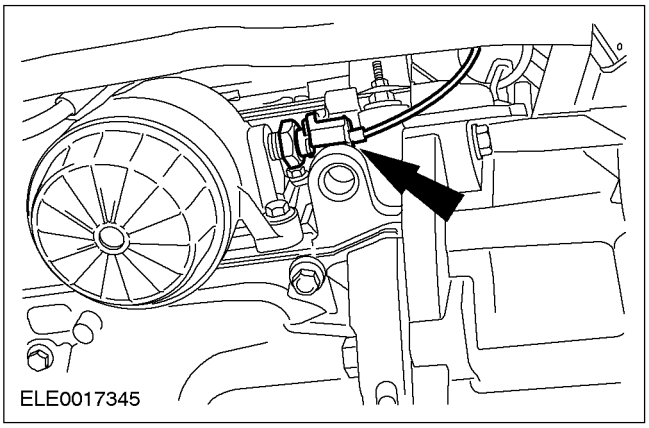
NOTE: Measure the oil pressure at the specified engine speed. Measure the oil pressure at an oil temperature of 80°C.

Measure the oil pressure (Engine - 1.8L and 2.0L)

1. Raise and support the vehicle. REFER to Section 100-02.

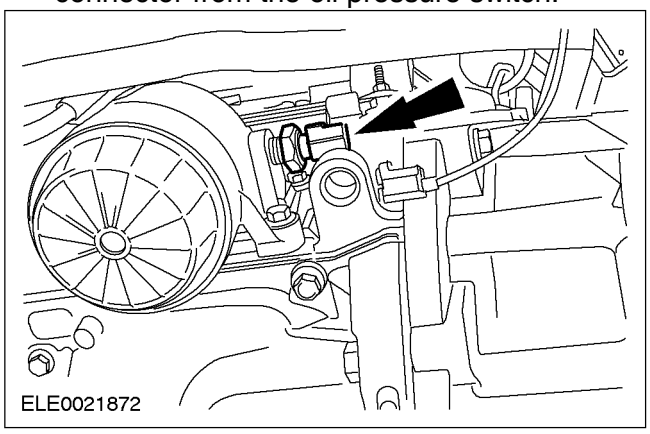


2. Remove the radiator lower cover.

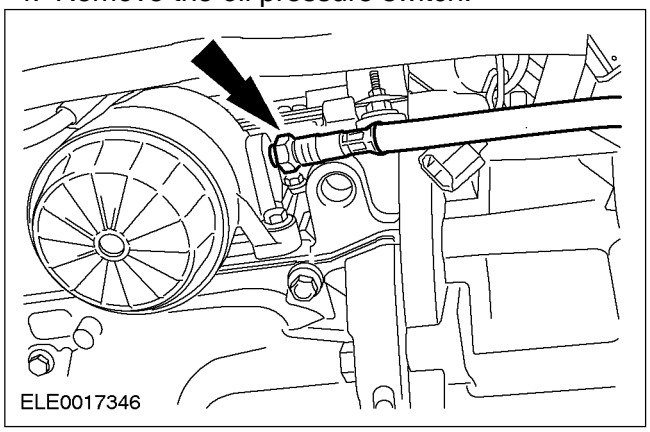


DIAGNOSIS AND TESTING (Continued)

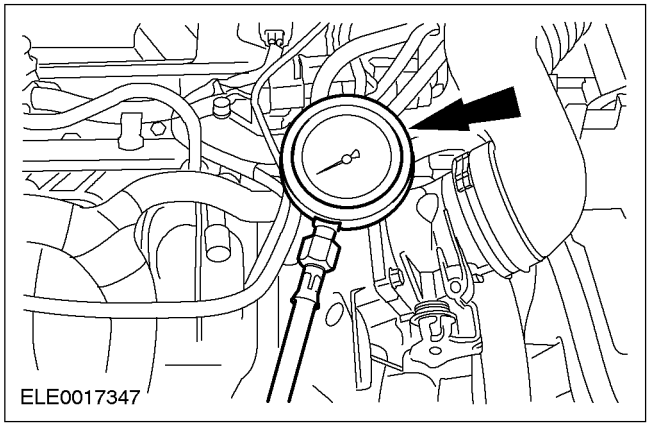
3. Disconnect the oil pressure switch electrical connector from the oil pressure switch.



4. Remove the oil pressure switch.

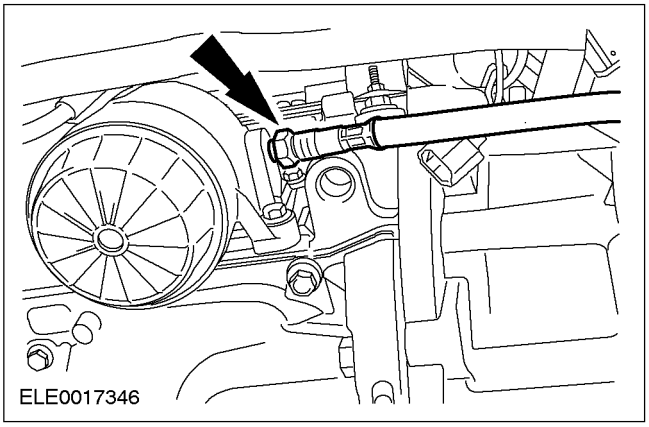


5. Attach the oil pressure gauge (GV 2134) with the oil pressure gauge connector to the oil pressure switch bore, and position it to allow reading from above.
6. Lower the vehicle.

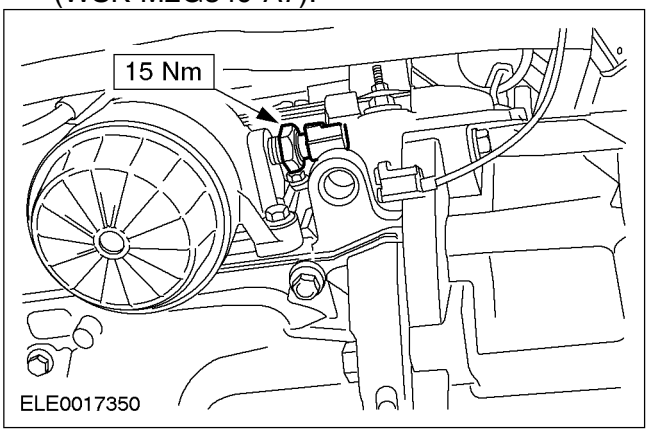


NOTE: Oil pressure at 2000 rpm: 3.5 bar.

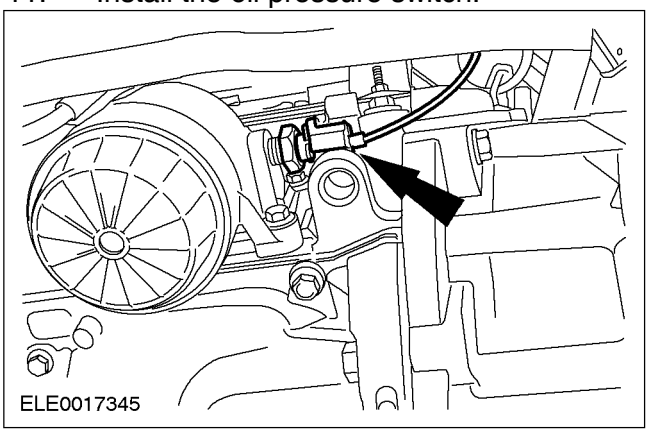
7. Measure the oil pressure.
8. Raise and support the vehicle. REFER to Section 100-02.



9. Detach the oil pressure gauge and connector from the oil pressure switch bore.
10. Coat the oil pressure switch with sealant (WSK-M2G349-A7).

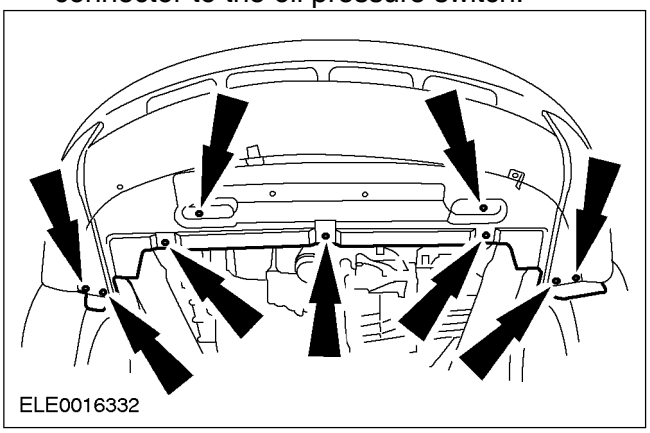


11. Install the oil pressure switch.



DIAGNOSIS AND TESTING (Continued)

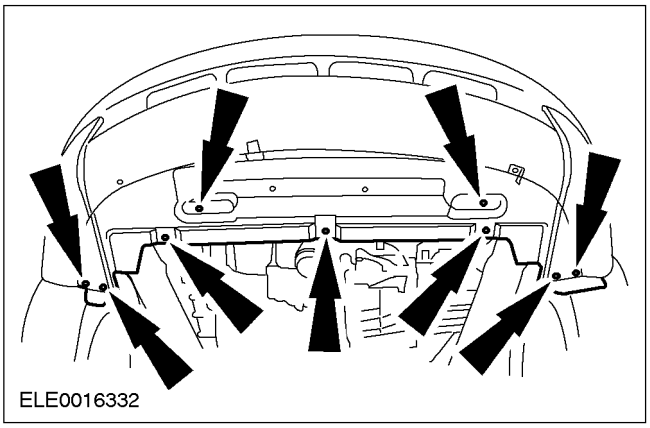
12. Connect the oil pressure switch electrical connector to the oil pressure switch.



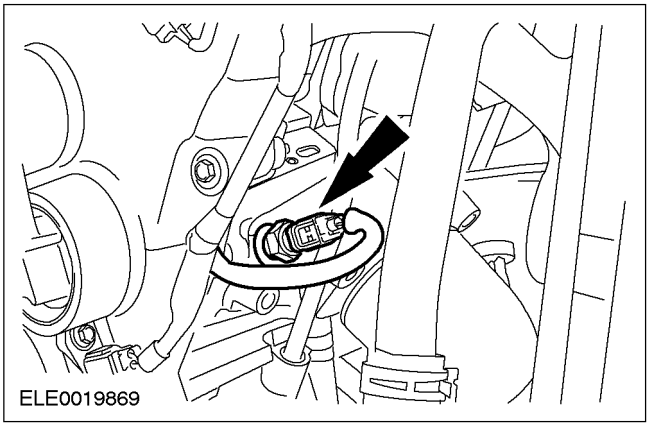
13. Install the radiator lower cover.
14. Lower the vehicle.

Measure the oil pressure (Engine - 2.5L and 3.0L)

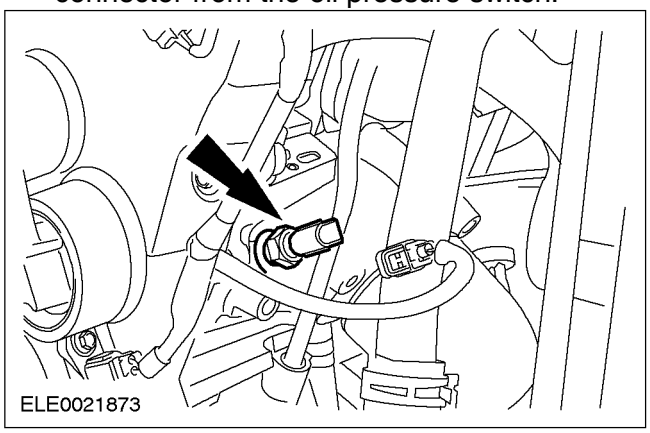
1. Raise and support the vehicle. REFER to Section 100-02.



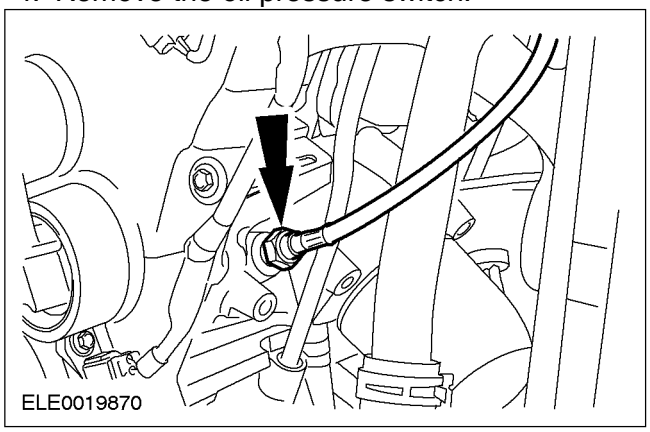
2. Remove the radiator lower cover.



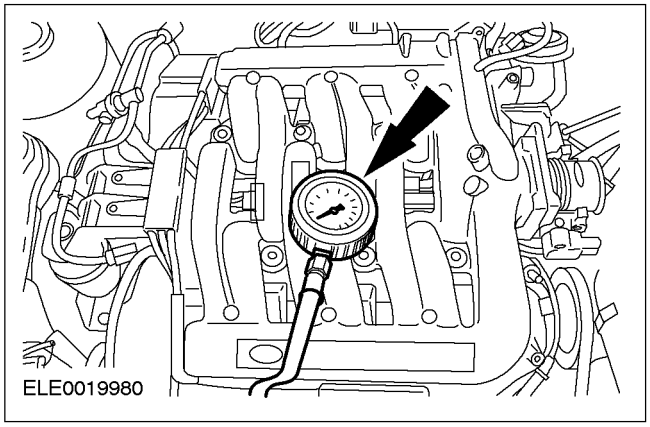
3. Disconnect the oil pressure switch electrical connector from the oil pressure switch.



4. Remove the oil pressure switch.

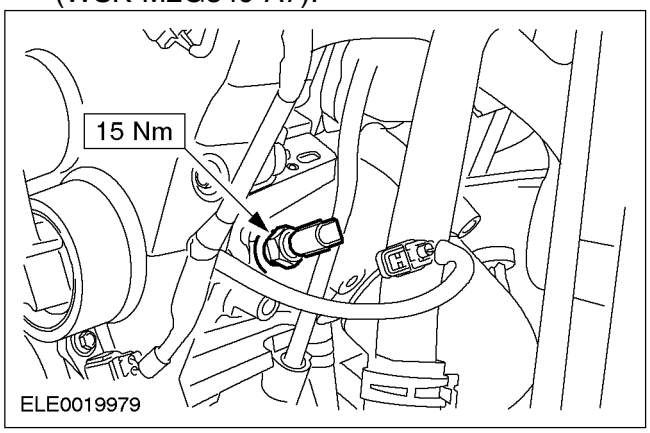


5. Attach the oil pressure gauge (GV 2134) with oil pressure gauge connector to the oil pressure switch bore, and position it to allow reading from above.
6. Lower the vehicle.

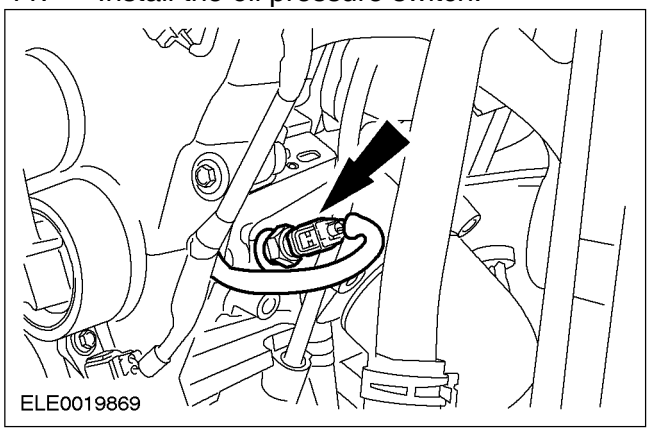


DIAGNOSIS AND TESTING (Continued)

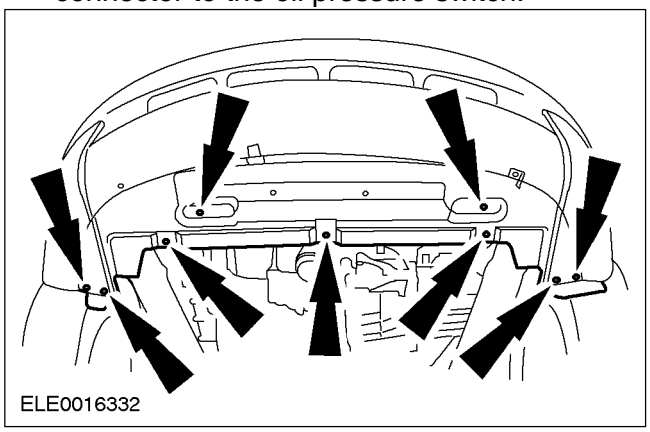
7. Measure the oil pressure. Engine - 2.5L - REFER to Section 303-01A / 303-01B. Engine - 3.0L -
8. Raise and support the vehicle. REFER to Section 100-02.
9. Detach the oil pressure gauge and connector from the oil pressure switch bore.
10. Coat the oil pressure switch with sealant (WSK-M2G349-A7).



11. Install the oil pressure switch.



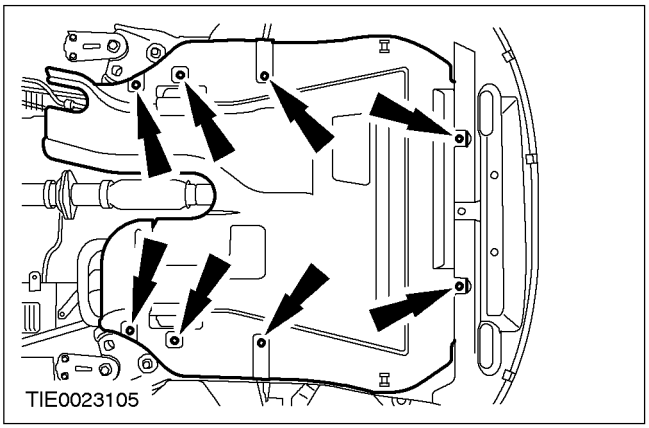
12. Connect the oil pressure switch electrical connector to the oil pressure switch.



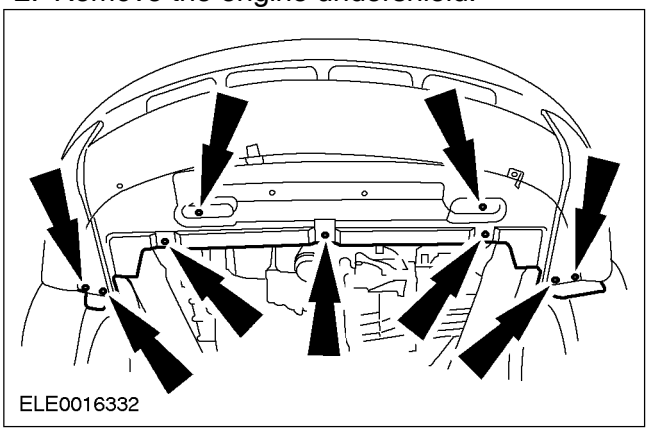
13. Install the radiator lower cover.
14. Lower the vehicle.

Measure the oil pressure (Engine - 2.0L Diesel)

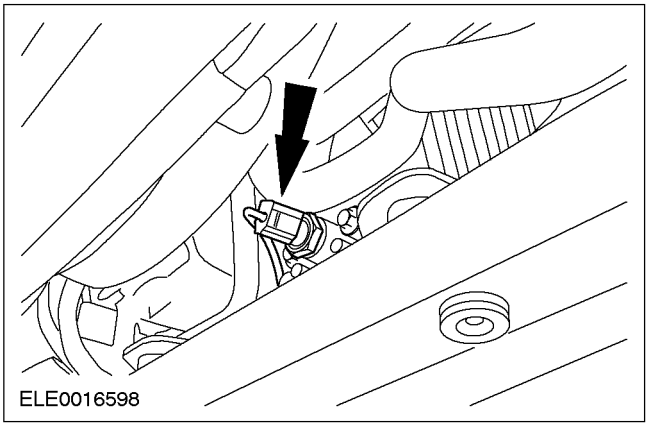
1. Raise and support the vehicle. REFER to Section 100-02.



2. Remove the engine undershield.

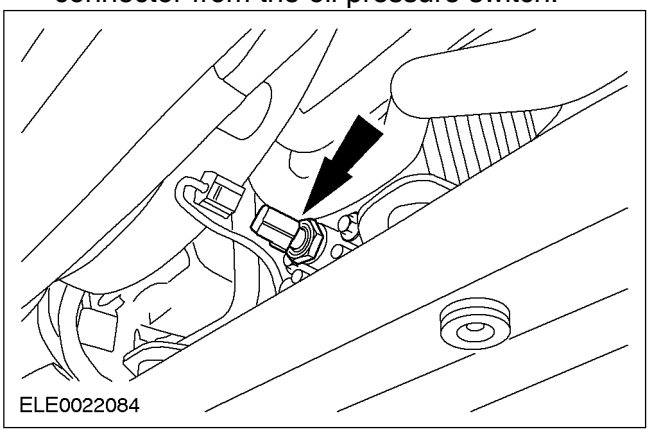


3. Remove the radiator lower cover.

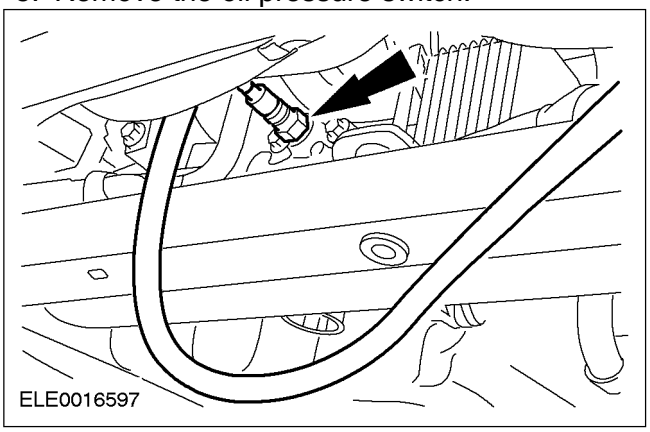


DIAGNOSIS AND TESTING (Continued)

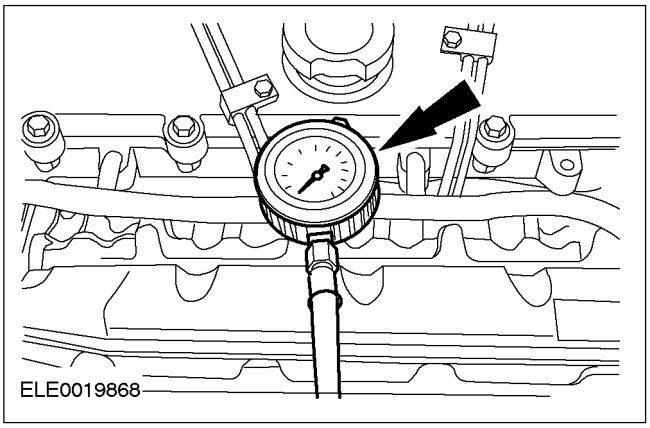
4. Disconnect the oil pressure switch electrical connector from the oil pressure switch.



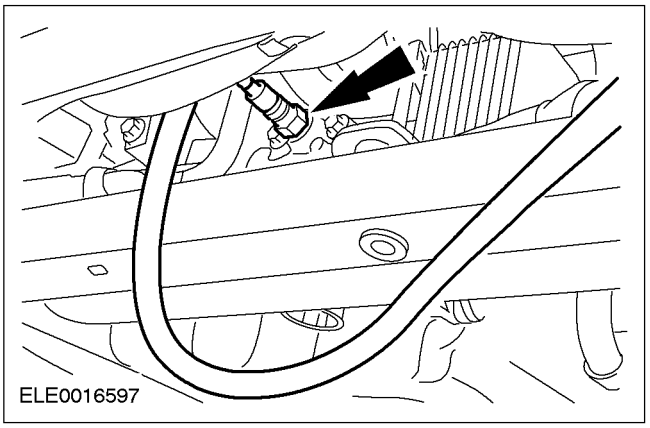
5. Remove the oil pressure switch.



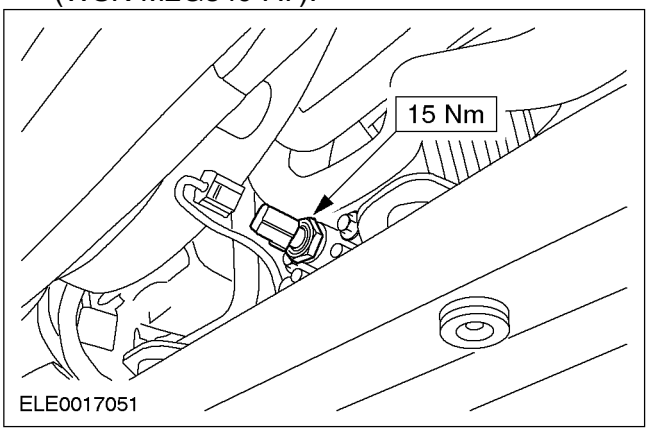
6. Attach the oil pressure gauge (GV 2134) with the oil pressure gauge connector, and position it to allow reading from above.
7. Lower the vehicle.



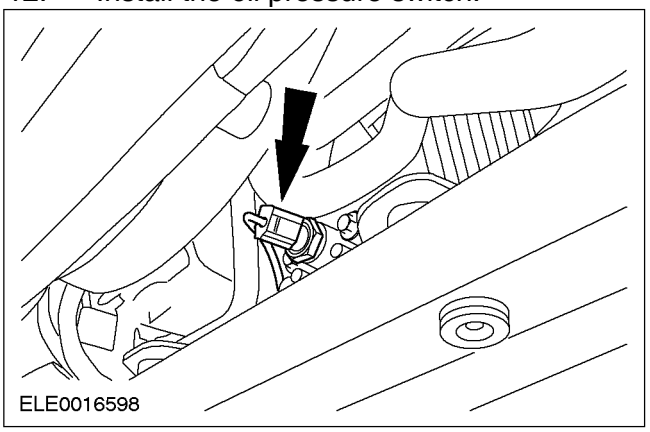
8. Measure the oil pressure. REFER to Section 303-01A / 303-01B.
9. Raise and support the vehicle. REFER to Section 100-02.



10. Remove the oil pressure gauge and the oil pressure gauge connector.
11. Coat the oil pressure switch with sealant (WSK-M2G349-A7).

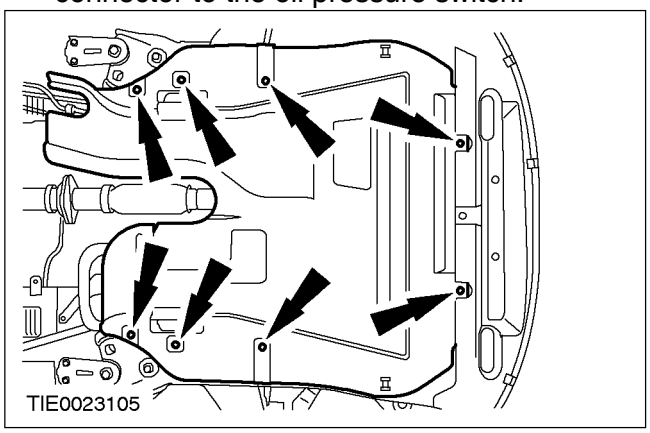


12. Install the oil pressure switch.

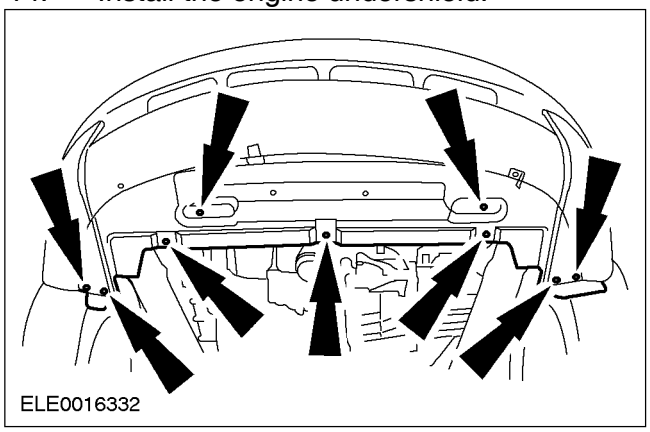


DIAGNOSIS AND TESTING (Continued)

13. Connect the oil pressure switch electrical connector to the oil pressure switch.



14. Install the engine undershield.



15. Install the radiator lower cover.
16. Lower the vehicle.

Valve train analysis - static (engine off)

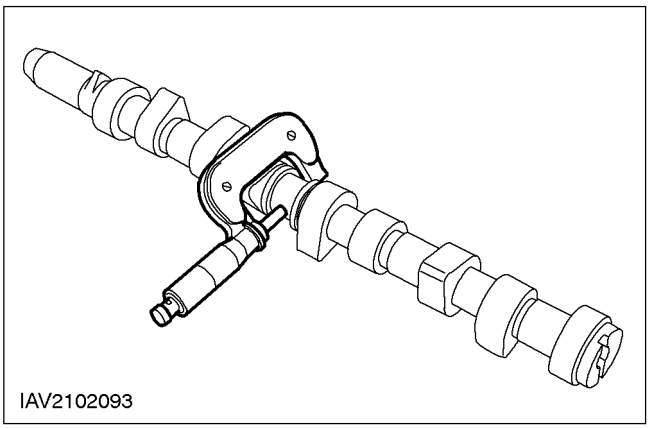
Remove the valve cover.

Check all components of the valve train for damage and wear. Make sure that only original components are installed and that all nuts and bolts are tightened to the specified torque.

GENERAL PROCEDURES

Camshaft Bearing Journal Diameter

1. **Determine the diameter of the camshaft journals.**
   - Using a micrometer measure the diameter at 90 degrees intervals to determine if the journals are out-of-round.
   - Measure at two different points on the journal to determine if there is any tapering.
   - If the measurements are out of the specified range, install a new camshaft.


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GENERAL PROCEDURES

Camshaft Bearing Journal Clearance

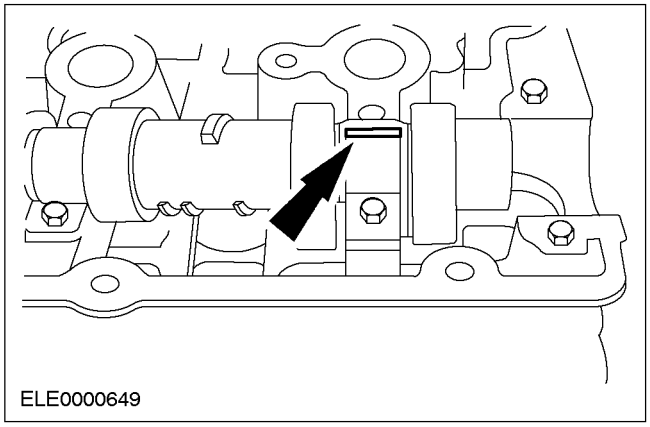
1. **NOTE:** Make sure that the following stages are followed exactly. The tappets or followers must be removed to carry out this measurement.

NOTE: Make sure that the camshaft is to specification.

NOTE: The bearing caps and journals should be free from engine oil and dirt.

Position on a width of plastigage on the bearing cap.

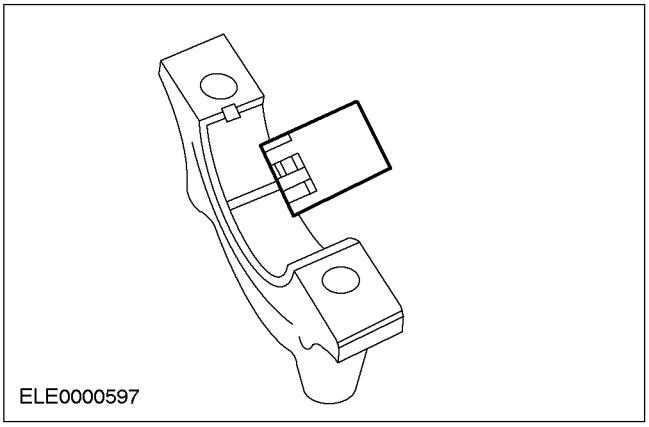
- Insert the camshaft, without lubrication, into the cylinder head.
- Position a plastigage strip, which should be equal to the width of the bearing cap, on the bearing journal.



2. **Following the tightening specification, install the camshaft bearing caps. Refer to the corresponding Section 303-01.**
3. **NOTE:** Do not strike the bearing caps.

Remove the camshaft bearing caps, refer to the corresponding Section 303-01.

4. **Using the Plastigage, read off the measurement.**
   - Compare the width of plastigage with the plastigage scale.
   - The value that is read off is the bearing clearance.



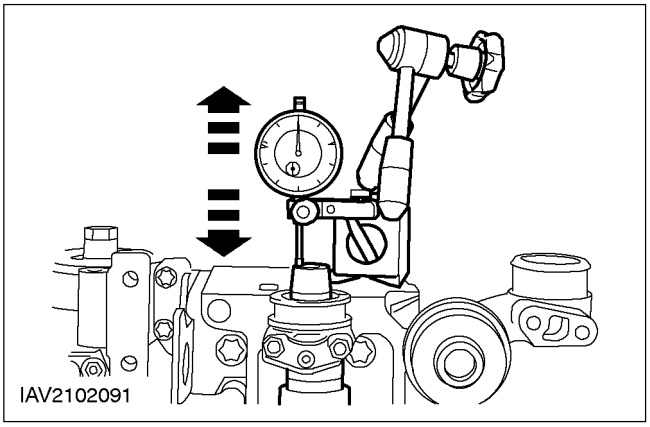
GENERAL PROCEDURES

Camshaft End Play

1. **NOTE:** Make sure that the camshaft is to specification.

   Using a Dial Indicator Gauge, measure the end play.

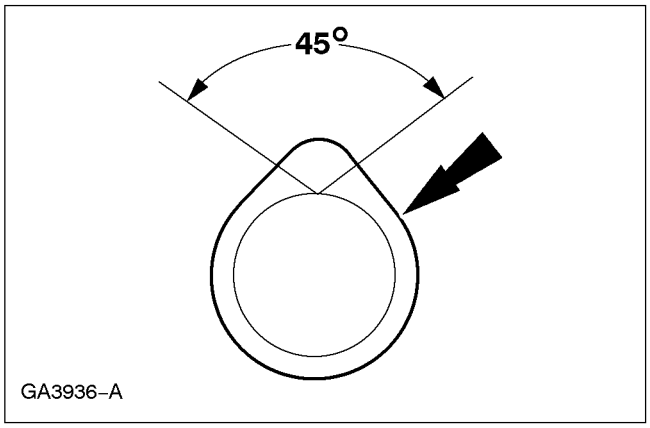
   - Slide the camshaft in both directions. Read and note the maximum and minimum values on the Dial Indicator Gauge.
   - End play = maximum value minus minimum value
   - If the measurement is out of specification, install new components.



GENERAL PROCEDURES

Camshaft Surface Inspection

1. **Inspect the camshaft lobes for pitting or damage in the active area. Minor pitting is acceptable outside the active area.**

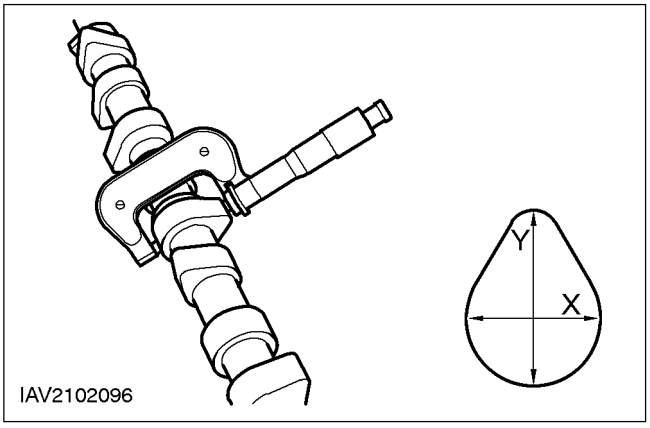


GENERAL PROCEDURES

Camshaft Lobe Lift

1. Determine the cam lift.

- Using a micrometer measure the cam in two directions.
- The difference between the two measurements is the cam lift.



GENERAL PROCEDURES

Crankshaft Main Bearing Journal Clearance

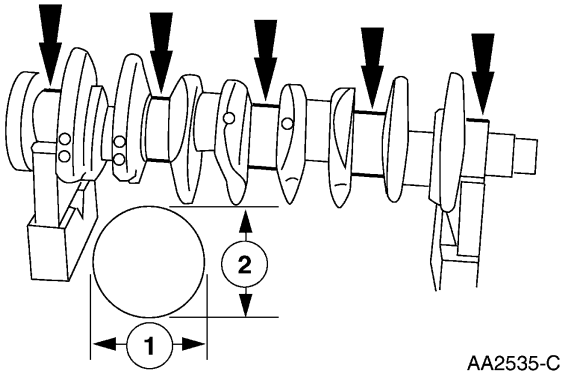
1. **Information not available at time of going to press.**

GENERAL PROCEDURES

Crankshaft Main Bearing Journal Diameter

General Equipment
Micrometer

1. **Measure the diameter of the main bearing journals and the big-end bearing journals.**
   - Repeat the measurement with the micrometer offset by 90°, in order to determine any eccentricity which may be present.
   - Measure the journal at two different positions to determine any conicity which may be present.



GENERAL PROCEDURES

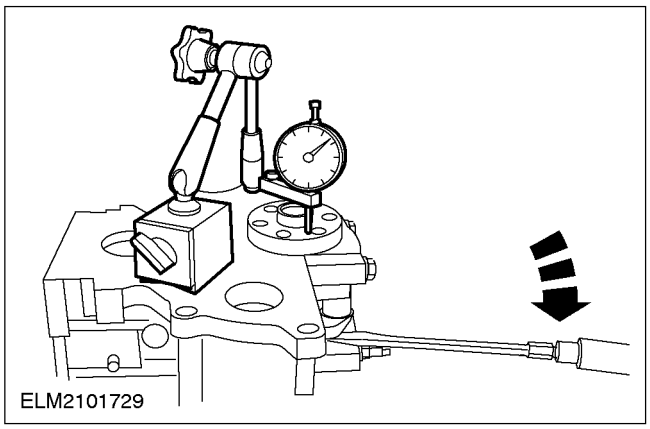
Crankshaft End Play

General Equipment
Dial indicator
Dial indicator fixture

1. **NOTE:** Operation for vehicles with Zetec-E engines only. Dismantling the crank gear is not permitted on Zetec-SE engines.

   Determine the end float

   - Place on the dial indicator and bracket .
   - Determine the end float by raising the crankshaft with the aid of a screwdriver.
   - If necessary, correct the end float by using new thrust half washers.



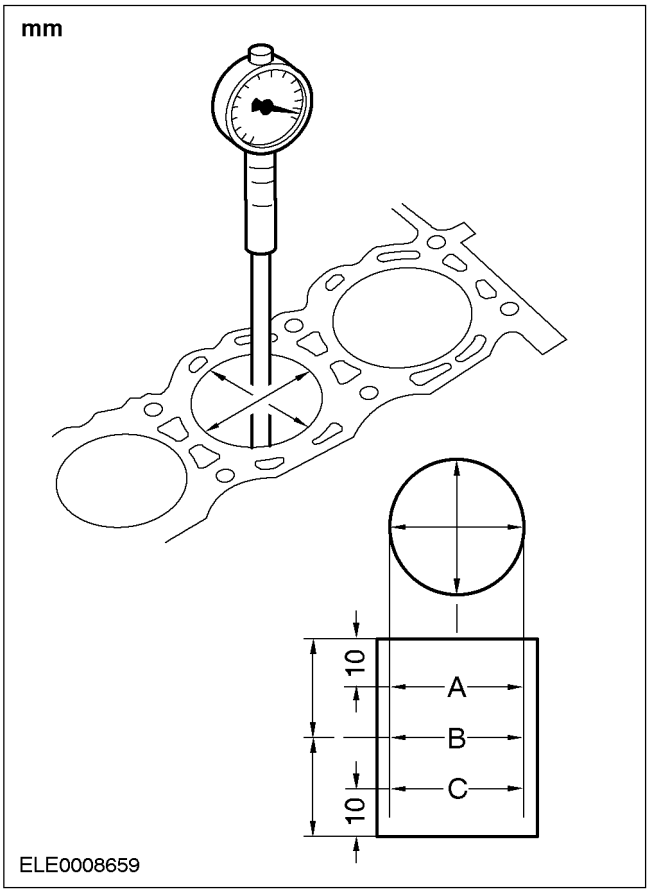
GENERAL PROCEDURES

Cylinder Bore Taper

1. **NOTE:** The main bearing caps or lower crankcase must be in place and tightened to the specified torque; however, the bearing shells should not be installed.

   Measure the cylinder bore with an internal micrometer.

   - Carry out the measurements in different directions and at different heights to determine if there is any out-of-roundness or tapering.
   - If the measurement is out of the specified range, install a new block or hone out the cylinder block (if aplicable/allowed).



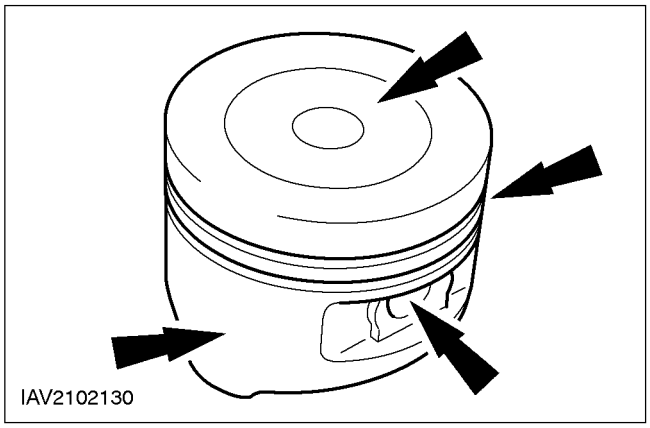
GENERAL PROCEDURES

Piston Inspection

1. **CAUTION: Do not use any aggressive cleaning fluid or a wire brush to clean the piston.**

   Carry out a visual inspection.

   - Clean the piston skirt, pin bush, ring grooves and crown and check for wear or cracks.
   - If there are signs of wear on the piston skirt, check whether the connecting rod is twisted or bent.



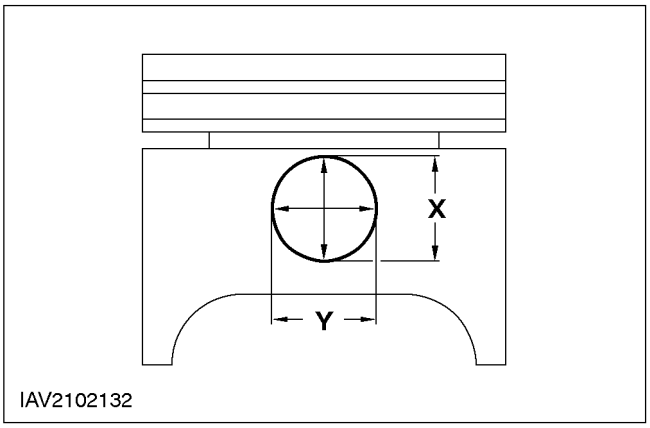
GENERAL PROCEDURES

Piston Pin to Bore Diameter

1. **NOTE:** The piston and piston pin form a matched pair. Do not mix up the components.

   Measure the diameter of the piston pin bore.

   - Measure the diameter in two directions.
   - If the values are not to specification, install both a new piston and a new piston pin.



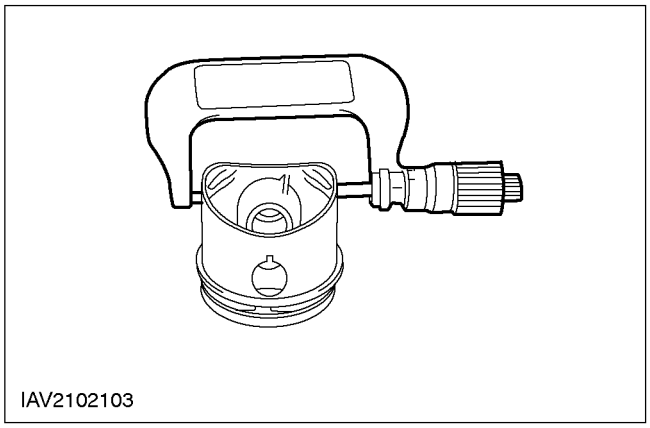
GENERAL PROCEDURES

Piston Diameter

General Equipment
Micrometer

1. **NOTE:** Mark the piston to make sure the piston is installed correctly.

   Using a Micrometer measure the piston diameter.



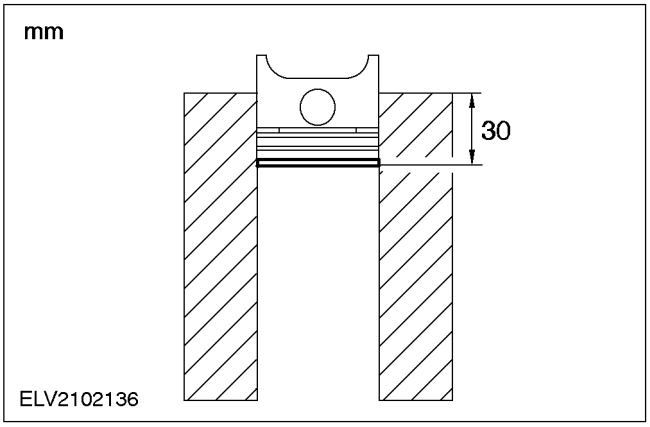
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GENERAL PROCEDURES

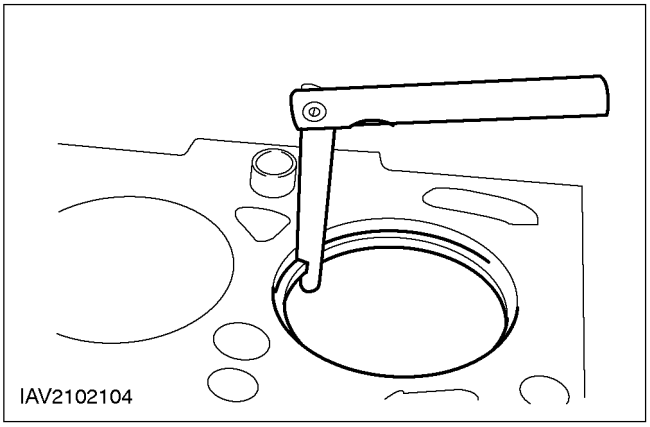
Piston Ring End Gap

1. **CAUTION: Do not mix up the piston rings. Install the piston rings in the same position and location.**

   Take the piston ring and use a piston without rings to push the piston ring about 30 mm into the cylinder bore.



2. **Using the Feeler Gauge, measure the piston ring gap.**



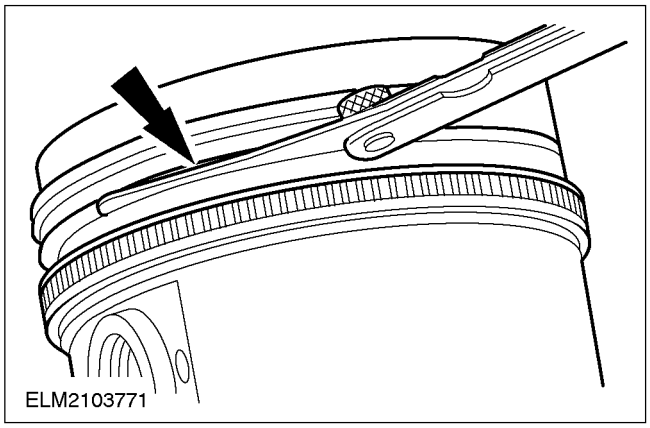
GENERAL PROCEDURES

Piston Ring-to-Groove Clearance

General Equipment
Feeler Gauge

1. **NOTE:** The piston ring must protrude from the piston groove. To determine the piston ring clearance, insert the Feeler Gauge right to the back of the groove, behind the wear ridge.

   Using the Feeler Gauge , measure the piston ring clearance.



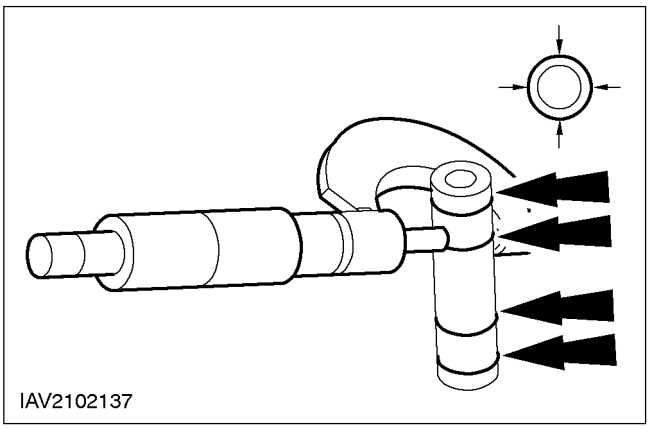
GENERAL PROCEDURES

Piston Pin Diameter

1. **NOTE:** The piston and piston pin are a matched pair. Do not mix up the components.

   Measure the piston pin diameter.

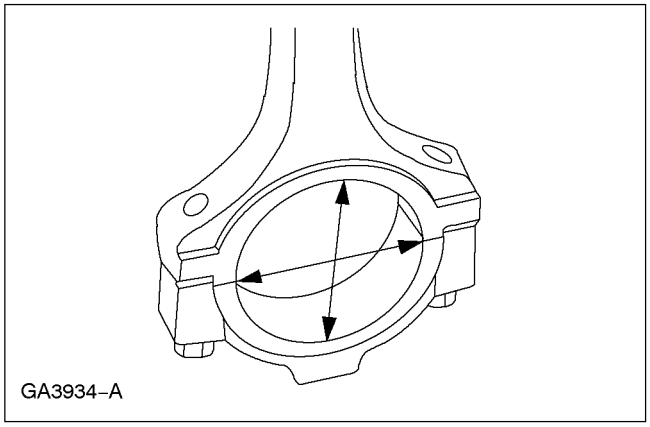
   - Measure the diameter in two directions.
   - If the values are not to specification, install a new piston and a new piston pin.



GENERAL PROCEDURES

Connecting Rod Large End Bore

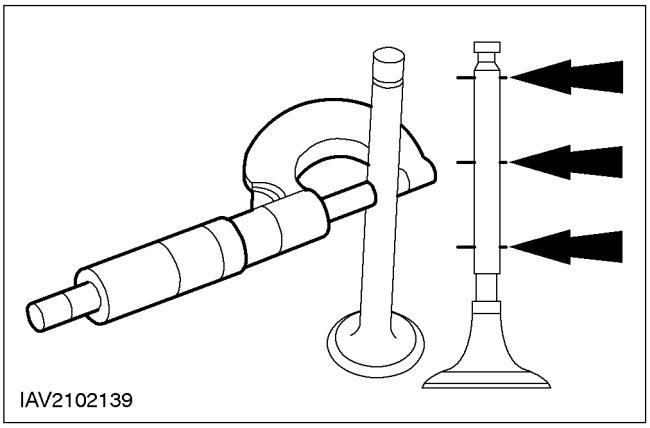
1. **Measure the bearing bore in two directions. The difference is the connecting rod bore out-of-round. Verify the out-of-round and the bearing bore is within specification.**



GENERAL PROCEDURES

Valve Stem Diameter

1. **Using a micrometer measure the diameter of the valve stems.**
   - If the measurements are not to specification, install a new valve.



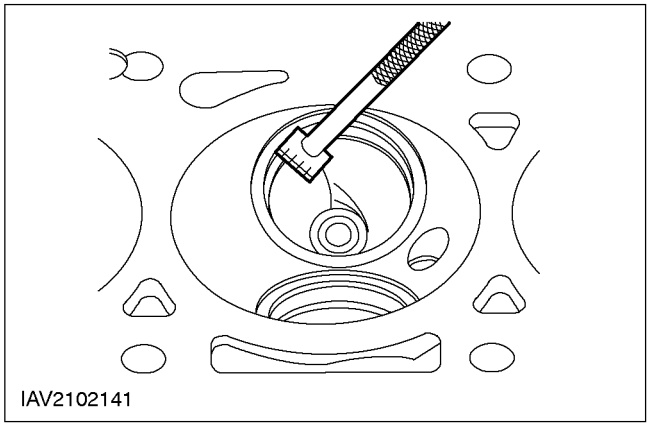
GENERAL PROCEDURES

Valve Seat Inspection

General Equipment
Valve seat width scale

1. Measure the width of the valve seat.

- Measure the valve seat width using the Valve seat width scale.
- If the value is not to specification rework the valve seat.



GENERAL PROCEDURES

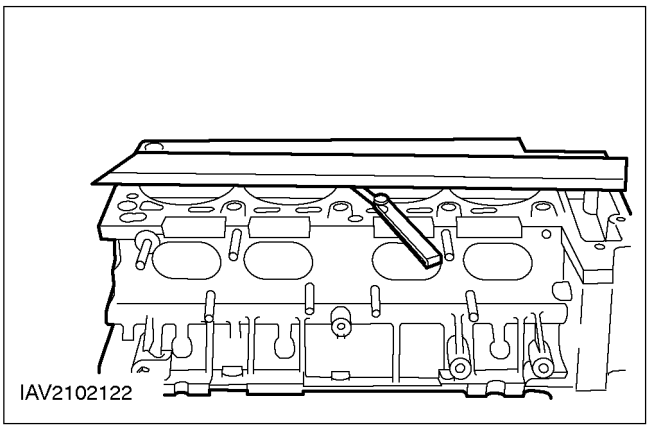
Cylinder Head Distortion

General Equipment
Feeler Gauge
Straight edge

1. **CAUTION: The mating face of the 2.5L engines must not be reworked.**

   Using a straight edge and feeler gauge, measure the cylinder head distortion.

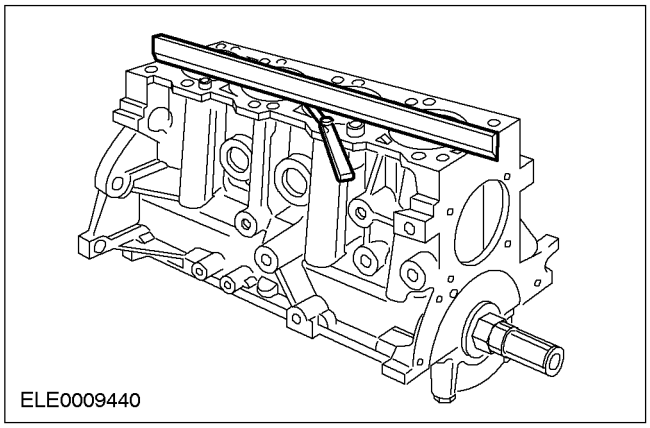
   - Measure the mating face distortion.
   - If the value is not to specification rework the mating face.



GENERAL PROCEDURES

Cylinder Block Distortion

1. **Using a Straight Edge and a Feeler Gauge, measure the cylinder block/cylinder head distortion.**
   - Measure the mating face distortion.
   - If the value is not to specification rework the mating face (if allowed).



GENERAL PROCEDURES

Exhaust Manifold Cleaning and Inspection

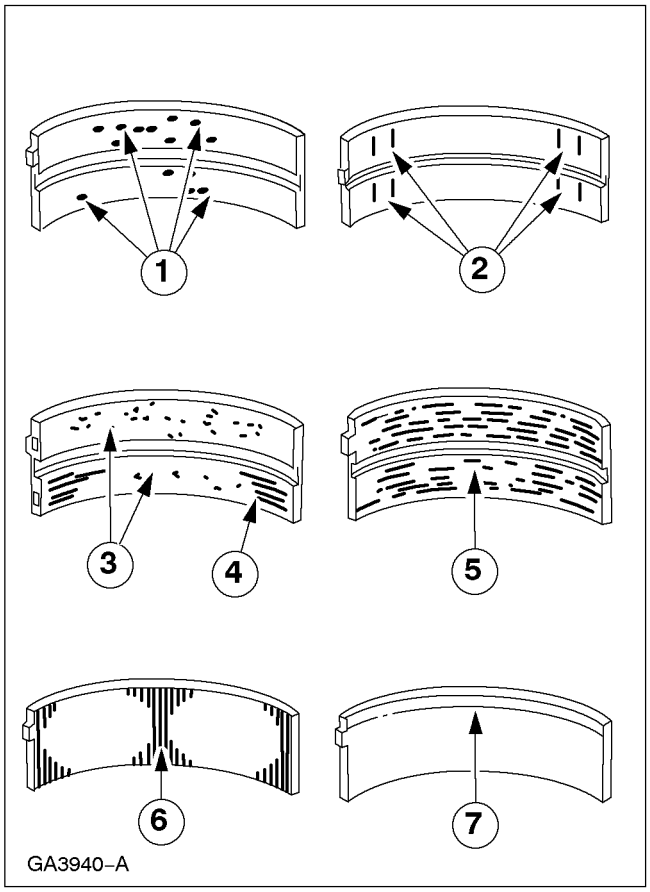
1. **Inspect the cylinder head joining flanges of the exhaust manifold for evidence of exhaust gas leaks.**
2. **Inspect the exhaust manifold for cracks, damaged gasket surfaces, or other damage that would make it unfit for further use.**

GENERAL PROCEDURES

Bearing Inspection

1. Inspect bearings for the following defects.

1. Cratering - fatigue failure
2. Spot polishing - incorrect seating.
3. Imbedded dirt engine oil.
4. Scratching - dirty engine oil.
5. Base exposed - poor lubrication.
6. Both edges worn - journal damaged.
7. One edge worn - journal tapered or bearing not seated.



SECTION 303-01A Engine

VEHICLE APPLICATION: 2003.0 Mondeo

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Valves	(21 215 4)	303-01-35
Camshafts	(21 284 0)	303-01-37
Timing Chain	(21 314 0)	303-01-47
Cylinder Head	(21 163 0)	303-01-60
Oil Pan	(21 154 0)	303-01-77
Oil Pump	(21 714 0)	303-01-91
Crankshaft Rear Seal	(21 468 4)	303-01-93

REMOVAL AND INSTALLATION

Engine — Vehicles With: Automatic Transaxle		303-01-95

DISASSEMBLY

Engine	(21 134 8)	303-01-105

ASSEMBLY

Engine..... (21 134 8) 303-01-113

INSTALLATION

Engine — Vehicles With: Automatic Transaxle..... 303-01-126

SPECIFICATIONS

Engine Data 1.8L 110 PS

Description	
Firing order	1-3-4-2
Bore diameter	83 mm
Stroke	83.1 mm
Compression ratio	10.8 : 1
Engine performance (EEC) – 5500 rpm	81 kW (110 PS)
Torque at 3950 rpm	165 Nm
Maximum permissible engine speed — intermittent	6175 rpm
Fuel shut off	6925 rpm

Engine Data 1.8L 125 PS

Description	
Firing order	1-3-4-2
Bore diameter	83 mm
Stroke	83.1 mm
Compression ratio	10.8 : 1
Engine performance (EEC) – 6000 rpm	92 kW (125 PS)
Torque at 4500 rpm	170 Nm
Maximum permissible engine speed — intermittent	6800 rpm
Fuel shut off	6925 rpm

Engine Data 2.0L 145 PS

Description	
Firing order	1-3-4-2
Bore diameter	87.5 mm
Stroke	83.1 mm
Compression ratio	10.8 : 1
Engine performance (EEC) – 6000 rpm	107 kW (145 PS)
Torque at 4500 rpm	190 Nm
Maximum permissible engine speed — intermittent	6675 rpm
Fuel shut off	6925 rpm

Engine Oil

Viscosity / ambient temperature	Type	Specification
Recommended engine oil		
SAE 5W-30 / below -20°C to over +40°C	Ford Formula E Economy Motor Oil	ACEA A1/B1 and WSS-M2C912-A1 or WSS-M2C913-A
Alternative engine oils		
SAE 10W-30 / -20°C to over +40°C	Ford Super Multigrade Motor Oil	ACEA A1/B1 or A2/B2 and/or API/SH/CD EC
SAE 10W-40 / -20°C to over +40°C	Ford XR+ High-performance High-lubricity Motor Oil	ACEA A3/B3 and/or API/SH/CD EC
SAE 5W-40 / below -20°C to over +40°C	Ford Formula S Synthetic Motor Oil	ACEA A3/B3 and/or API/SH/CD EC

If engine oils with these specifications are not available, only use engine oils which conform to specification API SH/EC (Energy Conserving) or better.

SPECIFICATIONS (Continued)

Oil system

Description	bar
Pressure relief valve opening pressure	5

If other types of engine oil are used, these must conform at least to the respective API SH/EC viscosity class.

Engine Oil Capacity

Description	Liters
Initial fill, including oil filter	4.6
Service fill including filter	4.3
Service fill excluding filter	3.9

Valve Dimensions

Description	mm
Valve clearance (engine cold), intake	0.22 – 0.28
Valve clearance (engine cold), exhaust	0.27 – 0.33
Valve stem diameter, intake	5.465 - 5.480
Valve stem diameter, exhaust	5.470 - 5.485

Camshaft Dimensions

Description	mm
Camshaft journal diameter	24.97 ± 0.01
Camshaft journal clearance	0.055 - 0.060
Camshaft endplay	0.09 - 0.24
Camshaft lobe lift, intake, 81 kW (110 PS)	7.4
Camshaft lobe lift, intake, 92 kW (125 PS)	8.5
Camshaft lobe lift, intake, 107 kW (145 PS)	8.8
Camshaft lobe lift, exhaust	7.7

Crankshaft Dimensions

Description	mm
Crankshaft main bearing journal	0.019 - 0.035
Crankshaft main bearing journal diameter	57.018 - 57.040
Crankshaft endplay	0.335 ± 0.115

Piston Dimensions, 1.8L Engine

Description	mm
Piston diameter - Class 1	82.965 - 82.975
Piston diameter - Class 2	82.975 - 82.985
Piston diameter - Class 3	82.985 - 82.995

Piston Dimensions, 2.0L Engine

Description	mm
Piston diameter - Class 1	87.465 - 87.475
Piston diameter - Class 2	87.475 - 87.485
Piston diameter - Class 3	87.485 - 87.495

Piston Ring Dimensions

Description	mm
Piston ring end gap (oil control ring)	0.2 - 0.7

SPECIFICATIONS (Continued)

Cylinder Block

Description	mm
Cylinder bore diameter, 1.8L Engine	83.000 + 0.030
Cylinder bore diameter, 2.0L Engine	87.500 + 0.030
Cylinder block distortion (maximum)	0.1

Connecting Rod Dimensions

Description	mm
Large end bore diameter	50.035 ± 0.01

Torque Specifications

Description	Nm	lb-ft	lb-in
Cylinder head retaining bolts	a)	–	–
Timing chain guide retaining bolts	10	–	89
Camshaft bearing caps retaining bolts	a)	–	–
Camshaft sprocket retaining bolts	65	48	–
Camshaft position (CMP) sensor retaining bolt	6	-	53
Engine front cover retaining bolts	a)	–	–
Crankshaft pulley retaining bolts	a)	–	–
Coolant expansion tank retaining nut	10	–	89
Coolant plug to cylinder block	43	32	-
Coolant plugs (4) to cylinder head	75	55	-
Power steering pump retaining bolt	23	17	–
Power steering reservoir retaining bolts	25	18	–
Power steering reservoir retaining nut	10	–	89
Power steering pipe to the power steering	65	48	–
Power steering bracket retaining nut	15	11	–
Exhaust manifold bracket retaining bolts	25	18	–
Exhaust manifold upper heat shield retaining bolts	10	–	89
Exhaust manifold lower heat shield retaining bolts	10	–	89
Exhaust manifold to the cylinder head	55	41	–
Exhaust manifold studs to cylinder head	17	13	-
Exhaust gas recirculation (EGR) tube to cylinder head	55	41	-
Water pump pulley retaining bolts	25	18	–
Valve cover retaining bolts	10	–	89
Oil pressure switch	15	11	-
Oil pump retaining bolts	a)	–	–
Oil pan retaining bolts	25	18	–
Oil cooler to oil filter adaptor retaining bolt	34	25	-
Crankshaft rear oil seal retaining bolts	10	–	89
Flywheel retaining bolts	a)	–	–
Oil filter adaptor retaining bolts	25	18	–
Positive crankcase ventilation housing retaining bolts	10	–	89
Knock sensor retaining bolt	20	15	–
Thermostat housing retaining bolts	10	–	89
Water pump retaining bolts	10	–	89
Oil pump sprocket retaining bolt	25	18	–
Oil pump chain guide retaining bolts	10	–	89

SPECIFICATIONS (Continued)

Description	Nm	lb-ft	lb-in
Oil pump chain tensioner retaining bolt	10	–	89
Timing chain guide retaining bolts	10	–	89
Crankshaft position sensor retaining bolts	7	–	62
Accessory drive belt idler pulley retaining bolt	25	18	–
Intake manifold retaining bolts	18	13	–
Transaxle retaining bolts	44	32	–
Transaxle right–hand retaining bolts	44	32	–
Halfshaft center bearing carrier retaining bolts	48	35	–
Intermediate shaft bearing cap retaining nuts	25	18	–
Starter motor retaining bolts	35	26	–
Wiring harness retaining bracket nuts	20	15	–
A/C compressor retaining bolts	25	18	–
Engine rear mount retaining nut	80	59	–
Engine front mount studs to front cover	10		89
Engine front mount retaining bolts	80	59	–
Top mount retaining nut	59	44	–
Piston cooling jets	4	-	35

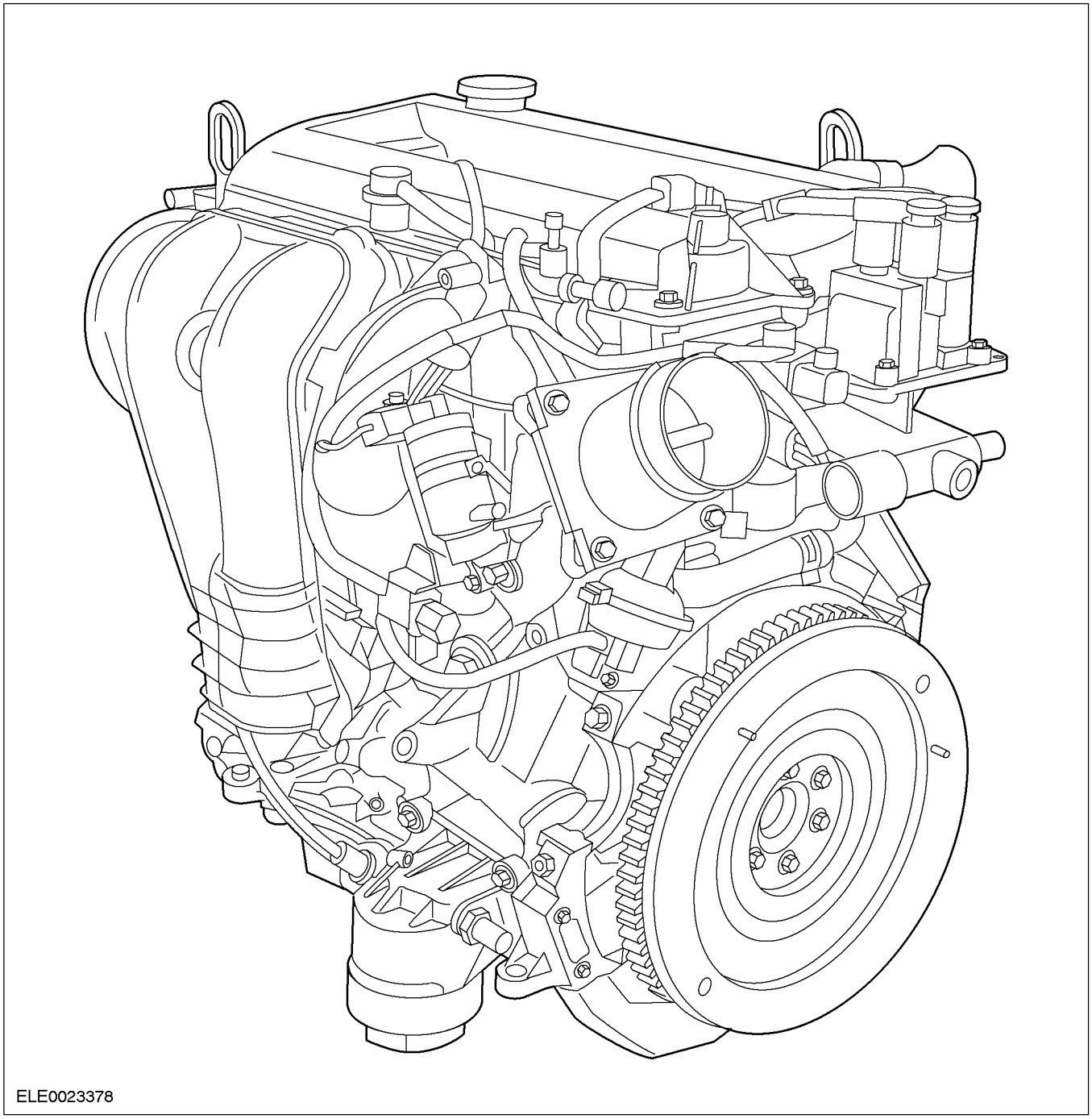
a) Refer to the procedure in this section.

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Sealant, oil pan contact surface to oil seal carrier, oil pan to cylinder block, oil pan to front cover	WSE–M4G323–A6
Oil pressure switch sealant (Loctite 243)	WSK–M2G349–A7
Engine front cover blanking plug sealant (3M 2510)	ESS–M11P24–A1
Anti–seize grease	ESE–M1244–A
Power steering fluid	ESP–M2C166–A
Silicone grease	ESE–M1C171–AA

DESCRIPTION AND OPERATION

Engine



The vehicle is available with the Duratec-HE range of petrol engines which supersedes the Zetec-E range of engines.

This range of engines has been developed by Ford in collaboration with Mazda in Japan.

The engines are built in the Ford engine plants at Dearborn (USA) and Chihuahua (Mexico).

Apart from increasing the torque and power output, the development objectives were to reduce the engine weight, noise emissions, fuel consumption and pollutant emissions.

Two variants are available with a total of three different power output levels:

DESCRIPTION AND OPERATION (Continued)

- 1.8L engine developing 81 kW (110 PS)
- 1.8L engine developing 92 kW (125 PS)
- 2.0L engine developing 107 kW (145 PS)

The complete engine is made of cast aluminum which, when combined with the plastic intake manifold, gives a very light unit.

NOTE: Because of the fine tolerance in the bearing clearances and bearing shells, no service operations whatsoever are permitted on the crank assembly. In the event of damage, the complete cylinder block and crank assembly must be changed.

Further design features include a stiffening frame incorporating the main bearing caps which support the crankshaft in the cylinder block, and the deep-drawn side walls of the cylinder block which reduce engine vibration.

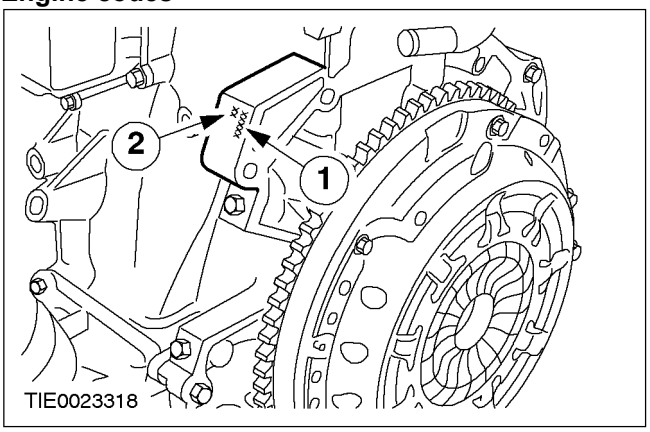
The camshafts are driven by a pinned link chain which runs very quietly and is also maintenance-free.

For the first time on a Ford product, the engine management for the Duratec-HE is provided by a Visteon Black Oak system.

This engine management systems controls the sequential multipoint fuel injection (SFI), the electrically heated thermostat and the electronically controlled water-cooled exhaust gas recirculation (EGR) valve.

In addition, the Black Oak system also controls the swirl of the combustion air flowing into the cylinders by means of swirl plates.

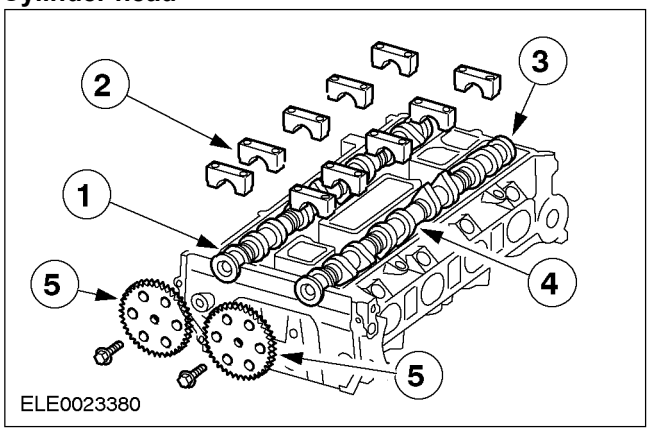
Engine codes



Item	Part Number	Description
1	–	CGBA code for 1.8L/81 kW engine, Europe stage III, 2000.1 MY
1	–	CGBB code for 1.8L/81 kW engine, Germany, stage IV, 2001.5 MY
1	–	CHBA code for 1.8L/92 kW engine, Europe, stage III, 2001.5 MY
1	–	CHBB code for 1.8L/92 kW engine, Germany, stage IV, 2001.5 MY
1	–	CJBA code for 2.0L/107 kW engine, Europe, stage III, 2001.5 MY
1	–	CJBB code for 2.0L/107 kW engine, Germany, stage IV, 2001.5 MY
2	–	Engine serial number

DESCRIPTION AND OPERATION (Continued)

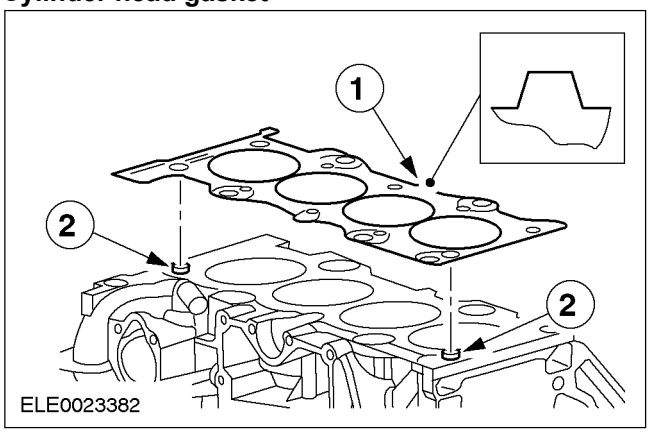
Cylinder head



Item	Part Number	Description
1	–	Exhaust camshaft
2	–	Bearing cap
3	–	Cam to identify cylinder No. 1
4	–	Intake camshaft
5	–	Camshaft sprockets

The design and the valve arrangement in the cylinder head is similar to the head of the Zetec-SE engines.

Cylinder head gasket



Item	Part Number	Description
1	–	Mark
2	–	Locating dowels

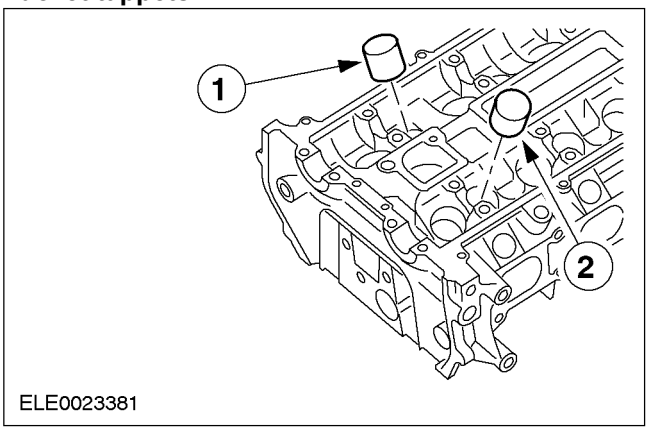
A four-layer laminated steel cylinder head gasket is used.

The cylinder head gaskets for the different engine variants are marked as follows:

- 1.8L: 2 trapezoidal marks
- 2.0L: 1 trapezoidal mark

The cylinder head gasket and cylinder head are located with two locating dowels.

Bucket tappets



Item	Part Number	Description
1	–	Exhaust valve tappet
2	–	Intake valve tappet

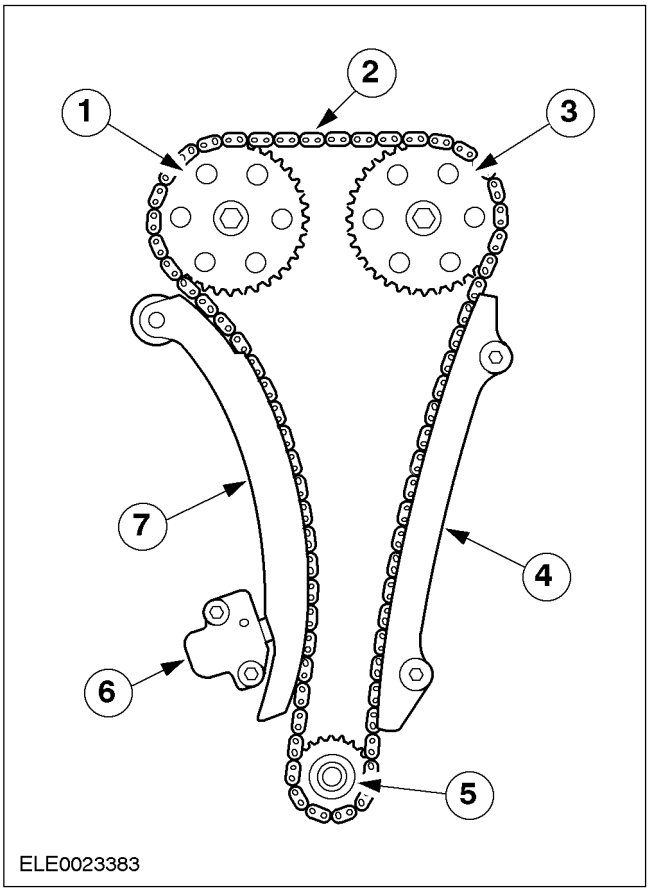
Mechanical tappets are fitted without adjusting shims.

Because of the special materials and the optimized cam profiles, the wear in the area of the valve gear is so minute that checking and adjustment of the valve clearances is only necessary after the engine has been in extensive service.

Different sizes of replacement bucket tappets are available in the event of wear or repairs to the valve gear.

DESCRIPTION AND OPERATION (Continued)

Camshaft drive



Item	Part Number	Description
1	–	Exhaust camshaft sprocket
2	–	Timing chain
3	–	Intake camshaft sprocket
4	–	Chain guide
5	–	Crankshaft sprocket
6	–	Hydraulic chain tensioner
7	–	Chain tensioner arm

The camshafts are driven by a low-noise, maintenance-free pinned link timing chain.

This is lubricated by the engine oil circuit.

An elongated chain guide and a chain tensioner arm ensure optimum chain guidance and silent running.

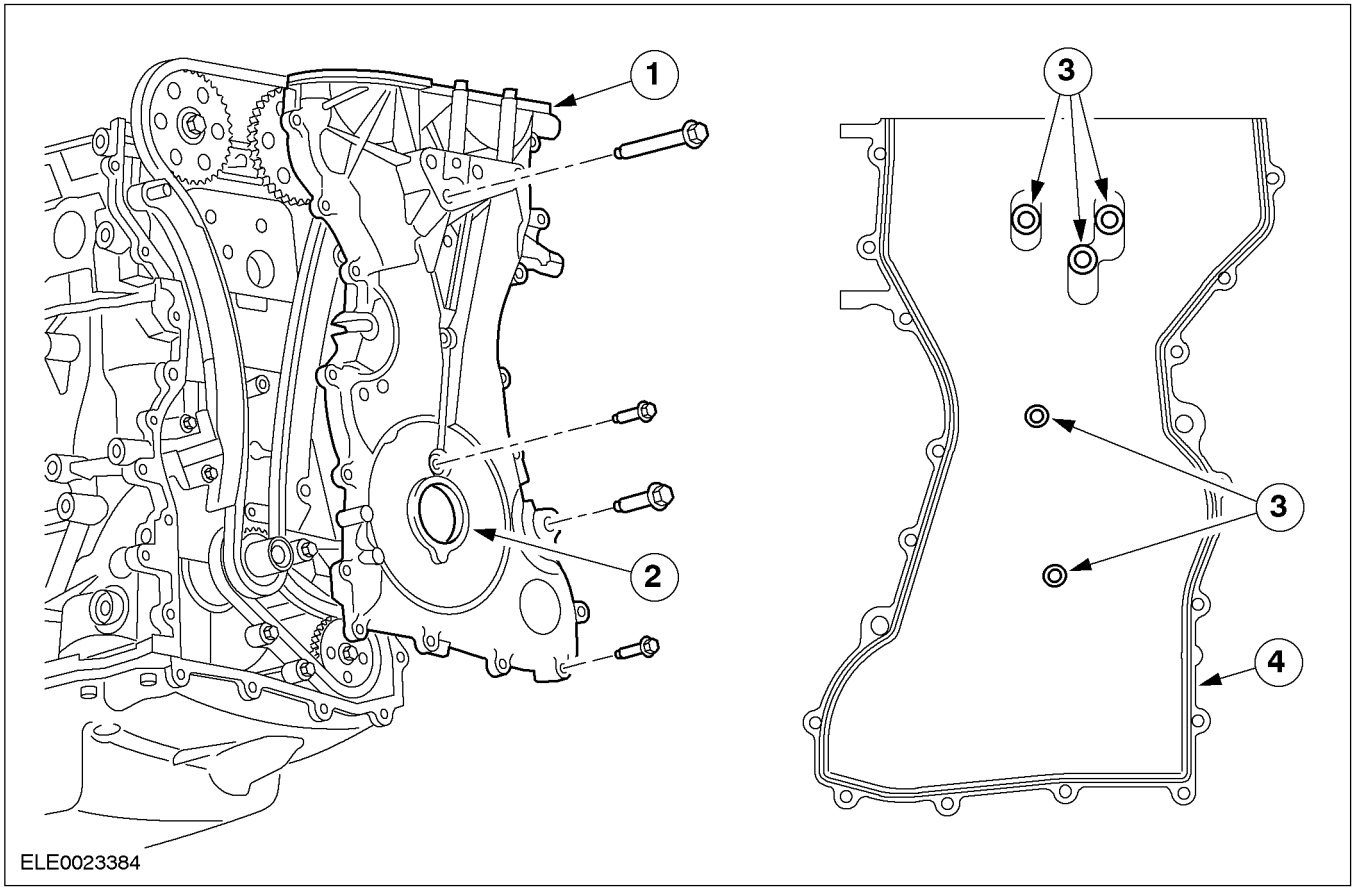
The chain is tensioned by a hydraulic chain tensioner which is supplied from the engine oil circuit.

The chain tensioner can be used again after removal.

The camshaft drive requires no maintenance.

DESCRIPTION AND OPERATION

Front cover



Item	Part Number	Description
1	–	Front cover
2	–	Crankshaft oil seal
3	–	Sealer for sealing at bores
4	–	Sealer for sealing cover

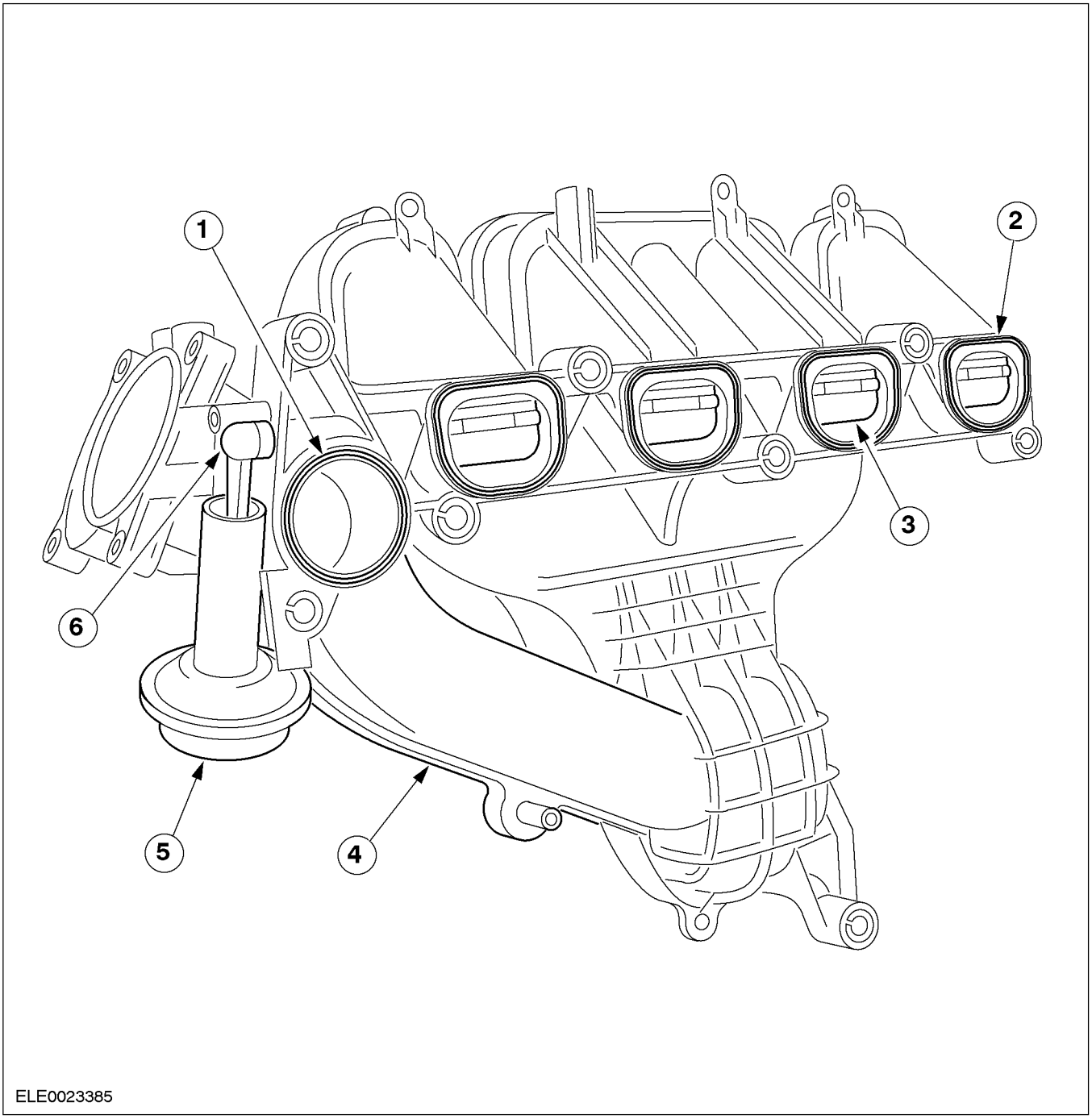
The camshaft drive is sealed with an aluminum front cover.

The crankshaft oil seal is inserted in this front cover.

The front cover is installed using sealer.

DESCRIPTION AND OPERATION

Intake manifold



Item	Part Number	Description
1	–	Exhaust gas recirculation gasket
2	–	Intake port gasket
3	–	Swirl plate
4	–	Connecting pipe
5	–	Swirl plate vacuum diaphragm unit
6	–	Actuating linkage

The plastic intake manifold incorporates swirl plates which reduce the cross-section of the intake passages at low speeds.

DESCRIPTION AND OPERATION (Continued)

The measure produces increased intake air swirl at low engine speeds.

The increased intake air swirl makes the mixture ignite more readily around the spark plug, which ultimately reduces fuel consumption and exhaust emissions.

The swirl plates are adjusted by means of a vacuum diaphragm unit on the intake manifold.

The system is actuated by a solenoid valve.

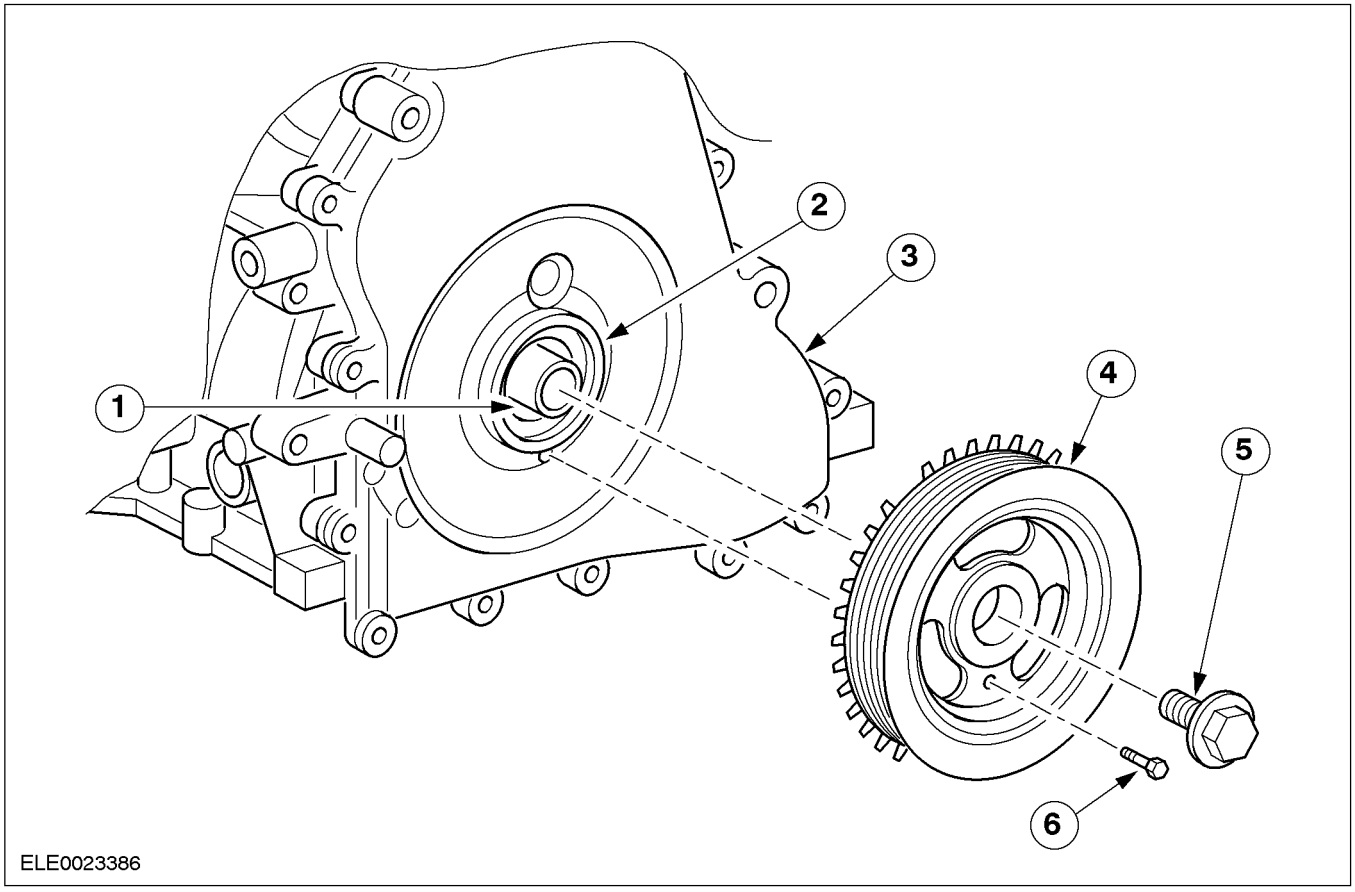
The swirl plates are designed so that they allow the required quantity of air to flow past.

When the engine is switched off, the swirl plates are closed.

The intake manifold is sealed by a total of five rubber gaskets (four gaskets for the intake ports and one gasket for the exhaust gas recirculation) which are inserted and held in position and must be changed if serviced.

The recirculated exhaust gas is distributed uniformly between all four intake ports through a connecting pipe (incorporated in the intake manifold).

Crankshaft vibration damper



Item	Part Number	Description
1	–	Crankshaft
2	–	Crankshaft oil seal
3	–	Front cover
4	–	Crankshaft vibration damper
5	–	Retaining bolt
6	–	M6 bolt

The crankshaft vibration damper forms a unit with the rotor for indicating the crankshaft position.

It is secured to the crankshaft by the contact pressure of the retaining bolt (free to turn on the seat on the crankshaft).

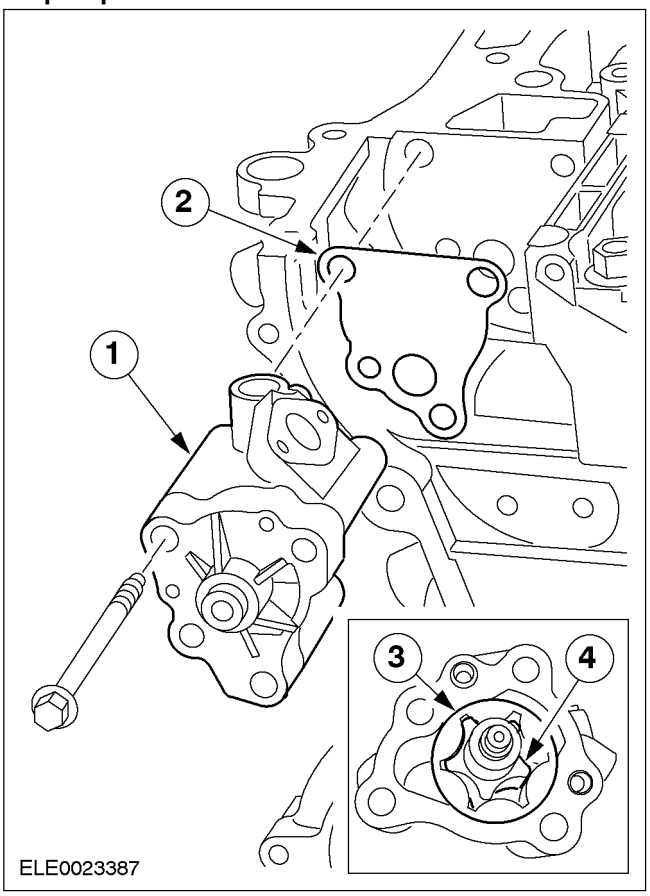
The retaining bolt must be changed after removal.

The vibration damper is positioned with the aid of an M6 bolt.

DESCRIPTION AND OPERATION (Continued)

NOTE: The M6 bolt must never be used as support when tightening the retaining bolt as this could damage the timing cover.

Oil pump

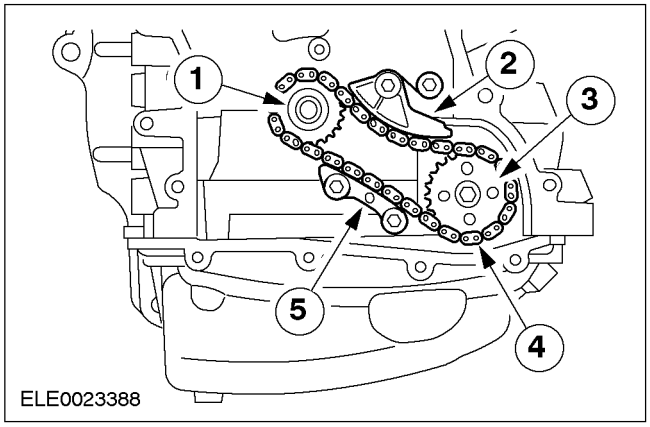


Item	Part Number	Description
1	–	Oil pump
2	–	Gasket
3	–	Outer rotor
4	–	Inner rotor

A rotor oil pump is used for engine lubrication on the Duratec-HE engines.

The rotor oil pump is a positive displacement pump with an internally toothed outer rotor and an externally toothed inner rotor.

The rotor pump works very evenly, can produce high pressures and is therefore fundamental for optimum engine lubrication.



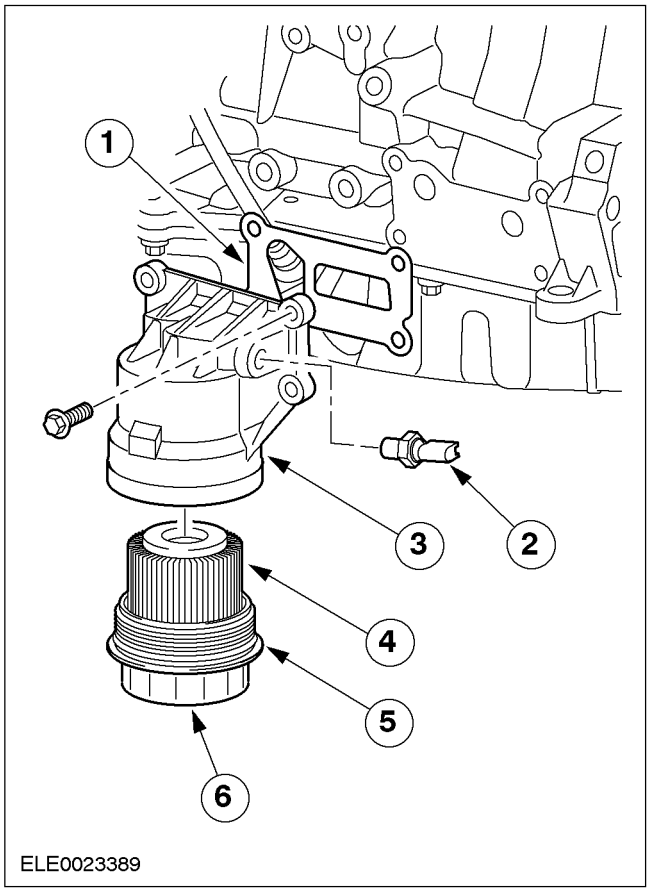
Item	Part Number	Description
1	–	Crankshaft sprocket
2	–	Spring-loaded chain tensioner
3	–	Oil pump sprocket
4	–	Driving chain
5	–	Chain guide

The oil pump is mounted on the cylinder block on the timing case side at the bottom and driven directly from the crankshaft by a separate driving chain.

A chain guide and a spring-loaded chain tensioner ensure quiet maintenance-free operation.

DESCRIPTION AND OPERATION (Continued)

Oil filter



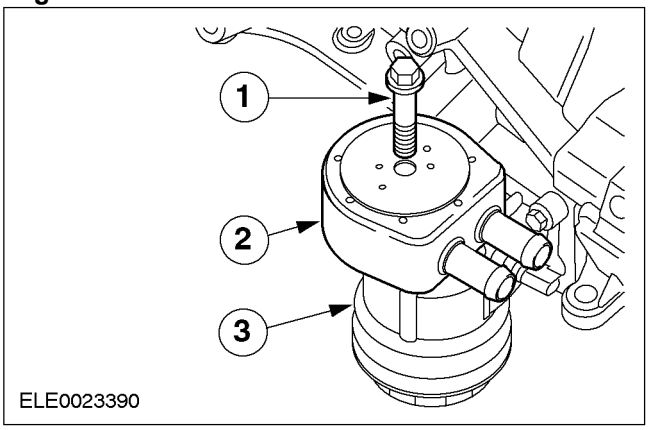
Item	Part Number	Description
1	–	Gasket
2	–	Oil pressure switch
3	–	Oil filter housing
4	–	Oil filter element
5	–	O-ring seal
6	–	Oil filter cap

An oil filter housing with an integral filter element is used on the Duratec-HE engines.

The oil filter housing is mounted on the cylinder block with a gasket.

For service this means that only the oil filter element itself and the O-ring seal on the oil filter cap must be changed.

Engine oil cooler



Item	Part Number	Description
1	–	Retaining bolt
2	–	Oil cooler
3	–	Oil filter housing

An engine oil cooler is also installed in combination with the automatic transmission (CD4E) in some markets due to the climatic conditions.

This is mounted on the oil filter housing with a retaining bolt and sealed with an O-ring seal.

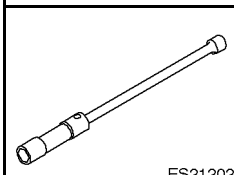
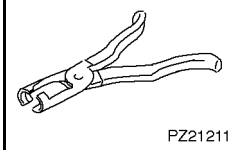
DIAGNOSIS AND TESTING

Engine

REFER to Section 303-00.

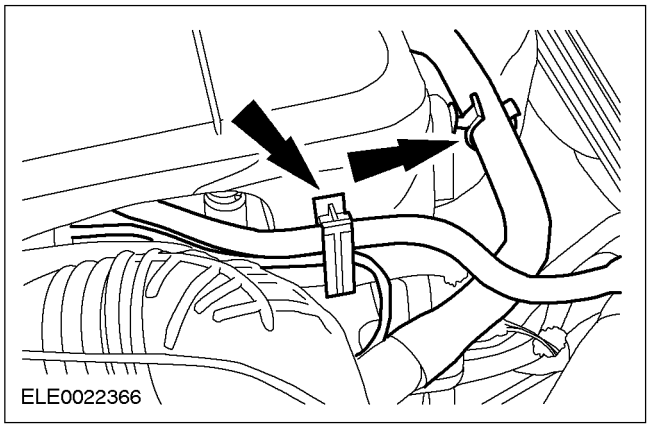
GENERAL PROCEDURES

Valve Clearance Adjustment

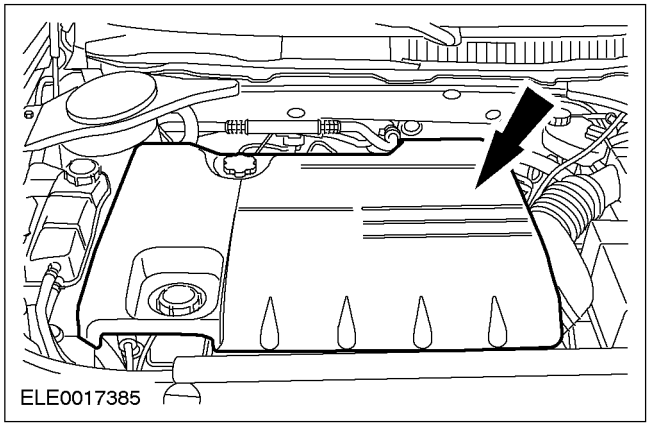
Special Tool(s)	
 ES21202	Socket, Spark Plug 303-499 (21-202)
 PZ21211	Pliers. Valve Stem Oil Seal 303-508 (21-211)

General Equipment
Feeler gauges

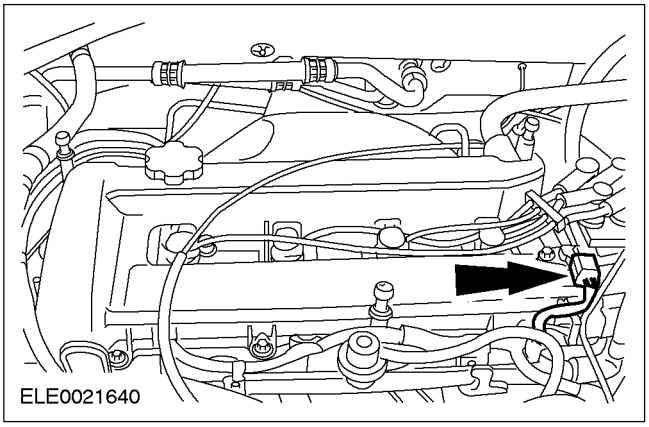
1. **Detach the positive crankcase ventilation (PCV) hose and the vacuum hose from the engine upper cover.**



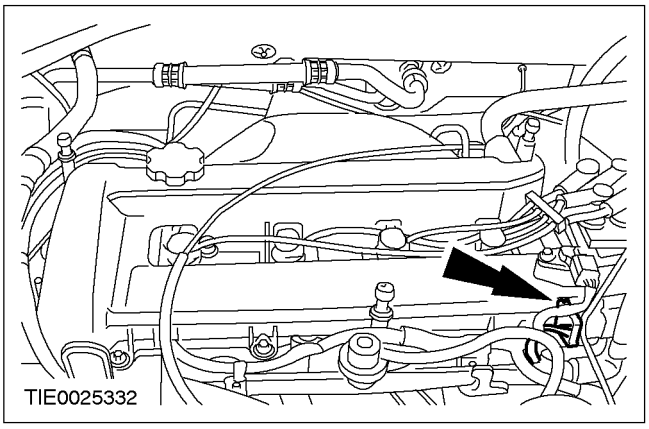
2. **Remove the engine upper cover.**



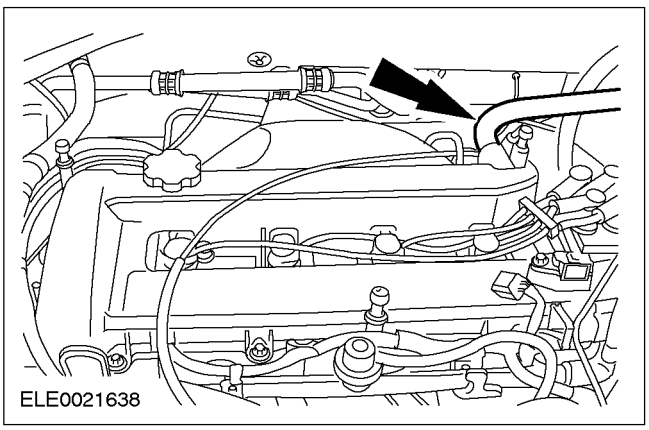
3. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
4. **Disconnect the camshaft position (CMP) sensor electrical connector.**



5. **Detach the engine wiring harness electrical connector from the valve cover.**

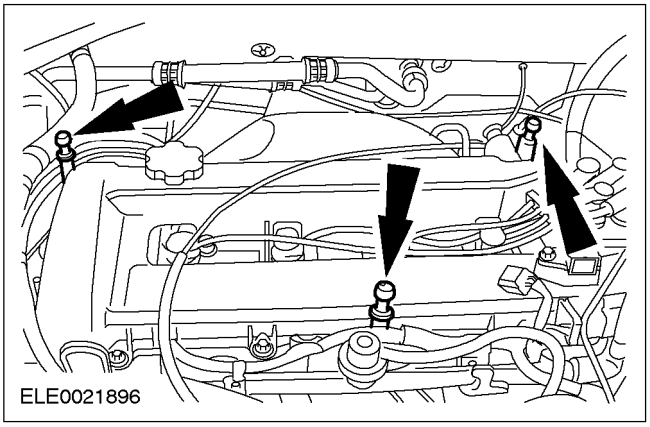


6. **Detach the PCV hose from the valve cover.**

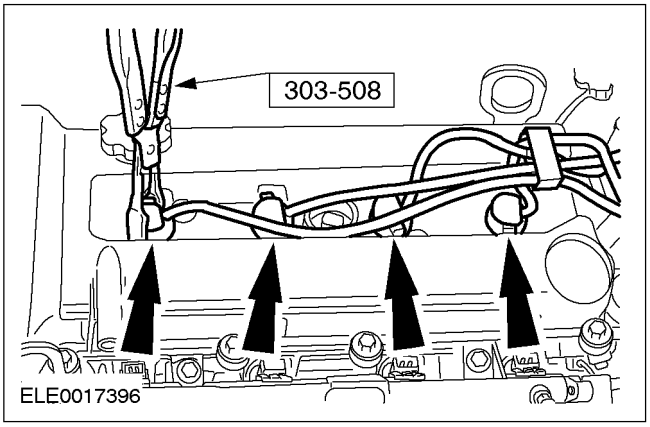


GENERAL PROCEDURES (Continued)

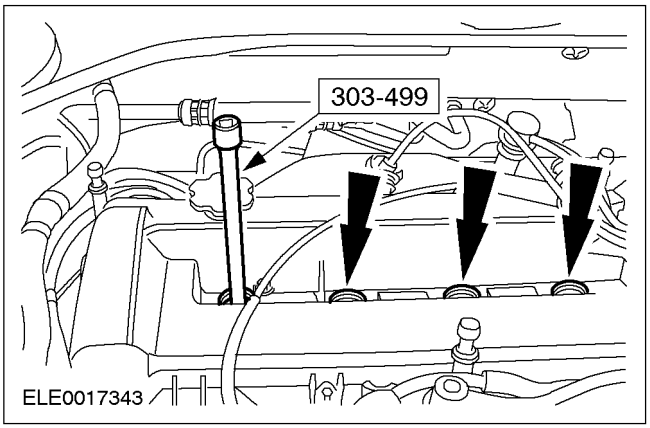
7. Remove the engine upper cover retaining brackets.



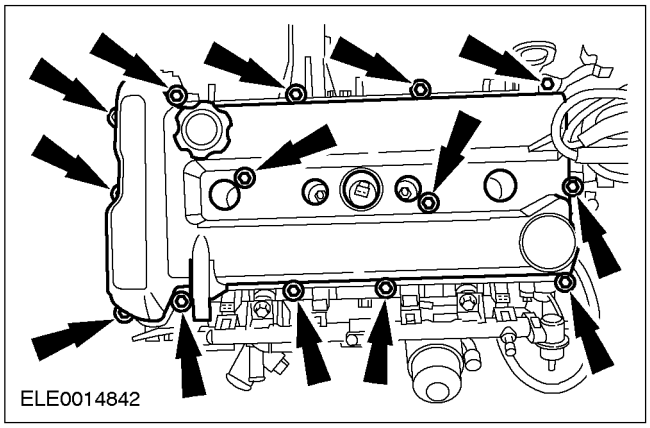
8. Using the special tool, disconnect the spark plug electrical connectors.



9. Using the special tool, remove the spark plugs.



10. Remove the valve cover.

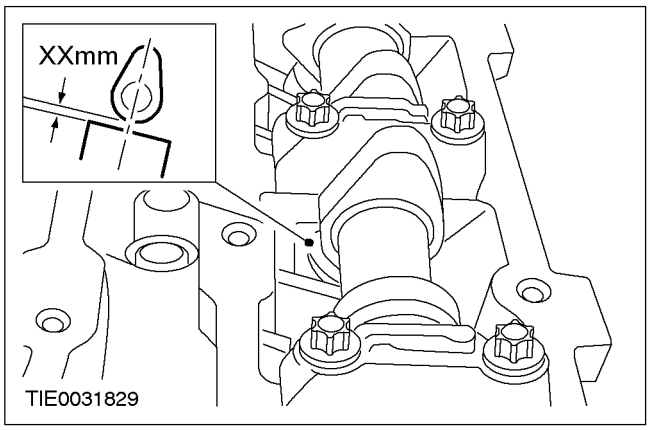


11. CAUTION: Only turn the engine in the normal direction of rotation.

Turn the engine until piston No. 1 is at top dead center (TDC).

12. NOTE: Note down each cylinder number and the valve clearances measured.

Using a suitable set of feeler gauges, measure the valve clearances.



13. CAUTION: Only turn the engine in the normal direction of rotation.

Turn the engine until each piston is at TDC and measure the valve clearances.

14. NOTE: Only carry out the following steps when the valve clearance(s) require adjustment. For additional information, refer to Specifications in this section.

Remove the camshafts. For additional information, refer to Camshafts in this section.

GENERAL PROCEDURES (Continued)

15. NOTE: The number on the valve tappet indicates the valve tappet thickness.

Determine the valve tappet thickness required:

1. Remove the valve tappet and read the thickness from the underside.
2. Valve tappet thickness required = thickness of currently installed valve tappet + the measured valve clearance - the required valve clearance. For additional information, refer to Specifications in this section.
3. Install the correct valve tappet.

16. NOTE: Do not install the valve cover at this stage.

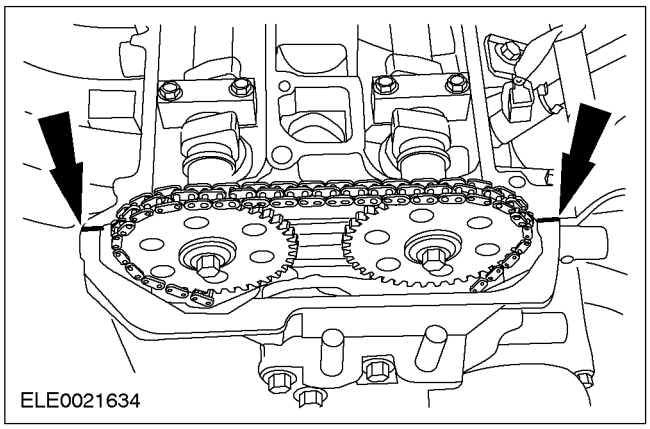
Install the camshafts. For additional information, refer to Camshafts in this section.

17. CAUTION: Only turn the engine in the normal direction of rotation.

Turn the engine until each piston is at TDC and measure the valve clearances.

18. Repeat this procedure as necessary until all valve clearances are within the specified tolerance.

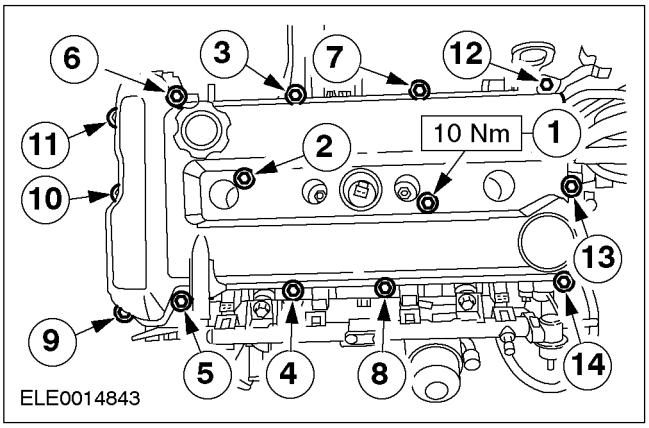
19. Apply a small bead of silicon sealantto the areas as shown.



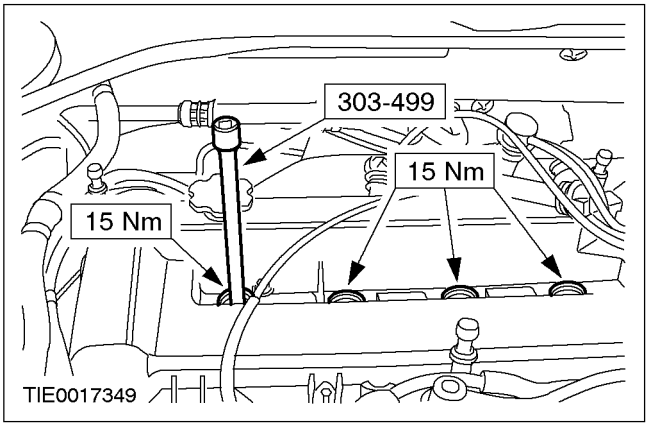
20. NOTE: Install a new valve cover gasket if necessary.

Install the valve cover.

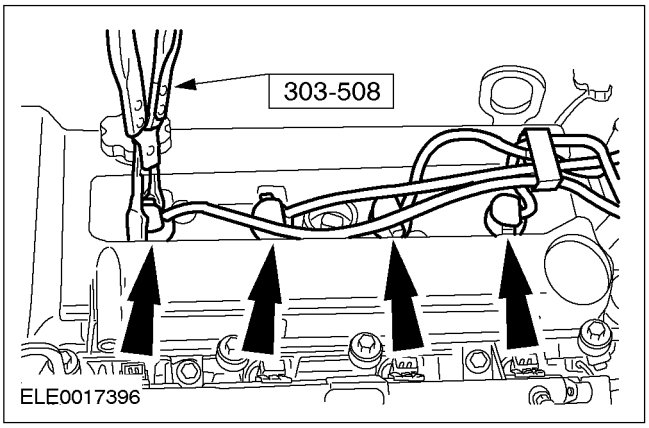
- Tighten the bolts in the sequence shown.



21. Using the special tool, install the spark plugs.

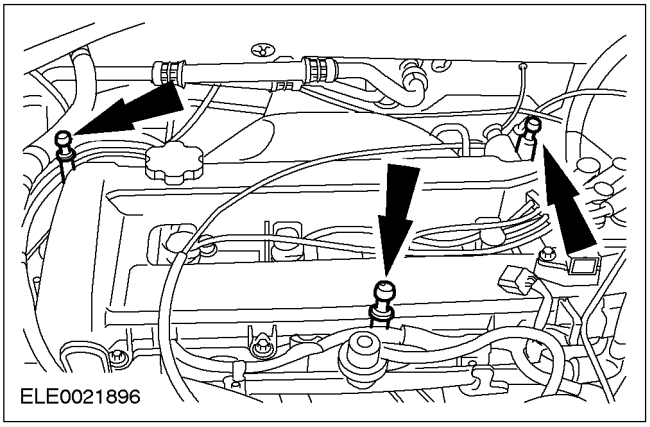


22. Using the special tool, connect the spark plug electrical connectors.

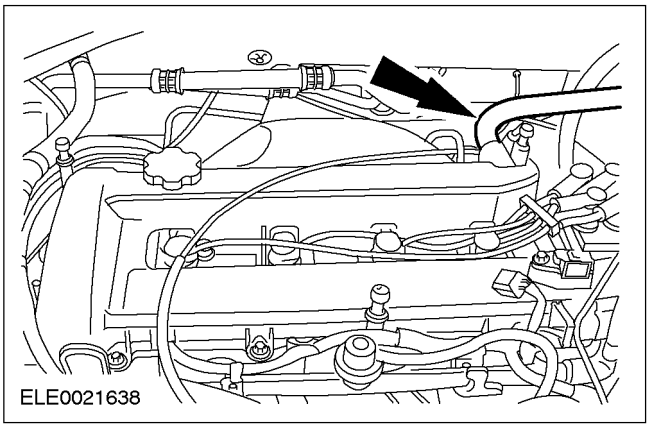


GENERAL PROCEDURES (Continued)

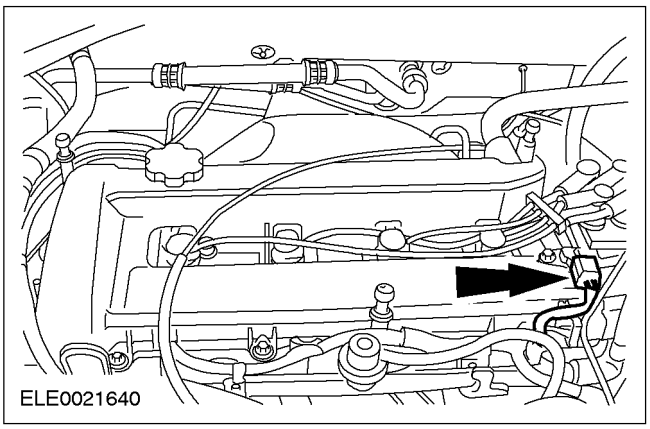
23. Install the engine upper cover retaining brackets.



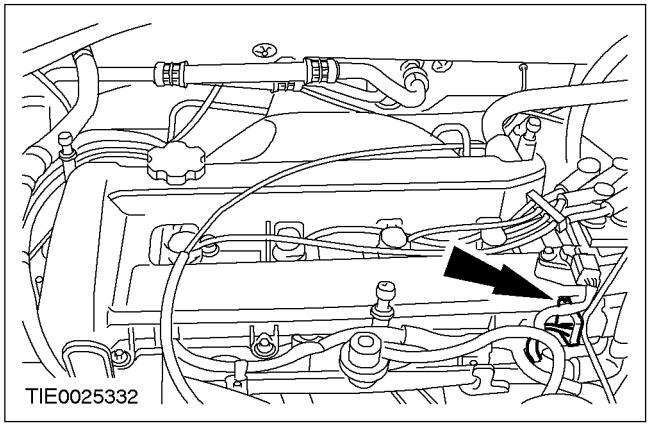
24. Attach the PCV hose to the valve cover.



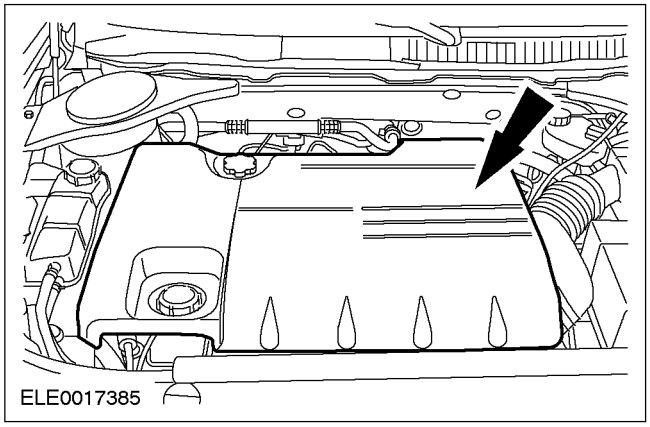
25. Connect the CMP sensor electrical connector.



26. Attach the engine wiring harness electrical connector to the valve cover.

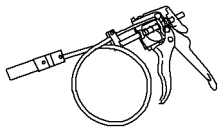


27. Connect the battery ground cable. For additional information, refer to Section 414-01.
28. Install the engine upper cover.



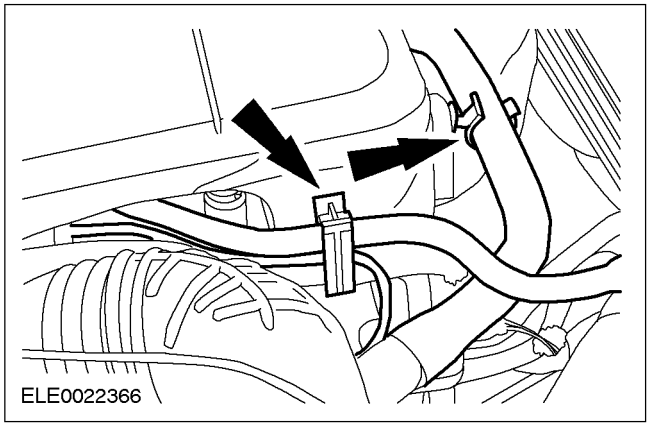
IN-VEHICLE REPAIR

Intake Manifold (21 183 0)

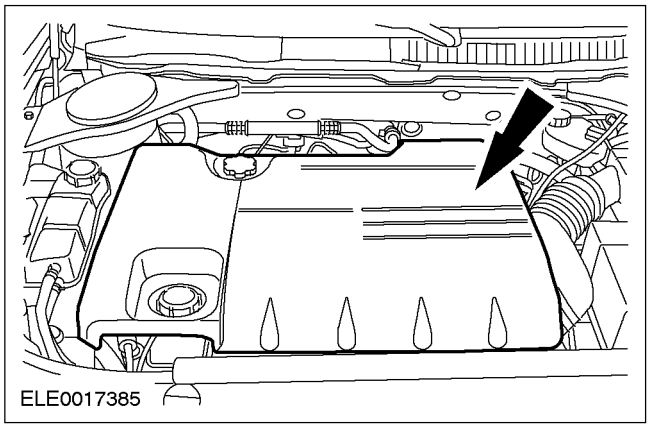
Special Tool(s)	
 24003	Remover/Installer, Cooling Hose Clamp 303-397 (24-003)

Removal

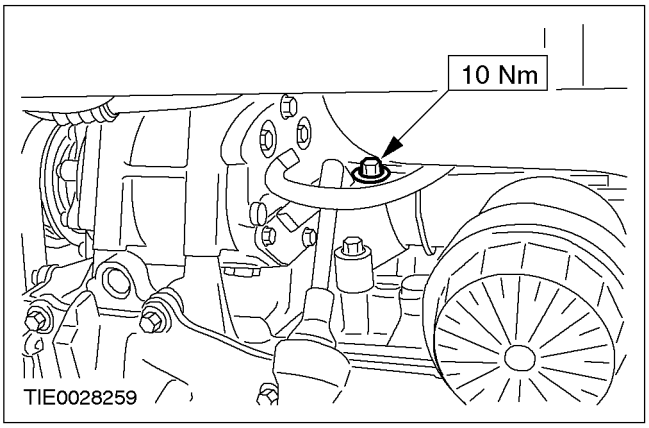
1. **Detach the positive crankcase ventilation (PCV) hose and the vacuum hose from the engine upper cover.**



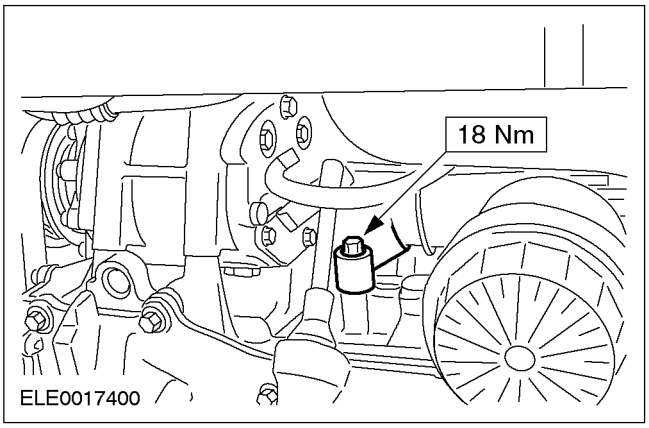
2. **Remove the engine upper cover.**



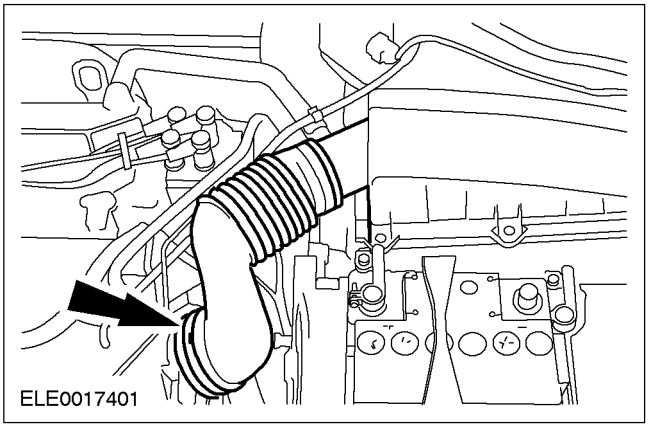
3. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
4. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
5. **Remove the oil level indicator lower retaining bolt.**



6. **Remove the intake manifold lower retaining bolt.**



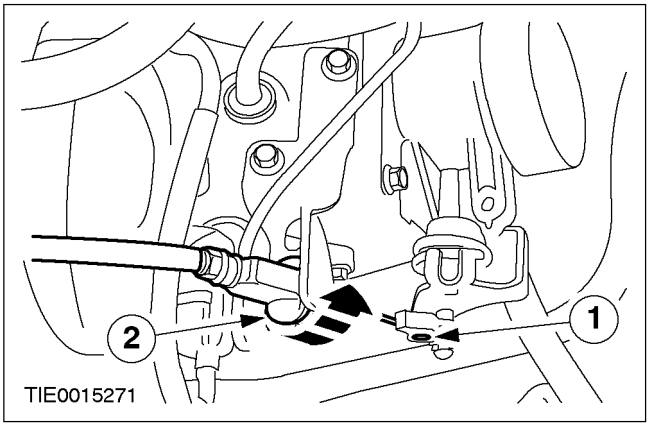
7. **Lower the vehicle.**
8. **Detach the air cleaner outlet pipe from the throttle body (TB).**



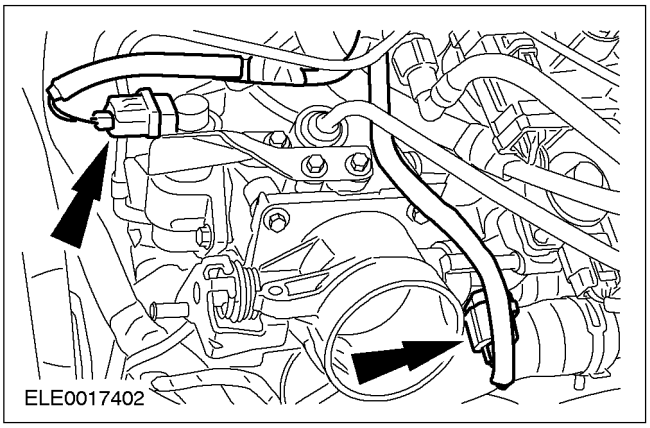
IN-VEHICLE REPAIR (Continued)

9. Detach the accelerator cable.

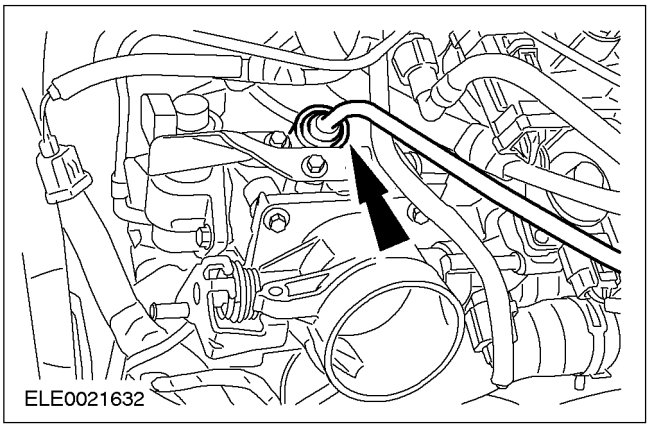
1. Detach the inner cable.
2. Turn the cable out of the bracket.
   - Detach the cable and position it to one side.



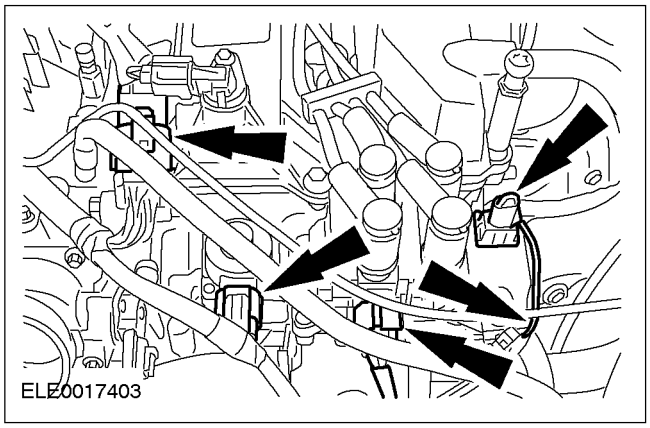
10. Disconnect the throttle position (TP) sensor and the idle air control (IAC) valve electrical connectors.



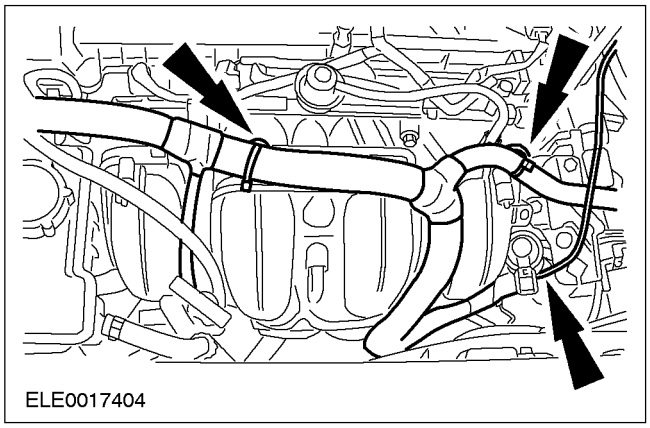
11. Disconnect the brake booster vacuum line from the intake manifold.



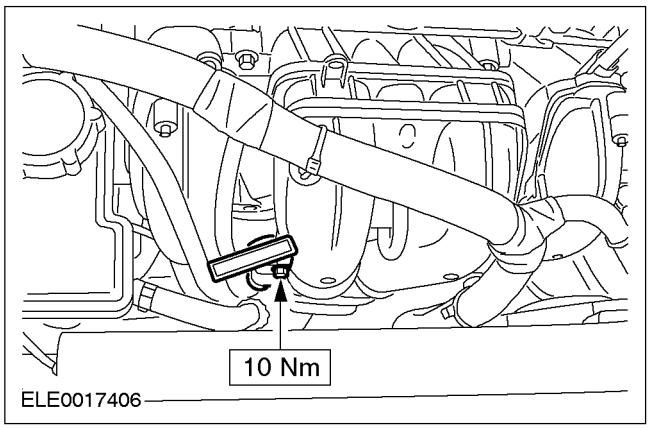
12. Disconnect the electrical connectors.



13. Detach the engine wiring harness from the intake manifold.

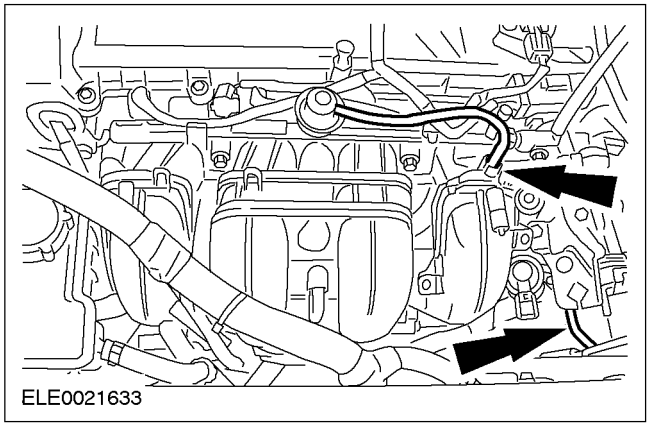


14. Remove the oil level indicator and tube.

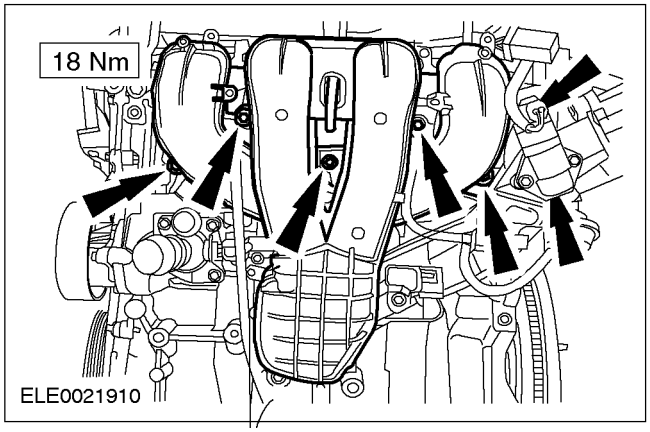


IN-VEHICLE REPAIR (Continued)

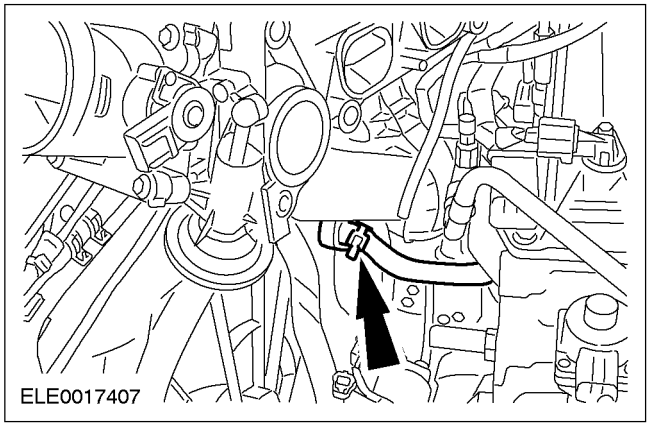
15. **Disconnect the vacuum hoses from the intake manifold.**



16. **Disconnect the engine air shut off valve, the manifold absolute pressure (MAP) sensor and the swirl plates solenoid valve electrical connectors.**
17. **Remove the intake manifold bolts (engine shown removed for clarity).**
    - Detach the intake manifold from the cylinder head.



18. **Disconnect the PCV hose from the intake manifold.**



19. **Detach the knock sensor (KS) electrical connector from the intake manifold.**
20. **Remove the intake manifold.**

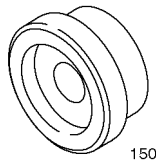
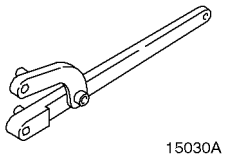
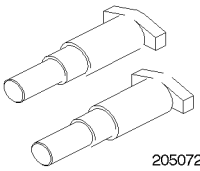
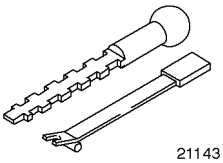
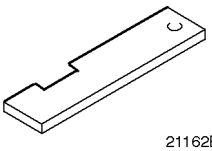
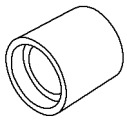
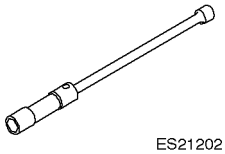
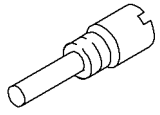
Installation

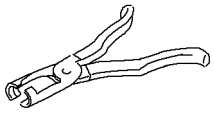
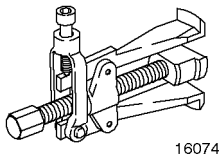
1. **NOTE:** Install new gaskets.

   To install, reverse the removal procedure.
2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

IN-VEHICLE REPAIR

Crankshaft Front Seal (21 467 0)

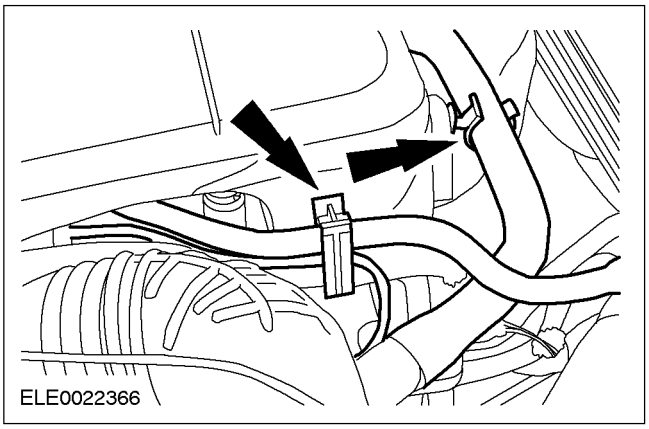
Special Tool(s)	
 1502651	Adapter for 205-071 (15-026A) 205-071-02 (15-026-51)
 15030A	Flange Holding Wrench, Universal 205-072 (15-030A)
 20507202	Adapter for 205-072 205-072-02 (15-030A-02)
 21143	Remover, Crankshaft Oil Seal 303-293(21-143)
 21162B	Timing Plate, Camshaft Alignment 303-376 (21-162B)
 21171	Installer, Crankshaft Oil Seal 303-395 (21-171)
 ES21202	Remover/Installer, Spark Plug 303-499 (21-202)
 PZ21210	Timing Peg, Crankshaft TDC 303-507 (21-210)

Special Tool(s)	
 PZ21211	Pliers, Valve Stem Oil Seal 303-508 (21-211)
 16074	Remover, Halfshaft Oil Seal 308-208 (16-074)

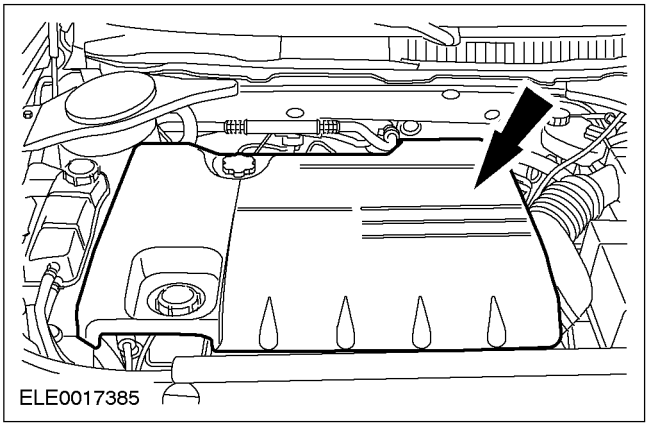
General Equipment
M6 x 18 mm bolt

Removal

1. **Detach the positive crankcase ventilation (PCV) hose and the vacuum hose from the engine upper cover.**

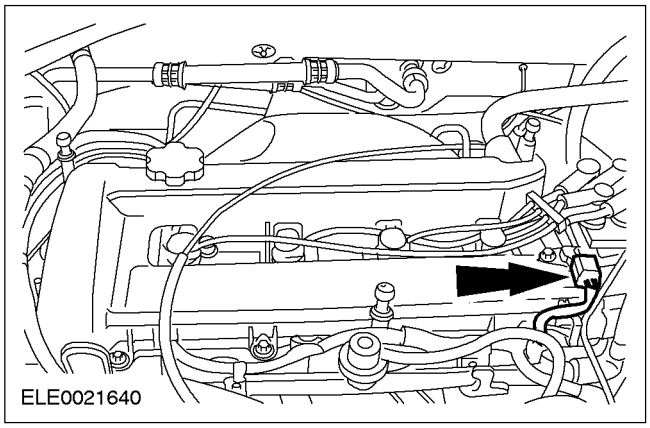

ELE0022366

2. **Remove the engine upper cover.**

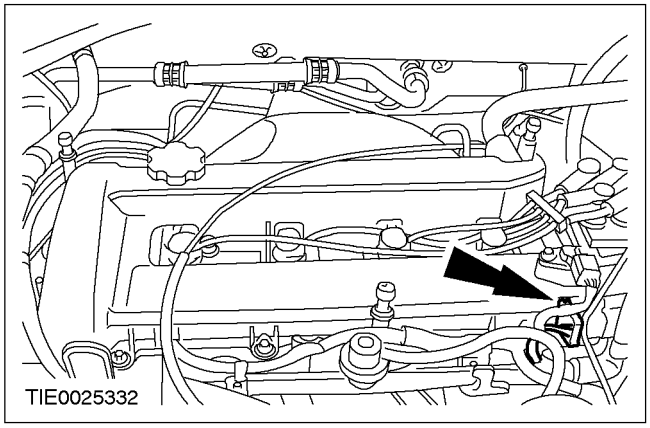

ELE0017385

IN-VEHICLE REPAIR (Continued)

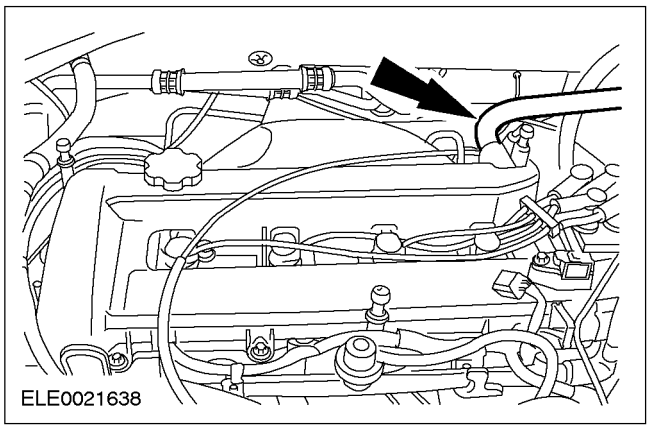
3. Disconnect the battery ground cable. For additional information, refer to Section 414-01.
4. Disconnect the camshaft position (CMP) sensor electrical connector.



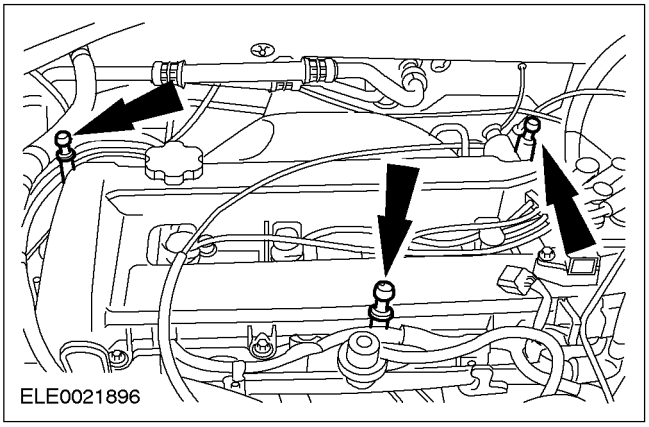
5. Detach the engine wiring harness electrical connector from the valve cover.



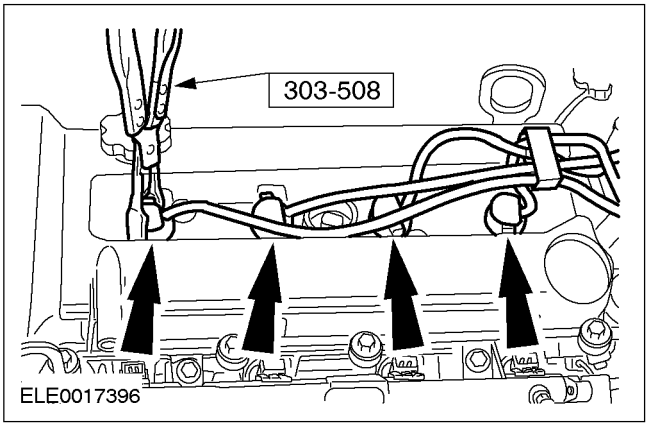
6. Detach the PCV hose from the valve cover.



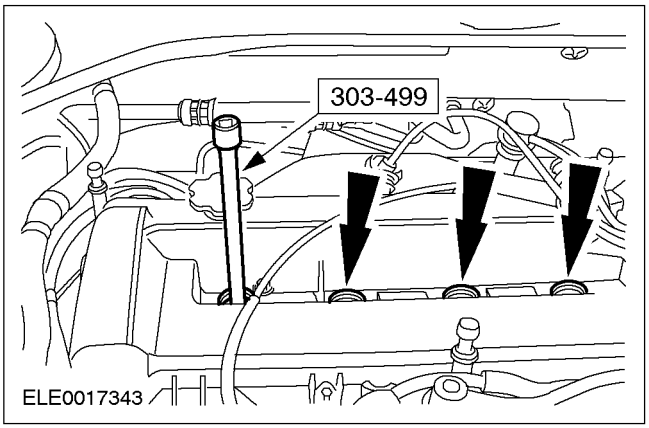
7. Remove the engine upper cover retaining brackets.



8. Using the special tool, disconnect the spark plug electrical connectors.

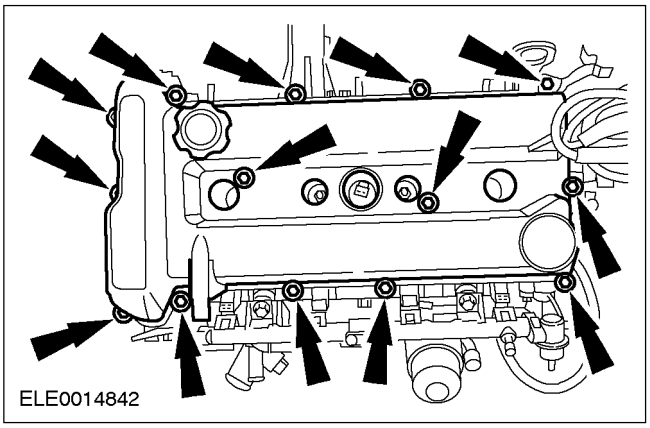


9. Using the special tool, remove the spark plugs.



IN-VEHICLE REPAIR (Continued)

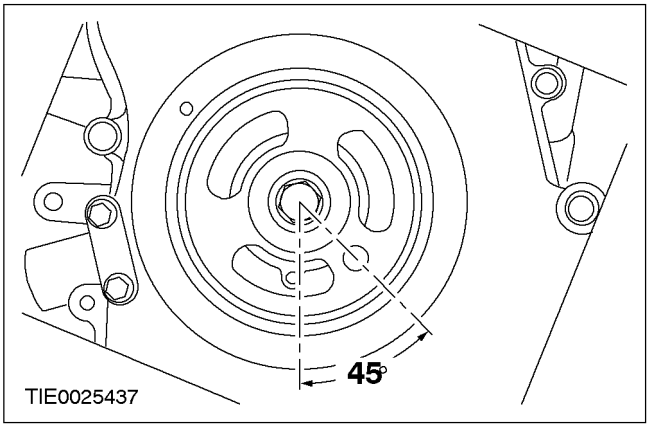
10. Remove the valve cover.



11. Remove the accessory drive belt. For additional information, refer to Section 303-05.

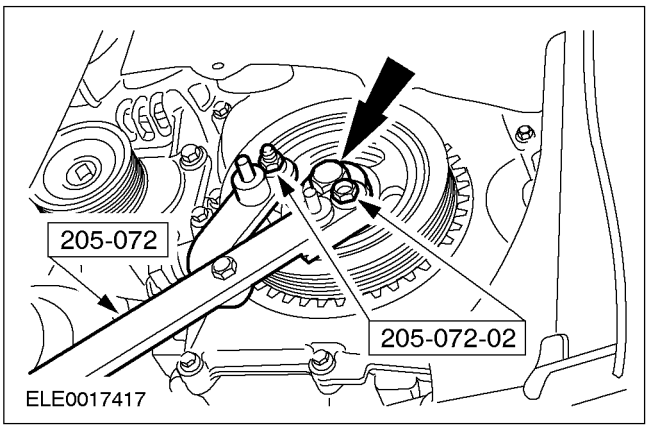
12. NOTE: Only turn the engine in the normal direction of rotation.

Turn the engine until piston No. 1 is approximately 45 degrees before top dead center (TDC).



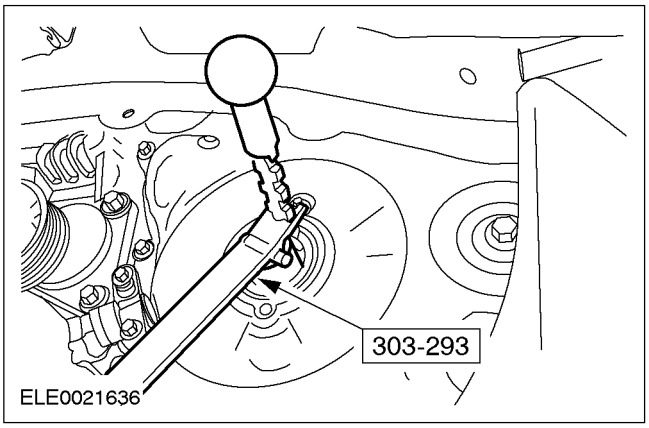
13. NOTE: Do not discard the crankshaft pulley retaining bolt.

Using the special tools, prevent the crankshaft pulley from rotating and remove the crankshaft pulley



14. Using the special tool, remove the crankshaft front oil seal.

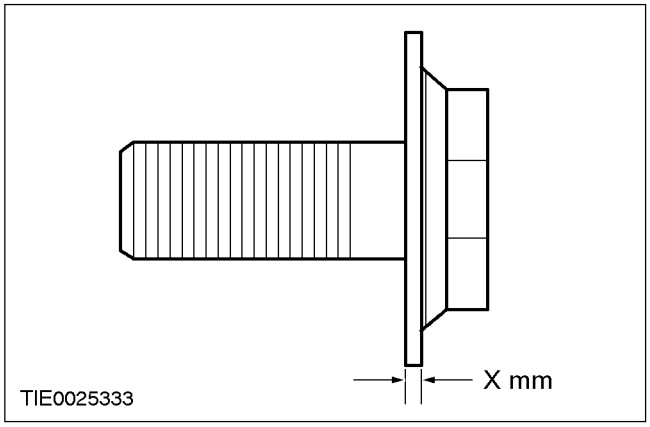
- Discard the oil seal.



IN-VEHICLE REPAIR (Continued)

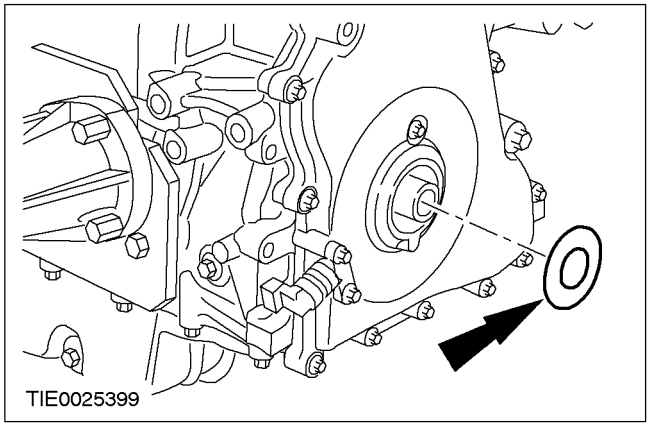
Installation

1. **Measure the thickness of the crankshaft pulley retaining bolt washer.**



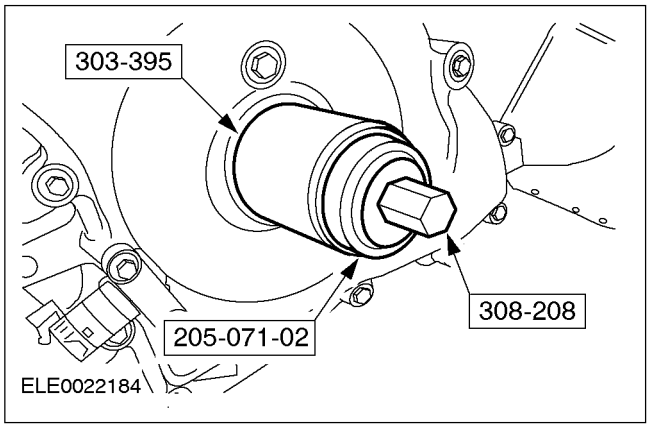
2. **NOTE:** If the thickness of the crankshaft pulley retaining bolt washer is less then 5.5 mm, a friction washer must be installed.

   Install a friction washer to the crankshaft (engine shown removed for clarity).



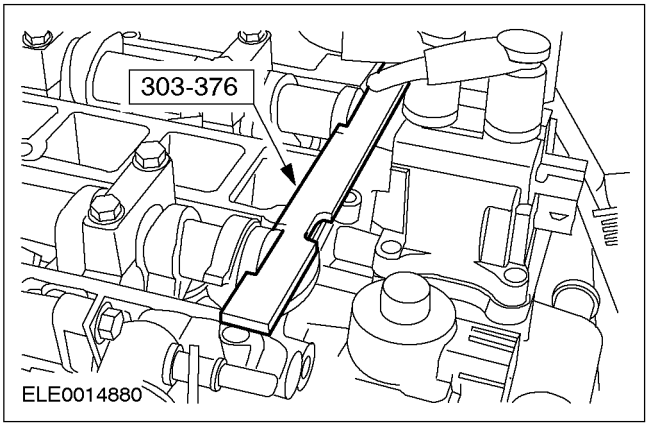
3. **NOTE:** Install a new crankshaft front oil seal.

   Using the special tools, install the crankshaft front oil seal.

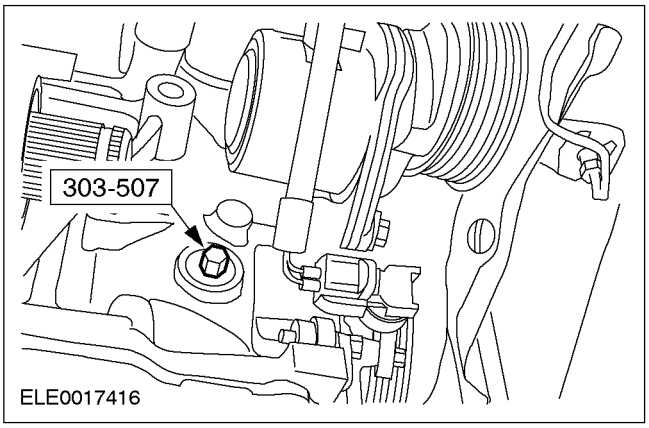


4. **Lower the vehicle.**
5. **NOTE:** Only turn the engine in the normal direction of rotation.

   Using an open-ended wrench, carefully turn the camshafts until the cams of cylinder No. 4 are at valve overlap position.
6. **Install the special tool.**



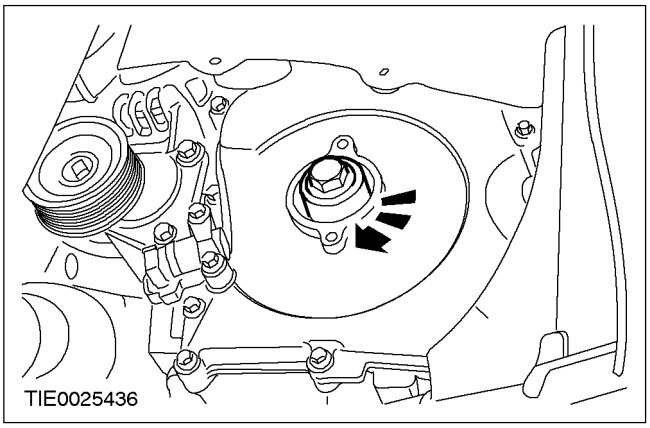
7. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
8. **Remove the cylinder block lower blanking plug and install the special tool.**



IN-VEHICLE REPAIR (Continued)

9. **NOTE:** Only turn the engine in the normal direction of rotation.

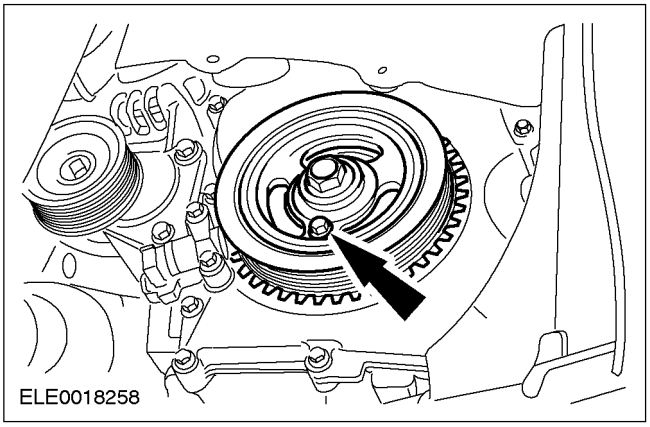
   Using the crankshaft pulley retaining bolt, turn the engine until piston No. 1 is at TDC.



10. **Remove the crankshaft pulley retaining bolt.**
    - Discard the bolt.

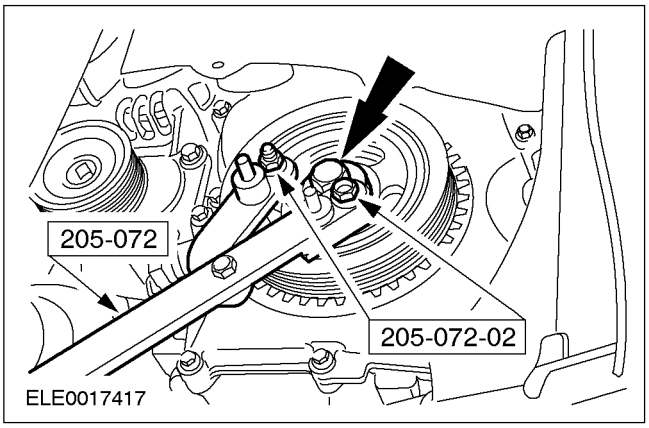
11. **CAUTION: Only tighten the crankshaft pulley securing bolt finger tight.**

    Install the crankshaft pulley onto the crankshaft and secure the crankshaft pulley to the front cover using a M6 x 18 mm bolt.

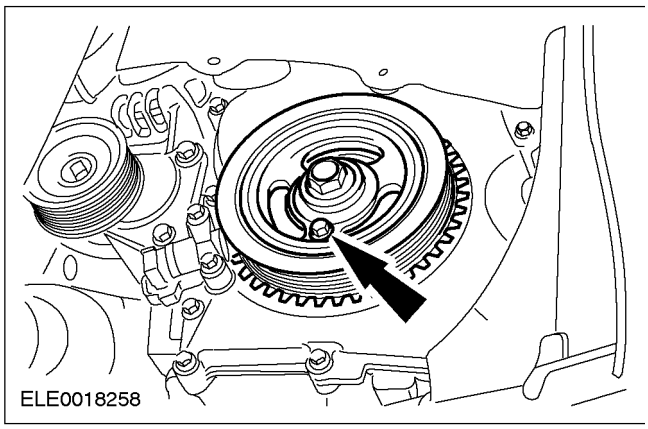


12. **NOTE:** Install a new crankshaft pulley retaining bolt.

    Using the special tools, prevent the crankshaft pulley from rotating and tighten the crankshaft pulley retaining bolt.
    - Tighten the bolt in two stages.
    - Stage 1: 100 Nm.
    - Stage 2: 90 degrees.



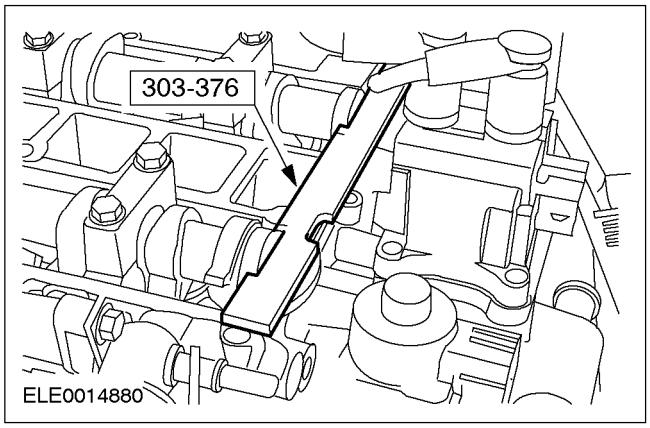
13. **Remove the crankshaft pulley securing bolt.**



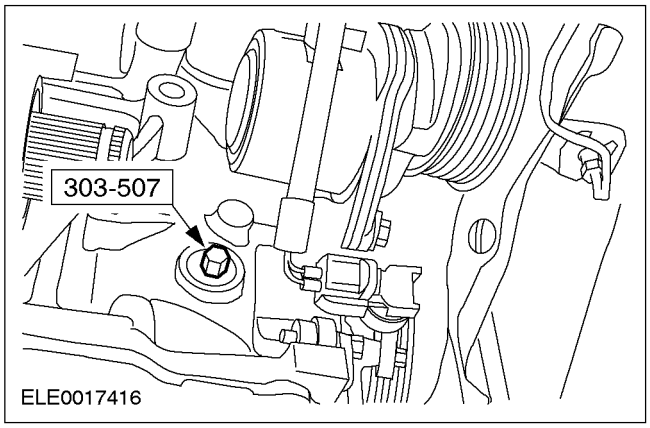
14. **Lower the vehicle.**

IN-VEHICLE REPAIR (Continued)

15. **Remove the special tool.**

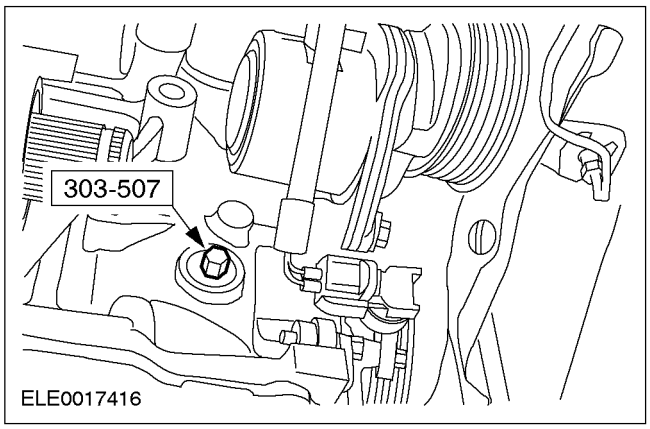


16. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
17. **Remove the special tool.**



18. **NOTE:** Only turn the engine in the normal direction of rotation.

    Turn the engine two revolutions.
19. **Install the special tool.**

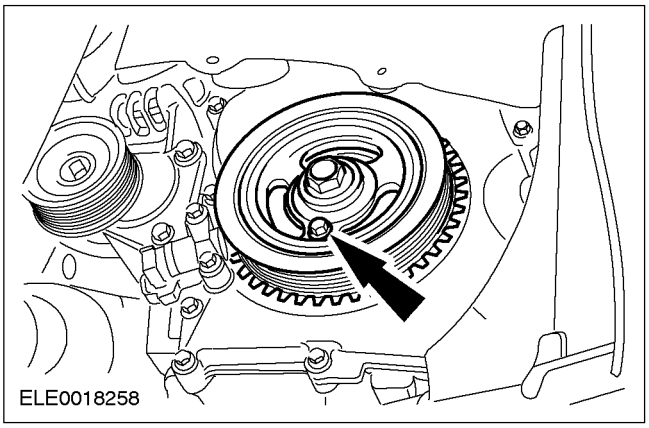


20. **NOTE:** Only turn the engine in the normal direction of rotation.

    Turn the engine until piston No. 1 is at TDC.
21. **CAUTION: Only tighten the crankshaft pulley securing bolt finger tight.**

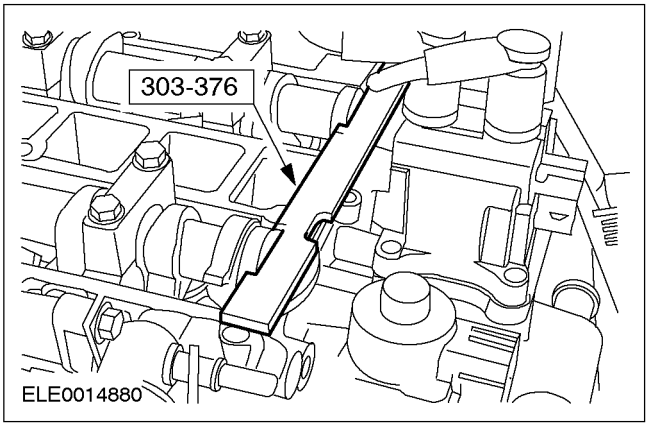
NOTE: If it is not possible to install the crankshaft pulley securing bolt, correct the valve timing.

Using a M6 x 18 mm bolt, check the position of the crankshaft pulley.



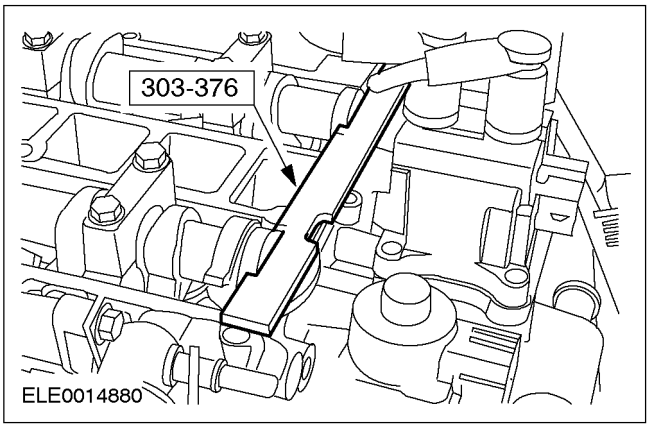
22. **Lower the vehicle.**
23. **NOTE:** If it is not possible to install the special tool, correct the valve timing.

Using the special tool, check the position of the camshafts.



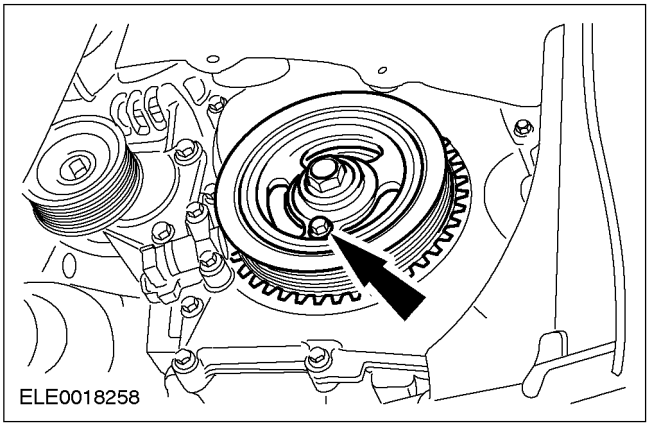
IN-VEHICLE REPAIR (Continued)

24. Remove the special tool.

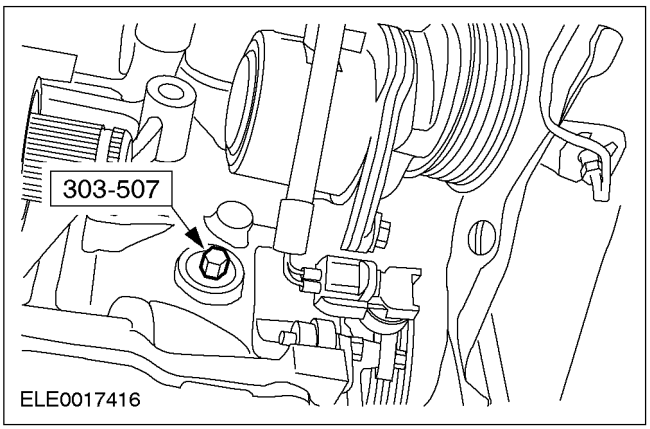


25. Raise and support the vehicle. For additional information, refer to Section 100-02.

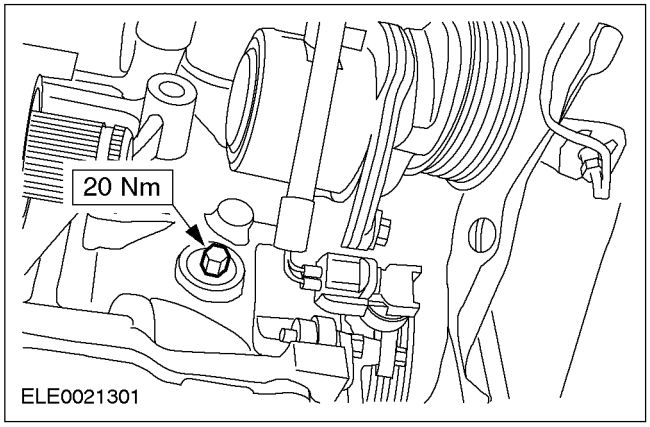
26. Remove the crankshaft pulley securing bolt.



27. Remove the special tool.

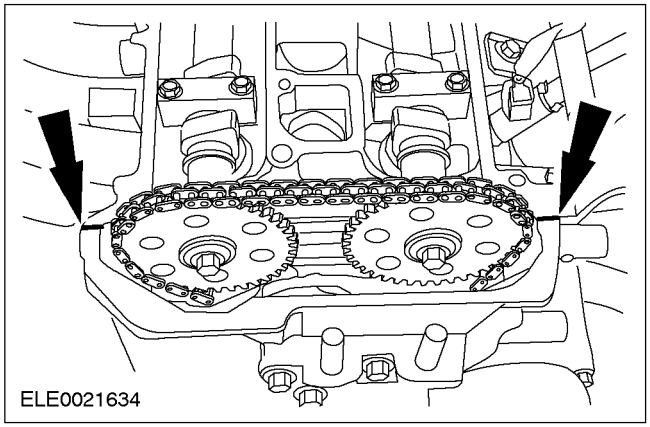


28. Install the cylinder block lower blanking plug.



29. Install the accessory drive belt. For additional information, refer to Section 303-05.

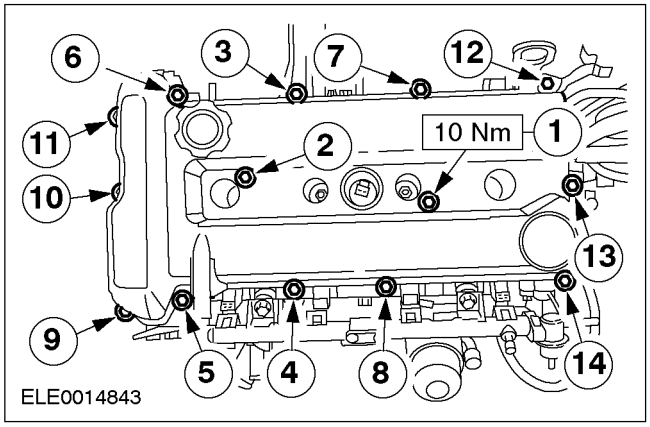
30. Apply a small bead of silicon sealant to the areas as shown.



31. NOTE: Install a new valve cover gasket if necessary.

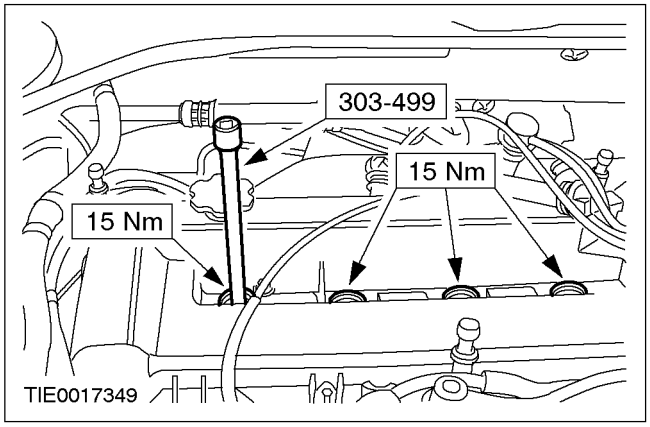
Install the valve cover.

- Tighten the bolts in the sequence shown.

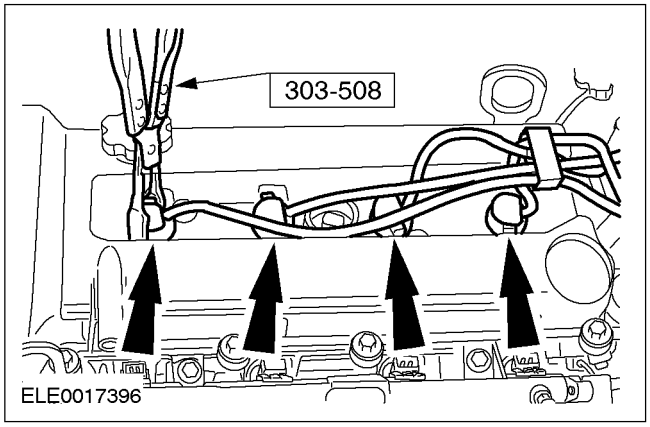


IN-VEHICLE REPAIR (Continued)

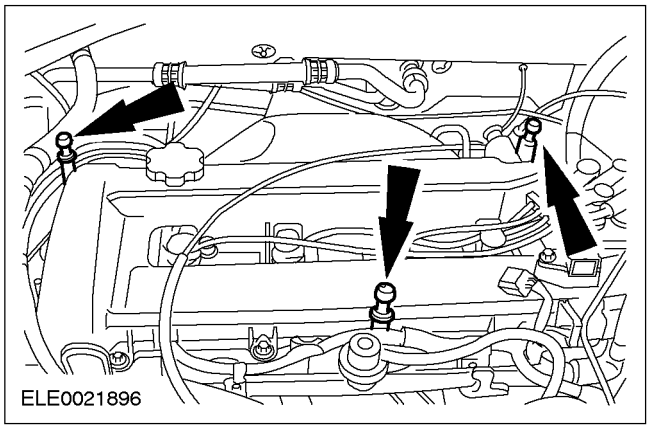
32. Using the special tool, install the spark plugs.



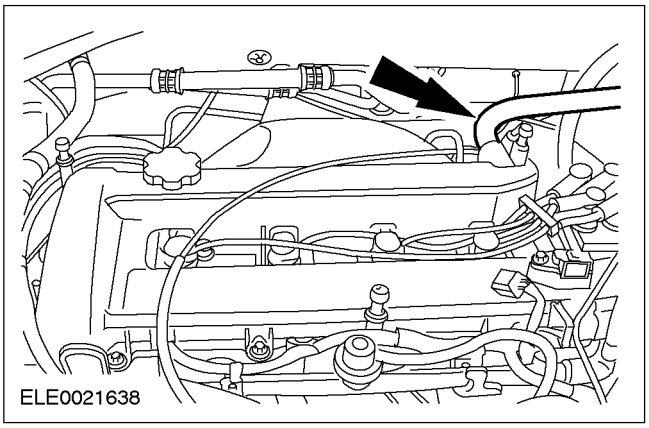
33. Using the special tool, connect the spark plug electrical connectors.



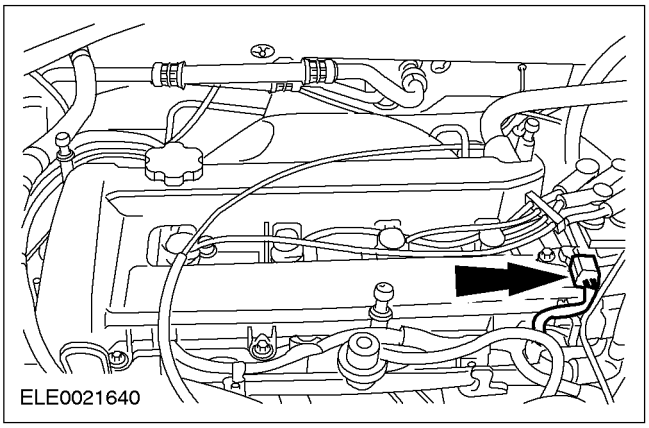
34. Install the engine upper cover retaining brackets.



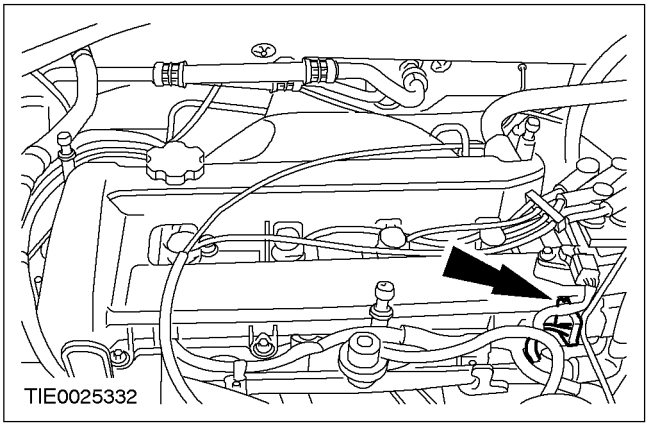
35. Attach the PCV hose to the valve cover.



36. Connect the CMP sensor electrical connector.



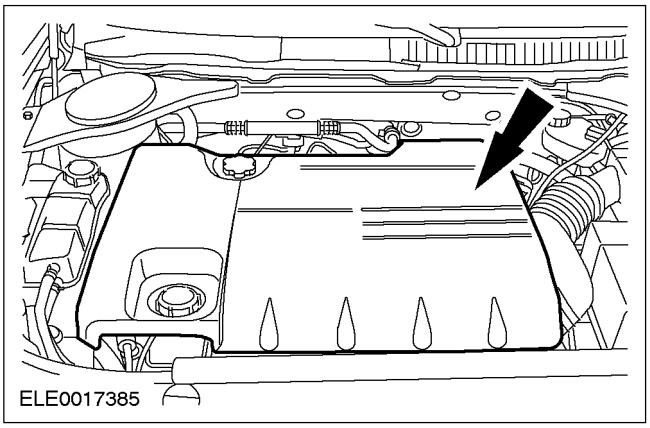
37. Attach the engine wiring harness electrical connector to the valve cover.



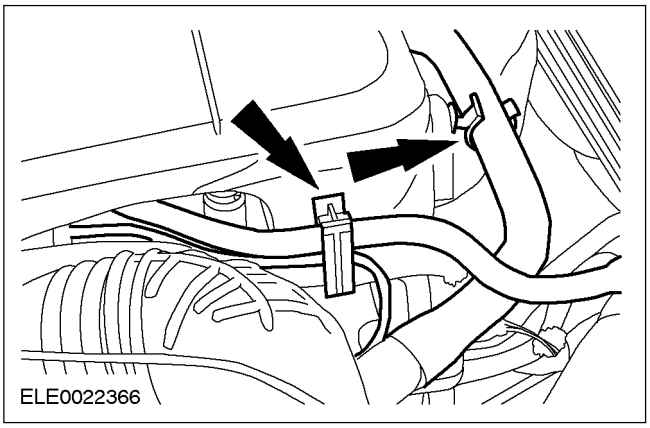
38. Connect the battery ground cable. For additional information, refer to Section 414-01.

IN-VEHICLE REPAIR (Continued)

39. Install the engine upper cover.



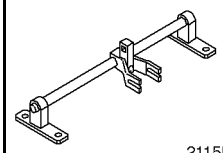
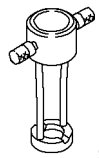
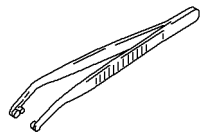
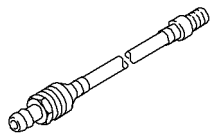
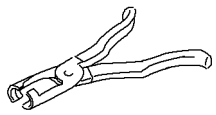
40. Attach the PCV hose and the vacuum hose to the engine upper cover.



41. Initialize the door window motors. For additional information, refer to Section 501-11.

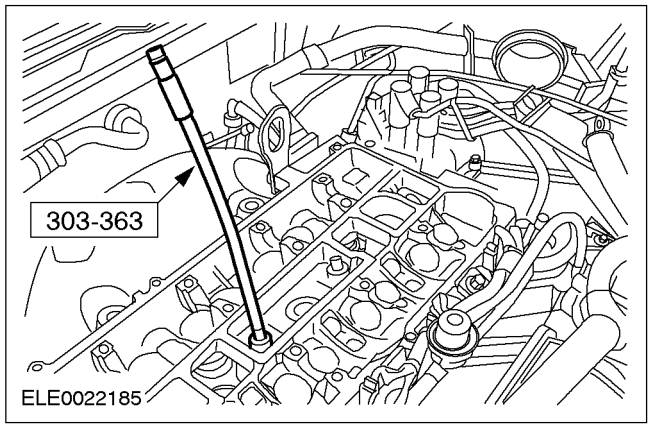
IN-VEHICLE REPAIR

Valve Seals (21 238 0)

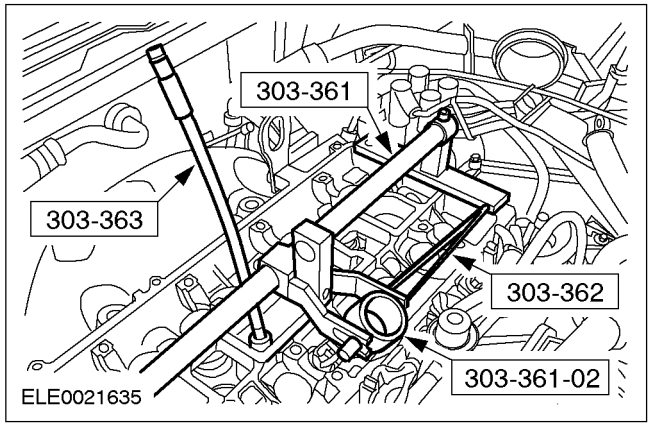
Special Tool(s)	
 21155	Compressor, Valve Spring 303-361 (21-155)
 2115502A	Adapter for 303-361 303-361-02 (21-155-02A)
 21156	Installer, Valve Stem Collets 303-362 (21-156)
 21157	Adapter, Air Supply (Cylinder Head) 303-363 (21-157)
 21165	Pliers, Valve Stem Oil Seal 303-508 (21-165)

Removal

1. **Remove the camshafts.** **For additional information, refer to Camshafts in this section.**
2. **Using the special tool, apply 7 to 10 bar of compressed air into the cylinder.**



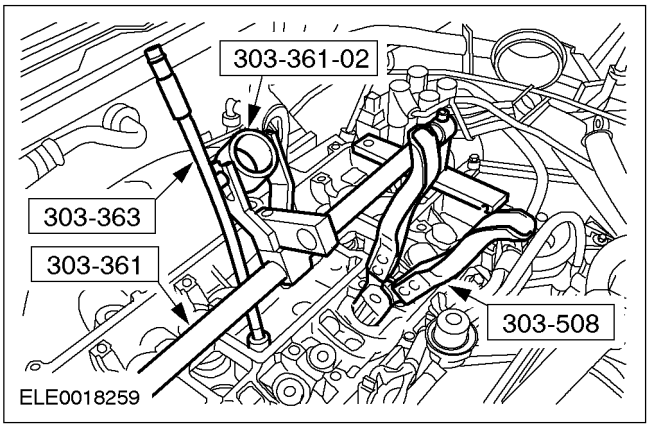
3. **Remove the valve tappets and keep them in order for reassembly.**
4. **Using the special tools, remove the valve springs.**
   - Compress the valve spring.
   - Remove the valve collets.
   - Release the valve spring.
   - Remove the valve spring retainer and the valve spring.



IN-VEHICLE REPAIR (Continued)

5. Using the special tools, remove the valve seals.

- Discard the valve seals.



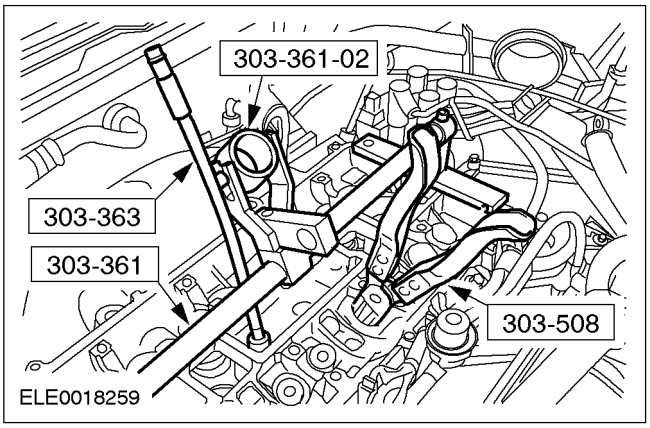
Installation

1. NOTE: Install new valve seals.

NOTE: Cover the valve collet groove on the valve stem with a protective sleeve.

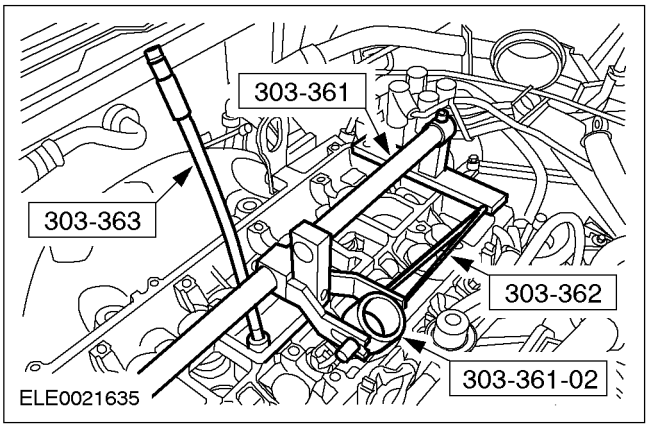
Using the special tools, install the valve seals.

- Remove the protective sleeve.



2. Using the special tools, install the valve springs.

- Install the valve spring retainer and the valve springs.
- Compress the valve spring.
- Install the valve collets.
- Release the valve spring.



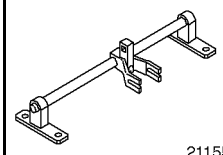
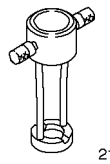
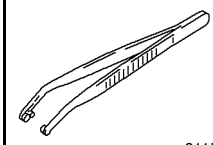
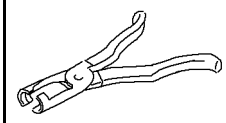
3. Remove the special tools.

4. Install the valve tappets.

5. Install the camshafts. **For additional information, refer to Camshafts in this section.**

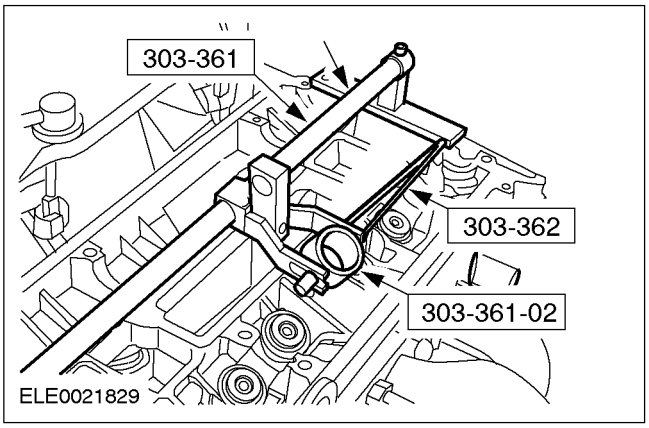
IN-VEHICLE REPAIR

Valves (21 215 4)

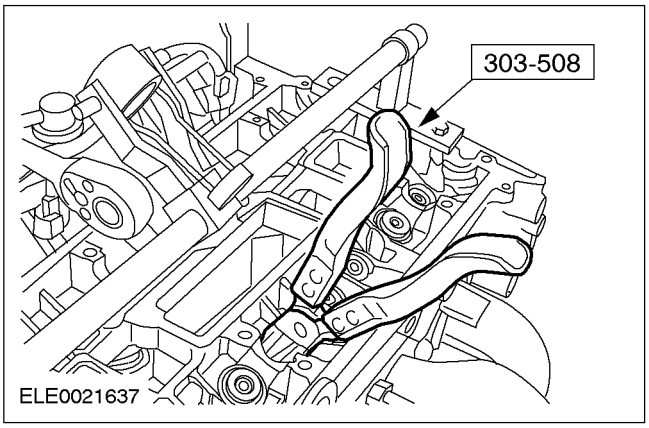
Special Tool(s)	
 21155	Compressor, Valve Spring 303-361 (21-155)
 2115502A	Adapter for 303-361 303-361-02 (21-155-02A)
 21156	Installer, Valve Stem Collets 303-362 (21-156)
 21165	Pliers, Valve Stem Oil Seal 303-508 (21-165)

Removal

1. **Remove the cylinder head.** **For additional information, refer to Cylinder Head in this section.**
2. **Using the special tools, remove the valve springs.**
   - Compress the valve spring.
   - Remove the valve collets.
   - Release the valve spring.
   - Remove the valve spring retainer and the valve spring.



3. **Using the special tool, remove the valve seals.**
   - Discard the valve seals.



4. **Remove the valves.**

Installation

1. **Install the valves.**

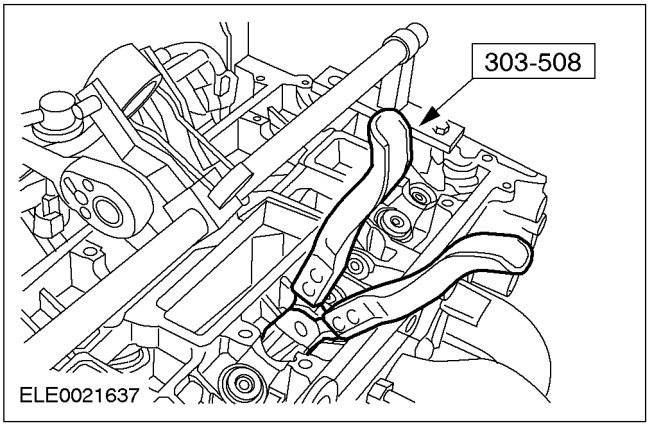
IN-VEHICLE REPAIR (Continued)

2. NOTE: Install new valve seals.

NOTE: Cover the valve collet groove on the valve stem with a protective sleeve.

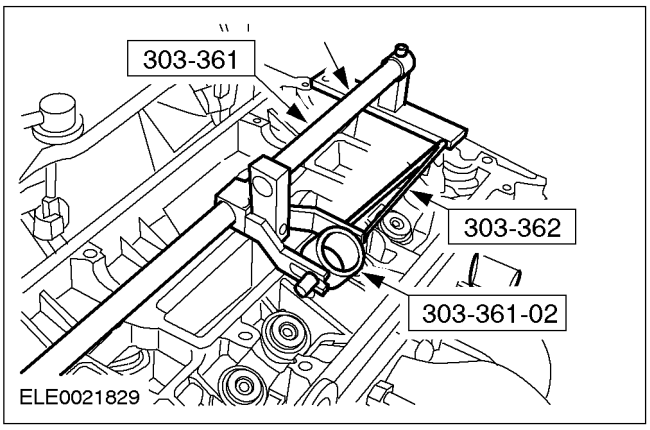
Using the special tool, install the valve seals.

- Remove the protective sleeve.



3. Using the special tools, install the valve springs.

- Install the valve spring retainer and the valve spring.
- Compress the valve spring
- Install the valve collets.
- Release the valve spring.

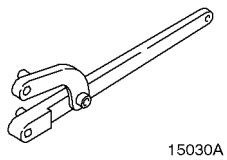
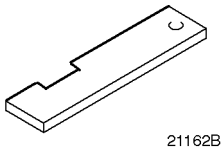
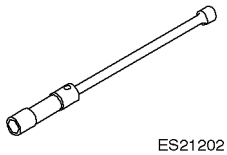
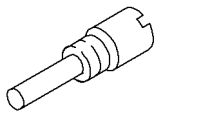
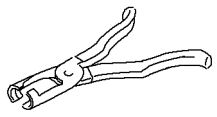


4. Remove the special tools.

5. Install the cylinder head. For additional information, refer to Cylinder Head in this section.

IN-VEHICLE REPAIR

Camshafts (21 284 0)

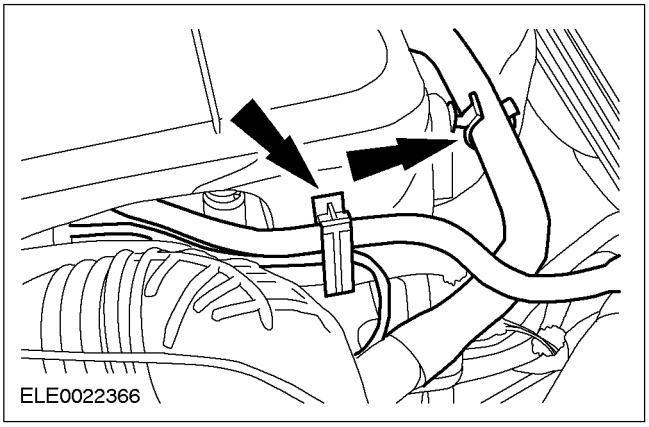
Special Tool(s)	
 15030A	Flange Holding Wrench, Universal 205-072 (15-030A)
 21162B	Timing Plate, Camshaft Alignment 303-376 (21-162B)
 ES21202	Remover/Installer, Spark Plug 303-499 (21-202)
 PZ21210	Timing Peg, Crankshaft TDC 303-507 (21-210)
 PZ21211	Pliers, Valve Stem Oil Seal 303-508 (21-211)

General Equipment
M6 x 18 mm bolt
M6 x 25 mm bolt

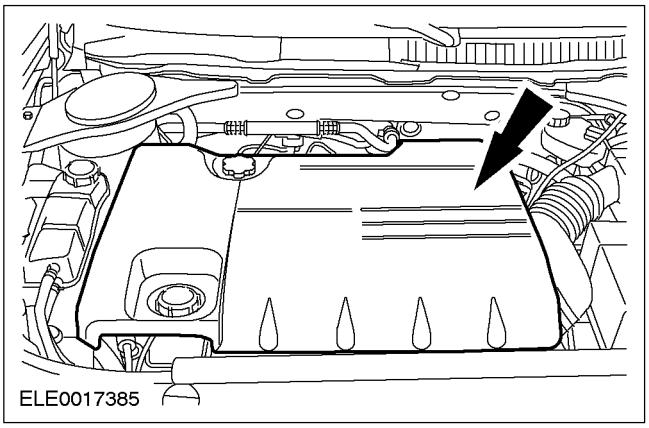
Name	Specification
Silicone sealant	WSE-M4G323-A6
Sealant 3M 2510	ESS-M11P24-A1
Hypoid oil	SQM-2C9002-AA

Removal

1. **Detach the positive crankcase ventilation hose (PCV) and the vacuum hose from the engine upper cover.**



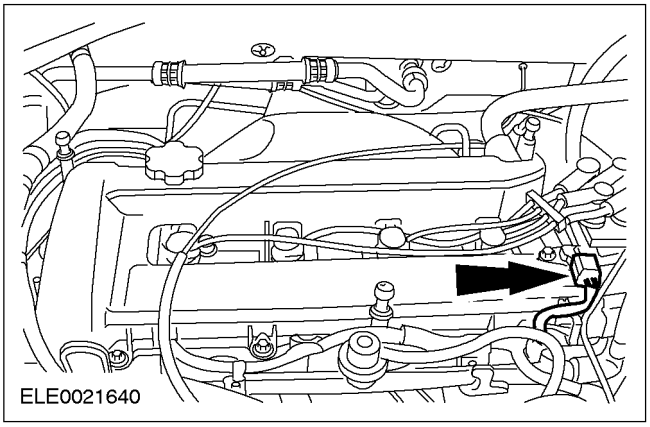
2. **Remove the engine upper cover.**



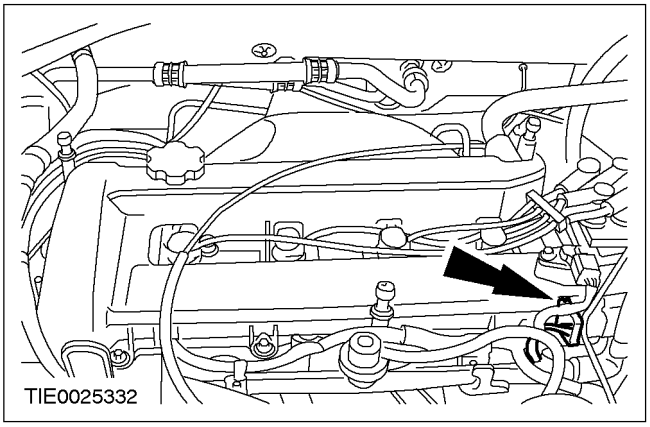
3. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**

IN-VEHICLE REPAIR (Continued)

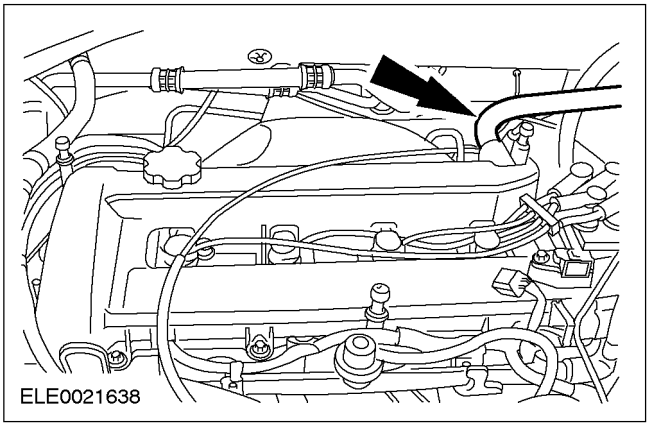
4. Disconnect the camshaft position (CMP) sensor electrical connector.



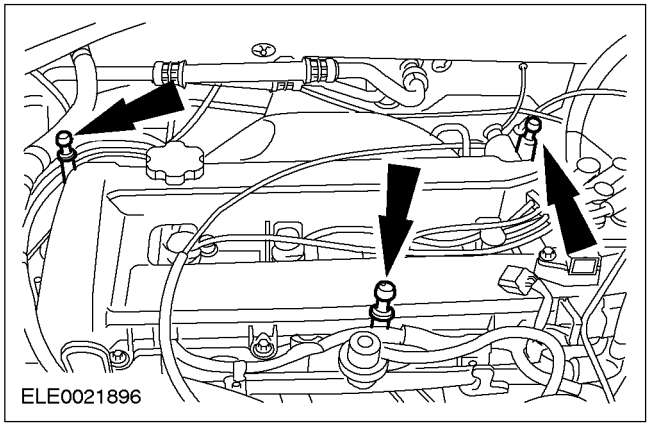
5. Detach the engine wiring harness electrical connector from the valve cover.



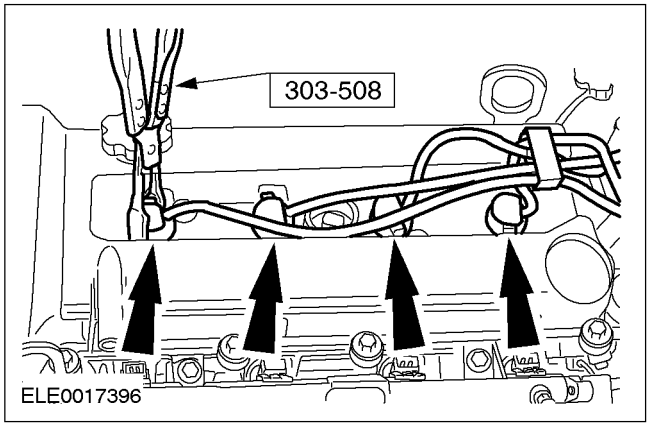
6. Detach the PCV hose from the valve cover.



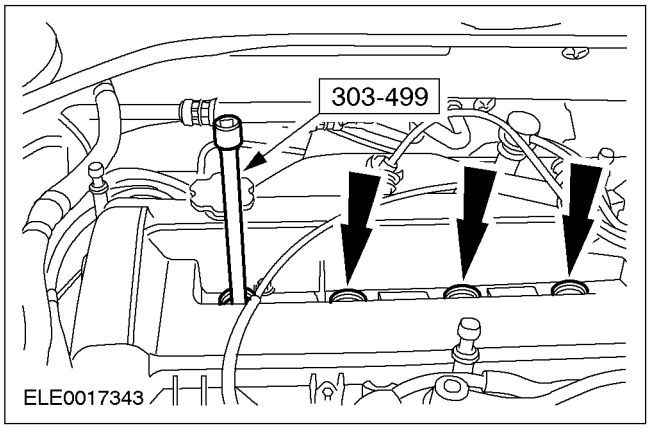
7. Remove the engine upper cover retaining brackets.



8. Using the special tool, disconnect the spark plug electrical connectors.

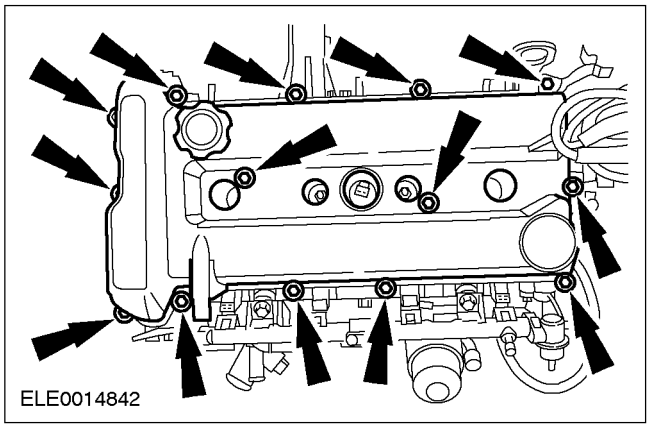


9. Using the special tool, remove the spark plugs.

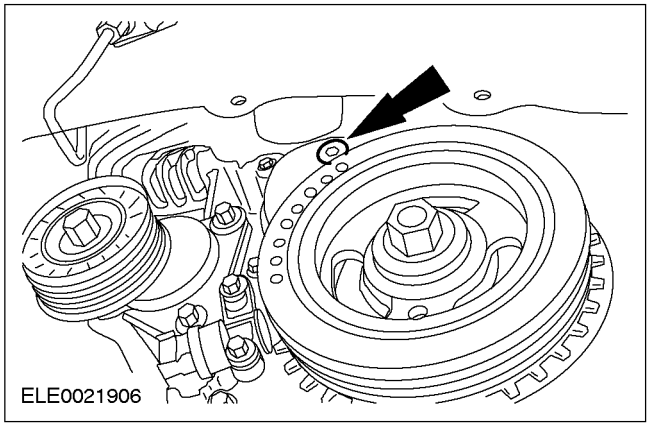


IN-VEHICLE REPAIR (Continued)

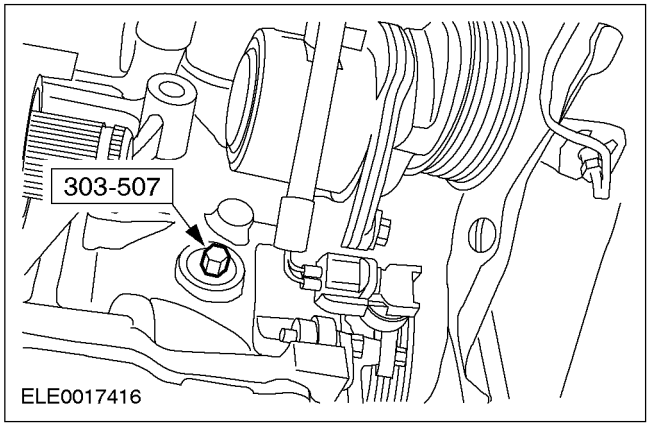
10. Remove the valve cover.



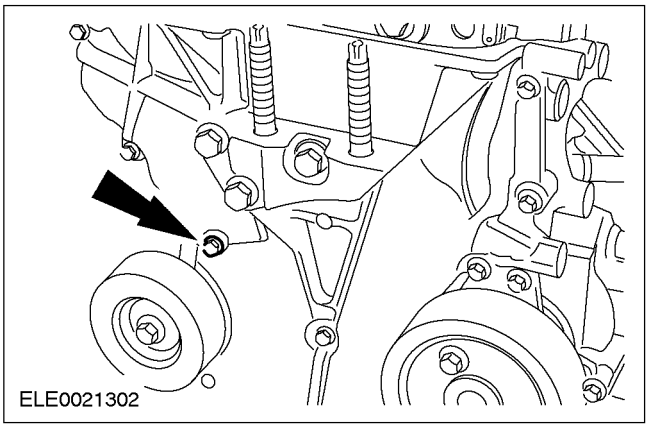
11. Remove the accessory drive belt. For additional information, refer to Section 303-05.
12. Raise and support the vehicle. For additional information, refer to Section 100-02.
13. Remove the engine front cover lower blanking plug.



14. Remove the cylinder block lower blanking plug and install the special tool.



15. Lower the vehicle.
16. Remove the engine front cover upper blanking plug.

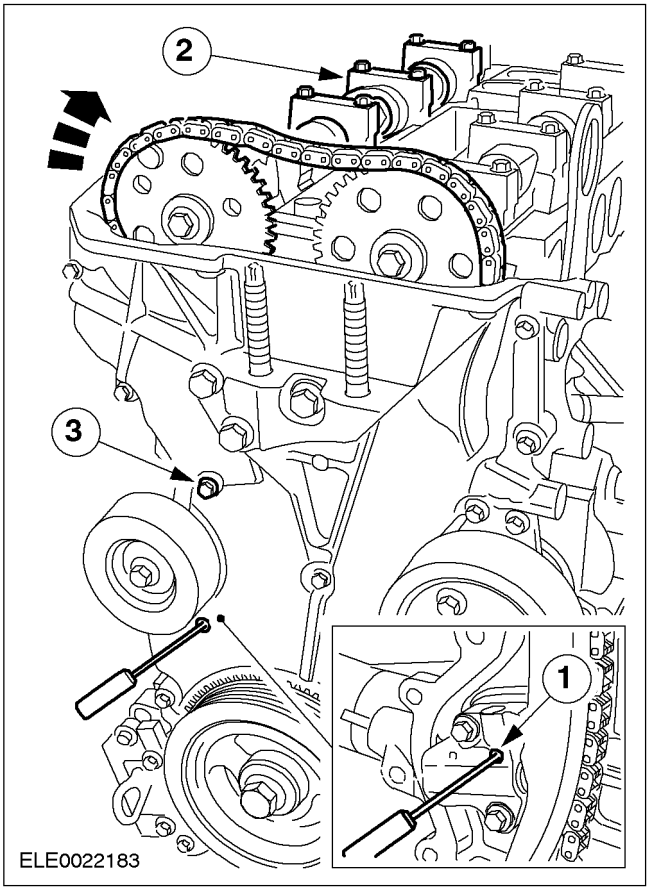


IN-VEHICLE REPAIR (Continued)

17. **CAUTION: To detension the timing chain, make sure the timing chain tensioner ratchet is in the released position.**

Detension the timing chain.

1. Using a suitable screwdriver, unlock the timing chain tensioner ratchet.
2. Carefully turn the exhaust camshaft by the hexagon in the normal direction of rotation, to detension the timing chain tensioner.
3. Install a suitable M6 x 18 mm bolt through the blanking plug to secure the timing chain guide in the detensioned position.

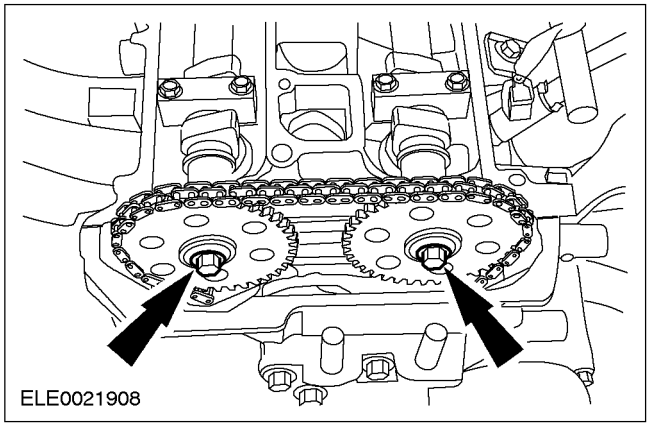


18. **CAUTION: Hold the camshaft by the hexagon with an open-ended wrench to stop it from turning.**

NOTE: Using a suitable piece of wire, prevent the timing chain and the sprocket from dropping into the timing case.

Loosen the camshaft sprockets retaining bolts.

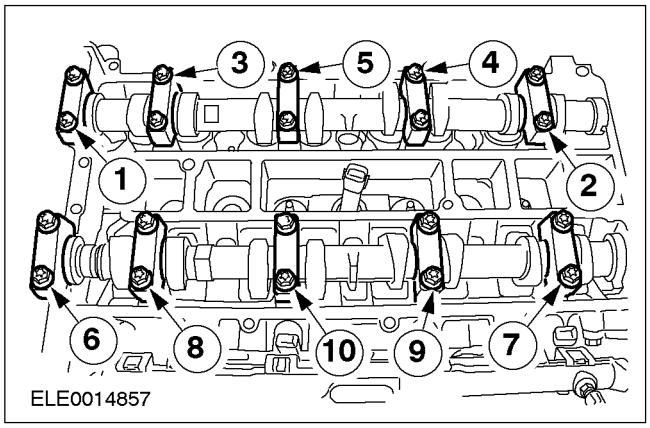
- Detach the exhaust camshaft sprocket together with the timing chain from the exhaust camshaft.



19. **CAUTION: Keep the camshaft bearing caps, the camshafts and the camshaft sprockets in order for installation.**

NOTE: Working in several stages, release each camshaft bearing cap retaining bolt two turns at a time.

Remove the camshaft bearing caps in the sequence shown .



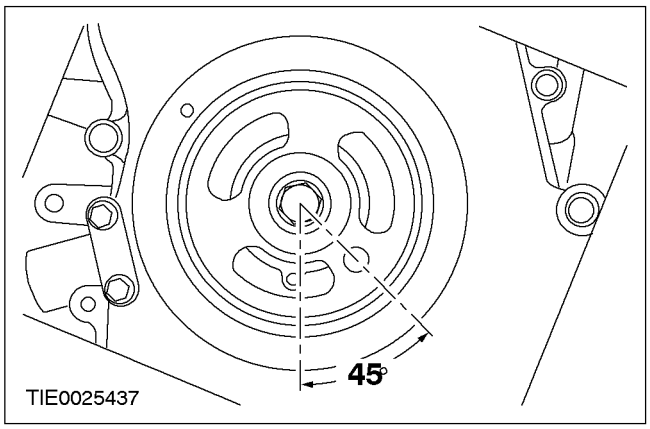
IN-VEHICLE REPAIR (Continued)

20. NOTE: Using a suitable piece of wire, prevent the timing chain and the sprocket from dropping into the timing case.

Detach the intake camshaft sprocket from the intake camshaft.

Installation

1. Turn the engine against its normal direction until piston No. 1 is approximately 45 degrees before top dead center (TDC).



2. NOTE: Do not tighten the camshaft sprocket retaining bolt at this stage.

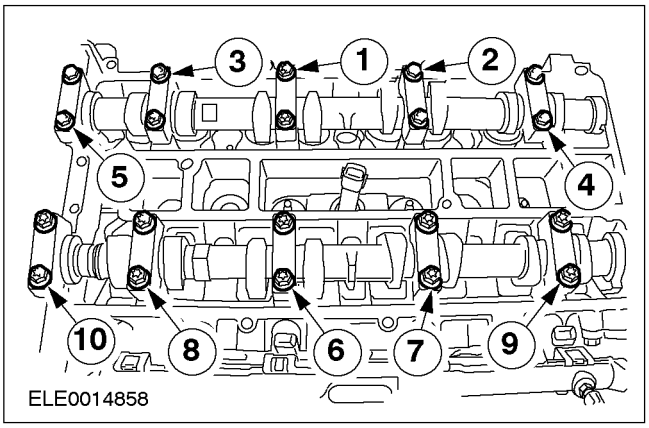
Attach the intake camshaft sprocket together with the timing chain to the intake camshaft and insert the intake camshaft.

3. CAUTION: Install the camshafts approximately at valve overlap position cylinder No. 4.

CAUTION: Install the camshafts and bearing caps in their original location.

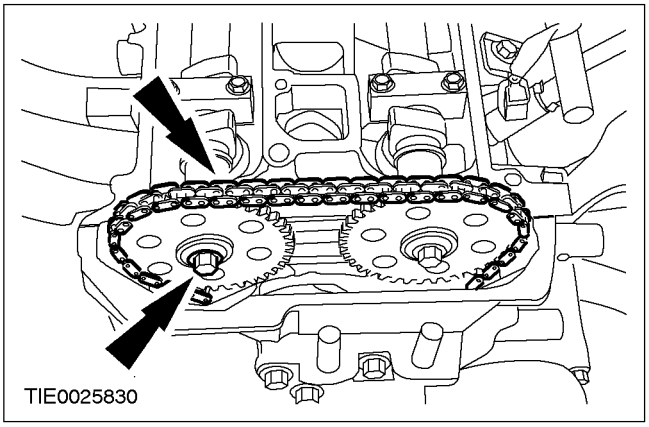
Install the camshafts.

- Working in several stages, evenly tighten the camshaft bearing cap bolts in the sequence shown, one half turn at a time.
- Coat the camshaft bearing caps with hypoid oil.
- Tighten the bolts in two stages:
- Stage 1: 7 Nm.
- Stage 2: 16 Nm.



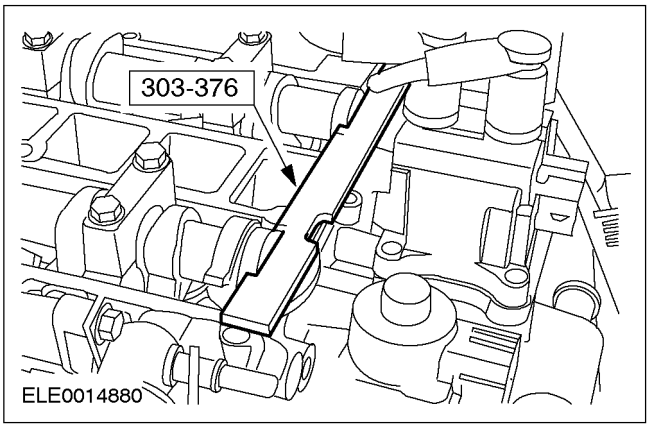
4. NOTE: Do not tighten the camshaft sprocket retaining bolt at this stage.

Attach the exhaust camshaft sprocket together with the timing chain to the exhaust camshaft.



IN-VEHICLE REPAIR (Continued)

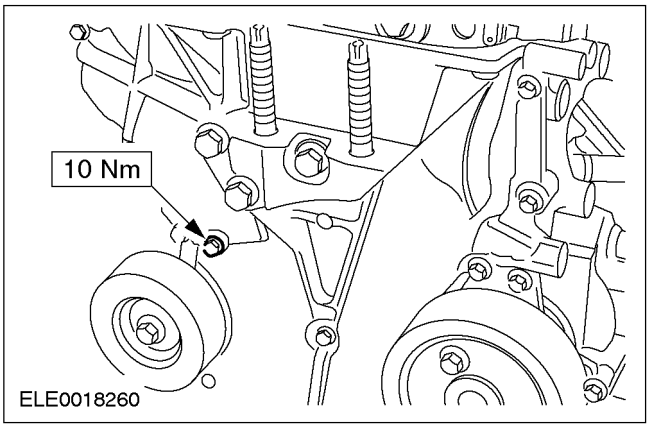
5. Install the special tool.



6. Coat the engine front cover upper blanking plug with sealant.

7. Tension the timing chain.

- Remove the timing chain guide securing bolt and install the engine front cover upper blanking plug.

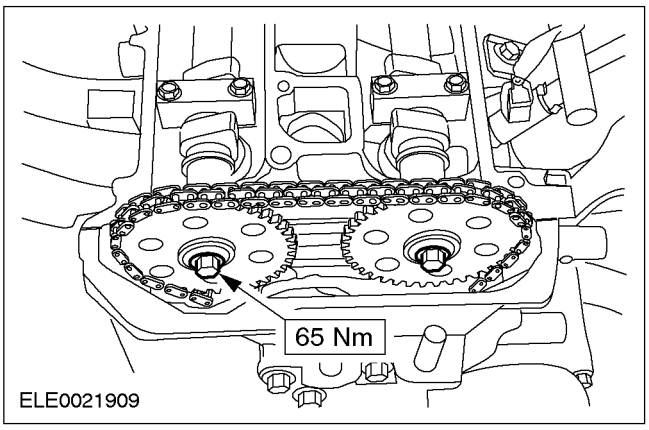


8. NOTE: Only turn the engine in the normal direction of rotation.

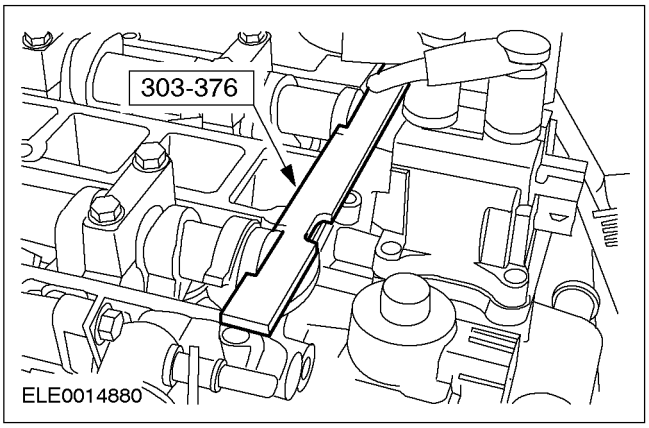
Turn the engine until piston No. 1 is at TDC.

9. NOTE: Hold the camshafts by the hexagon with an open-ended wrench to stop them from rotating.

Tighten the camshaft sprocket retaining bolts.

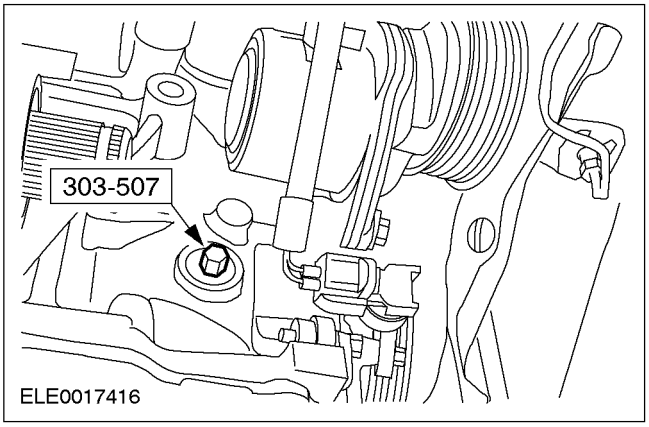


10. Remove the special tool.



11. Raise and support the vehicle. For additional information, refer to Section 100-02.

12. Remove the special tool from the cylinder block.

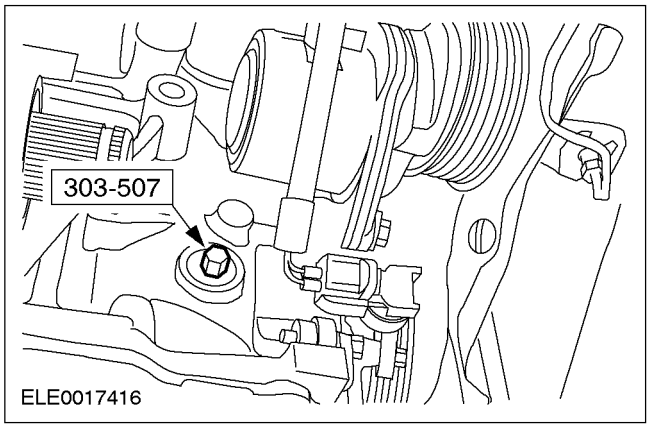


IN-VEHICLE REPAIR (Continued)

13. **NOTE:** Only turn the engine in the normal direction of rotation.

    Turn the engine two revolutions.

14. **Install the special tool.**



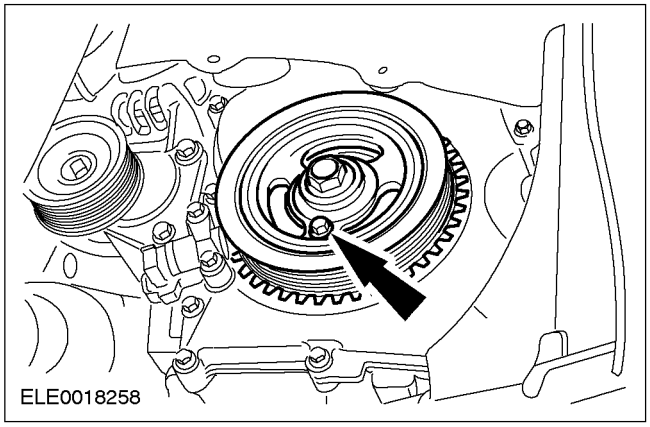
15. **NOTE:** Only turn the engine in the normal direction of rotation.

    Turn the engine until piston No. 1 is at TDC.

16. **CAUTION: Only tighten the crankshaft pulley securing bolt finger tight.**

NOTE: If it is not possible to install the crankshaft pulley securing bolt, correct the valve timing.

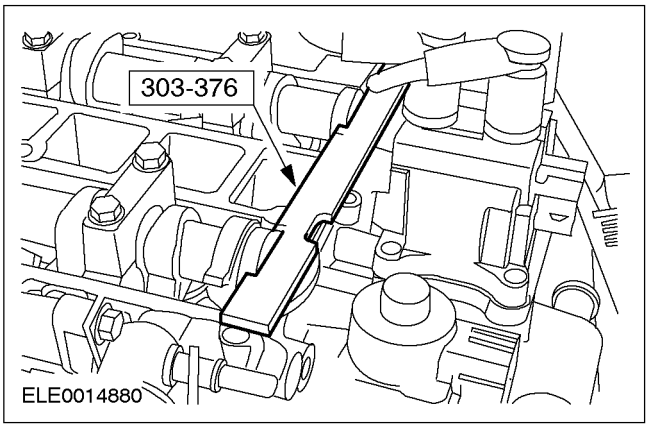
Using a M6 x 18 mm bolt, check the position of the crankshaft pulley.



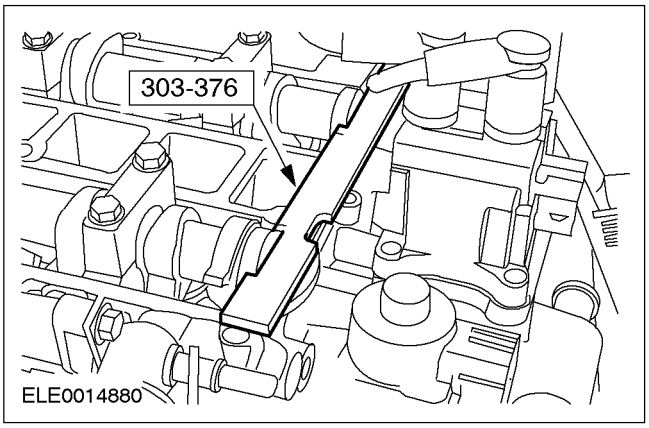
17. **Lower the vehicle.**

18. **NOTE:** If it is not possible to install the special tool, correct the valve timing.

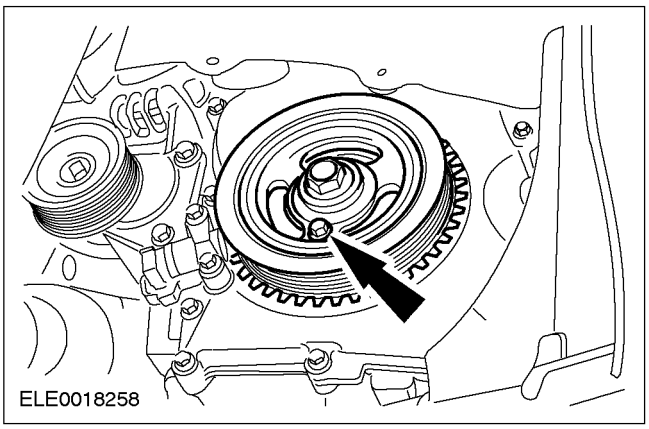
    Using the special tool, check the position of the camshafts.



19. **Remove the special tool.**

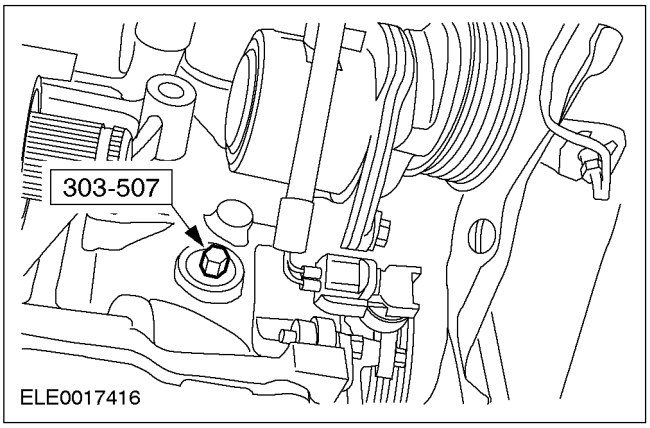


20. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
21. **Remove the crankshaft pulley securing bolt.**

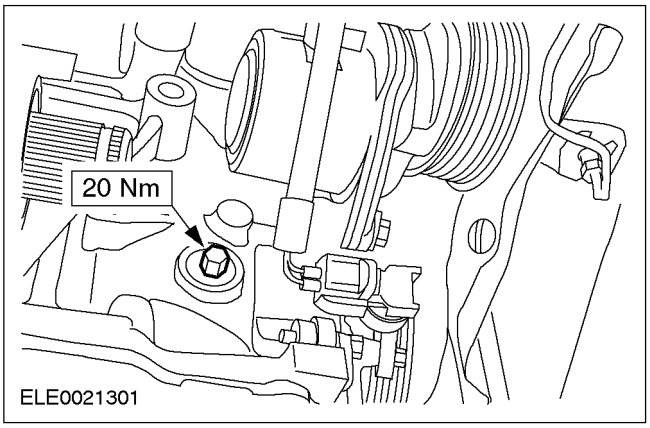


IN-VEHICLE REPAIR (Continued)

22. Remove the special tool.

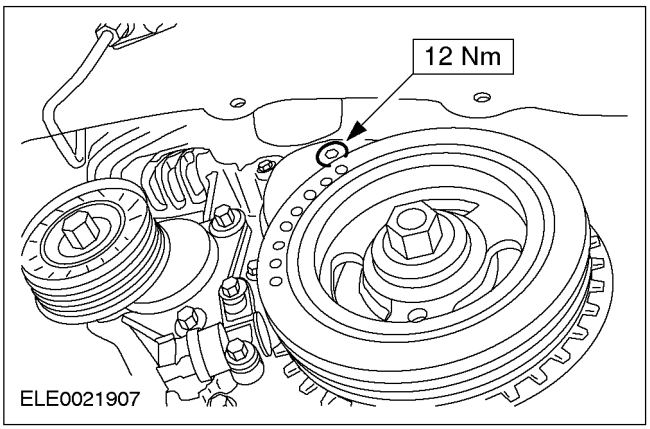


23. Install the cylinder block lower blanking plug.



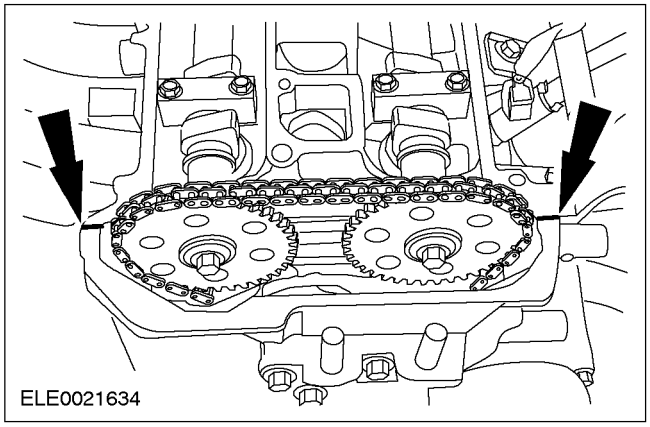
24. Coat the engine front cover lower blanking plug with sealant.

25. Install the engine front cover lower blanking plug.



26. Install the accessory drive belt. For additional information, refer to Section 303-05.

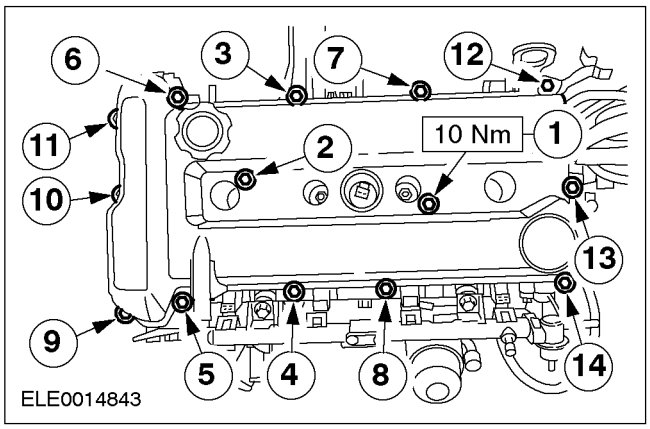
27. Apply a small bead of sealer to the areas as shown.



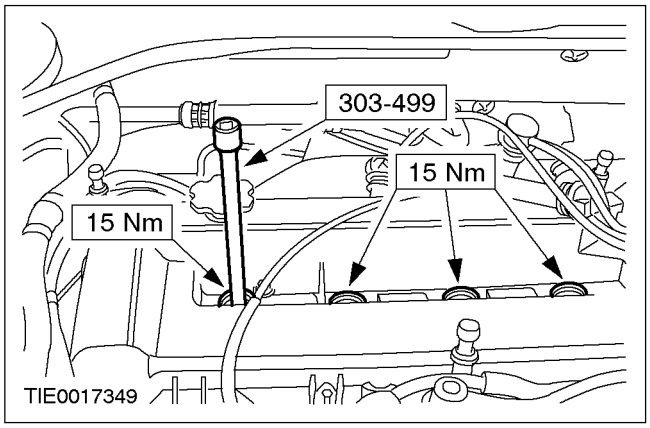
28. NOTE: Install a new valve cover gasket if necessary.

Install the valve cover.

- Tighten the bolts in the sequence shown.

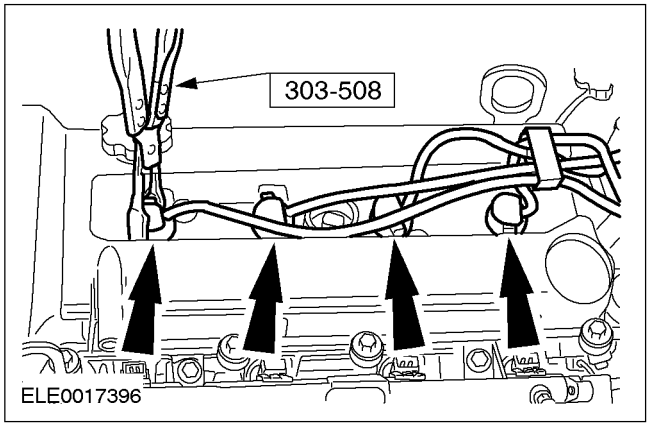


29. Using the special tool, install the spark plugs.

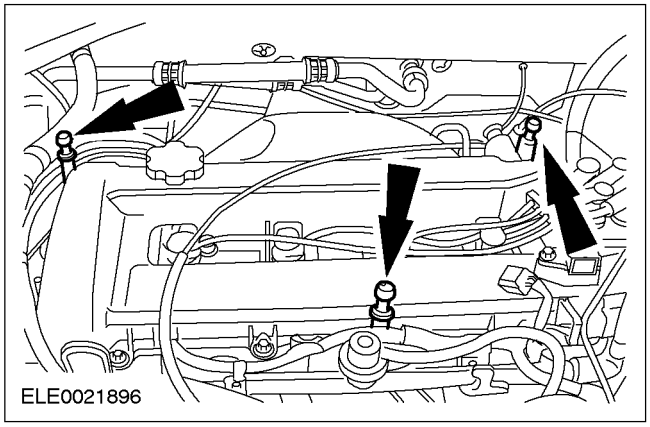


IN-VEHICLE REPAIR (Continued)

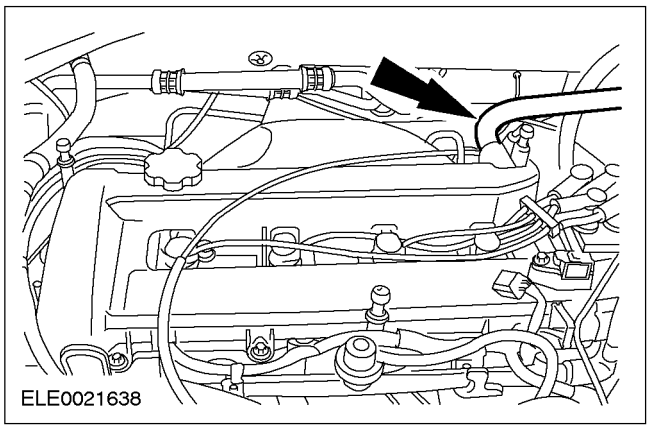
30. Using the special tool, connect the spark plug electrical connectors.



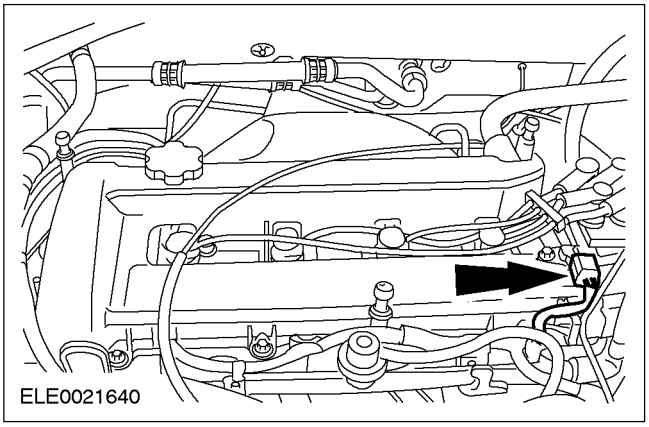
31. Install the engine upper cover retaining brackets.



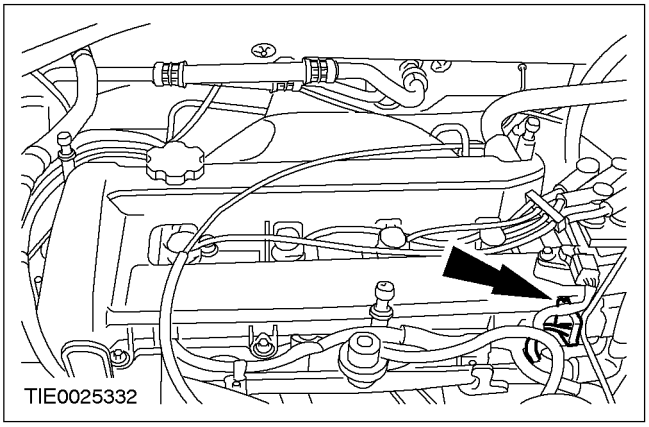
32. Attach the PCV hose to the valve cover.



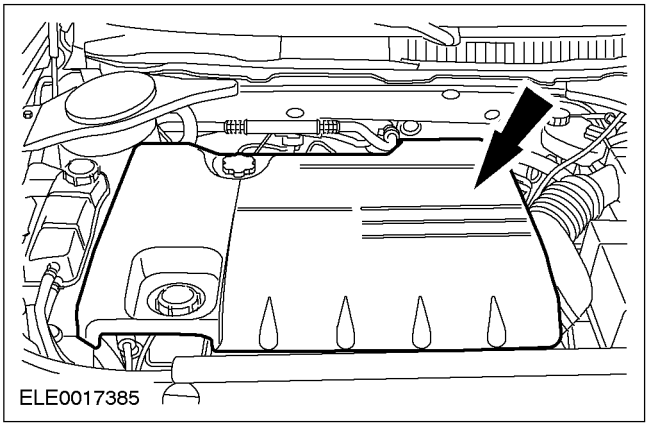
33. Connect the CMP sensor electrical connector.



34. Attach the engine wiring harness electrical connector to the valve cover.

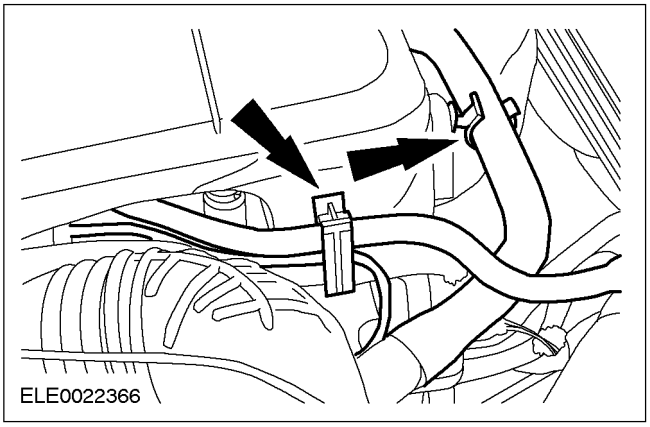


35. Connect the battery ground cable. For additional information, refer to Section 414-01.
36. Install the engine upper cover.



IN-VEHICLE REPAIR (Continued)

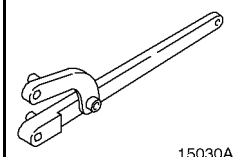
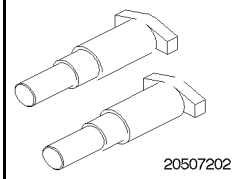
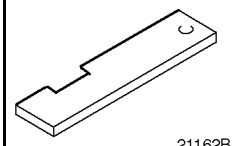
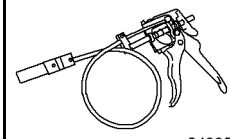
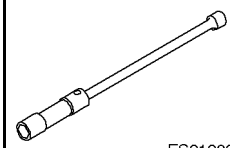
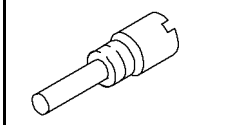
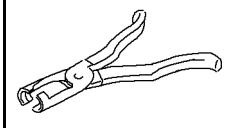
37. **Attach the PCV hose and the vacuum hose to the engine upper cover.**



38. **Initialize the door window motors. For additional information, refer to Section 501-11.**

IN-VEHICLE REPAIR

Timing Chain (21 314 0)

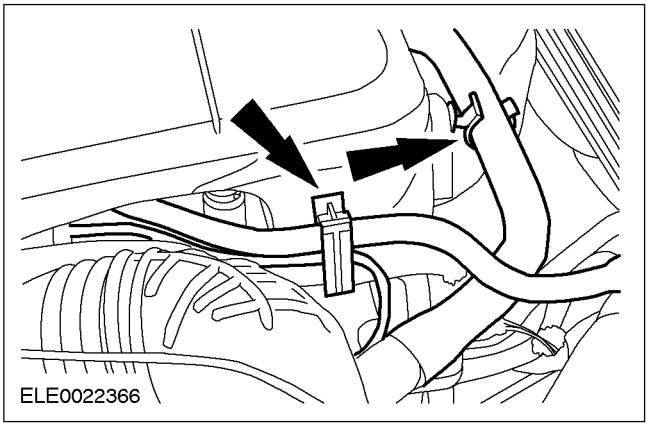
Special Tool(s)	
 15030A	Flange Holding Wrench, Universal 205-072 (15-030A)
 20507202	Adapter for 205-072 205-072-02 (15-030A-02)
 21162B	Timing Plate, Camshaft Alignment 303-376 (21-162B)
 24003	Remover/Installer, Cooling Hose Clamp 303-397 (24-003)
 ES21202	Remover/Installer, Spark Plug 303-499 (21-202)
 PZ21210	Timing Peg, Crankshaft TDC 303-507 (21-210)
 PZ21211	Pliers, Valve Stem Oil Seal 303-508 (21-211)

General Equipment
Trolley Jack
M6 x 18 mm bolt

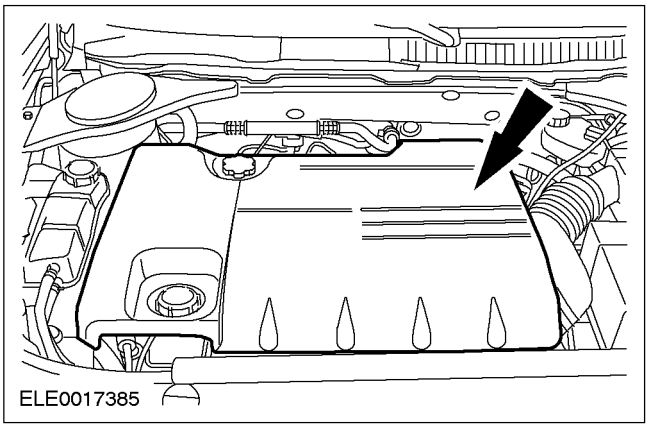
Name	Specification
Loctite 7070	
Silicone sealant	WSE-M4G323-A6

Removal

1. **Detach the positive crankcase ventilation (PCV) hose and the vacuum hose from the engine upper cover.**



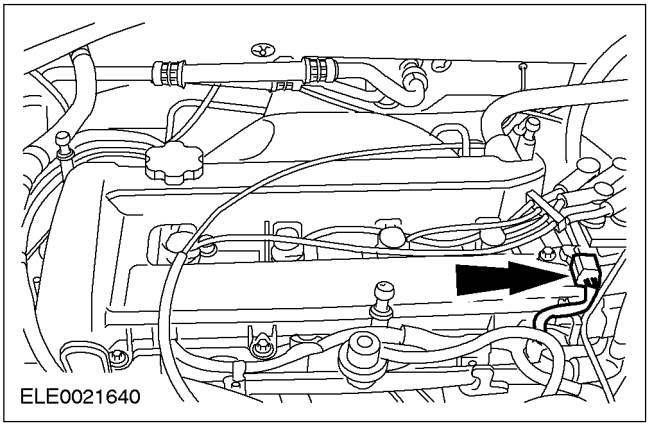
2. **Remove the engine upper cover.**



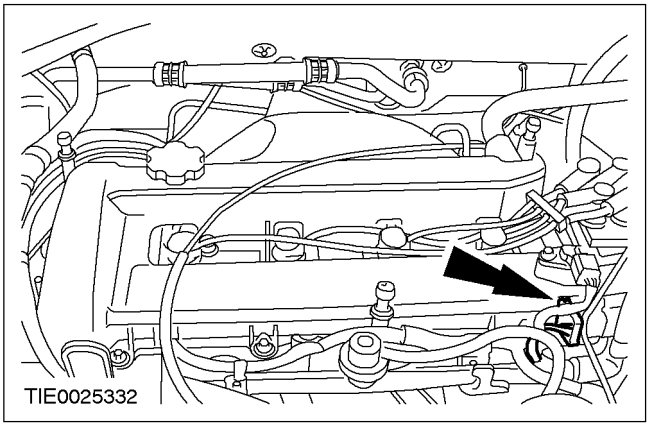
3. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**

IN-VEHICLE REPAIR (Continued)

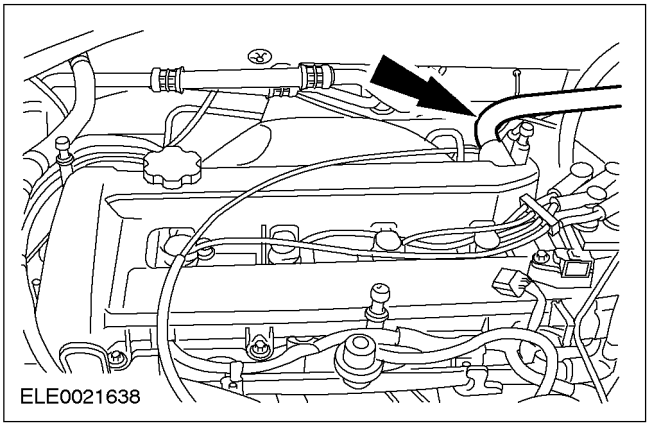
4. Disconnect the camshaft position (CMP) sensor electrical connector.



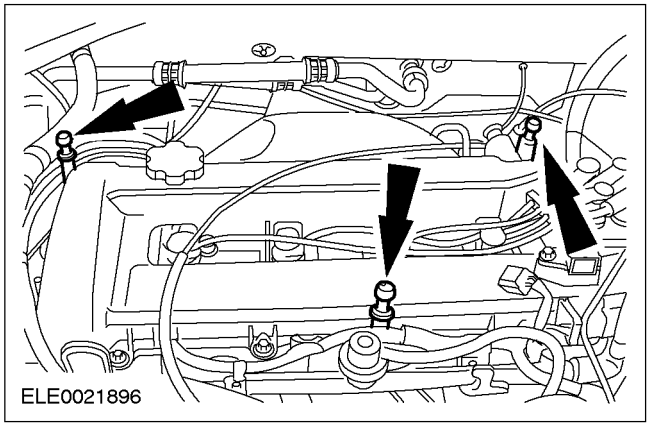
5. Detach the engine wiring harness electrical connector from the valve cover.



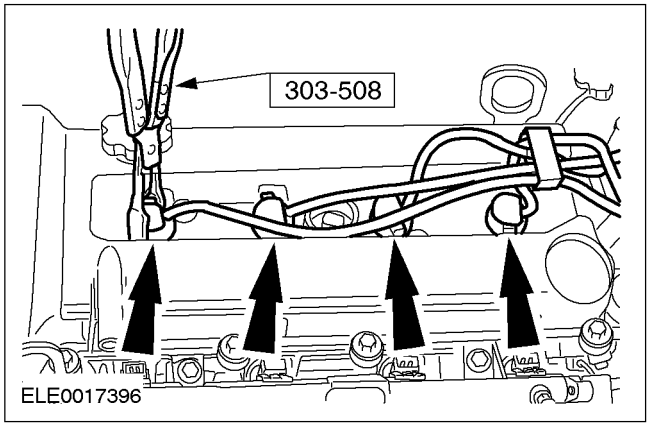
6. Detach the PCV hose from the valve cover.



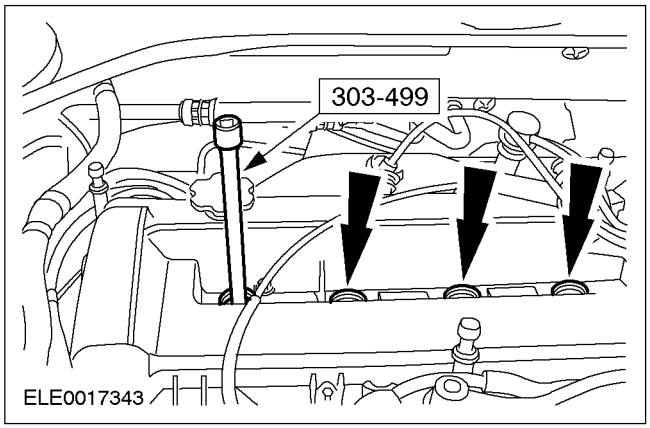
7. Remove the engine upper cover retaining brackets.



8. Using the special tool, disconnect the spark plug electrical connectors.

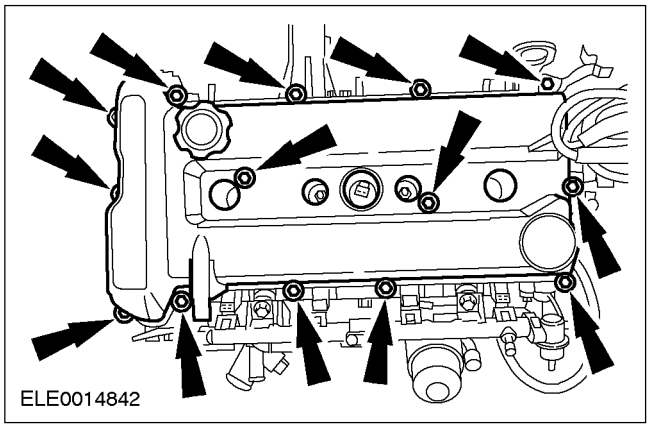


9. Using the special tool, remove the spark plugs.

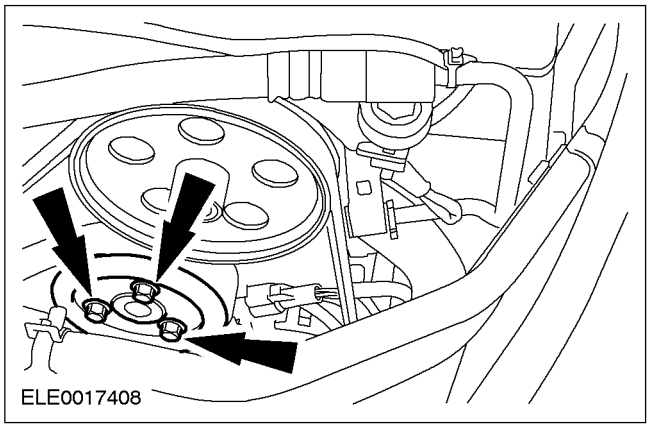


IN-VEHICLE REPAIR (Continued)

10. Remove the valve cover.



11. Loosen the water pump pulley retaining bolts by three turns.

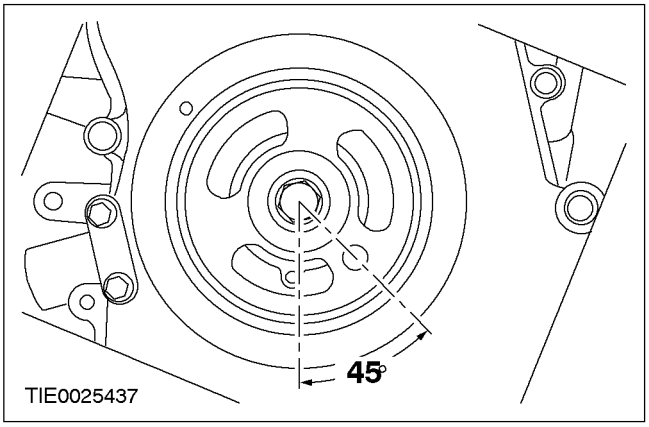


12. Remove the power steering pump. For additional information, refer to Section 211-02.

13. Raise and support the vehicle. For additional information, refer to Section 100-02.

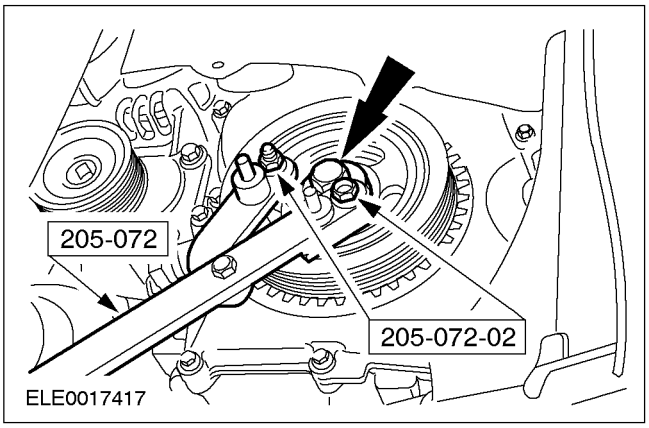
14. NOTE: Only turn the engine in the normal direction of rotation.

Turn the engine until piston No. 1 is approximately 45 degrees before top dead center (TDC).

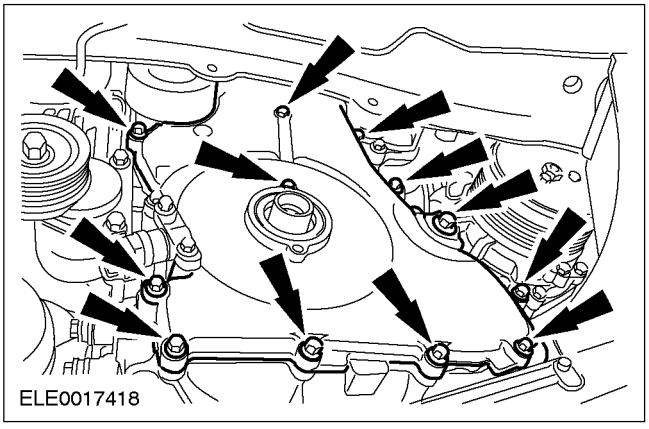


15. NOTE: Do not discard the crankshaft pulley retaining bolt.

Using the special tools, prevent the crankshaft pulley from rotating and remove the crankshaft pulley.

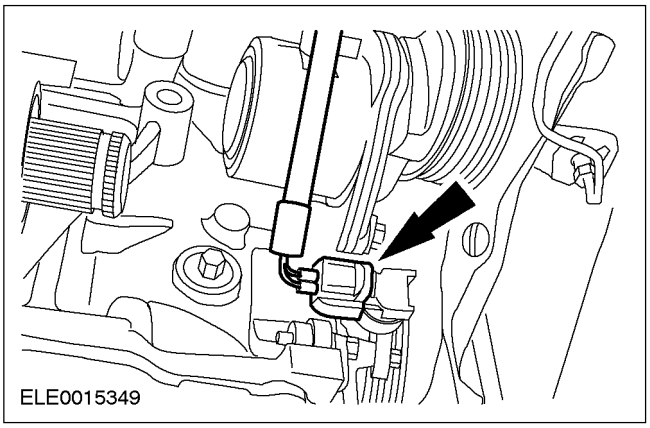


16. Remove the engine front cover lower bolts.

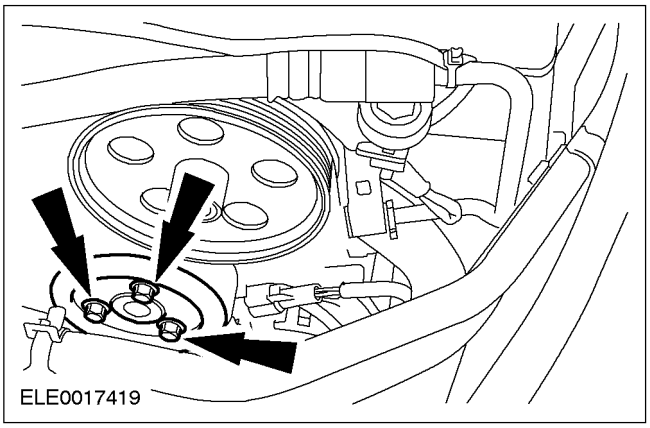


IN-VEHICLE REPAIR (Continued)

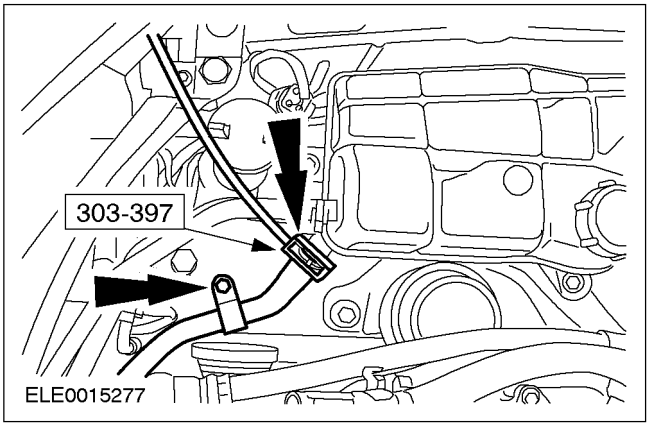
17. **Disconnect the crankshaft position (CKP) sensor electrical connector.**



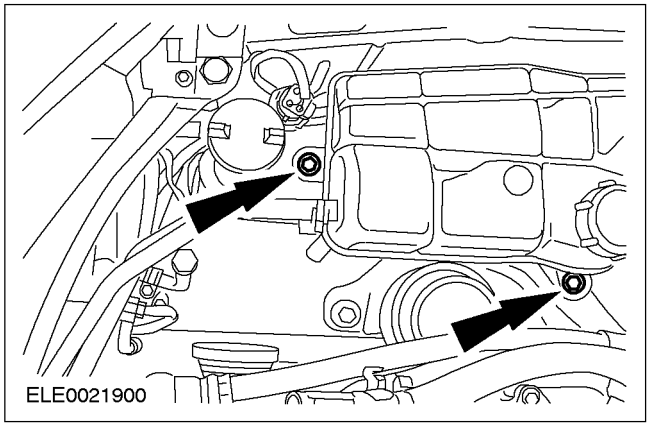
18. **Lower the vehicle.**
19. **Remove the water pump pulley.**



20. **Using the special tool, disconnect the coolant hose from the coolant expansion tank.**

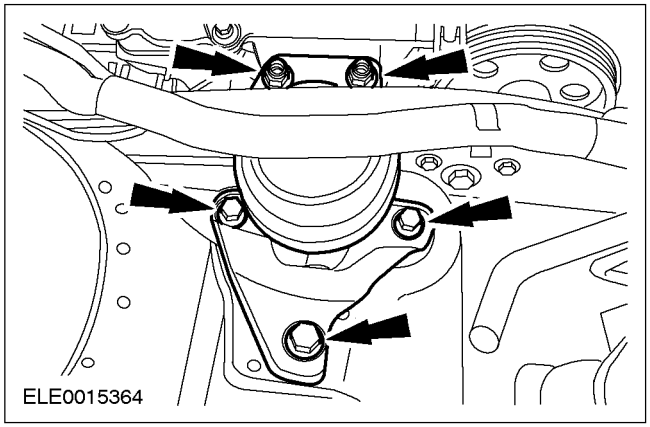


21. **Detach the coolant expansion tank and position it to one side.**

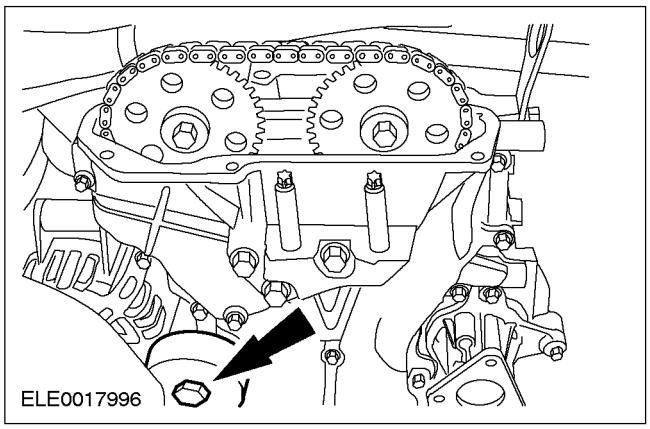


22. **NOTE:** Support the engine with wooden blocks.

    Position a trolley jack with the wooden block under the oil pan and raise the engine so that the engine front mount is free from load.
23. **Remove the engine front mount.**



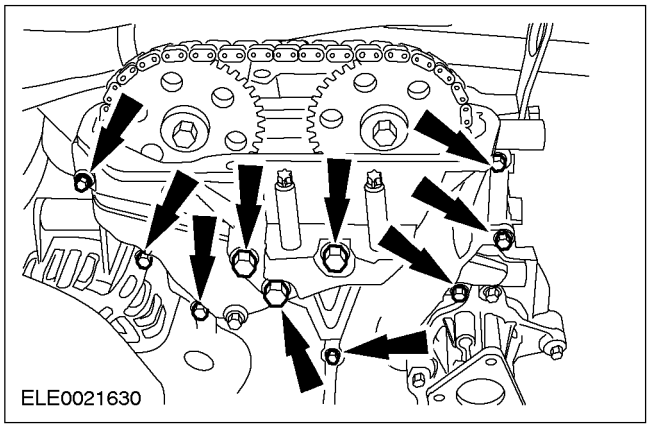
24. **Remove the accessory drive belt idler.**



IN-VEHICLE REPAIR (Continued)

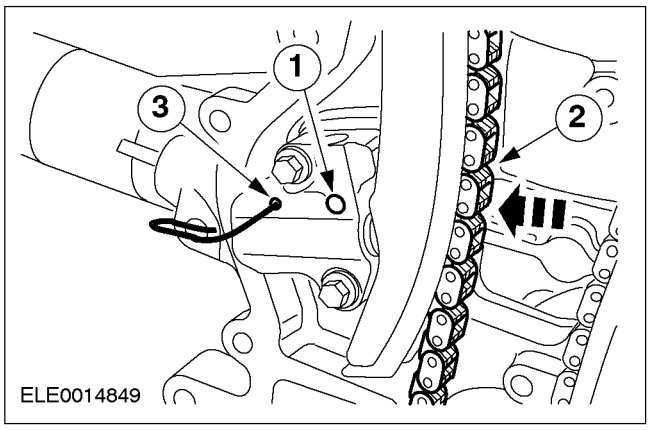
25. Remove the engine front cover upper retaining bolts.

- Remove the engine front cover.



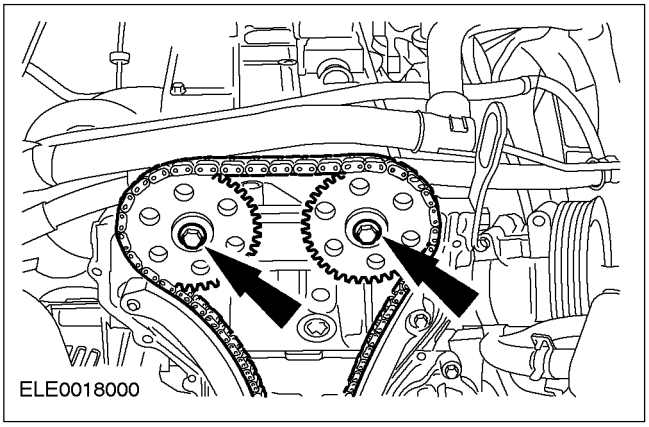
26. Detension the timing chain (engine shown removed for clarity).

1. Unlock the timing chain tensioner ratchet.
2. Apply pressure to the timing chain guide.
3. Fix the timing chain tensioner with a suitable pin punch.



27. NOTE: Hold the camshafts by the hexagon with an open-ended wrench to stop them from rotating.

Remove the camshaft sprockets and the timing chain.



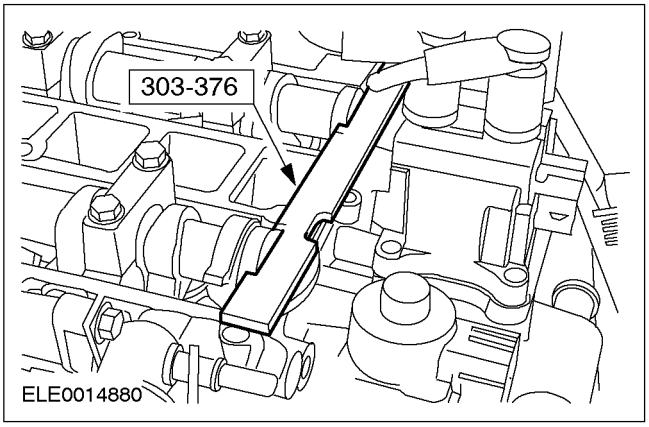
Installation

1. Clean the engine front cover mating faces with Loctite 7070.

2. NOTE: Only turn the engine in the normal direction of rotation.

Using an open-ended wrench, carefully turn the camshafts until the cams of cylinder No. 4 are at valve overlap position.

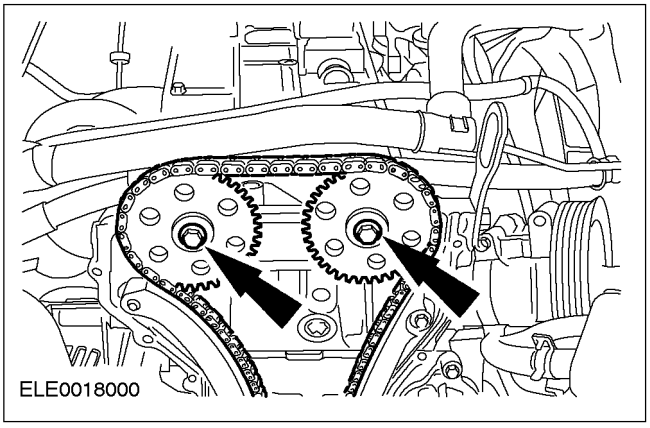
3. Install the special tool.



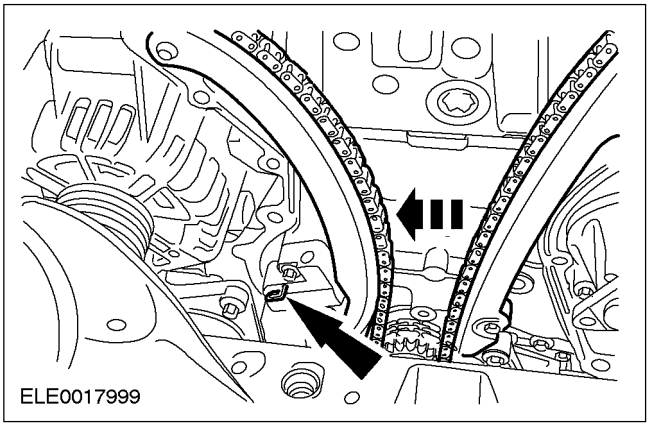
IN-VEHICLE REPAIR (Continued)

4. **CAUTION: Do not fully tighten the camshaft sprocket retaining bolts at this stage. Make sure the camshaft sprockets turn on the camshafts.**

   Install both camshaft sprockets and the timing chain.

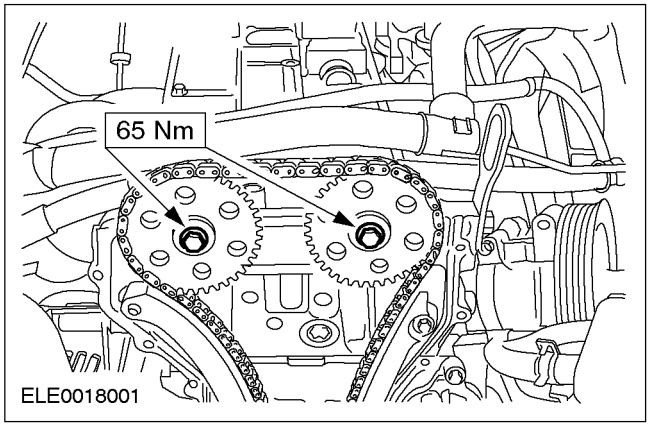


5. **Tension the timing chain.**
   - Apply pressure to the timing chain tensioner and remove the securing pin.



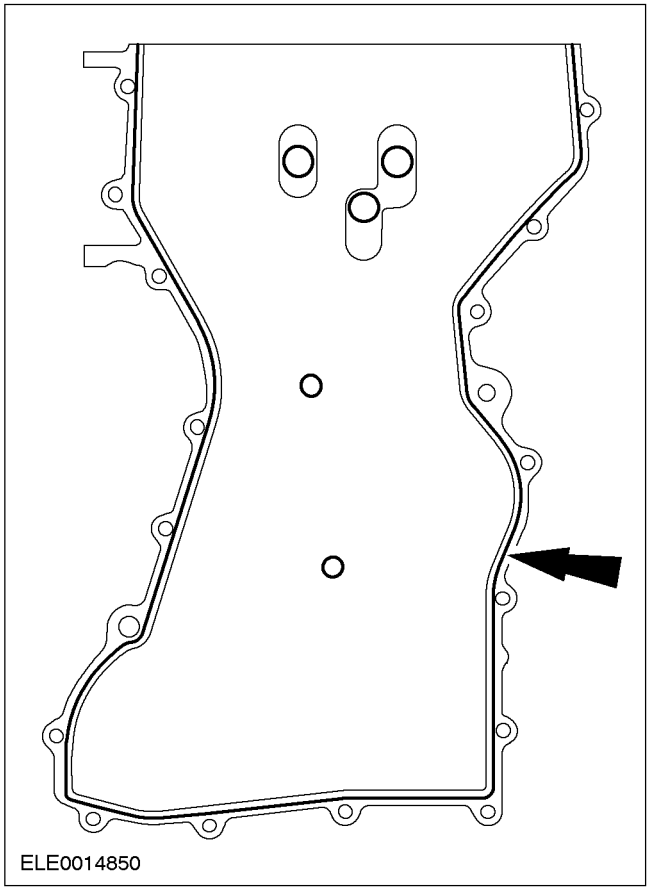
6. **CAUTION: Hold the camshafts by the hexagon with an open-ended wrench to stop them from rotating.**

   Tighten the camshaft sprocket retaining bolts.



7. **NOTE:** Install the engine front cover within 10 minutes of applying the silicone sealant.

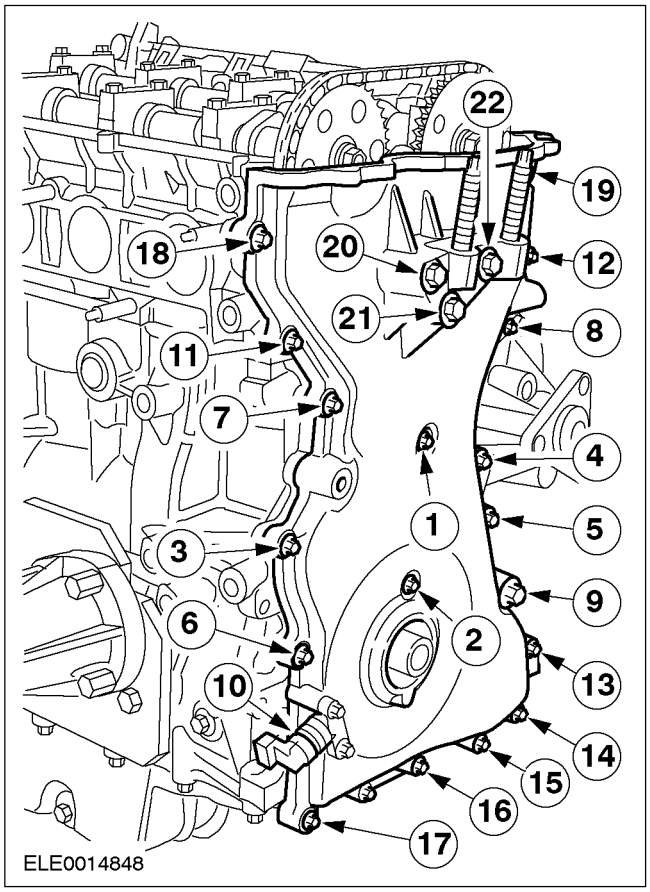
   Apply a 3 mm bead of silicone sealant to the engine front cover.



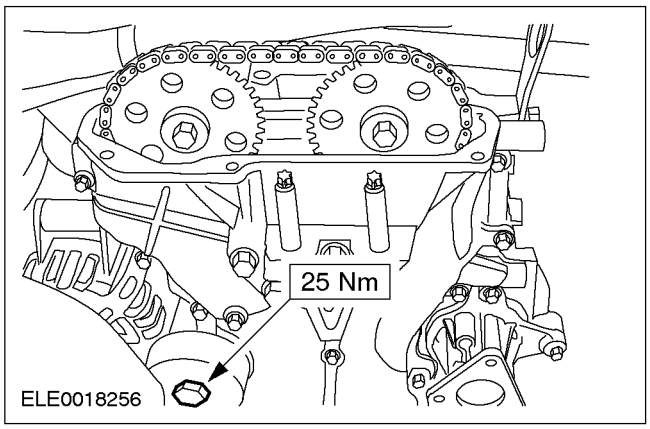
IN-VEHICLE REPAIR (Continued)

8. Install the engine front cover (engine shown removed for clarity).

- Tighten the bolts in the sequence shown.
- Bolts 1 through 8 to 10 Nm.
- Bolt 9: 48 Nm.
- Bolts 10 through 19 to 10 Nm.
- Bolts 20 through 22 to 48 Nm.

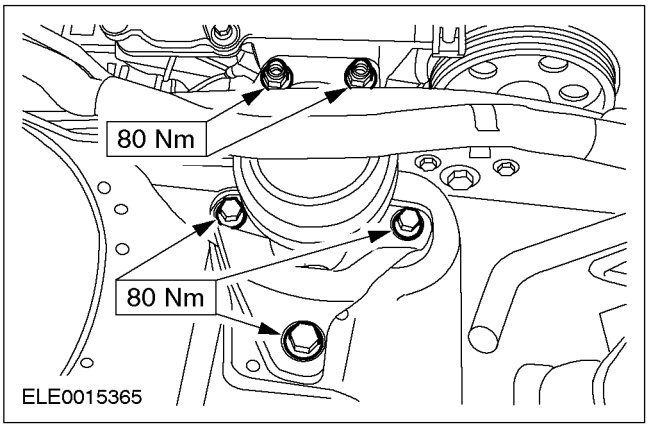


9. Install the accessory drive belt idler.



10. Install the engine front mount.

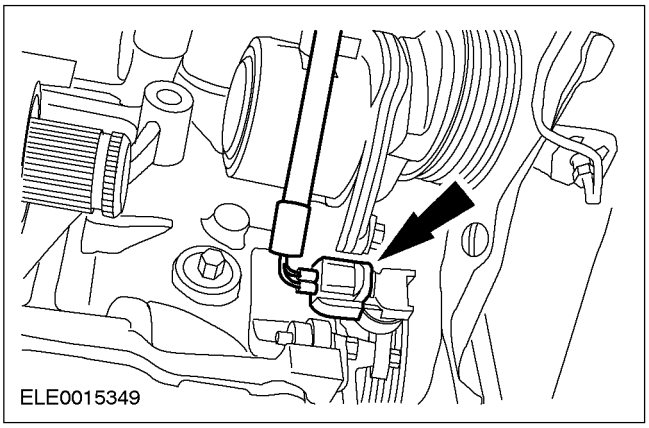
- Lower the engine and transmission assembly.
- Install the engine front mount.



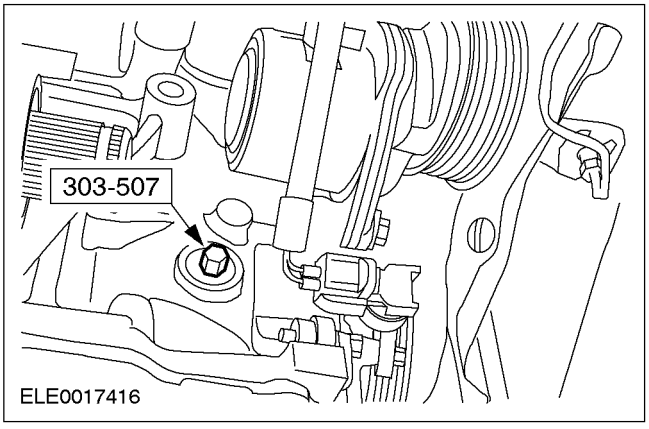
11. Remove the trolley jack.

12. Raise and support the vehicle. For additional information, refer to Section 100-02.

13. Connect the CKP sensor electrical connector.

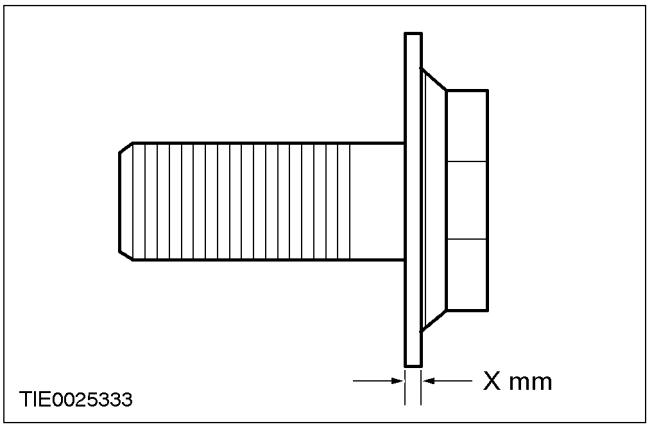


14. Remove the cylinder block lower blanking plug and install the special tool.



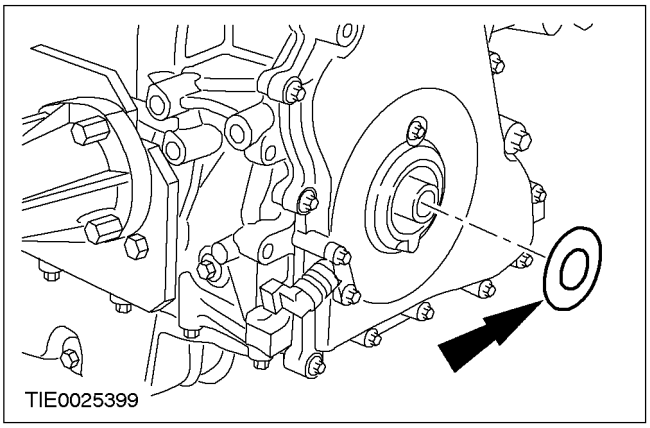
IN-VEHICLE REPAIR (Continued)

15. **Measure the thickness of the crankshaft pulley retaining bolt washer.**



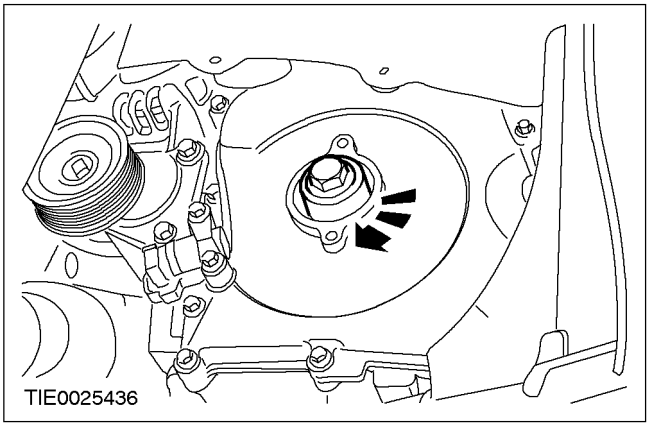
16. **NOTE:** If the thickness of the crankshaft pulley retaining bolt washer is less then 5.5 mm, a friction washer must be installed.

    Install a friction washer to the crankshaft (engine shown removed for clarity).



17. **NOTE:** Only turn the engine in the normal direction of rotation.

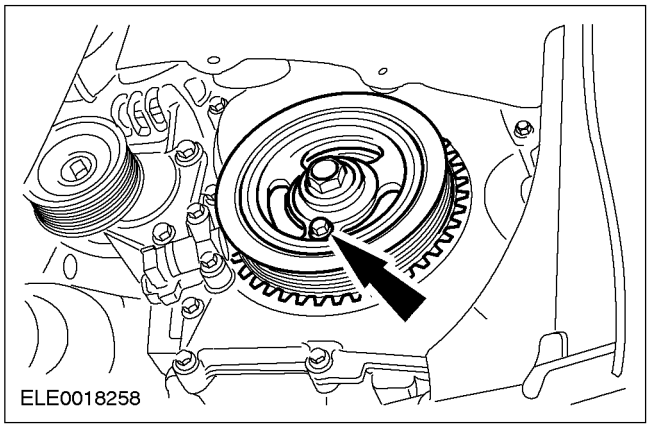
    Using the crankshaft pulley retaining bolt, turn the engine until piston No. 1 is at TDC.



18. **Remove the crankshaft pulley retaining bolt.**
    - Discard the bolt.

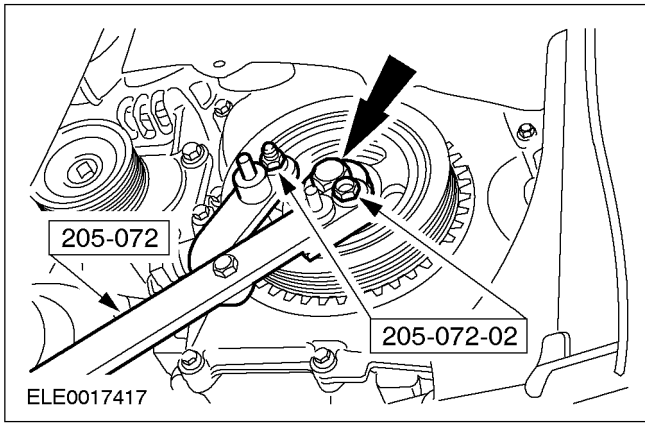
19. **CAUTION: Only tighten the crankshaft pulley securing bolt finger tight.**

    Install the crankshaft pulley onto the crankshaft and secure the crankshaft pulley to the front cover using a M6 x 18 mm bolt.



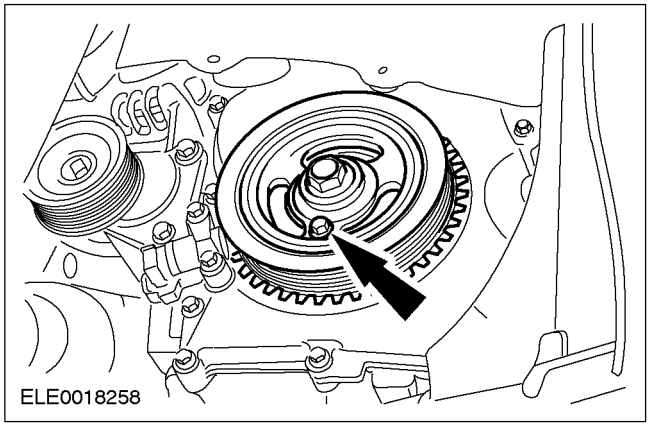
20. **NOTE:** Install a new crankshaft pulley retaining bolt.

    Using the special tools, prevent the crankshaft pulley from rotating and tighten the crankshaft pulley retaining bolt.
    - Tighten the bolt in two stages.
    - Stage 1: 100 Nm.
    - Stage 2: 90 degrees.

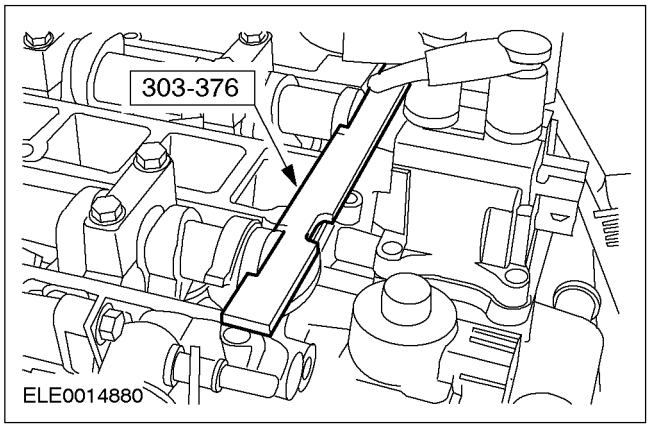


IN-VEHICLE REPAIR (Continued)

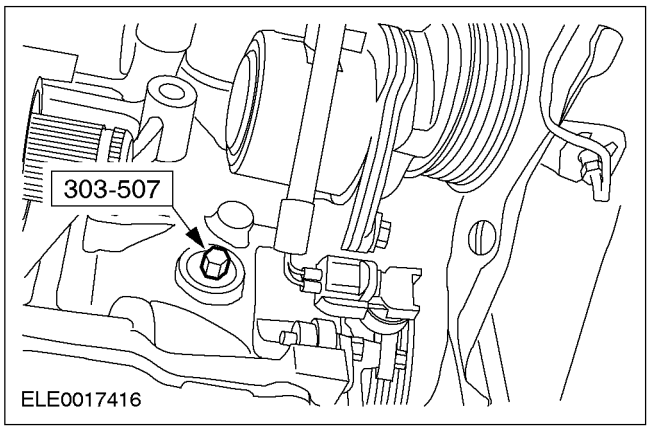
21. **Remove the crankshaft pulley securing bolt.**



22. **Lower the vehicle.**
23. **Remove the special tool.**



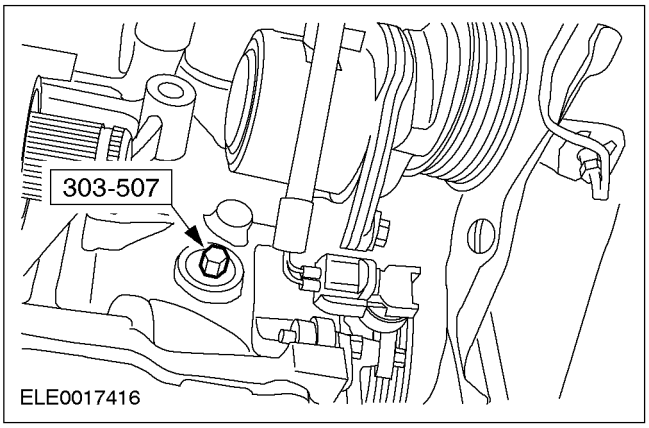
24. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
25. **Remove the special tool.**



26. **NOTE:** Only turn the engine in the normal direction of rotation.

    Turn the engine two revolutions.

27. **Install the special tool.**



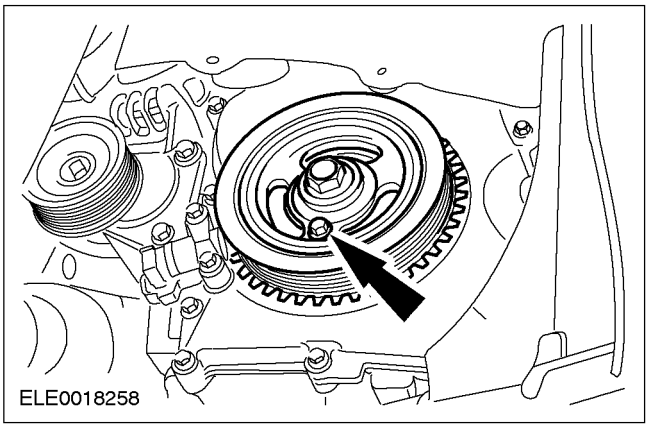
28. **NOTE:** Only turn the engine in the normal direction of rotation.

    Turn the engine until piston No. 1 is at TDC.

29. **CAUTION: Only tighten the crankshaft pulley securing bolt finger tight.**

NOTE: If it is not possible to install the crankshaft pulley securing bolt, correct the engine timing.

Using a M6 x 18 mm bolt, check the position of the crankshaft pulley.

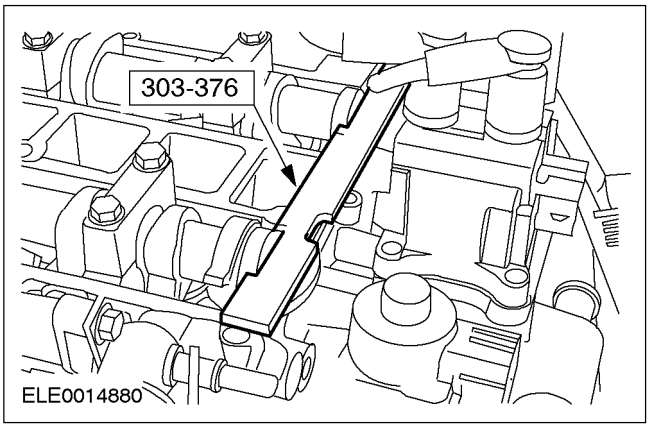


30. **Lower the vehicle.**

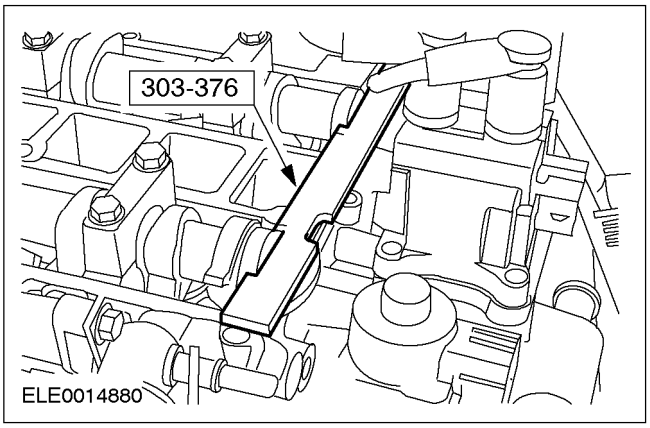
IN-VEHICLE REPAIR (Continued)

31. **NOTE:** If it is not possible to install the special tool, correct the engine timing.

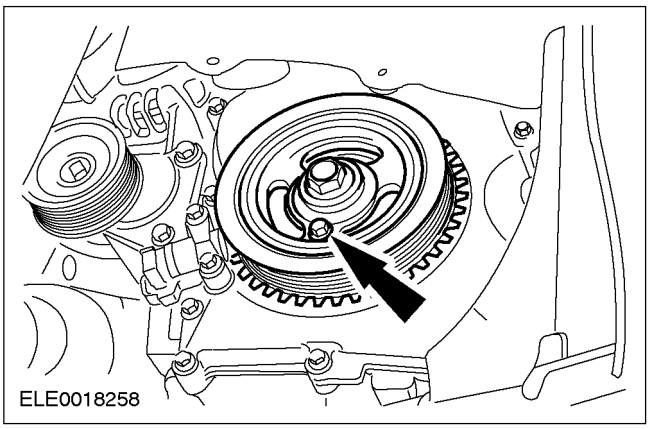
    Using the special tool, check the position of the camshafts.



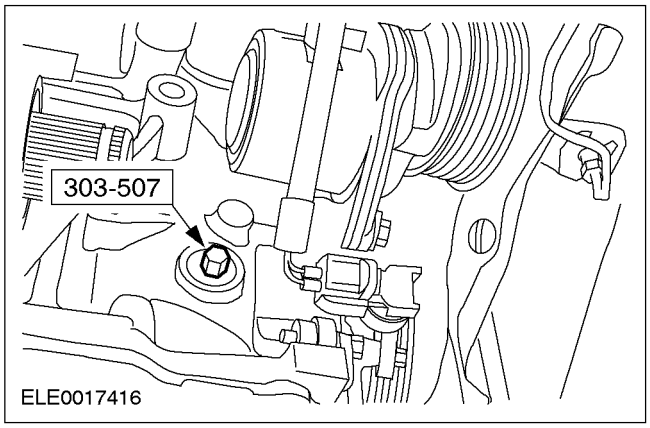
32. **Remove the special tool.**



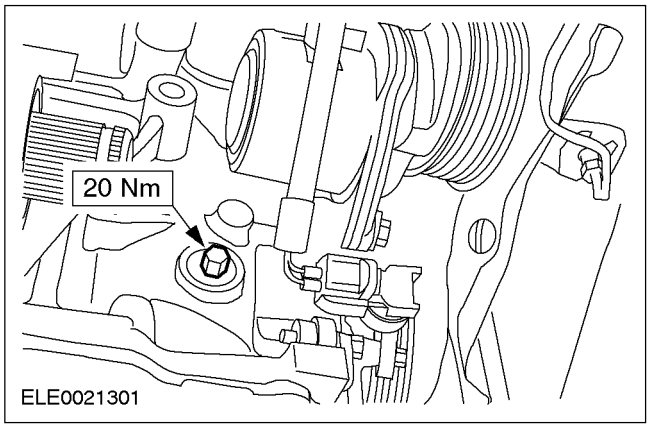
33. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
34. **Remove the crankshaft pulley securing bolt.**



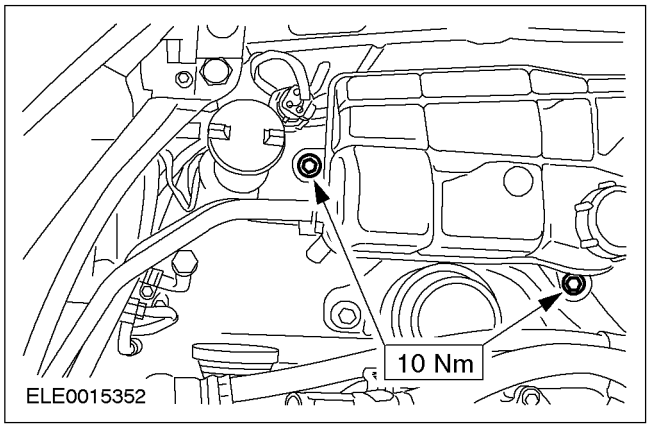
35. **Remove the special tool.**



36. **Install the cylinder block lower blanking plug.**

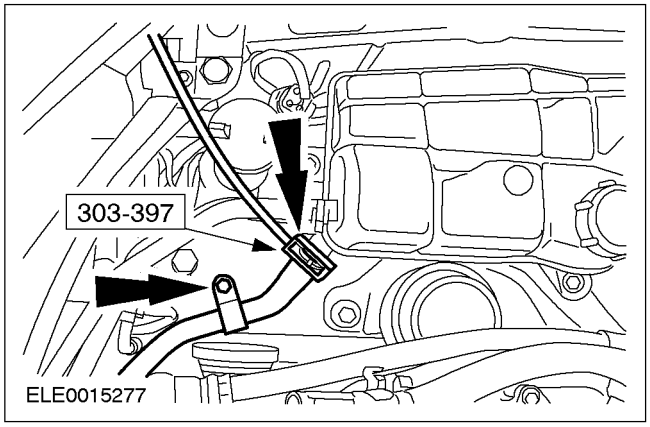


37. **Lower the vehicle.**
38. **Attach the coolant expansion tank.**



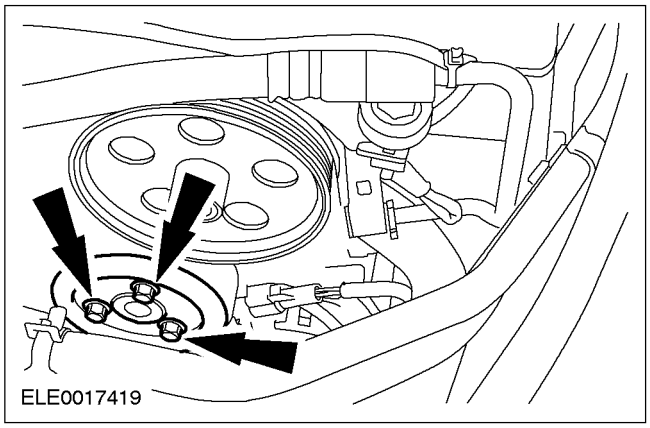
IN-VEHICLE REPAIR (Continued)

39. Using the special tool, connect the coolant hose to the coolant expansion tank.



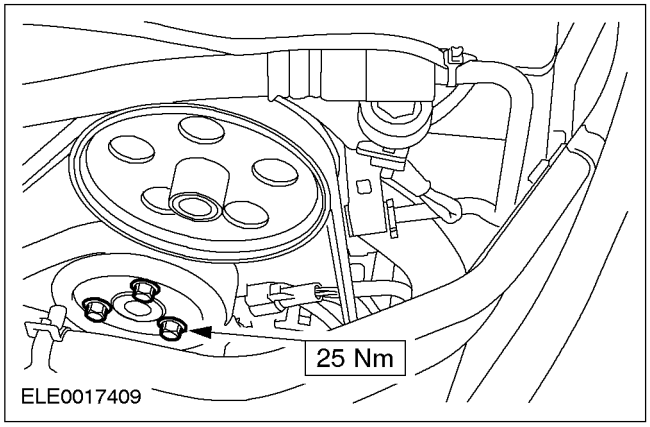
40. NOTE: Do not fully tighten the water pump pulley retaining bolts at this stage.

Install the water pump pulley.

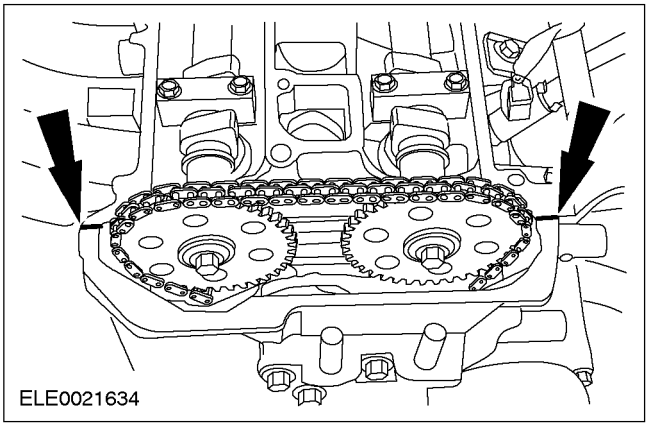


41. Install the power steering pump. For additional information, refer to Section 211-02.

42. Tighten the water pump pulley retaining bolts.



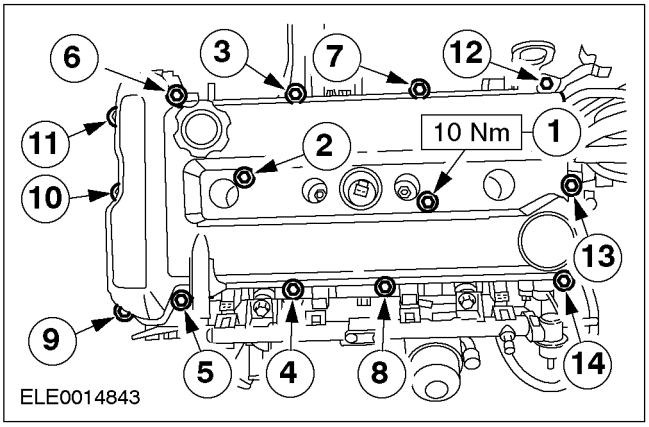
43. Apply a small bead of silicone sealant to the areas as shown.



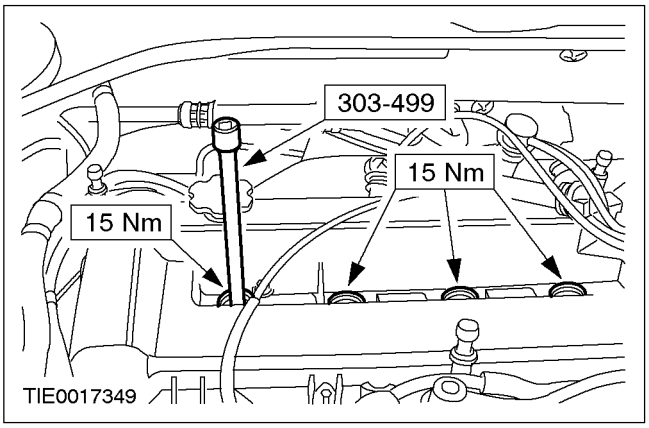
44. NOTE: Install a new valve cover gasket if necessary.

Install the valve cover.

- Tighten the bolts in the sequence shown.

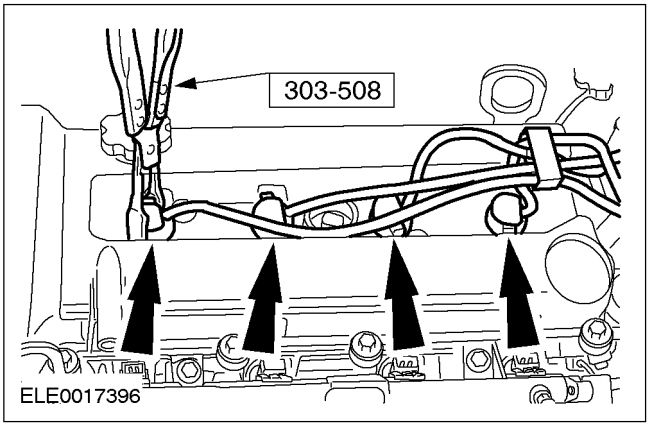


45. Using the special tool, install the spark plugs.

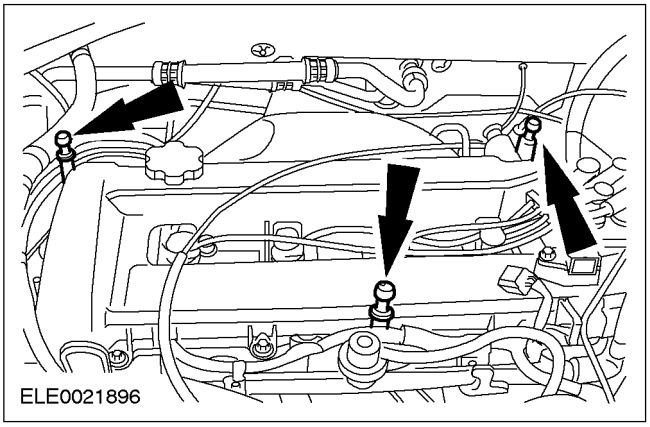


IN-VEHICLE REPAIR (Continued)

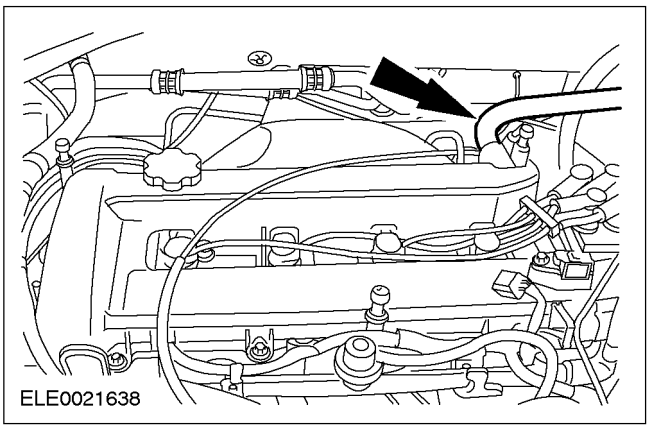
46. Using the special tool, connect the spark electrical connectors.



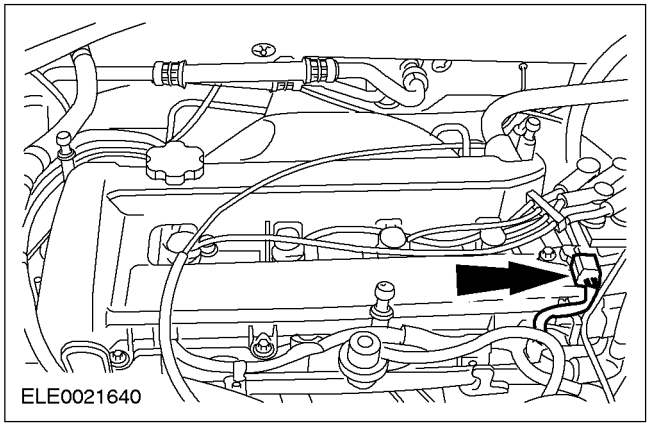
47. Install the engine upper cover retaining brackets.



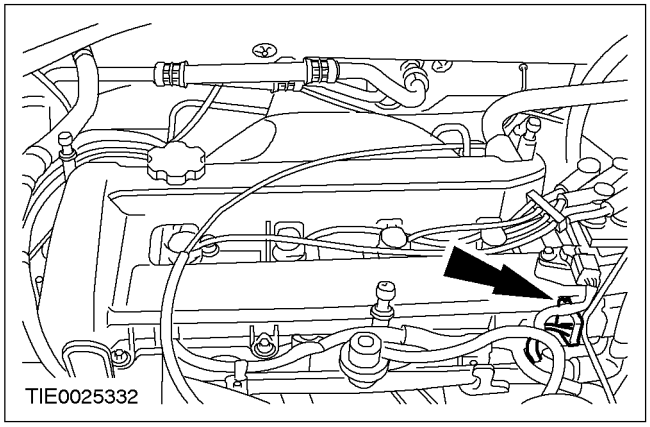
48. Attach the PCV hose to the valve cover.



49. Connect the CMP sensor electrical connector.

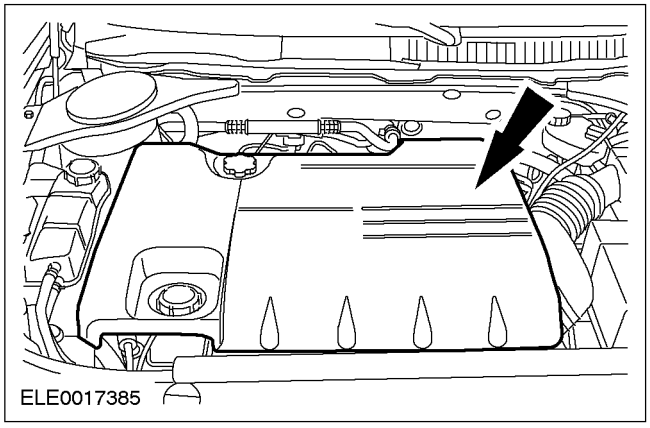


50. Attach the engine wiring harness electrical connector to the valve cover.



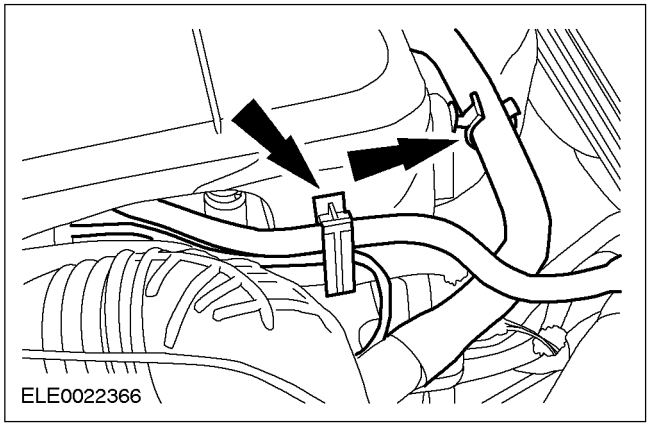
51. Connect the battery ground cable. For additional information, refer to Section 414-01.

52. Install the engine upper cover.



IN-VEHICLE REPAIR (Continued)

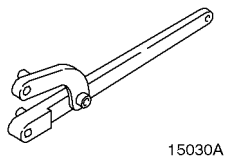
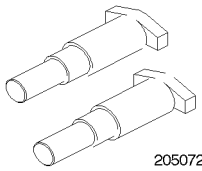
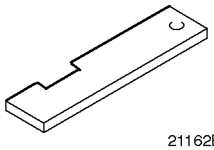
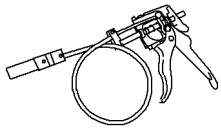
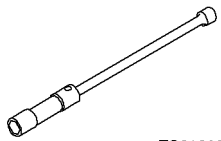
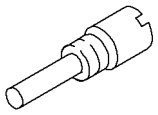
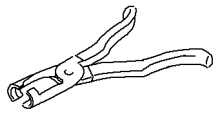
53. Attach the PCV hose and the vacuum hose to the engine upper cover.



54. Initialize the door window motors. For additional information, refer to Section 501-11.

IN-VEHICLE REPAIR

Cylinder Head (21 163 0)

Special Tool(s)	
 15030A	Flange Holding Wrench, Universal 205-072 (15-030A)
 20507202	Adapter for 205-072 205-072-02 (15-030A-02)
 21162B	Timing Plate, Camshaft Alignment 303-376 (21-162B)
 24003	Remover/Installer, Cooling Hose Clamp 303-397 (24-003)
 ES21202	Remover/Installer, Spark Plug 303-499 (21-202)
 PZ21210	Timing Peg, Crankshaft TDC 303-507 (21-210)
 PZ21211	Pliers, Valve Stem Oil Seal 303-508 (21-211)

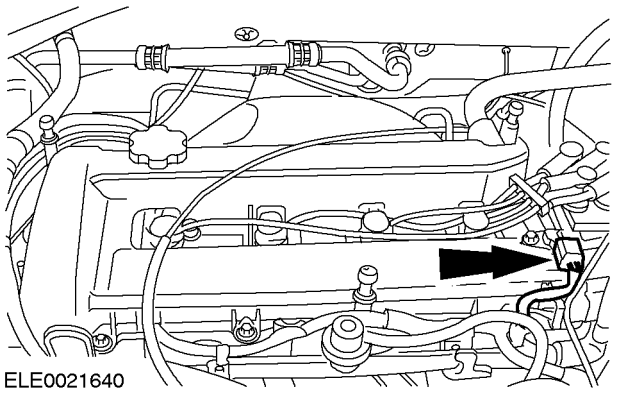
General Equipment
Trolley Jack
M6 x 18 mm bolt

Name	Specification
Loctite 7070	
Hypoid oil	SQM-2C9002-AA
Silicone sealant	WSE-M4G323-A6

Removal

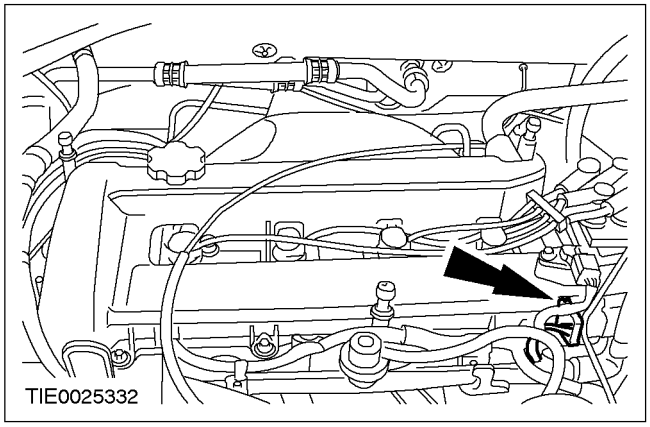
1. **WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.**

   Drain the cooling system. For additional information, refer to Section 303-03.
2. **Remove the intake manifold. For additional information, refer to Intake Manifold in this section.**
3. **Disconnect the camshaft position (CMP) sensor electrical connector.**

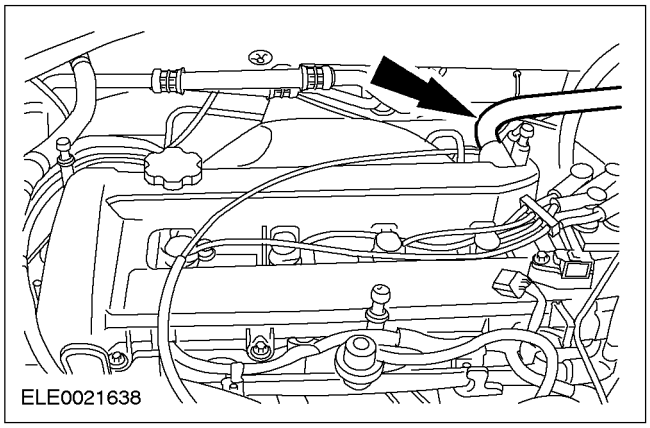

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IN-VEHICLE REPAIR (Continued)

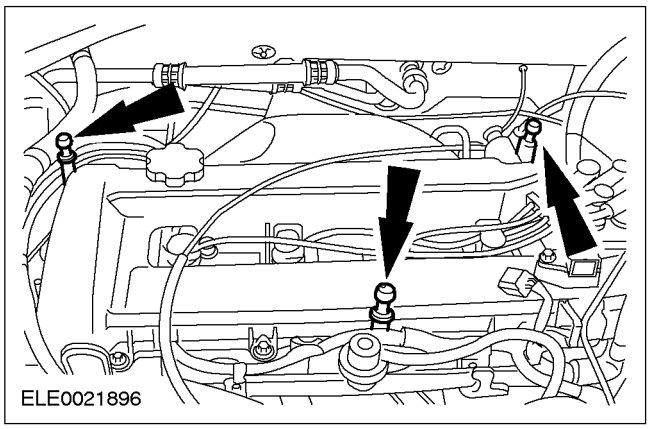
4. Detach the engine wiring harness electrical connector from the valve cover.



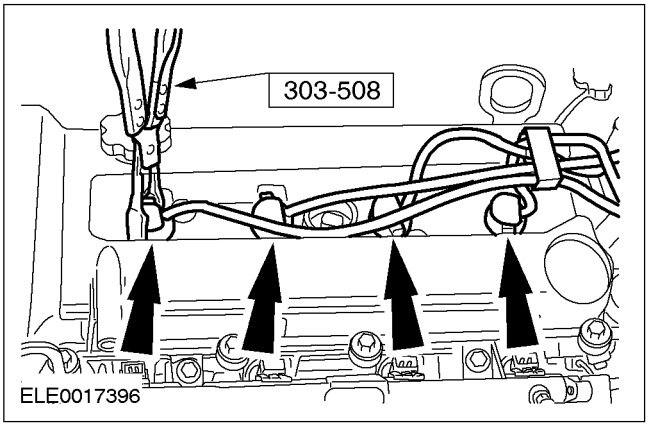
5. Detach the PCV hose from the valve cover.



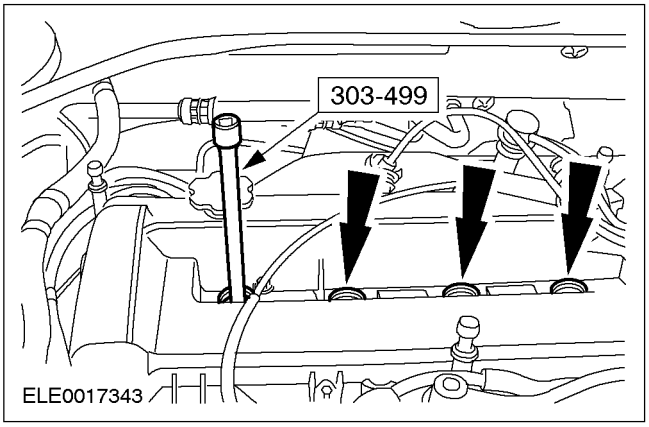
6. Remove the engine upper cover retaining brackets.



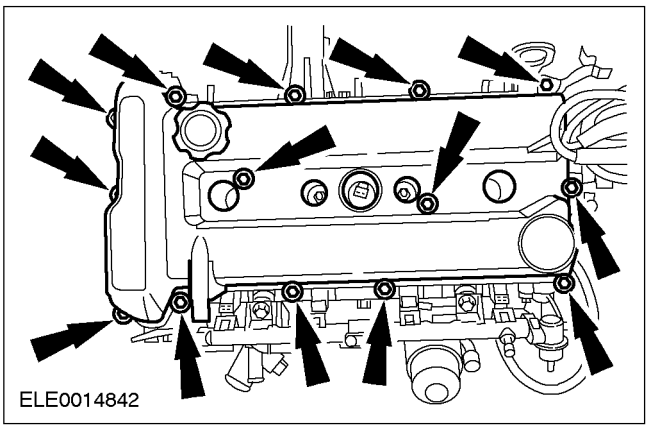
7. Using the special tool, disconnect the spark plug electrical connectors.



8. Using the special tool, remove the spark plugs.

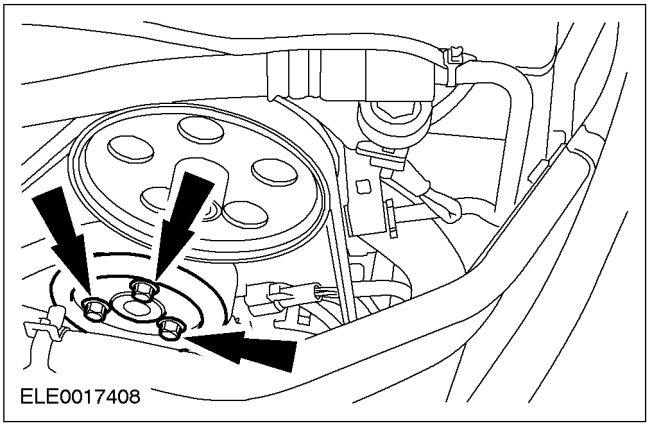


9. Remove the valve cover.



IN-VEHICLE REPAIR (Continued)

10. Loosen the water pump pulley retaining bolts by three turns.

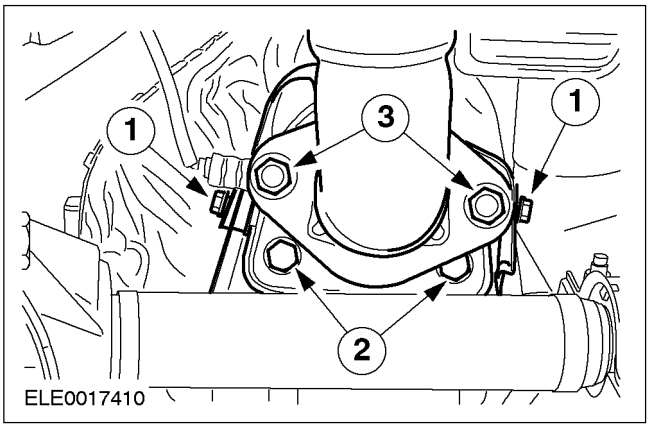


11. Remove the power steering pump. For additional information, refer to Section 211-02.

12. Raise and support the vehicle. For additional information, refer to Section 100-02.

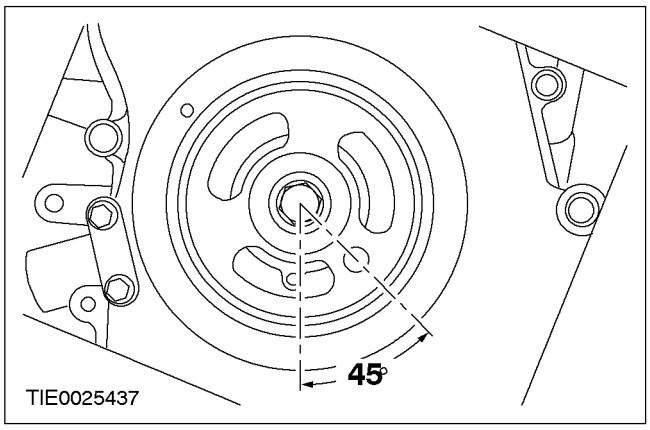
13. Disconnect the exhaust front pipe.

1. Remove the exhaust manifold heat shield lower retaining bolts.
2. Detach the exhaust manifold from the retaining bracket.
3. Detach the exhaust front pipe from the exhaust manifold.



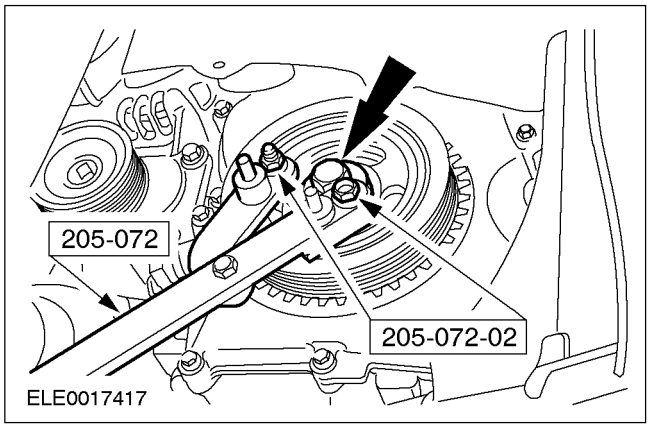
14. NOTE: Only turn the engine in the normal direction of rotation.

Turn the engine until piston No. 1 is approximately 45 degrees before top dead center (TDC).

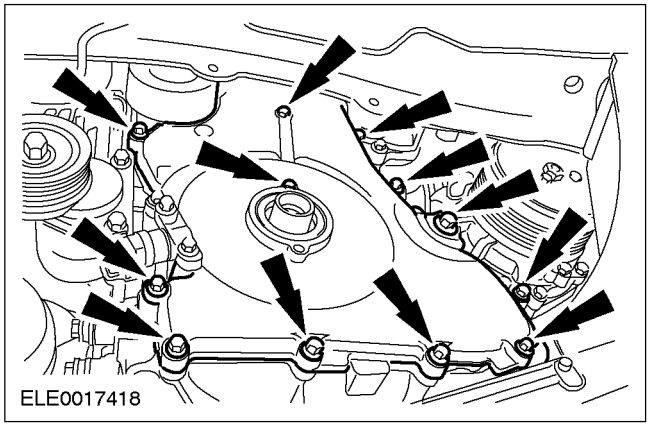


15. NOTE: Do not discard the crankshaft pulley retaining bolt.

Using the special tools, prevent the crankshaft pulley from rotating and remove the crankshaft pulley.

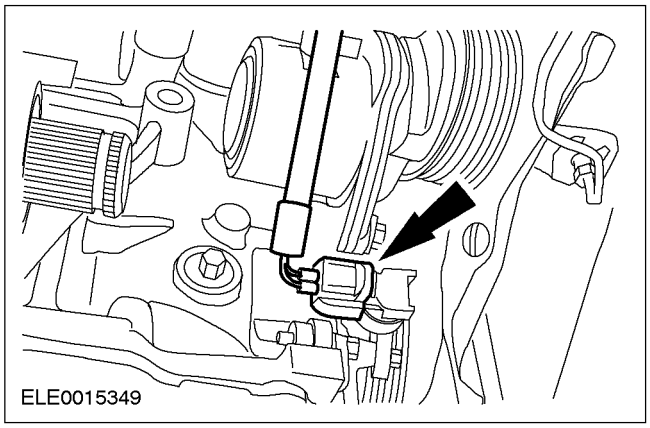


16. Remove the engine front cover lower retaining bolts.

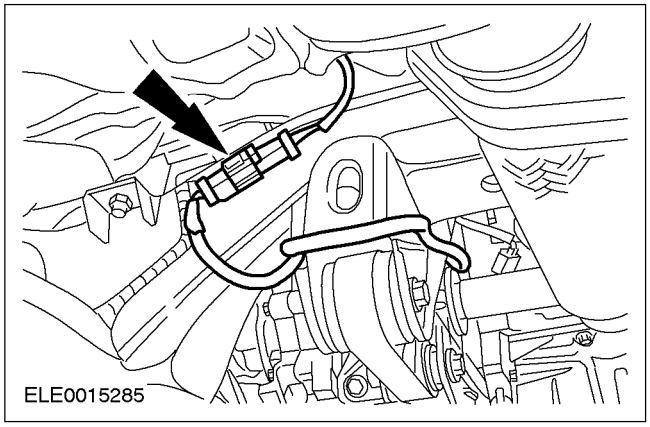


IN-VEHICLE REPAIR (Continued)

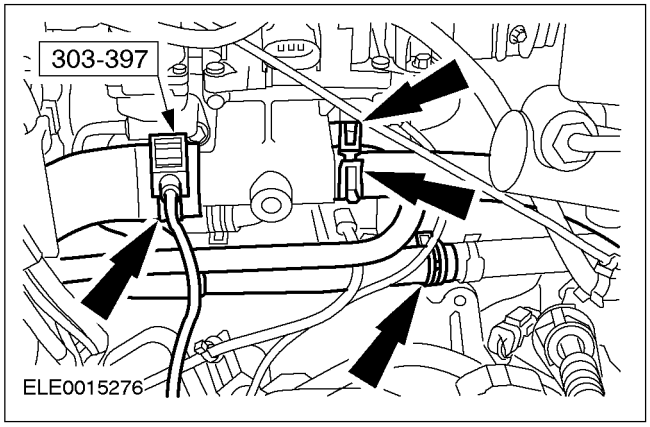
17. **Disconnect the crankshaft position (CKP) sensor electrical connector.**



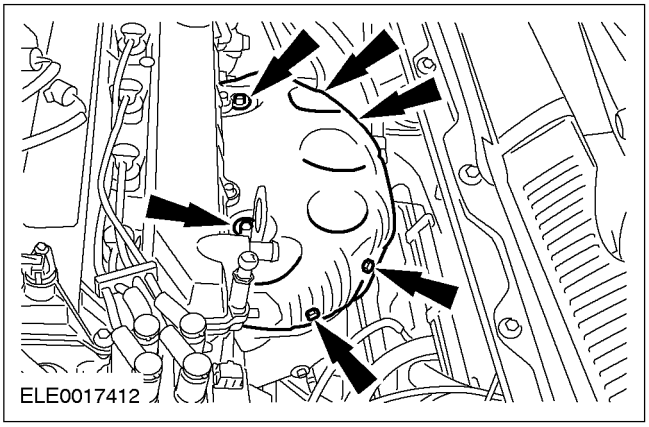
18. **Disconnect the heated oxygen sensor (HO2S) electrical connector.**



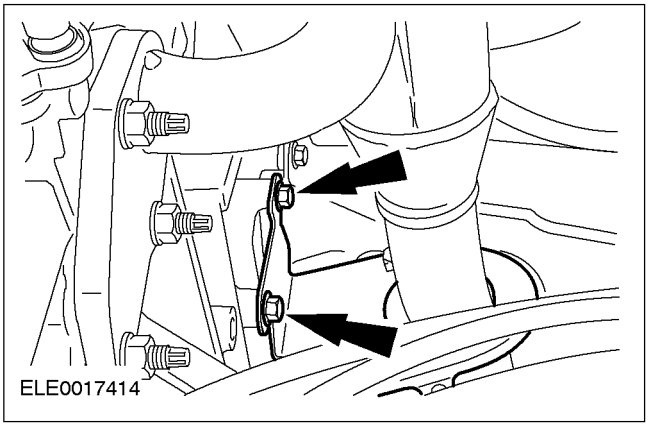
19. **Lower the vehicle.**
20. **Using the special tool, disconnect the coolant hoses.**



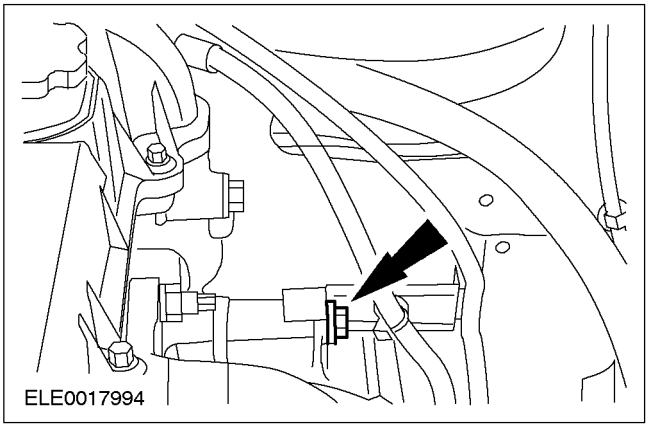
21. **Remove the exhaust manifold upper heat shield.**



22. **Detach the exhaust manifold retaining bracket.**

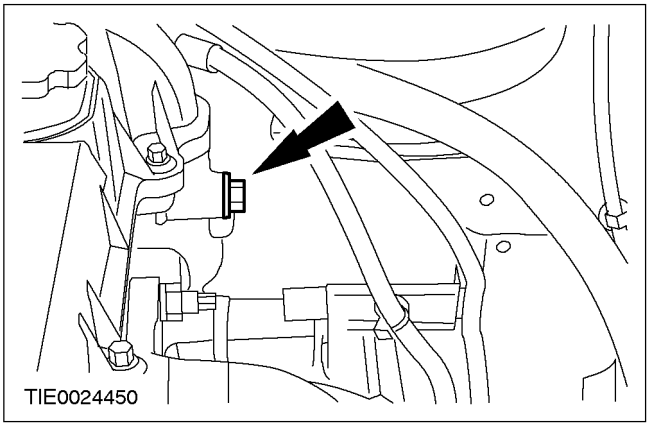


23. **Remove the generator upper retaining bolt.**

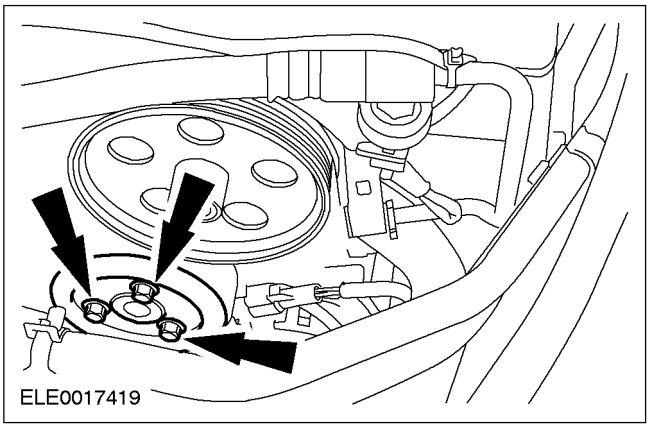


IN-VEHICLE REPAIR (Continued)

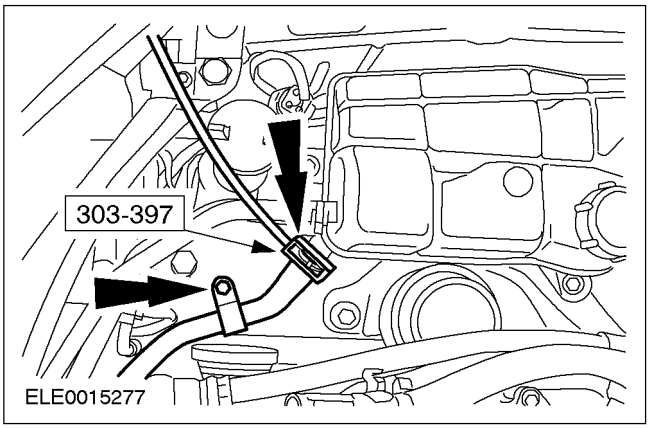
24. Detach the ground lead from the cylinder head.



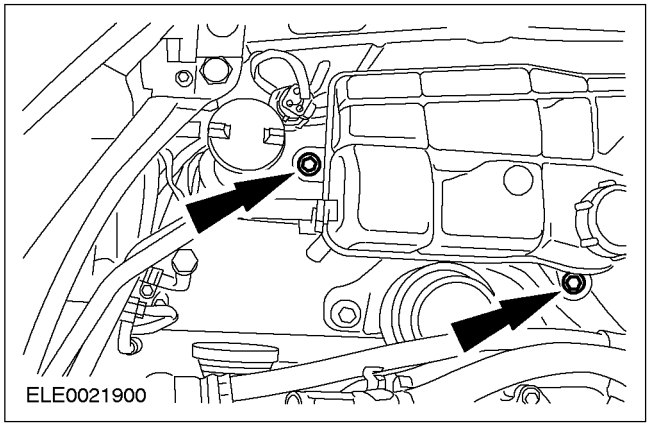
25. Remove the water pump pulley.



26. Using the special tool, disconnect the coolant hose from the coolant expansion tank.



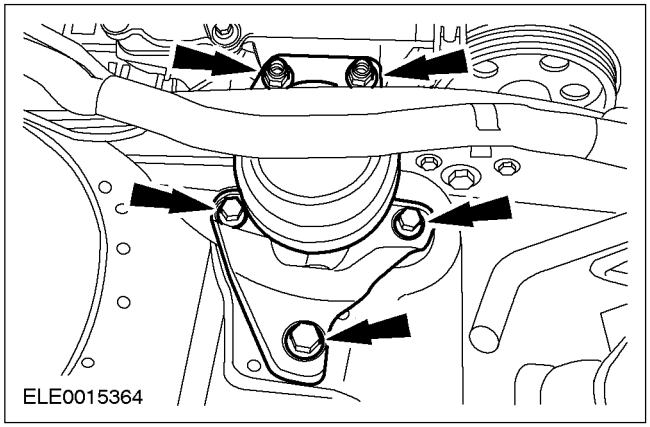
27. Detach the coolant expansion tank and position it to one side.



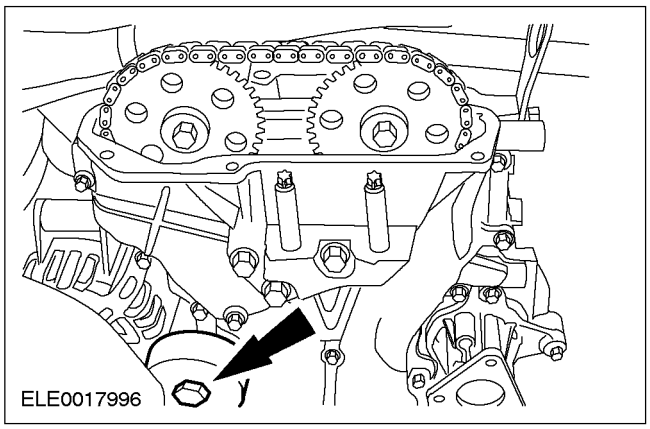
28. NOTE: Support the engine with suitable wooden blocks.

Position a trolley jack with the wooden block under the oil pan and raise the engine so that the engine front mount is free from load.

29. Remove the engine front mount.



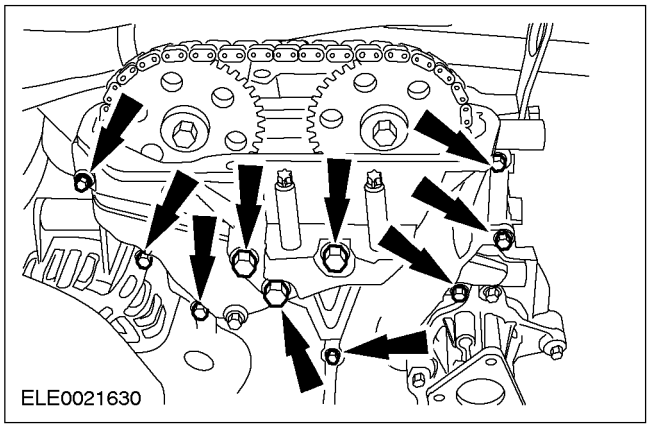
30. Remove the accessory drive belt idler.



IN-VEHICLE REPAIR (Continued)

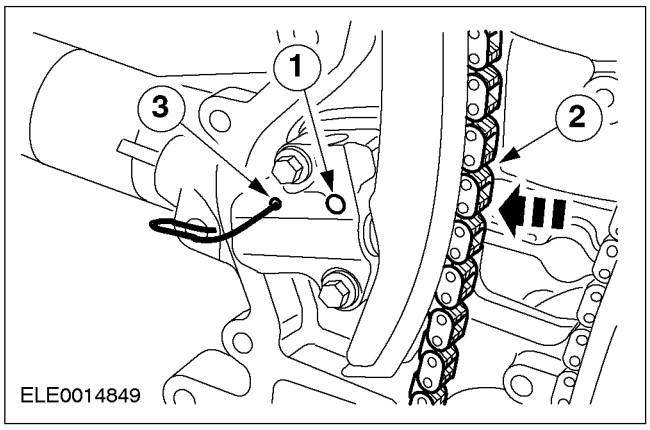
31. Remove the engine front cover upper retaining bolts.

- Remove the engine front cover.



32. Detension the timing chain (engine shown removed for clarity).

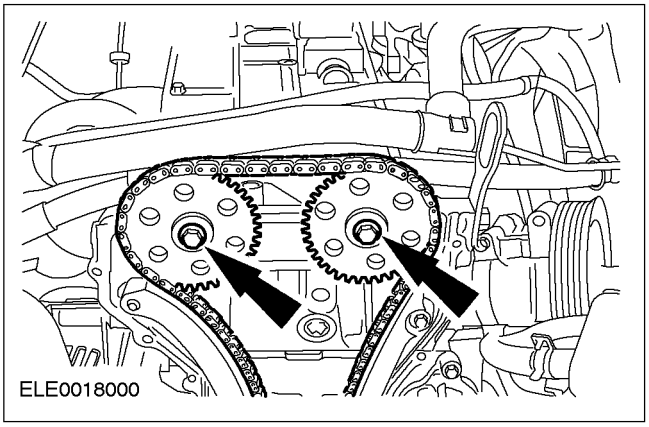
1. Unlock the timing chain tensioner ratchet.
2. Apply pressure to the timing chain guide.
3. Fix the timing chain tensioner with a suitable pin punch.



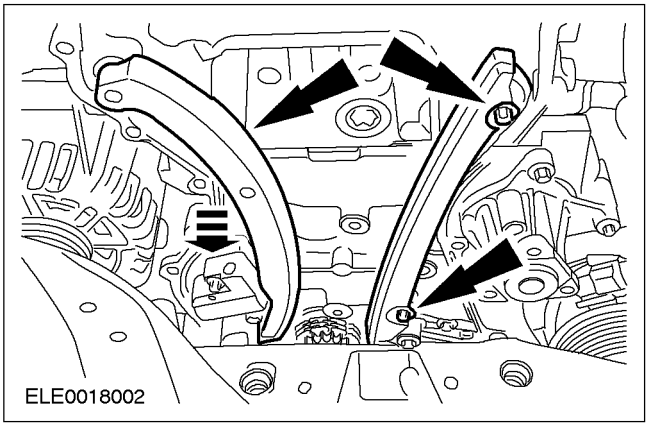
33. NOTE: Hold the camshafts by the hexagon with an open-ended wrench to prevent them from turning.

Remove the camshaft sprockets.

- Detach the timing chain from the camshaft sprockets.



34. Remove the timing chain guides.



IN-VEHICLE REPAIR (Continued)

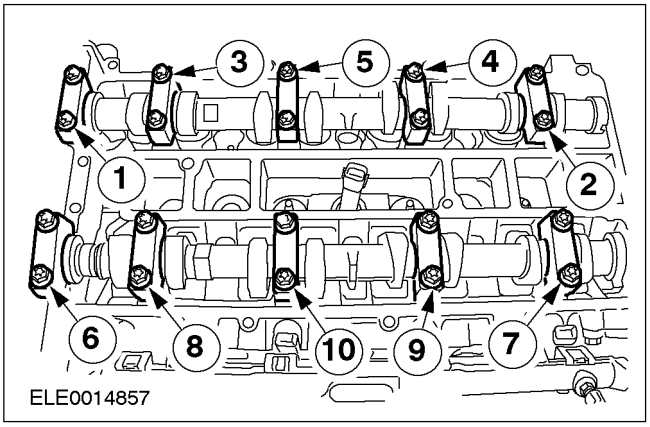
35. ⚠ CAUTION: Keep the camshaft bearing caps, valve tappets and the camshafts in order for installation.

⚠ CAUTION: Remove the camshaft bearing caps in the sequence shown.

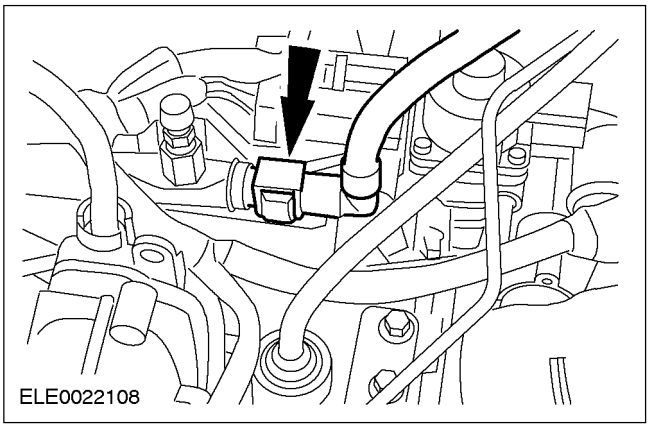
NOTE: Working in several stages, release each camshaft bearing cap retaining bolt two turns at a time.

Remove the camshaft bearing caps.

- Remove the valve tappets.



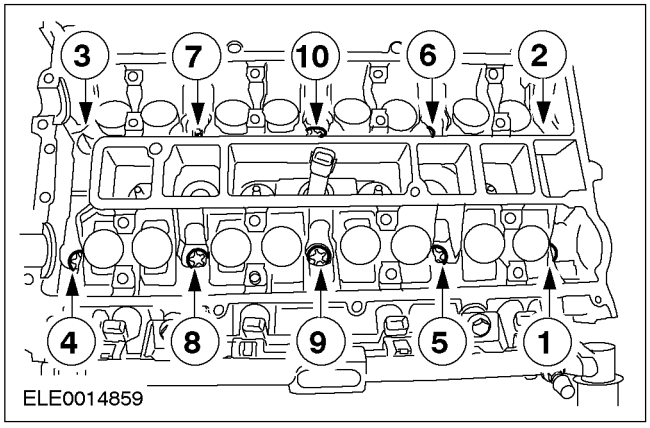
36. Disconnect the fuel supply line. For additional information, refer to Section 310-00.



37. ⚠ CAUTION: Remove the cylinder head bolts in the sequence shown.

Remove the cylinder head.

- Discard the gasket.
- Discard the bolts.

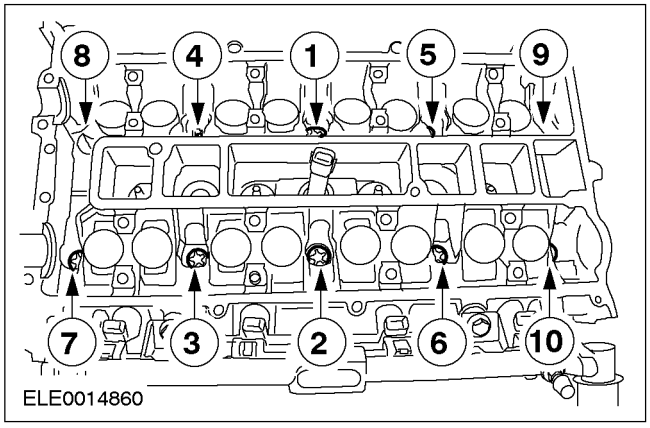


Installation

1. **Clean the engine front cover mating faces with Loctite 7070.**
2. **Check the cylinder head for distortion. For additional information, refer to Section 303-00.**
3. **NOTE:** Install new cylinder head bolts and gasket.

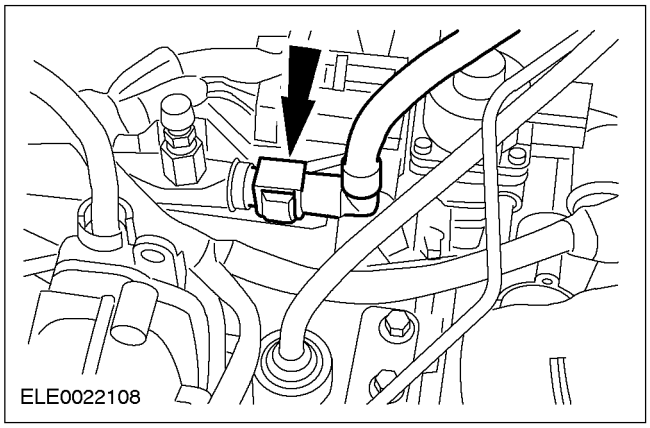
Install the cylinder head.

- Tighten the cylinder head bolts in the sequence shown in five stages:
- Stage 1: 5 Nm.
- Stage 2: 15 Nm.
- Stage 3: 45 Nm.
- Stage 4: 90 degrees.
- Stage 5: 90 degrees.



IN-VEHICLE REPAIR (Continued)

4. Connect the fuel supply line. For additional information, refer to Section 310-00.

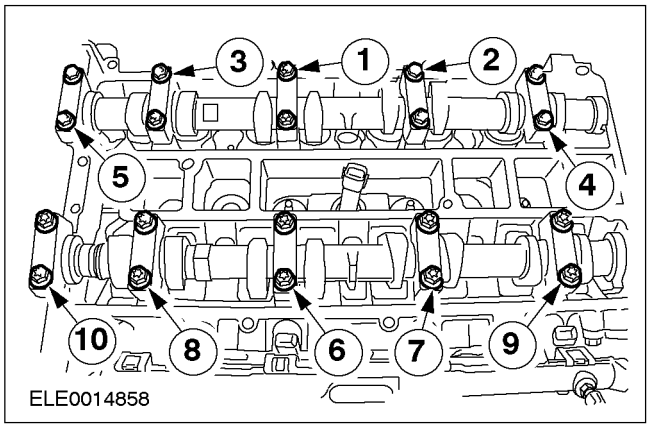


5. Install the valve tappets.

6. CAUTION: Working in several stages, evenly tighten the camshaft bearing cap bolts in the sequence shown, one half turn at a time.

Install the camshafts.

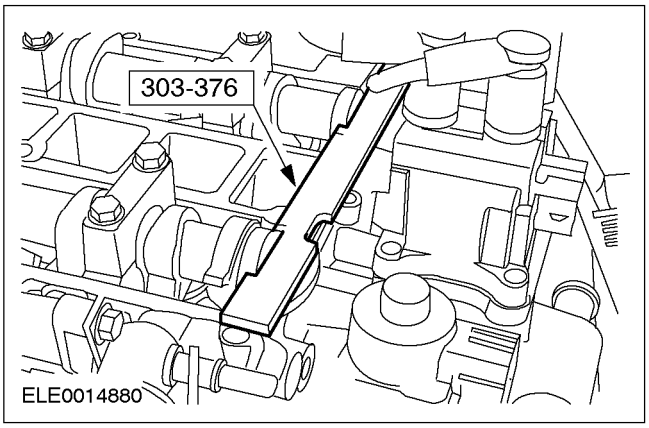
- Coat the camshaft bearing caps with hypoid oil.
- Tighten the bolts in the sequence shown in two stages:
- Stage 1: 7 Nm
- Stage 2: 16 Nm



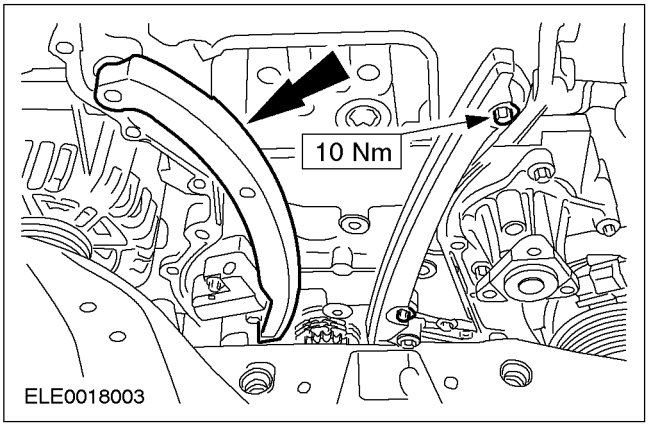
7. NOTE: Only turn the engine in the normal direction of rotation.

Using an open-ended wrench, carefully turn the camshafts until the cams of cylinder No. 4 are at valve overlap position.

8. Install the special tool.



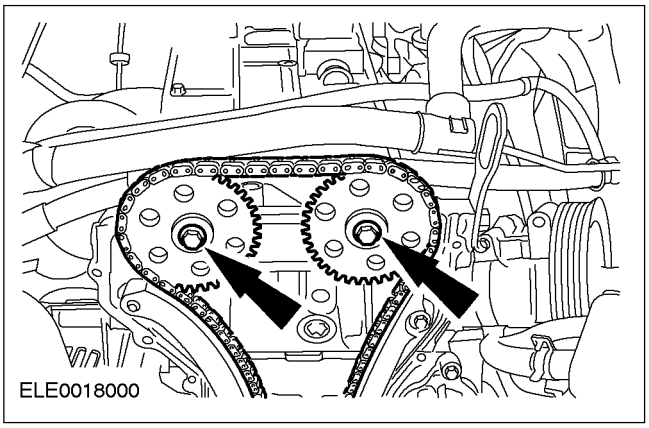
9. Install the timing chain guides.



10. CAUTION: Do not fully tighten the camshaft sprocket retaining bolts at this stage. Make sure the camshaft sprockets turn on the camshafts.

Install the camshaft sprockets.

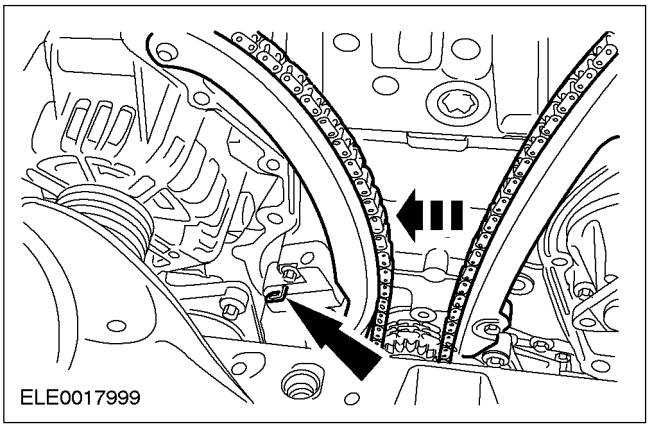
- Install the timing chain.



IN-VEHICLE REPAIR (Continued)

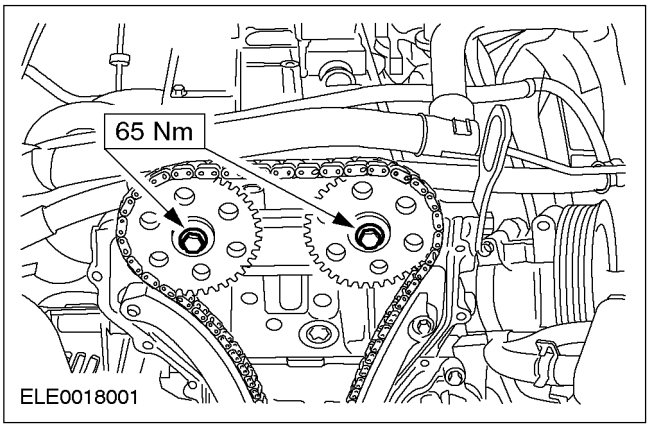
11. Tension the timing chain.

- Apply pressure to the timing chain tensioner, and remove the securing pin.



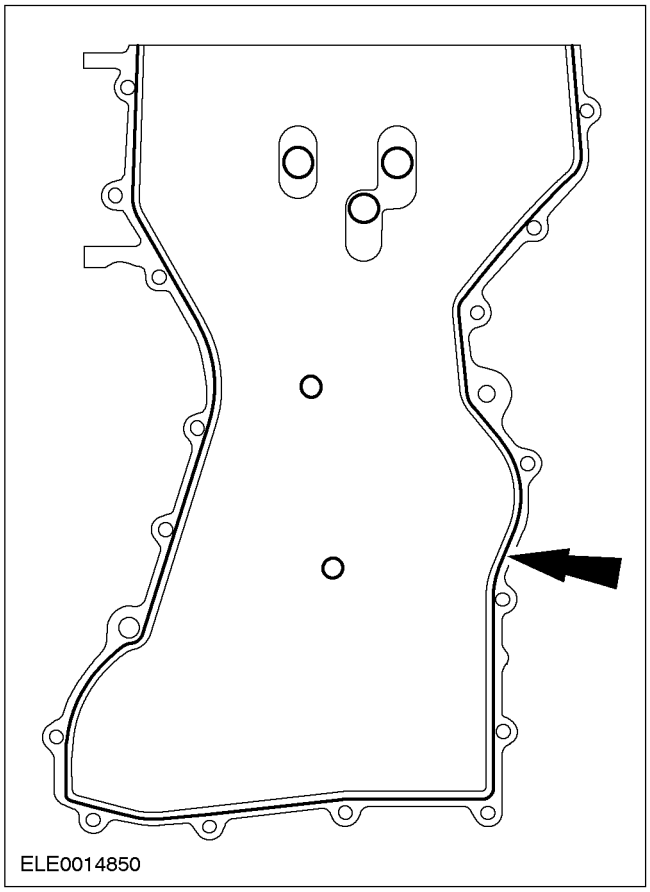
12. CAUTION: Hold the camshafts by the hexagon with an open-ended wrench to prevent them from turning.

Tighten the camshaft sprocket retaining bolts.



13. NOTE: Install the front cover within 10 minutes of applying the silicone sealant.

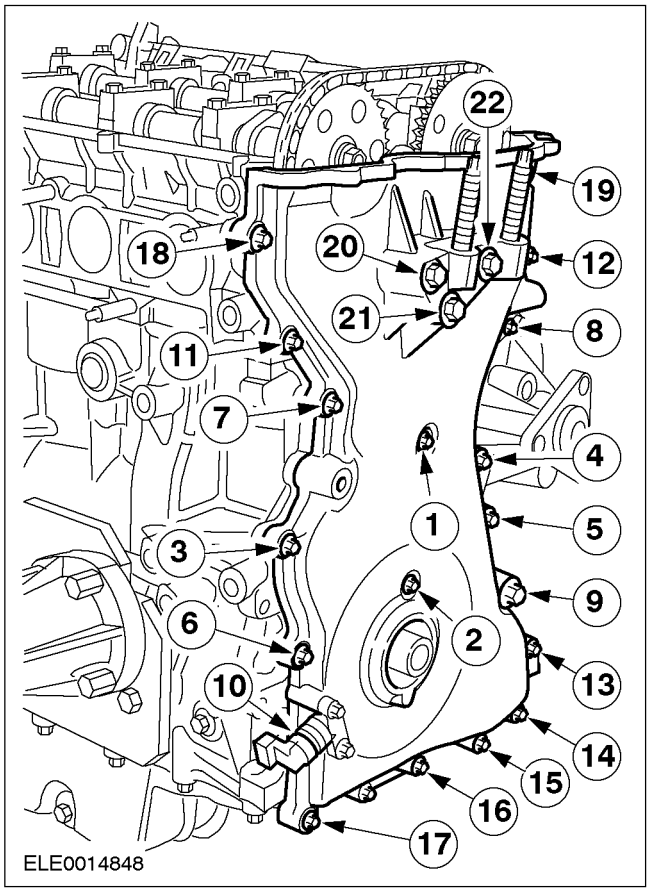
Apply a 3 mm bead of silicone sealant to the front cover.



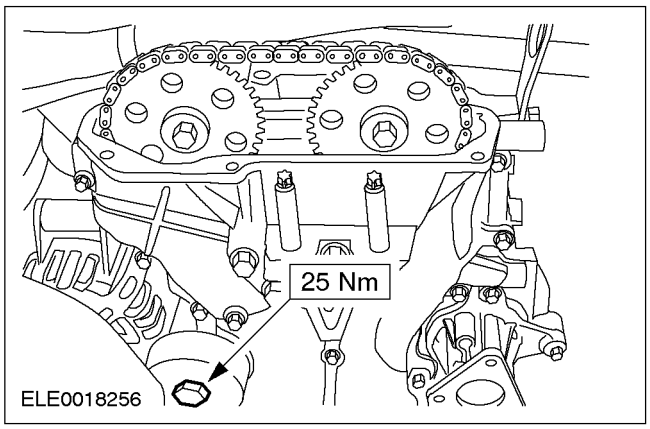
IN-VEHICLE REPAIR (Continued)

14. Install the engine front cover (engine shown removed for clarity).

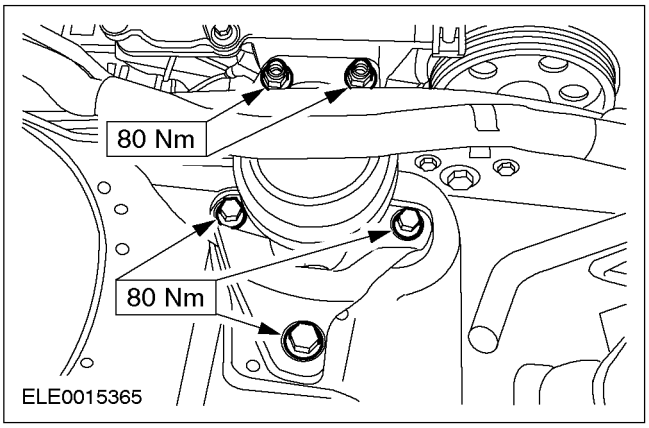
- Tighten the bolts in the sequence shown:
- Bolts 1 through 8 to 10 Nm.
- Bolt 9: 48 Nm.
- Bolts 10 through 19 to 10 Nm.
- Bolts 20 through 22 to 48 Nm.



15. Install the accessory drive belt idler.



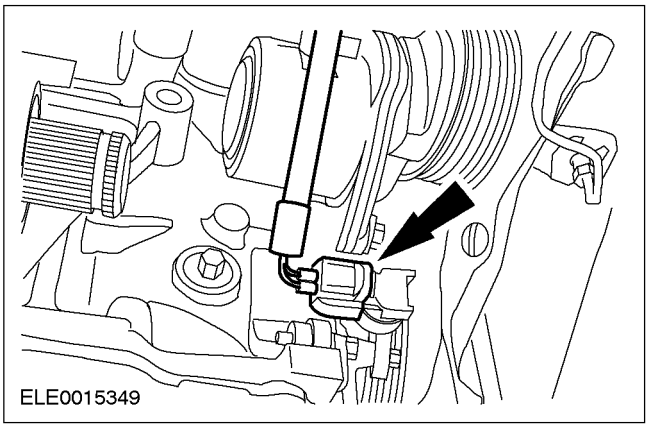
16. Install the engine front mount.



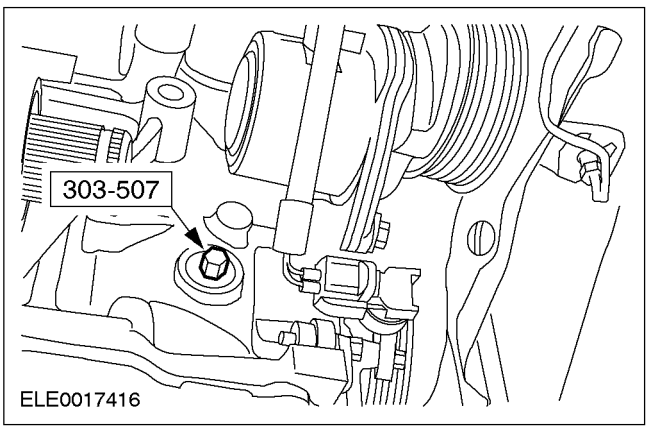
17. Remove the trolley jack.

18. Raise and support the vehicle. For additional information, refer to Section 100-02.

19. Connect the CKP sensor electrical connector.

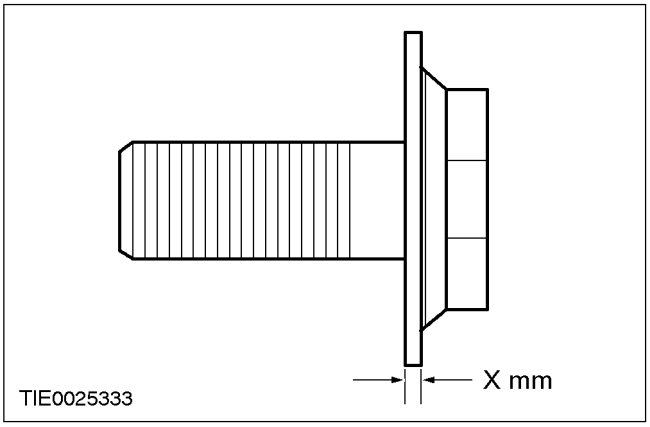


20. Remove the cylinder block lower blanking plug and install the special tool.



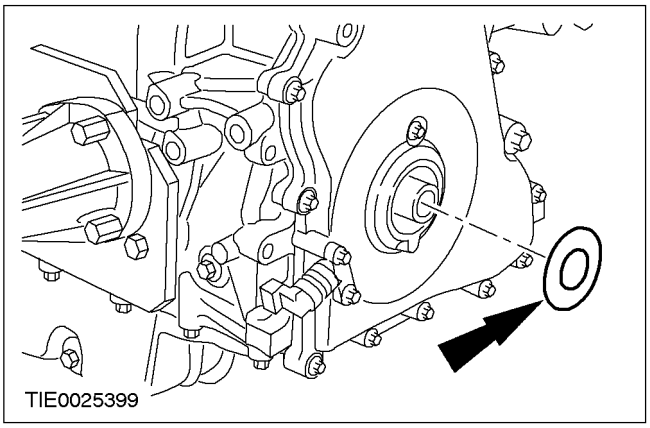
IN-VEHICLE REPAIR (Continued)

21. **Measure the thickness of the crankshaft pulley retaining bolt washer.**



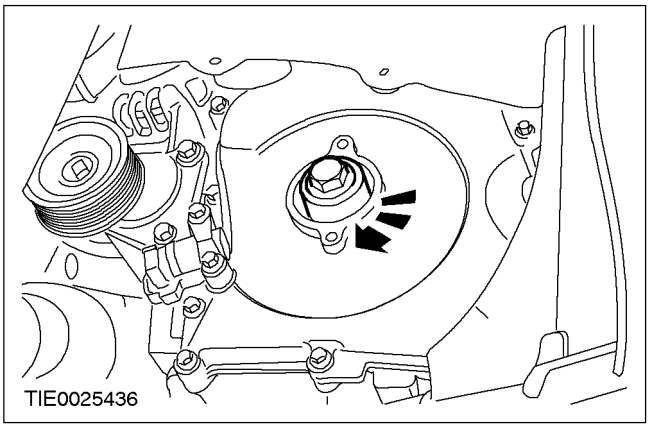
22. **NOTE:** If the thickness of the crankshaft pulley retaining bolt washer is less then 5.5 mm, a friction washer must be installed.

    Install a friction washer to the crankshaft (engine shown removed for clarity).



23. **NOTE:** Only turn the engine in the normal direction of rotation.

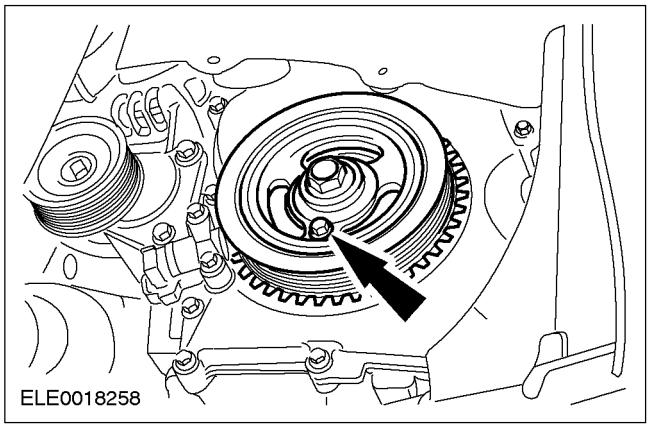
    Using the crankshaft pulley retaining bolt, turn the engine until piston No. 1 is at TDC.



24. **Remove the crankshaft pulley retaining bolt.**
    - Discard the bolt.

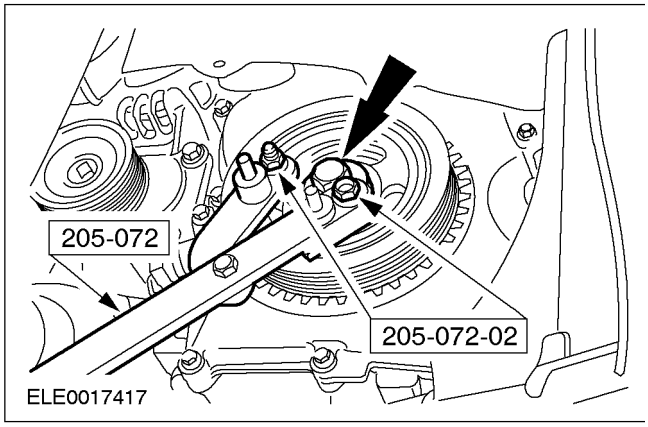
25. **CAUTION: Only tighten the crankshaft pulley securing bolt finger tight.**

    Install the crankshaft pulley onto the crankshaft and secure the crankshaft pulley to the front cover using a M6 x 18 mm bolt.



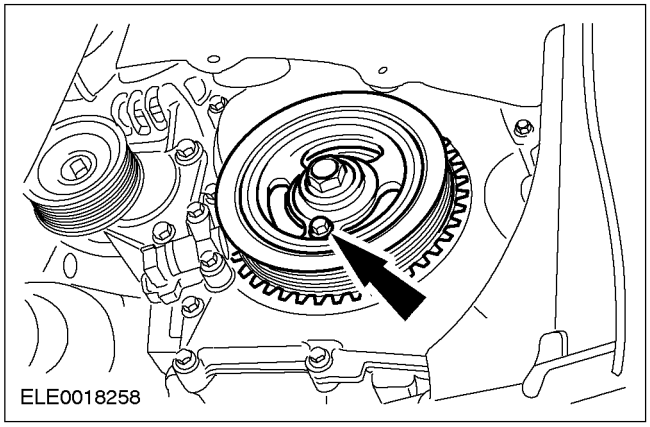
26. **NOTE:** Install a new crankshaft pulley retaining bolt.

    Using the special tools, prevent the crankshaft pulley from rotating and tighten the crankshaft pulley retaining bolt.
    - Tighten the bolt in two stages.
    - Stage 1: 100 Nm.
    - Stage 2: 90 degrees.

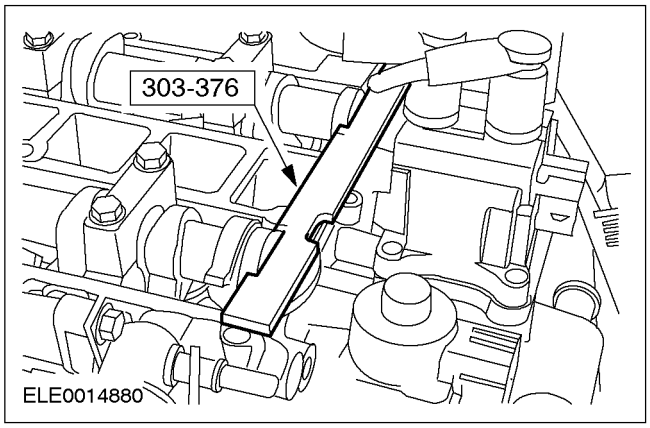


IN-VEHICLE REPAIR (Continued)

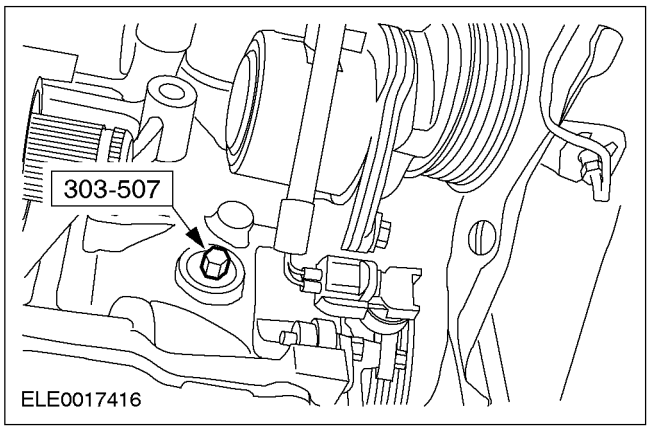
27. **Remove the crankshaft pulley securing bolt.**



28. **Lower the vehicle.**
29. **Remove the special tool.**



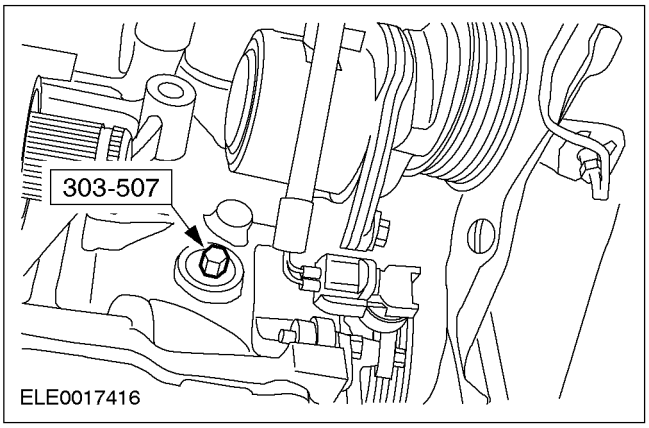
30. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
31. **Remove the special tool.**



32. **NOTE:** Only turn the engine in the normal direction of rotation.

    Turn the engine two revolutions.

33. **Install the special tool.**



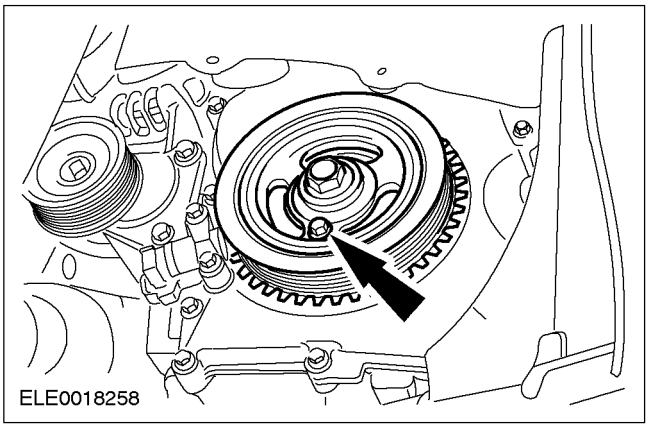
34. **NOTE:** Only turn the engine in the normal direction of rotation.

    Turn the engine until piston No. 1 is at TDC.

35. **CAUTION: Only tighten the crankshaft pulley securing bolt finger tight.**

NOTE: If it is not possible to install the crankshaft pulley securing bolt, correct the engine timing.

Using a M6 x 18 mm bolt, check the position of the crankshaft pulley.

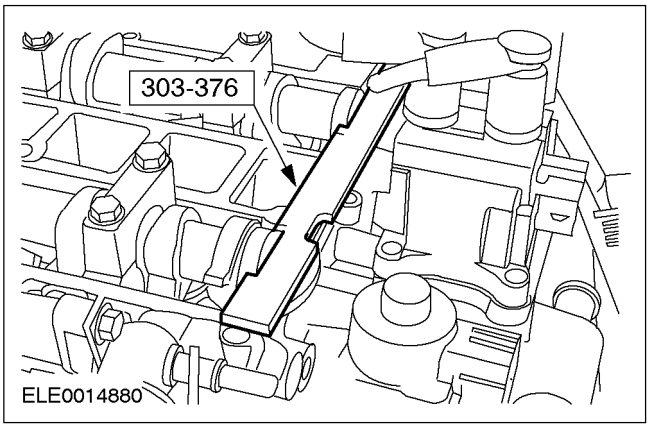


36. **Lower the vehicle.**

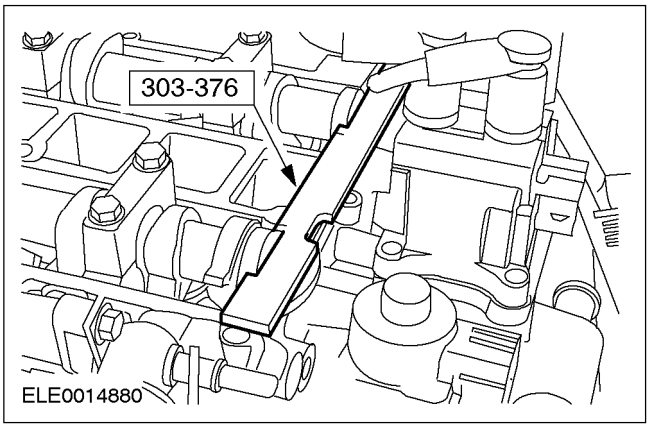
IN-VEHICLE REPAIR (Continued)

37. **NOTE:** If it is not possible to install the special tool, correct the engine timing.

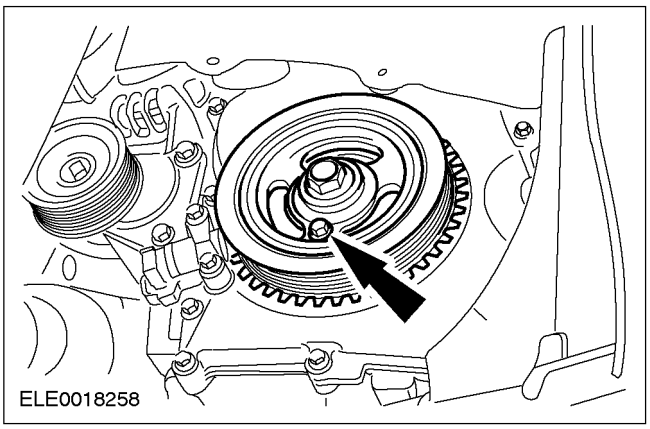
    Using the special tool, check the position of the camshafts.



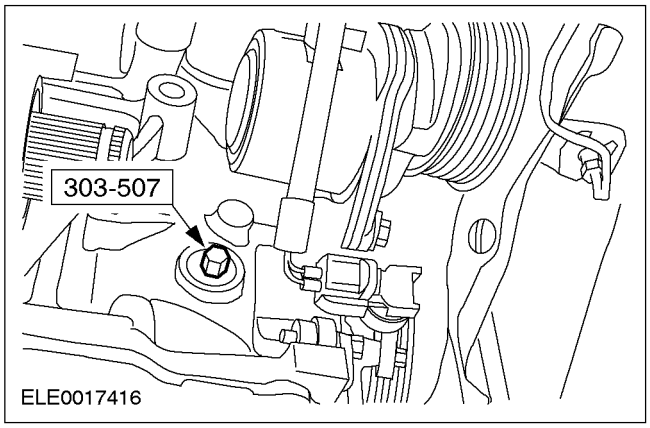
38. **Remove the special tool.**



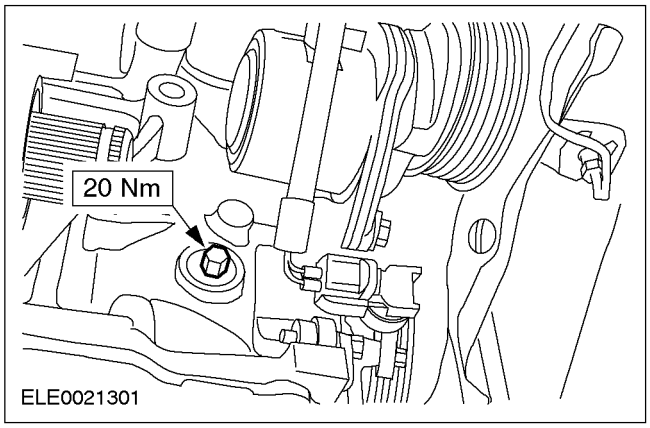
39. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
40. **Remove the crankshaft pulley securing bolt.**



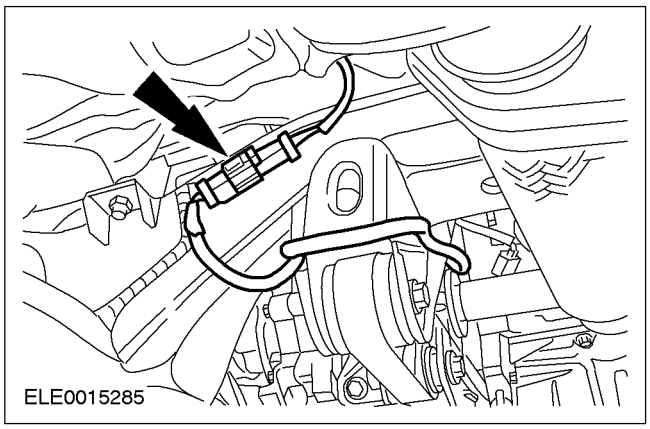
41. **Remove the special tool.**



42. **Install the cylinder block lower blanking plug.**



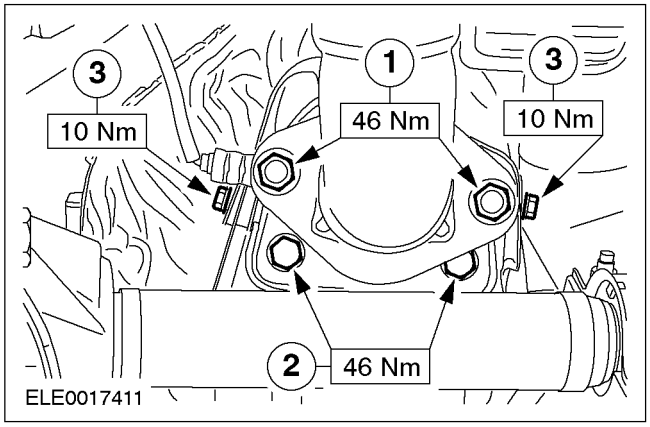
43. **Connect the HO2S sensor electrical connector.**



IN-VEHICLE REPAIR (Continued)

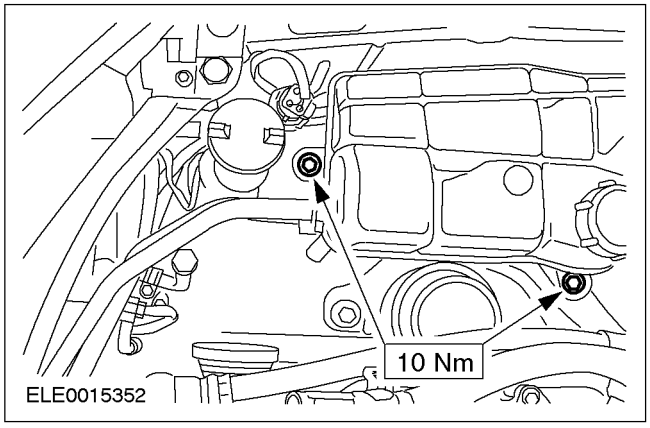
44. Connect the exhaust front pipe.

1. Attach the exhaust front pipe to the exhaust manifold.
2. Attach the exhaust manifold to the retaining bracket.
3. Install the exhaust manifold heat shield lower retaining bolts.

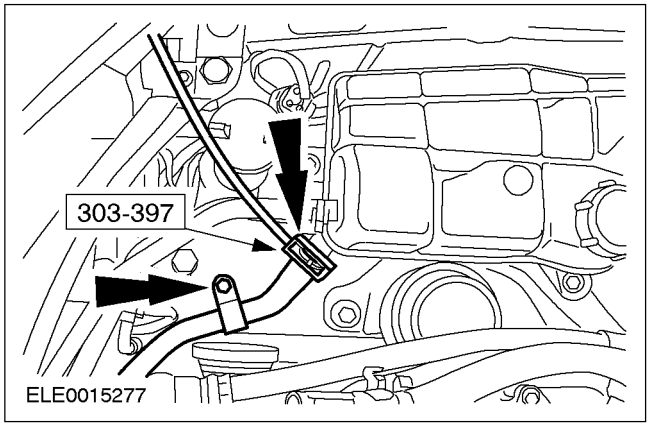


45. Lower the vehicle.

46. Attach the coolant expansion tank.

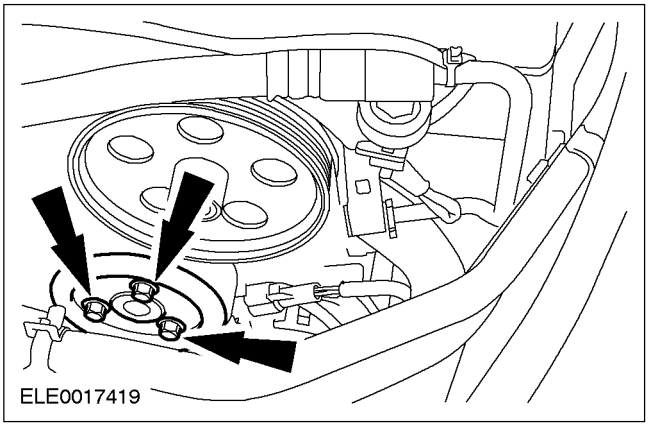


47. Using the special tool, connect the coolant hose to the coolant expansion tank.

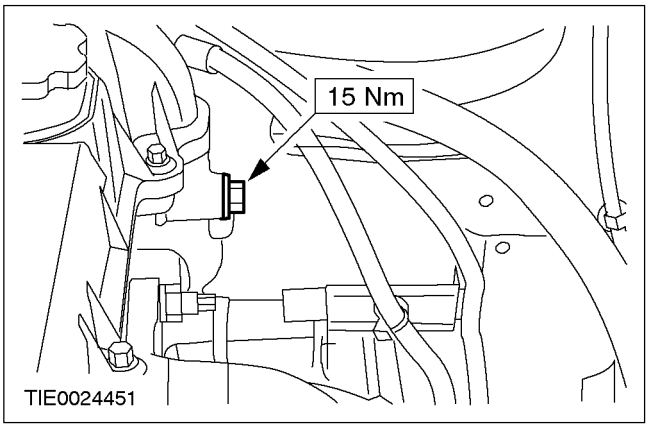


48. NOTE: Do not fully tighten the water pump pulley retaining bolts at this stage.

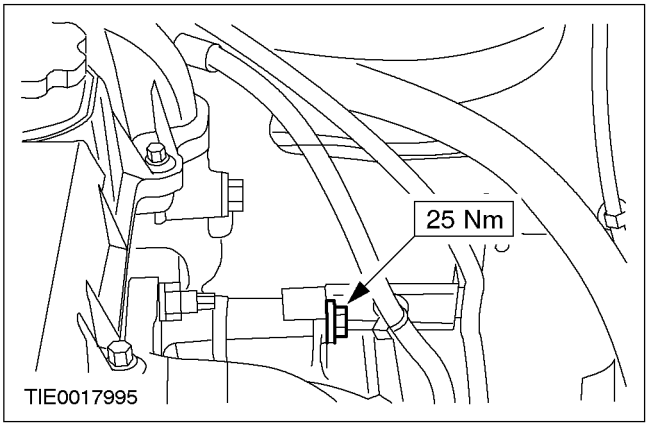
Install the water pump pulley.



49. Attach the ground lead to the cylinder head.

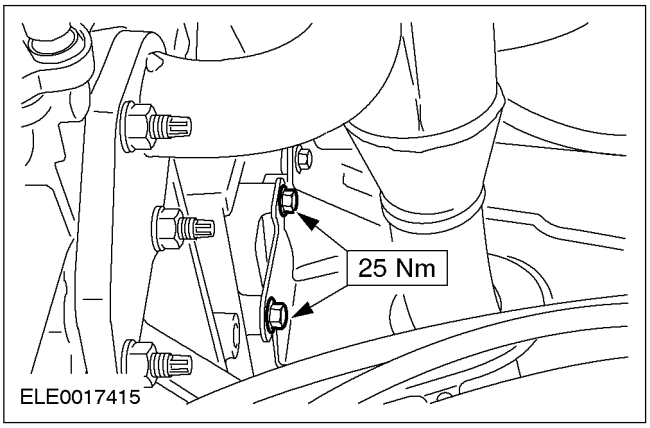


50. Install the generator upper retaining bolt.

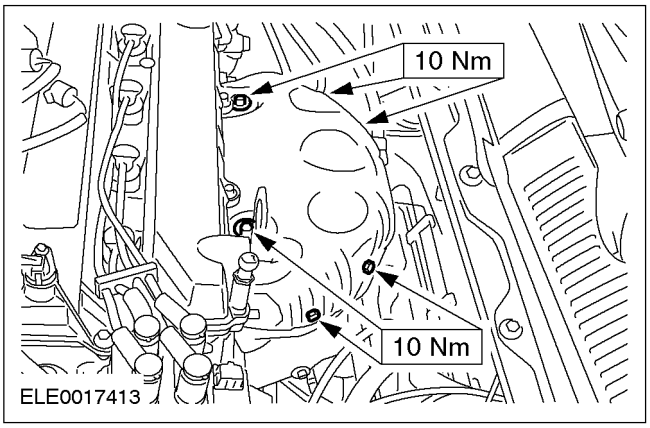


IN-VEHICLE REPAIR (Continued)

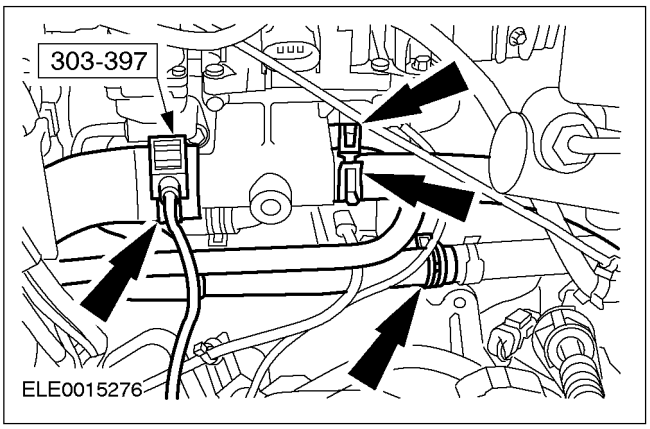
51. Attach the exhaust manifold bracket.



52. Install the exhaust manifold upper heat shield.

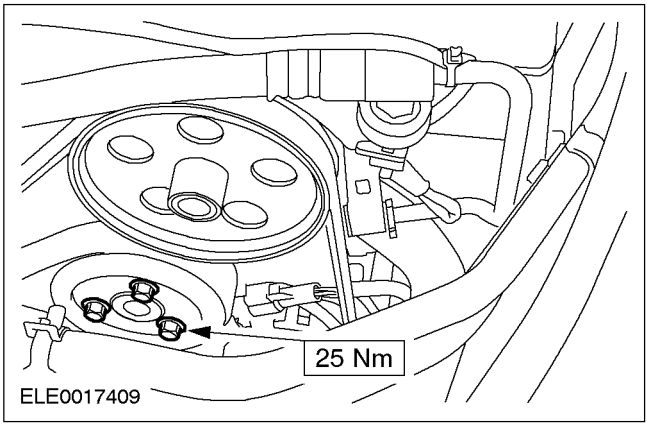


53. Using the special tool, connect the coolant hoses.

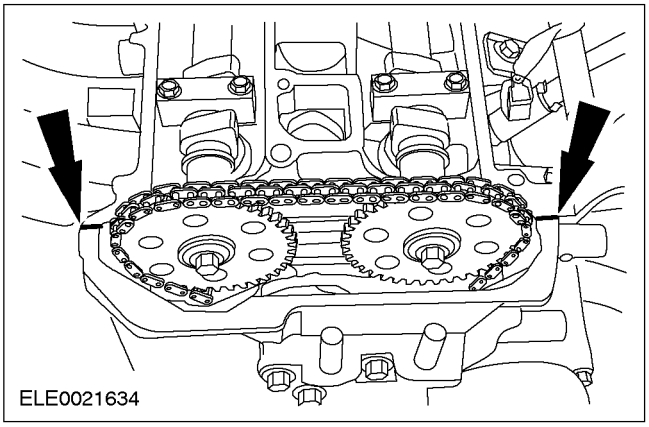


54. Install the power steering pump. For additional information, refer to Section 211-02.

55. Tighten the water pump pulley retaining bolts.



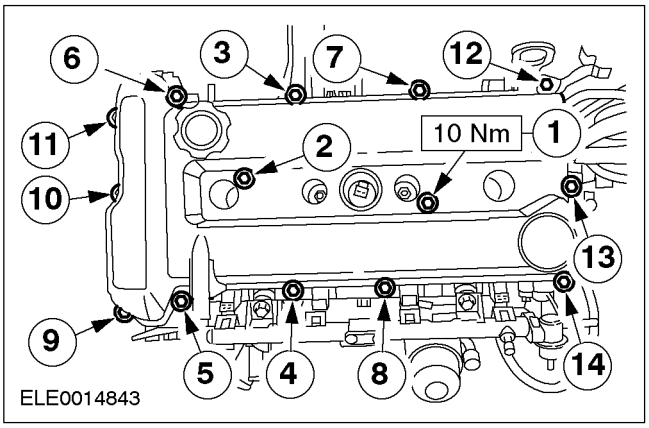
56. Apply a small bead of silicone sealant to the areas as shown.



57. NOTE: Install a new valve cover gasket if necessary.

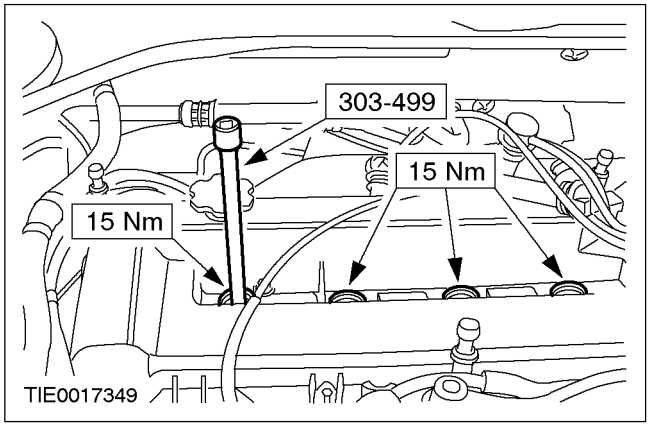
Install the valve cover.

- Tighten the bolts in the sequence shown.

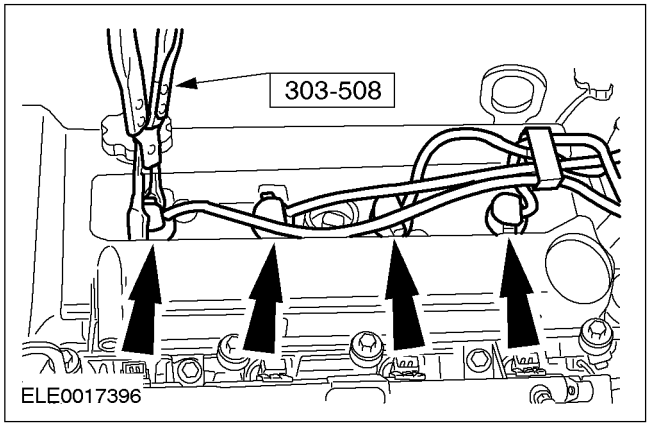


IN-VEHICLE REPAIR (Continued)

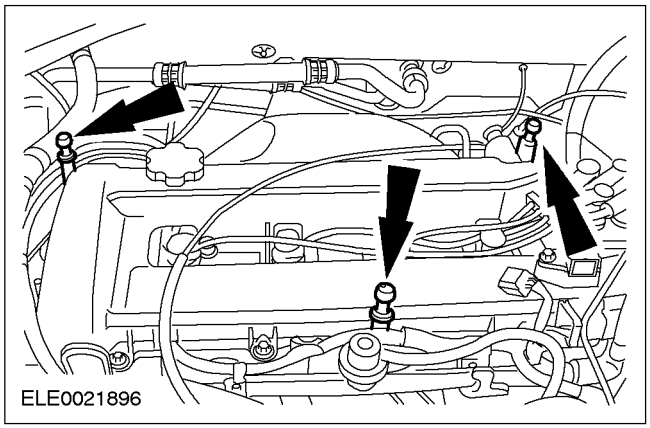
58. Using the special tool, install the spark plugs.



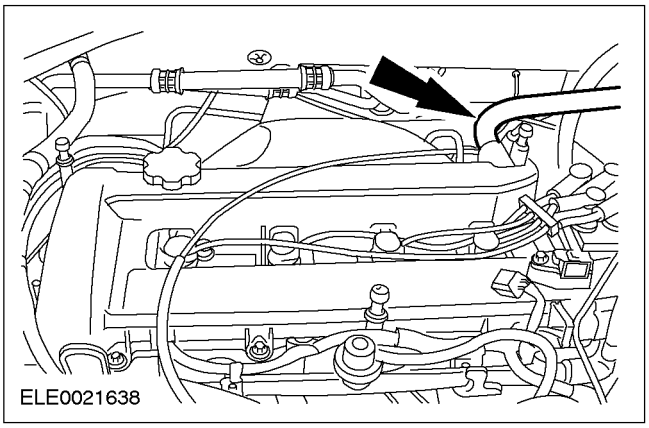
59. Using the special tool, connect the spark plug electrical connectors.



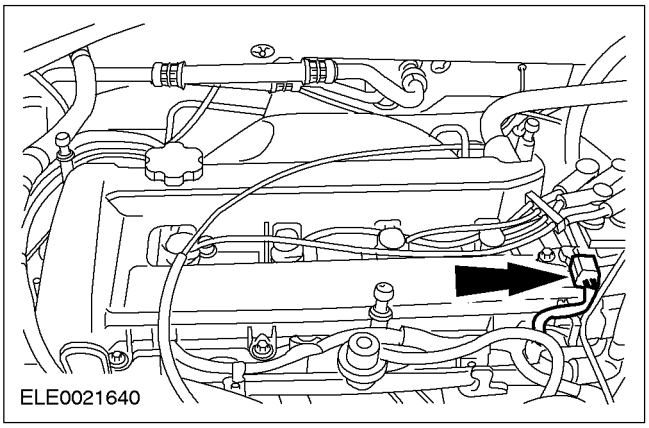
60. Install the engine upper cover retaining brackets.



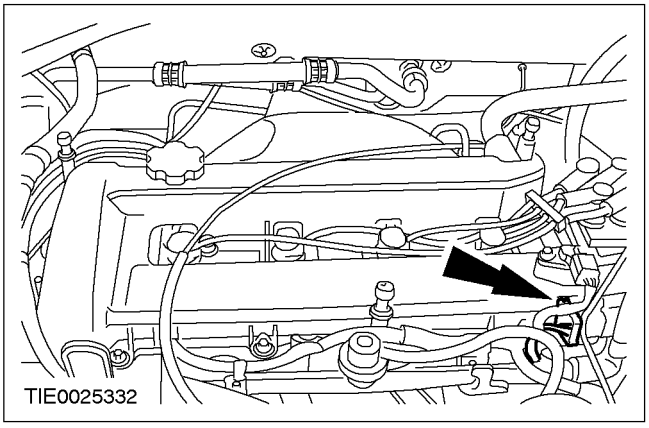
61. Attach the PCV hose to the valve cover.



62. Connect the CMP sensor electrical connector.



63. Attach the engine wiring harness electrical connector to the valve cover.



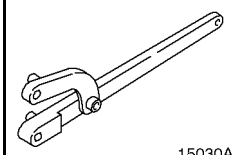
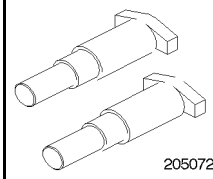
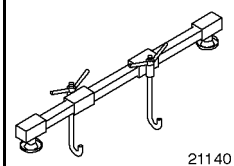
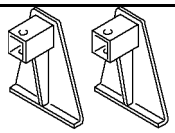
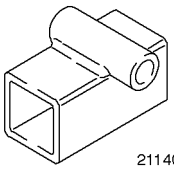
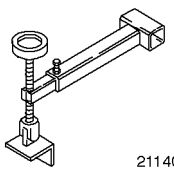
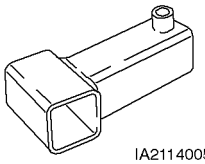
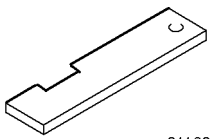
64. Install the intake manifold. For additional information, refer to Intake Manifold in this section.
65. Fill and bleed the cooling system. For additional information, refer to Section 303-03.

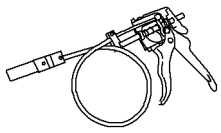
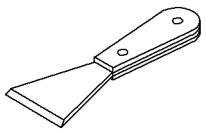
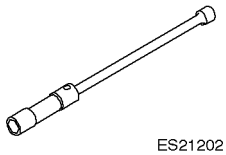
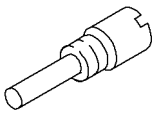
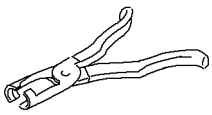
IN-VEHICLE REPAIR (Continued)

66. **Fill and bleed the power steering system. For additional information, refer to Section 211-02.**
67. **Initialize the door window motors. For additional information, refer to Section 501-11.**

IN-VEHICLE REPAIR

Oil Pan (21 154 0)

Special Tool(s)	
 15030A	Flange Holding Wrench, Universal 205-072 (15-030A)
 20507202	Adapter for 205-072 205-072-02 (15-030A-02)
 21140	Support Bar, Engine 303-290 (21-140)
 2114001	Adapter for 303-290 (21-140) 303-290-01 (21-140-01)
 2114002	Adapter for 303-290 (21-140) 303-290-02 (21-140-02)
 2114003	Adapter for 303-290 (21-140) 303-290-03 (21-140-03)
 IA2114005	Adapter for 303-290 (21-140) 303-290-05A (21-140-05A)
 21162B	Timing Plate, Camshaft Alignment 303-376 (21-162B)

Special Tool(s)	
 24003	Remover/Installer, Cooling Hose Clamp 303-397 (24-003)
 21179	Separator, Oil Pan 303-428 (21-179)
 ES21202	Remover/Installer, Spark Plug 303-499 (21-202)
 PZ21210	Timing Peg, Crankshaft TDC 303-507 (21-210)
 PZ21211	Pliers, Valve Stem Oil Seal 303-508 (21-211)

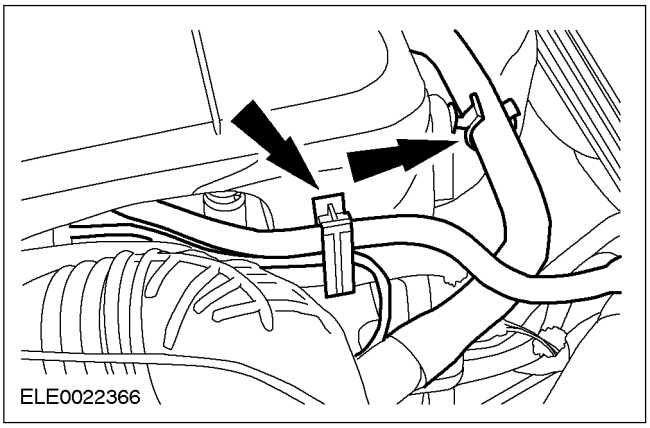
General Equipment
Trolley Jack
M6 x 18 mm bolt

Name	Specification
Loctite 7070	
Engine oil	WSS-M2C913-A
Silicone sealant	WSE-M4G323-A6

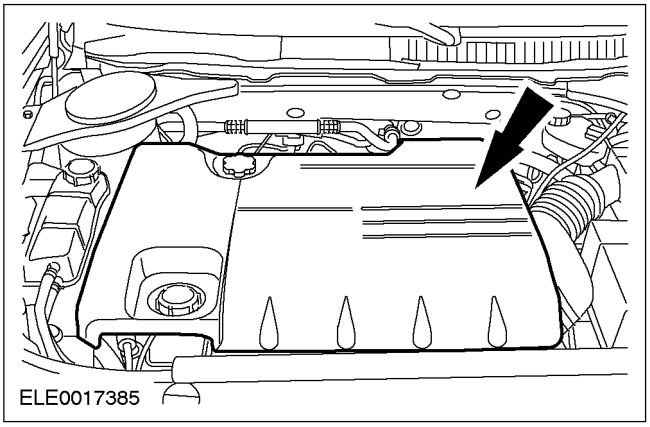
IN-VEHICLE REPAIR (Continued)

Removal

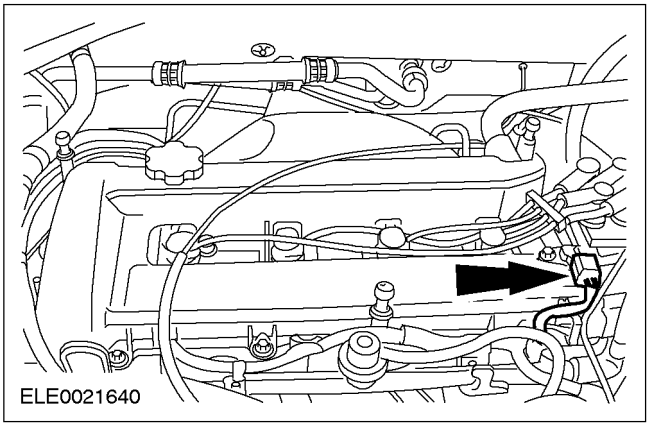
1. **Detach the positive crankcase ventilation (PCV) hose and the vacuum hose from the engine upper cover.**



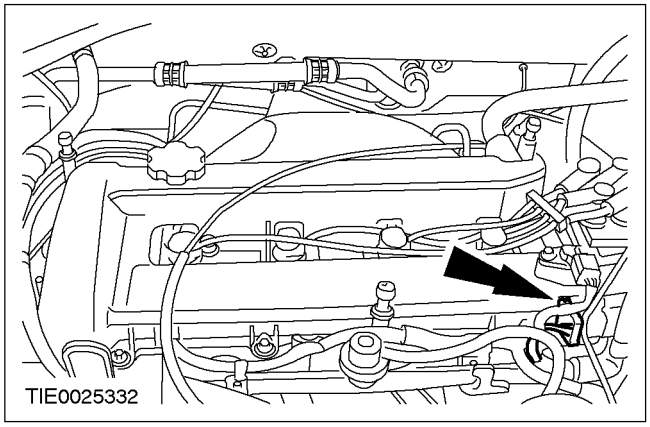
2. **Remove the engine upper cover.**



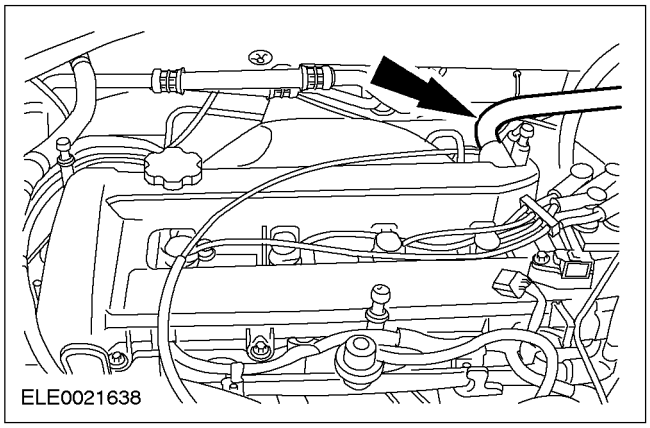
3. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
4. **Disconnect the camshaft position sensor (CMP) sensor electrical connector.**



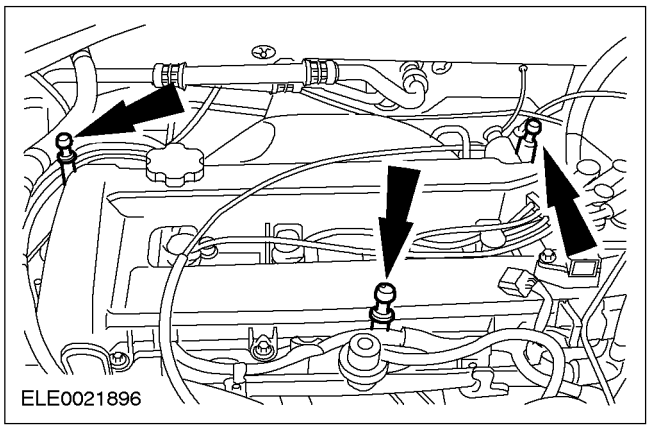
5. **Detach the engine wiring harness electrical connector from the valve cover.**



6. **Detach the PCV hose from the valve cover.**

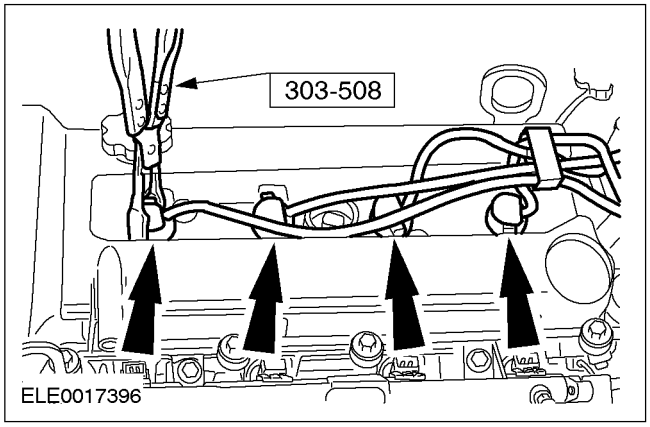


7. **Remove the engine upper cover brackets.**

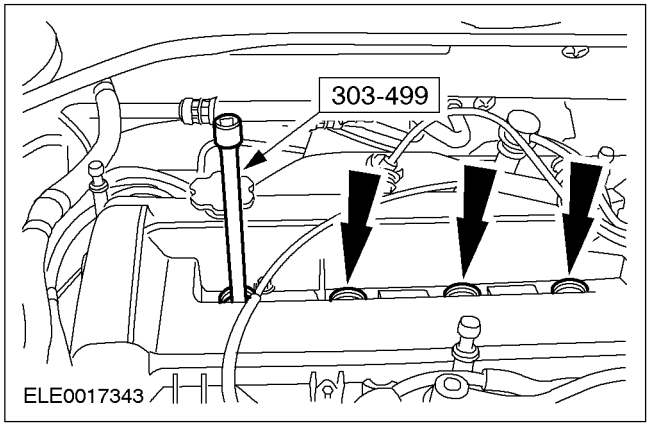


IN-VEHICLE REPAIR (Continued)

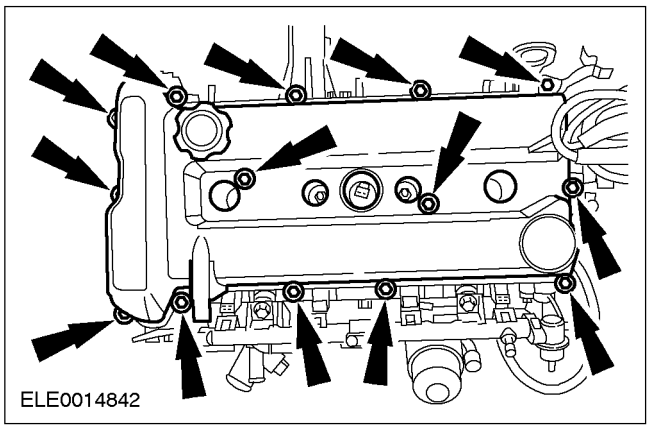
8. **Using the special tool, disconnect the spark plug electrical connectors.**



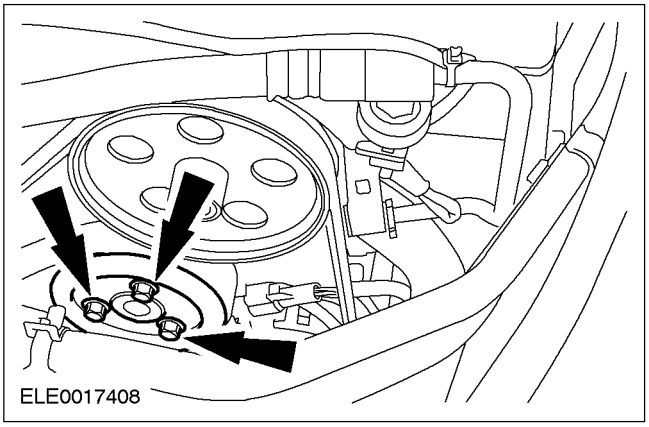
9. **Using the special tool, remove the spark plugs.**



10. **Remove the valve cover.**

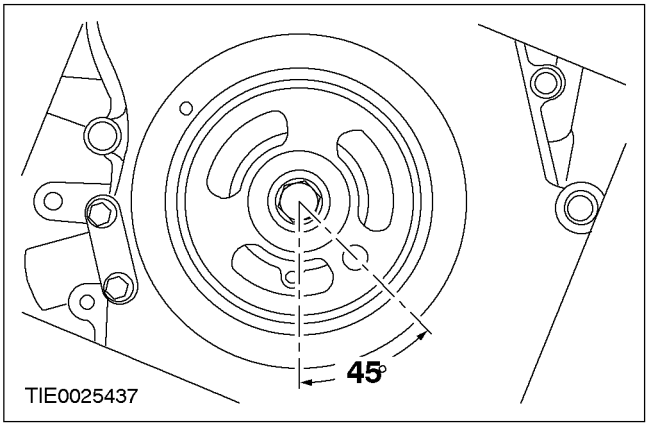


11. **Loosen the water pump pulley retaining bolts by three turns.**



12. **Remove the power steering pump. For additional information, refer to Section 211-02.**
13. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
14. **NOTE:** Only turn the engine in the normal direction of rotation.

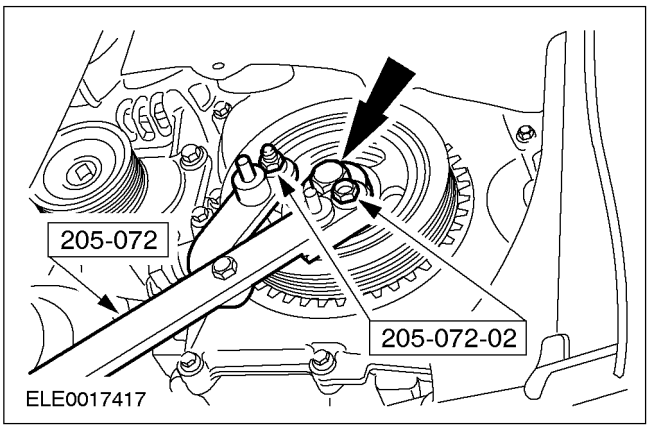
    Turn the engine until piston No. 1 is approximately 45 degrees before top dead center (TDC).



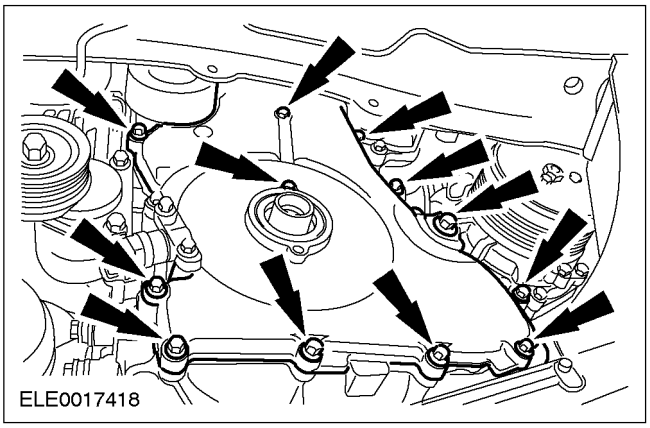
IN-VEHICLE REPAIR (Continued)

15. **NOTE:** Do not discard the crankshaft pulley retaining bolt.

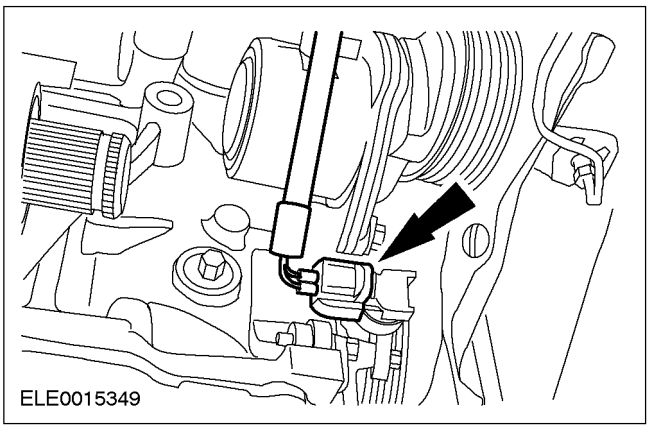
    Using the special tools, prevent the crankshaft pulley from rotating and remove the crankshaft pulley.



16. **Remove the engine front cover lower retaining bolts.**

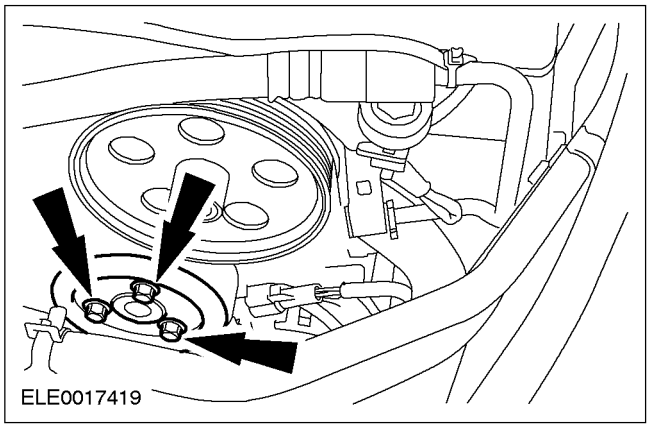


17. **Disconnect the crankshaft position (CKP) sensor electrical connector.**

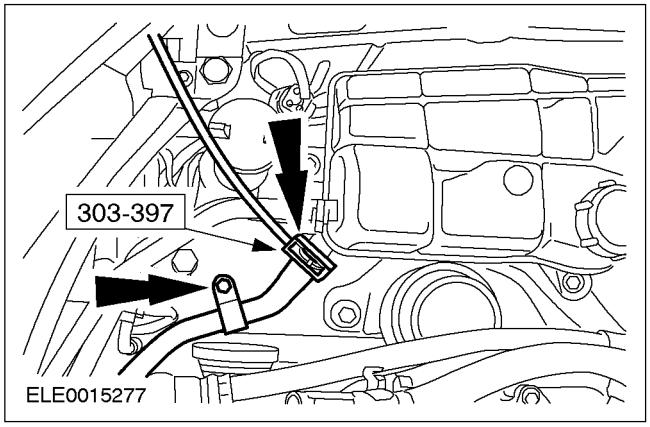


18. **Lower the vehicle.**

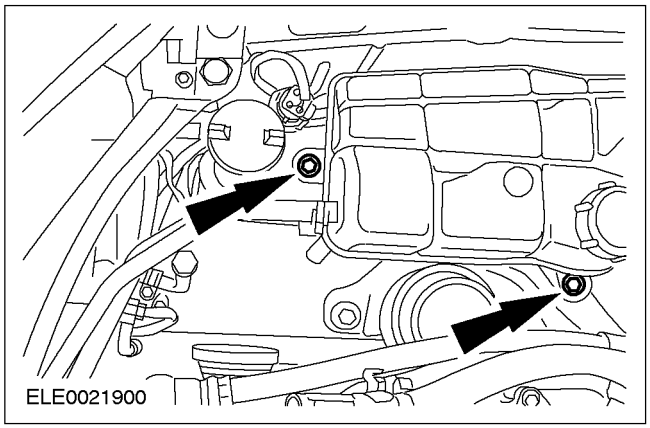
19. **Remove the water pump pulley.**



20. **Using the special tool, disconnect the coolant hose from the coolant expansion tank.**



21. **Detach the coolant expansion tank and position it to one side.**



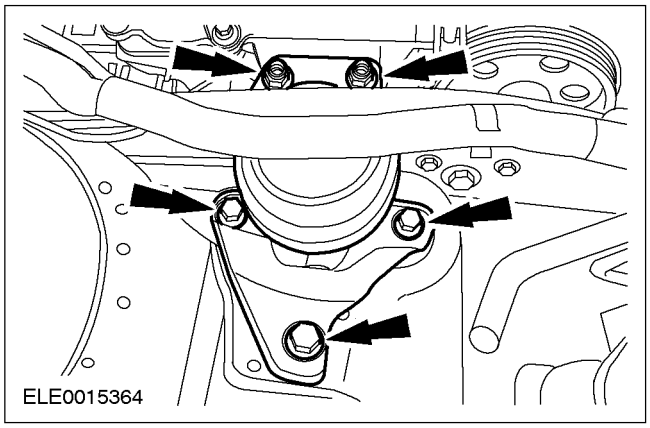
22. **NOTE:** Support the engine with wooden blocks.

    Position a trolley jack with the wooden block under the oil pan and raise the

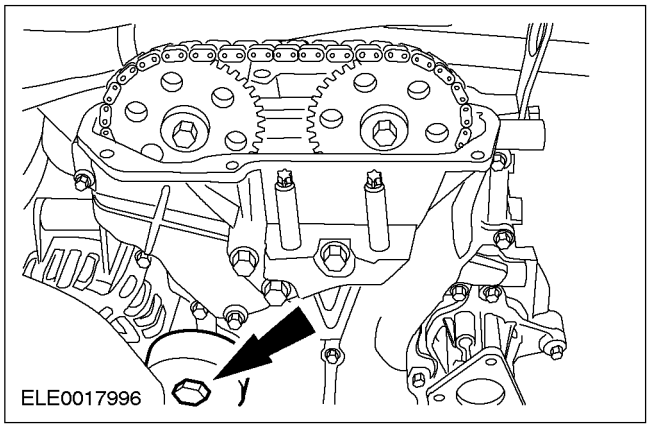
IN-VEHICLE REPAIR (Continued)

engine so that the engine front mount is free from load.

23. Remove the engine front mount.

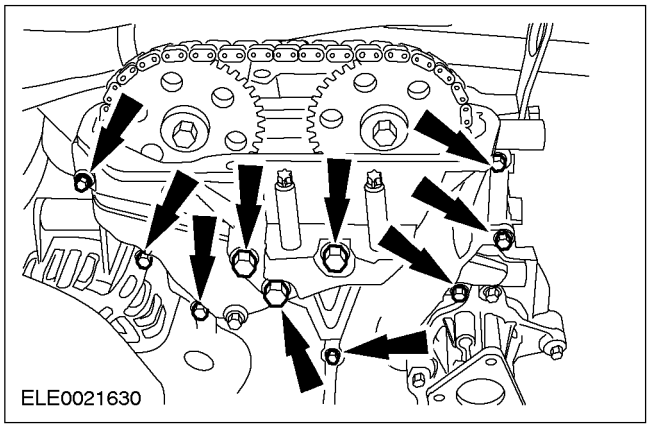


24. Remove the accessory drive belt idler.

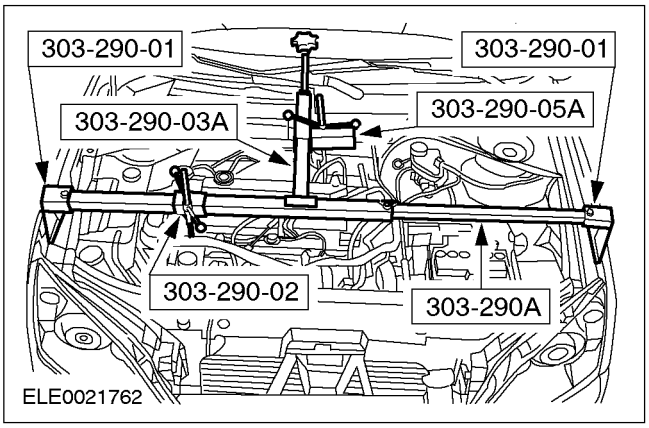


25. Remove the engine front cover upper retaining bolts.

- Remove the engine front cover.



26. Install the special tools.

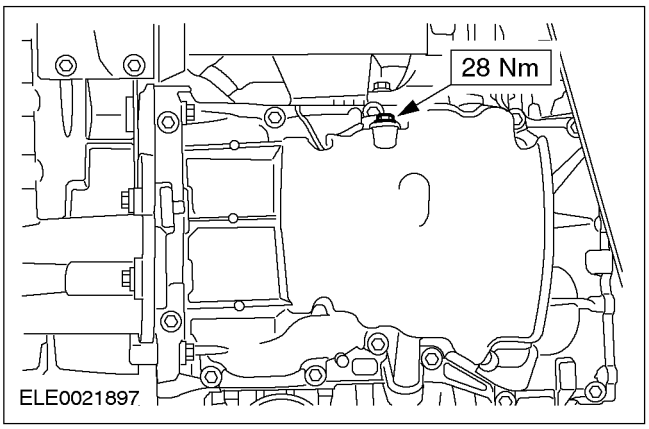


27. Raise and support the vehicle. For additional information, refer to Section 100-02.

28. NOTE: Inspect the oil pan drain plug seal for damage. Install a new drain plug and seal if required.

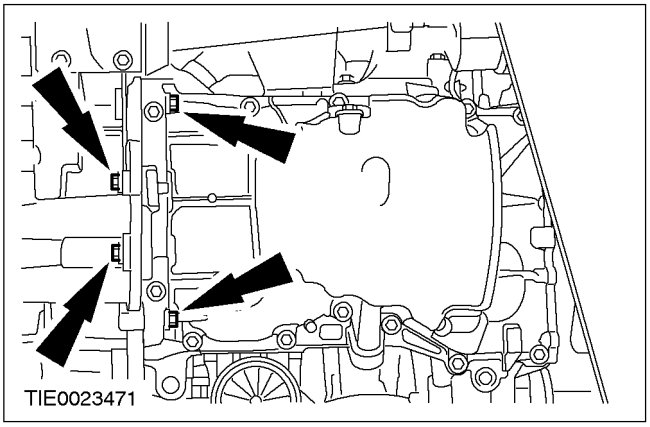
Drain the engine oil.

- Allow the oil to drain into a suitable container.
- Install the drain plug.

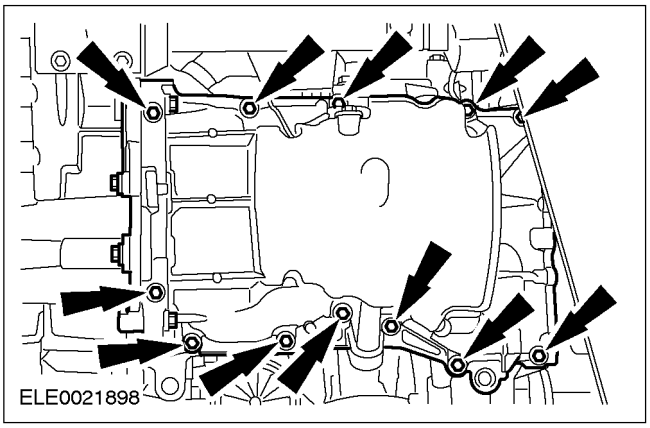


IN-VEHICLE REPAIR (Continued)

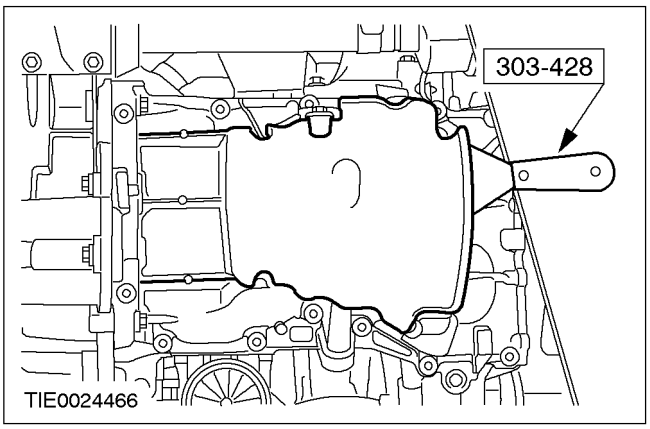
29. Remove the transaxle lower retaining bolts.



30. Remove the oil pan retaining bolts.

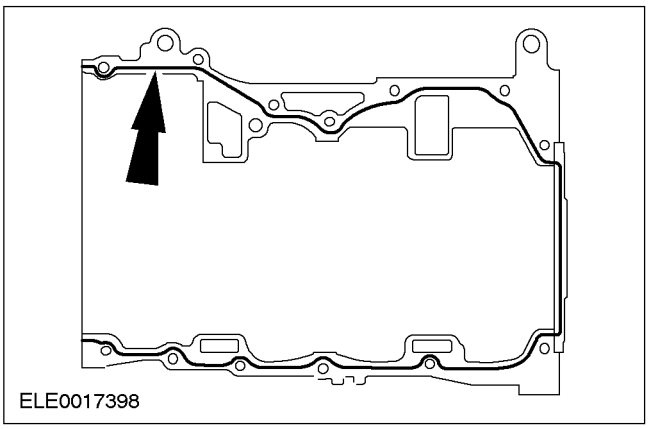


31. Using the special tool, remove the oil pan.



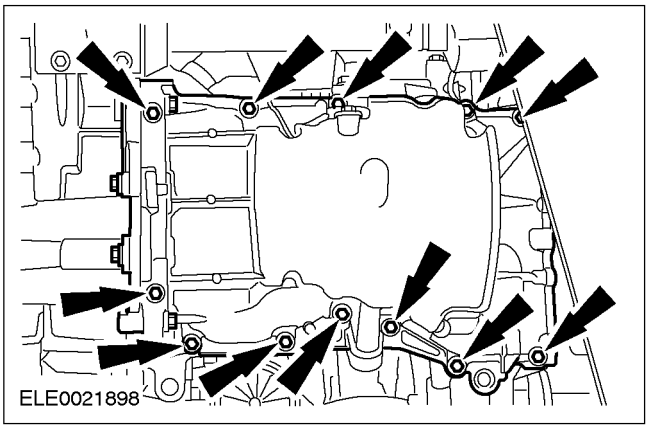
2. NOTE: Install the oil pan within 10 minutes of applying the silicone sealant and tighten the retaining bolts within a further 5 minutes.

Apply a 3 mm bead of silicone sealant to the oil pan.



3. NOTE: Do not tighten the retaining bolts at this stage.

Install the oil pan.



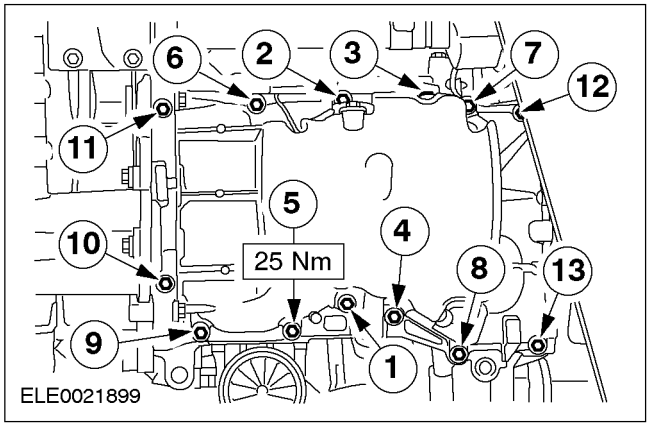
4. Using a suitable straight edge, align the oil pan to the cylinder block mating face on the timing chain side.

Installation

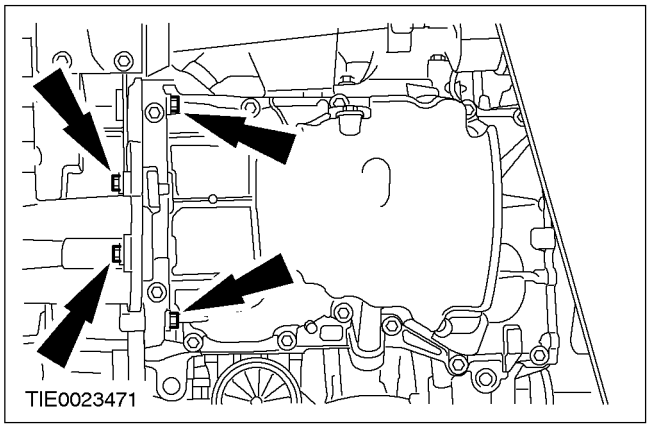
1. Using Loctite 7070, clean the engine cylinder block and oil pan mating faces.

IN-VEHICLE REPAIR (Continued)

5. Tighten the oil pan retaining bolts in the sequence shown.



6. Install the transaxle lower retaining bolts.

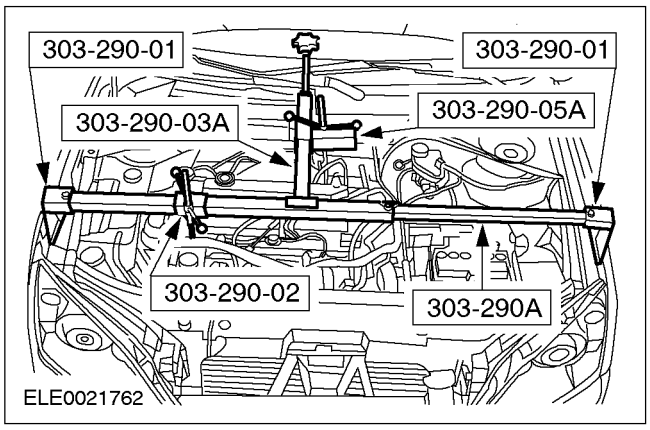


7. Lower the vehicle.

8. NOTE: Support the engine with wooden blocks.

Using a trolley jack, support the engine and transmission assembly.

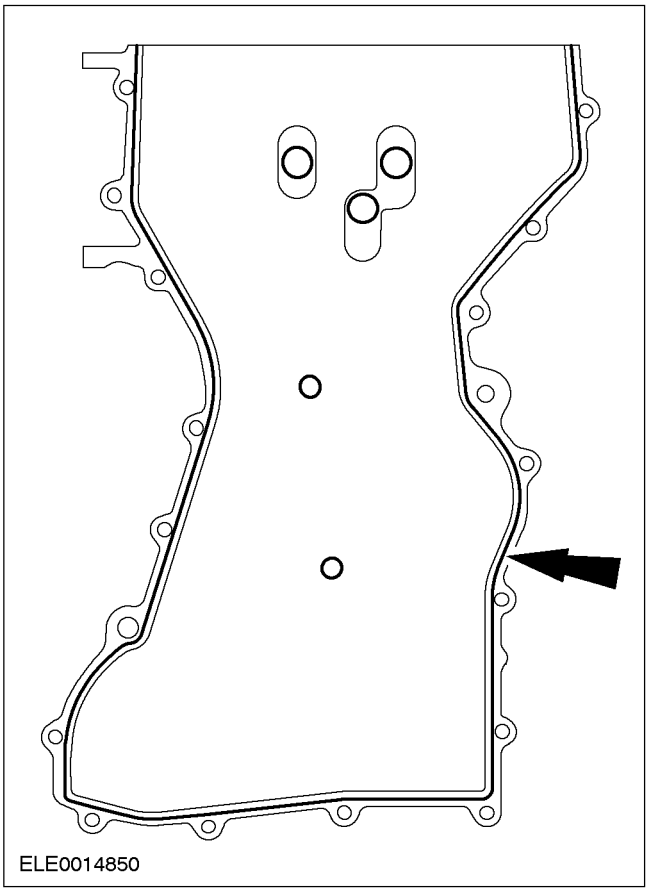
9. Remove the special tools.



10. Clean the engine front cover mating faces with Loctite 7070.

11. NOTE: Install the engine front cover within 10 minutes of applying the silicone sealer.

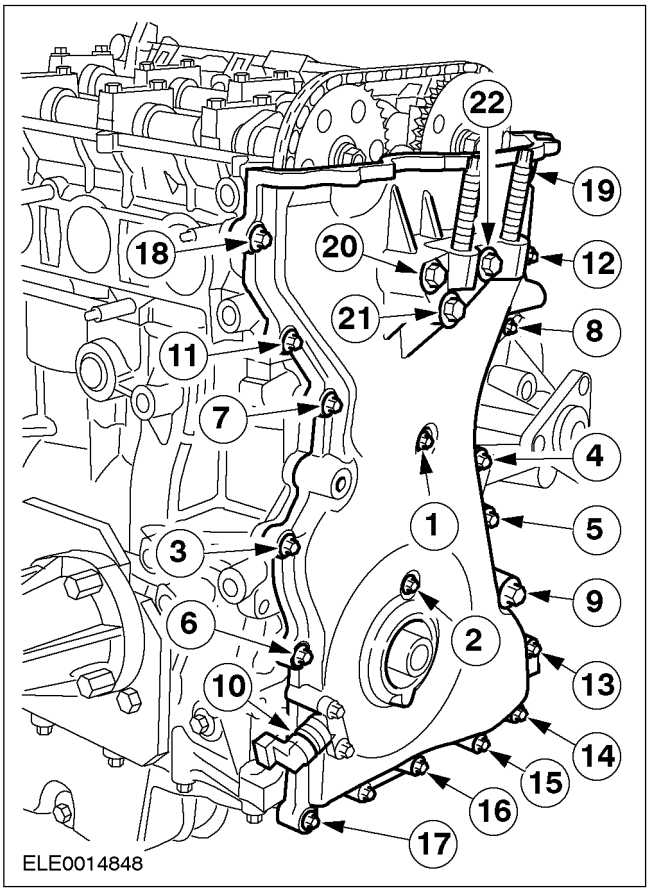
Apply a 3 mm bead of silicone sealer to the front cover.



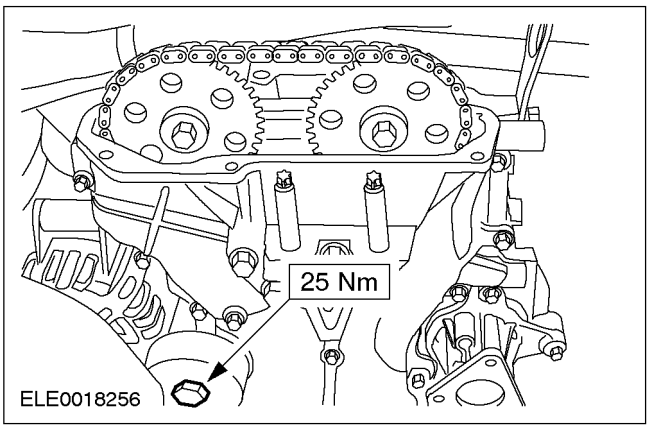
IN-VEHICLE REPAIR (Continued)

12. Install the engine front cover (engine shown removed for clarity).

- Tighten the bolts in the sequence shown.
- Bolts 1 through 8 to 10 Nm.
- Bolt 9: 48 Nm.
- Bolts 10 through 19 to 10 Nm.
- Bolts 20 through 22 to 48 Nm.

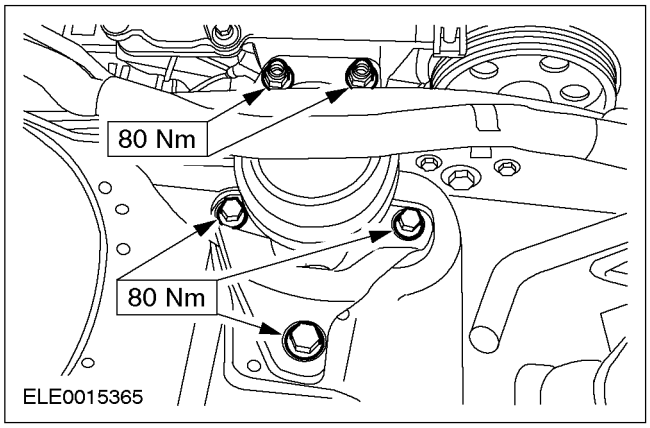


13. Install the accessory drive belt idler.

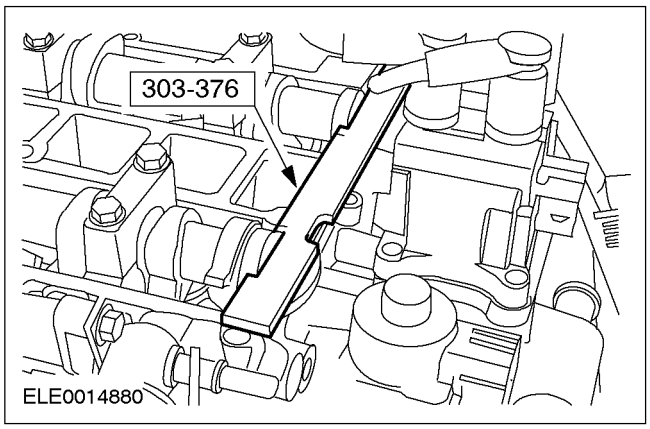


14. Install the engine front mount.

- Lower the engine and transmission assembly.
- Install the engine front mount.



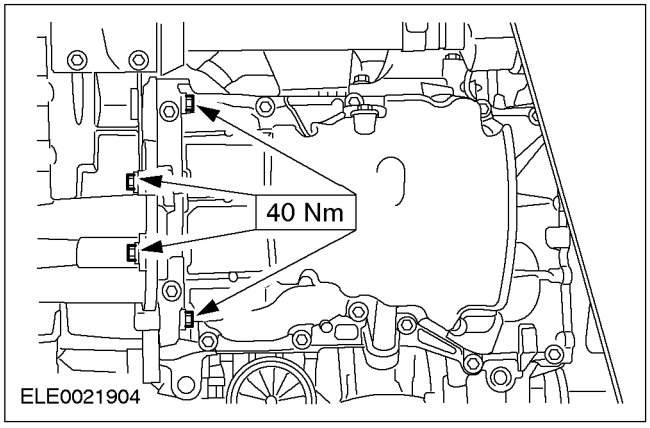
15. Install the special tool.



16. Remove the trolley jack.

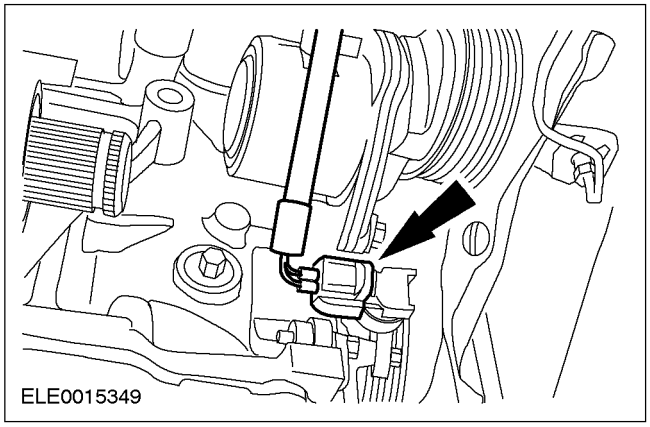
17. Raise and support the vehicle. For additional information, refer to Section 100-02.

18. Install the transaxle lower retaining bolts.

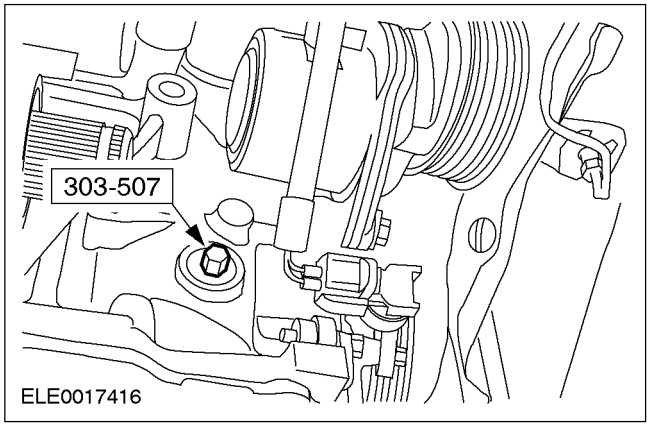


IN-VEHICLE REPAIR (Continued)

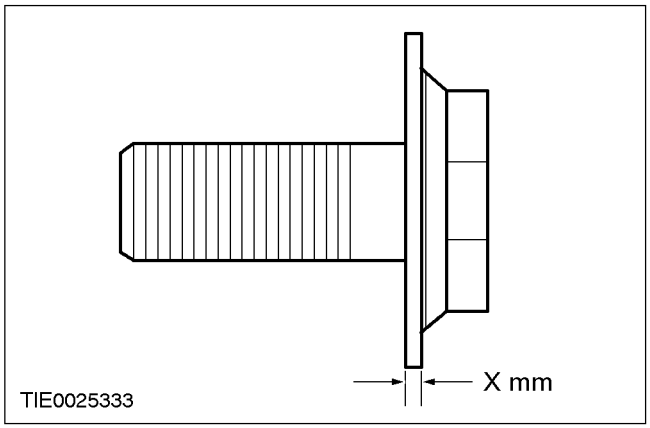
19. Connect the CKP sensor electrical connector.



20. Remove the cylinder block lower blanking plug and install the special tool.

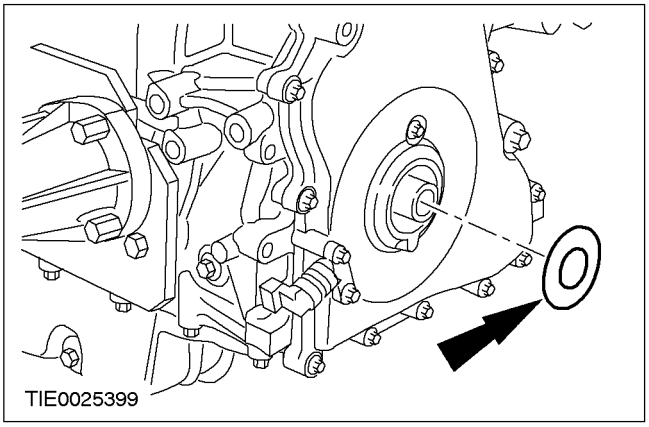


21. Measure the thickness of the crankshaft pulley retaining bolt washer.



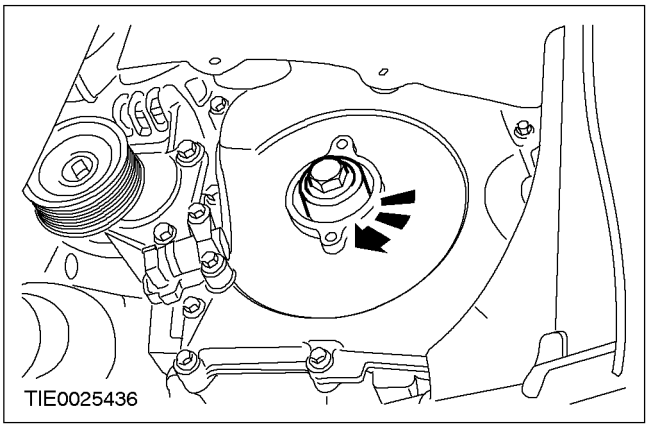
22. NOTE: If the thickness of the crankshaft pulley retaining bolt washer is less then 5.5 mm, a friction washer must be installed.

Install a friction washer to the crankshaft (engine shown removed for clarity).



23. NOTE: Only turn the engine in the normal direction of rotation.

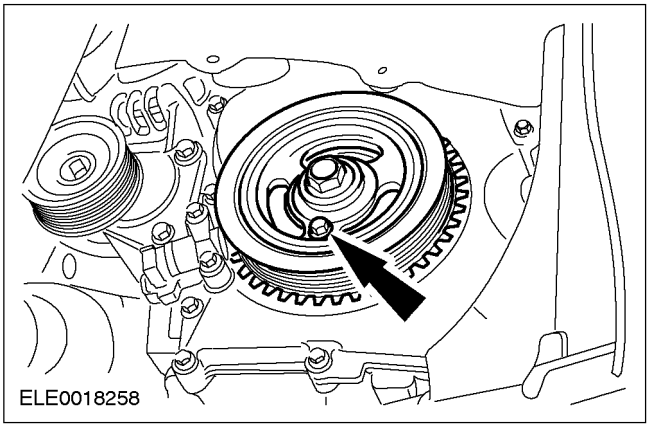
Using the crankshaft pulley retaining bolt, turn the engine until piston No. 1 is at TDC.



IN-VEHICLE REPAIR (Continued)

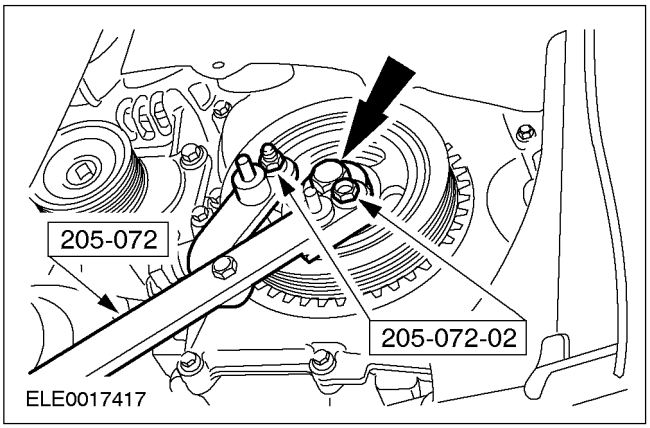
24. **Remove the crankshaft pulley retaining bolt.**
    - Discard the bolt.
25. **CAUTION: Only tighten the crankshaft pulley securing bolt finger tight.**

    Install the crankshaft pulley onto the crankshaft and secure the crankshaft pulley to the front cover using a M6 x 18 mm bolt.

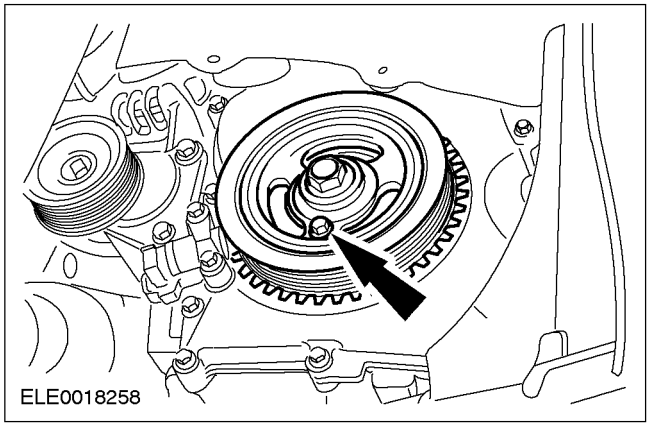


26. **NOTE:** Install a new crankshaft pulley retaining bolt.

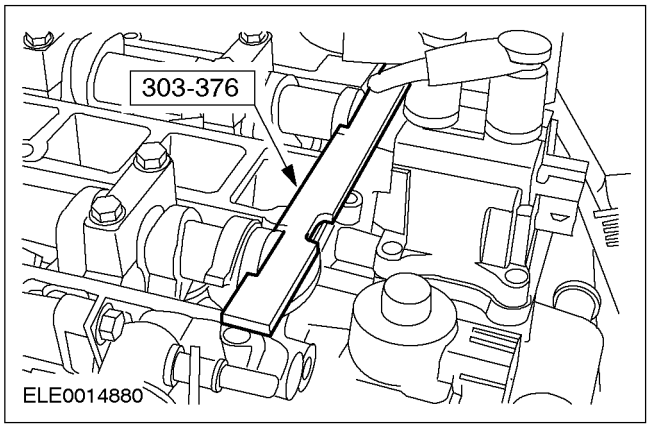
    Using the special tools, prevent the crankshaft pulley from rotating and tighten the crankshaft pulley retaining bolt.
    - Tighten the bolt in two stages.
    - Stage 1: 100 Nm.
    - Stage 2: 90 degrees.



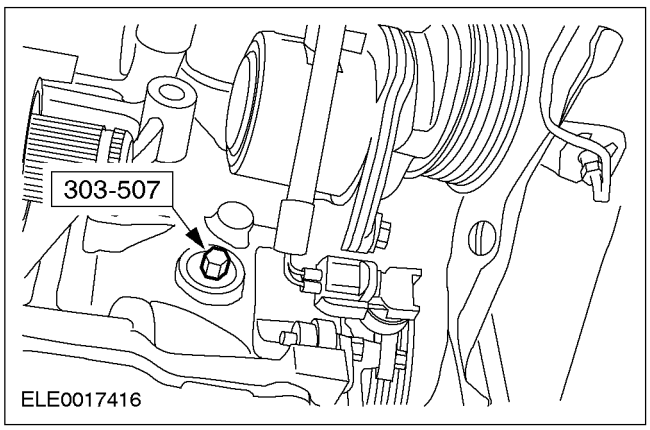
27. **Remove the crankshaft pulley securing bolt.**



28. **Lower the vehicle.**
29. **Remove the special tool.**



30. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
31. **Remove the special tool from the cylinder block.**

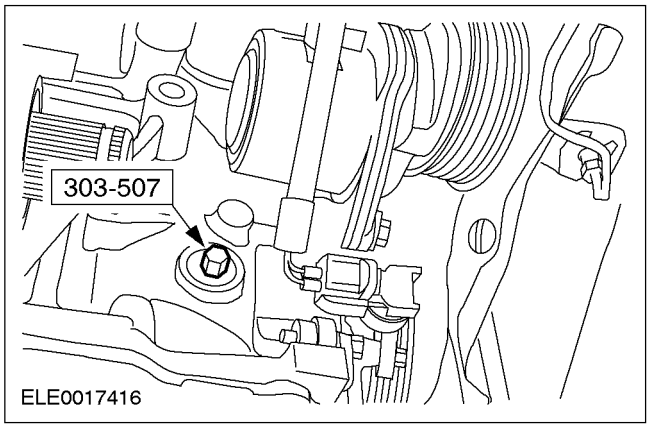


IN-VEHICLE REPAIR (Continued)

32. **NOTE:** Only turn the engine in the normal direction of rotation.

    Turn the engine two revolutions.

33. **Install the special tool.**



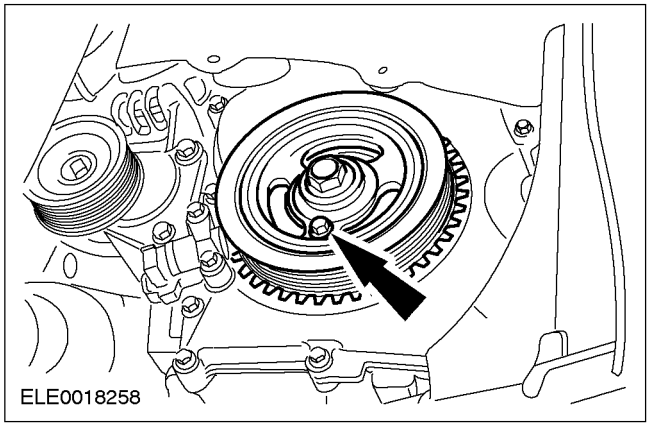
34. **NOTE:** Only turn the engine in the normal direction of rotation.

    Turn the engine until piston No. 1 is at TDC.

35. **CAUTION: Only tighten the crankshaft pulley securing bolt finger tight.**

NOTE: If it is not possible to install the crankshaft pulley securing bolt, correct the engine timing.

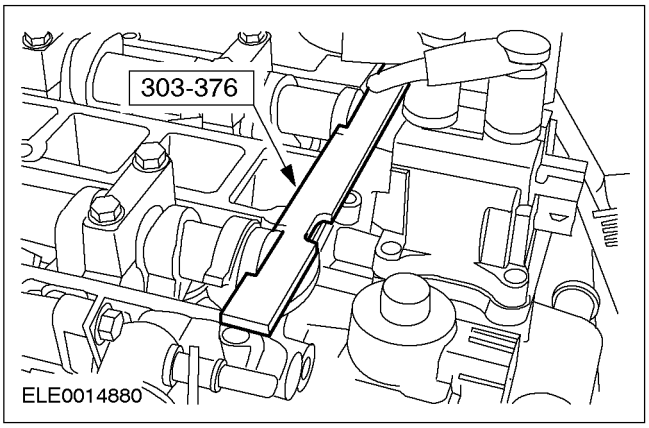
Using a M6 x 18 mm bolt, check the position of the crankshaft pulley.



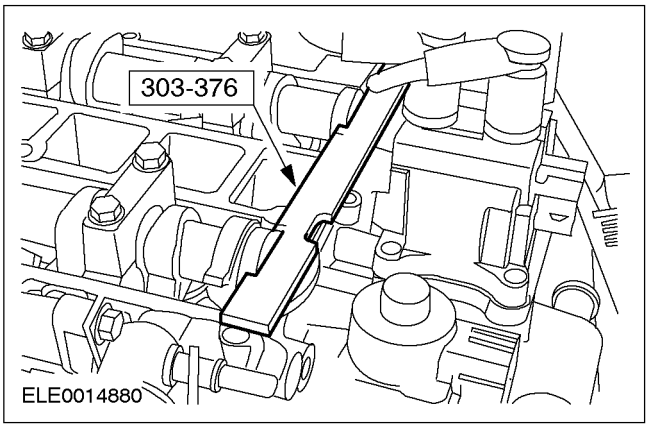
36. **Lower the vehicle.**

37. **NOTE:** If it is not possible to install the special tool, correct the engine timing.

Using the special tool, check the position of the camshafts.

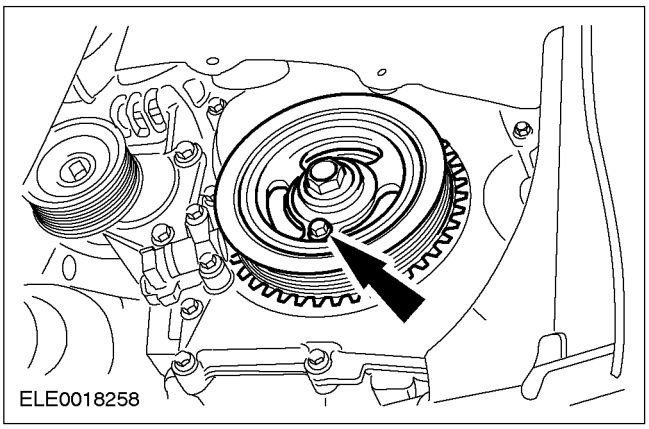


38. **Remove the special tool.**



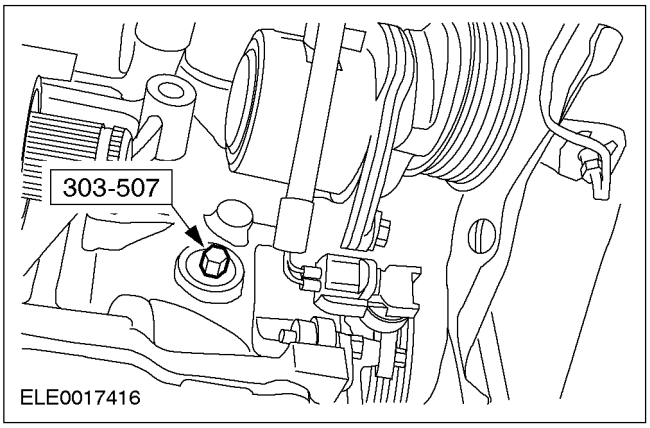
39. **Raise and support the vehicle. For additional information, refer to Section 100-02.**

40. **Remove the crankshaft pulley securing bolt.**

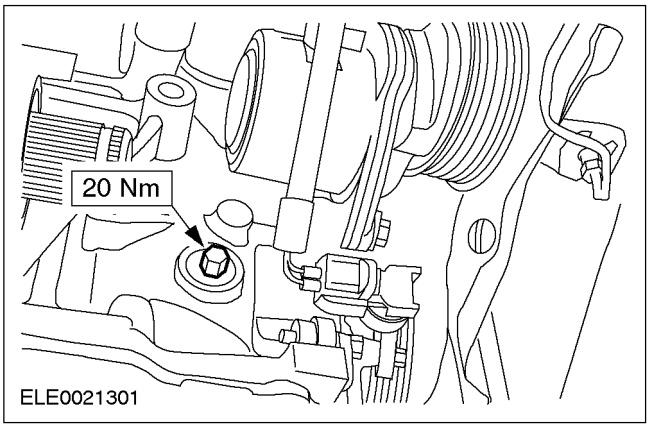


IN-VEHICLE REPAIR (Continued)

41. Remove the special tool.

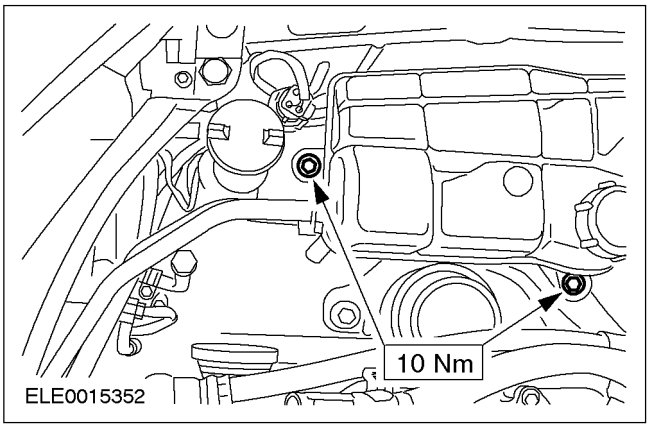


42. Install the cylinder block lower blanking plug.

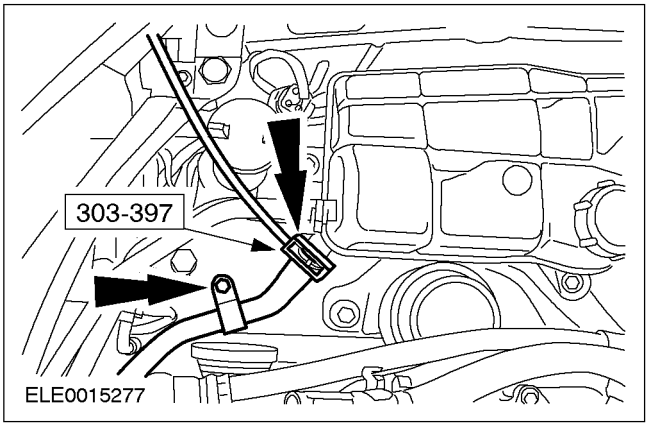


43. Lower the vehicle.

44. Attach the coolant expansion tank.

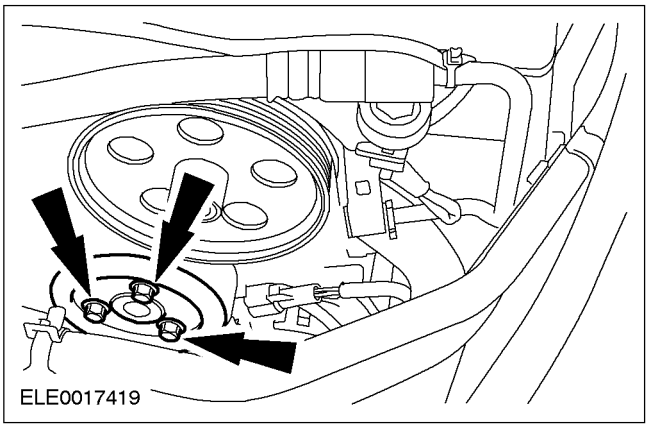


45. Using the special tool, connect the coolant hose to the coolant expansion tank.



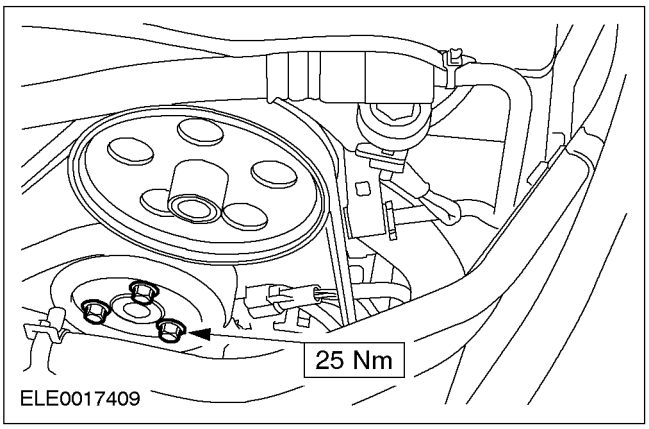
46. NOTE: Do not fully tighten the water pump pulley retaining bolts at this stage.

Install the water pump pulley.



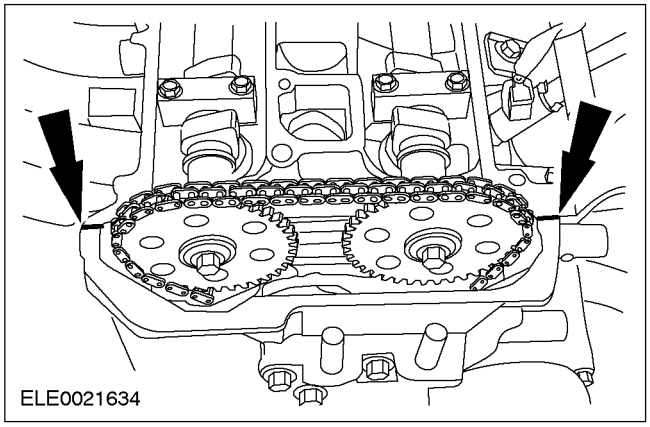
47. Install the power steering pump. For additional information, refer to Section 211-02.

48. Tighten the water pump pulley retaining bolts.



IN-VEHICLE REPAIR (Continued)

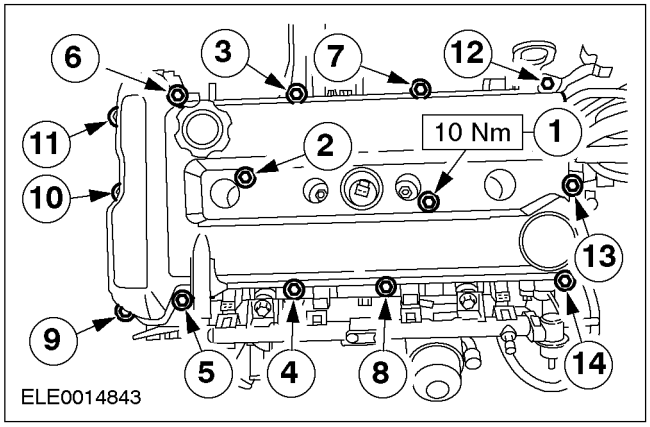
49. Apply a small bead of silicone sealant to the areas as shown.



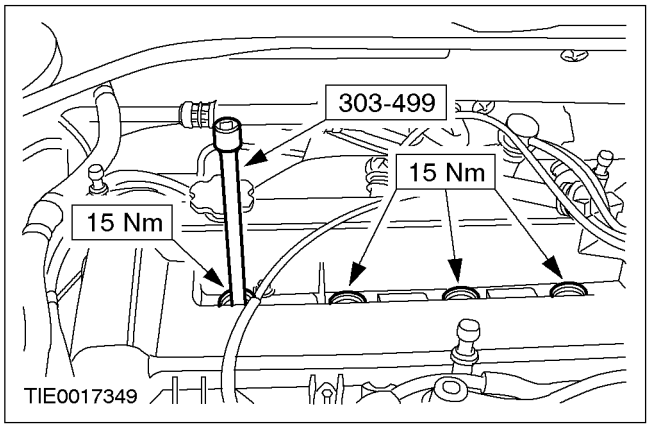
50. NOTE: Install a new valve cover gasket if necessary.

Install the valve cover.

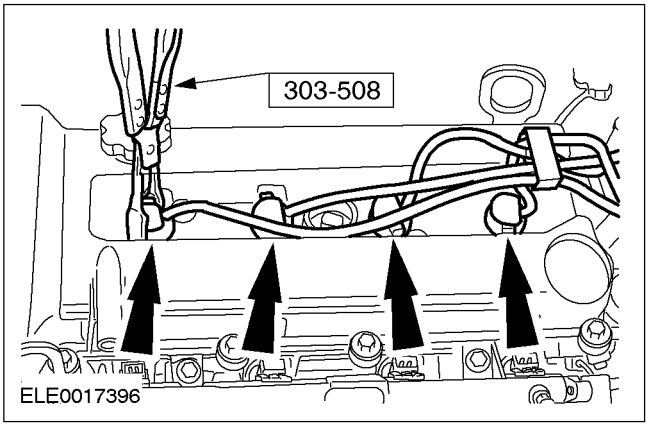
- Tighten the bolts in the sequence shown.



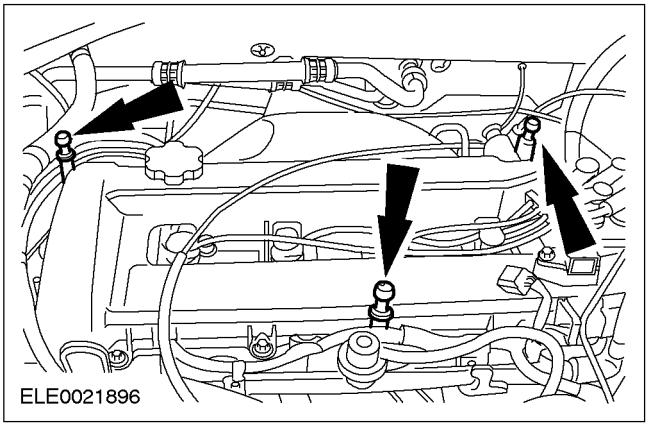
51. Using the special tool, install the spark plugs.



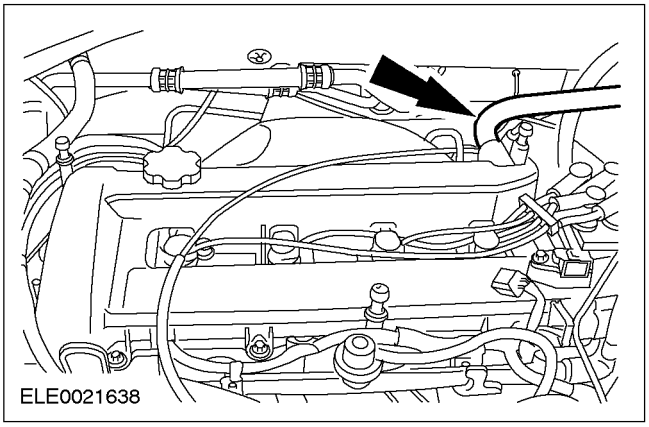
52. Using the special tool, connect the spark plug electrical connectors.



53. Install the engine upper cover retaining brackets.

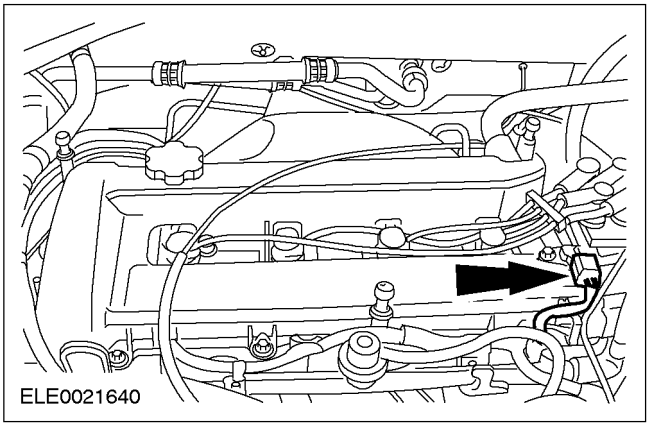


54. Attach the PCV hose to the valve cover.

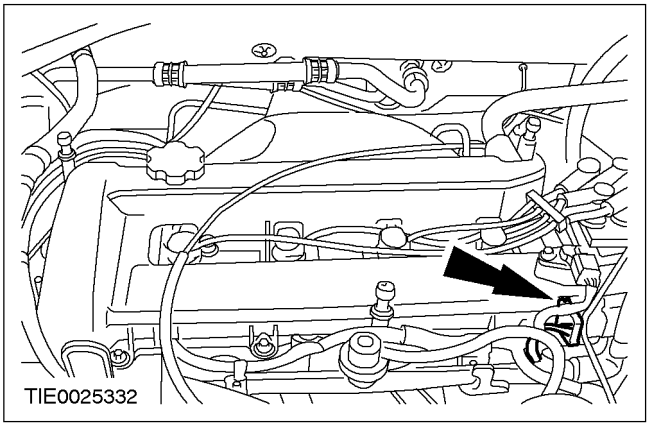


IN-VEHICLE REPAIR (Continued)

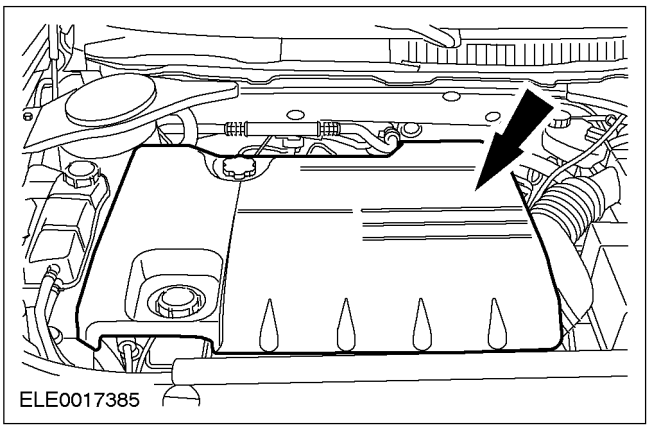
55. Connect the CMP sensor electrical connector.



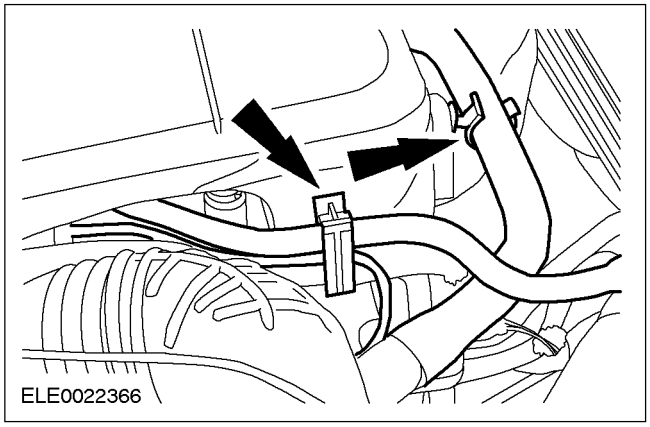
56. Attach the engine wiring harness electrical connector to the valve cover.



57. Connect the battery ground cable. For additional information, refer to Section 414-01.
58. Install the engine upper cover.



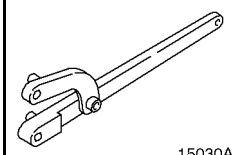
59. Attach the PCV hose and the vacuum hose to the engine upper cover.



60. Fill the engine with engine oil.
61. Initialize the door window motors. For additional information, refer to Section 501-11.

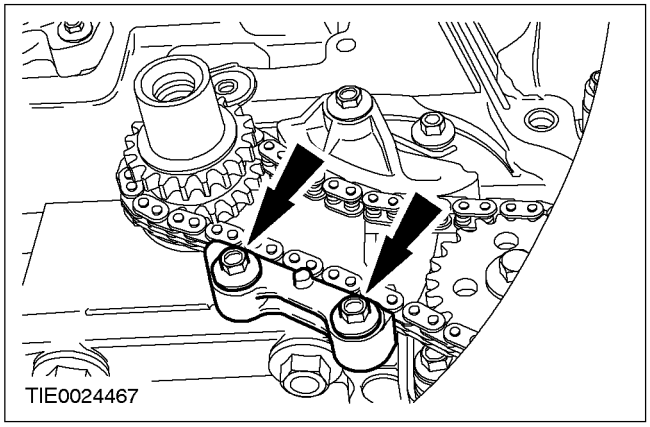
IN-VEHICLE REPAIR

Oil Pump (21 714 0)

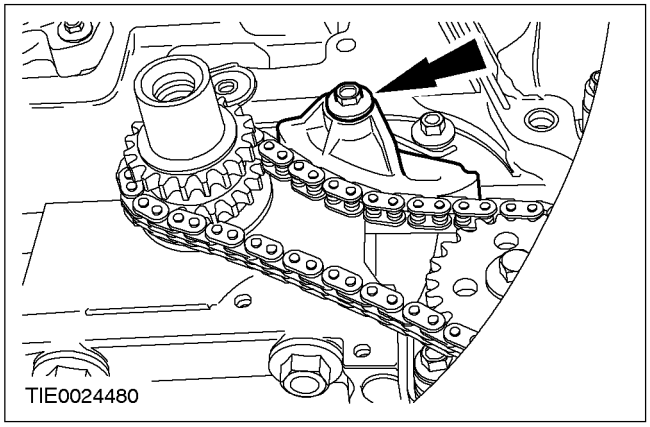
Special Tool(s)	
 15030A	Flange Holding Wrench, Universal 205-072 (15-030A)

Removal

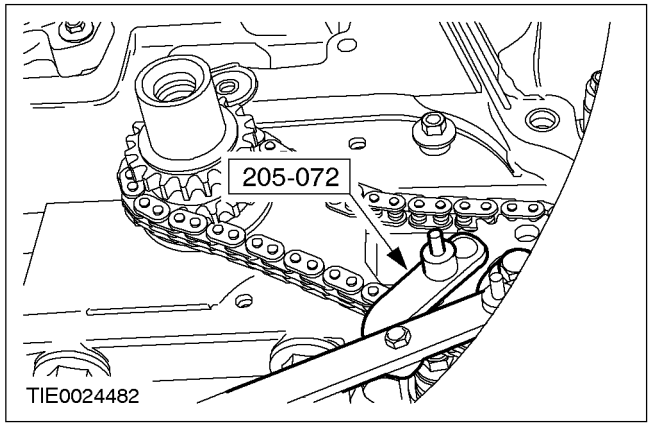
1. **Remove the timing chain.** **For additional information, refer to Timing Chain in this section.**
2. **Remove the oil pan.** **For additional information, refer to Oil Pan in this section.**
3. **Remove the oil pump chain guide.**


TIE0024467

4. **Remove the oil pump chain tensioner.**

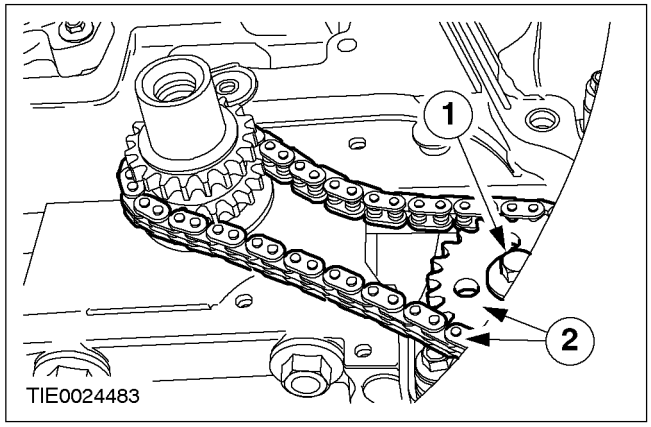

TIE0024480

5. **Using the special tool, loosen the oil pump sprocket retaining bolt.**



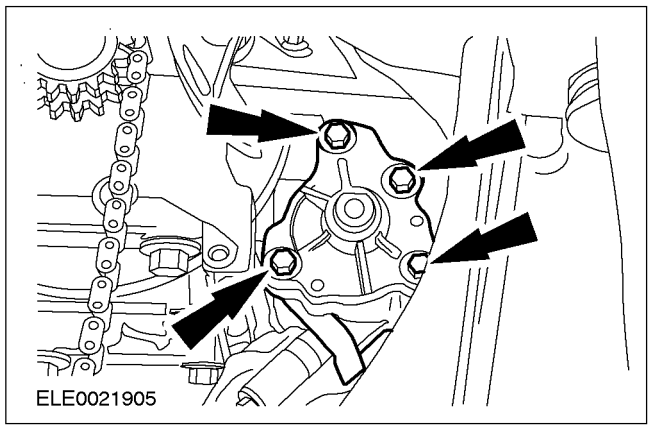
TIE0024482

6. **Remove the oil pump chain.**
   1. Remove the oil pump sprocket retaining bolt.
   2. Remove the oil pump chain and the oil pump sprocket.



TIE0024483

7. **Remove the oil pump.**
   - Discard the gasket.

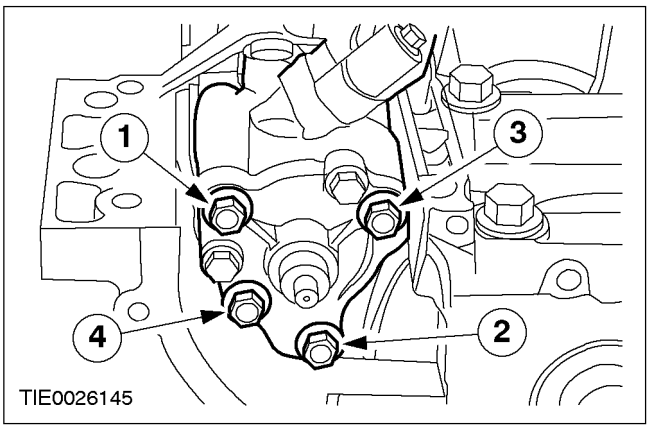

ELE0021905

IN-VEHICLE REPAIR (Continued)

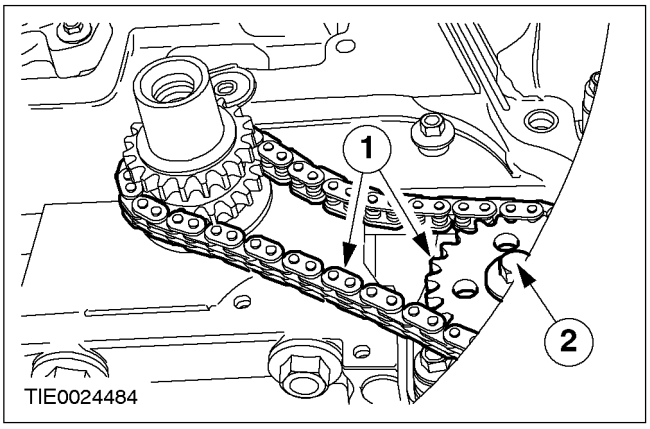
Installation

1. **NOTE:** Install a new oil pump gasket.

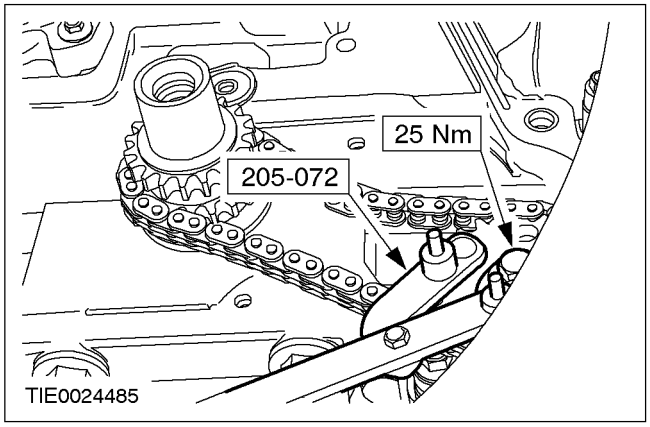
   Install the oil pump.
   - Tighten the bolts in the sequence shown in two stages.
   - Stage 1: 10 Nm.
   - Stage 2: 23 Nm.



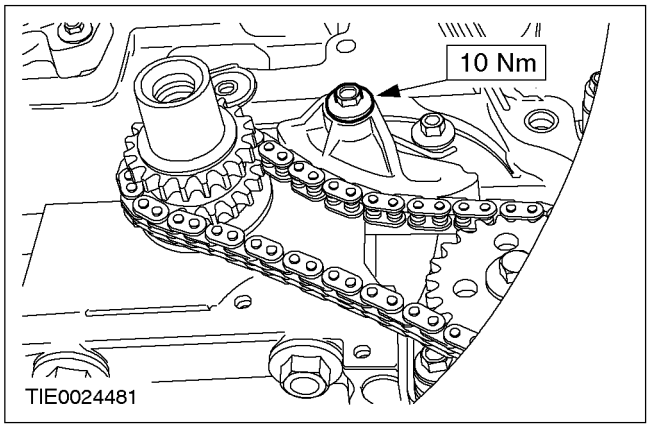
2. **Install the oil pump chain.**
   1. Install the oil pump chain and the oil pump sprocket.
   2. Install the oil pump sprocket retaining bolt.



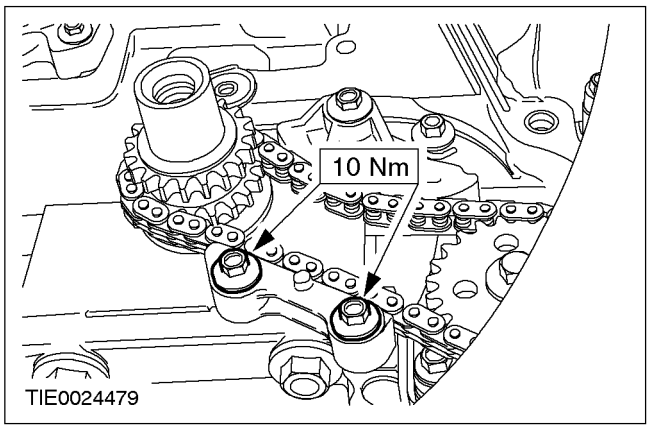
3. **Using the special tool, tighten the oil pump sprocket retaining bolt.**



4. **Install the oil pump chain tensioner.**



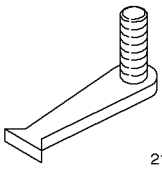
5. **Install the oil pump chain guide.**



6. **Install the oil pan.** **For additional information, refer to Oil Pan in this section.**
7. **Install the timing chain.** **For additional information, refer to Timing Chain in this section.**

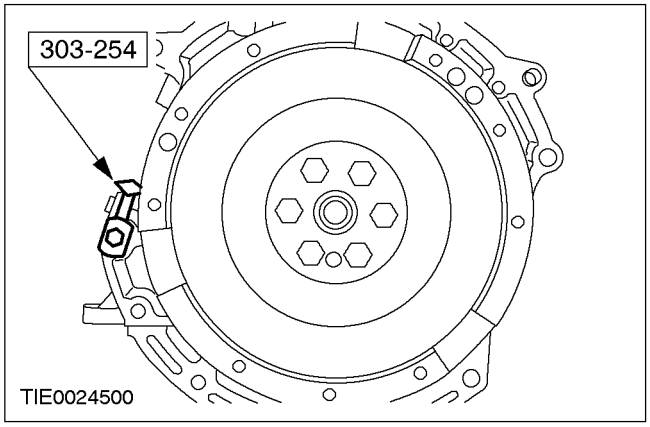
IN-VEHICLE REPAIR

Crankshaft Rear Seal (21 468 4)

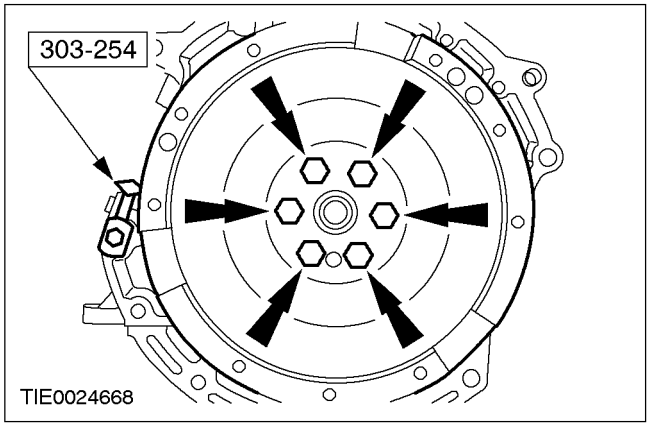
Special Tool(s)	
 21135	Locking Tool, Flywheel 303–254 (21–135)

Removal

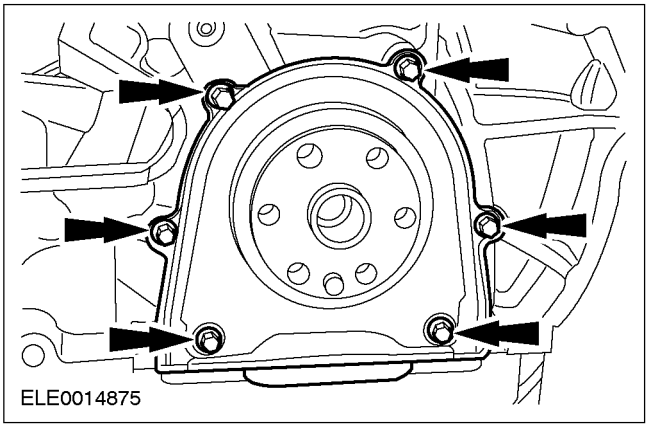
1. **Remove the oil pan.** **For additional information, refer to Oil Pan in this section.**
2. **Remove the clutch disc and pressure plate.**
3. **Using the special tool, lock the flywheel in position.**



4. **Remove the flywheel.**
   - Discard the bolts.



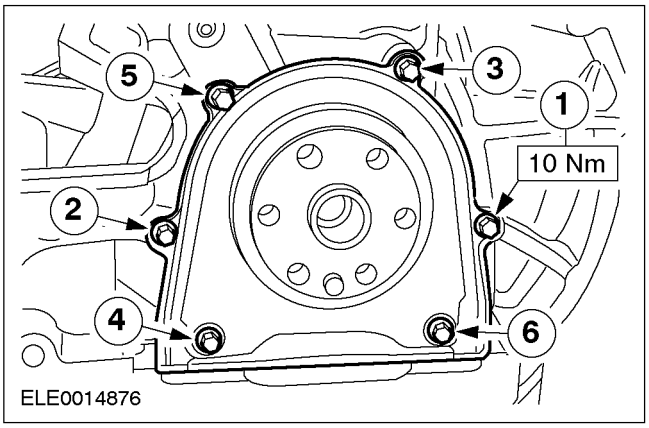
5. **Remove the special tool.**
6. **Remove the crankshaft rear oil seal carrier.**
   - Discard the crankshaft rear oil seal carrier.



Installation

1. **NOTE:** Install a new crankshaft rear oil seal carrier.

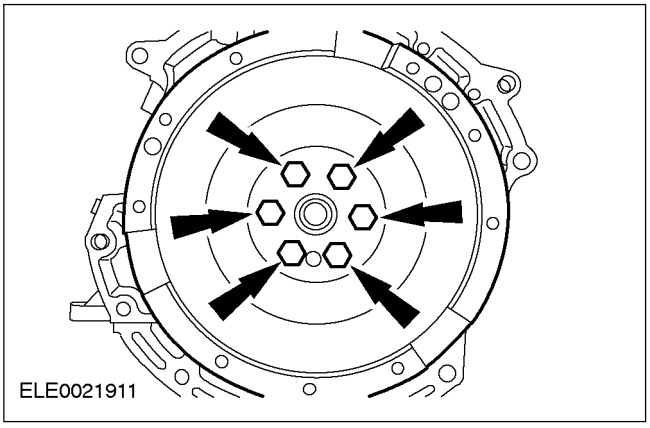
   Install the crankshaft rear oil seal carrier.
   - Tighten the retaining bolts in the sequence shown.



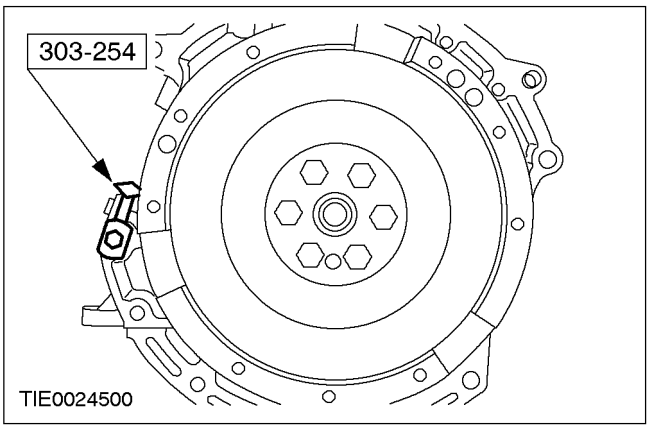
IN-VEHICLE REPAIR (Continued)

2. **NOTE:** Install new flywheel bolts.

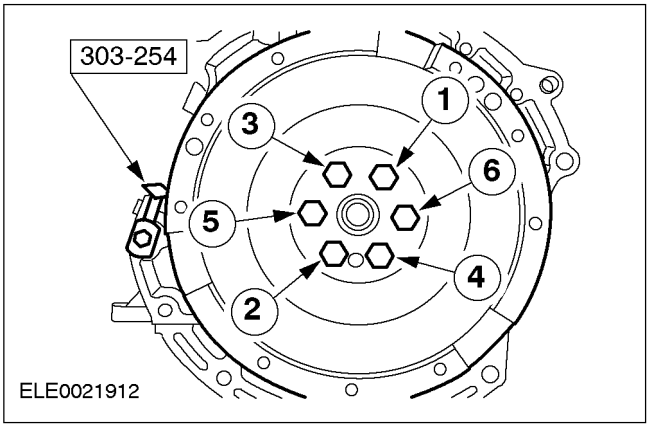
   Install the flywheel.



3. **Using the special tool, lock the flywheel in position.**



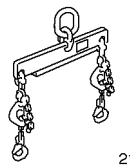
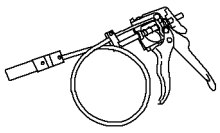
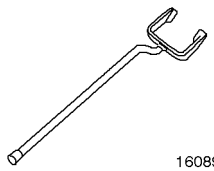
4. **Tighten the flywheel bolts.**
   - Tighten the bolts in the sequence shown in three stages.
   - Stage 1: 50 Nm.
   - Stage 2: 80 Nm.
   - Stage 3: 112 Nm.



5. **Remove the special tool.**
6. **Install the clutch disc and pressure plate.**
7. **Install the oil pan.** **For additional information, refer to Oil Pan in this section.**

REMOVAL

Engine — Vehicles With: Automatic Transaxle

Special Tool(s)	
 21068A	Lifting Bracket, Engine 303-122 (21-068A)
 24003	Remover/Installer, Cooling Hose Clamp 303-397 (24-003)
 16089	Remover, Halfshaft 308-256 (16-089)

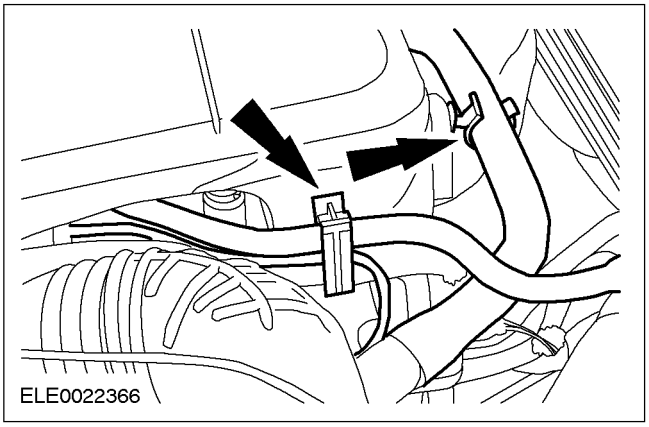
General Equipment
Workshop Table
Engine Hoist

Removal

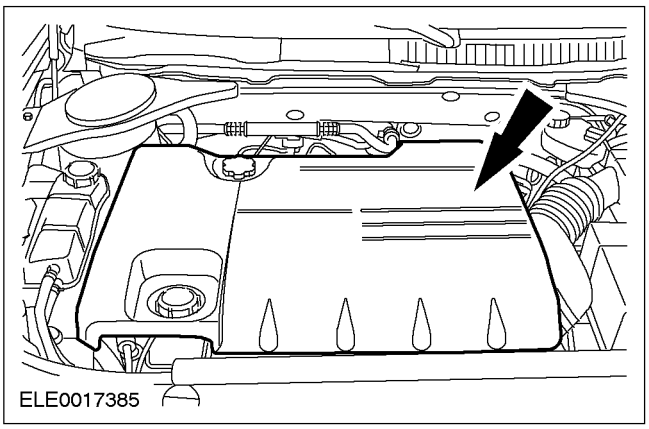
All vehicles

1. **WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.**

   Detach the positive crankcase ventilation (PCV) hose and the vacuum hose from the engine upper cover.


ELE0022366

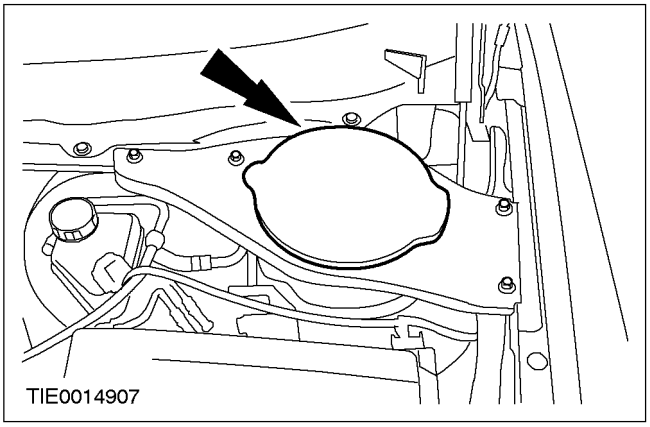
2. **Remove the engine upper cover.**


ELE0017385

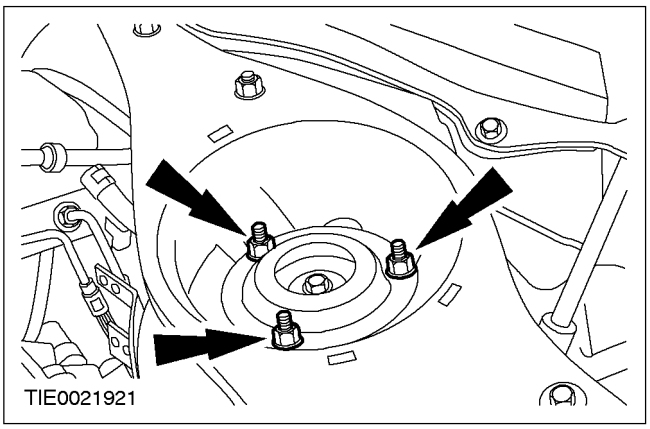
3. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**

REMOVAL (Continued)

4. Remove the strut and spring assembly top mount brace cover on both sides.



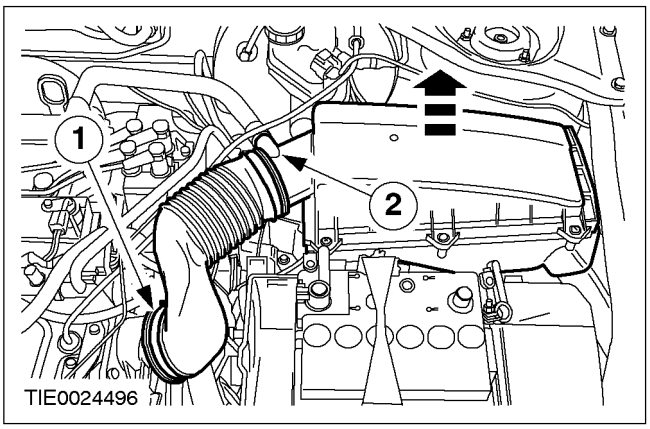
5. Loosen the strut and spring assembly top mount retaining nuts by four turns on both sides.



6. Drain the cooling system. For additional information, refer to Section 303-03.

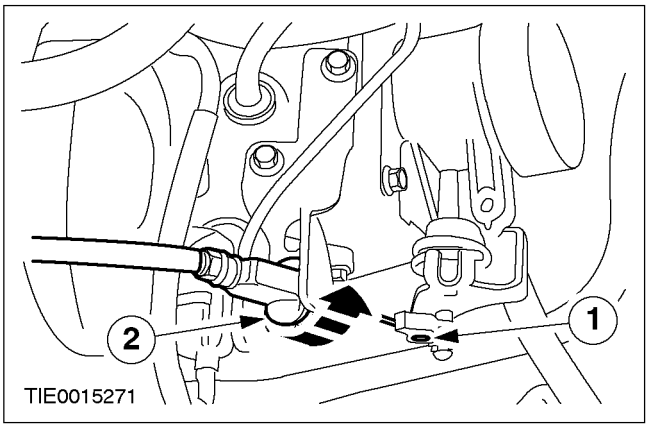
7. Remove the air cleaner housing.

1. Detach the hose clamp from the air cleaner outlet pipe.
2. Disconnect the PCV hose.



8. Detach the accelerator cable from the retaining bracket and position it to one side.

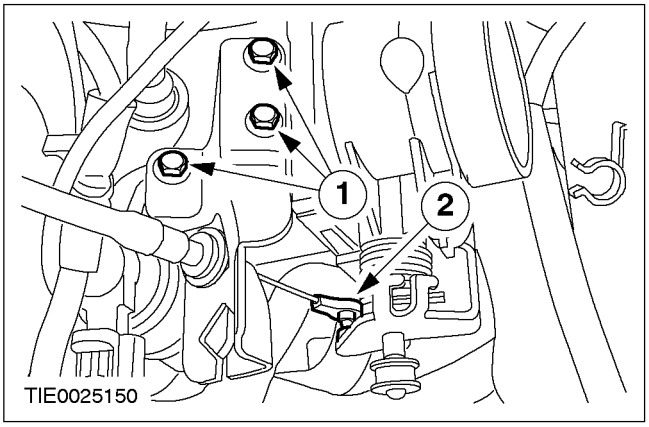
1. Detach the inner cable from the throttle body.
2. Turn the cable out of the bracket.



Vehicles with speed control

9. Detach the speed control cable from the retaining bracket and position it to one side.

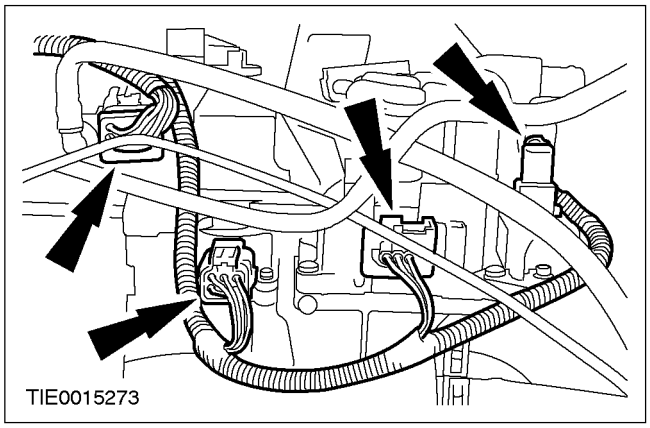
1. Detach the speed control cable retaining bracket from the throttle body.
2. Detach the inner cable from the throttle body.



REMOVAL (Continued)

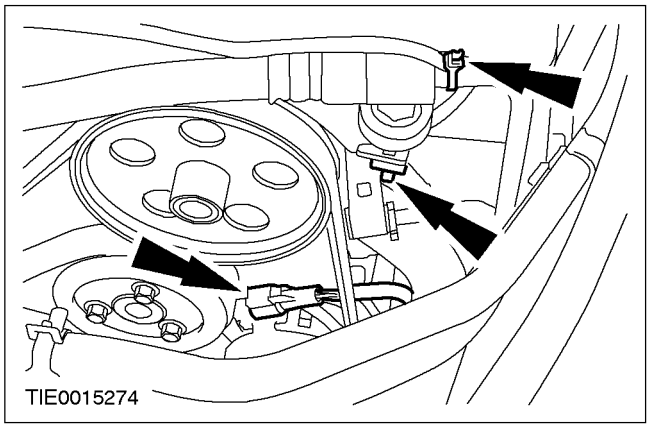
All vehicles

10. Disconnect the wiring harness electrical connectors.

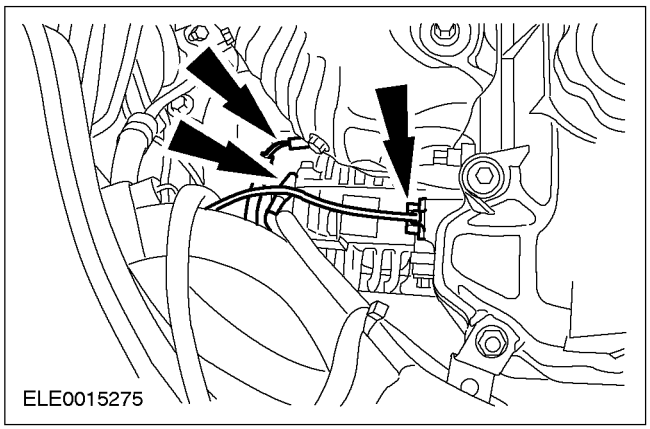


11. Disconnect the engine wiring harness.

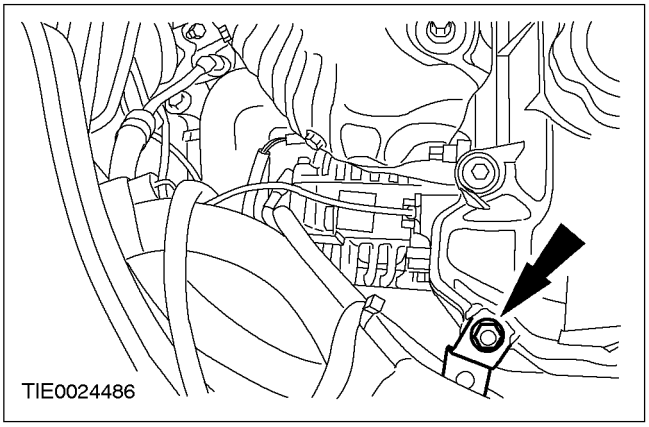
- Remove the clip.



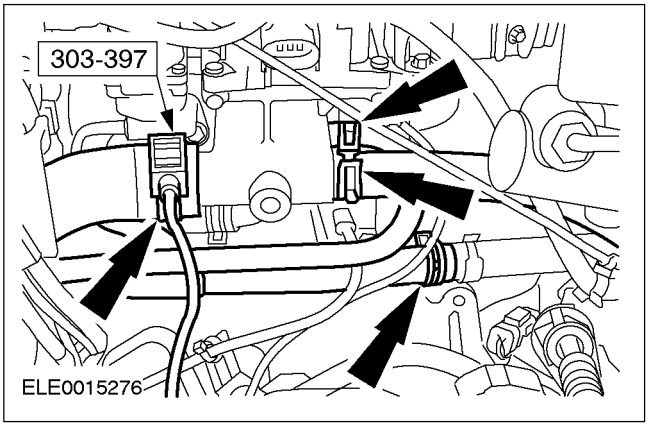
12. Disconnect the generator electrical connectors.



13. Detach the power steering line bracket from the valve cover.

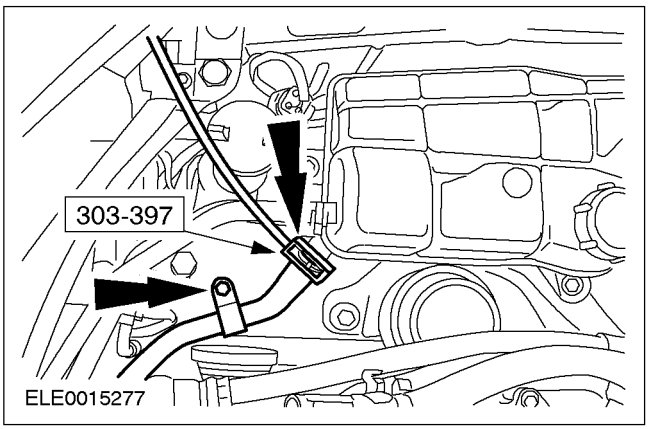


14. Using the special tool, disconnect the coolant hoses.



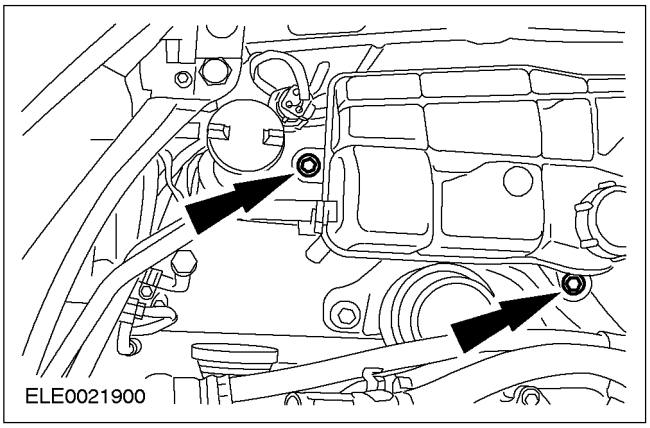
15. Using the special tool, disconnect the coolant hose from the expansion tank.

- Remove the clip.

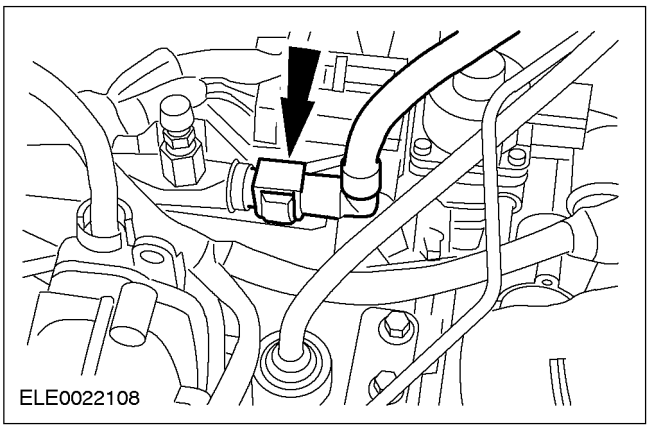


REMOVAL (Continued)

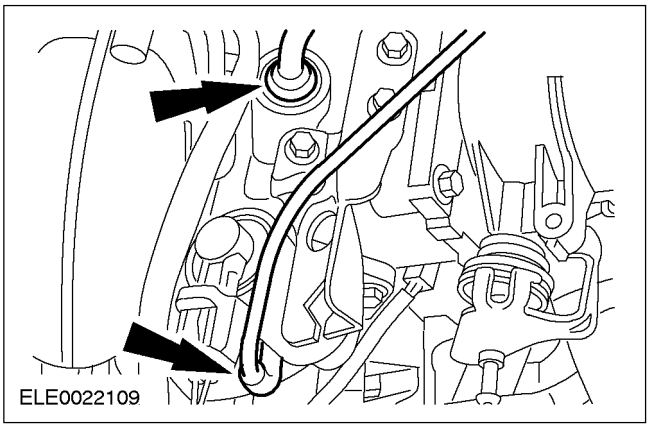
16. Detach the coolant expansion tank from the wheel housing and position it to one side.



17. Disconnect the fuel supply line. For additional information, refer to Section 310-00.

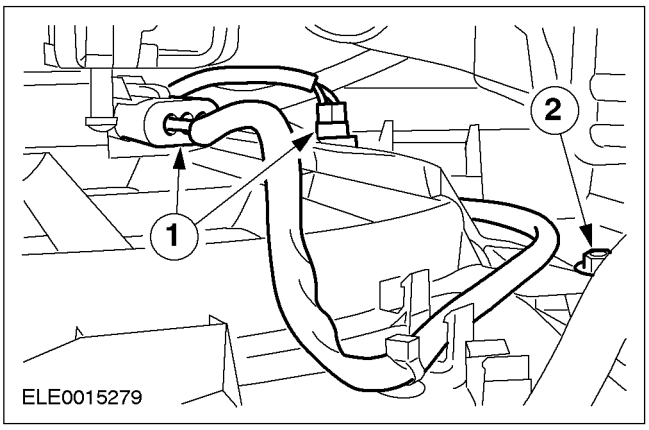


18. Disconnect the vacuum hoses.

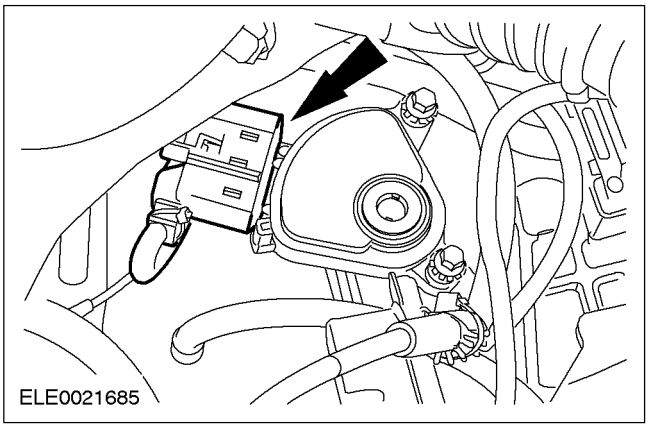


19. Remove the cooling fan motor and shroud.

1. Disconnect the electrical connectors.
2. Remove the nut on both sides (left-hand side shown).

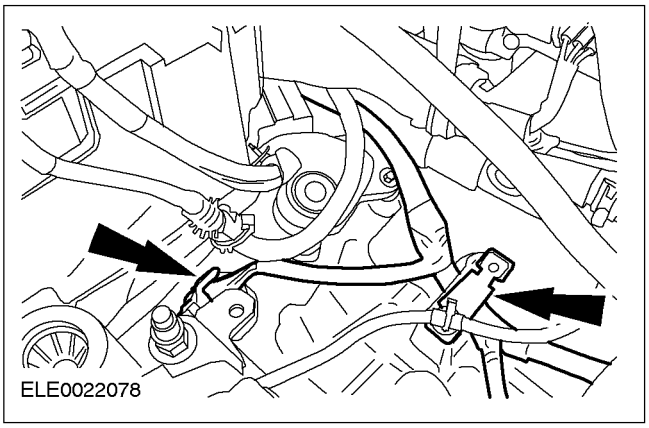


20. Disconnect the transmission range (TR) sensor electrical connector.



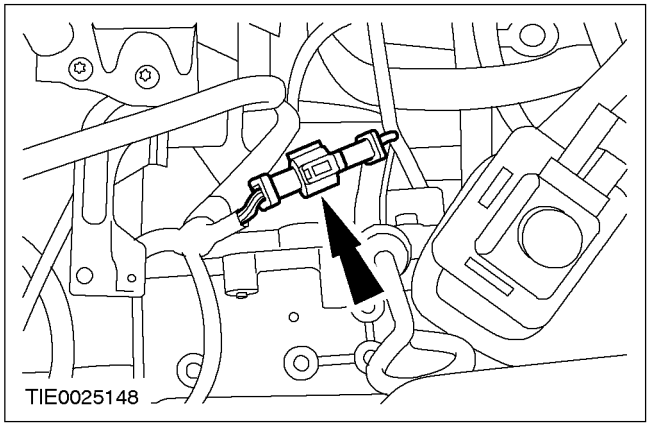
21. Disconnect the automatic transmission control electrical connector.

- Remove the wiring harness retaining clip.
- Remove the cable ties.

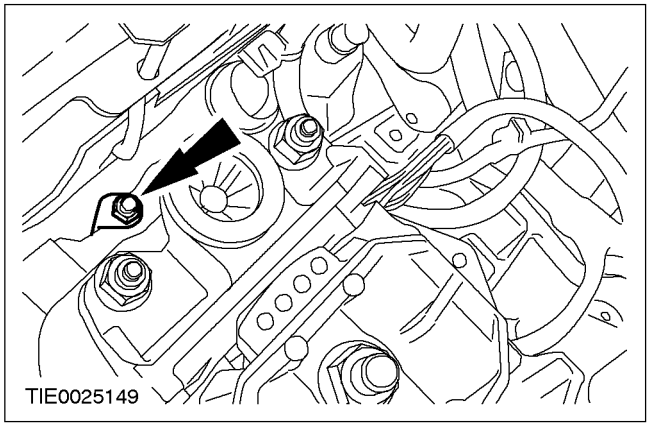


REMOVAL (Continued)

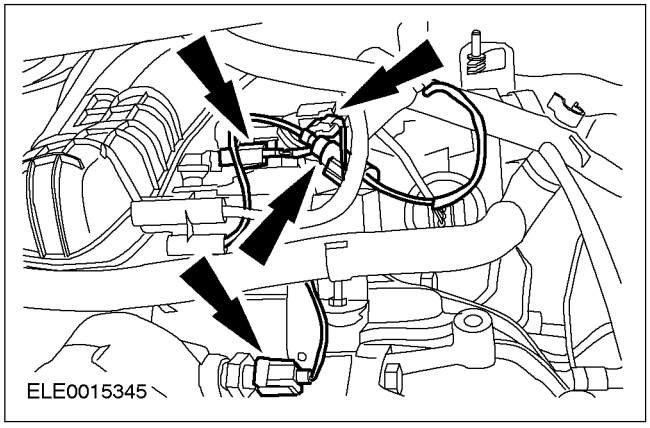
22. **Disconnect the heated oxygen (HO2S) sensor electrical connector.**



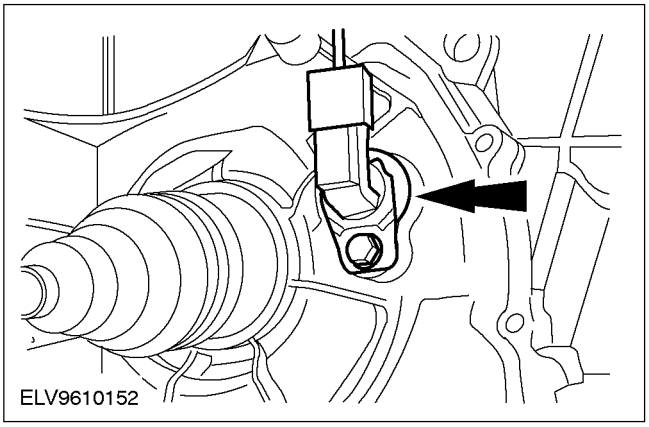
23. **Disconnect the ground cable from the transaxle.**



24. **Remove the subframe. For additional information, refer to Section 502-00.**
25. **Disconnect the wiring harness electrical connectors.**



26. **Disconnect the output shaft speed (OSS) sensor electrical connector.**



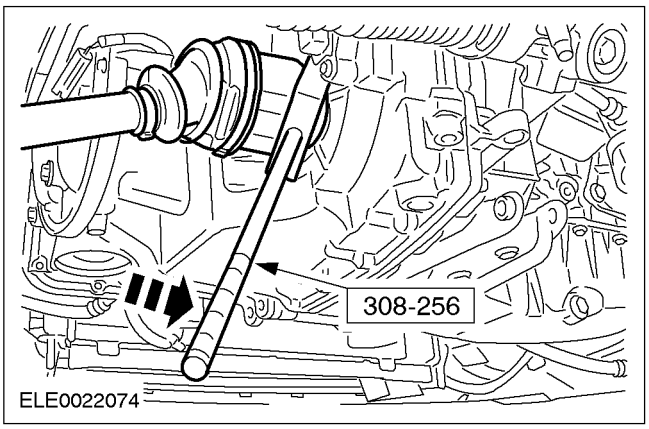
27. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

CAUTION: Do not damage the halfshaft oil seal.

NOTE: Plug the transaxle to prevent oil loss or dirt ingress.

Using the special tool, detach the left-hand halfshaft from the transaxle and secure it to one side.

- Discard the snap ring.



REMOVAL (Continued)

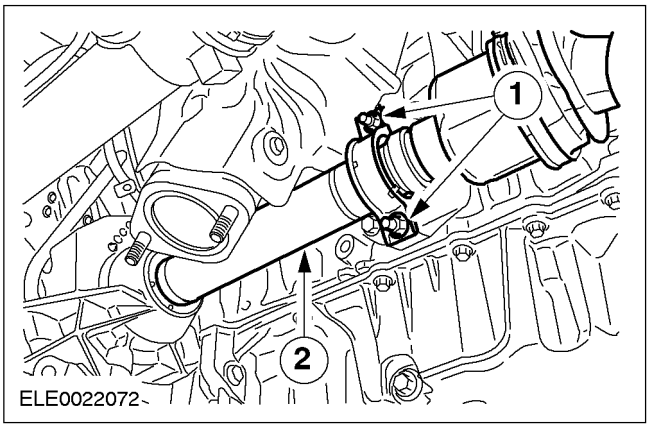
28. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

CAUTION: Do not damage the halfshaft oil seal.

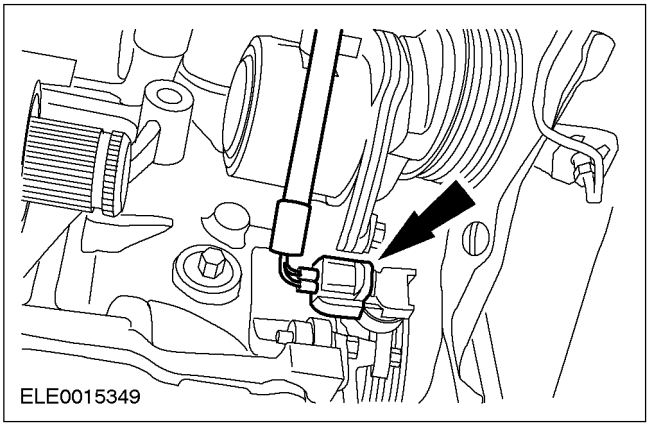
NOTE: Plug the transaxle to prevent oil loss or dirt ingress.

Detach the right-hand halfshaft and the intermediate shaft from the transaxle and secure it to one side.

- Remove and discard the center bearing cap and locknuts.



29. **Remove the accessory drive belt. For additional information, refer to Section 303-05.**
30. **Disconnect the crankshaft position (CKP) sensor electrical connector.**

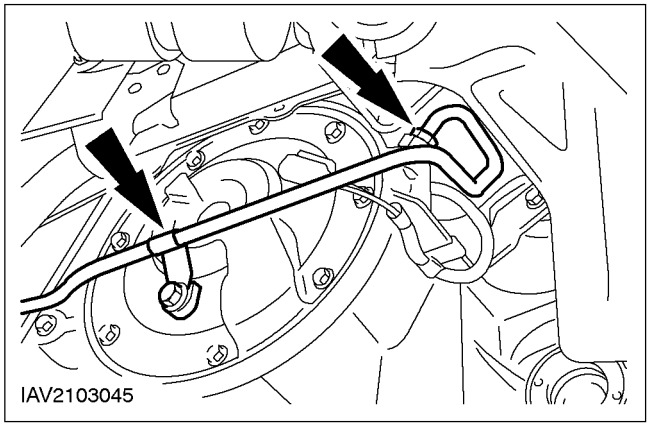


31. **CAUTION: Prevent the fluid pipe adapter from turning using an open-ended wrench, do not remove it from the transaxle housing.**

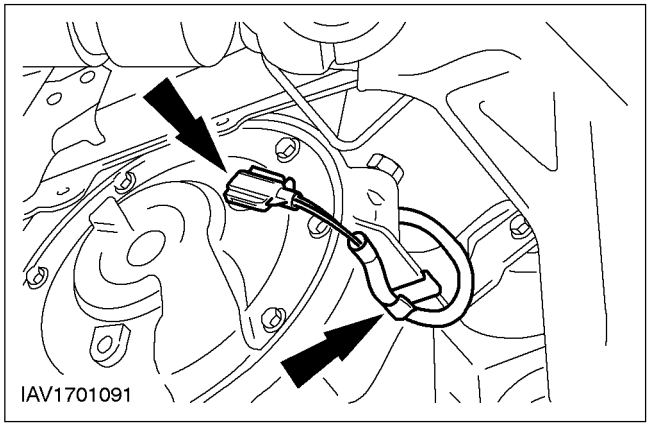
NOTE: Plug the fluid cooler openings to prevent oil loss or dirt ingress.

Detach the fluid cooler pipe from the transaxle.

- Detach the fluid pipe bracket from the transaxle.



32. **Disconnect the turbine shaft speed (TSS) sensor electrical connector.**
    - Remove the cable retaining clip.

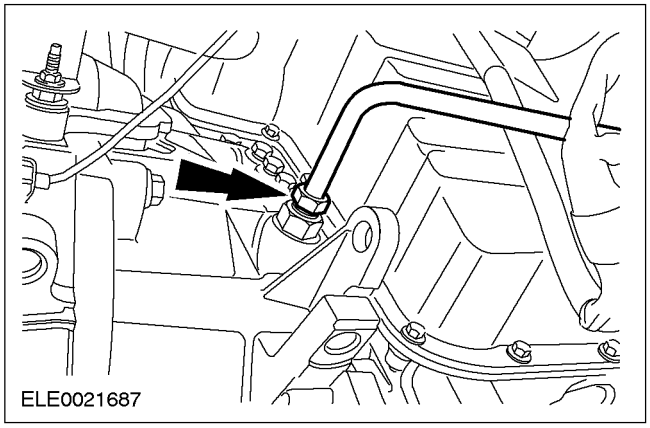


REMOVAL (Continued)

33. **CAUTION: Prevent the fluid pipe adapter from turning using an open-ended wrench, do not remove it from the transaxle housing.**

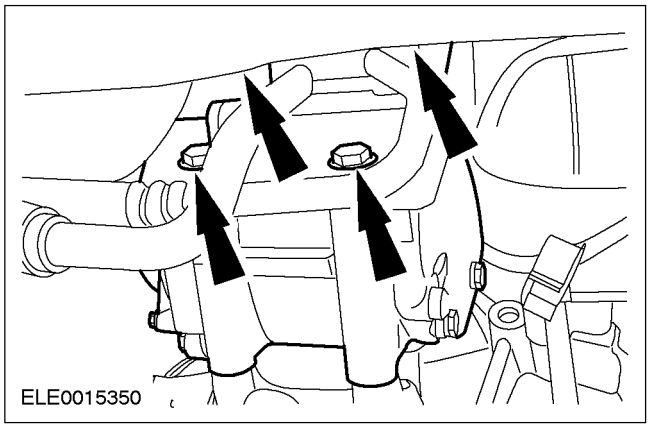
NOTE: Plug the fluid cooler openings to prevent oil loss or dirt ingress.

Detach the fluid cooler return pipe from the transaxle.

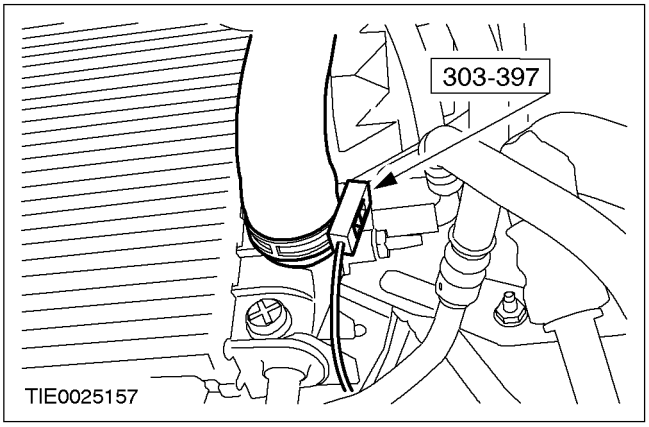


34. **CAUTION: Support the air conditioning (A/C) compressor before removing the retaining bolts and secure it to prevent load being placed on the refrigerant lines.**

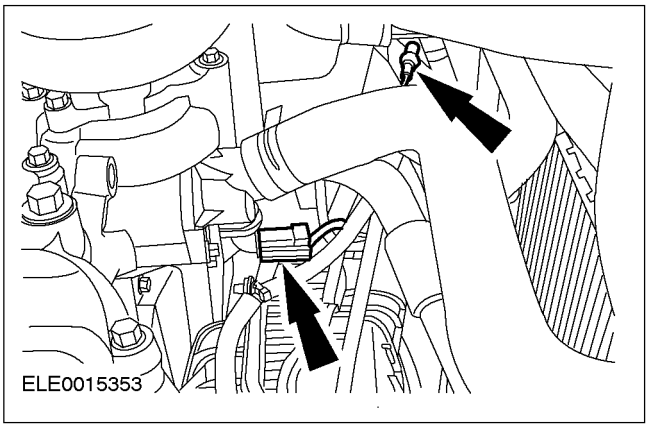
Detach the A/C compressor from the mounting bracket and secure it to one side.



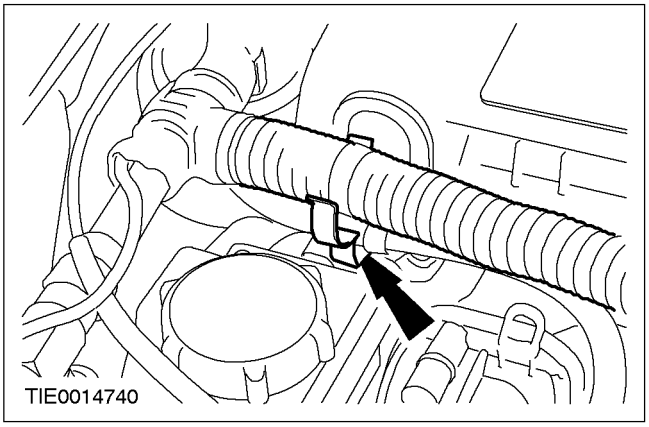
35. **Using the special tool, disconnect the coolant hose from the radiator.**



36. **Disconnect the wiring harness.**

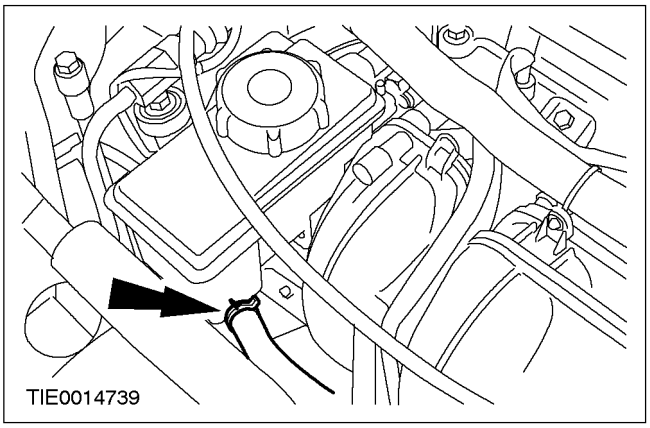


37. **Lower the vehicle.**
38. **Remove the engine wiring harness support bracket.**



REMOVAL (Continued)

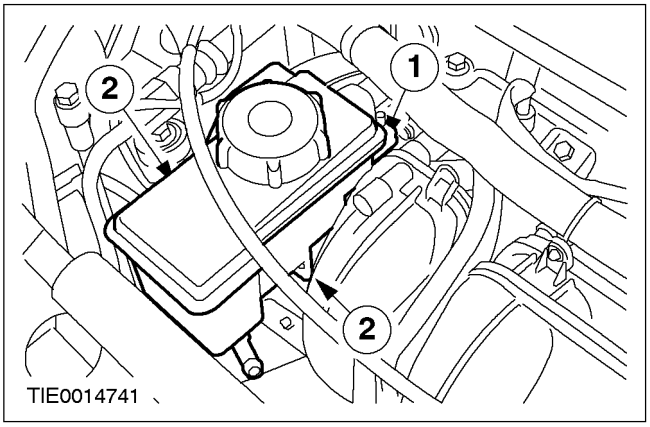
39. **Disconnect the power steering hose from the power steering fluid reservoir.**
    - Allow the fluid to drain into a suitable container.



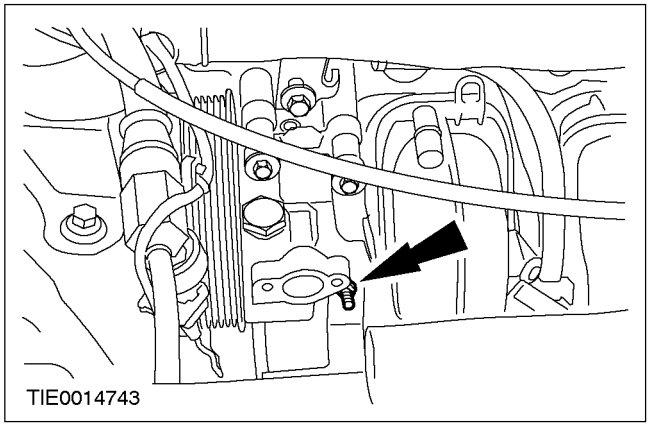
40. **NOTE:** The power steering fluid reservoir contains a filter. If the power steering fluid is contaminated a new power steering fluid reservoir must be installed.

    Remove the power steering fluid reservoir.

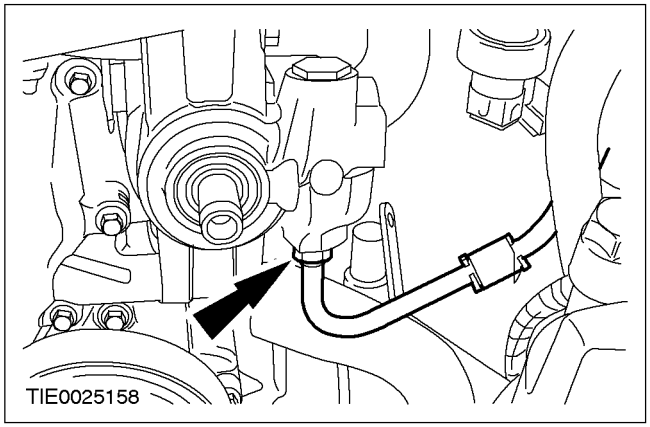
    1. Remove the rear retaining stud.
    2. Remove the front retaining bolts.
    - Discard the O-ring seals.



41. **Remove the power steering line support retaining nut.**



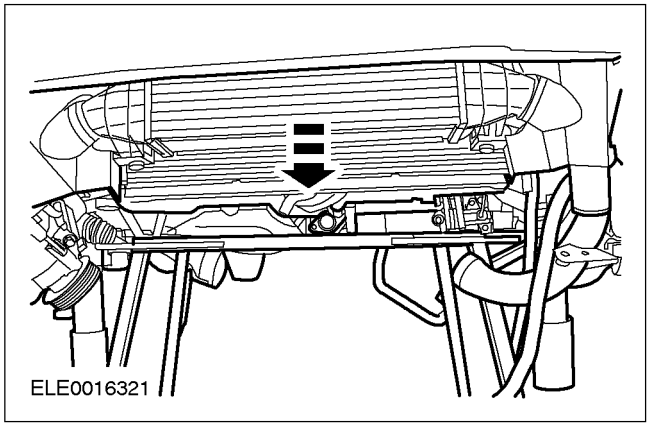
42. **Remove the power steering pump pulley. For additional information, refer to Section 211-02.**
43. **Disconnect the power steering line from the power steering pump.**



44. **Raise and support the vehicle. For additional information, refer to Section 100-02.**

REMOVAL (Continued)

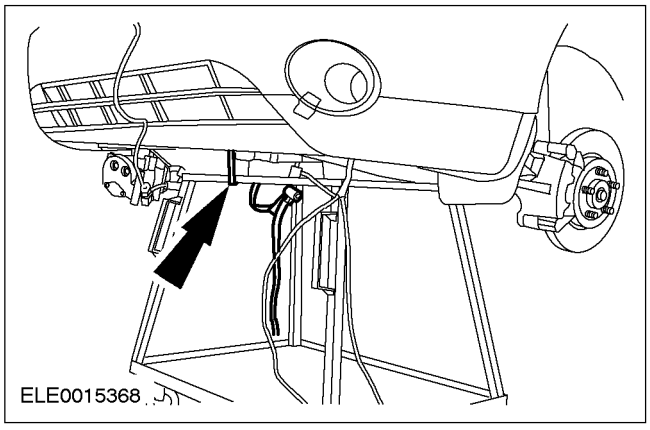
45. Position the workshop table under the vehicle and carefully lower the vehicle, until the engine and transaxle assembly is in the correct position to remove the engine mounts.



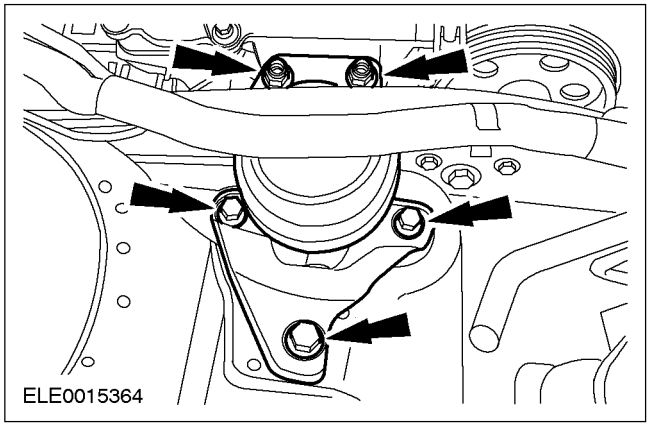
46. ⚠ CAUTION: Do not support the oil pan.

NOTE: Using suitable securing straps, secure the engine and the transaxle on a workshop table.

Using suitable wooden blocks, support the engine and transaxle assembly.

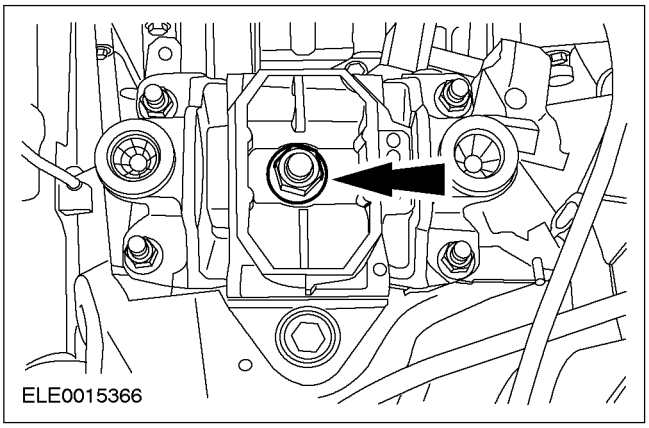


47. Remove the engine front mount.



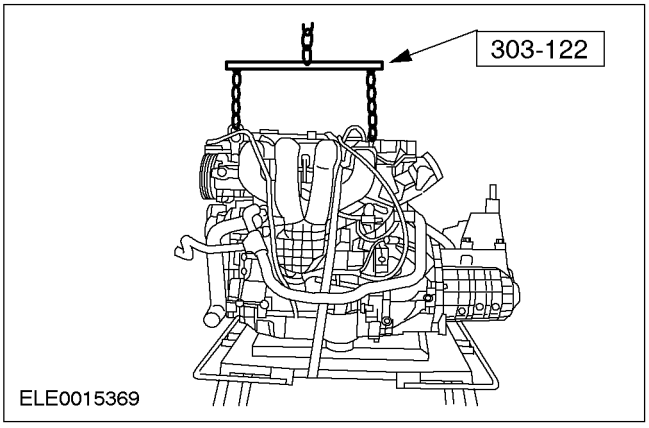
48. Remove the engine rear mount retaining nut.

- Discard the nut.

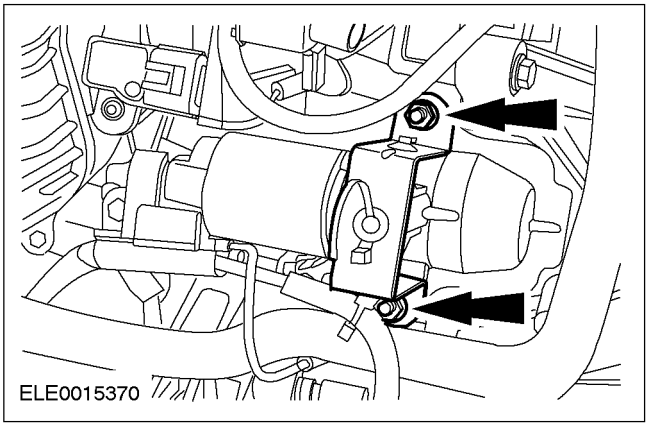


49. Raise and support the vehicle and remove the engine and transaxle assembly. For additional information, refer to Section 100-02.

50. Using a suitable engine hoist support the engine and transaxle assembly and remove the securing straps.



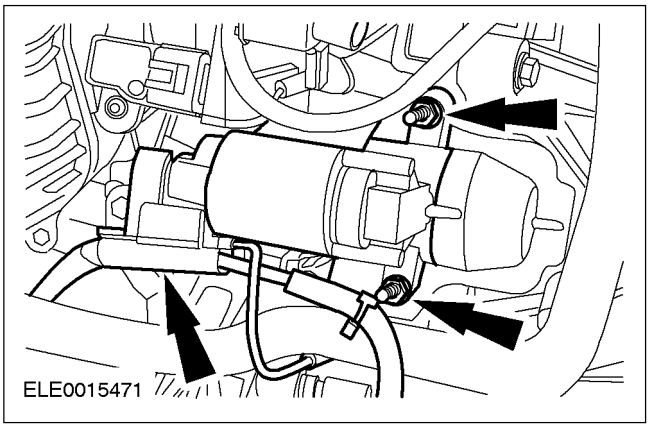
51. Remove the wiring harness retaining bracket.



REMOVAL (Continued)

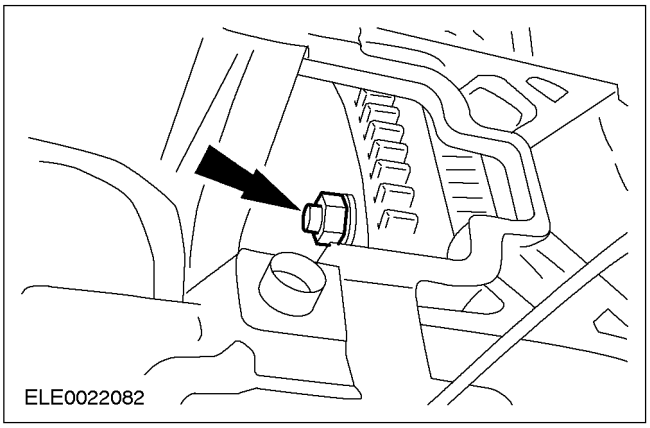
52. Remove the starter motor.

- Detach the wiring harness from the retaining bracket.

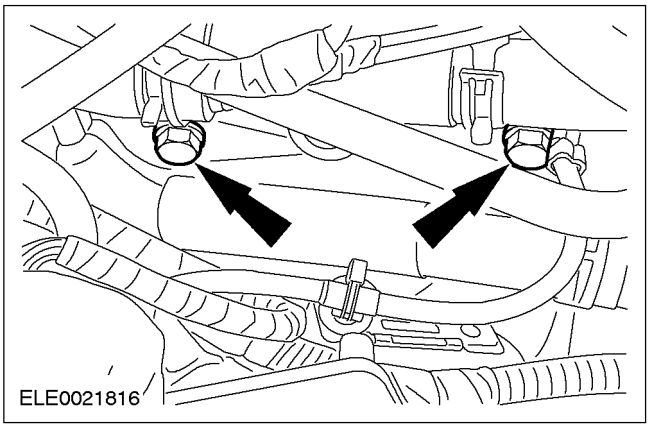


53. Remove the rubber cover and the four torque converter retaining nuts.

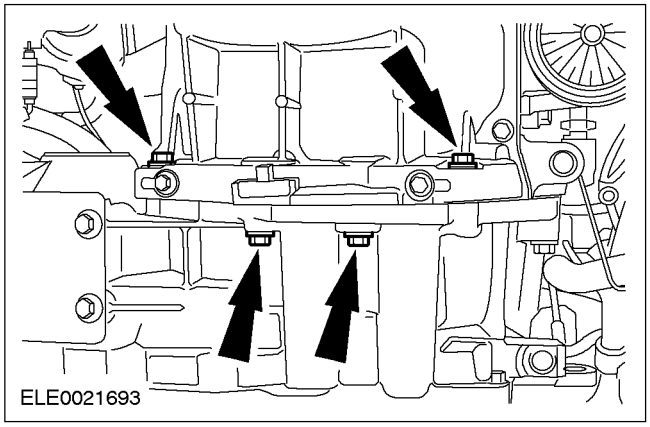
- Rotate the engine to gain access to the nuts.
- Discard the nuts.



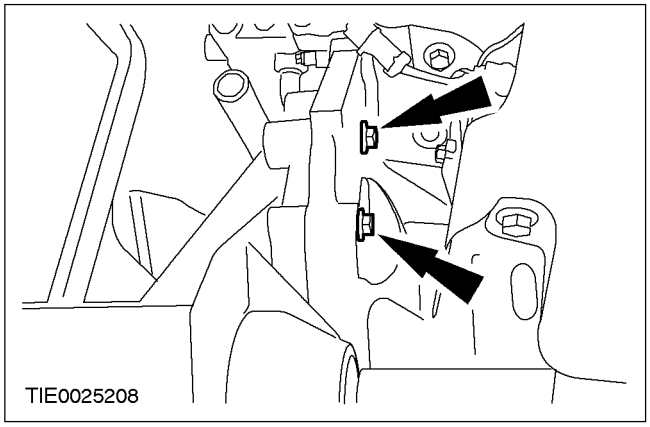
54. Remove the transaxle upper retaining bolts.



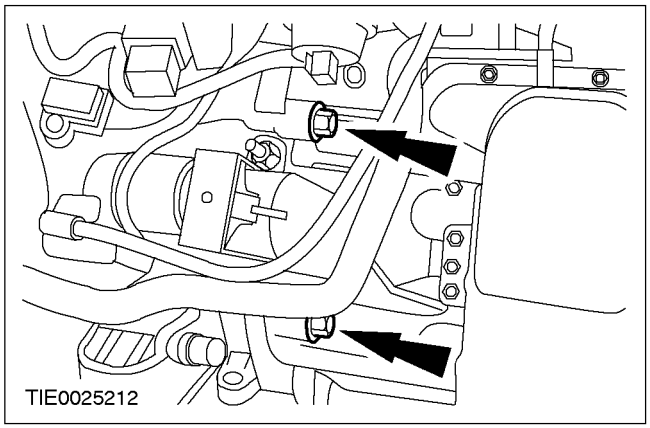
55. Remove the transaxle lower retaining bolts.



56. Remove the transaxle right-hand retaining bolts.



57. Remove the transaxle left-hand retaining bolts.

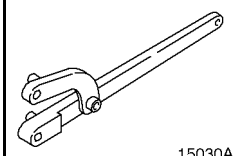
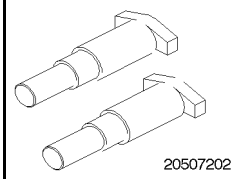
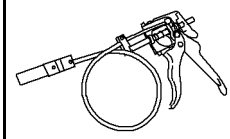
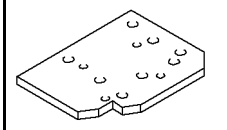
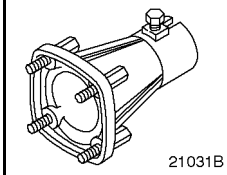
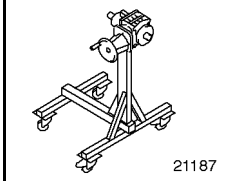
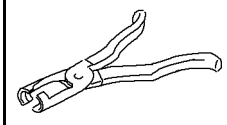
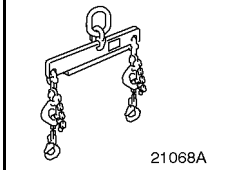


58. ⚠ CAUTION: Make sure that the torque converter remains in the transaxle.

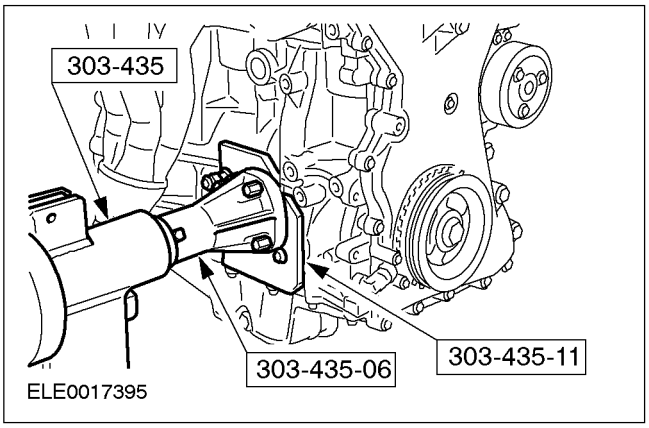
Remove the transaxle from the engine.

DISASSEMBLY

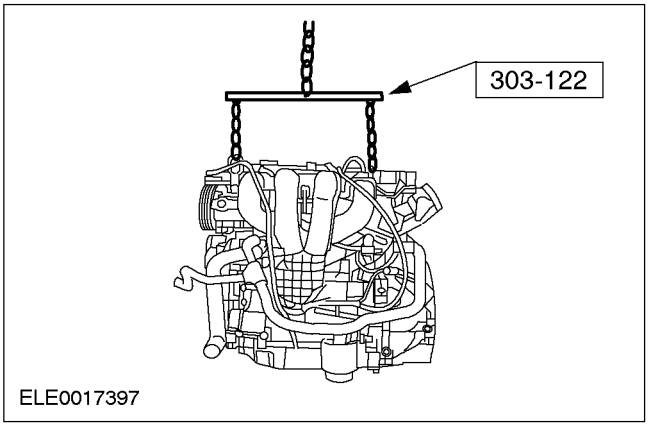
Engine (21 134 8)

Special Tool(s)	
 15030A	Flange Holding Wrench, Universal 205-072 (15-030A)
 20507202	Adaptor for 205-072 205-072-02 (15-030A-02)
 24003	Remover/Installer, Cooling Hose Clamp 303-397 (24-003)
 PZ21146C	Mounting Plate for 303-435-06 303-435-11 (21-146C)
 21031B	Mounting Bracket for 303-435 303-435-06 (21-031B)
 21187	Mounting Stand 303-435 (21-187)
 PZ21211	Pliers, Valve Stem Oil Seal 303-508 (21-211)
 21068A	Lifting Bracket, Engine 303-122 (21-068A)

1. Using the special tools, mount the engine to the mounting stand.

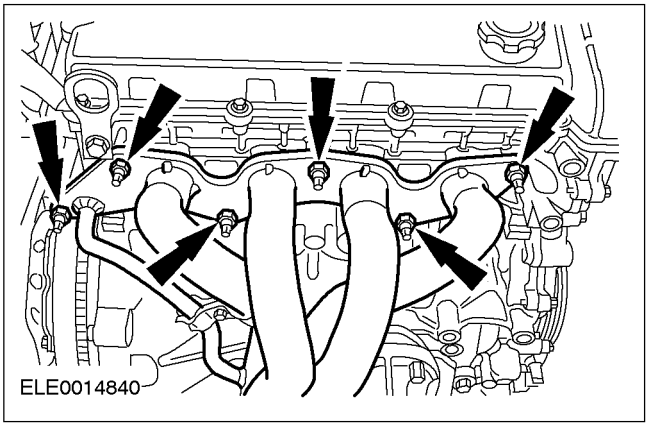


2. Remove the special tool.



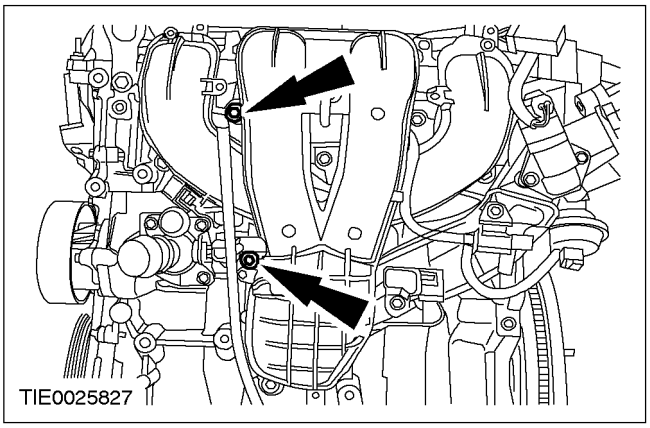
3. Remove the exhaust manifold.

- Discard the gasket.

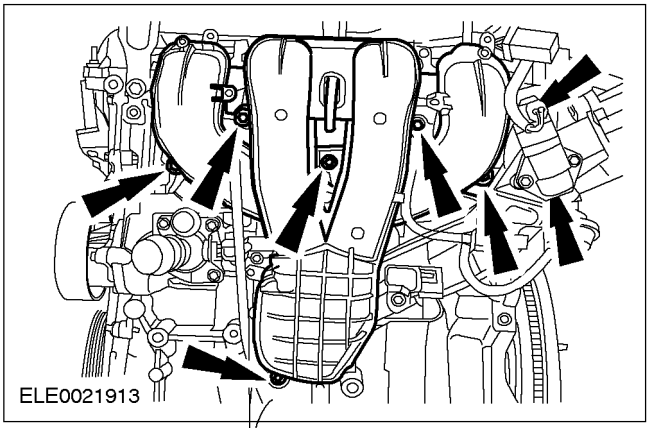


DISASSEMBLY (Continued)

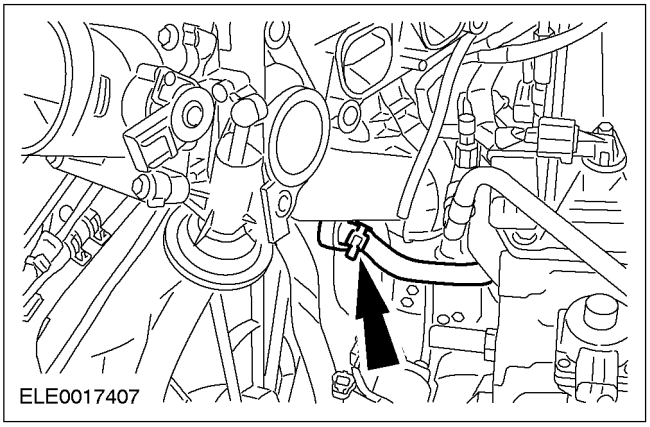
4. Remove the oil level indicator tube.



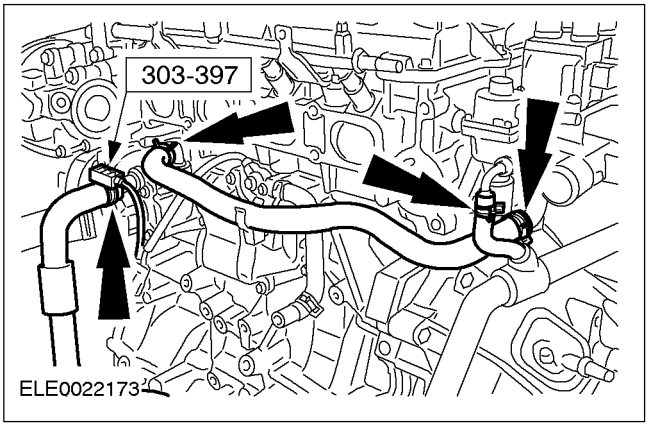
5. Remove the intake manifold.



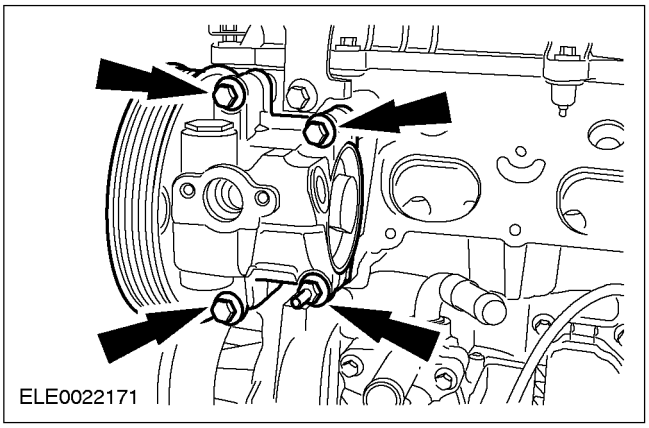
6. Disconnect the positive crankcase ventilation hose (PCV) from the intake manifold.



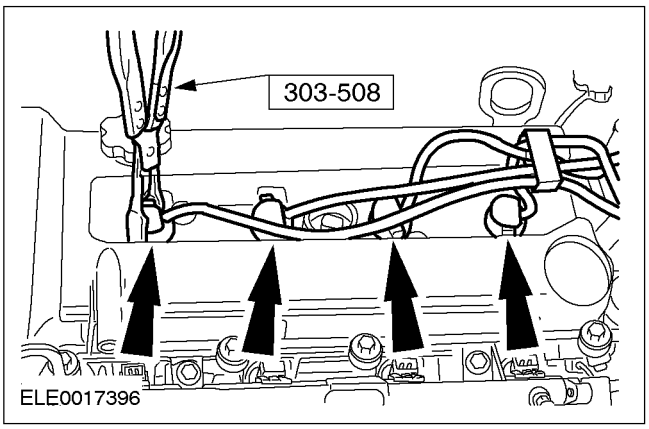
7. Using the special tool, disconnect the coolant hoses.



8. Remove the power steering pump.

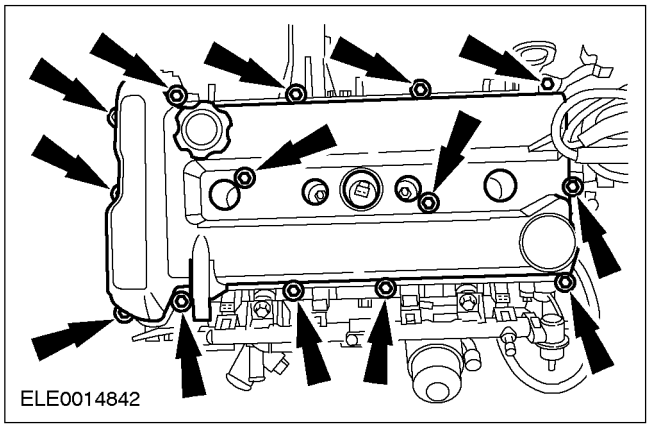


9. Using the special tool, disconnect the spark plug electrical connectors.

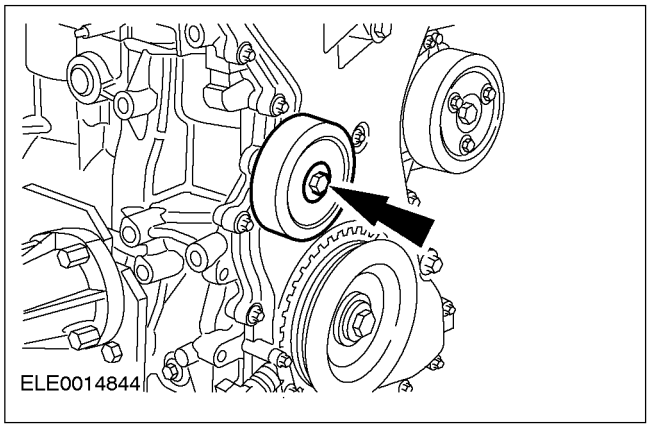


DISASSEMBLY (Continued)

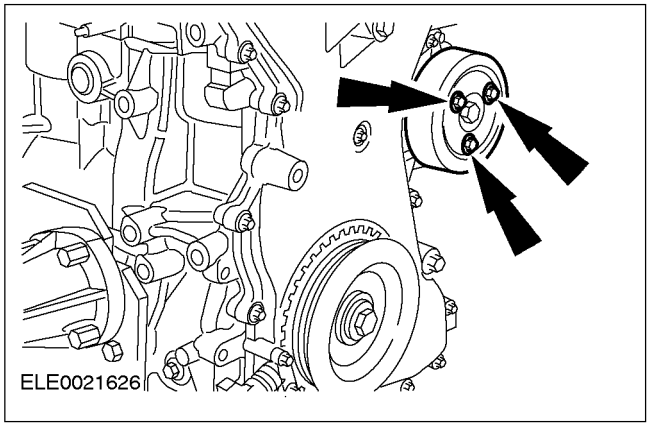
10. Remove the valve cover.



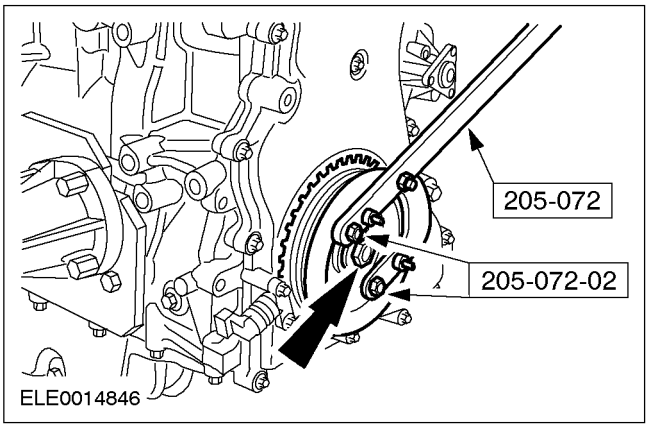
11. Remove the accessory drive belt idler pulley.



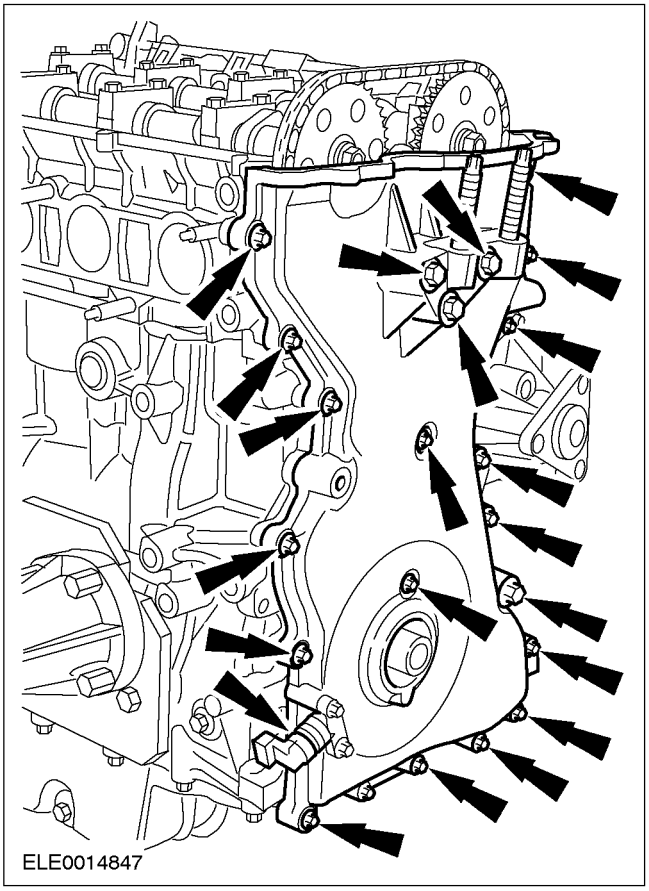
12. Remove the water pump pulley.



13. Using the special tools, prevent the crankshaft pulley from rotating and remove the crankshaft pulley.



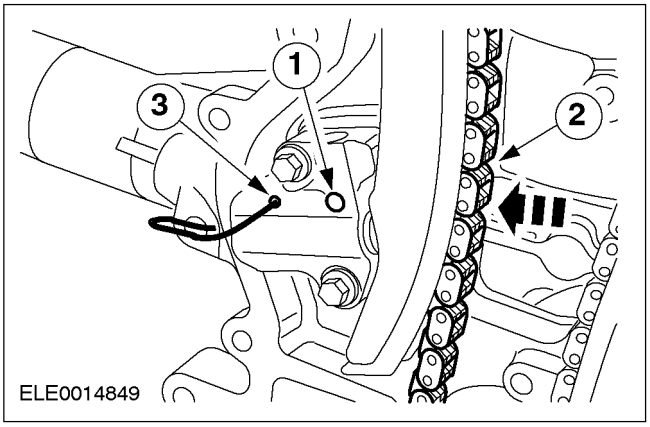
14. Remove the engine front cover.



DISASSEMBLY (Continued)

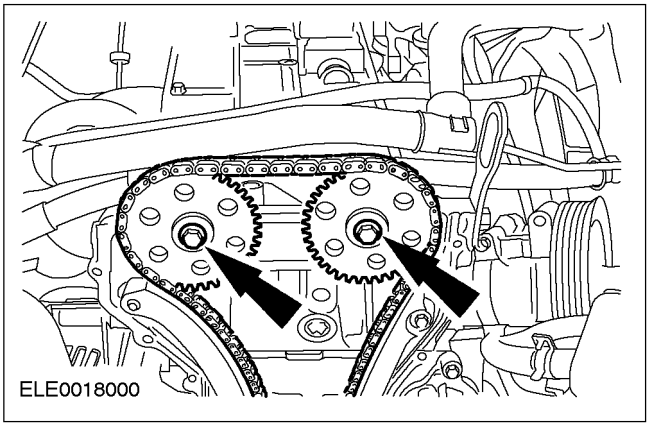
15. Detension the timing chain.

1. Unlock the timing chain tensioner ratchet.
2. Apply pressure to the timing chain guide.
3. Fix the timing chain tensioner with a suitable pin punch.

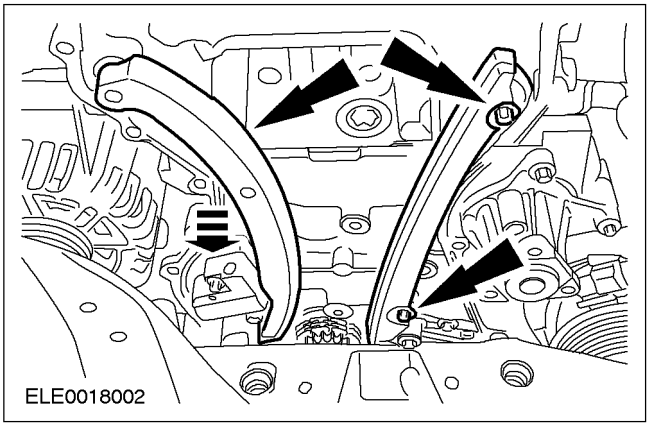


16. NOTE: Hold each camshaft by the hexagon with an open-ended wrench to stop it from turning.

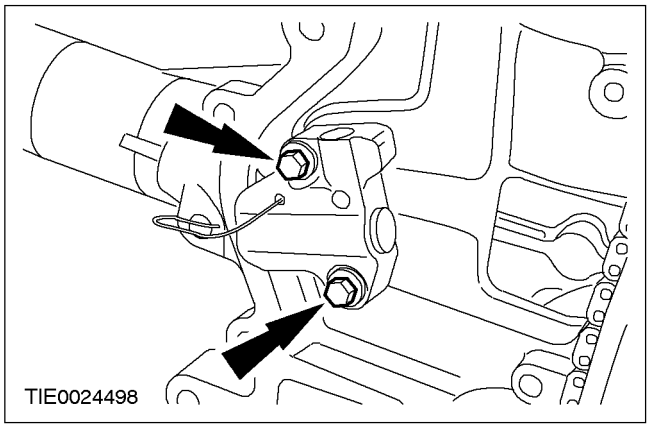
Remove the camshaft sprockets and the timing chain.



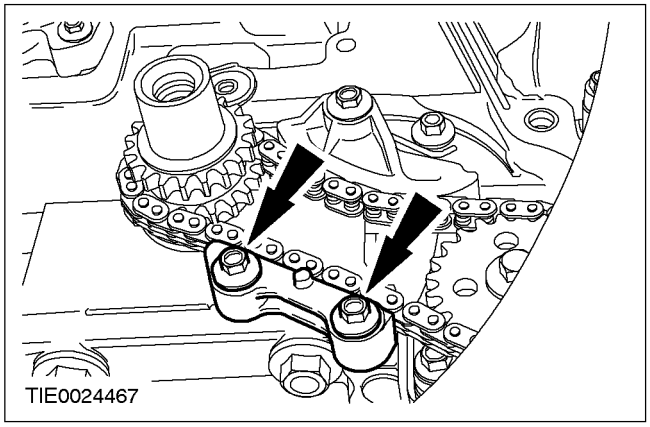
17. Remove the chain guides.



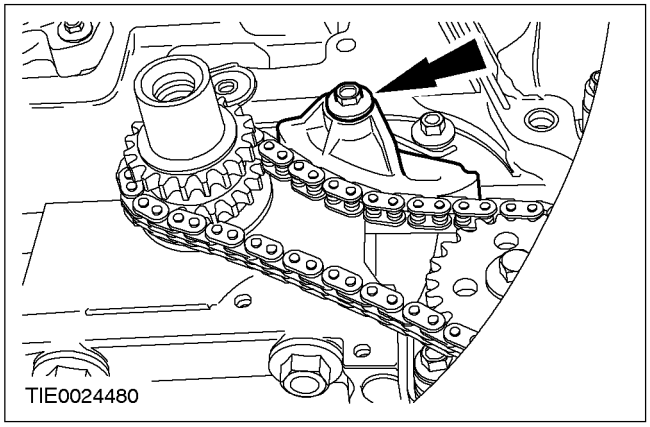
18. Remove the chain tensioner.



19. Remove the oil pump chain guide.

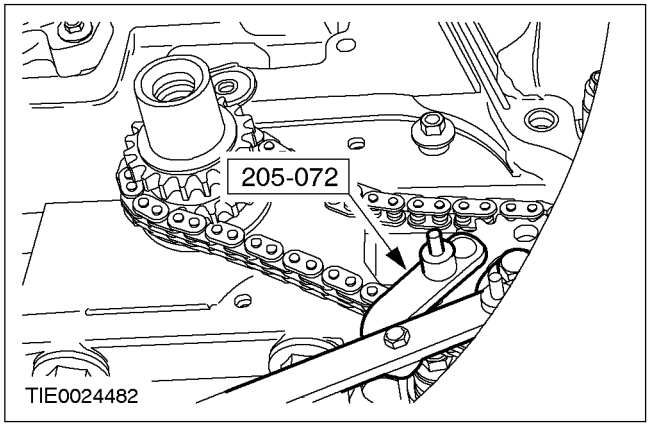


20. Remove the oil pump chain tensioner.



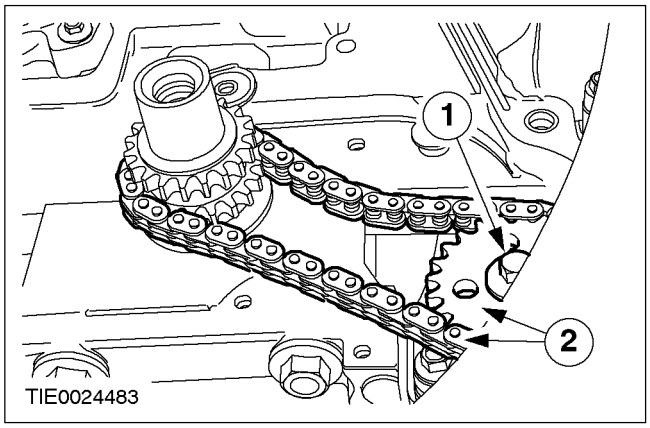
DISASSEMBLY (Continued)

21. Using the special tool, loosen the oil pump sprocket retaining bolt.

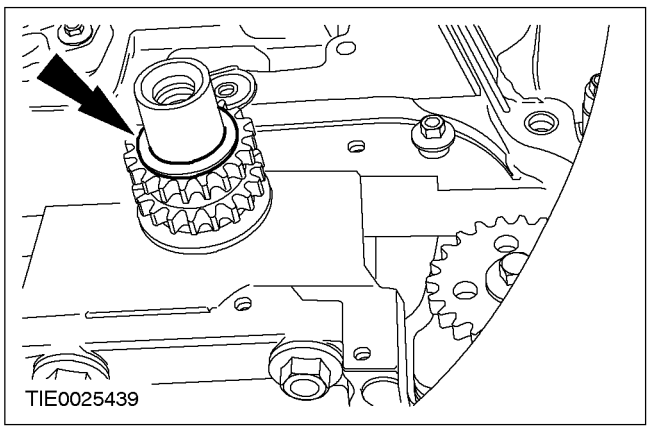


22. Remove the oil pump chain.

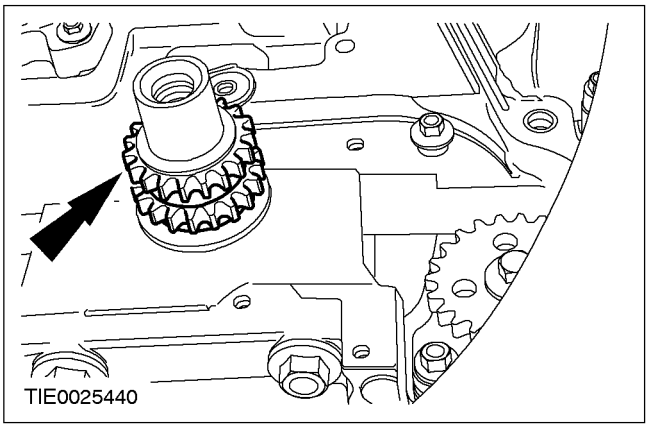
1. Remove the oil pump sprocket retaining bolt.
2. Remove the oil pump chain and the oil pump sprocket.



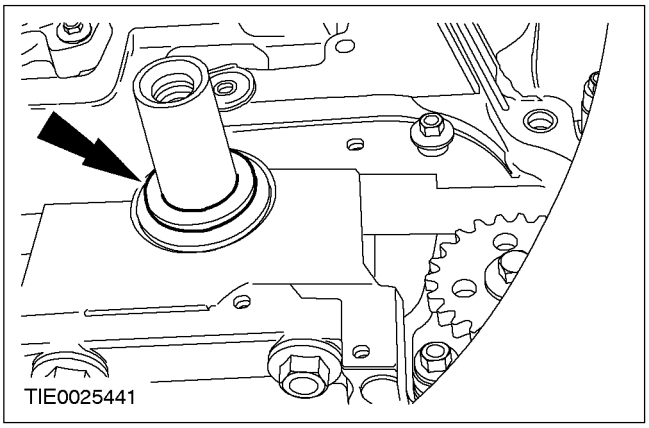
23. Remove the front friction washer (if equipped).



24. Remove the crankshaft sprocket.



25. Remove the rear friction washer (if equipped).

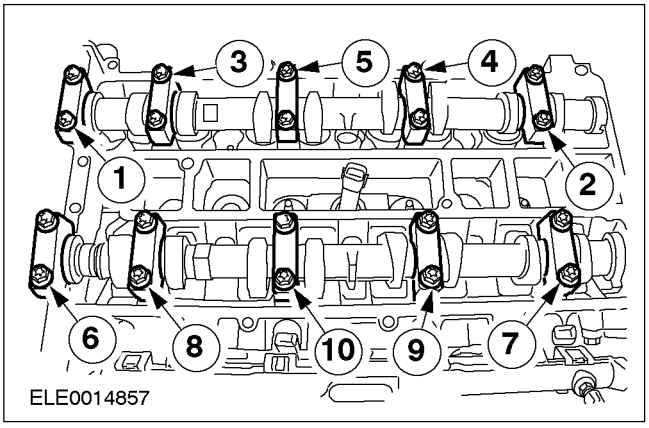


26. ⚠ CAUTION: Remove the camshaft bearing caps in the sequence shown.

NOTE: Working in several stages, release each camshaft bearing cap retaining bolt two turns at a time.

Remove the camshaft bearing caps.

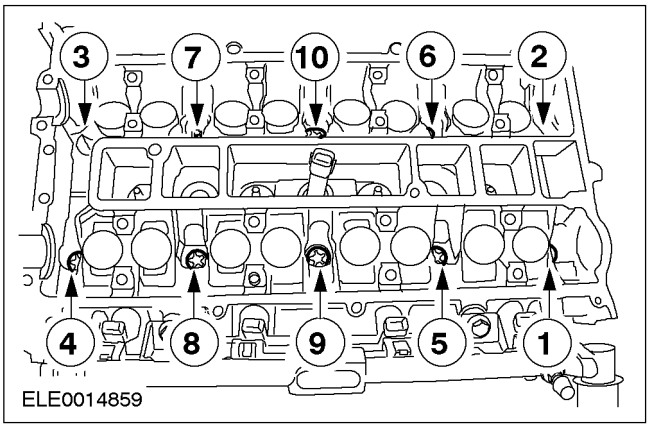
- Remove the camshafts.
- Remove the valve tappets.



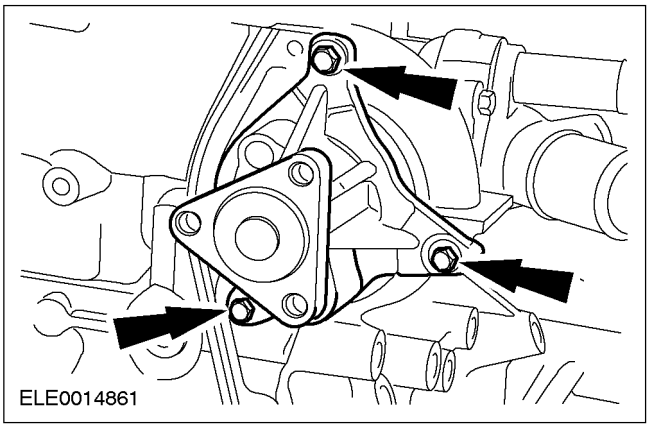
DISASSEMBLY (Continued)

27. **CAUTION: Remove the cylinder head bolts in the sequence shown.**

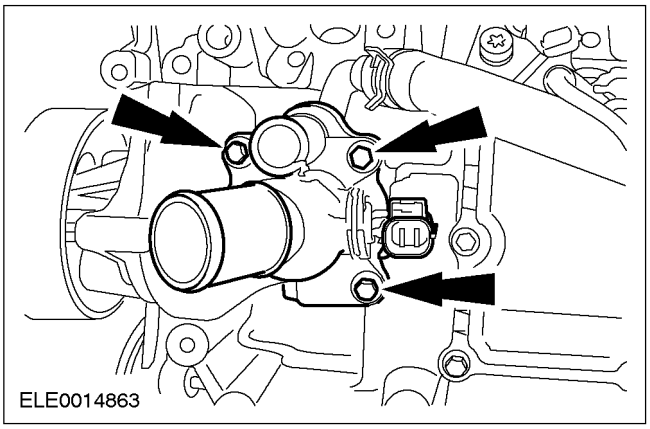
    Remove the cylinder head.
    - Discard the gasket.



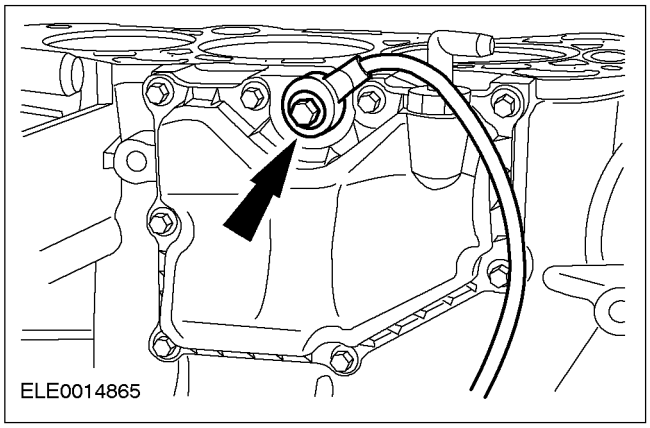
28. **Remove the water pump.**
    - Discard the O-ring.



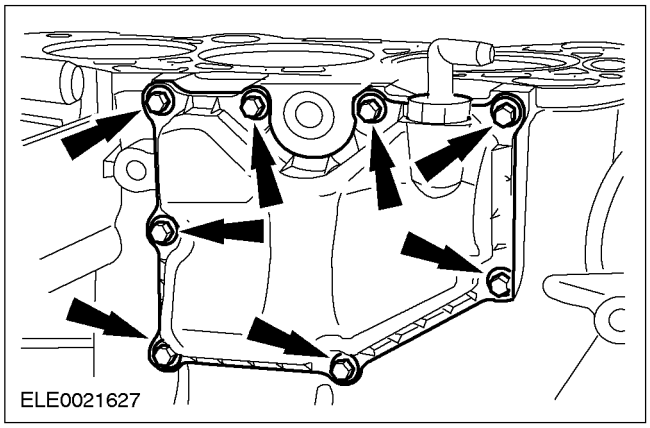
29. **Remove the thermostat housing.**
    - Discard the gasket.



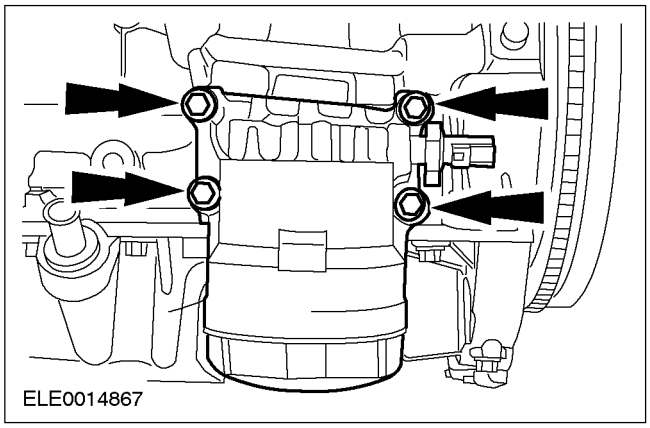
30. **Remove the knock sensor (KS).**



31. **Remove the crankcase ventilation oil separator.**



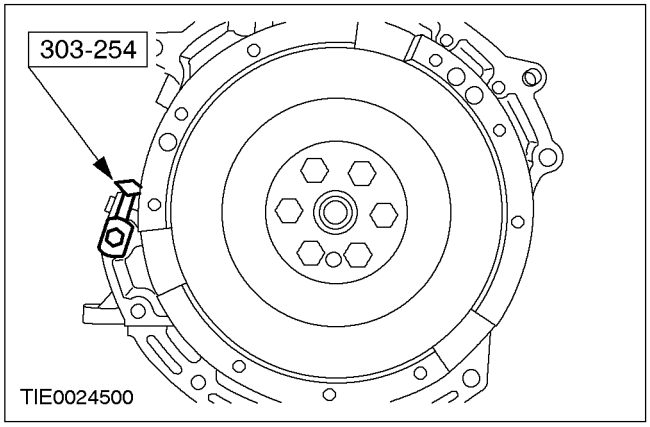
32. **Remove the oil filter adaptor.**
    - Discard the gasket.



33. **Remove the clutch disc and pressure plate.**

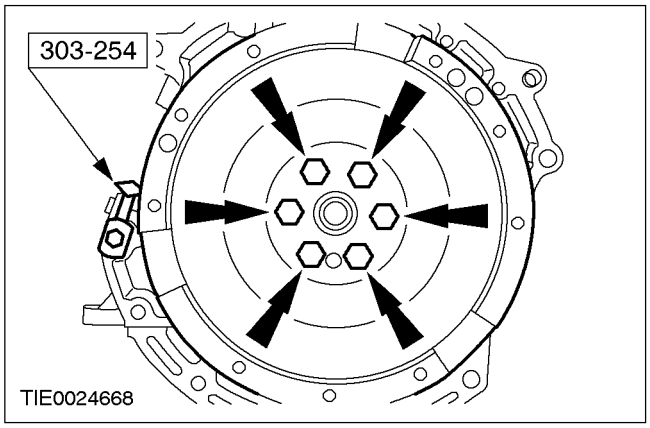
DISASSEMBLY (Continued)

34. Using the special tool, lock the flywheel in position.

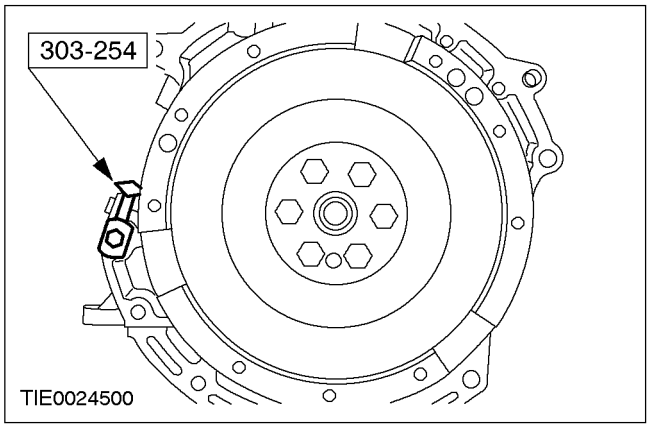


35. Remove the flywheel.

- Discard the bolts.



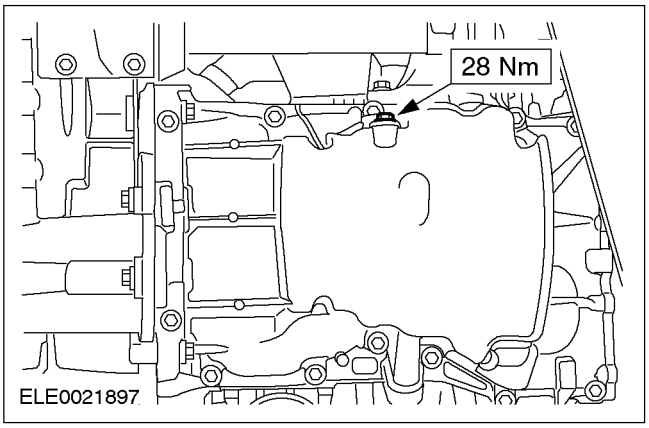
36. Remove the special tool.



37. NOTE: Inspect the oil pan drain plug seal for damage. Install a new drain plug and seal if required.

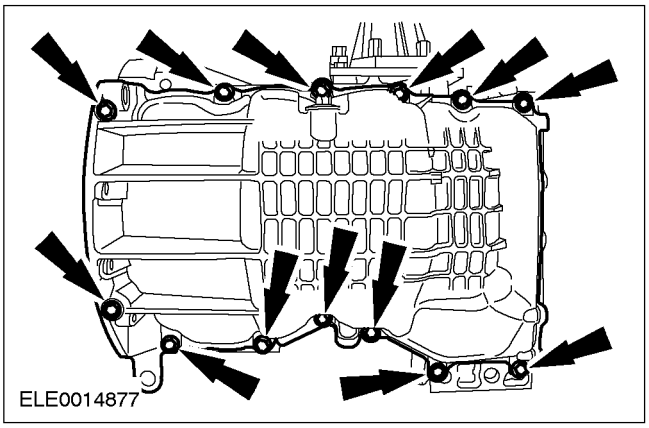
Drain the engine oil.

- Allow the oil to drain into a suitable container.
- Install the drain plug.



38. NOTE: Remove the oil pan by pulling it downwards to prevent oil deposits or abraded particles from entering the engine.

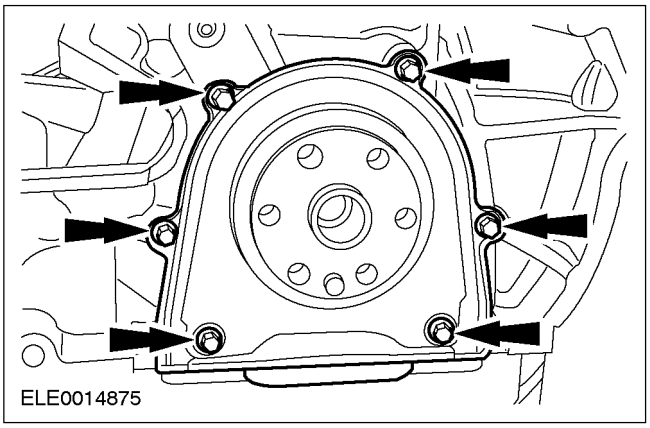
Remove the oil pan.



DISASSEMBLY (Continued)

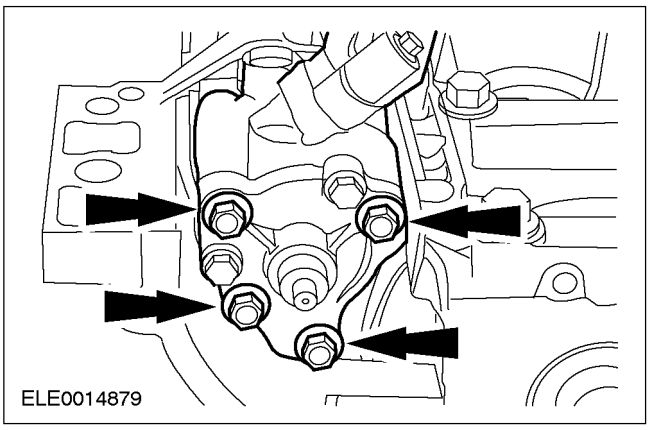
39. Remove the crankshaft rear oil seal carrier.

- Discard the oil seal carrier.



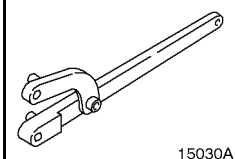
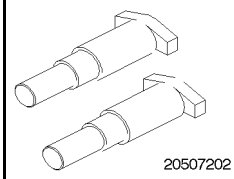
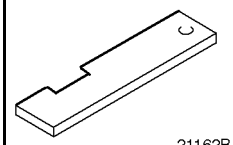
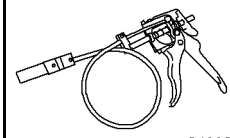
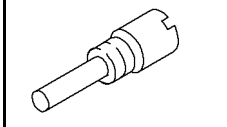
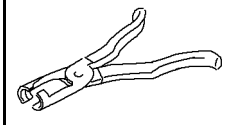
40. Remove the oil pump.

- Discard the gasket.



ASSEMBLY

Engine (21 134 8)

Special Tool(s)	
 15030A	Flange holding wrench, universal 205-072 (15-030A)
 20507202	Adaptor for 205-072 205-072-02 (15-030A-02)
 21068A	Lifting Bracket, Engine 303-122 (21-068A)
 21162B	Timing Plate, Camshaft Alignment 303-376 (21-162B)
 24003	Remover/Installer, Cooling Hose Clamp 303-397 (24-003)
 PZ21210	Timing Peg, Crankshaft TDC 303-507 (21-210)
 PZ21211	Pliers, Valve Stem Oil Seal 303-508 (21-211)

General Equipment
Engine hoist
M6 x 18 mm bolt
Straight edge

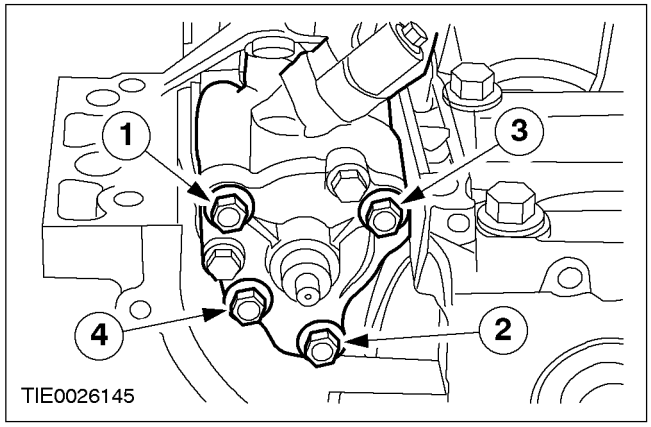
Name	Specification
Silicone sealant	WSE-M4G323-A6
Hypoid oil	SQM-2C9002-AA
Loctite7070	

Assembly

1. NOTE: Install a new oil pump gasket.

Install the oil pump.

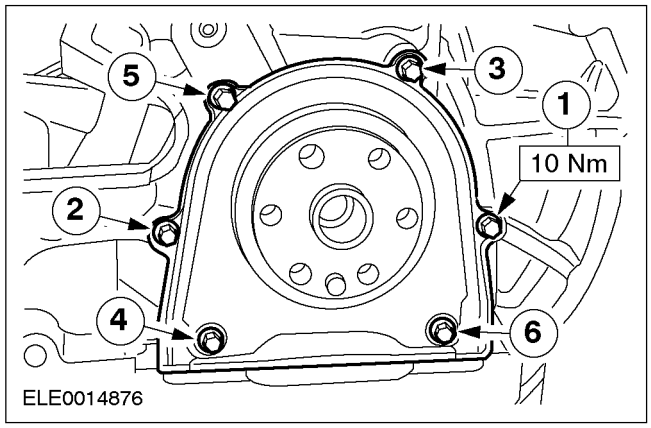
- Tighten the bolts in the sequence shown in two stages.
- Stage 1: 10 Nm.
- Stage 2: 23 Nm.



2. NOTE: Install a new crankshaft rear oil seal carrier.

Install the crankshaft rear oil seal carrier.

- Tighten the bolts in the sequence shown.

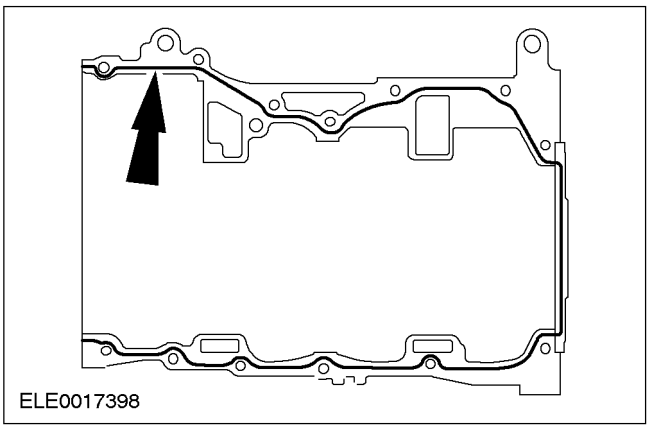


3. Using Loctite 7070, clean the engine cylinder block and oil pan mating faces.

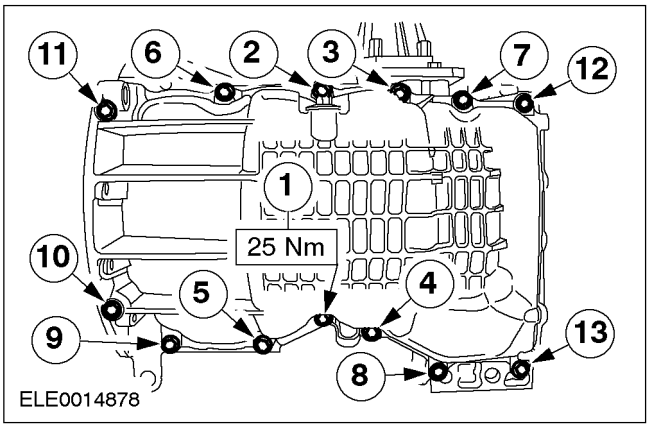
ASSEMBLY (Continued)

4. **NOTE:** Install the oil pan within 10 minutes of applying the sealer and tighten the retaining bolts within a further 5 minutes.

   Apply a 3 mm bead of sealant to the oil pan.

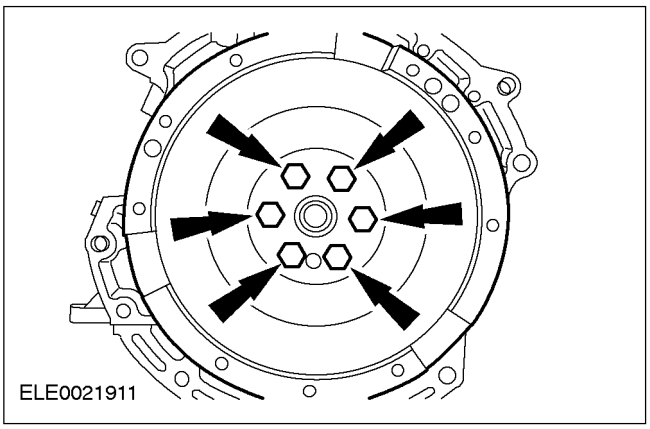


5. **Using a suitable straight edge, align the oil pan to the cylinder block mating face on the timing chain side.**
6. **Tighten the oil pan retaining bolts.**
   - Tighten the bolts in the sequence shown.

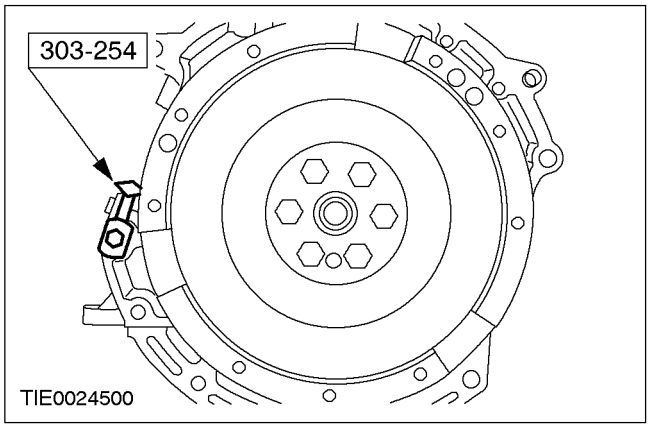


7. **NOTE:** Install new flywheel bolts.

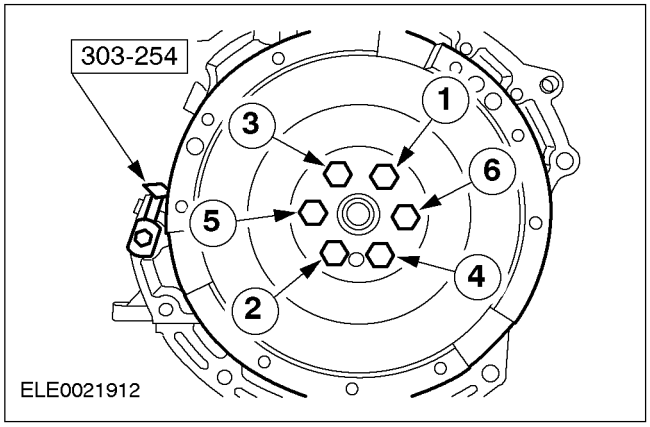
   Install the flywheel.



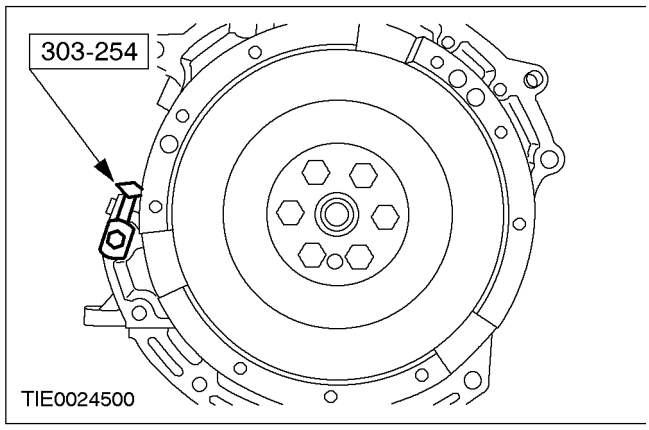
8. **Using the special tool, lock the flywheel in position.**



9. **Tighten the flywheel bolts.**
   - Tighten the bolts in the sequence shown in three stages.
   - Stage 1: 50 Nm.
   - Stage 2: 80 Nm.
   - Stage 3: 112 Nm.



10. **Remove the special tool.**

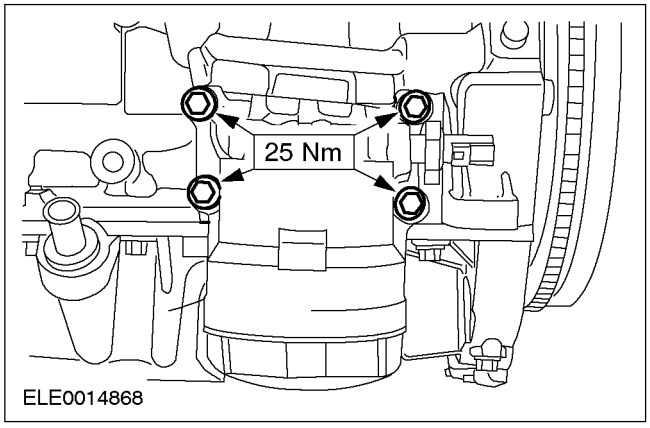


11. **Install the clutch disc and pressure plate.**

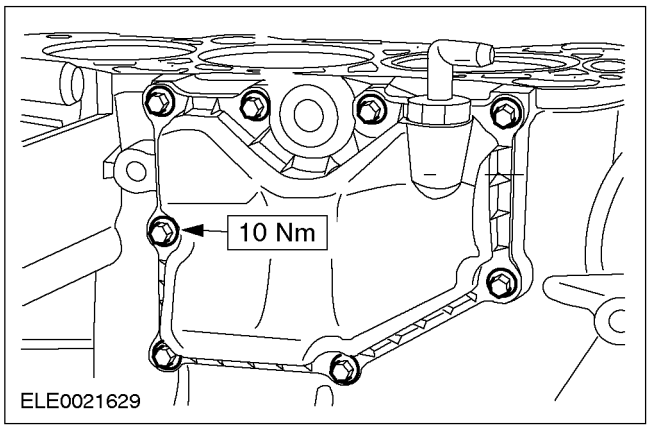
ASSEMBLY (Continued)

12. NOTE: Install a new oil filter adaptor gasket.

Install the oil filter adaptor.

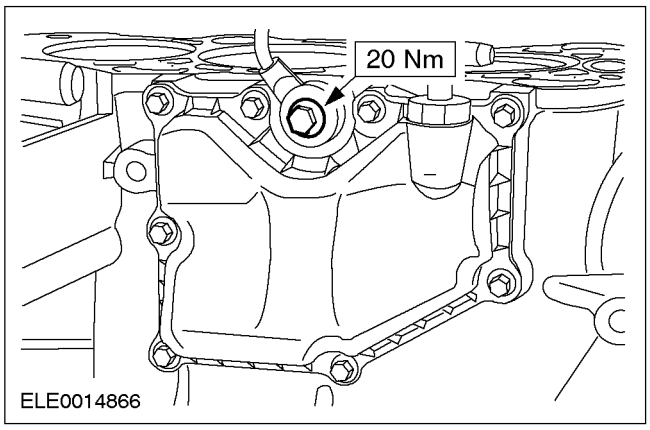


13. Install the positive crankcase ventilation oil separator.



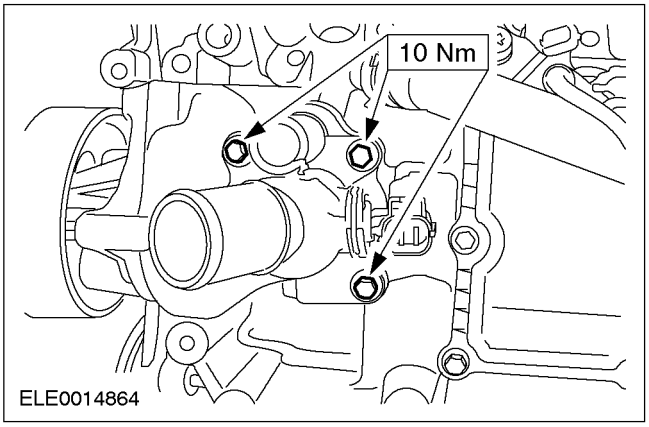
14. NOTE: Rotate the KS sensor as far counter-clockwise as possible without touching the PCV housing.

Install the knock sensor (KS).



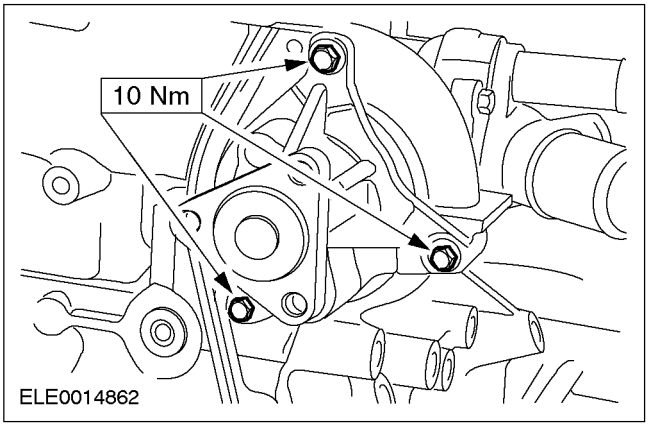
15. NOTE: Install a new thermostat housing gasket.

Install the thermostat housing.



16. NOTE: Install a new water pump O-ring.

Install the water pump.

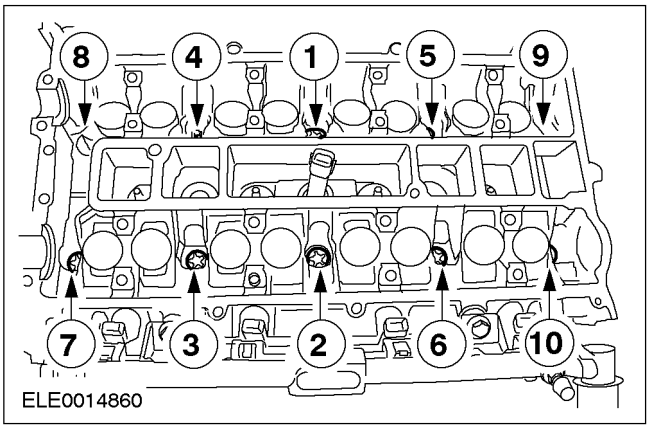


ASSEMBLY (Continued)

17. **NOTE:** Install new cylinder head bolts and gasket.

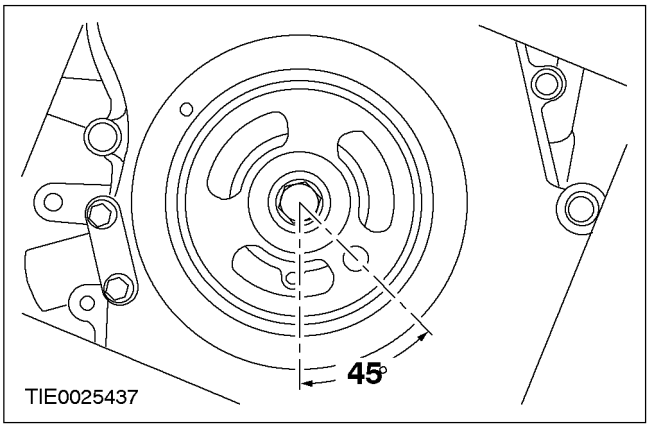
    Install the cylinder head.

    - Tighten the cylinder head bolts in five stages.
    - 1. Stage: 5 Nm.
    - 2. Stage: 15 Nm.
    - 3. Stage: 45 Nm.
    - 4. Stage: 90 degrees.
    - 5. Stage: 90 degrees.



18. **NOTE:** Only turn the engine in its normal direction of rotation.

    Turn the engine until piston No. 1 is approximately 45 degrees before top dead center (TDC).

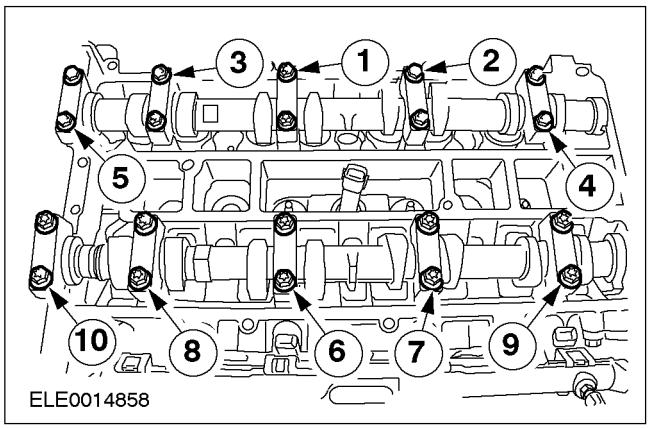


19. **Install the valve tappets.**

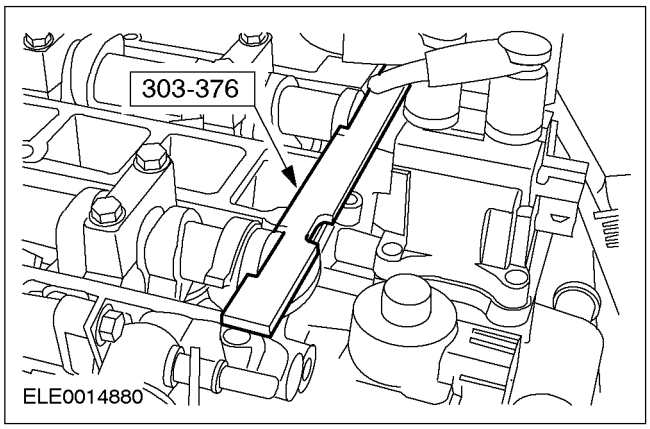
20. ⚠ **CAUTION: Install the camshafts approximately at valve overlap position cylinder No. 4.**

    Install the camshafts.

    - Working in several stages, evenly tighten the camshaft bearing cap bolts in the sequence shown, one half turn at a time.
    - Coat the camshaft bearing caps with hypoid oil.
    - Tighten the bolts in two stages.
    - Stage 1: 7 Nm.
    - Stage 2: 16 Nm.

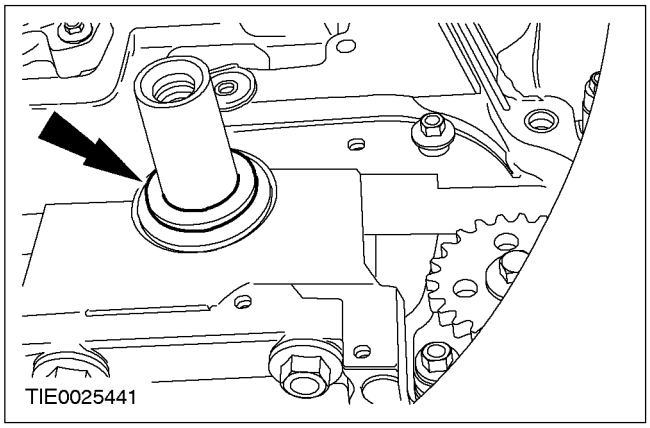


21. **Install the special tool.**

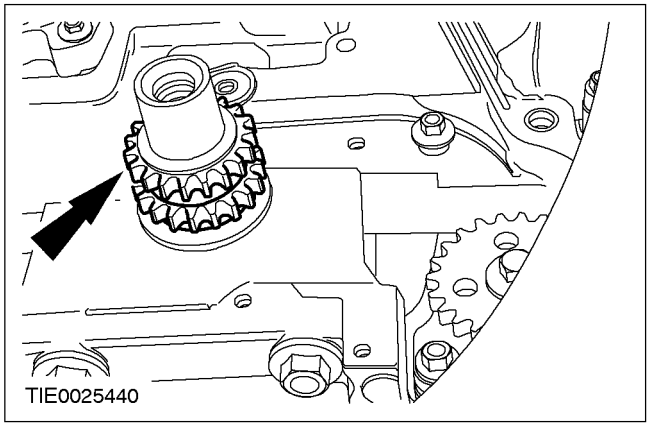


ASSEMBLY (Continued)

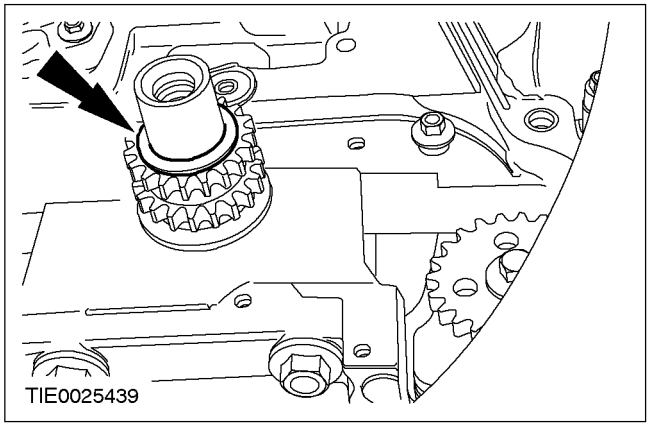
22. Install the rear friction washer.



23. Install the crankshaft sprocket.

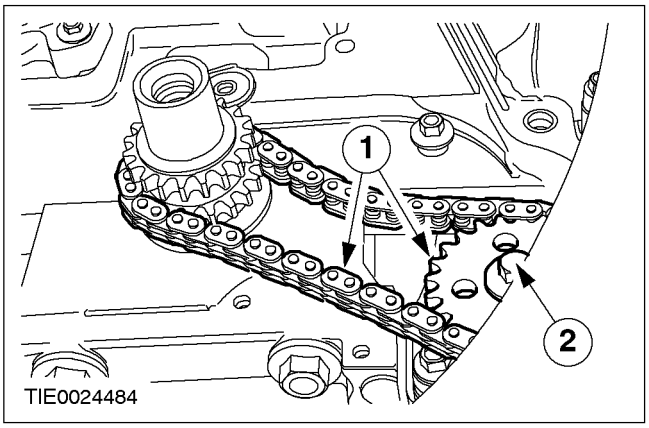


24. Install the front friction washer.

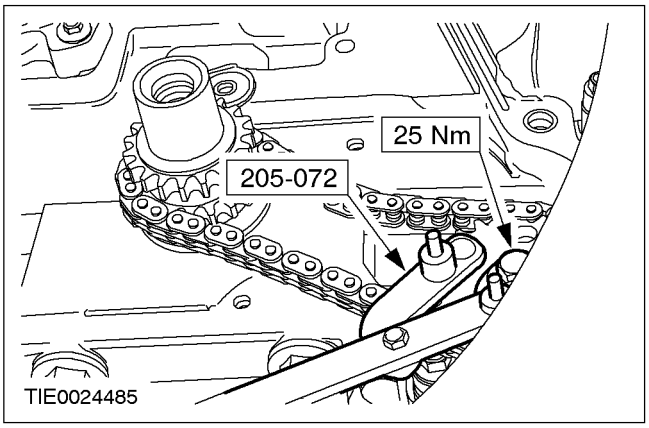


25. Install the oil pump chain.

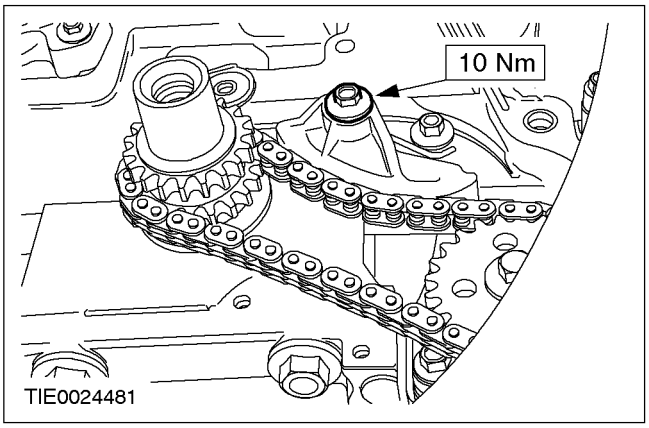
1. Install the oil pump chain and the oil pump sprocket.
2. Install the oil pump sprocket retaining bolt.



26. Using the special tool, tighten the oil pump sprocket retaining bolt.

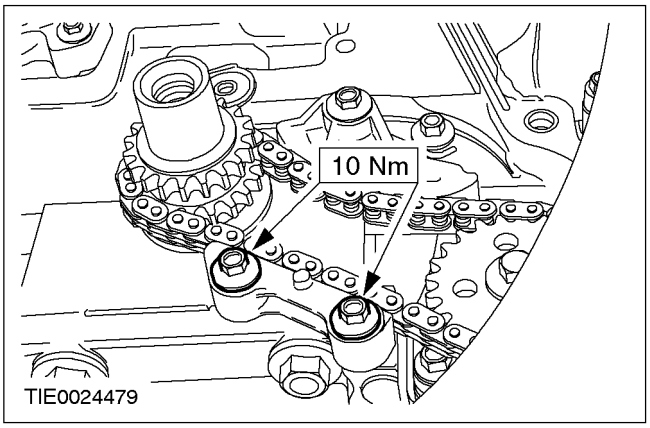


27. Install the oil pump chain tensioner.

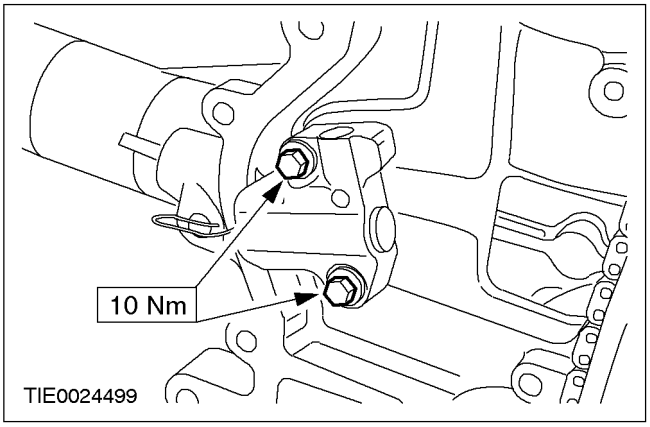


ASSEMBLY (Continued)

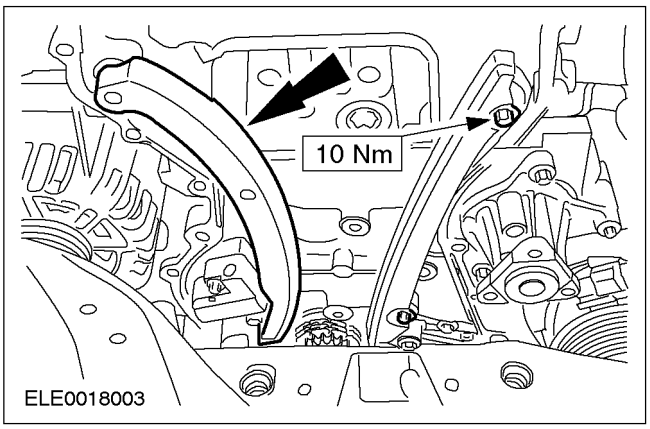
28. Install the oil pump chain guide.



29. Install the timing chain tensioner.



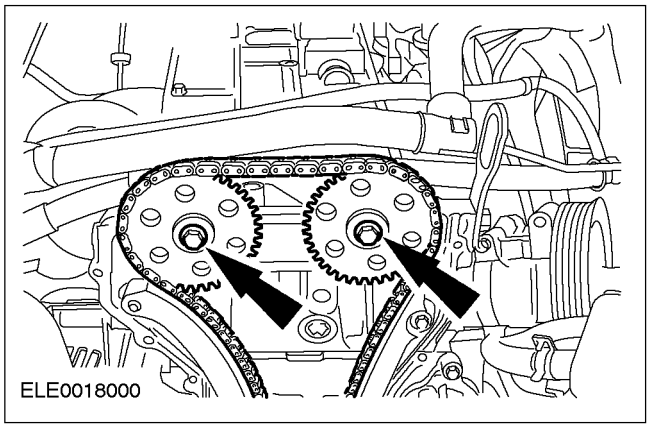
30. Install the timing chain guides.



31. CAUTION: Do not fully tighten the camshaft sprocket retaining bolts at this stage. Make sure the camshaft sprockets turn on the camshafts.

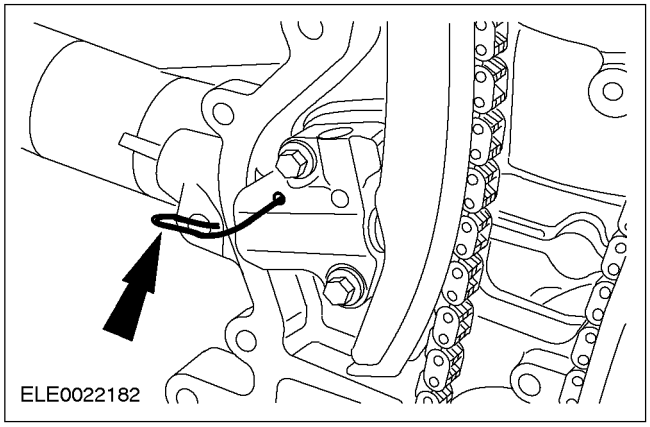
Install the camshaft sprockets.

- Install the timing chain.



32. Tension the timing chain.

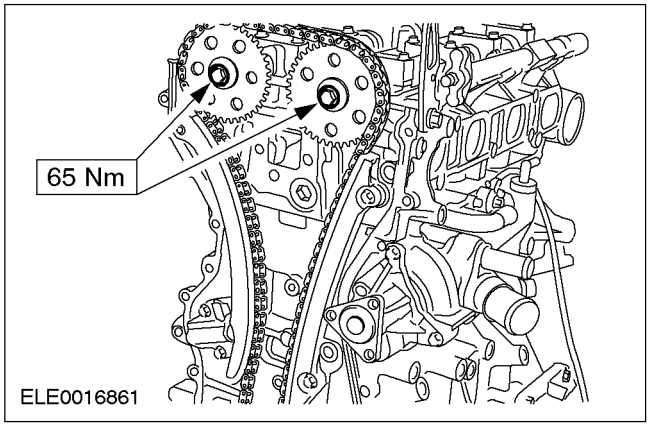
- Apply pressure to the timing chain and remove the securing pin.



ASSEMBLY (Continued)

33. **CAUTION: Hold each camshaft by the hexagon with an open-ended wrench to stop it from turning.**

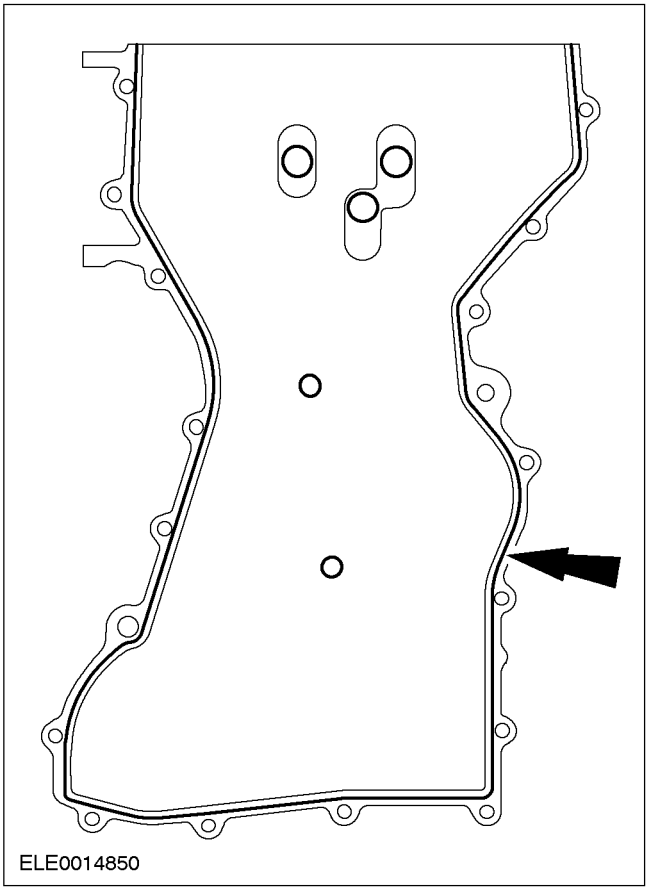
    Tighten the camshaft sprockets retaining bolts.



34. **Using Loctite 7070, clean the engine front cover mating faces.**

35. **NOTE:** Install the engine front cover within 10 minutes of applying the sealer.

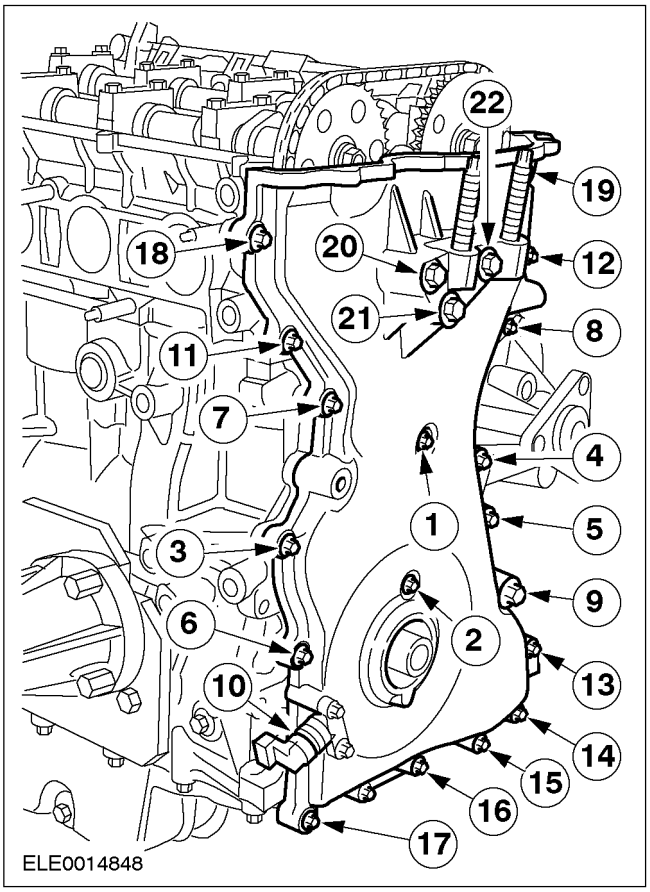
    Apply a 3 mm bead of sealant to the engine front cover.



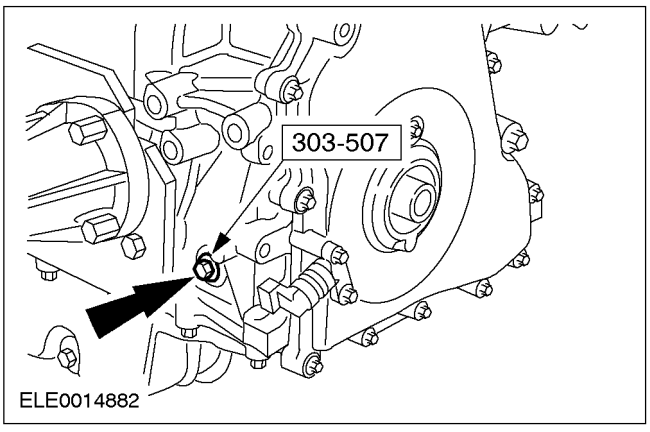
ASSEMBLY (Continued)

36. Install the engine front cover.

- Tighten the bolts in the sequence shown.
- Bolts 1 through 8 to 10 Nm
- Bolt 9: 48 Nm
- Bolts 10 through 19 to 10 Nm
- Bolts 20 through 22 to 48 Nm

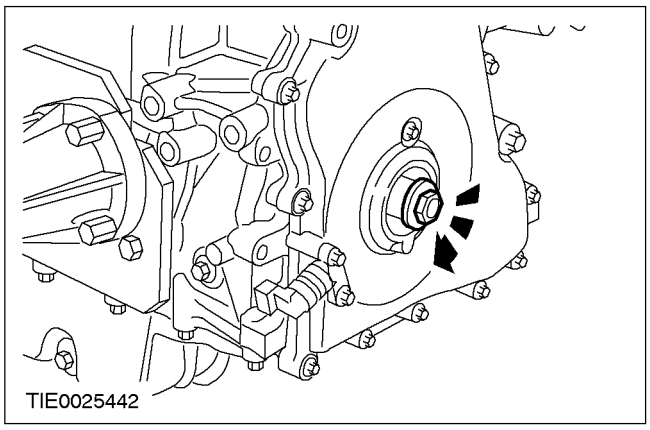


37. Remove the cylinder block lower blanking plug from the cylinder block and install the special tool.



38. NOTE: Only turn the engine in the normal direction of rotation.

Using the crankshaft pulley retaining bolt, turn the engine until piston No. 1 is at TDC.

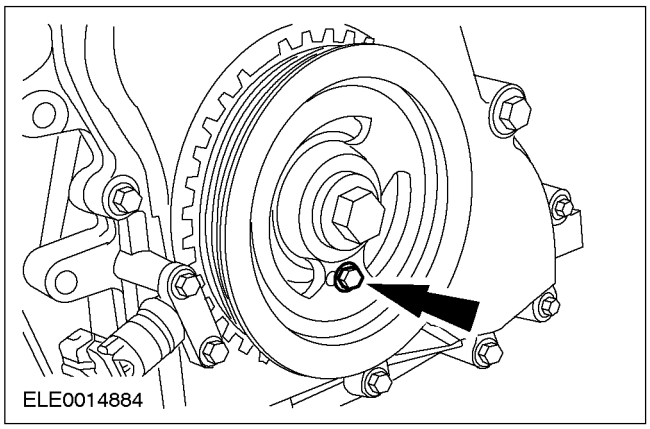


39. Remove the crankshaft pulley retaining bolt.

- Discard the bolt.

40. CAUTION: Only tighten the crankshaft pulley securing bolt finger tight.

Install the crankshaft pulley onto the crankshaft and secure the crankshaft pulley to the front cover using a M6 x 18 mm bolt.

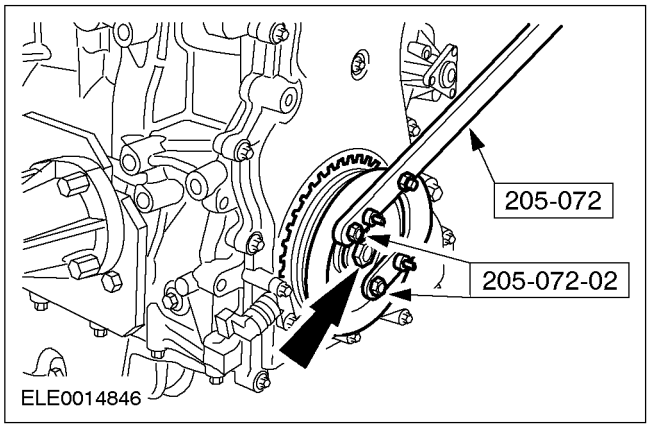


ASSEMBLY (Continued)

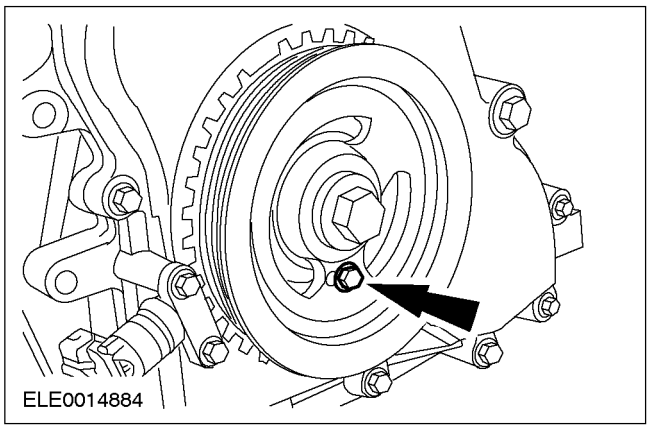
41. **NOTE:** Install a new crankshaft pulley retaining bolt.

    Using the special tools, prevent the crankshaft pulley from rotating and tighten the crankshaft pulley retaining bolt.

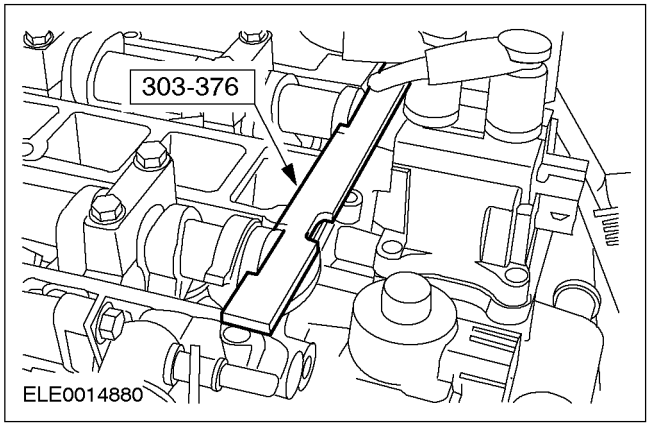
    - Tighten the bolt in two stages.
    - Stage 1: 100 Nm.
    - Stage 2: 90 degrees.



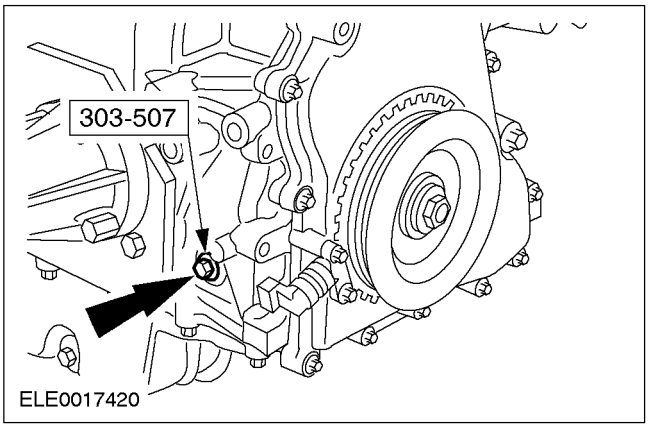
42. **Remove the crankshaft pulley securing bolt.**



43. **Remove the special tool.**



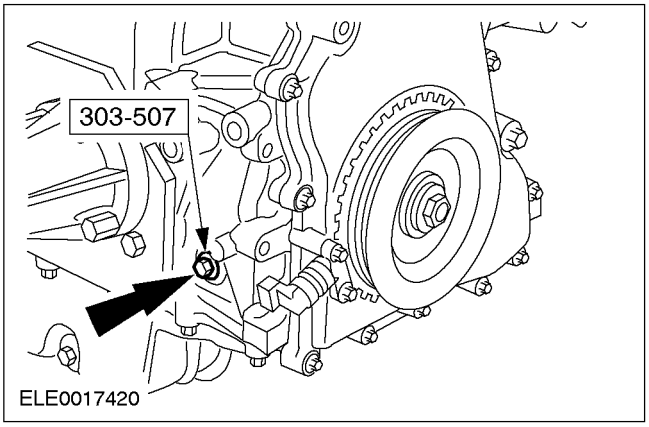
44. **Remove the special tool.**



45. **NOTE:** Only turn the engine in the normal direction of rotation.

    Turn the engine two revolutions.

46. **Install the special tool.**



47. **NOTE:** Only turn the engine in the normal direction of rotation.

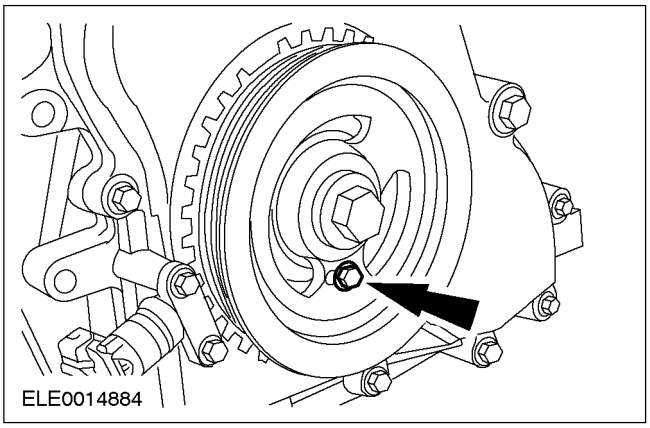
    Turn the engine until piston No. 1 is at TDC.

ASSEMBLY (Continued)

48. **⚠ CAUTION: Only tighten the crankshaft pulley securing bolt finger tight.**

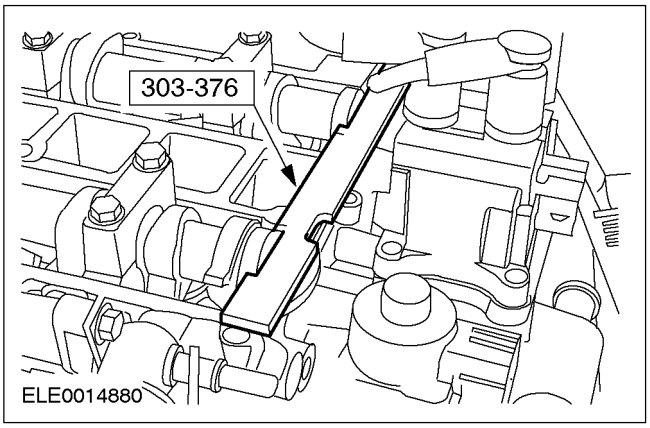
NOTE: If it is not possible to install the crankshaft pulley securing bolt, correct the engine timing.

Using a M6 x 18 mm bolt, check the position of the crankshaft pulley.

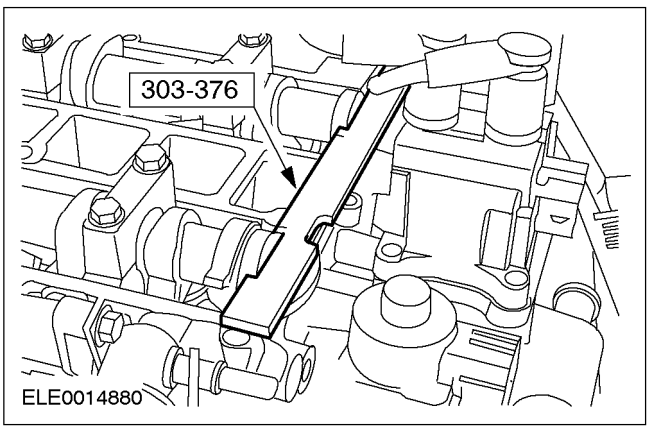


49. **NOTE:** If it is not possible to install the special tool, correct the engine timing.

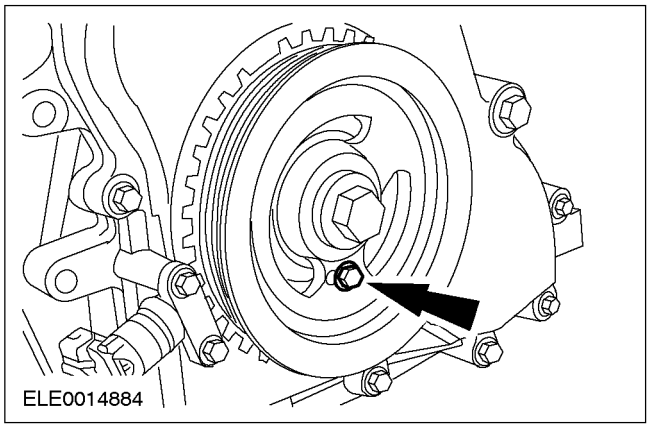
Using the special tool, check the position of the camshafts.



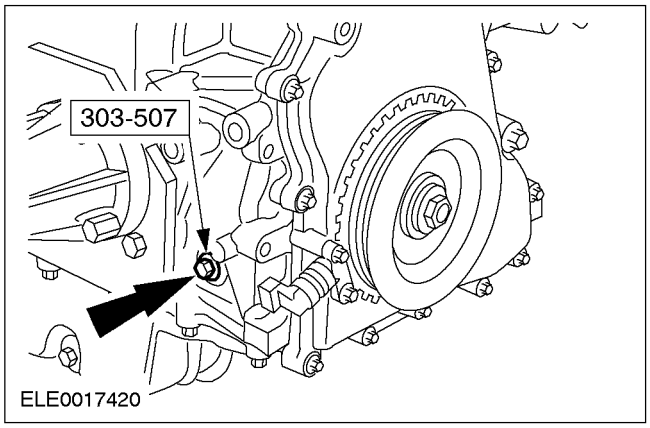
50. **Remove the special tool.**



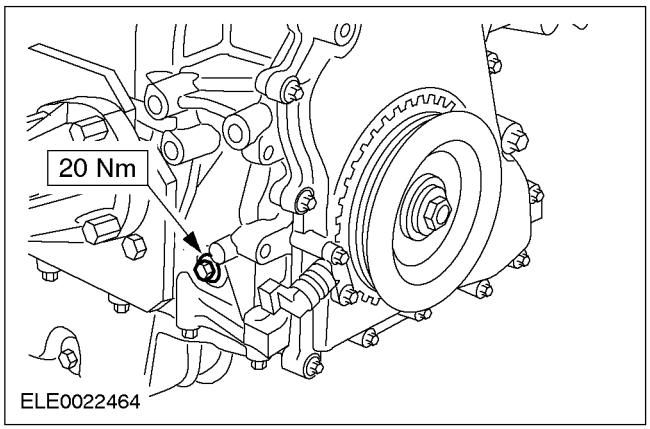
51. **Remove the crankshaft pulley securing bolt.**



52. **Remove the special tool.**



53. **Install the cylinder block lower blanking plug.**



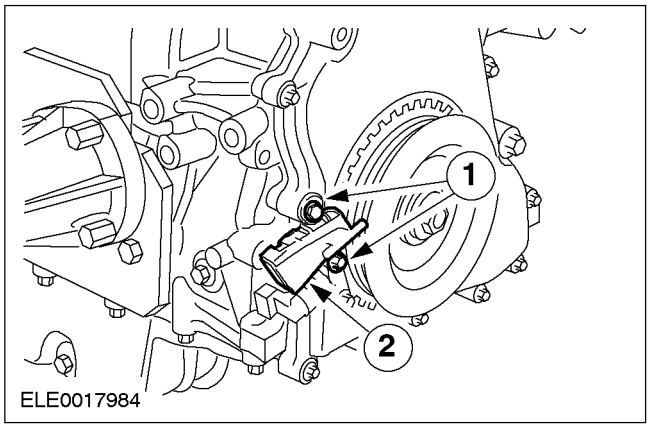
ASSEMBLY (Continued)

54. NOTE: When installing a new crankshaft pulley or engine front cover, the crankshaft position (CKP) sensor must be aligned using the tool supplied with the new component.

NOTE: Do not tighten the bolts at this stage.

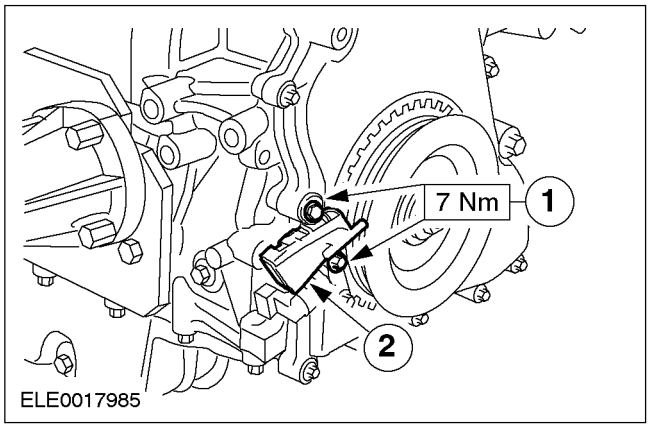
Align the CKP sensor.

1. Loosen the CKP sensor retaining bolts.
2. Insert the tool supplied, so that its hooked in the crankshaft pulley teeth.

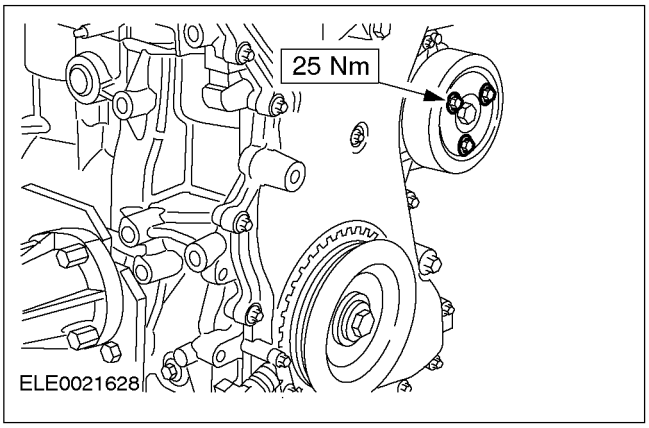


55. Install the CKP sensor.

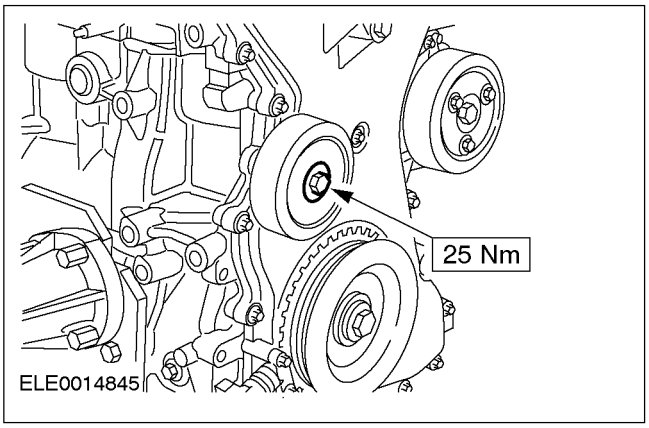
1. Tighten the CKP sensor retaining bolts.
2. Remove the tool.



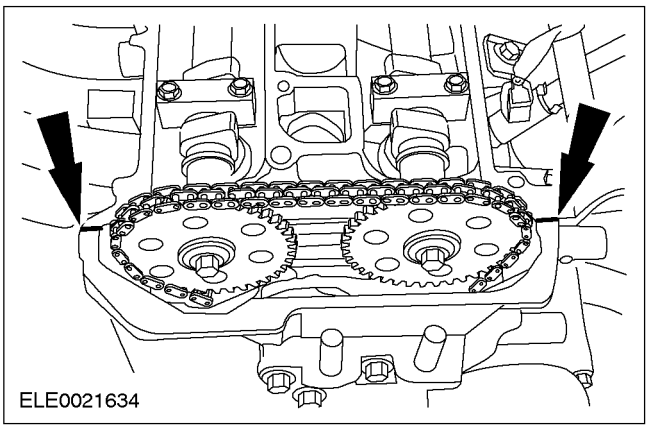
56. Install the water pump pulley.



57. Install the accessory drive belt idler pulley.



58. Apply a small bead of sealant to the areas as shown.

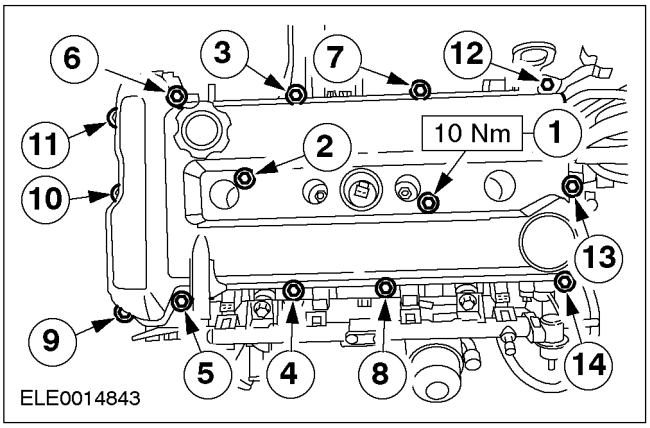


ASSEMBLY (Continued)

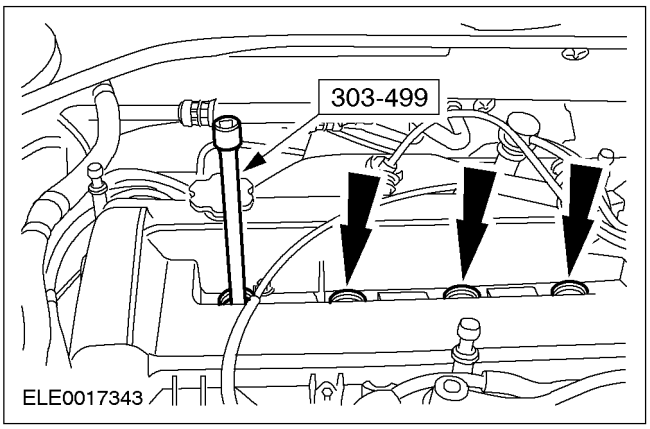
59. NOTE: Install a new valve cover gasket if necessary.

Install the valve cover.

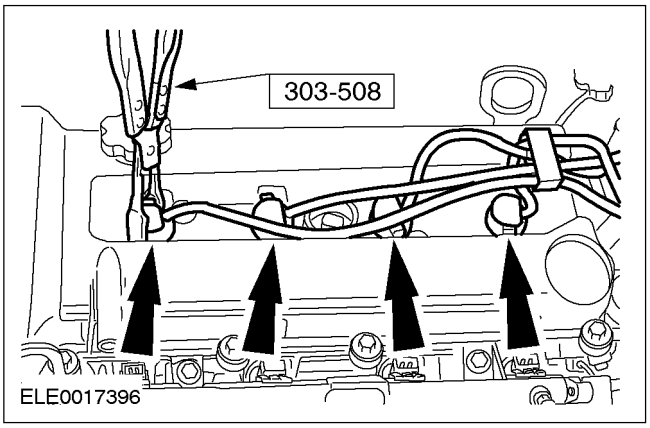
- Tighten the bolts in the sequence shown.



60. Using the special tool, install the spark plugs.

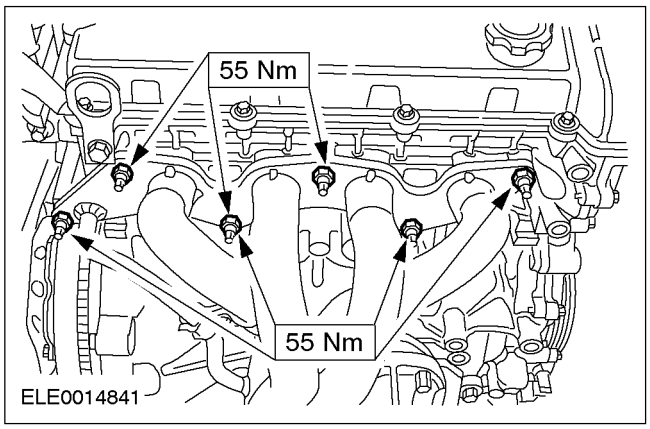


61. Using the special tool, connect the spark plug electrical connectors.

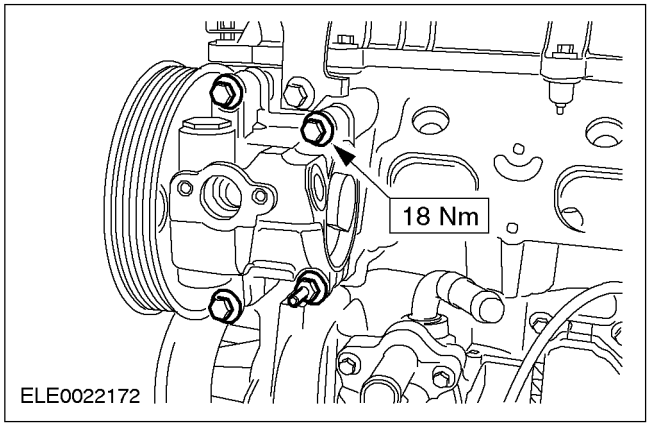


62. NOTE: Install a new exhaust manifold gasket.

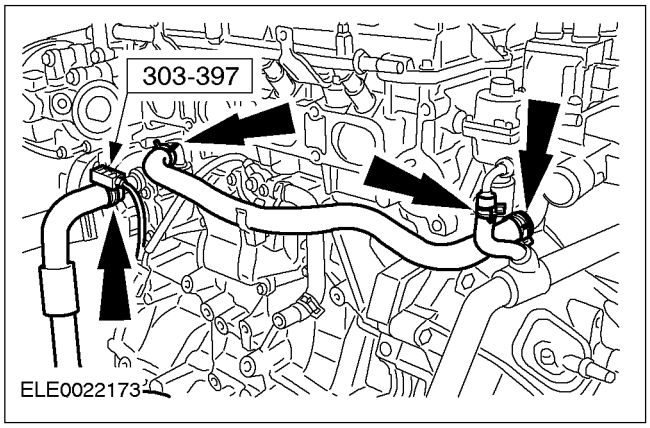
Install the exhaust manifold.



63. Install the power steering pump.

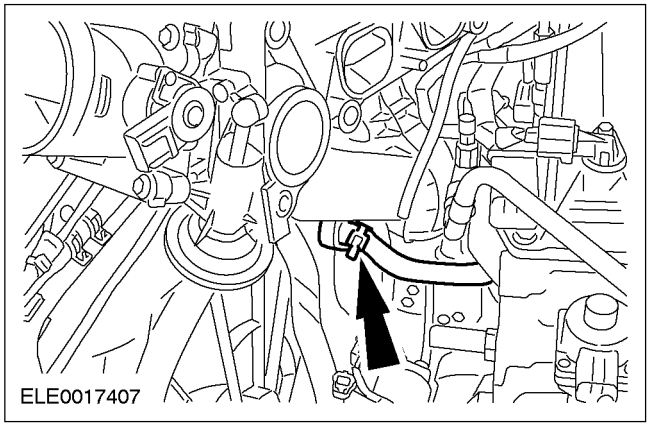


64. Using the special tool, install the coolant hoses.

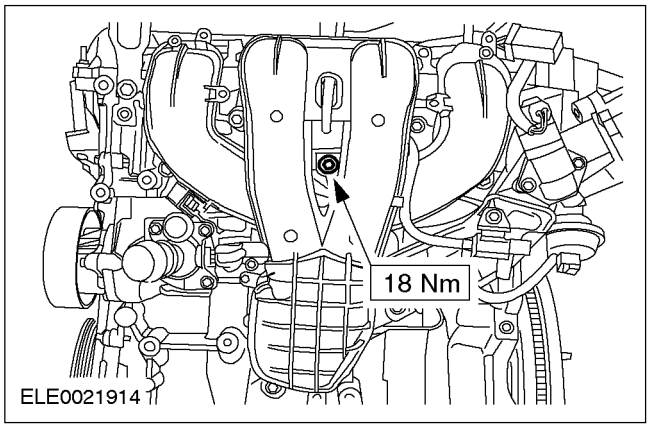


ASSEMBLY (Continued)

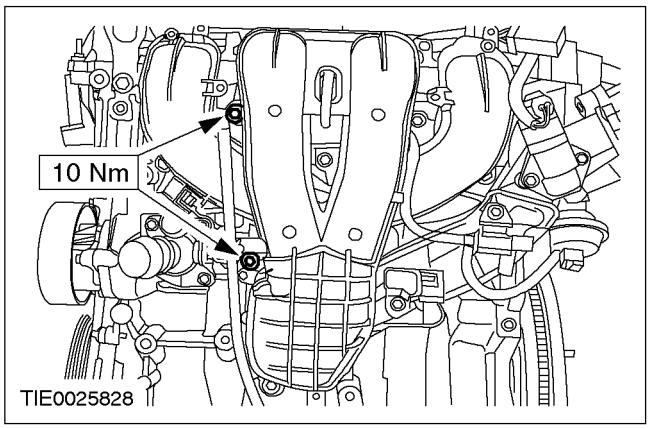
65. Connect the positive crankcase ventilation hose (PCV) to the intake manifold.



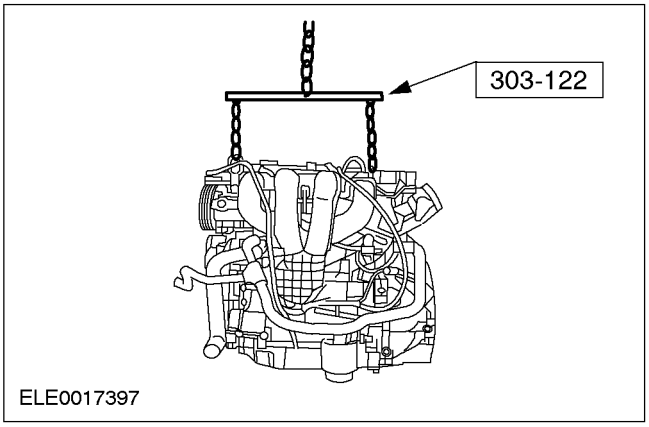
66. Install the intake manifold.



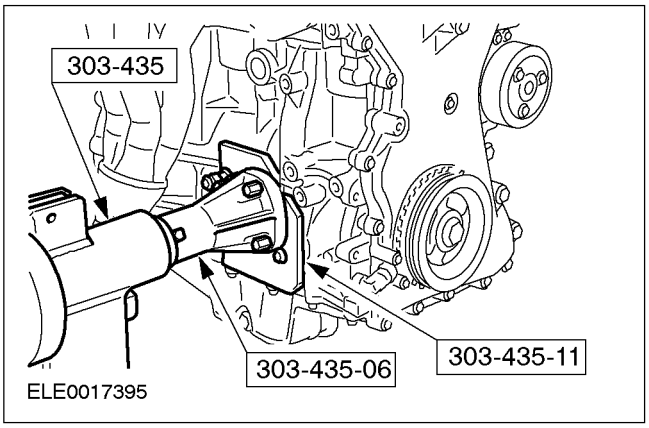
67. Install the oil level indicator tube.



68. Using the special tool and an engine hoist, support the engine.

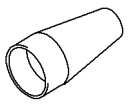
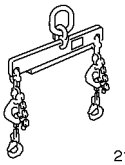
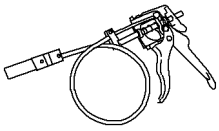


69. Remove the special tools.



INSTALLATION

Engine — Vehicles With: Automatic Transaxle

Special Tool(s)	
 13015	Expander, Teflon Seal 211-188 (13-015)
 21068A	Lifting Bracket, Engine 303-122 (21-068A)
 24003	Remover/Installer, Cooling Hose Clamp 303-397 (24-003)

General Equipment
Workshop Table
Engine Hoist

Name	Specification
High Temperature Grease	ESD-M1C220-A

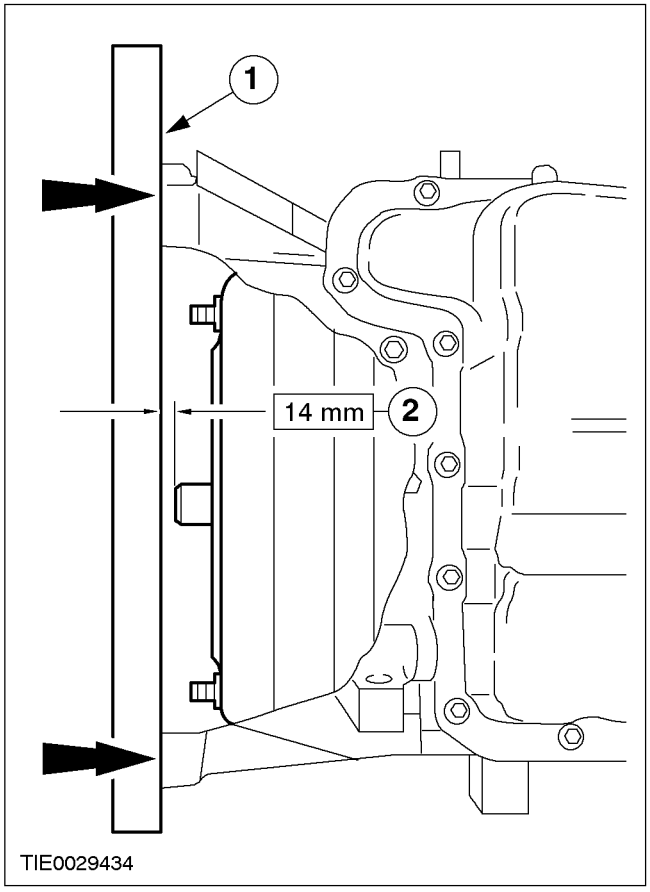
All vehicles

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

1. **CAUTION: The torque converter hub must engage fully in the oil pump drive gear.**

   Check the installation depth of the torque converter.

   1. Lay a steel straightedge across the automatic transaxle flange.
   2. Check the installation depth between the steel straight edge and the drive plate..
   3. Apply a thin layer of high temperature grease to the centering spigot on the torque converter.



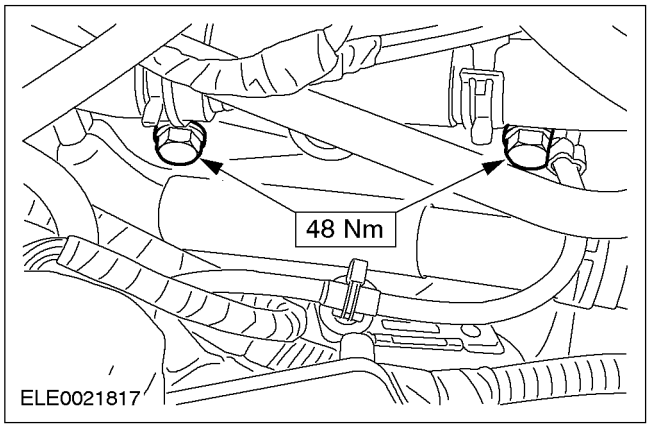
2. **NOTE:** Do not support the oil pan. Using suitable securing straps, secure the engine on the workshop table.

   Using wooden blocks, support the engine.

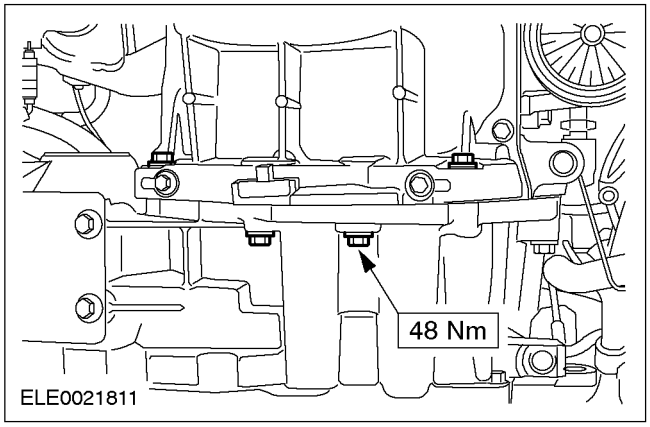
3. **Install the transaxle.**

INSTALLATION (Continued)

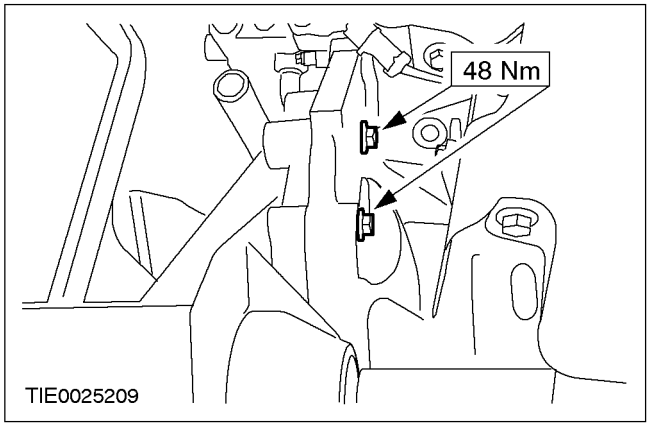
4. Install the transaxle upper retaining bolts.



5. Install the transaxle lower retaining bolts.



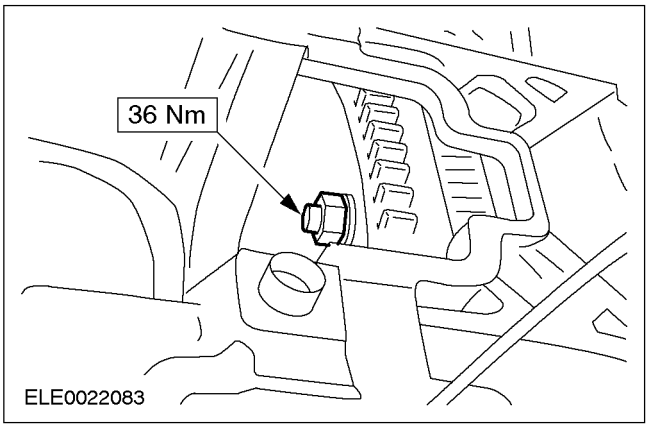
6. Install the transaxle right-hand retaining bolts.



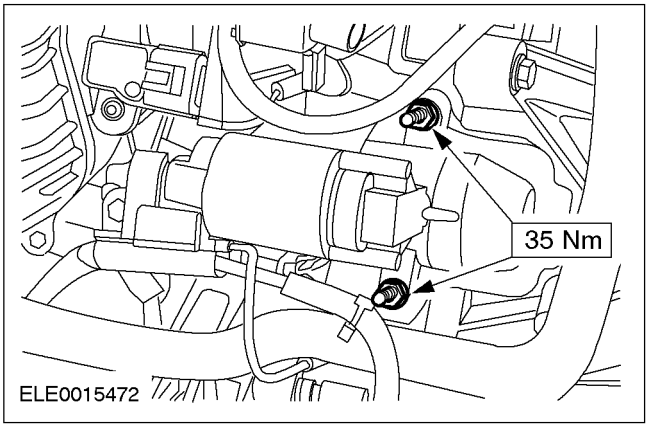
7. NOTE: Install new torque converter retaining nuts.

Install the torque converter retaining nuts (four nuts).

- Rotate the engine to gain access to the nuts.
- Install the cover.

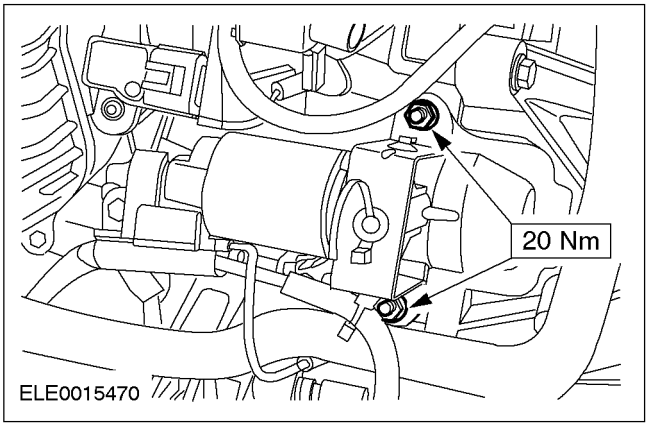


8. Install the starter motor.



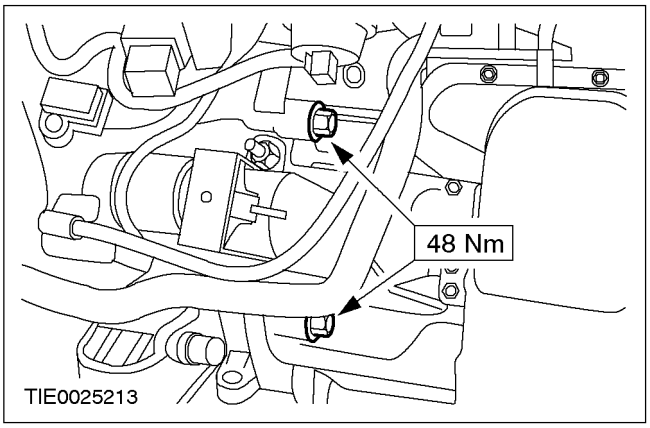
9. Install the wiring harness retaining bracket.

- Attach the wiring harness to the retaining bracket.

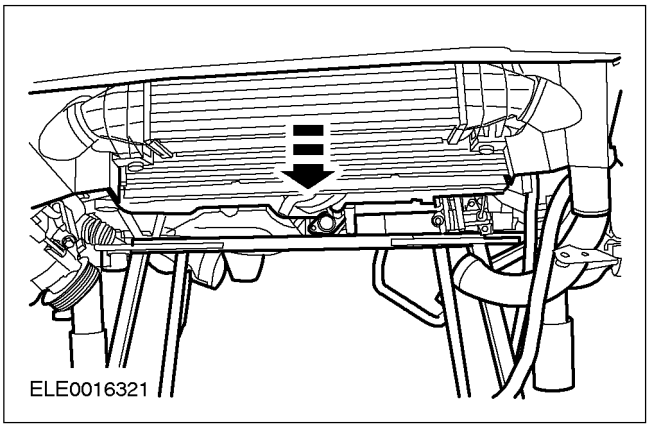


INSTALLATION (Continued)

10. Install the transaxle left-hand retaining bolts.



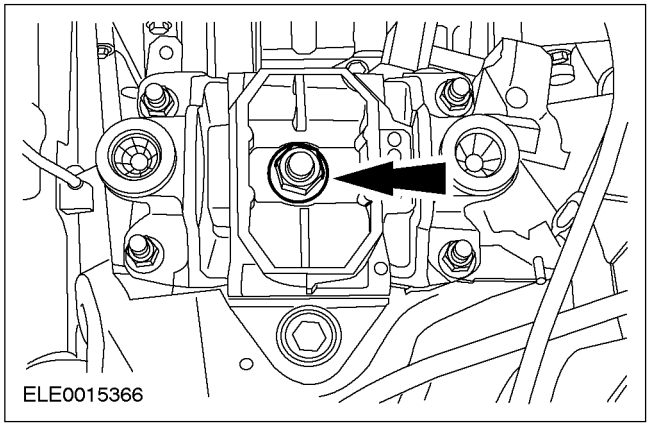
11. Position the workshop table under the vehicle and carefully lower the vehicle until the engine and transaxle assembly is in the correct position to install the engine mounts.



12. NOTE: Install a new engine rear mount retaining nut.

NOTE: Do not tighten the engine rear mount retaining nut at this stage.

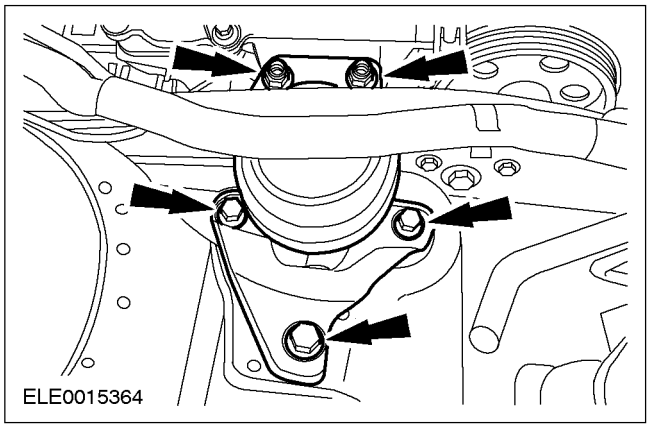
Install the engine rear mount retaining nut.



13. NOTE: Install new engine front mount retaining nuts.

NOTE: Do not tighten the retaining nuts and retaining bolts at this stage.

Install the engine front mount.

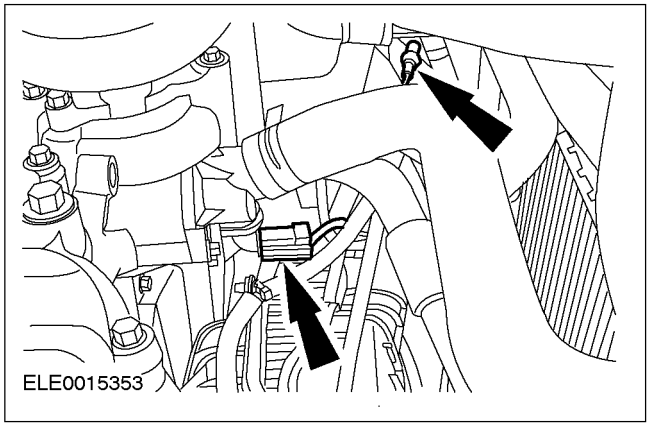


14. Remove the retaining straps from the transaxle.

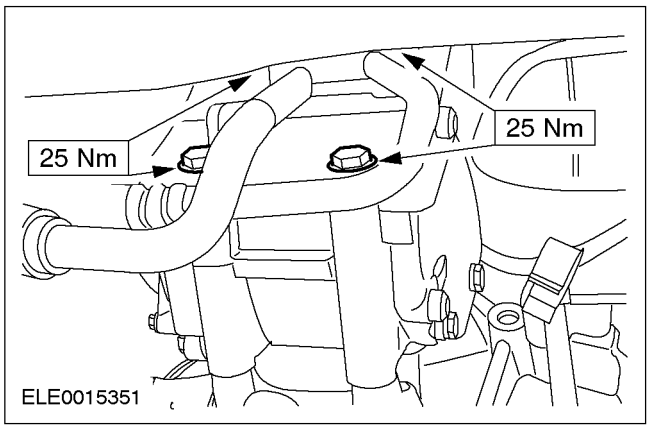
15. Raise and support the vehicle. For additional information, refer to Section 100-02.

INSTALLATION (Continued)

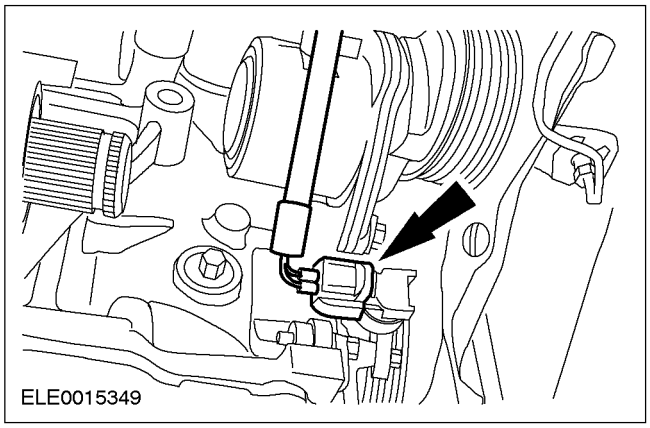
16. **Connect the wiring harness electrical connectors.**



17. **Attach the air conditioning (A/C) compressor to the mounting bracket.**



18. **Connect the crankshaft position (CKP) sensor electrical connector.**



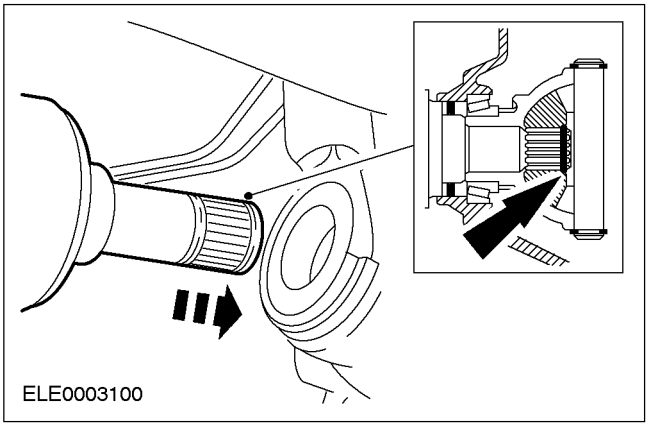
19. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

CAUTION: Do not damage the halfshaft oil seal.

CAUTION: Make sure the snap ring is correctly seated.

NOTE: Install a new snap ring.

Attach the left-hand halfshaft to the transaxle.

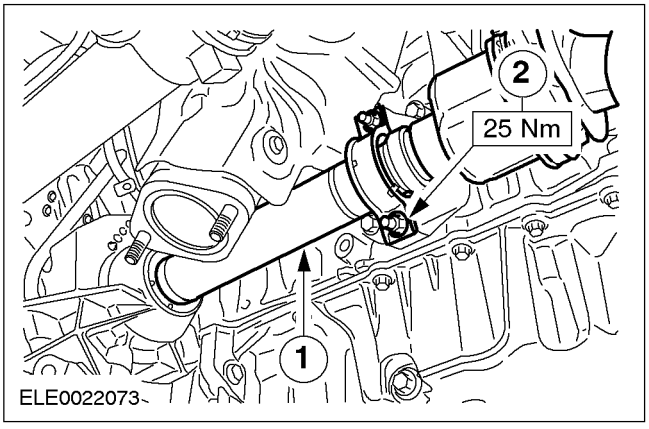


20. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

CAUTION: Do not damage the halfshaft oil seal.

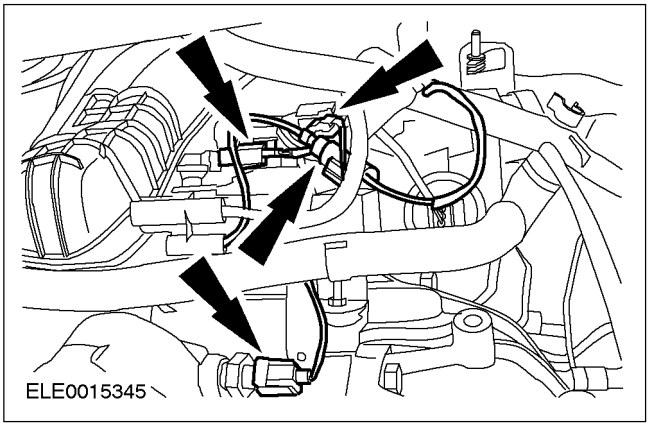
NOTE: Install a new center bearing cap and new retaining nuts.

Attach the right-hand halfshaft and the intermediate shaft to the transaxle.



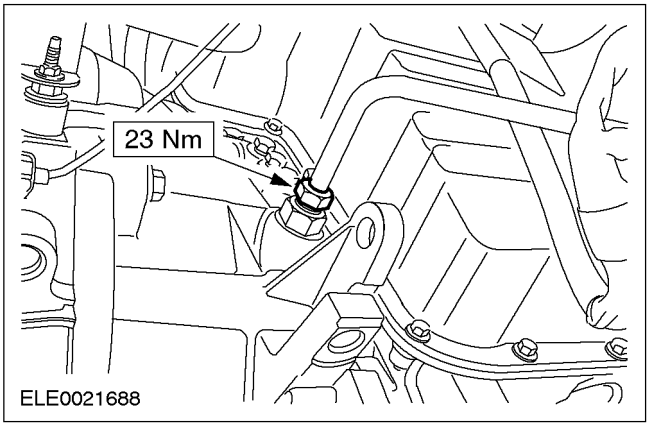
INSTALLATION (Continued)

21. **Connect the wiring harness electrical connectors.**

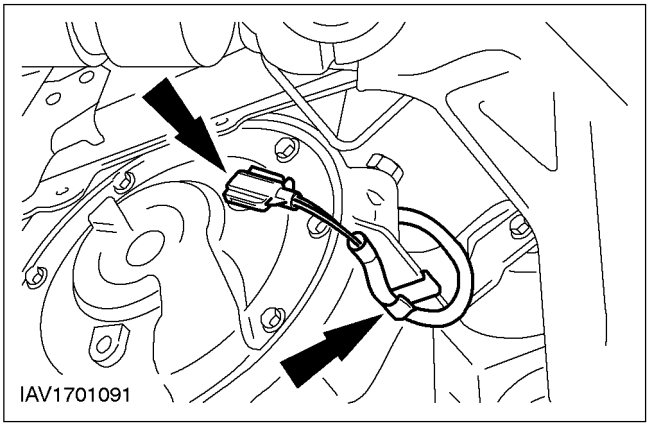


22. **CAUTION: Use an open ended spanner on the fluid line adapter to prevent it from turning.**

    Attach the fluid cooler return pipe to the transaxle.

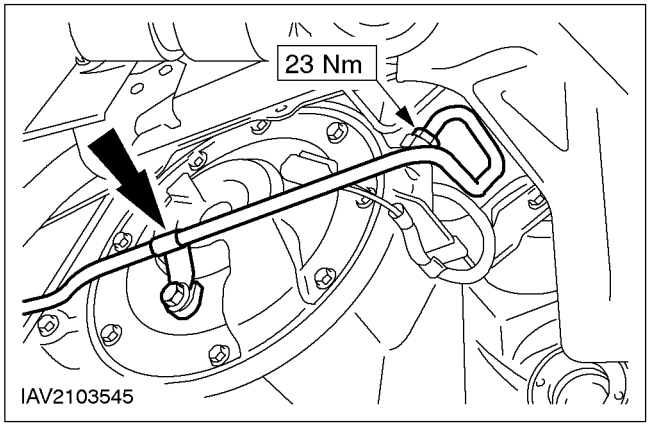


23. **Connect the turbine shaft speed (TSS) sensor electrical connector.**
    - Install the wiring retaining clip.

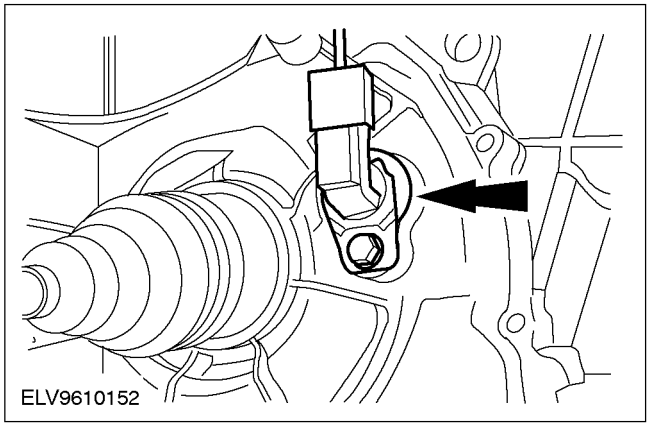


24. **CAUTION: Use an open ended spanner on the fluid line adaptor to prevent it from turning.**

    Attach the fluid cooler pipe to the transaxle.
    - Attach the fluid pipe bracket to the transaxle.



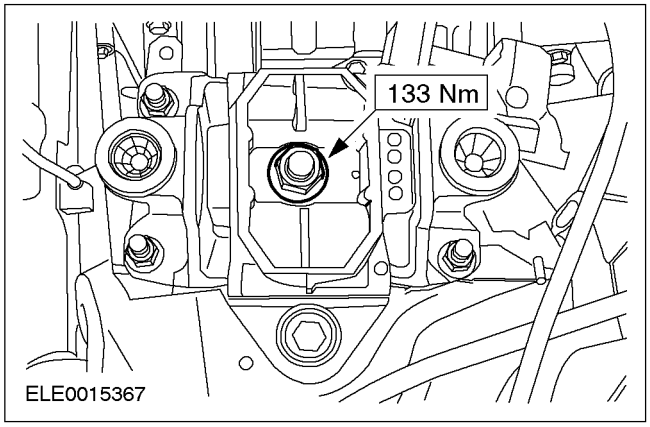
25. **Connect the output shaft speed (OSS) sensor electrical connector.**



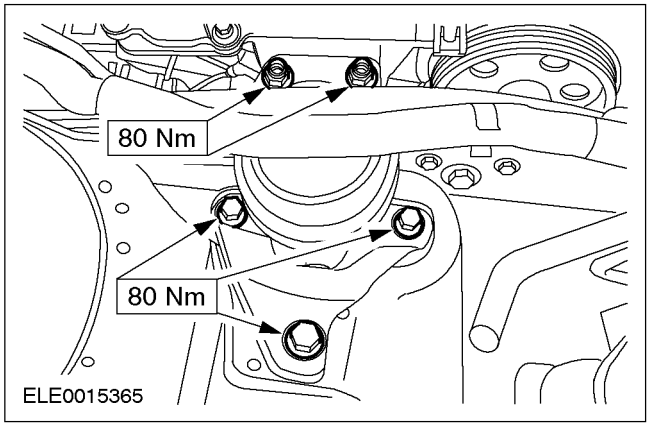
26. **Install the subframe. For additional information, refer to Section 502-00.**
27. **Lower the vehicle.**

INSTALLATION (Continued)

28. Tighten the engine rear mount retaining nut.

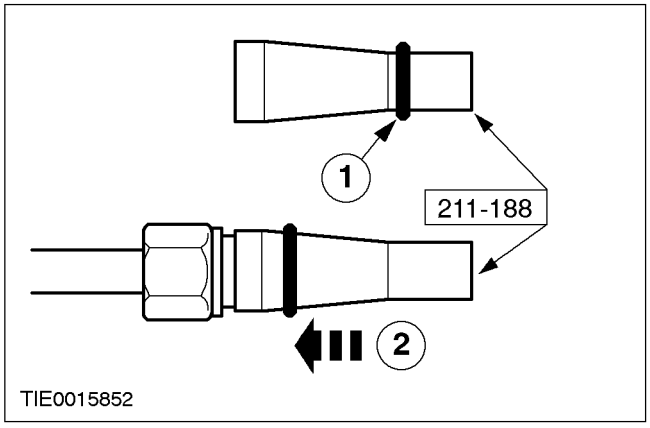


29. Tighten the engine front mount retaining nuts and retaining bolts.

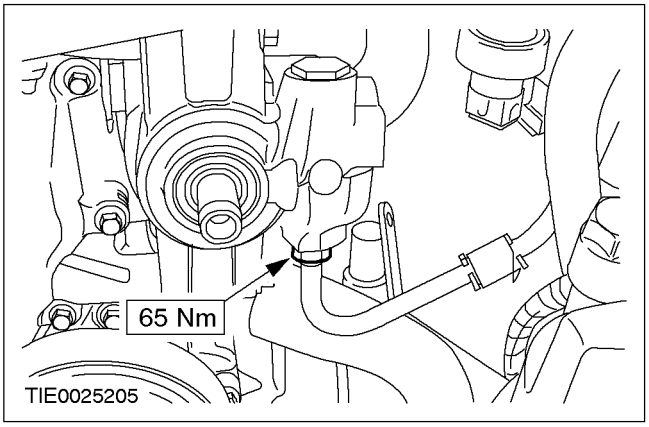


30. Using the special tool, install a new O-ring seal onto the power steering line to power steering pump union.

1. Push the O-ring seal onto the special tool.
2. Locate the special tool onto the union and install the O-ring seal.

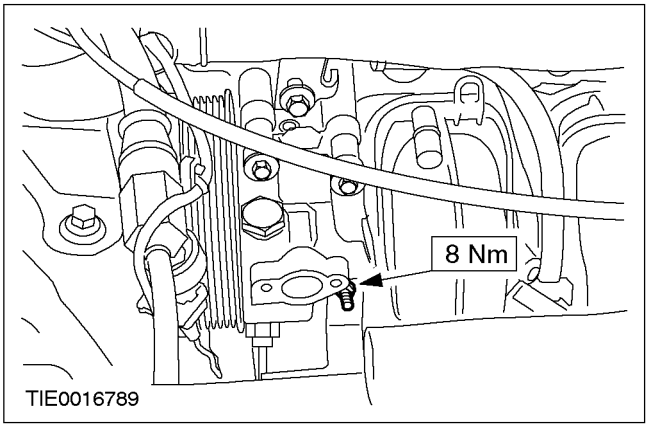


31. Connect the power steering line to the power steering pump.

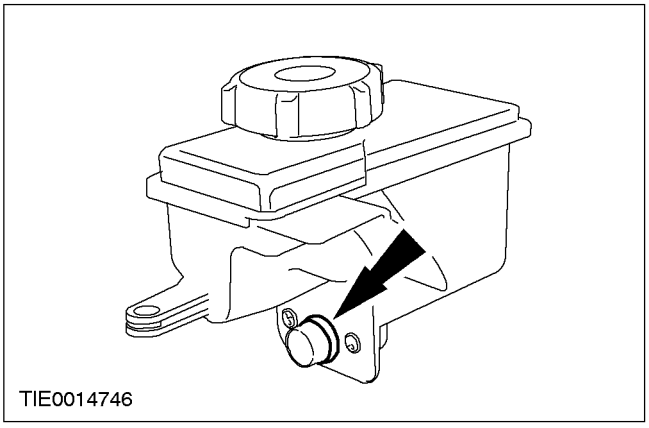


32. Install the power steering pump pulley. For additional information, refer to Section 211-02.

33. Install the power steering line support retaining nut.



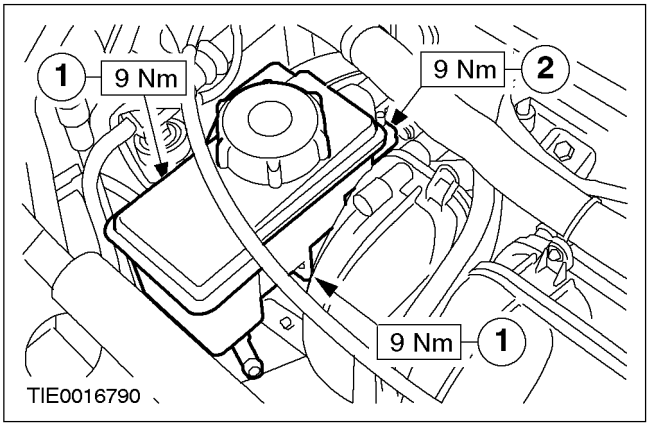
34. Install new O-ring seals.



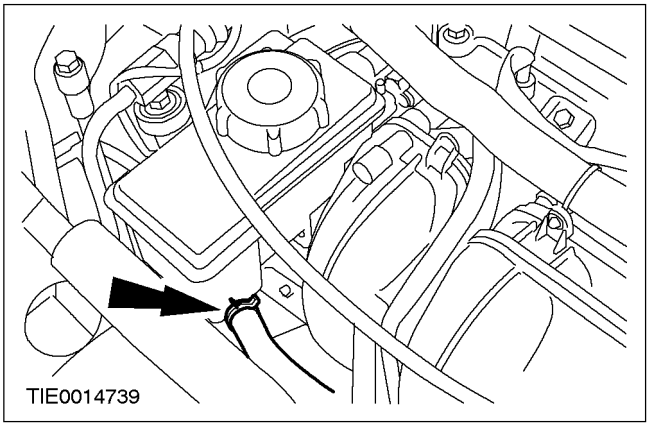
INSTALLATION (Continued)

35. Install the power steering fluid reservoir.

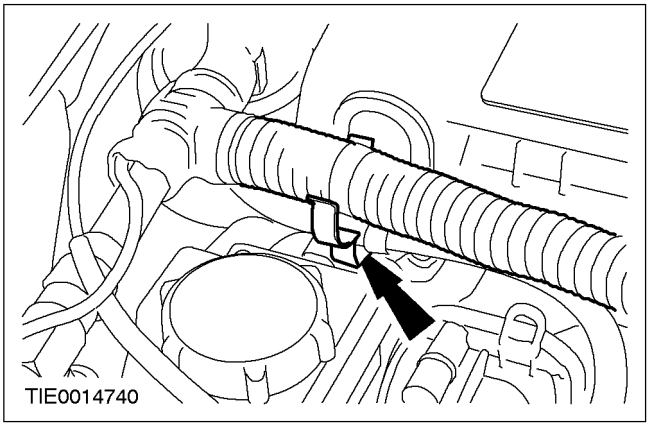
1. Install the front retaining bolts.
2. Install the retaining stud.



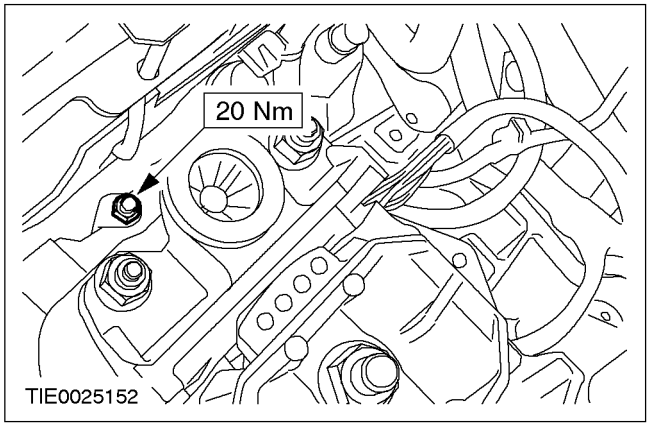
36. Connect the power steering hose to the power steering fluid reservoir.



37. Install the engine wiring harness bracket.

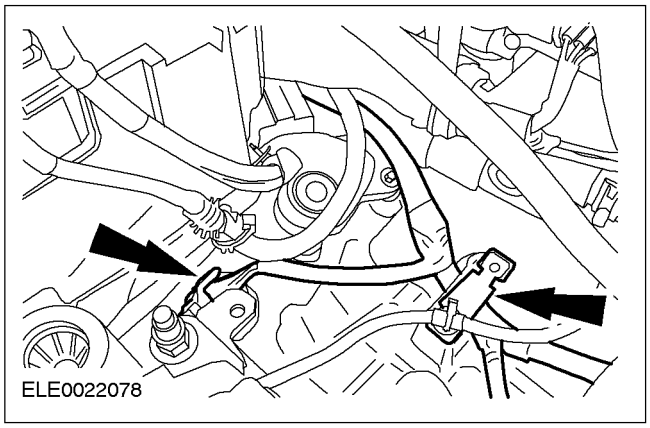


38. Attach the battery ground lead to the transaxle.

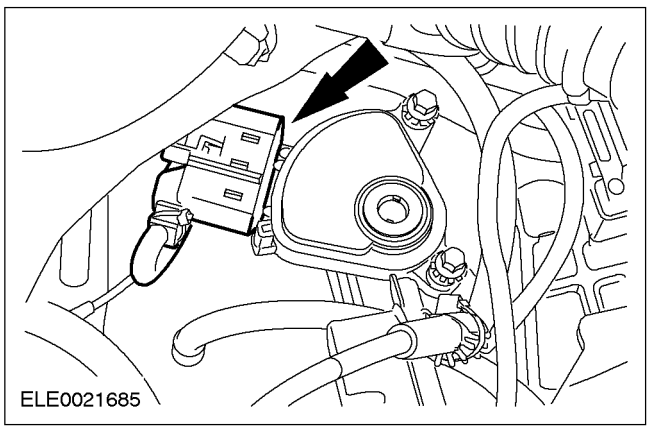


39. Connect the automatic transmission control electrical connector.

- Install the cable ties.
- Attach the wiring harness retaining clip to the retaining bracket.

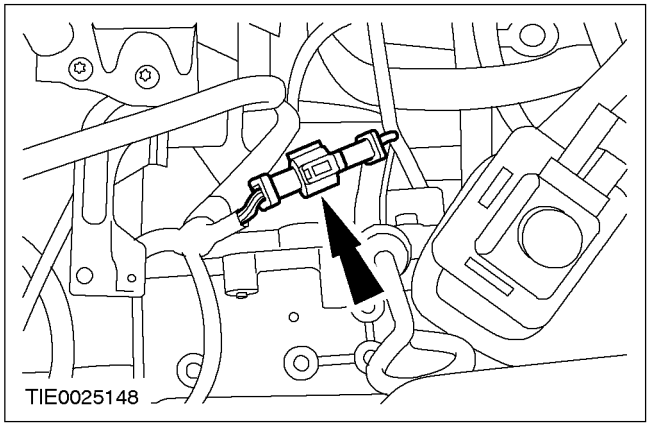


40. Connect the transmission range (TR) sensor electrical connector.



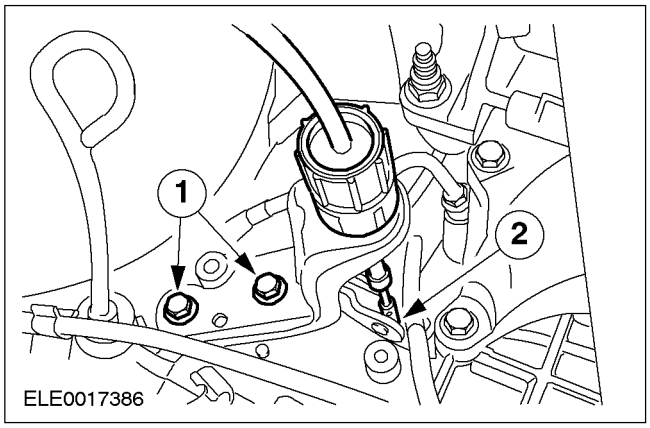
INSTALLATION (Continued)

41. Connect the heated oxygen (HO2S) sensor electrical connector.



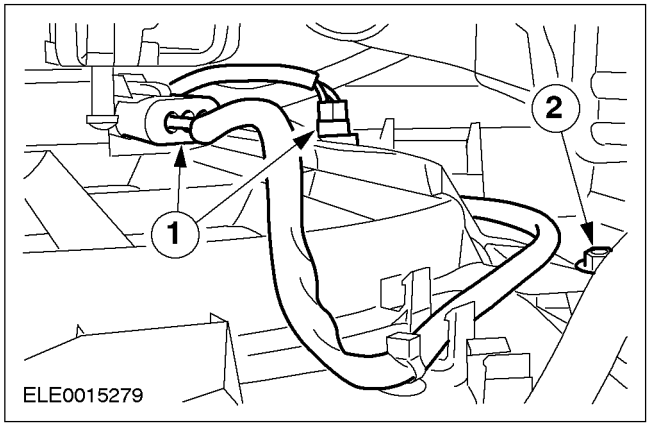
42. Attach the selector lever cable to the transaxle.

1. Install the selector lever cable bracket.
2. Attach the selector lever cable to the transaxle.

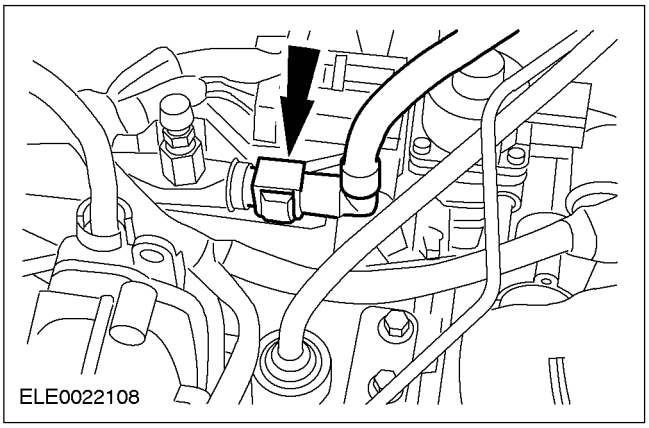


43. Install the cooling fan motor and shroud.

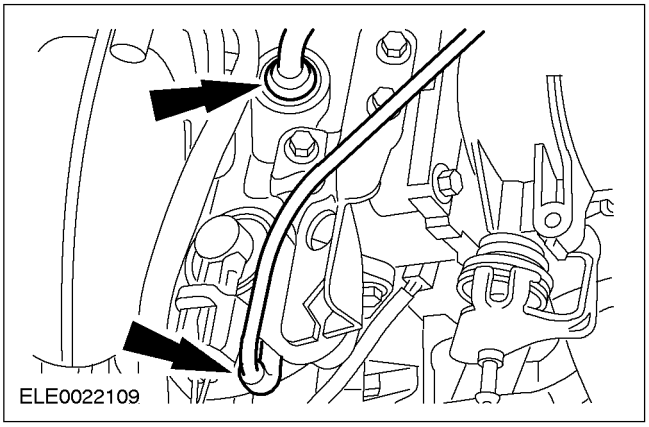
1. Connect the electrical connector.
2. Install the nuts on both sides (left-hand side shown).



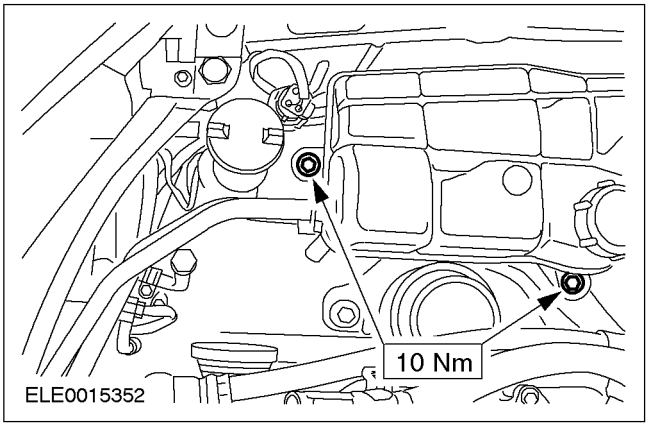
44. Connect the fuel supply line. For additional information, refer to Section 310-00.



45. Connect the vacuum hoses to the intake manifold.

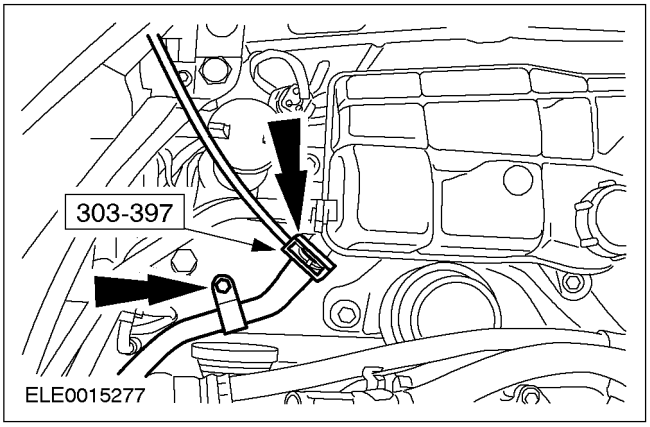


46. Attach the coolant expansion tank to the wheel housing.

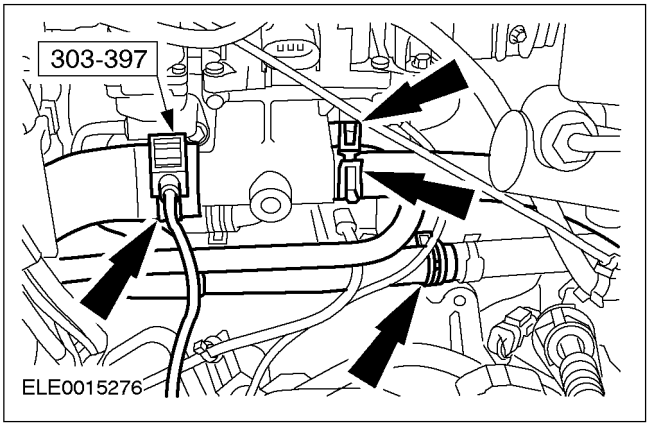


INSTALLATION (Continued)

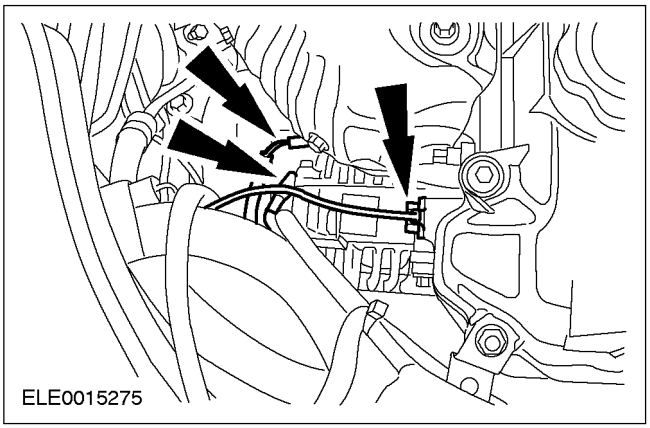
47. Using the special tool, install the coolant hose.



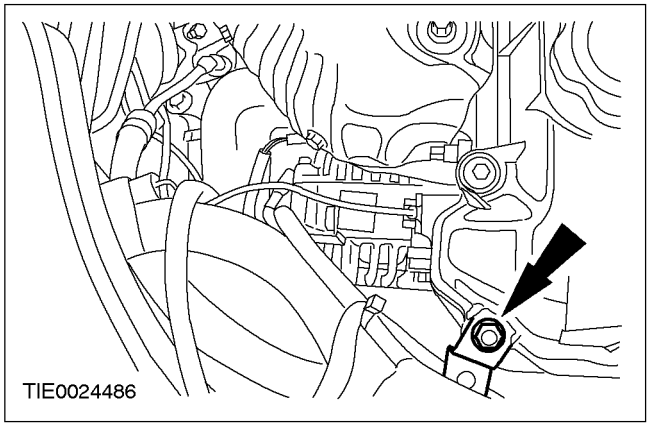
48. Using the special tool, connect the coolant hoses to the coolant connecting pipe.



49. Connect the generator electrical connectors.

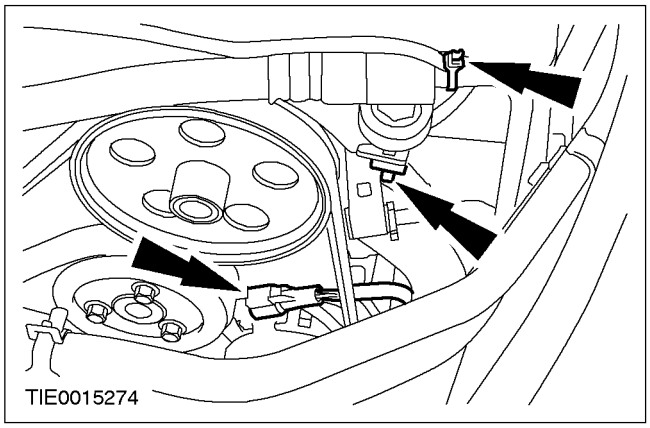


50. Attach the power steering line retaining bracket to the valve cover.

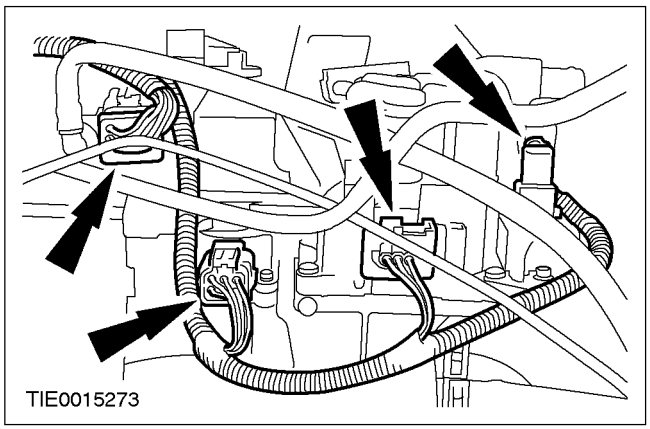


51. Connect the engine wiring harness electrical connectors.

- Install a new clip.



52. Connect the wiring harness electrical connectors.

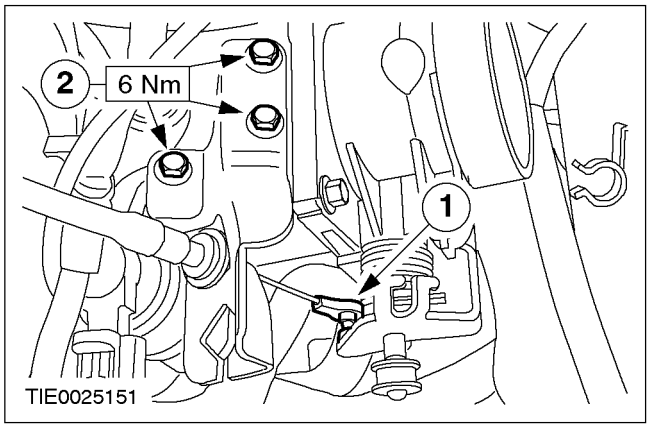


INSTALLATION (Continued)

Vehicles with speed control

53. Attach the speed control cable to the retaining bracket.

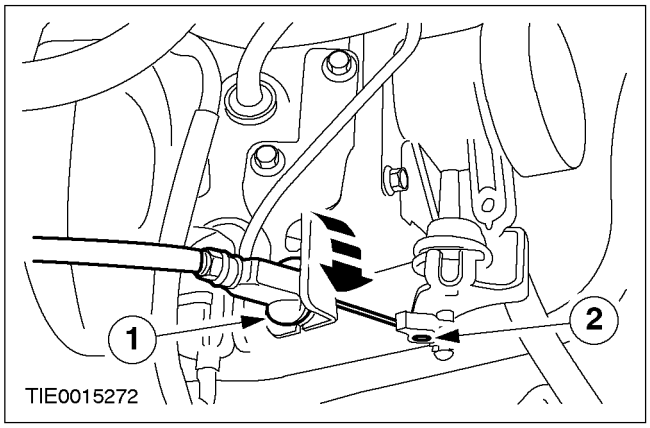
1. Attach the inner cable to the throttle body.
2. Attach the speed control cable retaining bracket to the throttle body.



All vehicles

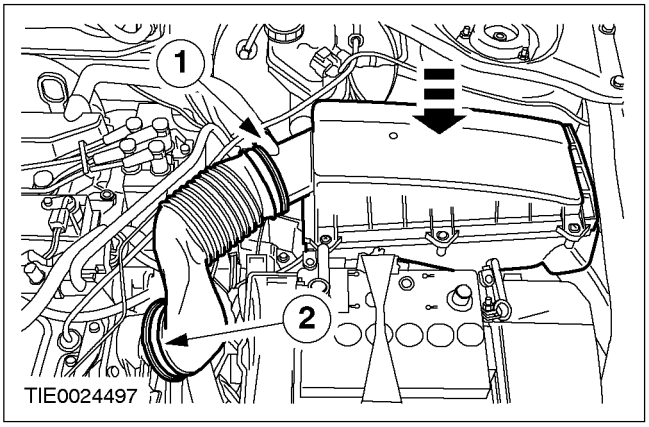
54. Attach the accelerator cable to the retaining bracket.

1. Turn the cable into the bracket.
2. Attach the inner cable to the throttle body.



55. Install the air cleaner housing.

1. Connect the positive crankcase ventilation (PCV) hose.
2. Attach the hose clamp to the intake air cleaner outlet pipe.

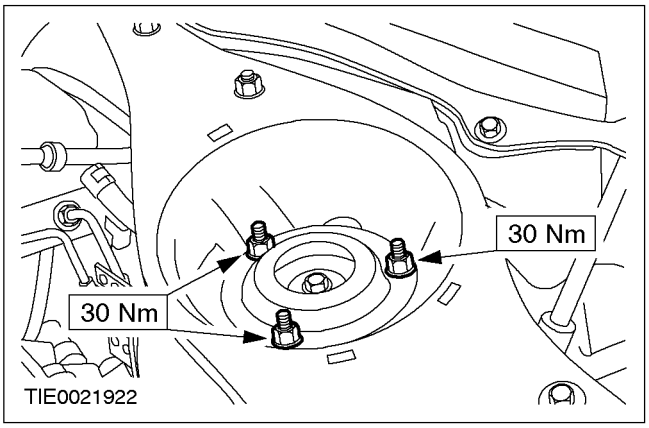


56. Fill the cooling system. For additional information, refer to Section 303-03.

57. Fill and bleed the power steering system. For additional information, refer to Section 211-00.

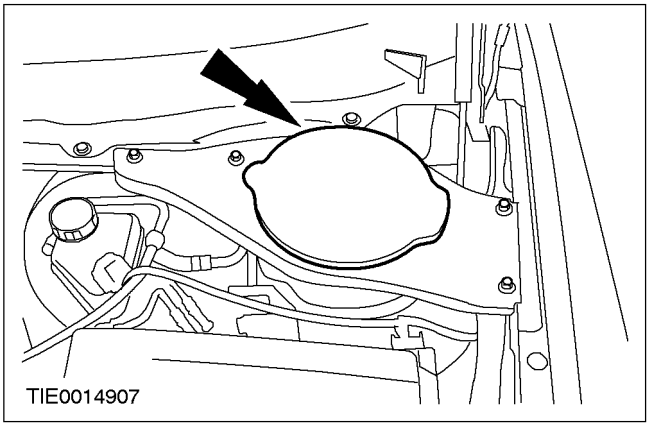
58. Connect the battery ground cable. For additional information, refer to Section 414-01.

59. Tighten the strut and spring assembly top mount retaining nuts on both sides.

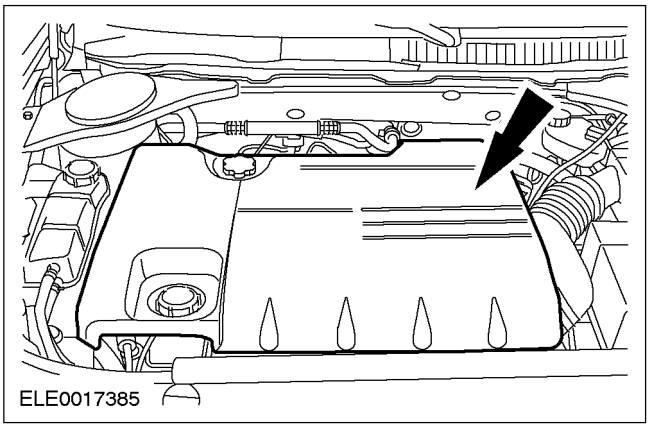


INSTALLATION (Continued)

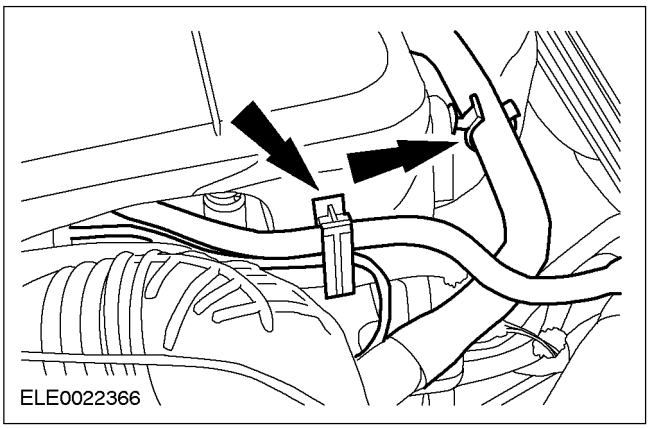
60. Install the strut and spring assembly top mount brace cover on both sides.



61. Install the engine upper cover.



62. Attach the PCV hose and the vacuum hose to the engine upper cover.



63. Initialize the door window motors. For additional information, refer to Section 501-11.

SECTION 303-01B Engine

VEHICLE APPLICATION: 2003.0 Mondeo

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Valve Cover RH ..... (21 140 0) 303-01-14
Crankshaft Pulley ..... (21 572 0) 303-01-17
Crankshaft Front Seal ..... (21 467 0) 303-01-19
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ASSEMBLY

Engine ..... (21 134 8) 303-01-66

INSTALLATION

Engine — Vehicles With: Automatic Transaxle 303-01-95

SPECIFICATIONS

Engine Data

Description	
Firing order	1 – 4 – 2 – 5 – 3 – 6
Engine management	EEC V
Emission standard	Stage IV
Engine code	LCBD
Bore (mm)	81.66
Stroke (mm)	79.5
Number of main bearings	5
Displacement (cm 3)	2499
Compression ratio	9,7:1
Power output kW /PS	125/170
Power output at (rev/min)	6250
Torque (Nm)	220
Torque at (rev/min)	4250
Idle speed (rpm)	725
Number of crankshaft main bearings	4
Number of camshaft bearings	4
Camshaft operation	Chain
Intake valve clearance	Hydraulic adjustment
Exhaust valve clearance	Hydraulic adjustment
Spark plug	AWSF32 F

Engine Oil

Description	Viscosity	Specification
Recommended engine oil Formula E	SAE 5W–30	WSS–M2C913–A
Alternative engine oils Formula S	SAE 5W–40	WSS–M2C912 A1 ACEA A3/B3
XR+ High Performance	SAE 10W–40	ACEA A3/B3

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Coolant	WSS–M97B44–D
Power steering hydraulic fluid	ESP–M2C166–H
Sealer – lower crankcase to cylinder block, mating faces – oil pan to lower crankcase, mating faces – cylinder head covers to cylinder heads, keyway – crankshaft vibration damper.	WSK–M4G320–A
Sealer – coolant plug to cylinder block	ESK–M4G260–A
Sealer – oil pressure switch, blanking plugs – oil and coolant passages	SM–4G–4644–AA/AB
Lubricant – O-rings – coolant connecting pipe	WSS–M97B44–D
Lubricant – spark plugs (Never Seeze)	ESE–M1244–A

Capacities

	Litres
Engine oil, initial fill including oil filter	6.0
Engine oil, including oil filter change	5.5
Engine oil, including oil filter change	5.0
Engine coolant	9.5

SPECIFICATIONS (Continued)

Cylinder Block

Description	mm
Cylinder block bore diameter, Class 1	81.640 – 81.650
Cylinder block bore diameter, Class 2	81.651 – 81.660
Cylinder block bore diameter, Class 3	81.661 – 81.670
Main bearing bore diameter	68.998 – 69.002

Pistons

Description	mm
Piston diameter, Class A	81.630 – 81.650
Piston diameter, Class B	81.638 – 81.662
Piston diameter, Class C	81.650 – 81.670
Piston ring gaps (installed)	
– upper compression ring	0.100 – 0.250
– lower compression ring	0.27 – 0.42
– oil control ring	0.15 – 0.65

Ring gap position: The piston ring gaps must be distributed evenly around the circumference of the piston This also applies to the oil control ring elements. Align the ring gaps at 120 degrees to each other.

Crankshaft

Description	mm
Crankshaft end play	0.135 – 0.255
Main bearing journal diameter, rear	62.968 – 62.992

Connecting Rods

Description	mm
Bore diameter, small end	21.071 – 21.032
Connecting rod length	138.06 – 138.4
Connecting rod clearance (radial)	0.028 – 0.066
Connecting rod bearing clearance (axial)	0.100 – 0.300

Piston Pin

Description	mm
Piston pin length	55.05 – 55.47
Piston pin diameter	21.011 – 21.013
Piston pin clearance in piston	-0.005 – +0.001
Piston pin to connecting rod clearance (radial)	0.028 – 0.066
Piston pin to connecting rod clearance (axial)	0.004 – 0.020

Camshafts

Description	mm
Bearing journal diameter	26.926 – 26.936
Bearing inside diameter	27.012 – 26.897
Camshaft end play	0.025 – 0.165

Valves

Description	mm
Valve stem clearance (exhaust)	0.045 – 0.094
Valve stem clearance (intake)	0.020 – 0.069

SPECIFICATIONS (Continued)

Description	mm
Valve head diameter (exhaust)	26
Valve head diameter (intake)	32

Cylinder Head

Description	mm
Maximum distortion (mating surface)	
Peak – to – valley height of mating surface (reference length mm vertical to groove direction)	

Lubrication System

Description	bar
Max. oil pressure at 1500 rpm	3.1

Torque Specifications

Description	Nm	lb-ft	lb-in
Transaxle retaining bolts	40	30	–
Engine mounting bracket to cylinder block	47	35	–
Front engine mounting	83	61	–
Rear engine mounting (MTX–75)	80	59	–
Center bolt to rear engine roll restrictor	80	59	–
Front exhaust pipe	40	30	–
Rear catalytic converter	40	30	–
Left and right-hand top mount nut	59	44	–
Starter motor bracket	48	35	–
Ground cable to automatic transmission housing	40	30	–
Mounting plate to cylinder block	47	35	–
Blanking plug – oil pump	10	–	89
Oil pump cover to oil pump	10	–	89
Oil pump to cylinder block	10	–	89
Oil baffle to lower crankcase	10	–	89
Oil intake pipe to lower crankcase, M6	10	–	89
Oil intake pipe to lower crankcase, M8	25	18	–
Oil line to radiator	23	17	–
Oil separator to cylinder block	10	–	89
Oil baffle to oil pan	10	–	89
Oil drain plug to oil pan	26	19	–
Oil pan to lower crankcase	25	18	–
Oil pressure switch to cylinder block	14	10	–
Cylinder head bolts, stage (refer to procedure in this section)			
Lower crankcase to cylinder block (refer to procedure in this section)			
Connecting rod bearing caps, stage (refer to procedure in this section)			
Camshaft bearing caps to cylinder head	10	–	89
Camshaft oil seal housing to cylinder head	10	–	89
Fixed timing chain guide to cylinder block	25	18	–
Timing chain tensioner to cylinder block	25	18	–
Timing case cover to cylinder block	25	18	–
Wiring harness bracket to timing case cover	10	–	89

SPECIFICATIONS (Continued)

Description	Nm	lb-ft	lb-in
Camshaft position sensor to timing case cover	10	–	89
Crankshaft position sensor to timing case cover	10	–	89
Pulley/vibration damper to crankshaft (refer to procedure in this section)			
Power steering pump to carrier of engine mounting bracket	25	18	–
Power steering pump bracket to timing case cover	10	–	89
Pulley to power steering pump	25	18	–
Stud of the power steering pump	10	–	89
Spark plugs	14	10	–
Cylinder head cover to cylinder head	10	–	89
Wiring harness retaining plate to cylinder head cover	10	–	89
Exhaust manifold to cylinder head (refer to procedure in this section)			
Knock sensor to cylinder head	34	25	–
Generator bracket to cylinder block	25	18	–
Generator mounting bolts	47	35	–
Engine drive plate to crankshaft	80	59	–
Flywheel to crankshaft	80	59	–
Camshaft oil seal carrier	10		89
Water pump to cylinder head (refer to procedure in this section)			
Coolant connecting pipe to cylinder head	10	–	89
Positive crankcase ventilation bracket to coolant connecting pipe	6	–	89
Coolant distribution pipe to cylinder head	6	–	89
Oil dipstick tube bracket to coolant distribution pipe	10	–	89
Wiring harness to cylinder head cover	5	–	44
Generator power connection	10	–	89
Lower intake manifold to cylinder heads (refer to procedure in this section)			
Upper intake manifold to valve cover (refer to procedure in this section)			
Intake manifold runner control actuator	10	–	89
EI coil to cylinder head cover	6	–	53
Ground cable to EI coil	6	–	53
Front driveshaft intermediate shaft bracket to cylinder block	47	35	–
Exhaust gas recirculation pipe to EGR valve	40	30	–
Unspecified bolt usage: M5 x 0,8	6	–	53
Unspecified bolt usage: M6 x 1	10	–	89
Unspecified bolt usage: M8 x 1,25	25	18	–
Unspecified bolt usage: M10 x 1,5	47	35	–
Unspecified bolt usage: M12 x 1,75	82	60	–
Unspecified bolt usage: M14 x 2	132	97	–

DIAGNOSIS AND TESTING

Engine

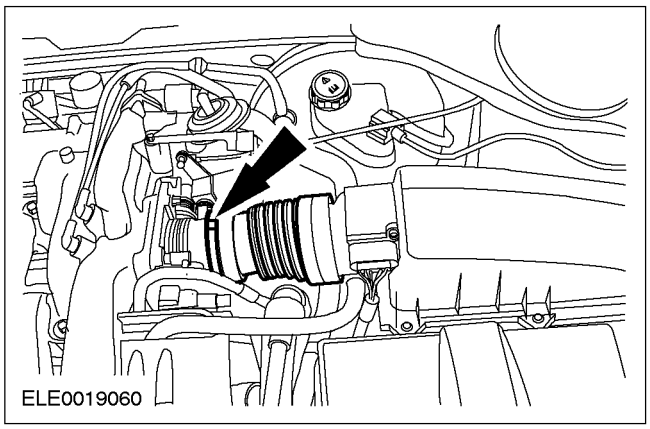
REFER to Section 303-00.

IN-VEHICLE REPAIR

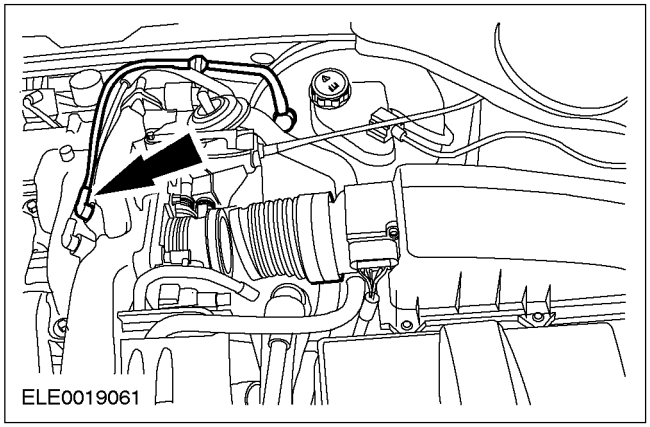
Upper Intake Manifold (21 183 0)

Removal

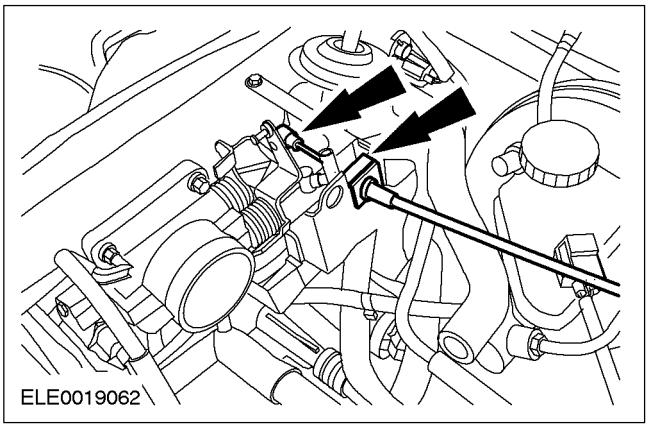
1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Disconnect the air intake hose from the upper intake manifold.**
   - Detach the hose clamp.



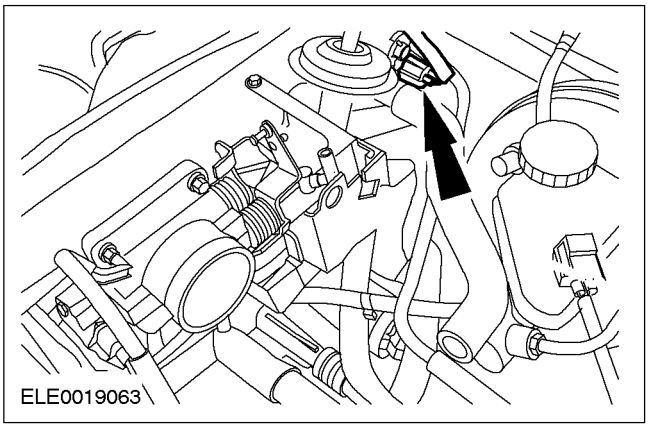
3. **Disconnect the brake booster vacuum pipe from the upper intake manifold.**



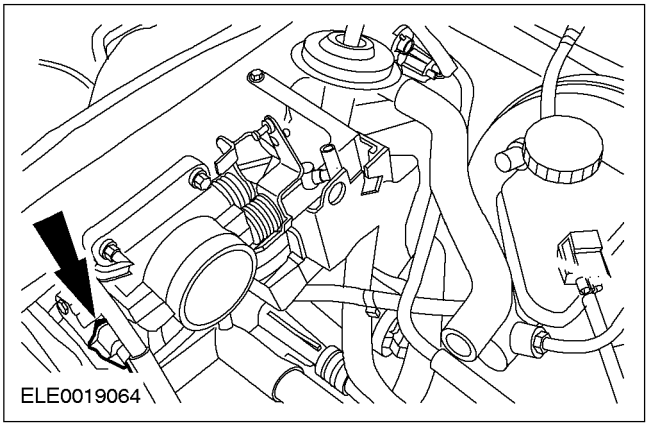
4. **Detach the accelerator cable.**
   - Detach the clips and the accelerator cable from the bracket.



5. **Disconnect the idle air control (IAC) valve electrical connector.**



6. **Disconnect the throttle position (TP) sensor electrical connector.**

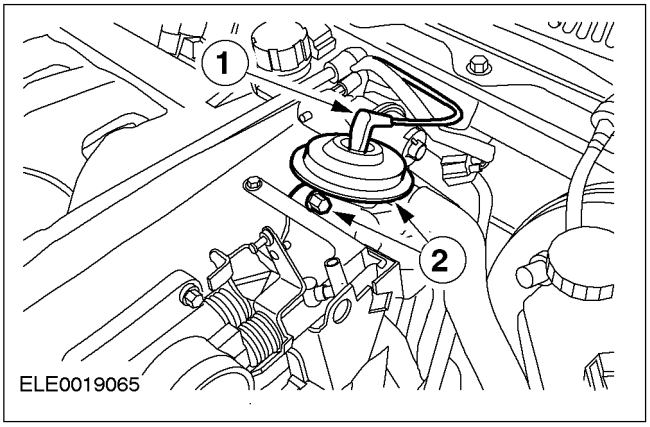


IN-VEHICLE REPAIR (Continued)

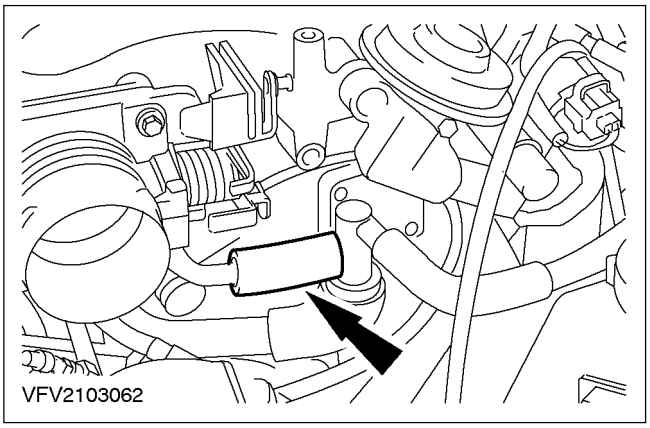
7. Remove the exhaust gas recirculation (EGR) valve from the upper intake manifold.

1. Disconnect the EGR valve vacuum hose.
2. Remove the bolts.

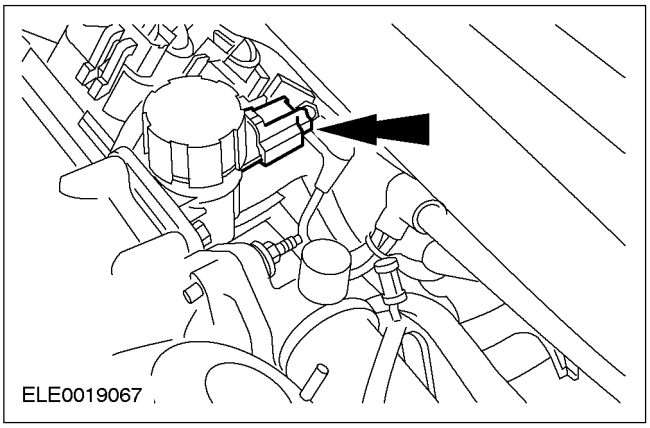
- Discard the gasket.



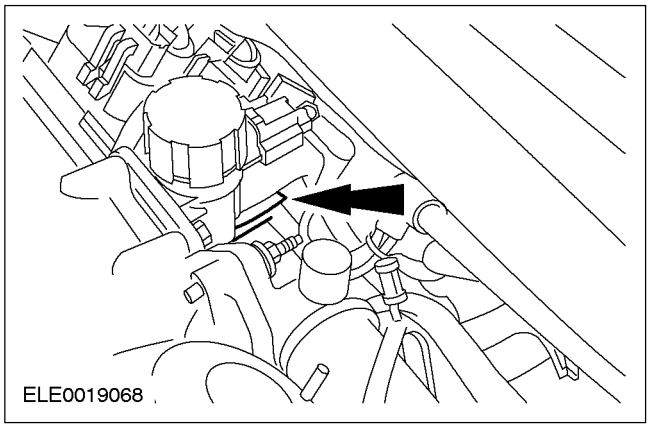
8. Disconnect the positive crankcase ventilation (PCV) hose.



9. Disconnect the electronic vacuum regulator (EVR) solenoid electrical connector.



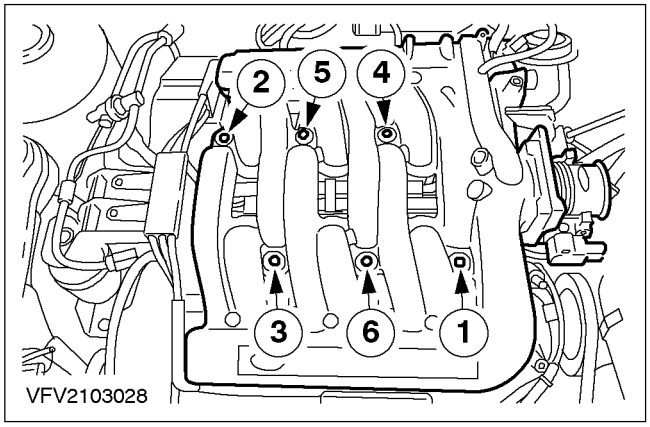
10. Disconnect the EVR vacuum hose.



11. NOTE: Remove the upper intake manifold retaining bolts in the sequence shown.

Remove the upper intake manifold.

- Discard the gaskets.



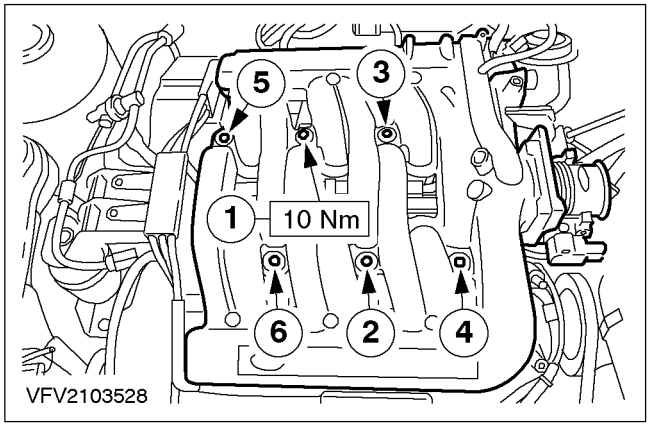
IN-VEHICLE REPAIR (Continued)

Installation

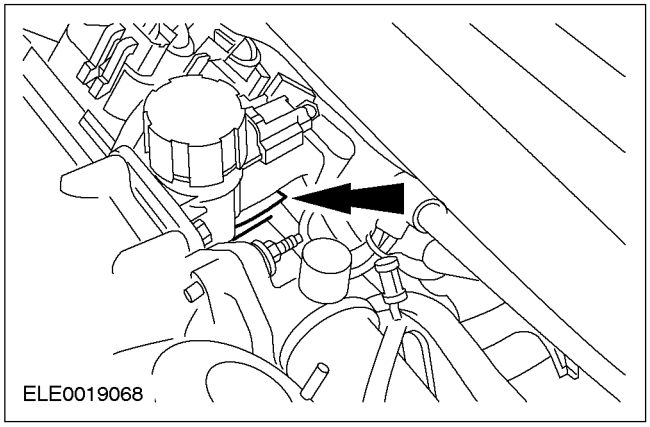
1. **NOTE:** Make sure insulating bushes are on the upper intake manifold retaining bolts.

   Install the upper intake manifold with new gaskets.

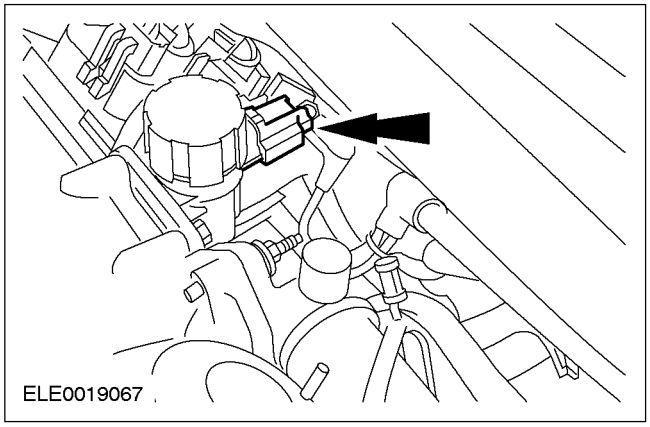
   - Tighten the bolts in the sequence shown.



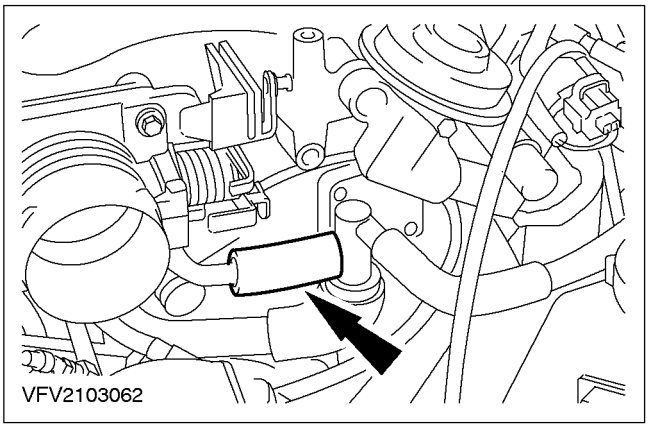
2. **Connect the EVR vacuum hose.**



3. **Connect the EVR solenoid electrical connector.**



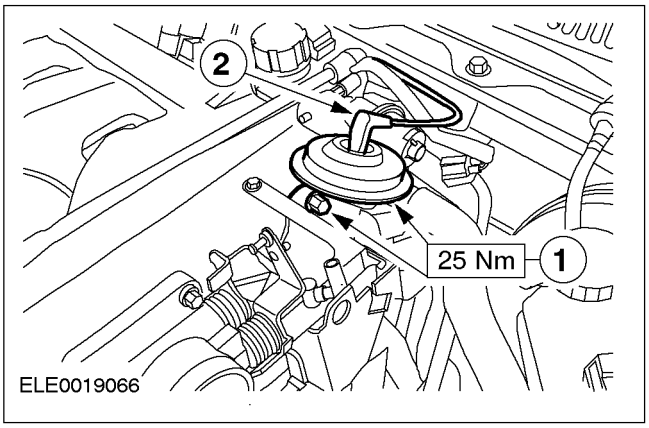
4. **Connect the PCV hose.**



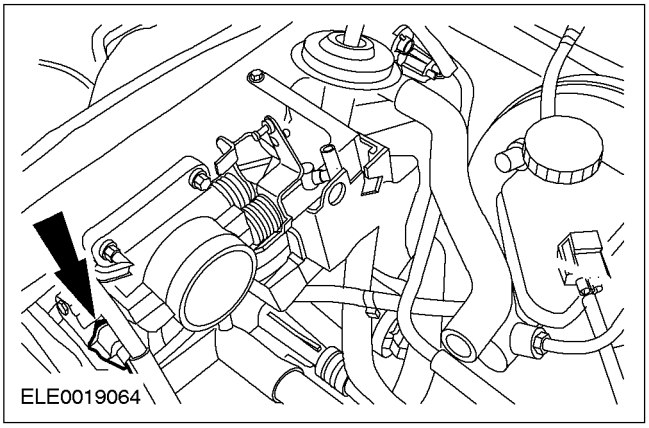
5. **NOTE:** Install a new gasket gasket.

   Install the EGR valve to the upper intake manifold.

   1. Install the retaining bolts.
   2. Connect the EGR valve vacuum hose.

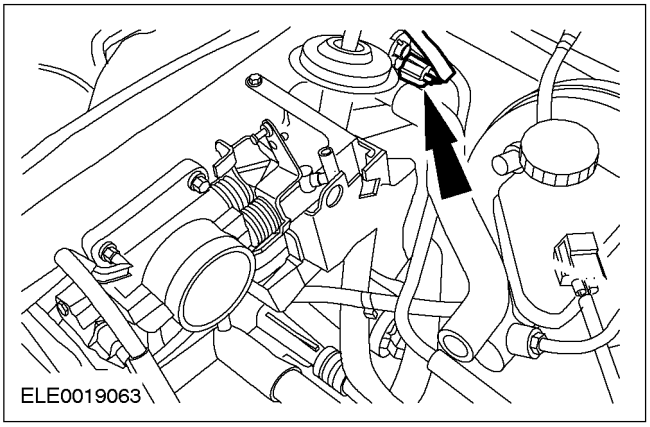


6. **Connect the TP sensor electrical connector.**



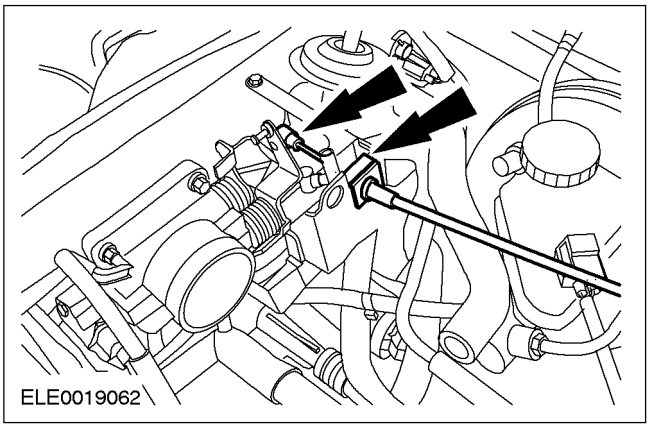
IN-VEHICLE REPAIR (Continued)

7. Connect the IAC valve electrical connector.

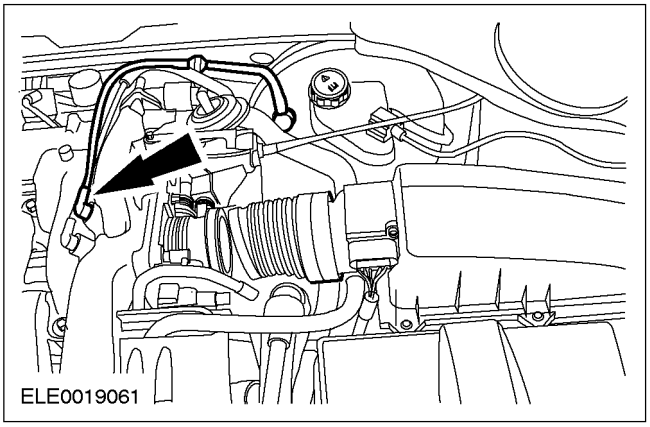


8. Attach the accelerator cable.

- Attach the clips and accelerator cable to the bracket.

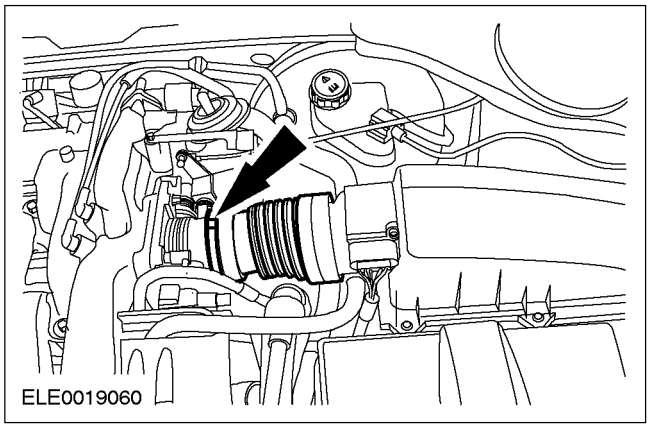


9. Connect the brake booster vacuum pipe.



10. Connect the air intake hose to the upper intake manifold.

- Attach the hose clamp.



11. Connect the battery ground cable. For additional information, refer to Section 414-01.

12. Initialize the door window motors. For additional information, refer to Section 501-11.

IN-VEHICLE REPAIR

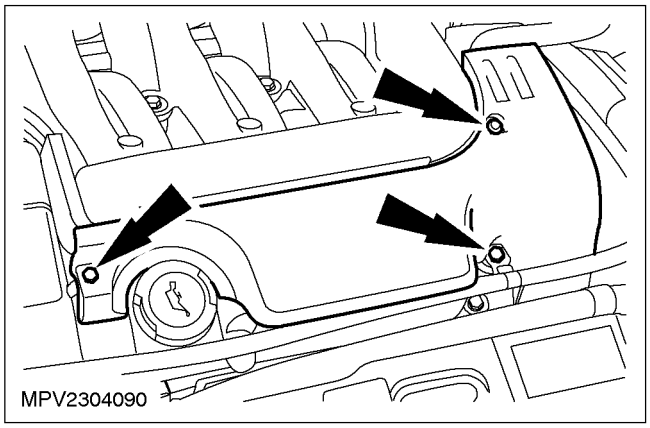
Valve Cover LH (21 141 0)

Name	Specification
Sealer	WSE-M4G323-A6

Removal

All vehicles

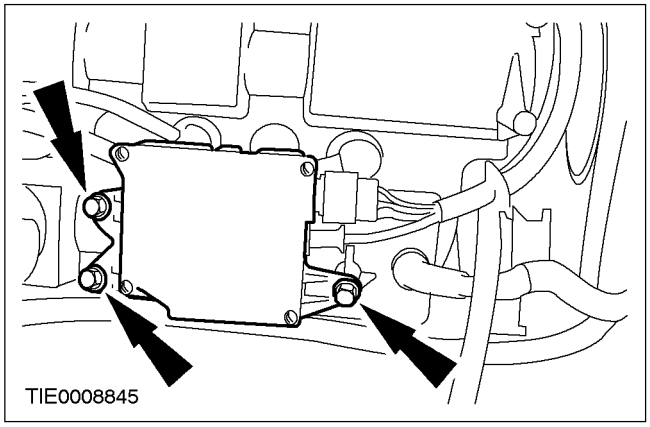
1. **Remove the engine upper cover.**



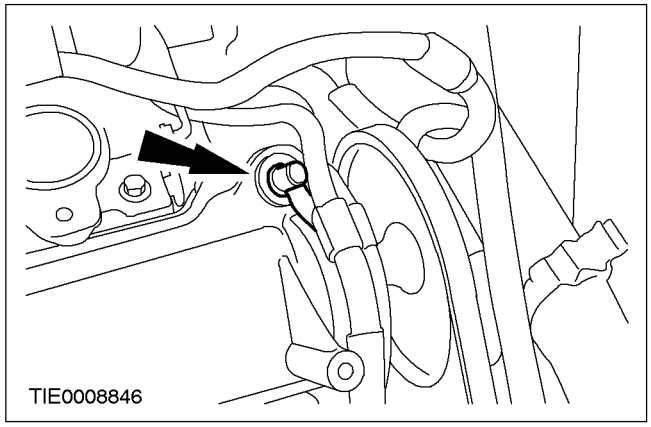
2. **Remove the upper intake manifold.** **For additional information, refer to Upper Intake Manifold in this section.**

Vehicles with automatic transaxle

3. **Remove the intake manifold runner control (IMRC) actuator bolts.**

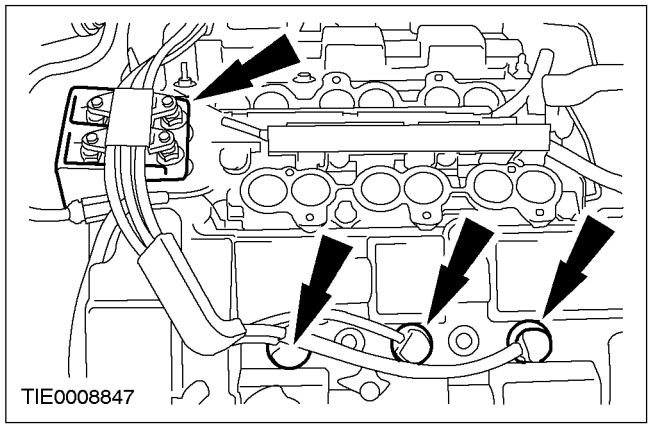


4. **Detach the cable bridge and position the IMRC actuator to one side.**

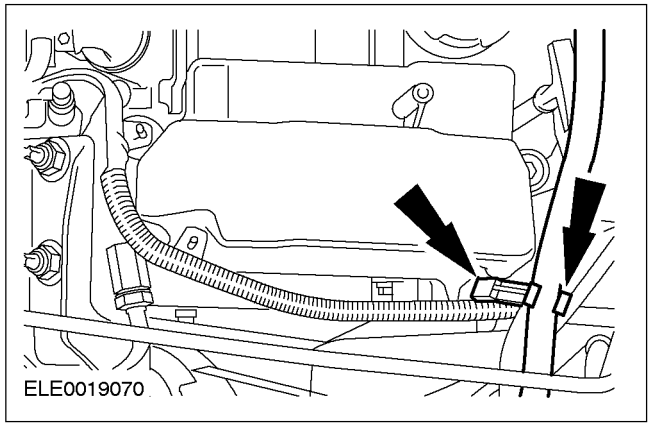


All vehicles

5. **Disconnect the left-hand spark plug electrical connectors.**
   - Detach the bracket.

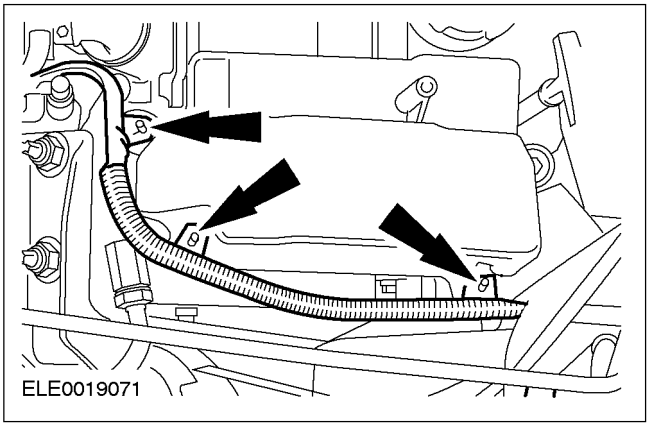


6. **Detach the coolant hose from the bracket (if equipped).**
   - Detach the bracket from the retaining stud.



IN-VEHICLE REPAIR (Continued)

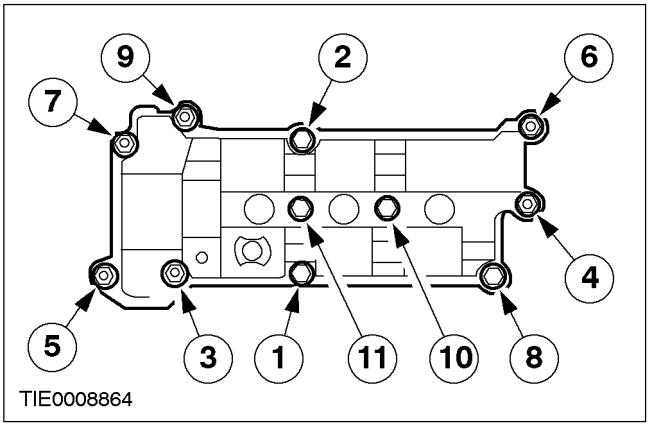
7. Detach the wiring harness from the left-hand valve cover.



8. NOTE: Remove the left-hand valve cover retaining bolts in the sequence shown.

Remove the left-hand valve cover.

- Discard the gasket.

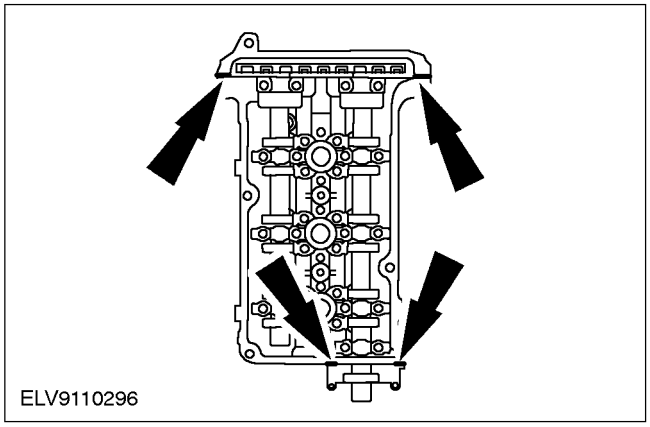


Installation

All vehicles

1. Clean the mating faces of the cylinder head and the left-hand valve cover with a clean lint free cloth.

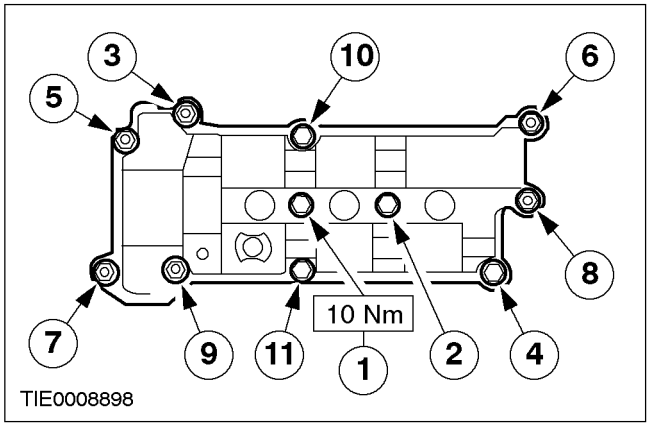
2. Apply sealer to the mating faces of the cylinder head.



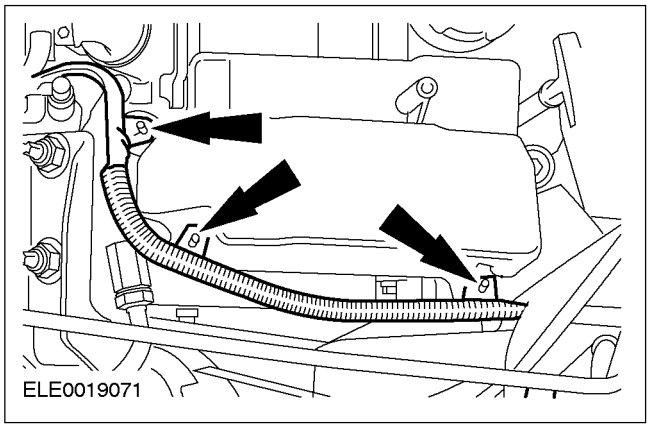
3. NOTE: Install a new gasket.

NOTE: Tighten the valve cover retaining bolts in the sequence shown.

Install the left-hand valve cover.

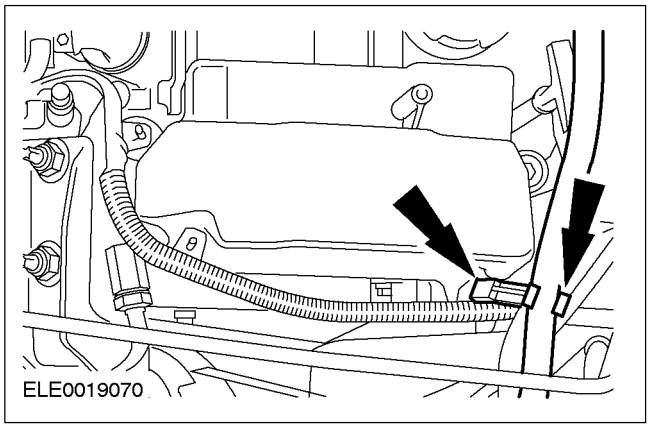


4. Attach the wiring harness to the left-hand valve cover.

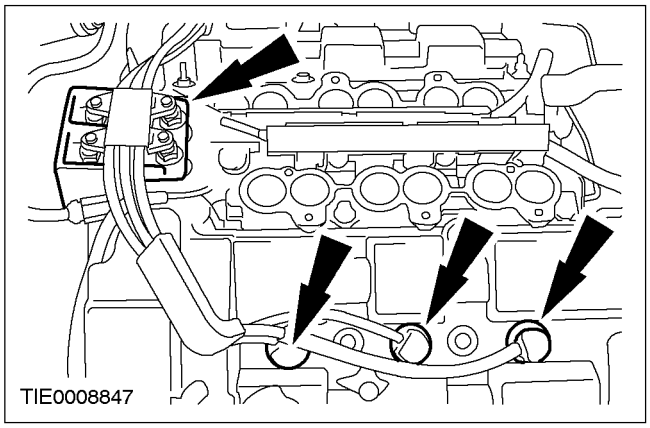


IN-VEHICLE REPAIR (Continued)

5. **Attach the coolant hose to the bracket (if equipped).**
   - Attach the bracket to the retaining stud.

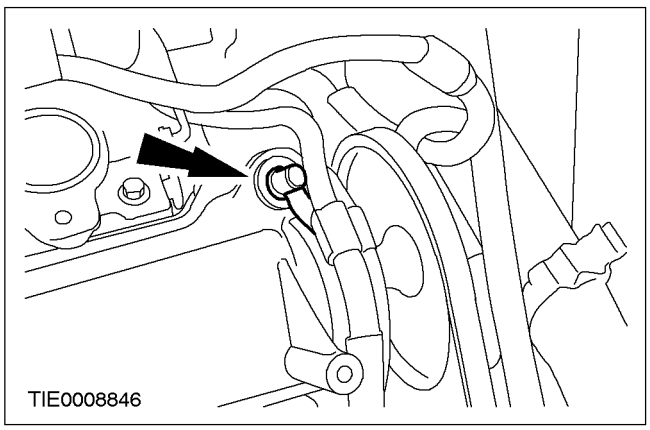


6. **Connect the left-hand spark plug electrical connectors.**
   - Attach the bracket.

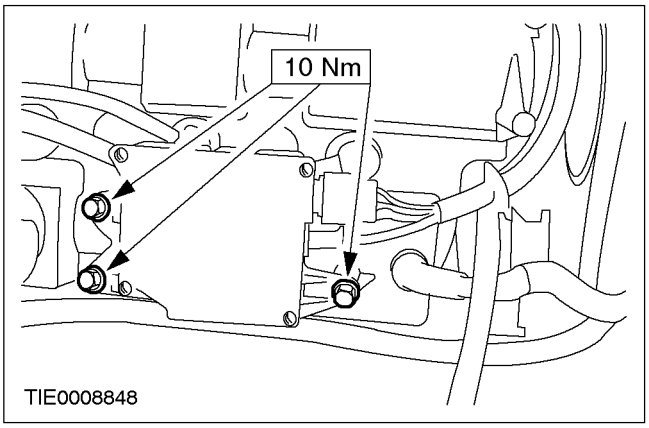


Vehicles with automatic transaxle

7. **Position the IMRC actuator and install the bridge.**



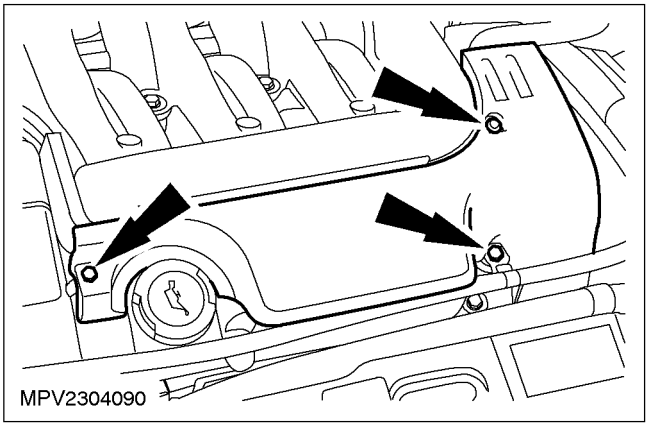
8. **Install the IMRC actuator bolts.**



9. **Install the upper intake manifold.** **For additional information, refer to Upper Intake Manifold in this section.**

All vehicles

10. **Install the engine upper cover.**



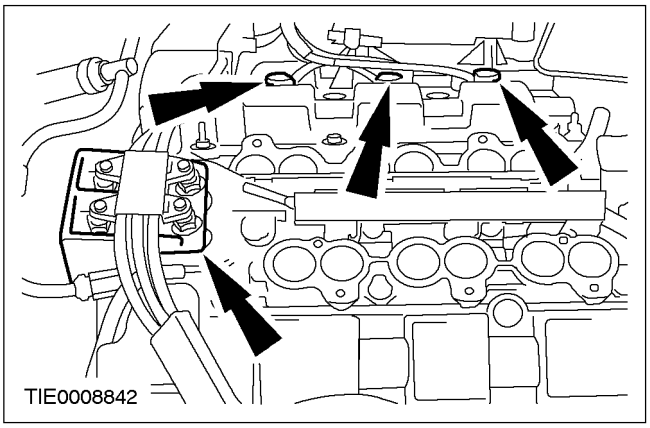
IN-VEHICLE REPAIR

Valve Cover RH (21 140 0)

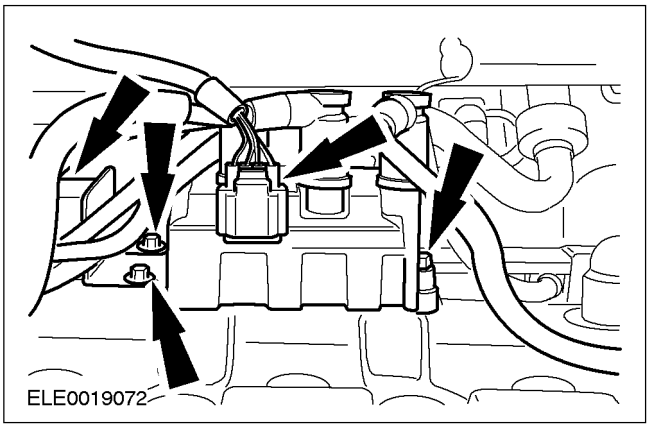
Name	Specification
Sealer	WSE-M4G323-A6

Removal

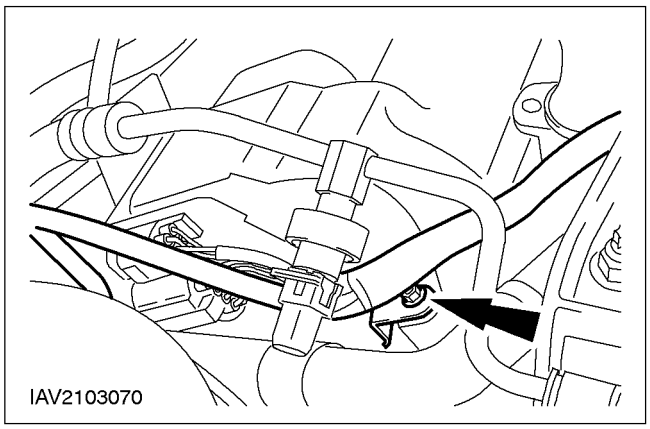
1. **Remove the upper intake manifold.** **For additional information, refer to Upper Intake Manifold in this section.**
2. **Disconnect the right-hand spark plug electrical connectors.**
   - Detach the bracket.



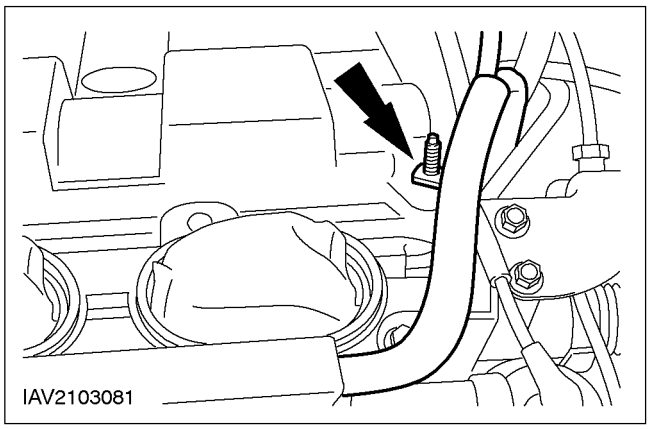
3. **Remove the electronic ignition (EI) coil.**
   - Disconnect the electrical connectors.



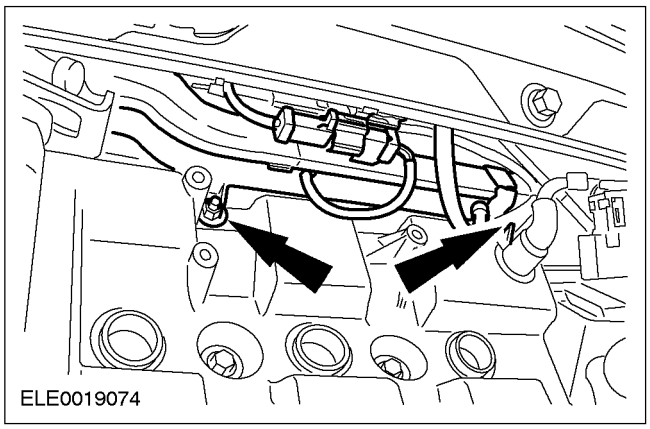
4. **Detach the front wiring harness bracket from the right-hand valve cover (if equipped).**



5. **Detach the rear wiring harness bracket from the right-hand valve cover (if equipped).**



6. **Detach the wiring rail from the right-hand valve cover.**

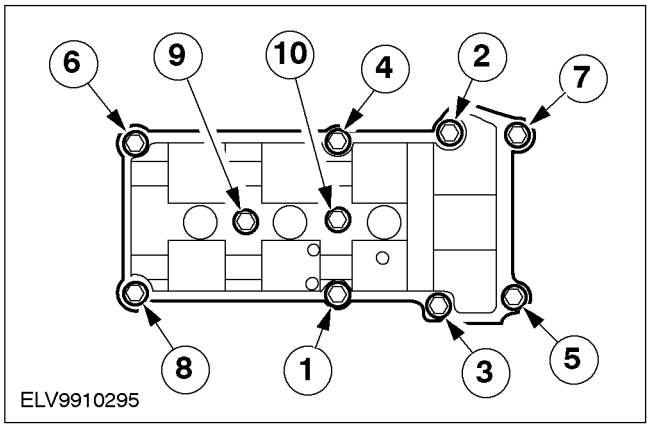


IN-VEHICLE REPAIR (Continued)

7. NOTE: Remove the right-hand valve cover retaining bolts in the sequence shown.

Remove the right-hand valve cover.

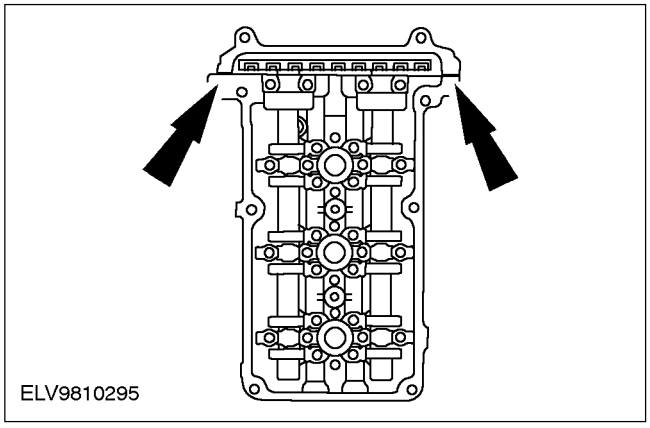
- Discard the gasket.



Installation

1. Clean the mating faces of the cylinder head and the right-hand valve cover with a clean lint free cloth.

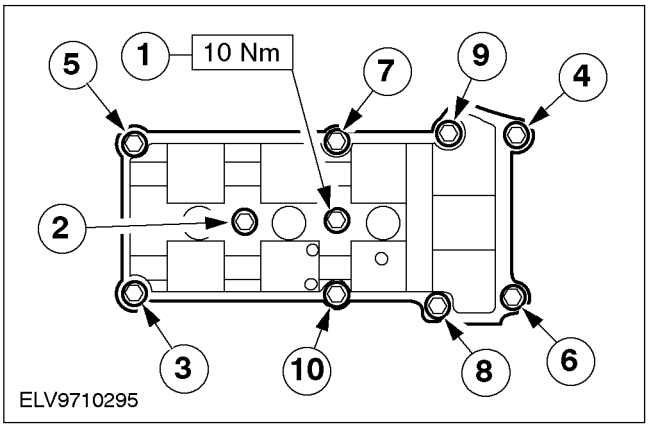
- Apply sealer to the mating faces of the cylinder head.



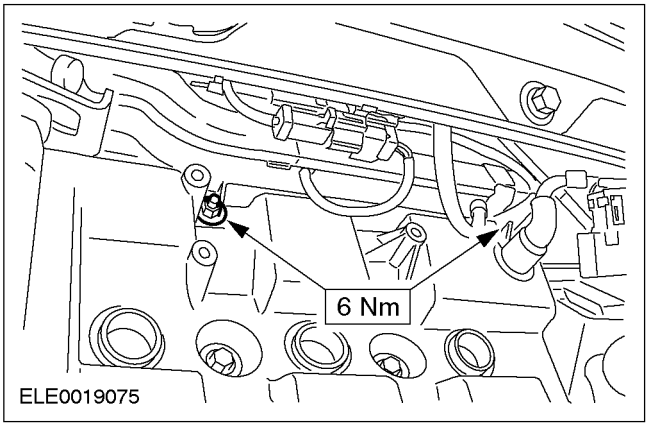
2. NOTE: Install a new gasket.

NOTE: Tighten the valve cover retaining bolts in the sequence shown.

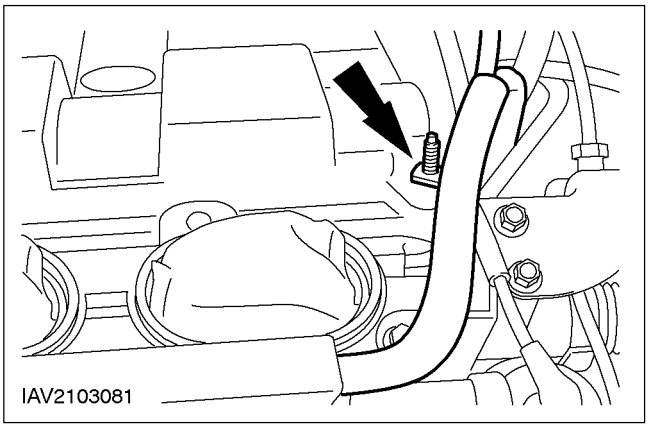
Install the right-hand valve cover.



3. Attach the wiring rail to the right-hand valve cover.

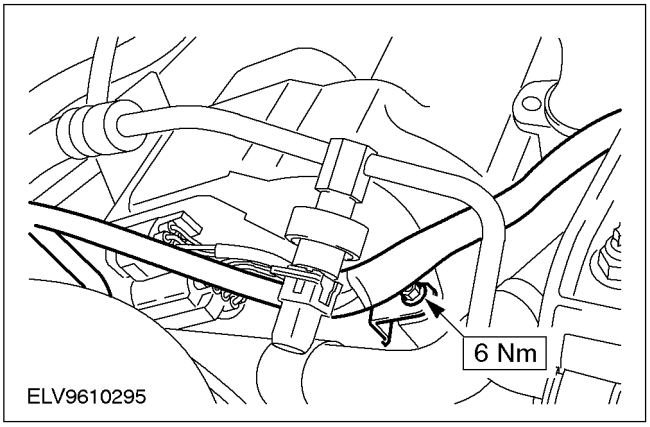


4. Attach the rear wiring harness bracket to the right-hand valve cover (if equipped).

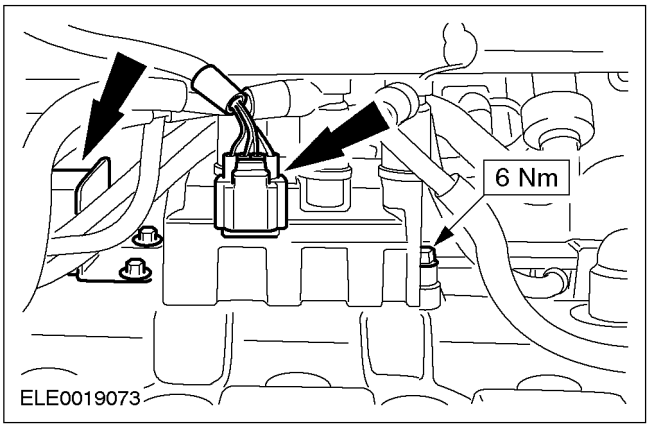


IN-VEHICLE REPAIR (Continued)

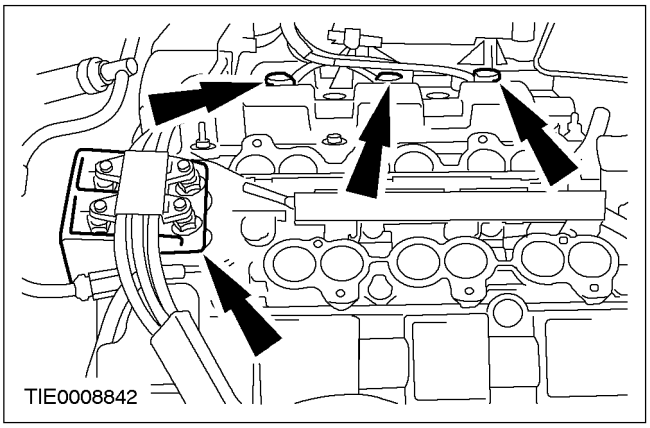
5. **Attach the front wiring harness bracket to the right-hand valve cover (if equipped).**



6. **Install the EI coil.**
   - Connect the electrical connectors.



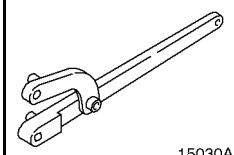
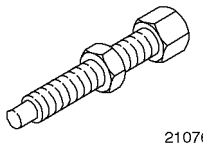
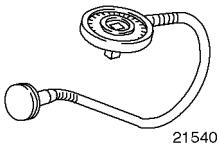
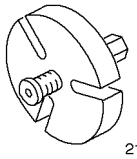
7. **Connect the right-hand spark plug electrical connectors.**
   - Attach the bracket.



8. **Install the upper intake manifold.** **For additional information, refer to Upper Intake Manifold in this section.**

IN-VEHICLE REPAIR

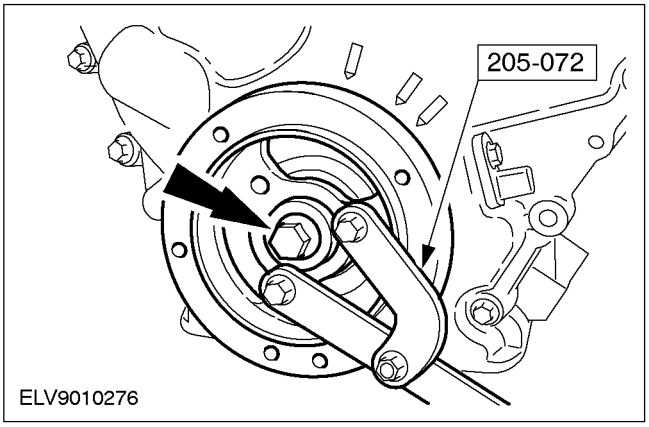
Crankshaft Pulley (21 572 0)

Special Tool(s)	
 15030A	Flange Holding Wrench, Universal 205-072 (15-030A)
 21076	Remover/ Installer, Crankshaft Vibration Damper 303-130 (21-076)
 21540	Angle Gauge, Bolt Tightening 303-174 (21-540)
 21153B	Remover, Crankshaft Vibration Damper 303-338 (21-153B)

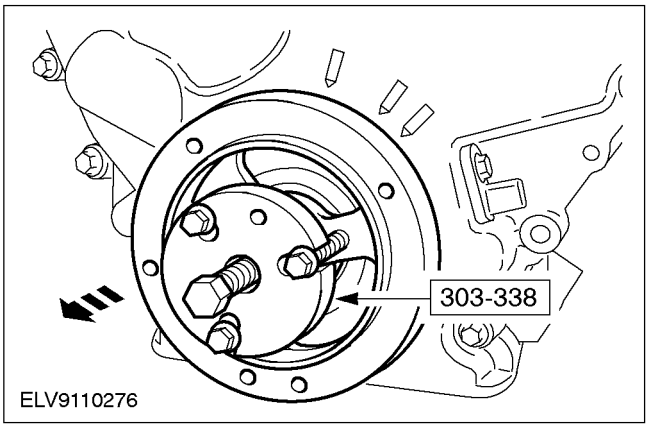
Name	Specification
Sealer (Loctite 5900)	WSE-M4G323-A6

Removal

1. **Remove the accessory drive belt. For additional information, refer to Section 303-05.**
2. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
3. **Using the special tool, remove the crankshaft pulley retaining bolt.**
   - Discard the bolt.



4. **Using the special tool, remove the crankshaft pulley.**

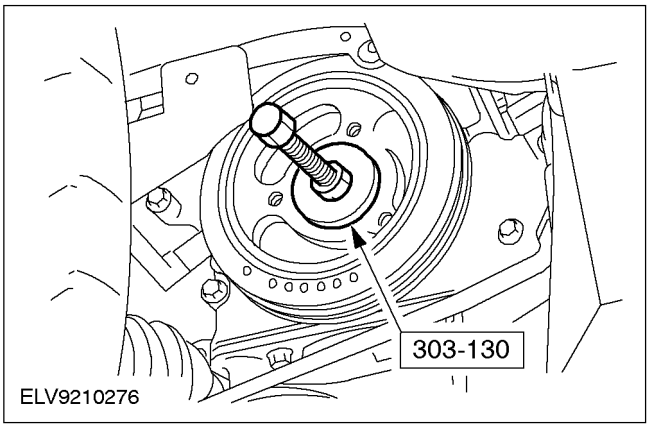


IN-VEHICLE REPAIR (Continued)

Installation

1. **NOTE:** Use the crankshaft pulley retaining bolt washer for installation.

   Using the special tool, install the crankshaft pulley.

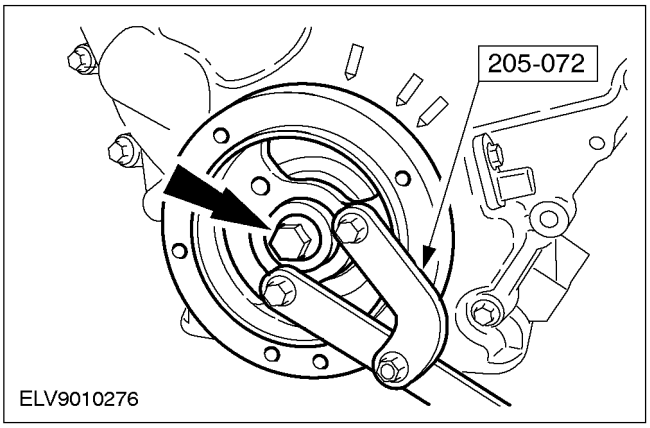


2. **NOTE:** Install a new retaining bolt.

NOTE: Coat the Woodruff key groove and the crankshaft pulley retaining bolt with sealer.

   Using the special tool, tighten the crankshaft pulley retaining bolt in four stages.

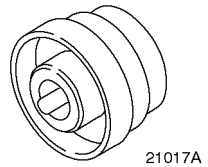
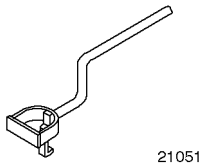
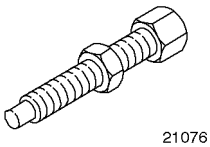
   1. Stage 1: 120 Nm
   2. Stage 2: Loosen the retaining bolt by 360 degrees.
   3. Stage 3: 50 Nm
   4. Stage 4: 90 degrees



3. **Install the accessory drive belt. For additional information, refer to Section 303-05.**
4. **Lower the vehicle.**

IN-VEHICLE REPAIR

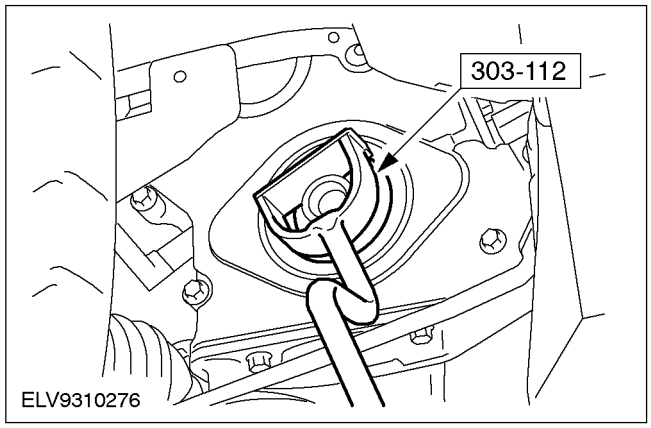
Crankshaft Front Seal (21 467 0)

Special Tool(s)	
 21017A	Installer/Aligner, Timing Cover Oil Seal 303-055 (21-017 A)
 21051	Remover, Oil Seal 303-112 (21-051)
 21076	Remover/Installer, Crankshaft Vibration Damper 303-130 (21-076)

Name	Specification
Vehicles built up to 10/2000:	
Engine oil	WSS-M2C912-A1/ WSS-M2C913-A
Vehicles built 10/2000 onwards:	
Engine oil	WSS-M2C913-A

Removal

1. **Remove the crankshaft pulley.** **For additional information, refer to Crankshaft Pulley in this section.**
2. **Using the special tool, remove the crankshaft front oil seal.**

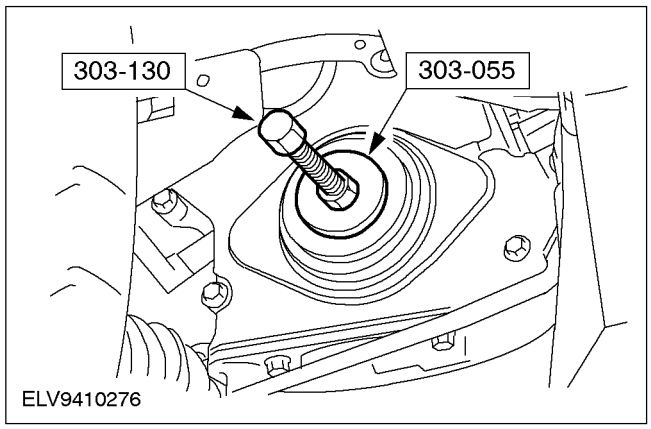


Installation

1. **NOTE:** Use the crankshaft pulley bolt washer for installation.

NOTE: Lubricate the outer ring of the oil seal with engine oil.

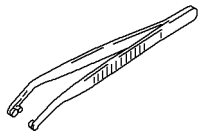
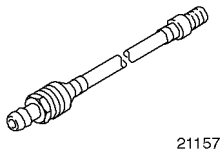
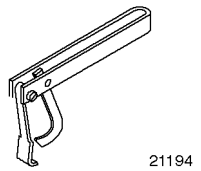
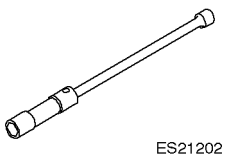
Using the special tool, install the crankshaft front oil seal.



2. **Install the crankshaft pulley.** **For additional information, refer to Crankshaft Pulley in this section.**

IN-VEHICLE REPAIR

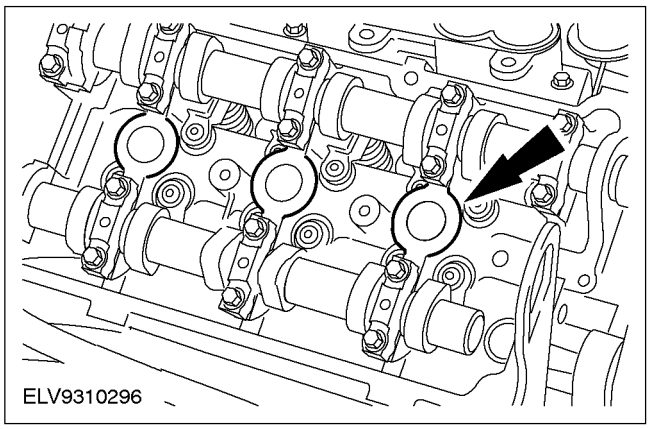
Valve Springs

Special Tool(s)	
 21156	Installer, Valve Stem Collets 303-362 (21-156)
 21157	Adapter, Air Supply (Cylinder Head) 303-363 (21-157)
 21194	Compressor, Valve Spring 303-461 (21-194)
 2119401	Adapter for 303-461 303-461-01 (21-194-01)
 ES21202	Socket, Spark Plug 303-499 (21-202)

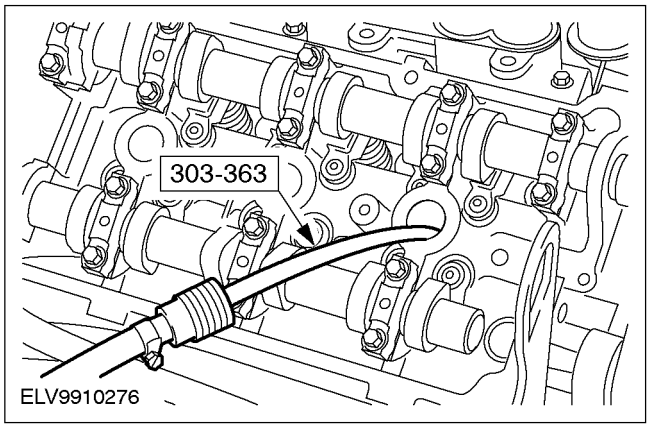
Removal

1. **Remove the left-hand valve cover. For additional information, refer to LH Valve Cover in this section.**
2. **Remove the right-hand valve cover. For additional information, refer to RH Valve Cover in this section.**
3. **CAUTION: The piston of the cylinder to be worked on must be at bottom dead center (BDC) and both valves be closed. Sudden loss of compressed air pressure could cause the valve to drop into the cylinder.**

   Remove the spark plugs.

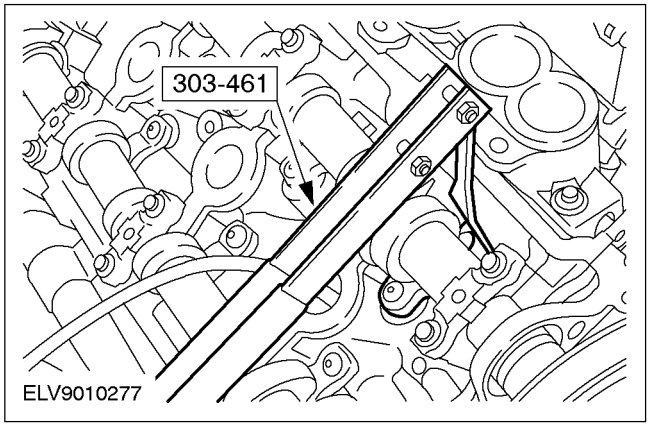


4. **Using the special tool, apply approximately 7 - 10 bar of compressed air to the appropriate cylinder.**

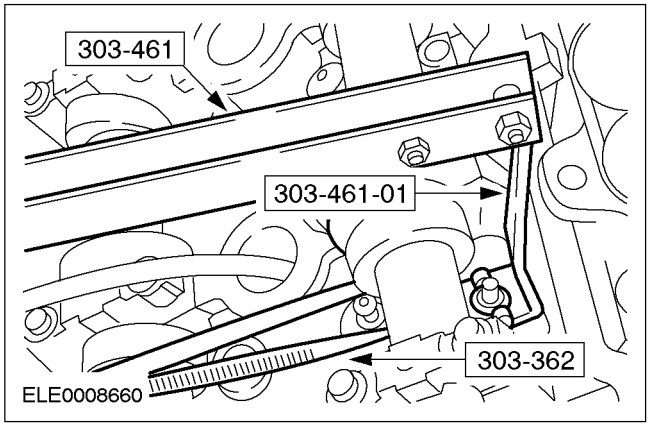


IN-VEHICLE REPAIR (Continued)

5. **Using the special tool, remove the cam followers.**

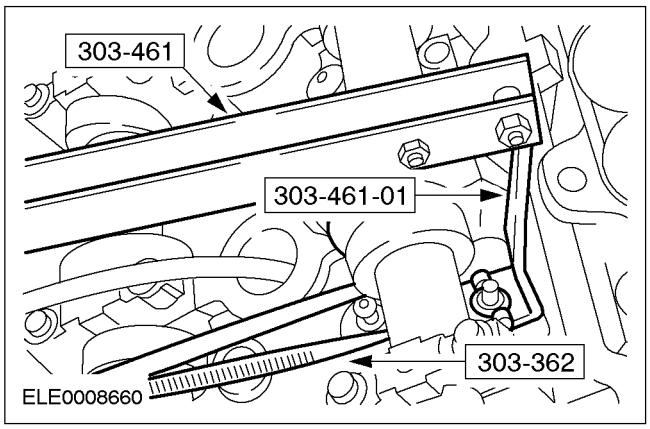


6. **Using the special tools, remove the valve springs.**

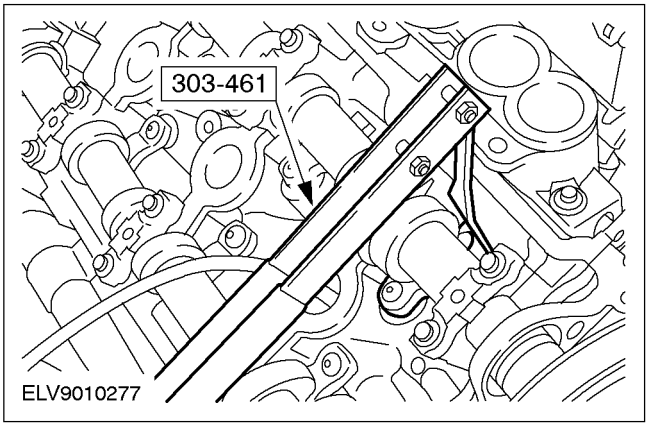


Installation

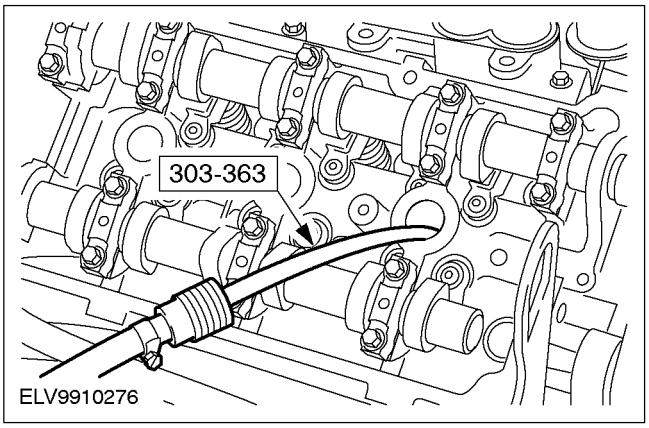
1. **Using the special tools, install the valve springs.**



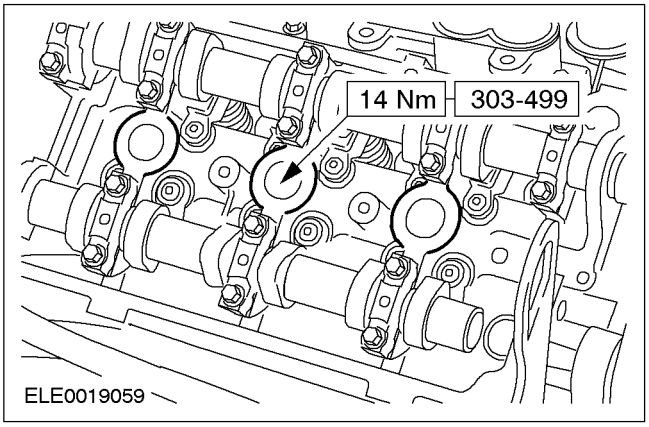
2. **Using the special tool, install the cam follower.**



3. **Remove the special tool.**



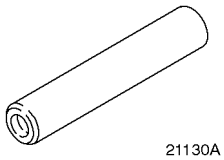
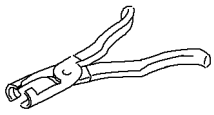
4. **Install the spark plugs.**



5. **Install the right-hand valve cover. For additional information, refer to RH Valve Cover in this section.**
6. **Install the left-hand valve cover. For additional information, refer to LH Valve Cover in this section.**

IN-VEHICLE REPAIR

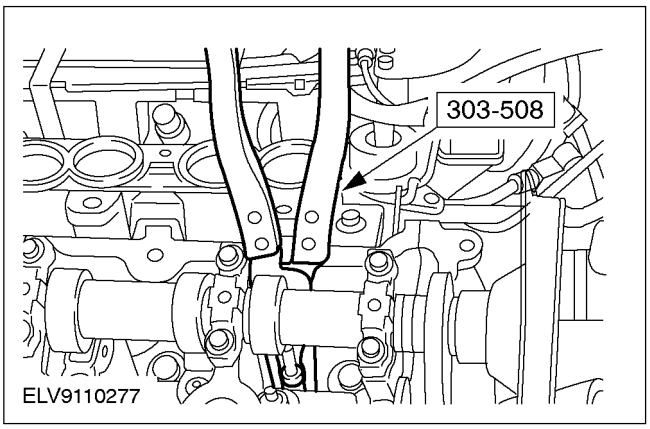
Valve Seals (21 238 0)

Special Tool(s)	
 21130A	Installer, Intake Valve Stem Oil Seal 303-247 (21-130A)
 PZ21211	Pliers, Valve Stem Oil Seal 303-508 (21-211)

General Equipment
Protective sleeve - valve stem

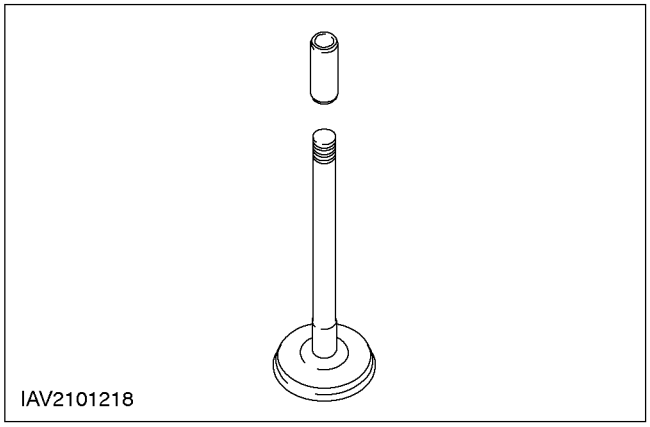
Removal

1. **Remove the valve springs.** **For additional information, refer to Valve Springs in this section.**
2. **Using the special tool, remove the valve stem oil seals.**



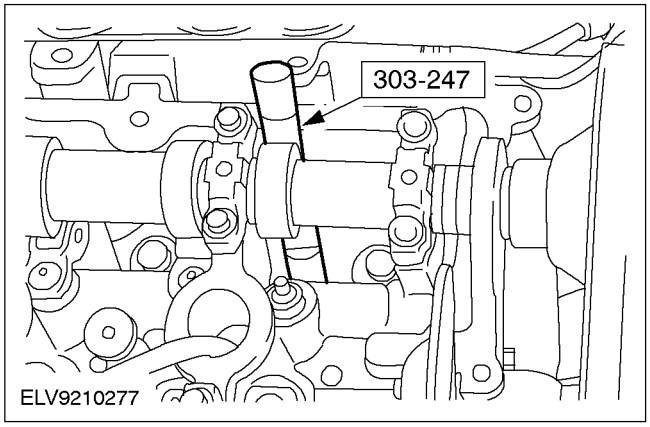
Installation

1. **Cover the collet groove with the valve stem protective sleeve (valve shown removed for clarity).**



2. **NOTE:** Install new oil seals.

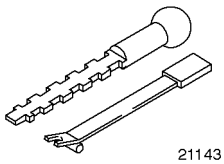
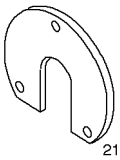
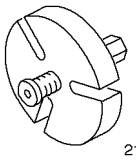
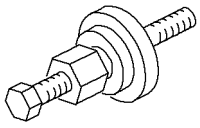
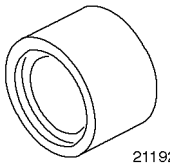
   Using the special tool, install the valve stem oil seals.



3. **Install the valve springs.** **For additional information, refer to Valve Springs in this section.**

IN-VEHICLE REPAIR

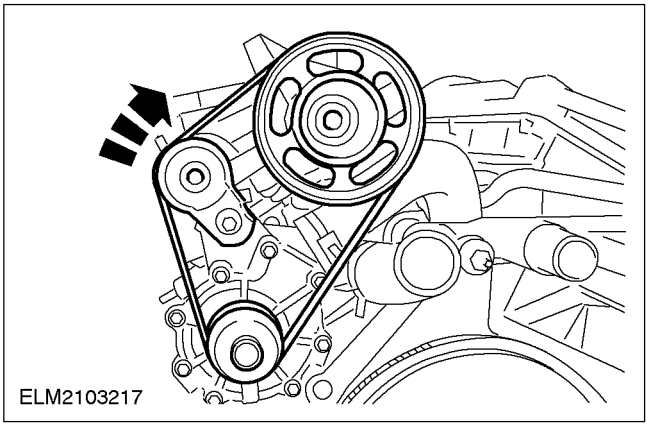
Camshaft Seal (21 288 0)

Special Tool(s)	
 21143	Remover, Crankshaft Oil Seal 303-293 (21-143)
 21153A02	Adapter for 303-338 303-338-02 (21-153 A-02)
 21153B	Remover, Crankshaft Vibration Damper 303-338 (21-153B)
 21192	Installer, Camshaft Pulley 303-458 (21-192)
 2119201	Adapter for 303-458 303-458-01 (21-192-01)

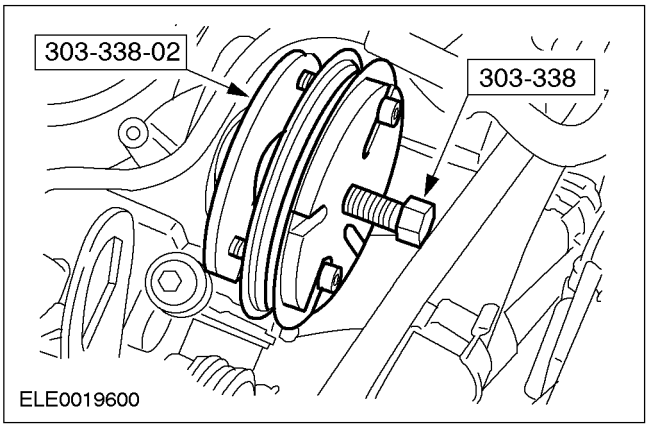
Name	Specification
Engine oil	WSS-M2C913-A

Removal

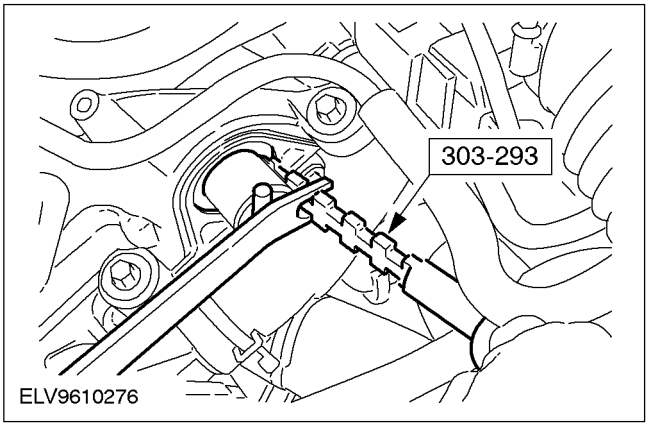
1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Remove the water pump drive belt.**
   - Rotate the belt tensioner clockwise to release the tension on the drive belt.



3. **Using the special tools, remove the camshaft pulley.**



4. **Using the special tool, remove the camshaft oil seal.**
   - Discard the seal.



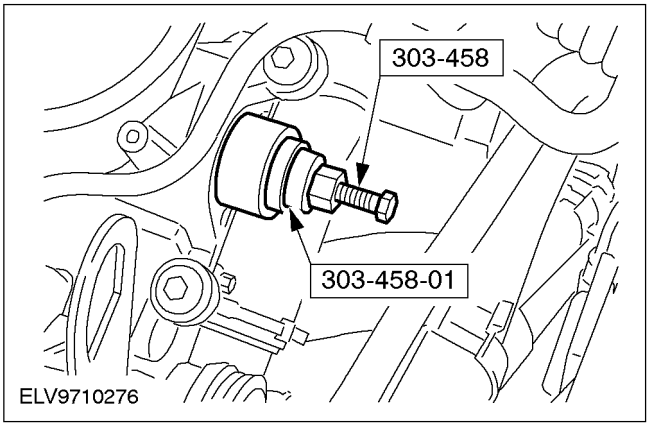
IN-VEHICLE REPAIR (Continued)

Installation

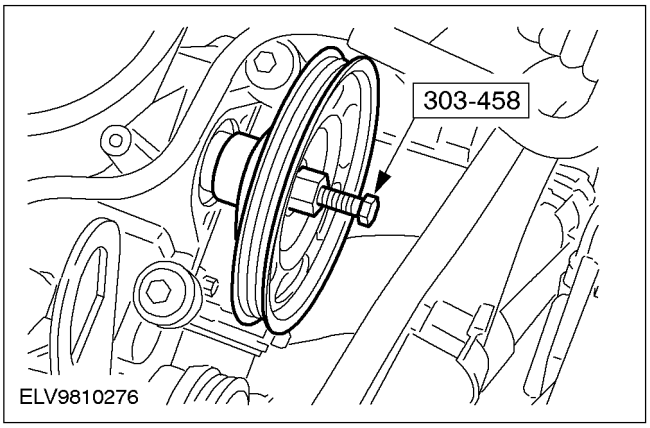
1. **NOTE:** Install a new oil seal.

   Using the special tools, install the camshaft oil seal.

   - Lubricate the oil seal with engine oil.

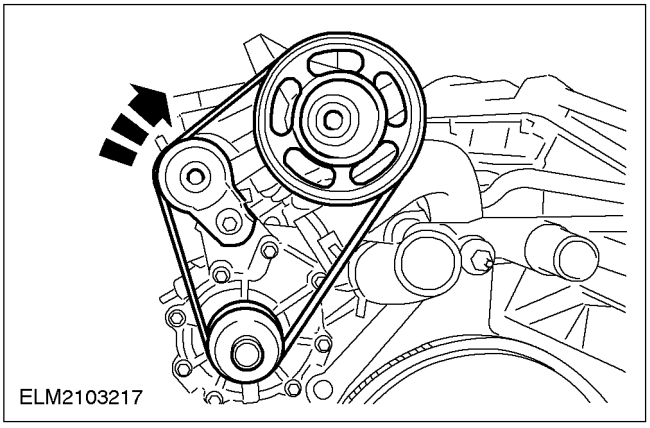


2. **Using the special tool, install the camshaft pulley.**



3. **Install the water pump drive belt.**

   - Rotate the belt tensioner clockwise to release the tension on the belt.



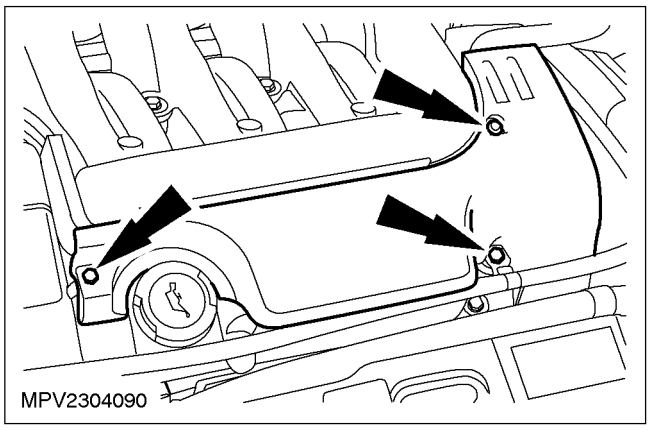
4. **Connect the battery ground cable. For additional information, refer to Section 414-01.**
5. **Initialize the door window motors. For additional information, refer to Section 501-11.**

IN-VEHICLE REPAIR

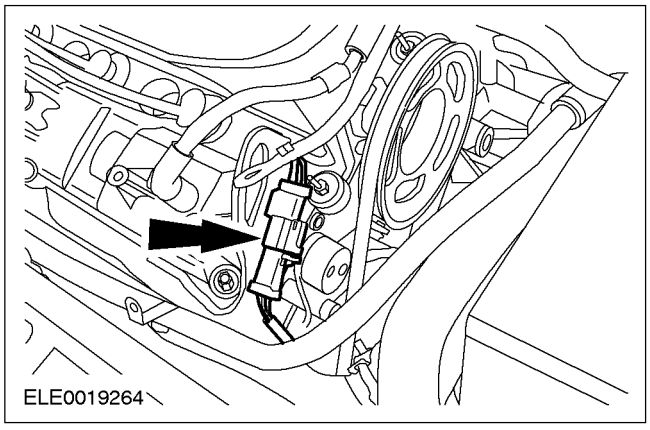
Exhaust Manifold LH (21 187 0)

Removal

1. Remove the engine upper cover.



2. Disconnect the left-hand heated oxygen sensor (HO2S) electrical connector.

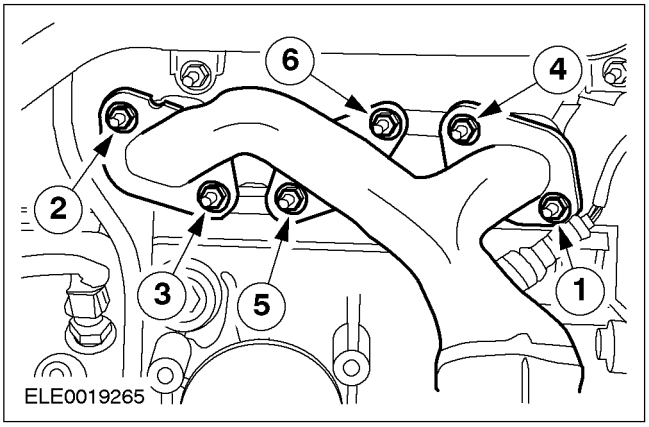


3. Remove the dual converter y-pipe. For additional information, refer to Section 309-00.

4. CAUTION: Remove the left-hand exhaust manifold retaining nuts in the sequence shown.

Remove the left-hand exhaust manifold (engine shown removed for clarity).

- Discard the gaskets and retaining nuts.

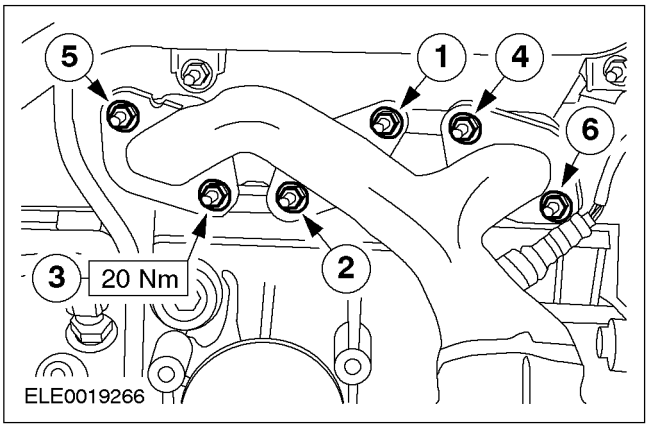


Installation

1. NOTE: Install new gaskets and retaining nuts.

Install the left-hand exhaust manifold.

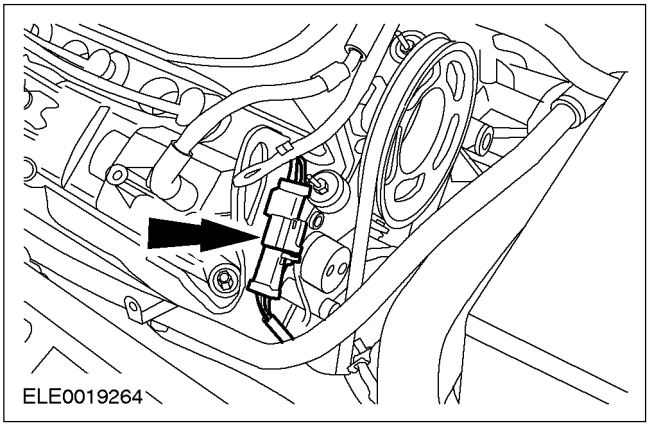
- Tighten the nuts in the sequence shown.



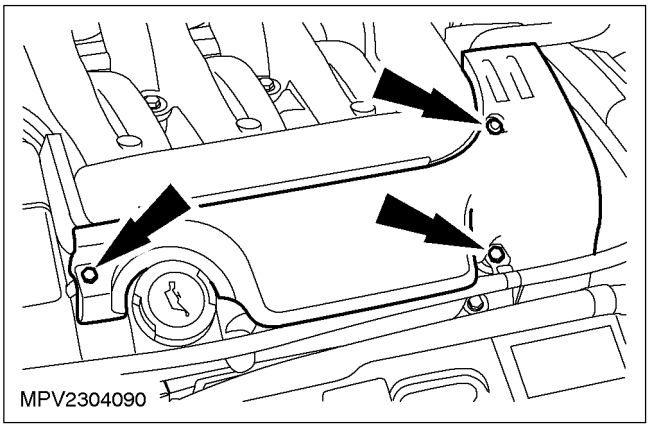
2. Install the dual converter y-pipe. For additional information, refer to Section 309-00.

IN-VEHICLE REPAIR (Continued)

3. **Connect the HO2S sensor electrical connector.**



4. **Install the engine upper cover.**

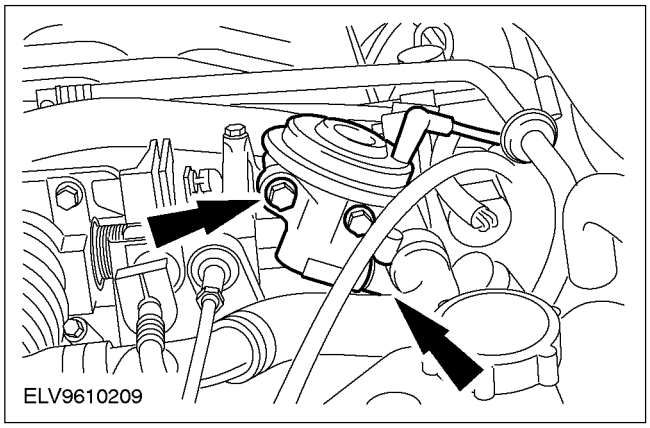


IN-VEHICLE REPAIR

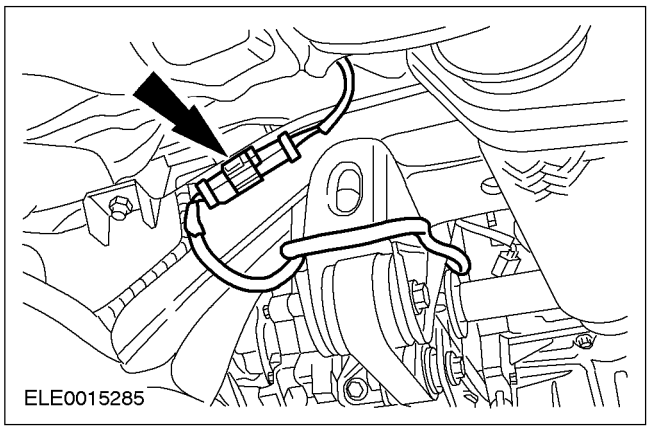
Exhaust Manifold RH (21 186 0)

Removal

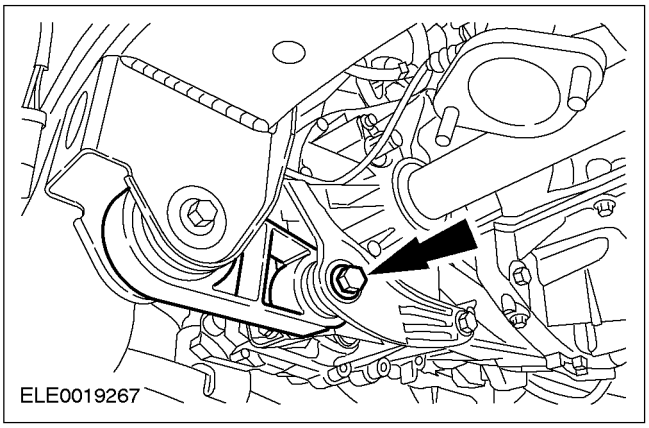
1. **Remove the generator. For additional information, refer to Section 414-02.**
2. **Loosen the exhaust gas recirculation (EGR) valve retaining bolts (if equipped).**



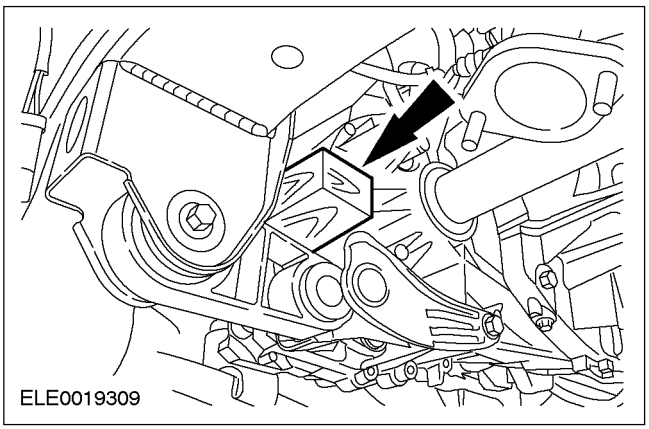
3. **Remove the dual converter y-pipe. For additional information, refer to Section 309-00.**
4. **Disconnect the right-hand heated oxygen sensor (HO2S) electrical connector (if equipped).**



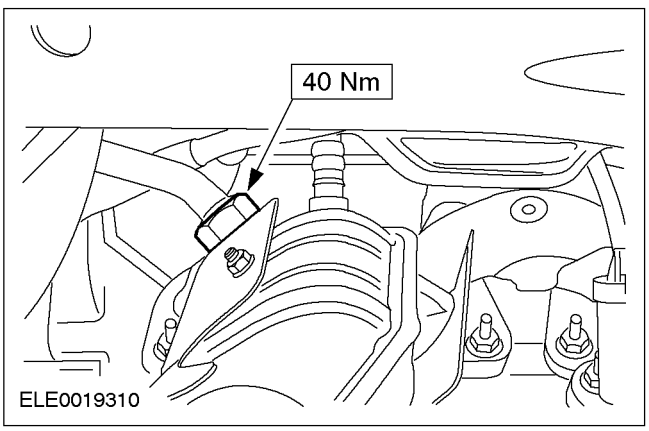
5. **Remove the engine right-hand roll restrictor center bolt.**



6. **Using a suitable wooden block, support the right-hand side of the engine.**



7. **Detach the EGR pipe from the right-hand exhaust manifold (if equipped).**

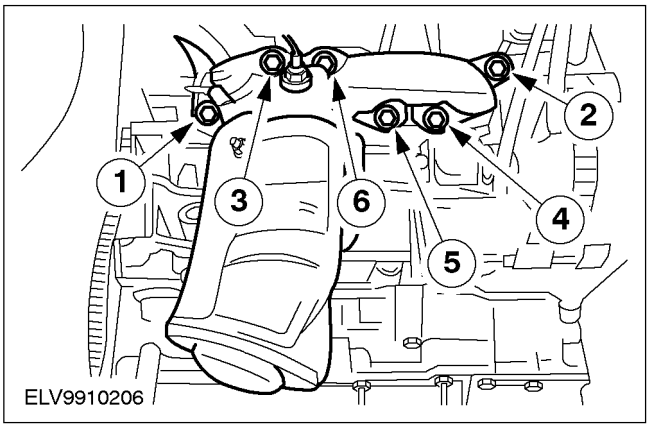


IN-VEHICLE REPAIR (Continued)

8. CAUTION: Remove the right-hand exhaust manifold retaining nuts in the sequence shown.

Remove the right-hand exhaust manifold (engine shown removed for clarity).

- Discard the gasket and the retaining nuts.

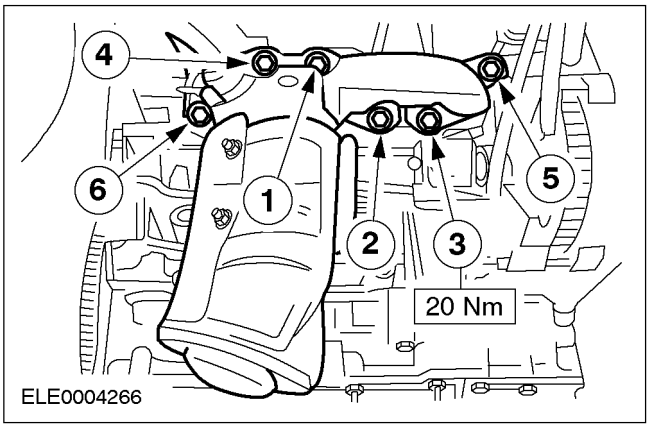


Installation

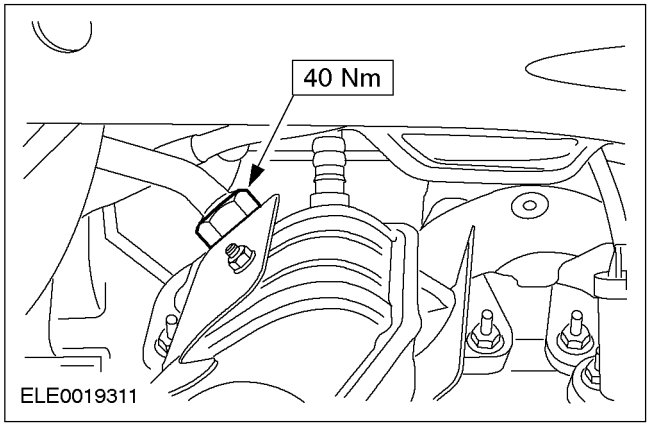
1. NOTE: Install new gaskets and retaining nuts.

NOTE: Tighten the nuts in the sequence shown.

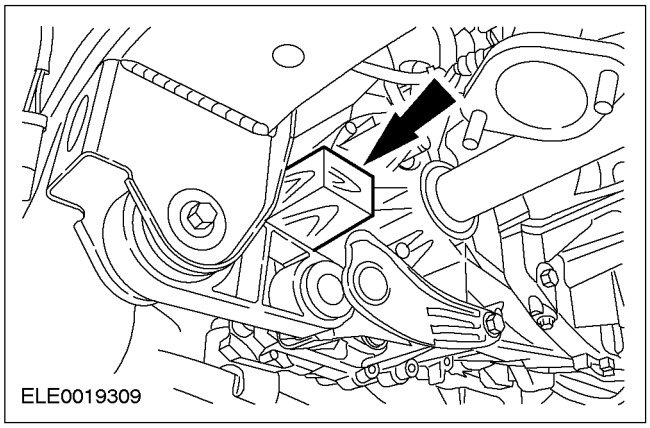
Install the right-hand exhaust manifold.



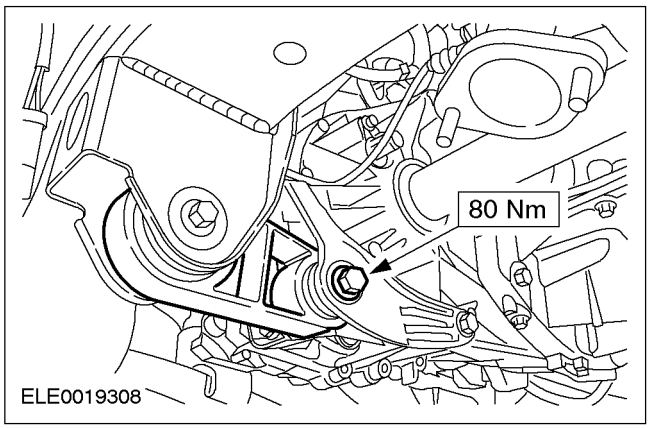
2. Attach the EGR pipe to the right-hand exhaust manifold (if equipped).



3. Remove the wooden block.

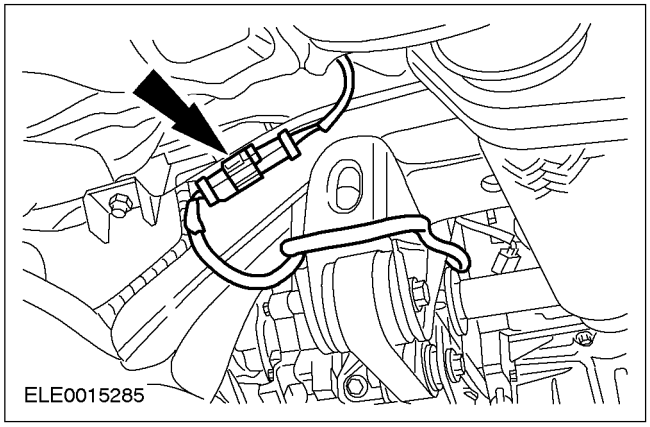


4. Install the engine right-hand roll restrictor center bolt.

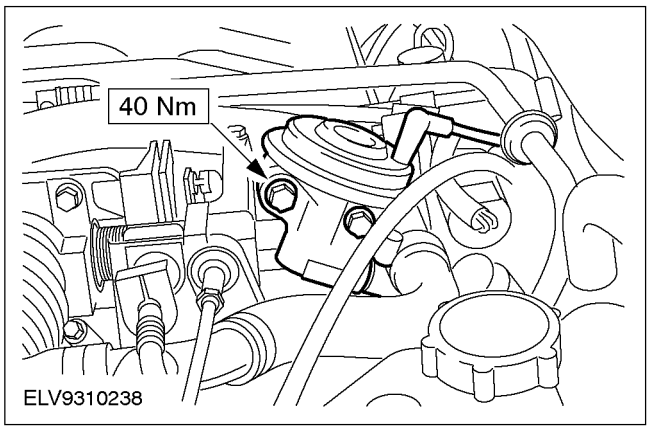


IN-VEHICLE REPAIR (Continued)

5. **Connect the H02S electrical connector (if equipped).**



6. **Install the dual converter y-pipe. For additional information, refer to Section 309-00.**
7. **Tighten the EGR valve retaining bolts (if equipped).**



8. **Install the generator. For additional information, refer to Section 414-02.**

IN-VEHICLE REPAIR

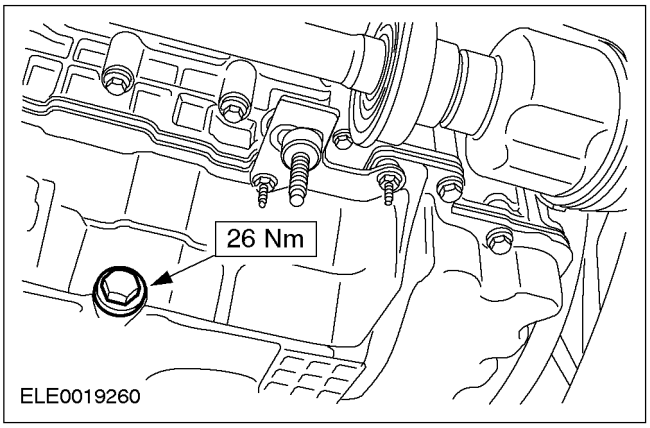
Oil Pan (21 154 0)

Name	Specification
Sealer	WSE-M4G323-A6
Engine oil	WSS-M2C913-A

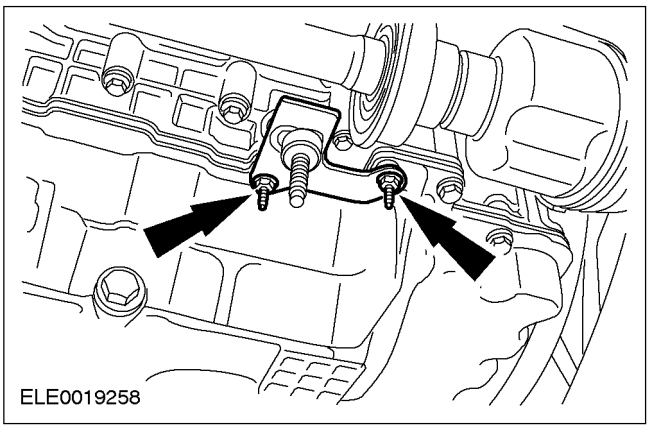
Removal

1. **Remove the dual converter y-pipe. For additional information, refer to Section 309-00.**
2. **NOTE:** Inspect the oil pan drain plug seal for damage. Install a new drain plug and seal if required.

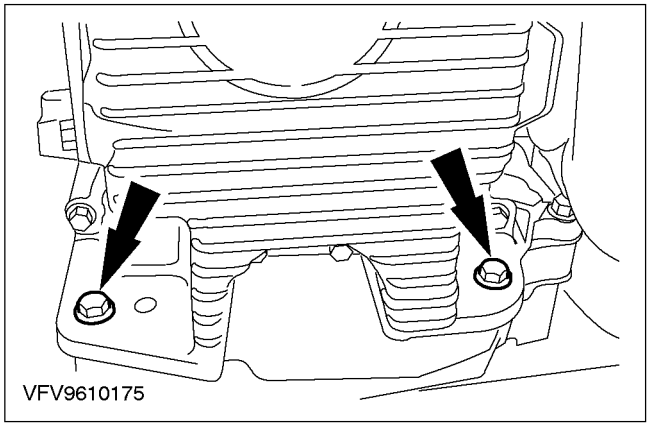
   Drain the engine oil.
   - Install the drain plug.



3. **Remove the exhaust front pipe bracket from the cylinder block.**

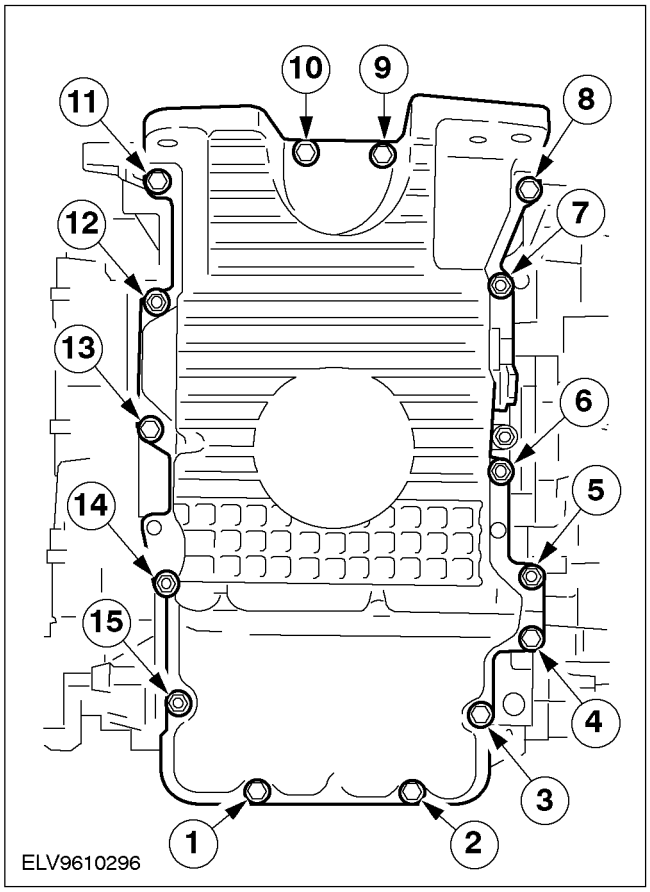


4. **Remove the oil pan flange retaining bolts.**



5. **NOTE:** Remove the oil pan retaining bolts in the sequence shown.

   Remove the oil pan.
   - Discard the gasket.

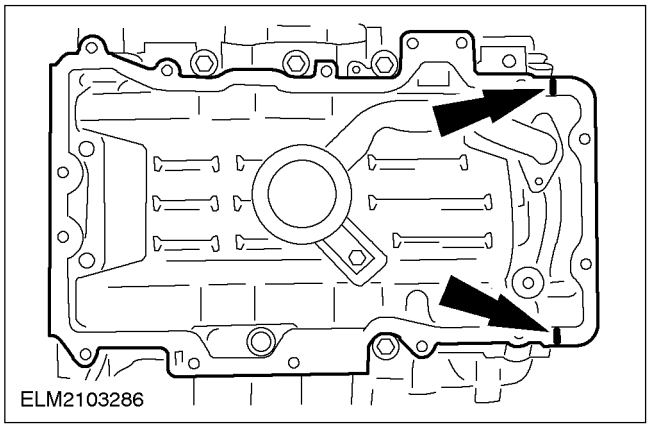


IN-VEHICLE REPAIR (Continued)

Installation

1. **CAUTION: Install the oil pan within five minutes of applying the sealer.**

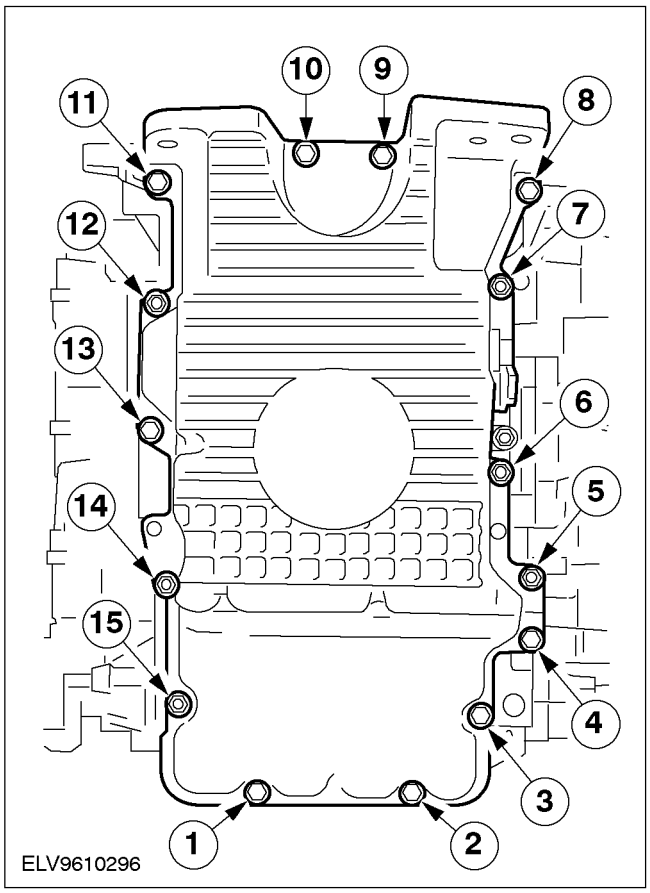
   Apply sealer approximately 10 mm in diameter where indicated.



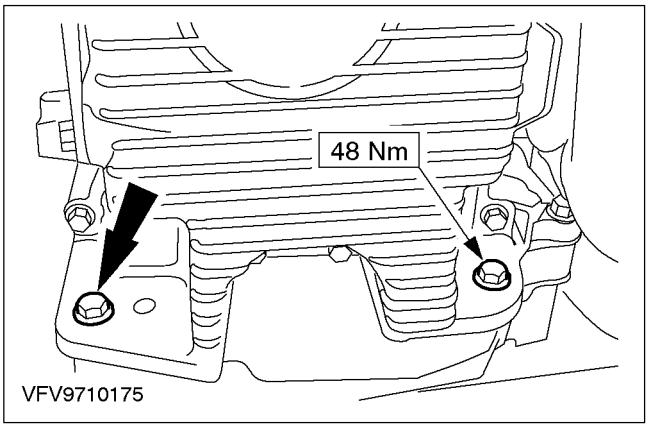
2. **NOTE:** Use a new gasket.

NOTE: Do not fully tighten the oil pan retaining bolts at this stage.

Install the oil pan.



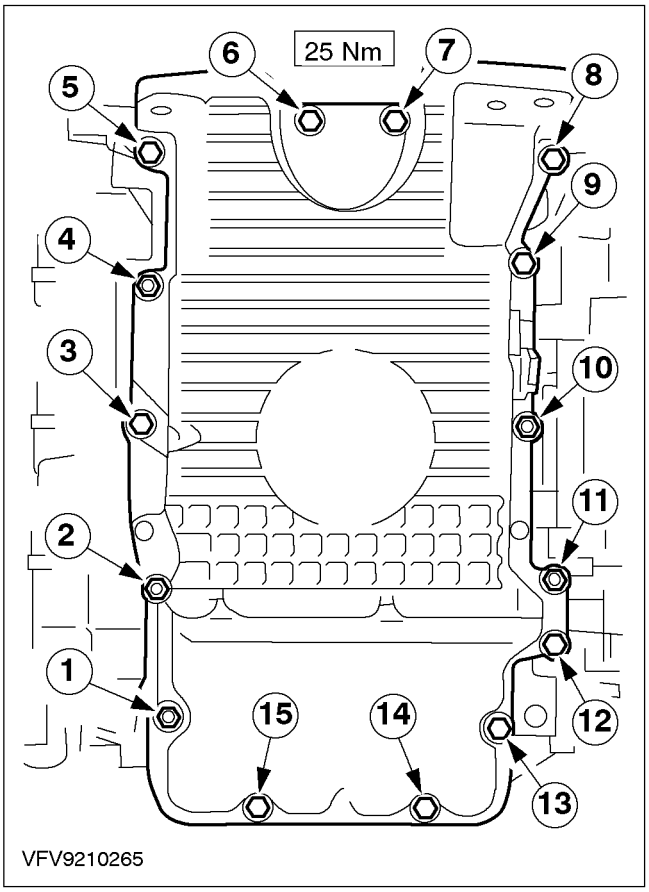
3. **Install the oil pan flange retaining bolts.**



4. **NOTE:** Location of the stud bolts.

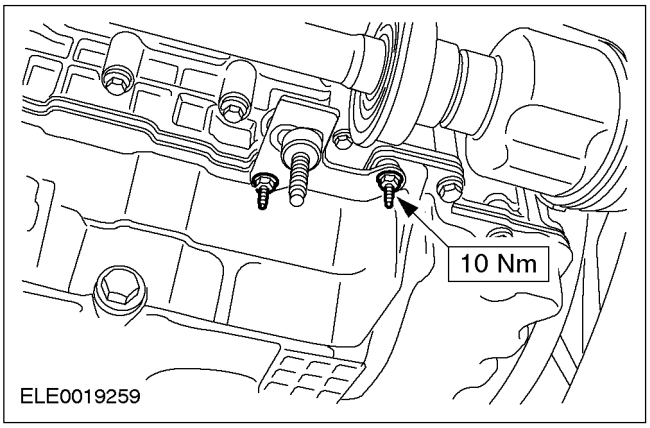
Install the oil pan retaining bolts and stud bolts.

- Tighten the retaining bolts and stud bolts in the sequence shown.



IN-VEHICLE REPAIR (Continued)

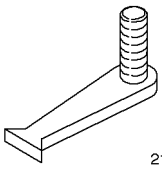
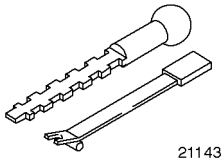
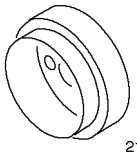
5. **Install the exhaust front pipe bracket.**



6. **Install the dual converter y-pipe. For additional information, refer to Section 309-00.**
7. **Fill the engine with engine oil.**

IN-VEHICLE REPAIR

Crankshaft Rear Seal (21 468 4)

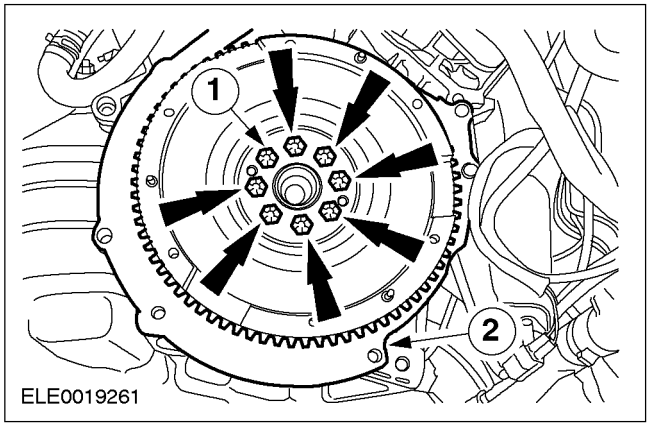
Special Tool(s)	
 21135	Locking Tool, Flywheel 303-254 (21-135)
 21143	Remover, Crankshaft Oil Seal 303-293 (21-143)
 21193A	Installer, Crankshaft Rear Oil Seal 303-460 (21-193A)

Name	Specification
Sealer	WSE-M4G323-A6
Engine oil	WSS-M2C913-A

Removal

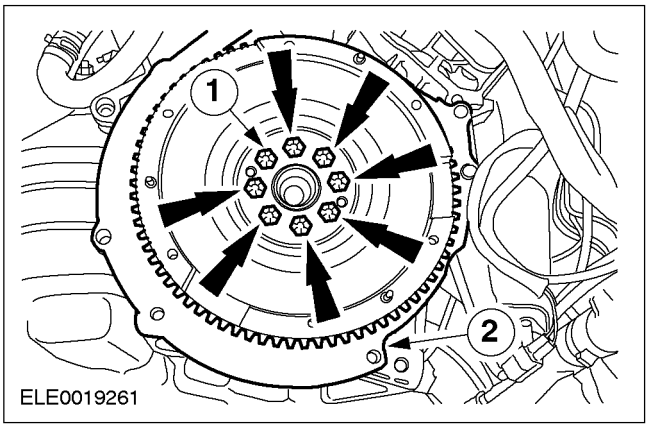
Vehicles with manual transaxle

1. **Remove the clutch disc and pressure plate.**
2. **Remove the flywheel**
   1. Remove the flywheel retaining bolts.
   2. Remove the adapter plate.



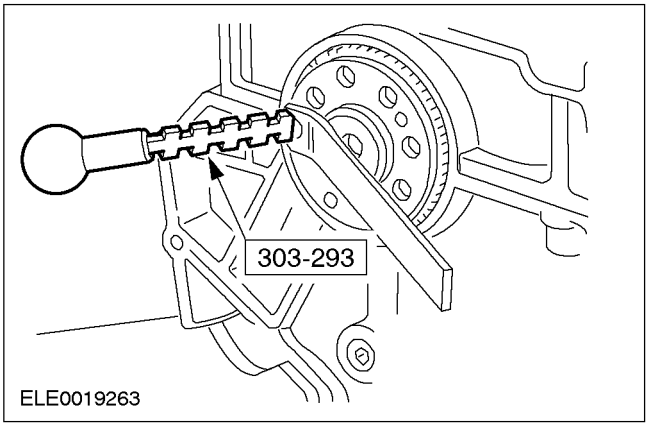
Vehicles with automatic transaxle

3. **Remove the automatic transaxle. For additional information, refer to Section 307-01A / 307-01B.**
4. **Remove the flexplate.**
   1. Remove the flexplate retaining bolts.
   2. Remove the adapter plate.



All vehicles

5. **Using the special tool, remove the crankshaft rear oil seal.**
   - Discard the seal.



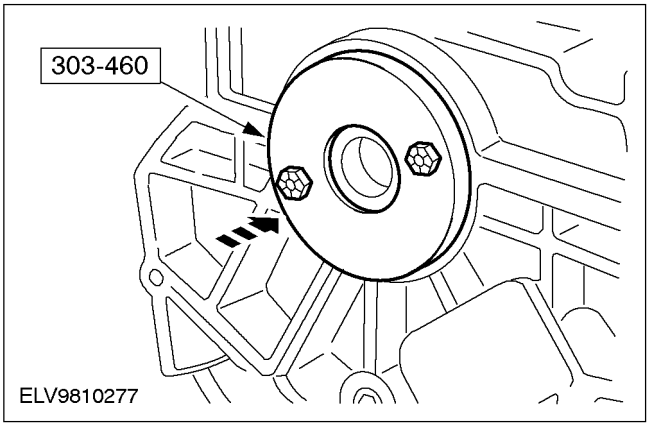
IN-VEHICLE REPAIR (Continued)

Installation

All vehicles

1. **NOTE:** Lubricate the sealing lip of the oil seal with clean engine oil.

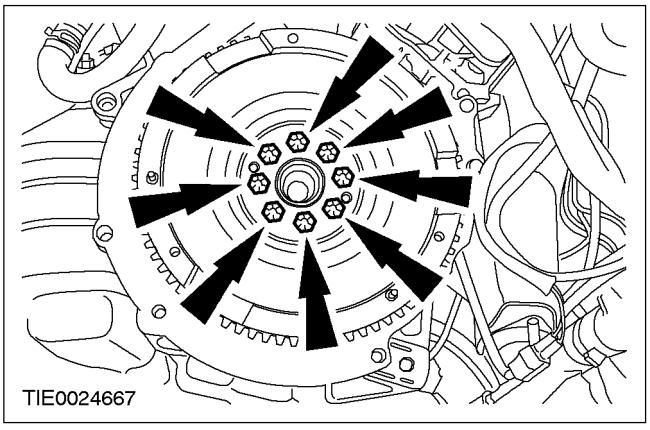
   Using the special tool, install the crankshaft rear oil seal.



Vehicles with automatic transaxle

2. **NOTE:** Do not fully tighten the flexplate retaining bolts at this stage.

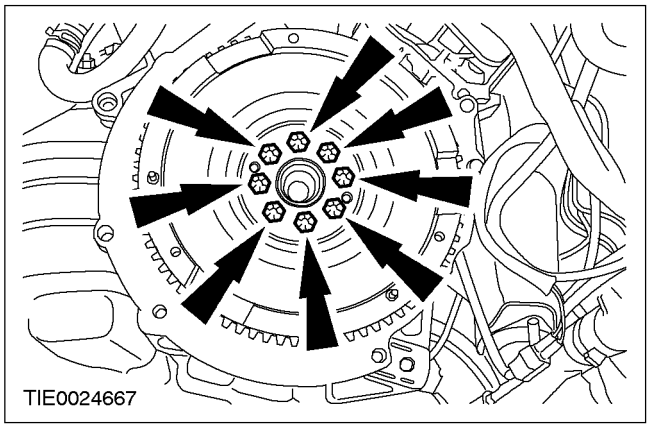
   Install the adapter plate and the flexplate.



Vehicles with manual transaxle

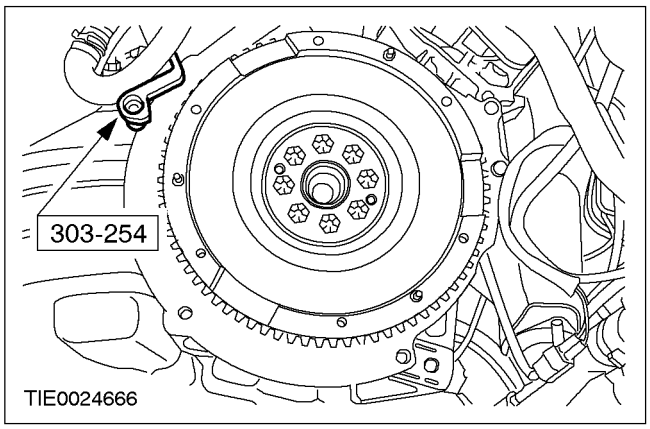
3. **NOTE:** Do not fully tighten the flywheel retaining bolts at this stage.

   Install the adapter plate and the flywheel.

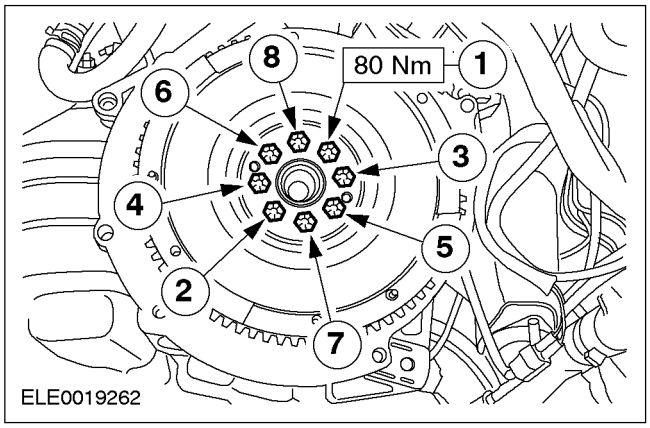


All vehicles

4. **Using the special tool, lock the flywheel or flexplate in position.**

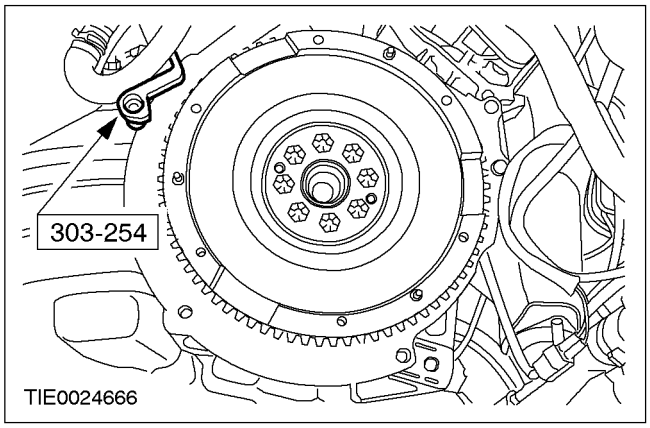


5. **Tighten the flywheel or flexplate retaining bolts in the sequence shown.**



IN-VEHICLE REPAIR (Continued)

6. Remove the special tool.



Vehicles with manual transaxle

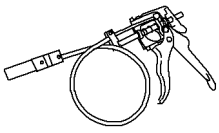
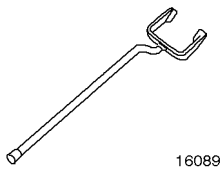
7. Install the clutch disc and pressure plate.

Vehicles with automatic transaxle

8. Install the automatic transaxle. For additional information, refer to Section 307-01A / 307-01B.

REMOVAL

Engine — Vehicles With: Automatic Transaxle

Special Tool(s)	
 24003	Remover/Installer Cooling Hose Clamp 303-397 (24-003)
 16089	Remover, Halfshaft 308-256 (16-089)

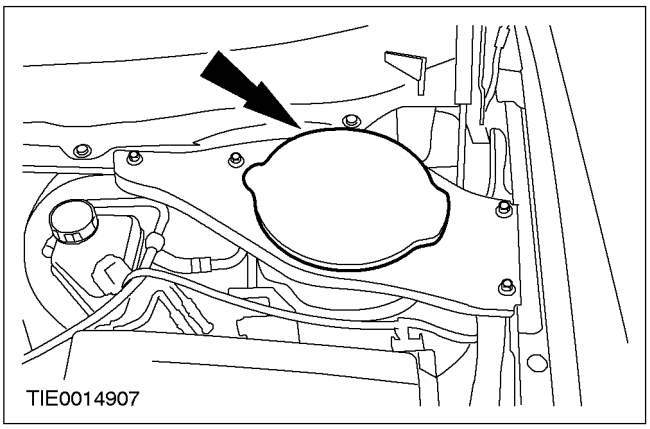
General Equipment
Workshop table
Workshop hoist
Securing straps

Removal

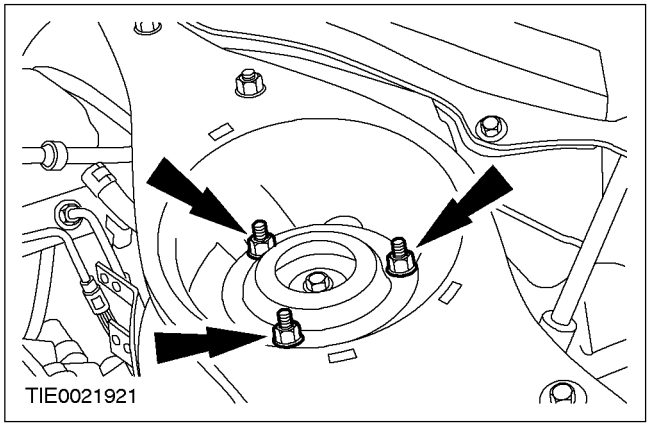
1. **WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.**

   Disconnect the battery ground cable. For additional information, refer to Section 414-01.

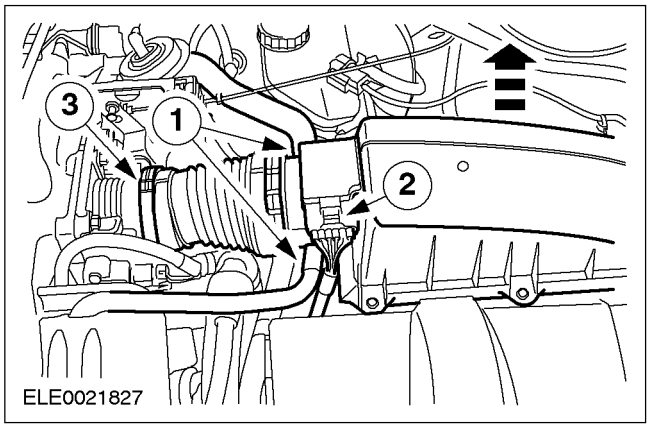
2. **Remove the strut and spring assembly top mount brace cover on both sides (left-hand side shown).**


TIE0014907

3. **Loosen the strut and spring assembly top mount retaining nuts by four turns on both sides.**

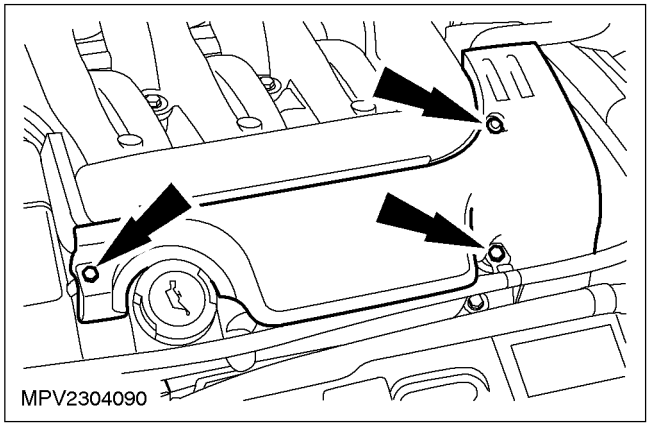

TIE0021921

4. **Remove the air cleaner.**
   1. Disconnect the positive crankcase ventilation (PCV) hoses.
   2. Disconnect the mass air flow (MAF) sensor electrical connector.
   3. Detach the air cleaner outlet hose.



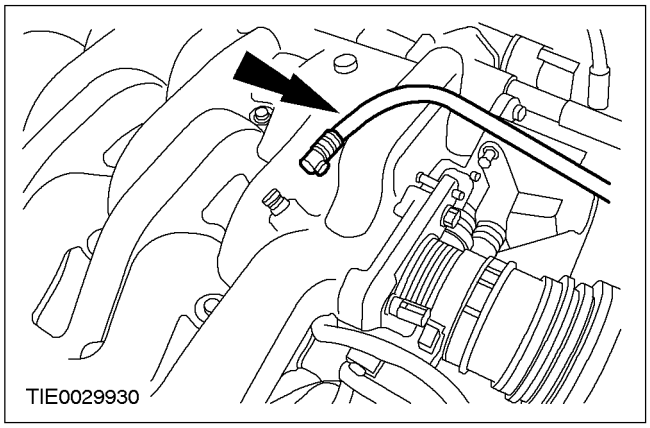
ELE0021827

5. **Remove the engine upper cover.**

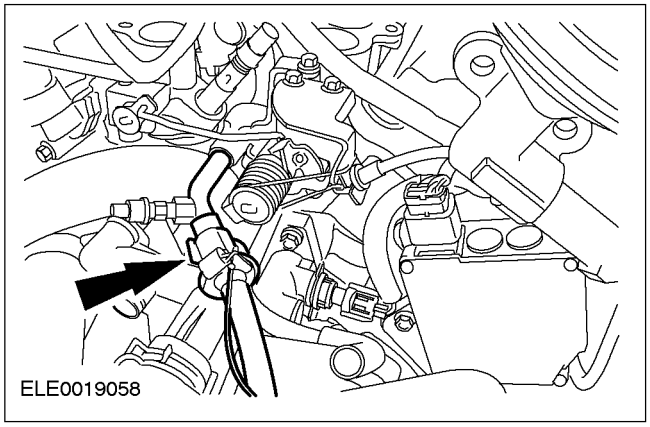

MPV2304090

REMOVAL (Continued)

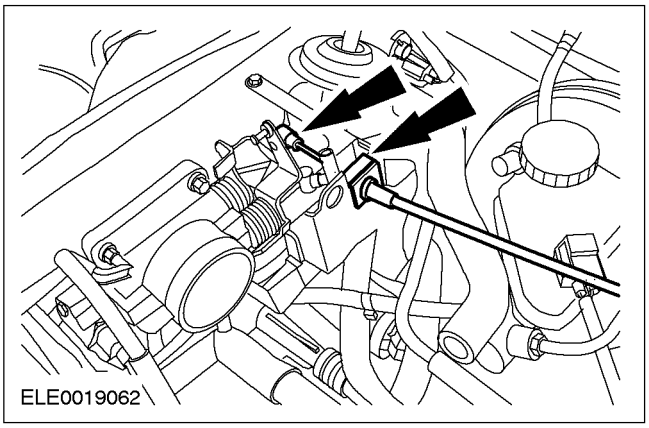
6. **Detach the brake booster vacuum pipe from the intake manifold.**



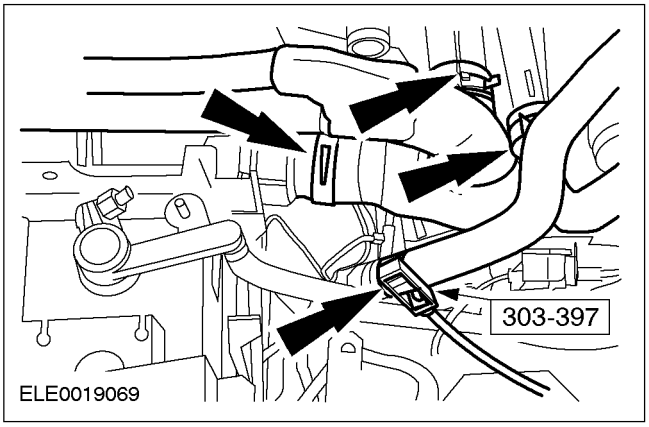
7. **Disconnect the fuel supply line. For additional information, refer to Section 310-00.**



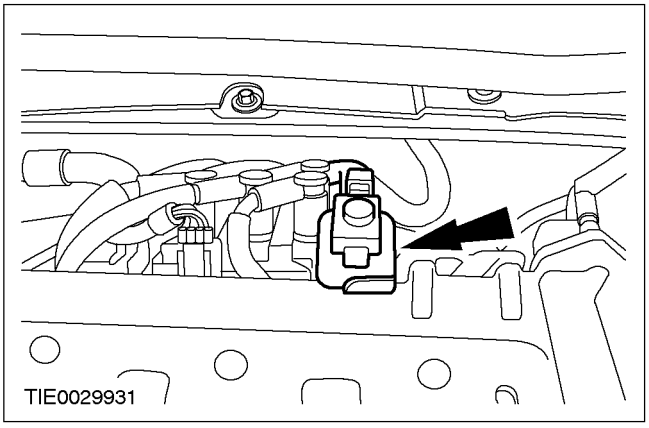
8. **Drain the cooling system. For additional information, refer to Section 303-03.**
9. **Remove the accessory drive belt. For additional information, refer to Section 303-05.**
10. **Remove the subframe. For additional information, refer to Section 502-00.**
11. **Lower the vehicle.**
12. **Detach the accelerator cable.**
    - Detach the clips and the accelerator cable from the bracket.



13. **Using the special tool, disconnect the coolant hoses from the coolant connecting pipe.**

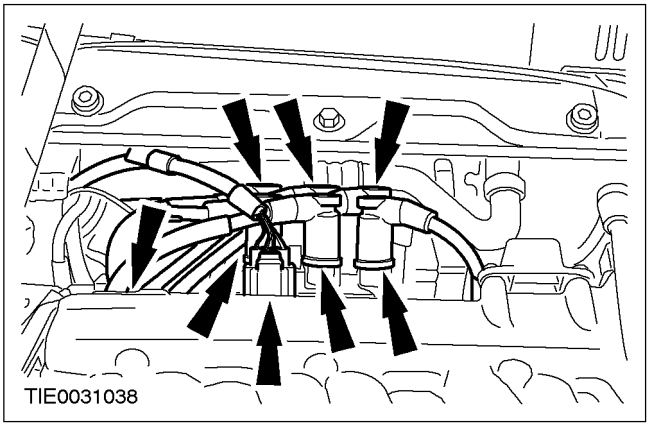


14. **Detach evaporative emission (EVAP) solenoid valve from the intake manifold.**

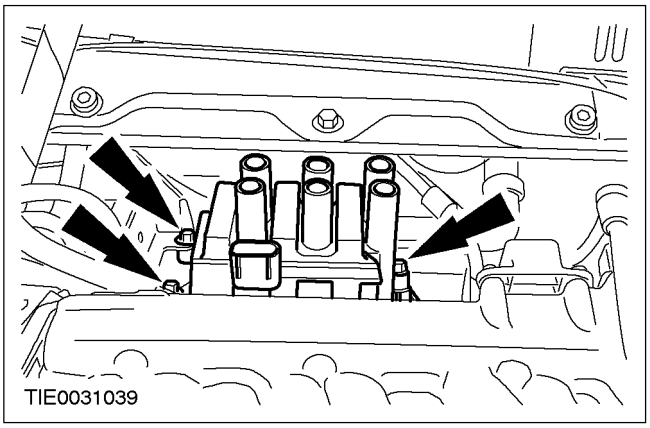


REMOVAL (Continued)

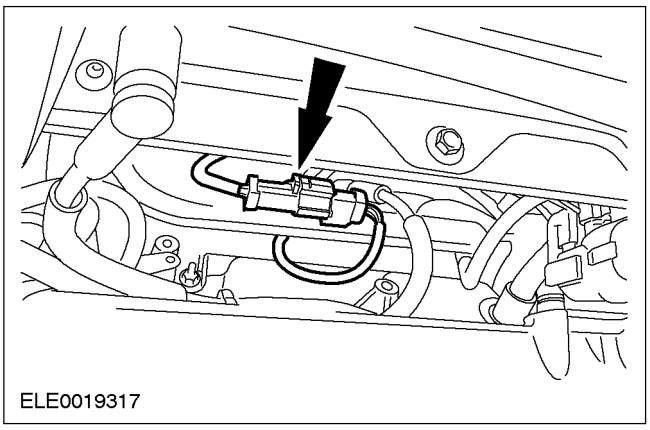
15. Disconnect the electronic ignition (EI) coil electrical connectors.



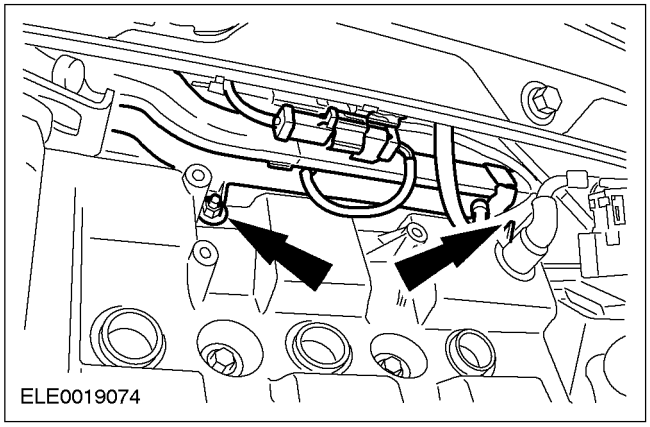
16. Remove the EI coil.



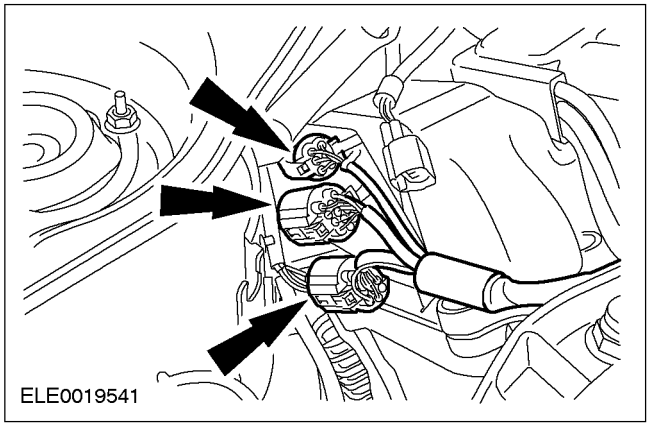
17. Disconnect the heated oxygen sensor (HO2S) electrical connector.



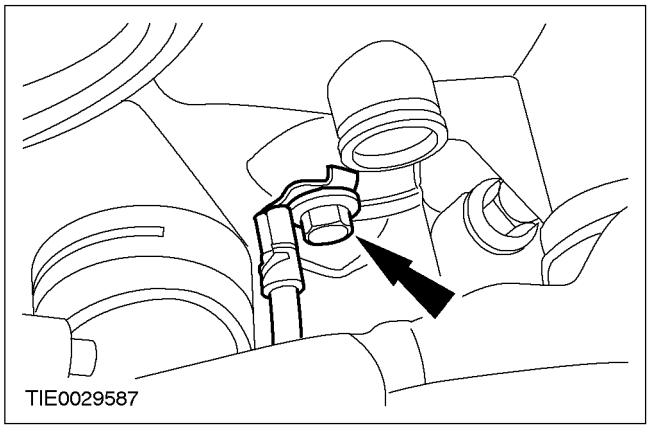
18. Detach the engine wiring harness from the right-hand valve cover.



19. Disconnect the engine wiring harness electrical connectors.

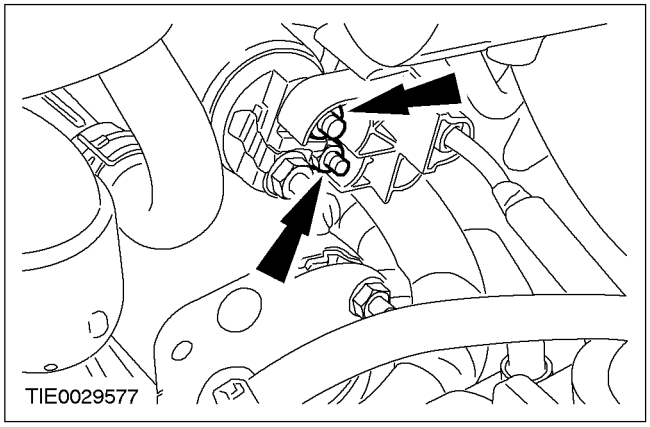


20. Disconnect the ground cable from the transaxle.

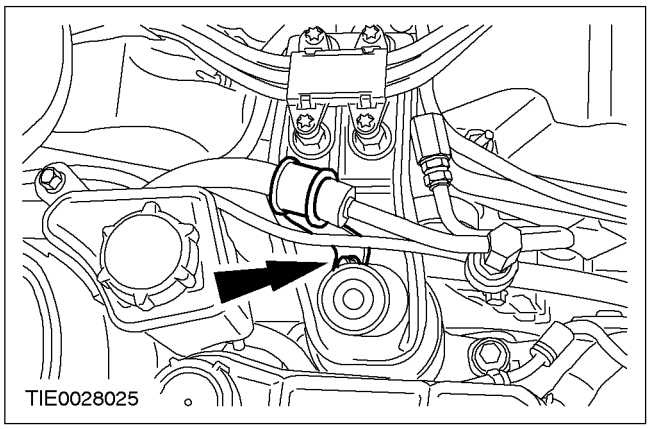


REMOVAL (Continued)

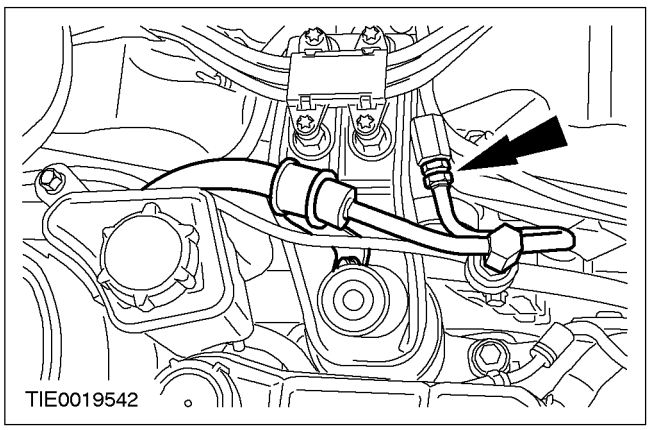
21. **Disconnect the starter motor electrical connectors.**



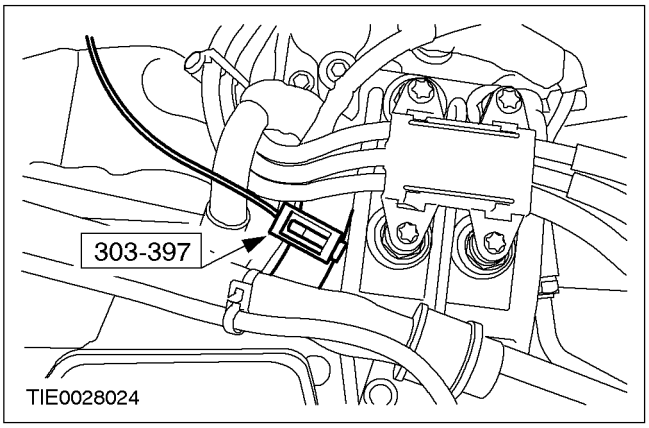
22. **Detach the power steering pump line support bracket from the engine front mount.**



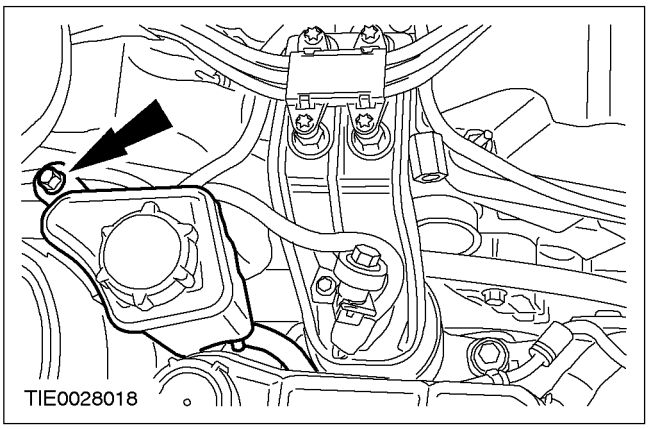
23. **Disconnect the power steering line.**
    - Remove the clip.
    - Allow the fluid to drain into a suitable container.



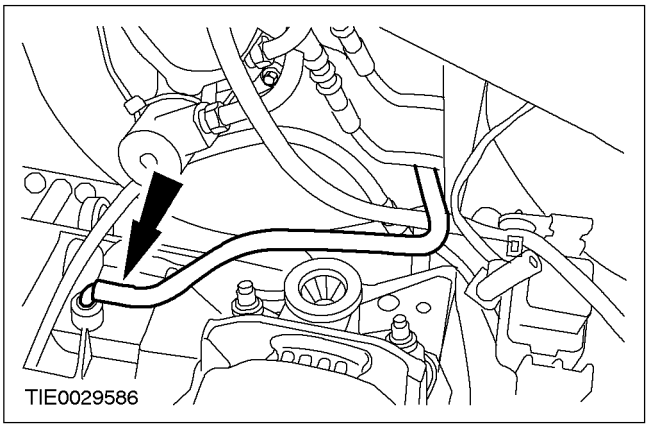
24. **Using the special tool, disconnect the power steering pump hose from the power steering pump.**
    - Allow the fluid to drain into a suitable container.



25. **Detach the power steering fluid reservoir from the radiator grille opening panel and position it to one side.**



26. **Disconnect the vent hose from the transaxle.**



REMOVAL (Continued)

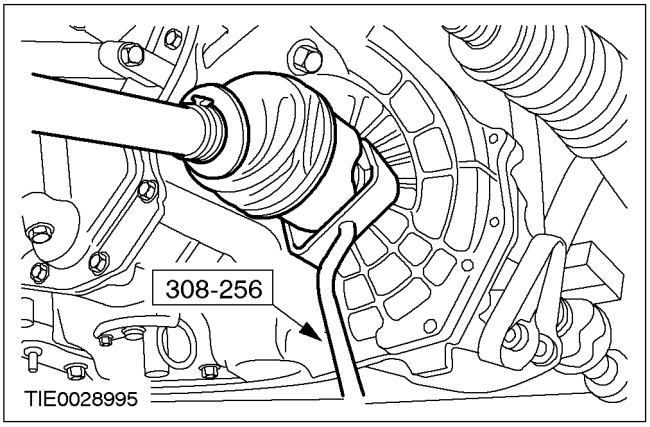
27. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
28. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

NOTE: Do not damage the halfshaft oil seal.

NOTE: Plug the transaxle to prevent oil loss or dirt ingress.

Using the special tool, detach the left-hand halfshaft from the transaxle and secure it to one side.

- Discard the snap ring.
- Discard the O-ring seal.



29. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

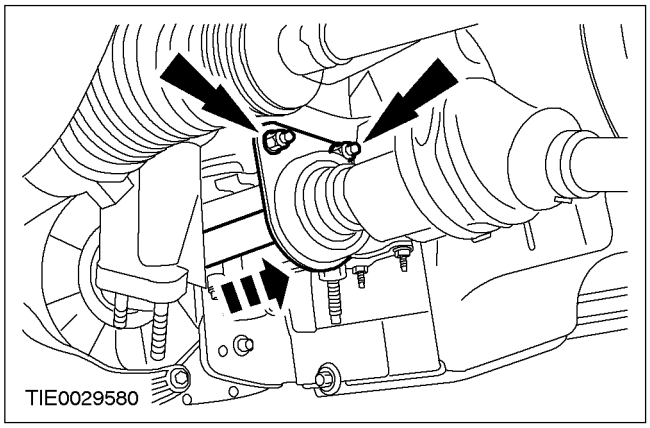
NOTE: Do not damage the halfshaft oil seal.

NOTE: Plug the transaxle to prevent oil loss or dirt ingress.

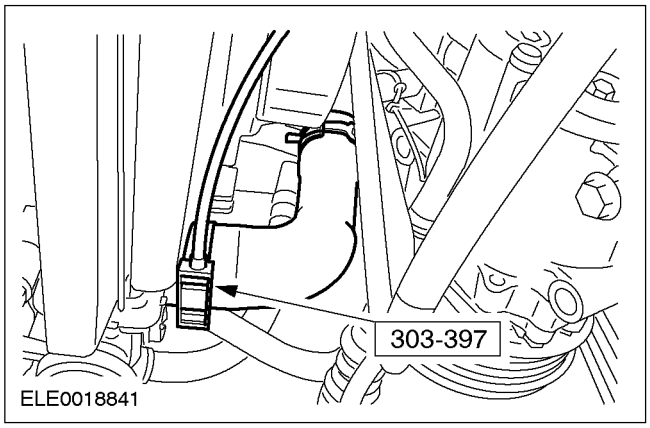
Detach the right-hand halfshaft and the intermediate shaft from the transaxle and secure it to one side.

- Discard the center bearing cap and locknuts.

1. Discard the O-ring seal

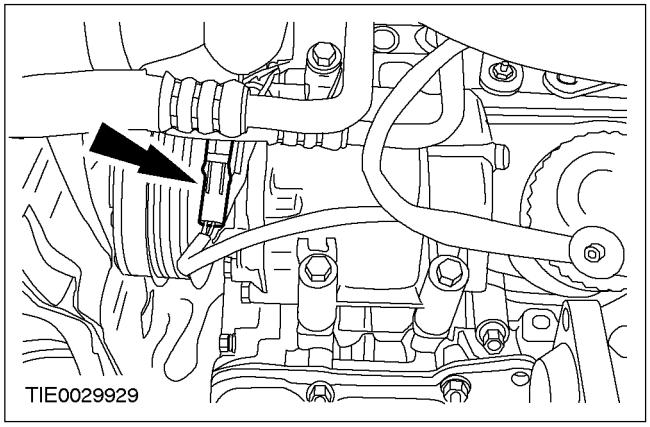


30. **Using the special tool, disconnect the lower coolant hose from the radiator.**



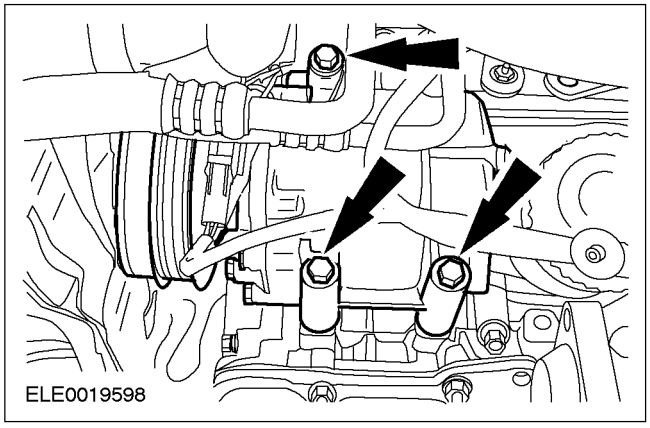
REMOVAL (Continued)

31. **Disconnect the air conditioning (A/C) electrical connector.**



32. **CAUTION: Support the A/C compressor before removing the retaining bolts and secure it to prevent load being placed on the refrigerant lines.**

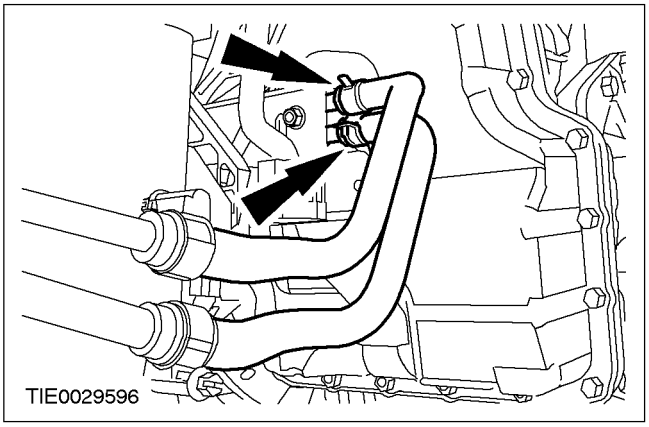
    Detach the A/C compressor from the mounting bracket and secure it to one side.



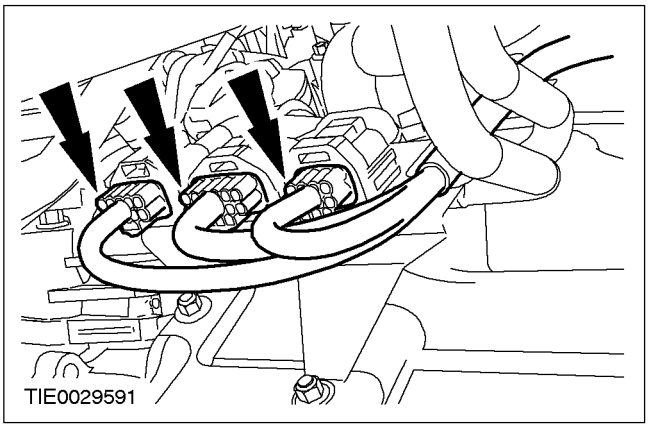
33. **NOTE:** Plug the fluid cooler pipes to prevent oil loss or dirt ingress.

    Disconnect the fluid cooler pipes from the transaxle.

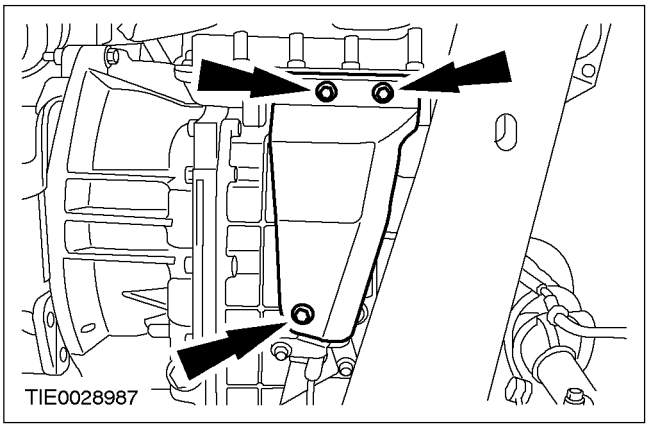
    - Allow the fluid to drain into a suitable container.



34. **Disconnect the transaxle electrical connectors.**



35. **Remove the selector cable cover.**

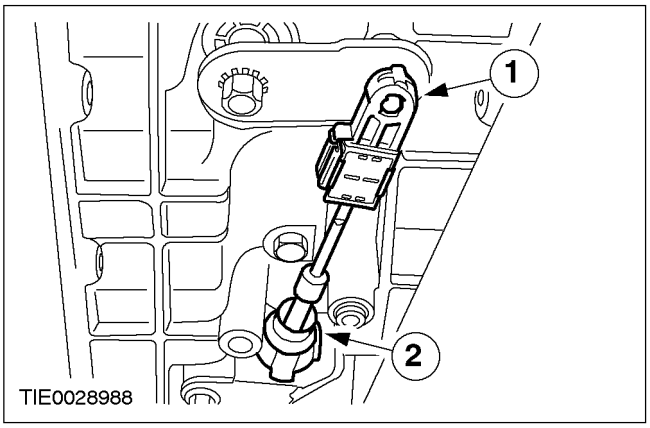


REMOVAL (Continued)

36. NOTE: Make sure the transaxle selector lever is in "P" (PARK) position.

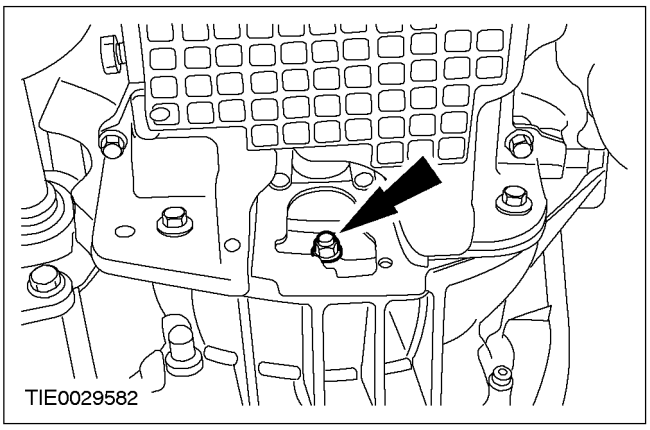
Detach the selector lever cable from the transaxle.

1. Detach the selector lever cable from the selector shaft.
2. Detach the selector lever cable from the transaxle.



37. Remove the torque converter retaining nuts.

- Remove the cover.
- Rotate the engine to gain access to the nuts.
- Discard the nuts.

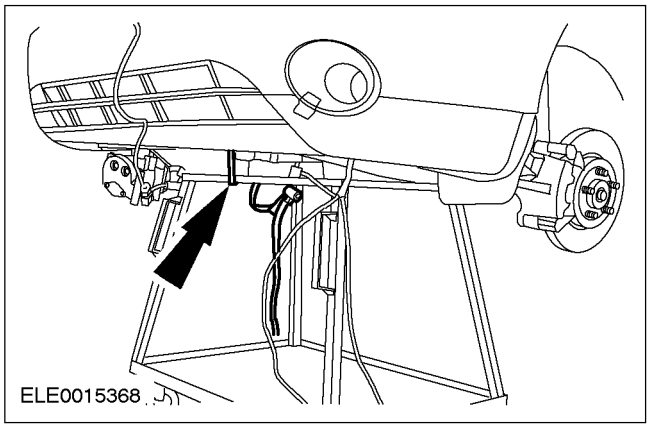


38. Position the workshop table under the vehicle and carefully lower the vehicle, until the engine and transaxle assembly is in the correct position to remove the engine mounts.

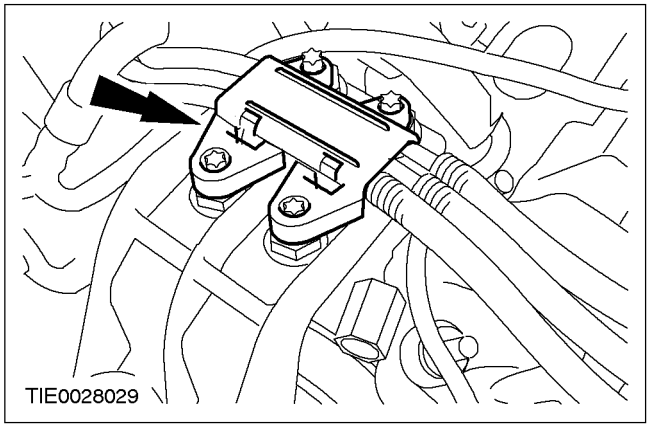
39. ⚠ CAUTION: Do not support directly on the oil pan.

NOTE: Using suitable securing straps, secure the engine and the transaxle on a workshop table.

Using suitable wooden blocks, support the engine and transaxle assembly.

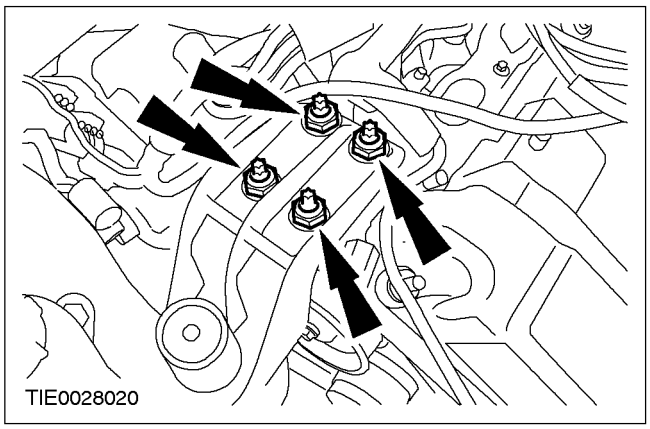


40. Detach the spark plug cable retaining bracket from the engine front mount.



41. Remove the engine front mount bracket retaining nuts.

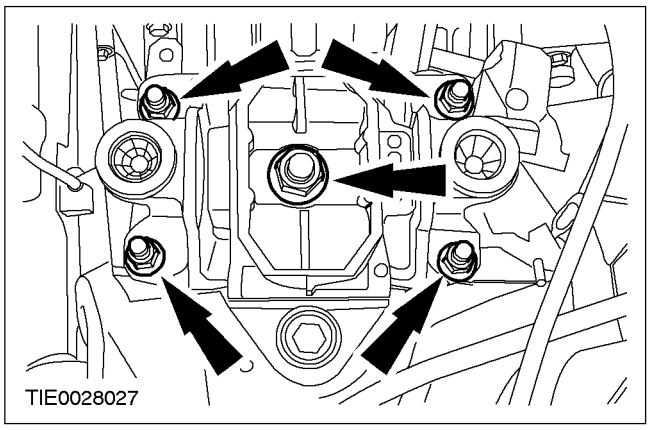
- Discard the nuts.



REMOVAL (Continued)

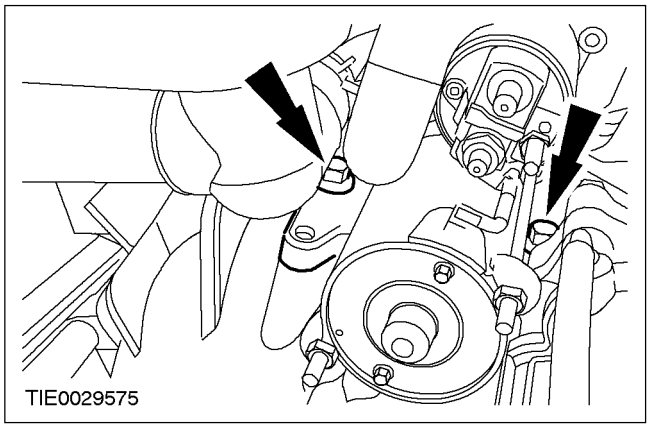
42. Remove the engine rear mount.

- Discard the nuts.

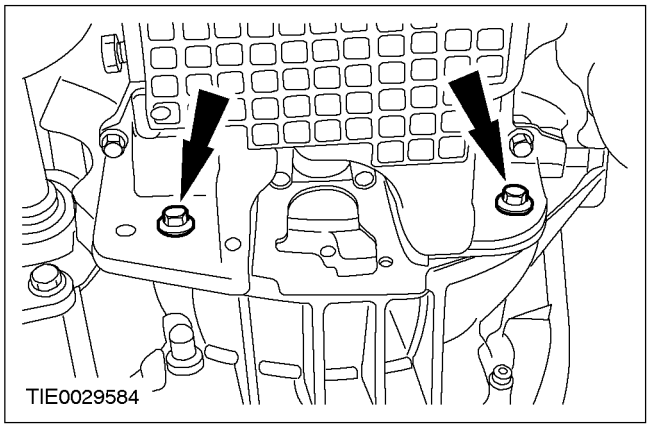


43. Raise and support the vehicle. For additional information, refer to Section 100-02.

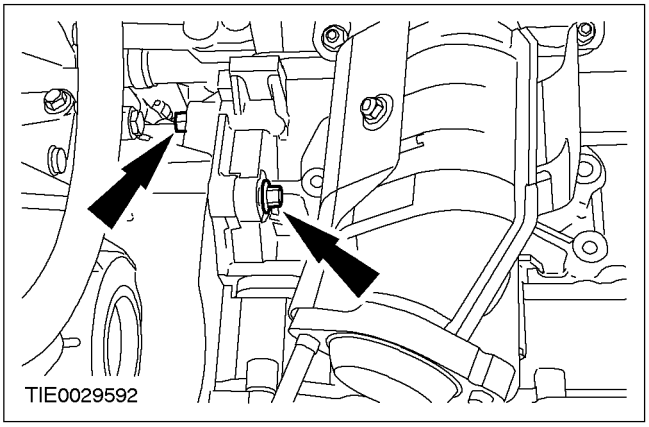
44. Remove the starter motor.



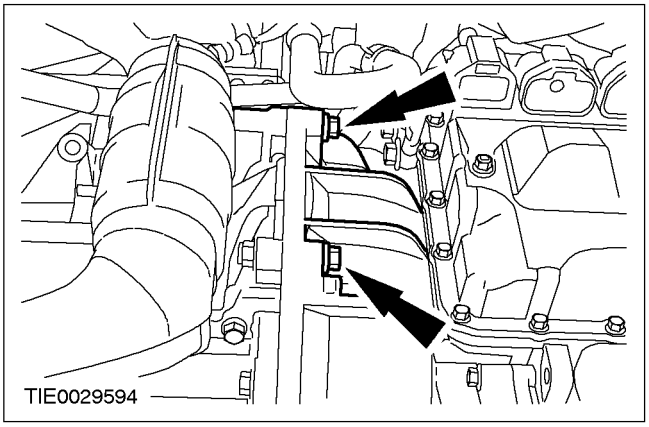
45. Remove the transaxle lower retaining bolts.



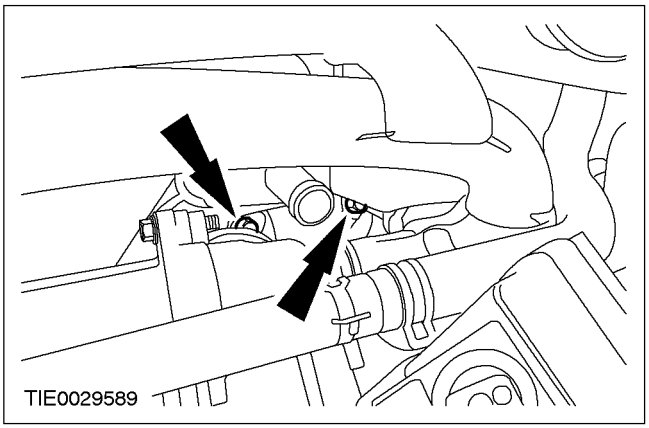
46. Remove the transaxle right-hand retaining bolts.



47. Remove the transaxle left-hand retaining bolts.



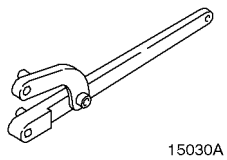
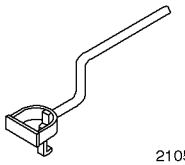
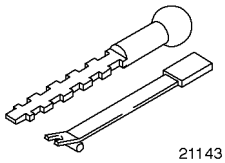
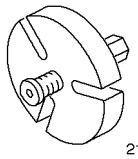
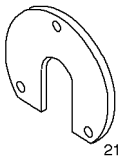
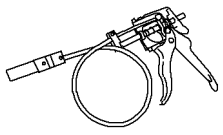
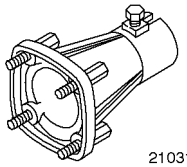
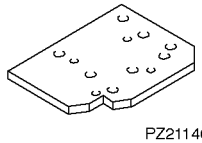
48. Remove the transaxle upper retaining bolts.

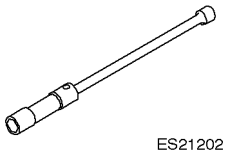
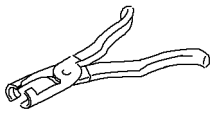


49. Remove the transaxle from the engine.

DISASSEMBLY

Engine (21 134 8)

Special Tool(s)	
 15030A	Flange Holding Wrench, Universal 205-072 (15-030A)
 21051	Remover, Oil Seal 303-112 (21-051)
 21143	Remover, Crankshaft Oil Seal 303-293 (21-143)
 21153B	Remover, Crankshaft Vibration Damper 303-338 (21-153B)
 21153A02	Adapter for 303-338 303-338-02 (21-153A-02)
 24003	Remover/Installer, Cooling Hose Clamp 303-397 (24-003)
 21031B	Mounting Bracket for 303-435 303-435-06 (21-031B)
 PZ21146C	Mounting Plate for 303-435-06 303-435-11 (21-146C)

Special Tool(s)	
 ES21202	Socket, Spark Plug 303-499 (21-202)
 PZ21211	Pliers, Valve Stem Oil Seal 303–509 (21-211)

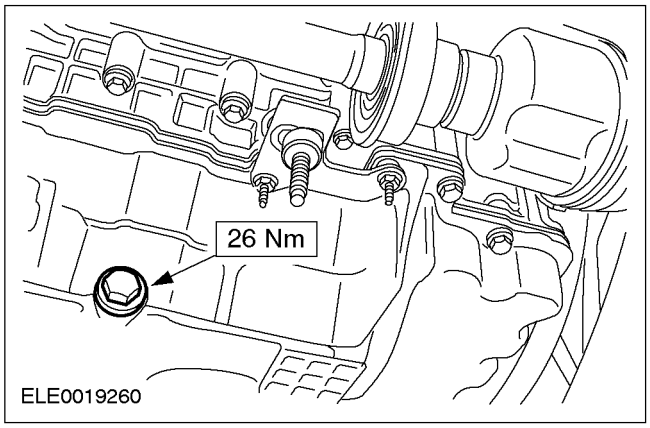
Name	Specification
Metal Surface Cleaner	WSE-M5B392-A

Disassembly

1. **NOTE:** Inspect the oil pan drain plug seal for damage. Install a new drain plug and seal if required.

   Drain the engine oil.

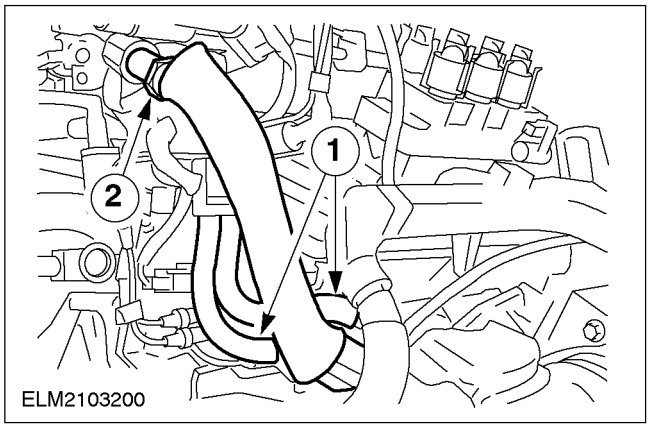
   - Allow the oil to drain into a suitable container.
   - Install the drain plug.



DISASSEMBLY (Continued)

2. Disconnect the exhaust gas recirculation (EGR) tube from the EGR valve.

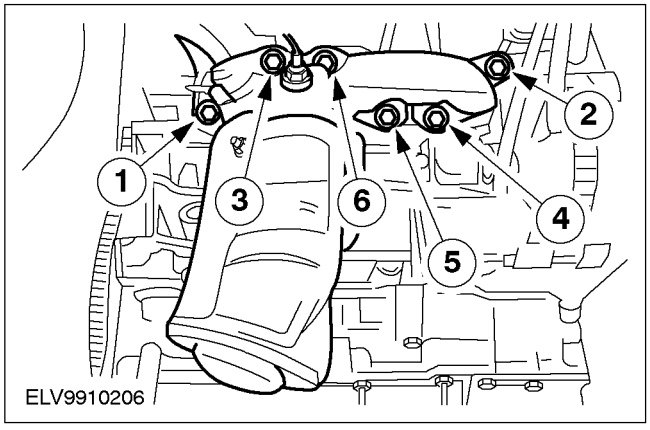
1. Disconnect the hoses.
2. Detach the tube fitting.



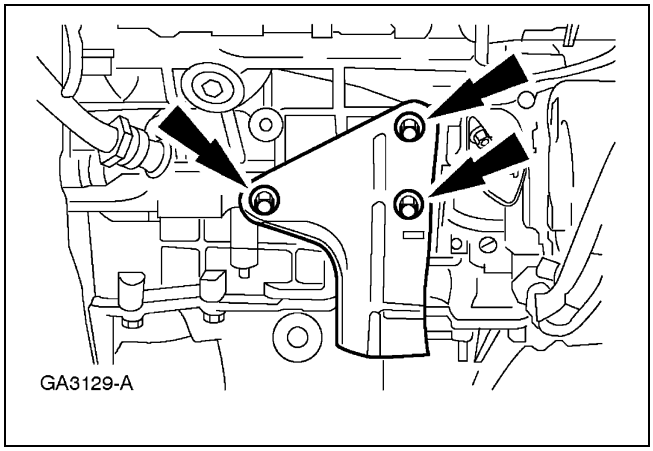
3. CAUTION: Remove the right-hand exhaust manifold retaining nuts in the sequence shown.

Remove the right-hand exhaust manifold.

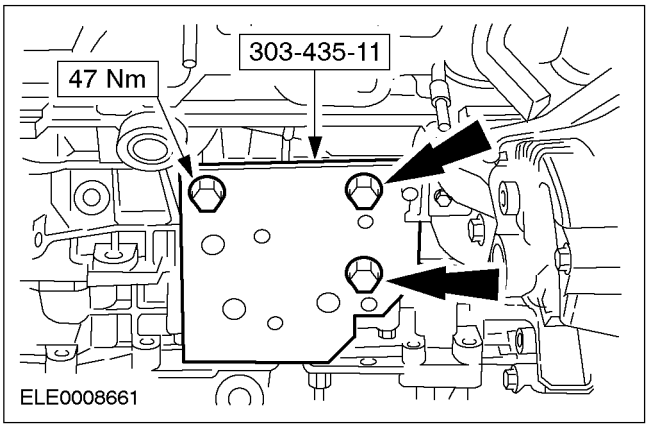
- Discard the gasket and the retaining nuts.



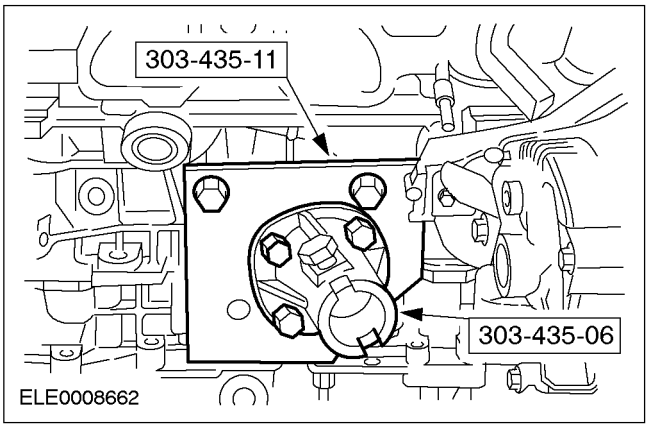
4. Remove the intermediate drive shaft bracket from the cylinder block.



5. Install the mounting plate to the engine.

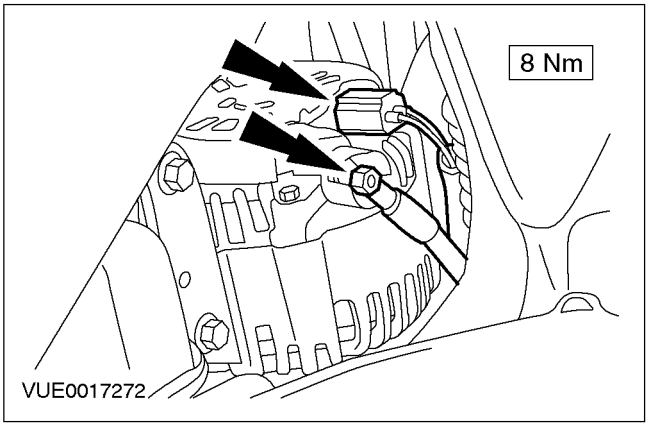


6. Install the mounting bracket to the mounting plate.



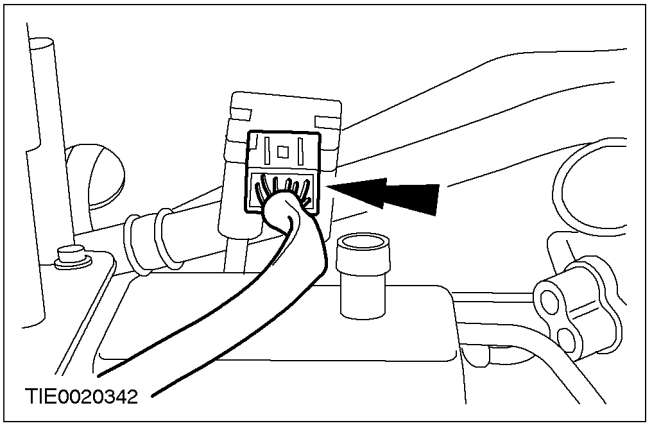
7. Mount the engine on the mounting stand.

8. Disconnect the generator electrical connectors.

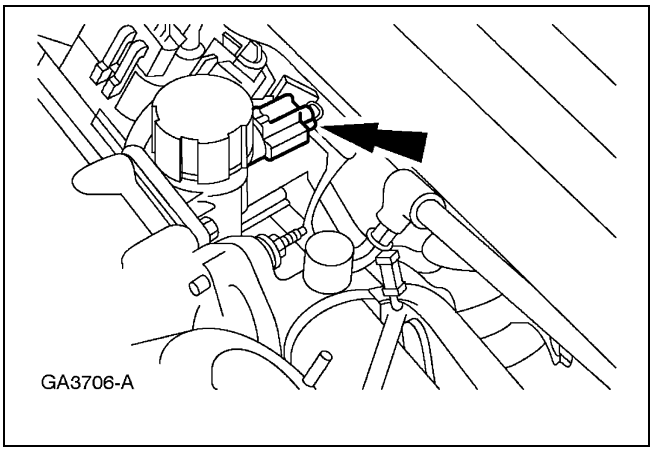


DISASSEMBLY (Continued)

9. Disconnect the differential pressure feedback EGR electrical connector.

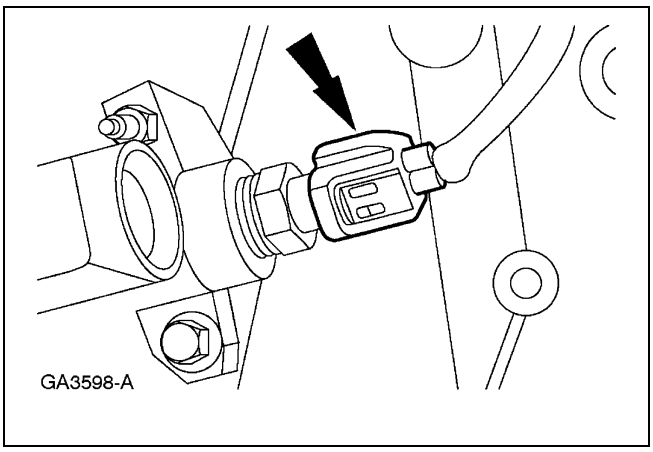


10. Disconnect the electronic vacuum regulator (EVR) solenoid valve electrical connector.

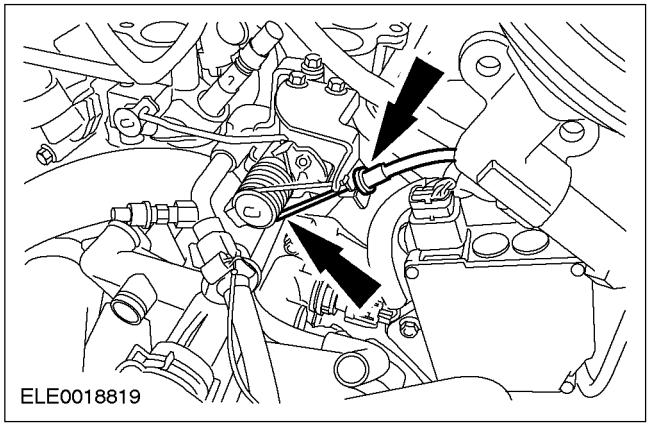


11. Disconnect the engine coolant temperature (ECT) sensor electrical connector.

- Detach the wiring harness.

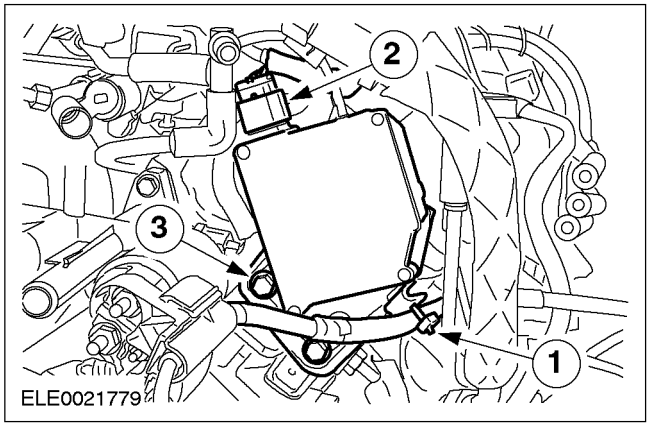


12. Detach the intake manifold runner control (IMRC) cable.



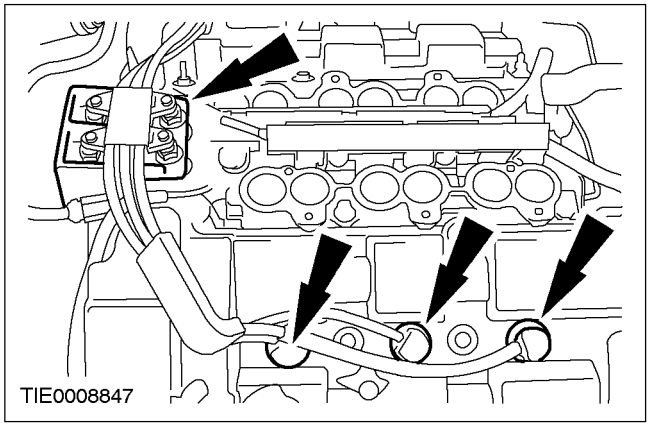
13. Remove the IMRC actuator.

1. Cut the cable ties.
2. Disconnect the IMRC electrical connector.
3. Remove the retaining bolts.



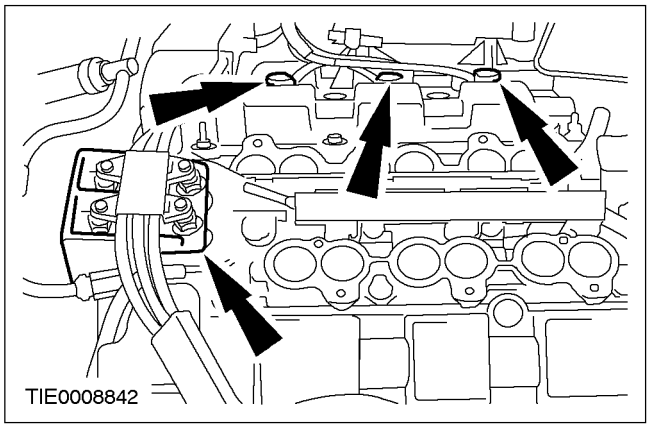
14. Disconnect the right-hand spark plug electrical connectors.

- Detach the bracket.

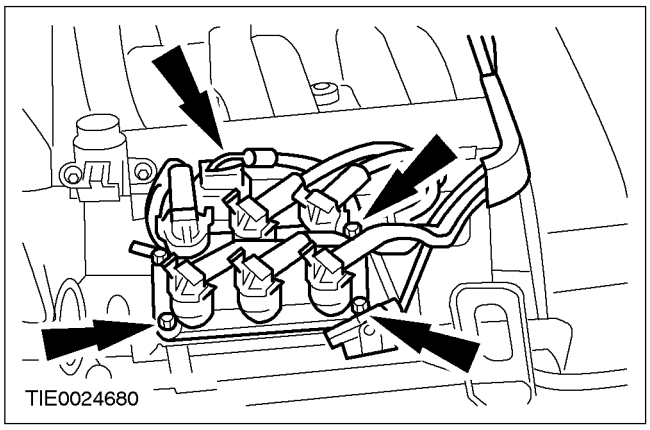


DISASSEMBLY (Continued)

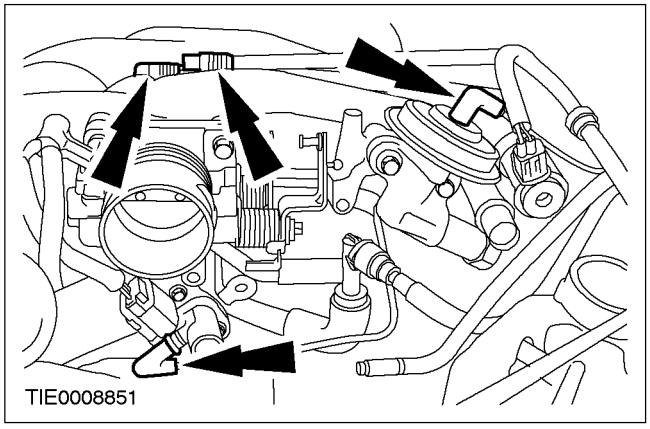
15. **Disconnect the left-hand spark plug electrical connectors.**
    - Detach the bracket.



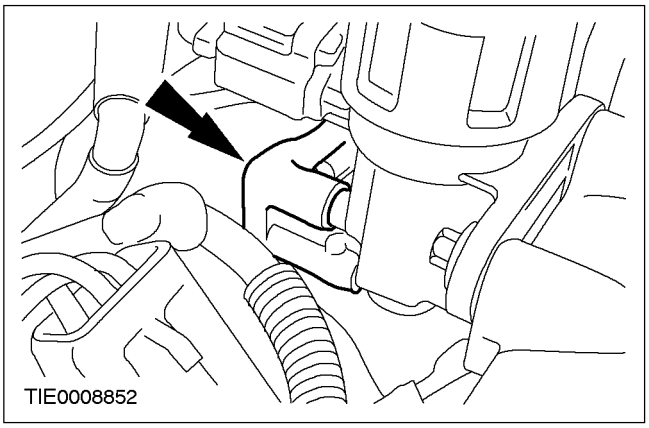
16. **Remove the electronic ignition coil (EI).**
    - Disconnect the EI electrical connector.



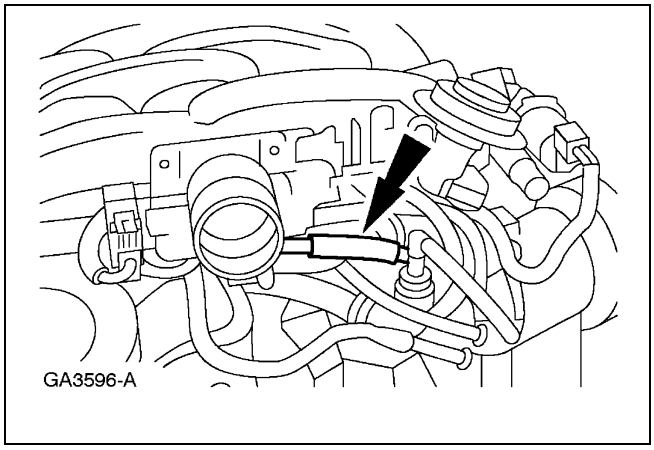
17. **Disconnect the vacuum hoses from the upper intake manifold, the EGR valve and the fuel pressure regulator.**



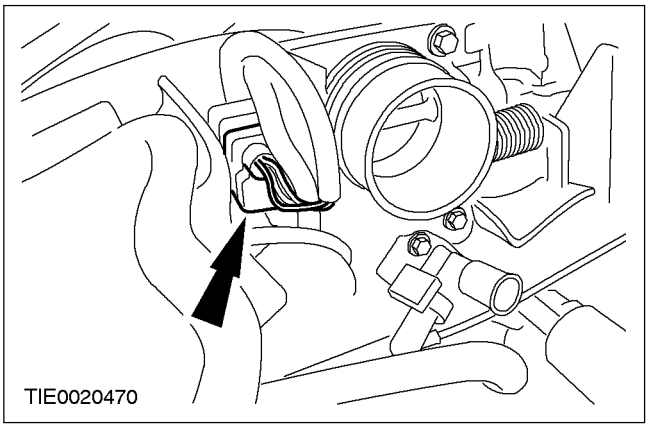
18. **Disconnect the electronic vacuum regulator (EVR) hoses.**
    - Remove the vacuum hose harness.



19. **Disconnect the positive crankcase ventilation (PCV) hose from the throttle body.**

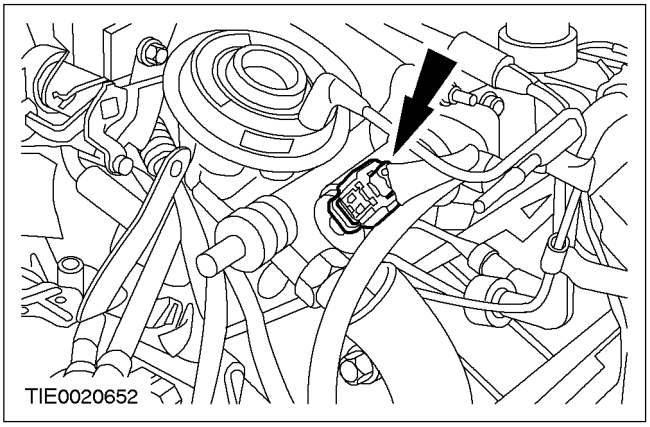


20. **Disconnect the throttle position (TP) sensor electrical connector.**



DISASSEMBLY (Continued)

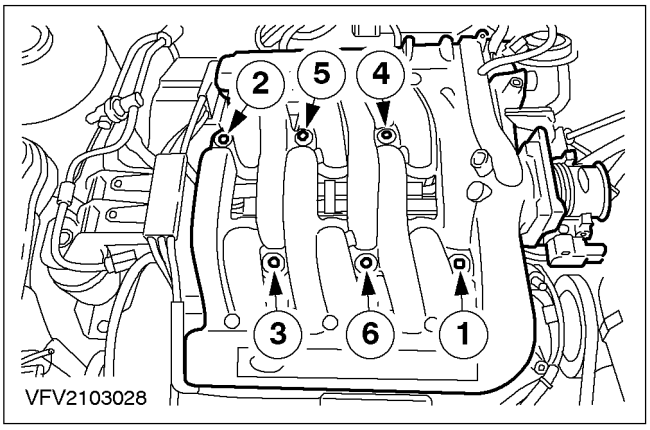
21. Disconnect the idle air control (IAC) valve electrical connector.



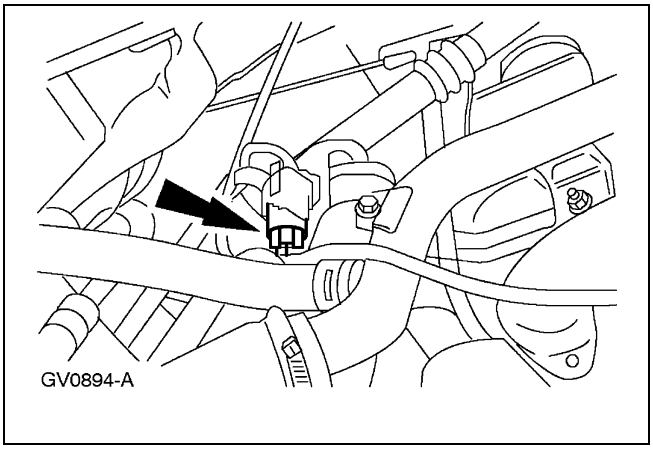
22. ⚠ CAUTION: Remove the upper intake manifold retaining bolts in the sequence shown.

Remove the upper intake manifold.

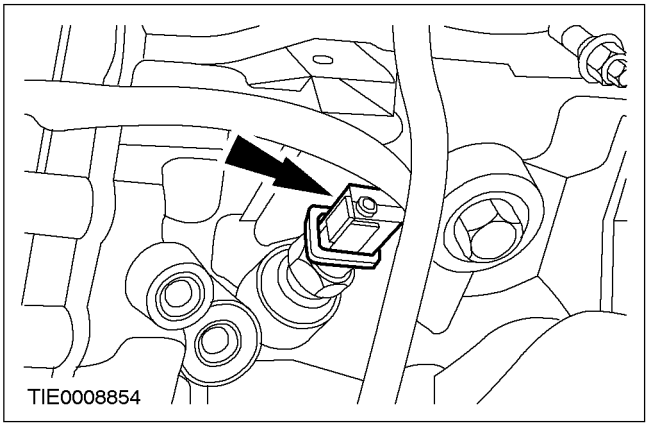
- Discard the gaskets.



23. Disconnect the heated oxygen sensor (HO2S) electrical connector.

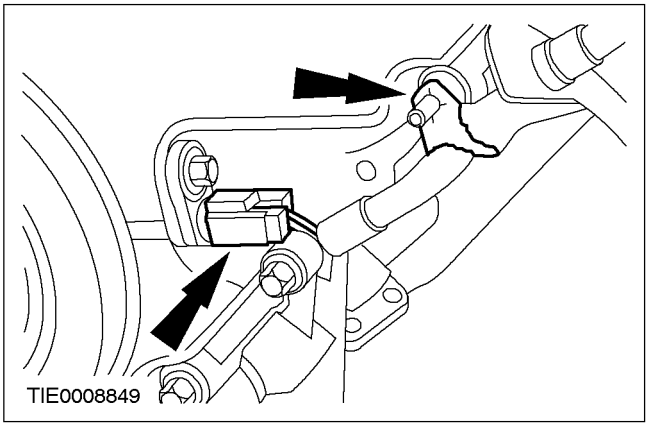


24. Disconnect the oil pressure switch electrical connector.



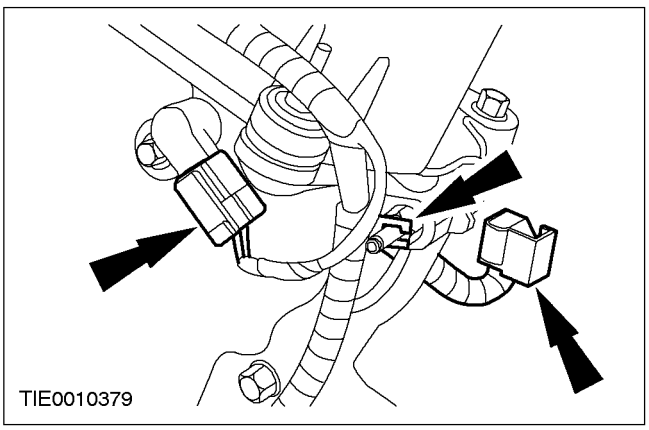
25. Disconnect the crankshaft position (CKP) sensor electrical connector.

- Detach the wiring harness from the retaining stud.



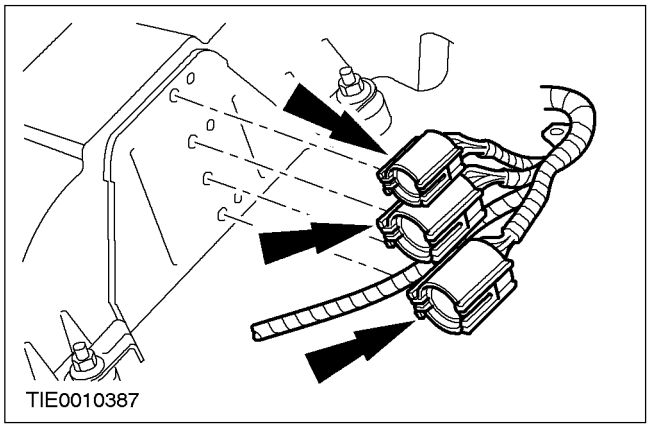
26. Disconnect the camshaft position (CMP) sensor electrical connector.

- Detach the wiring harness from the stud.

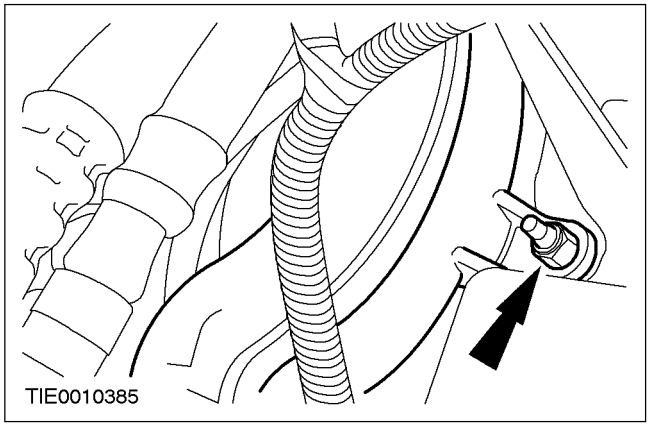


DISASSEMBLY (Continued)

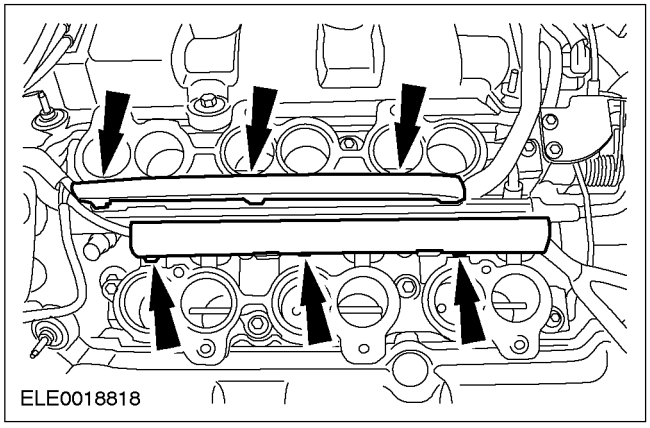
27. **Detach the wiring harness in-line electrical connectors from the mounting bracket.**



28. **Detach the wiring harness bracket from the right-hand valve cover (two nuts).**

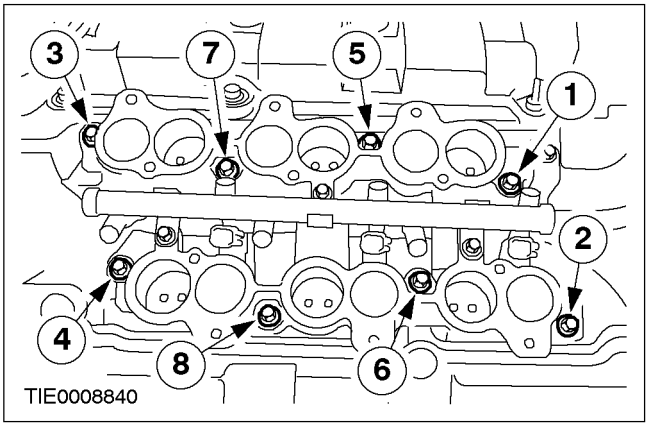


29. **Disconnect the fuel injector electrical connectors.**
    - Detach the wiring harness.

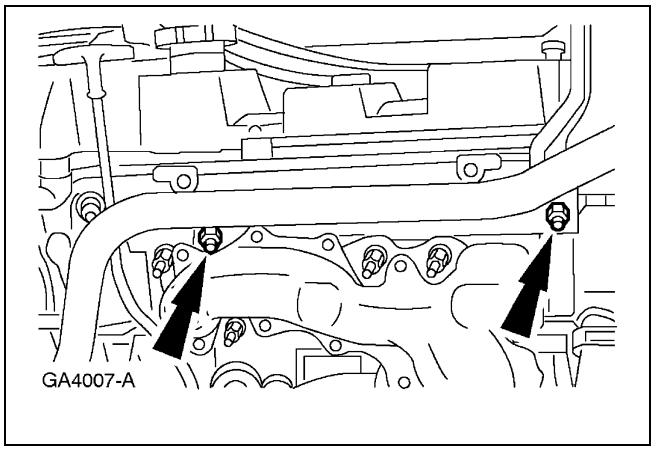


30. **CAUTION: Remove the lower intake manifold retaining bolts in the sequence shown.**

    Remove the lower intake manifold.
    - Discard the gaskets.

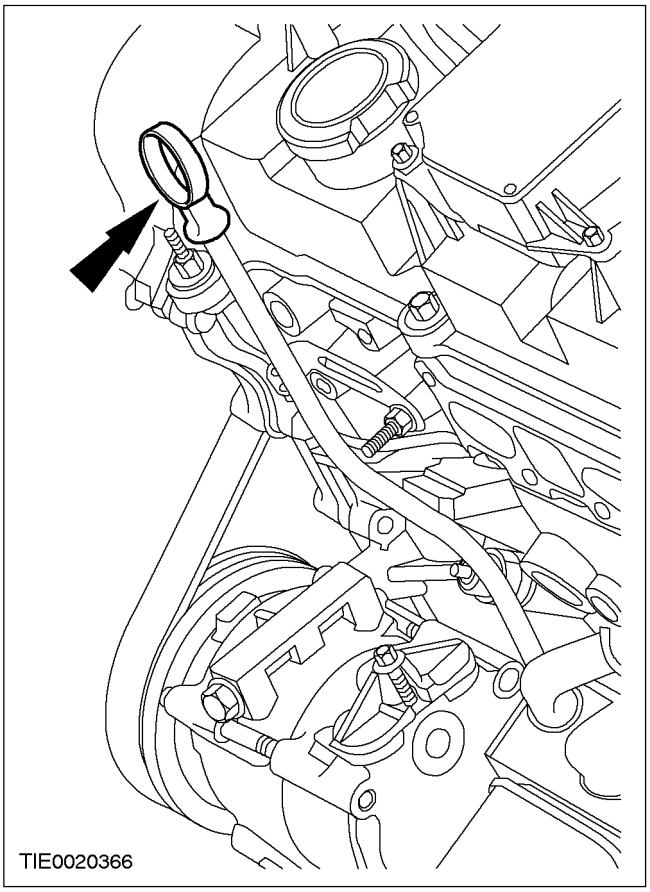


31. **Remove the coolant distribution tube.**



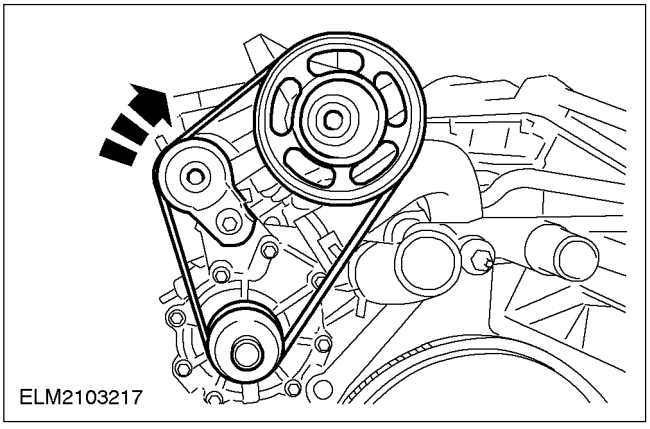
DISASSEMBLY (Continued)

32. Remove the oil level indicator and tube.



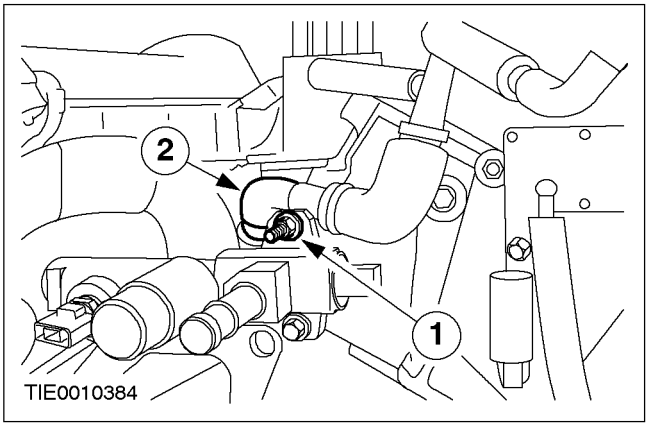
33. Remove the water pump drive belt.

- Rotate the belt tensioner clockwise to release the tension on the drive belt.

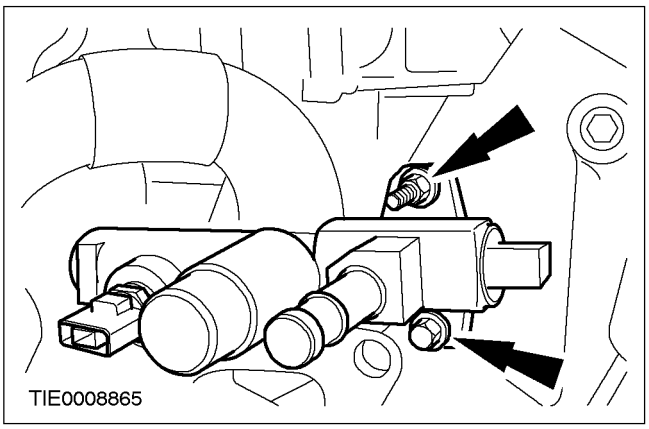


34. Remove the PCV valve and hoses.

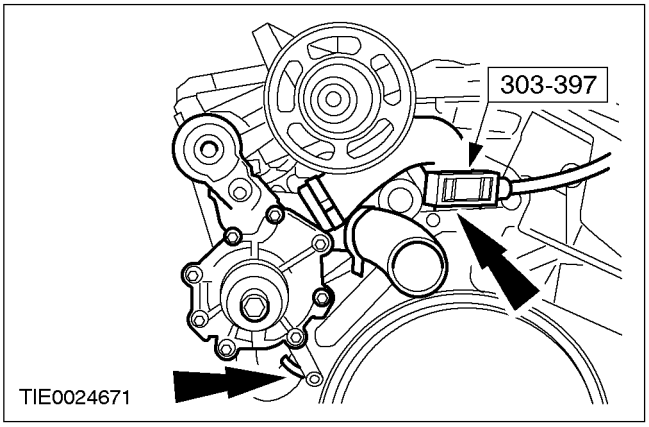
1. Remove the retaining nut.
2. Remove the PCV and hoses.



35. Remove the coolant bypass assembly.



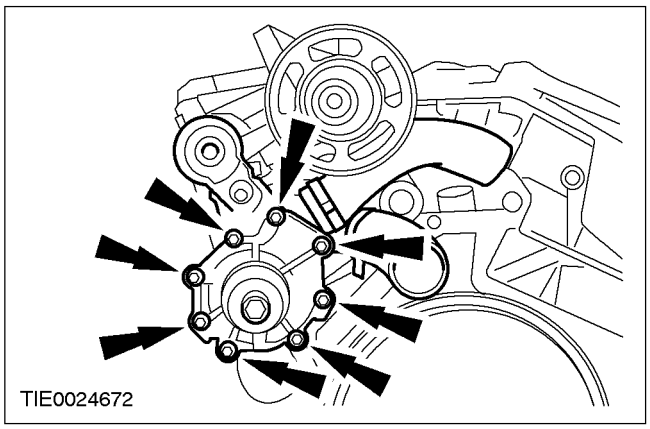
36. Using the special tool, disconnect the coolant hoses from the water pump.



DISASSEMBLY (Continued)

37. Remove the water pump.

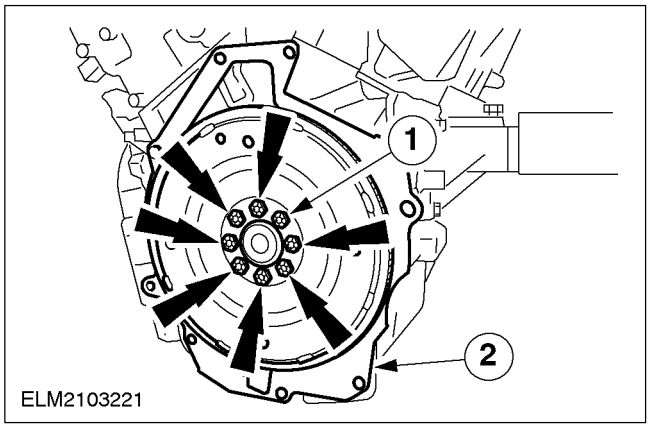
- Discard the gasket.



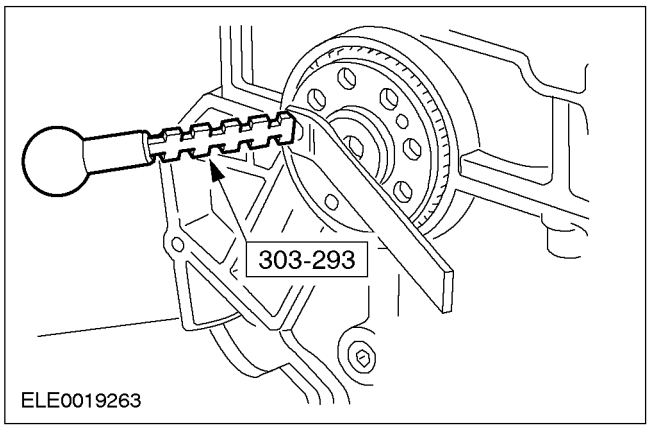
38. Remove the clutch disc and pressure plate.

39. Remove the flywheel.

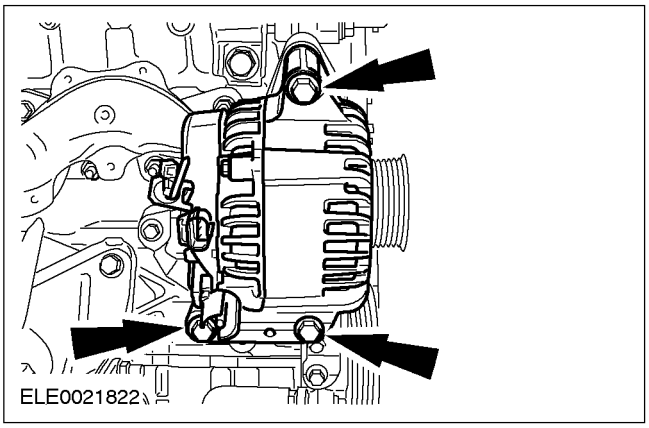
1. Remove the flywheel retaining bolts.
2. Remove the adapter plate.



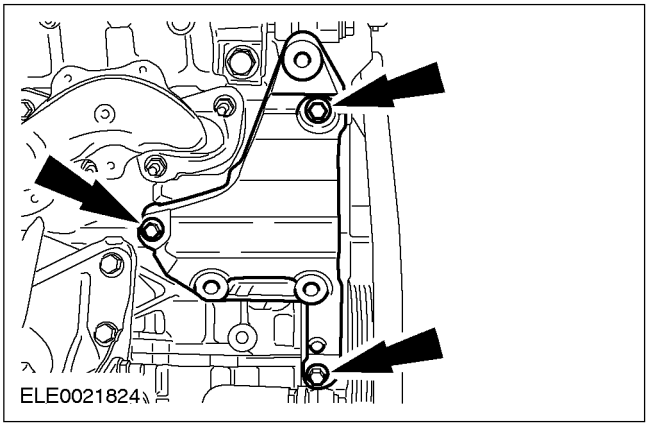
40. Using the special tool, remove the crankshaft rear oil seal.



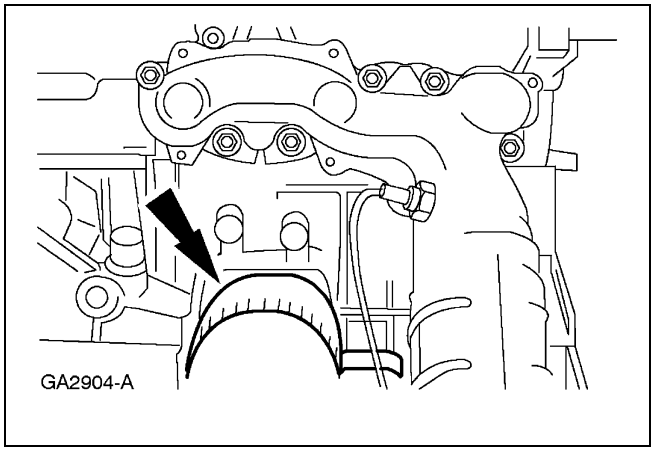
41. Remove the generator.



42. Remove the generator mounting bracket.



43. Remove the oil filter.

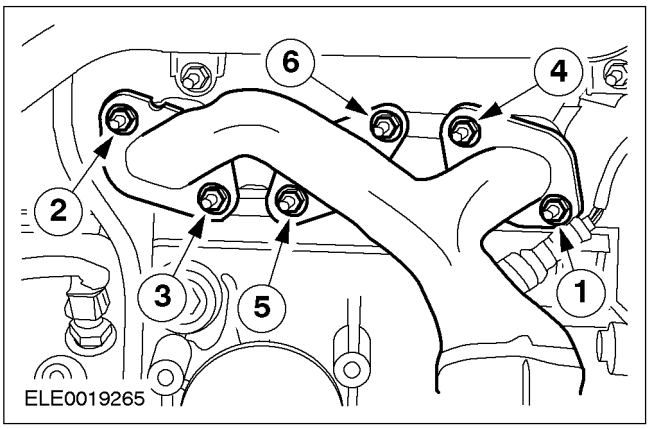


DISASSEMBLY (Continued)

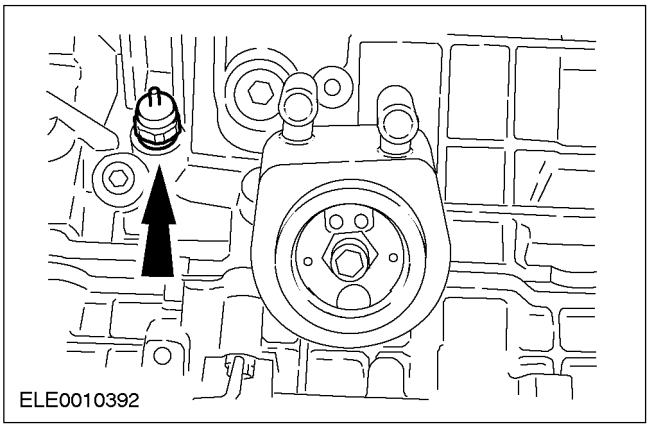
44. ⚠ CAUTION: Remove the left-hand exhaust manifold retaining nuts in the sequence shown.

Remove the left-hand exhaust manifold.

- Discard the gasket and the retaining nuts.



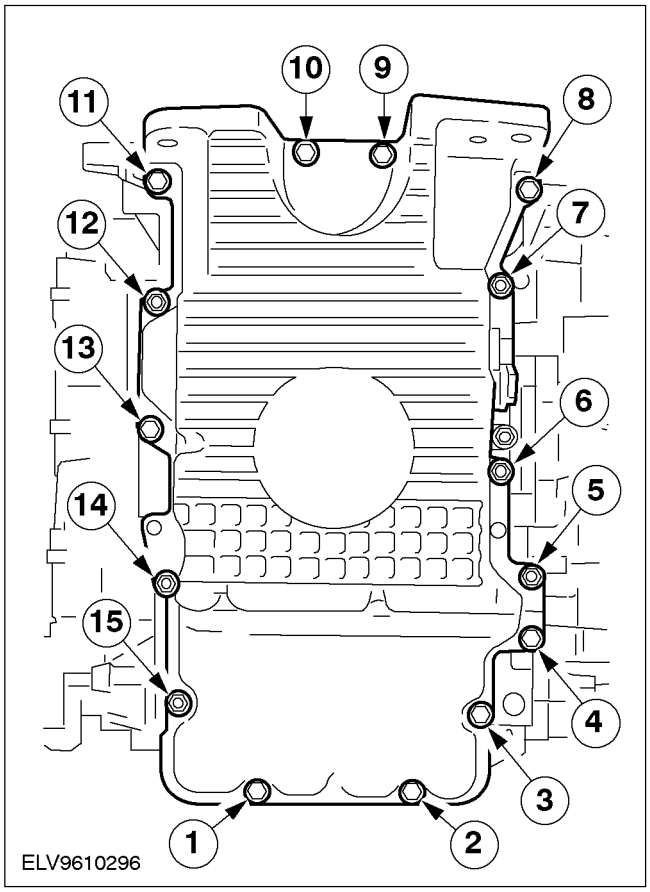
45. Remove the oil pressure switch.



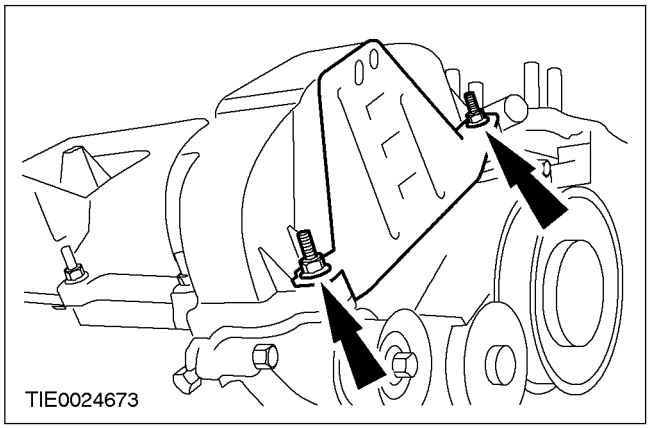
46. ⚠ CAUTION: Remove the oil pan retaining bolts and studs in the sequence shown.

Remove the oil pan.

- Discard the gasket.
- Clean and inspect oil pan and cylinder block using metal surface cleaner.



47. Remove the inline connector bracket from the valve cover.

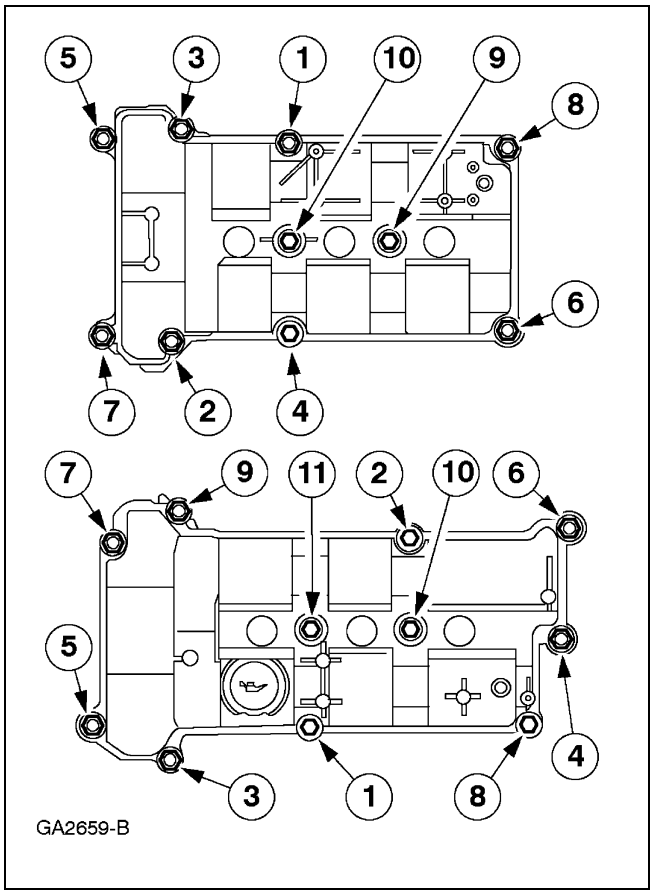


DISASSEMBLY (Continued)

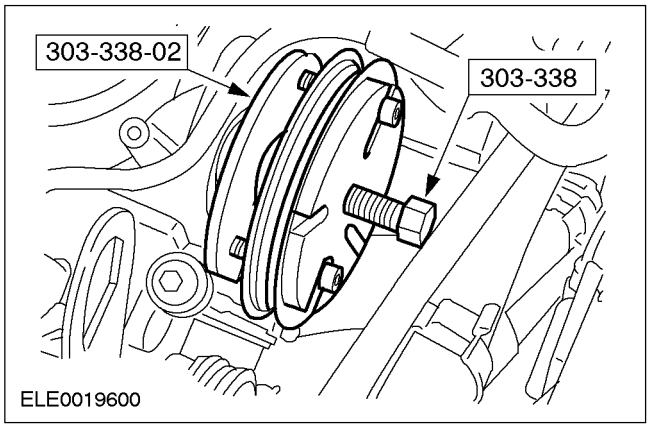
48. **CAUTION: Remove the valve cover retaining bolts and nuts in the sequence shown.**

Remove the valve covers.

- Discard the gaskets.



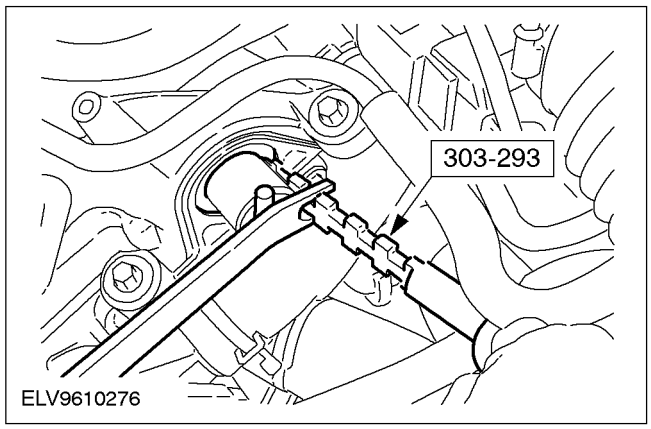
49. **Using the special tools, remove the camshaft pulley.**



50. **CAUTION: Do not damage the camshaft oil seal surface.**

Using the special tool, remove the camshaft oil seal.

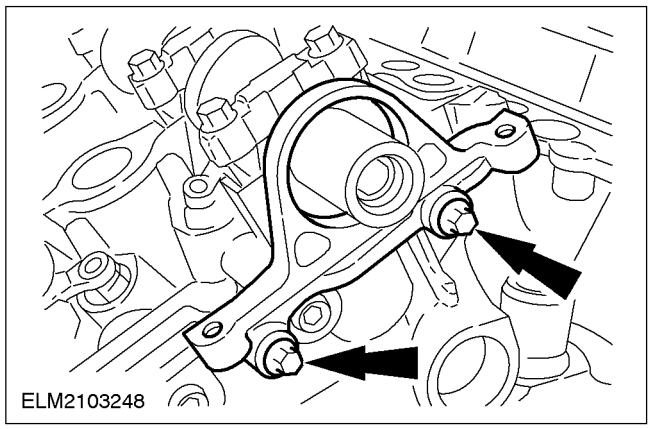
- Discard the oil seal.



51. **CAUTION: Protect the camshaft surface when removing the oil seal retainer.**

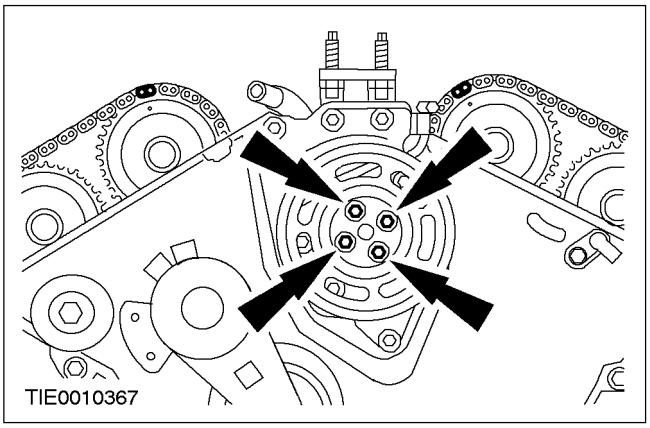
Remove the camshaft oil seal retainer.

- Discard the gasket.

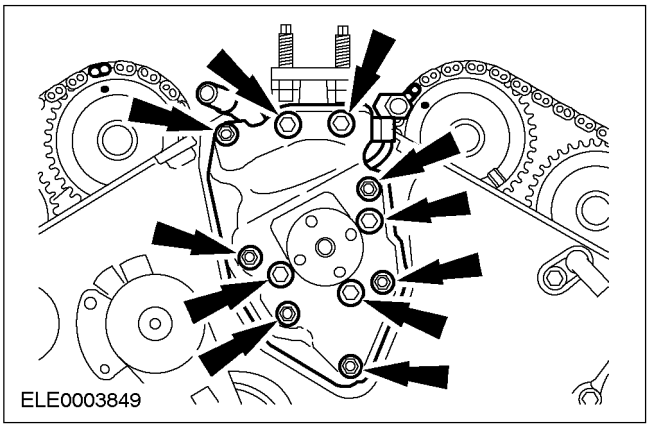


DISASSEMBLY (Continued)

52. Remove the power steering pump pulley.

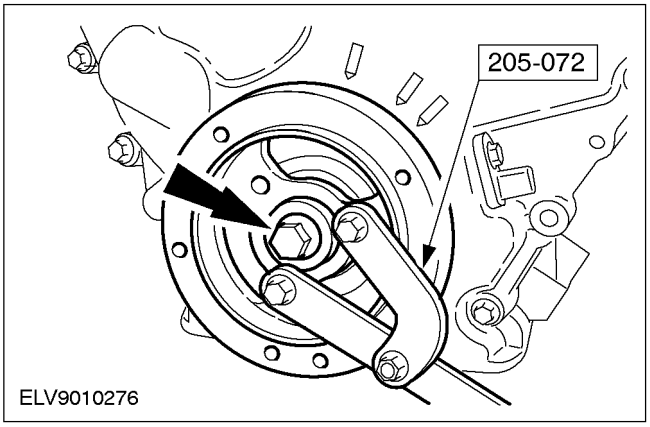


53. Remove the power steering pump and bracket (five bolts and six nuts).

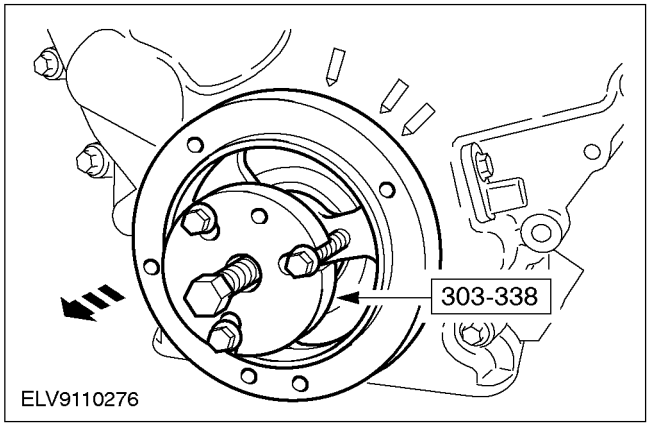


54. Using the special tool, remove the crankshaft pulley retaining bolt.

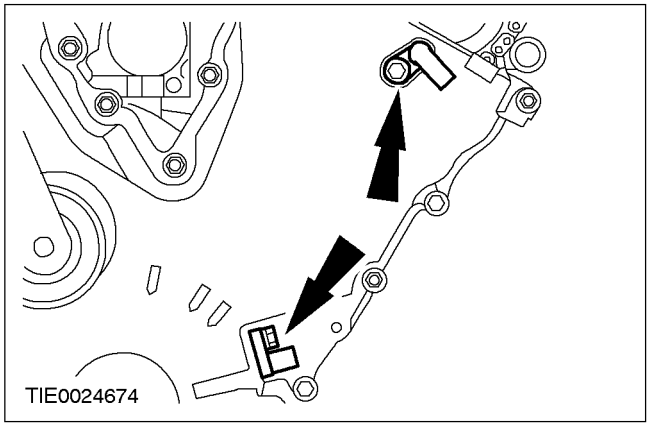
- Discard the crankshaft pulley retaining bolt.



55. Using the special tool, remove the crankshaft pulley.

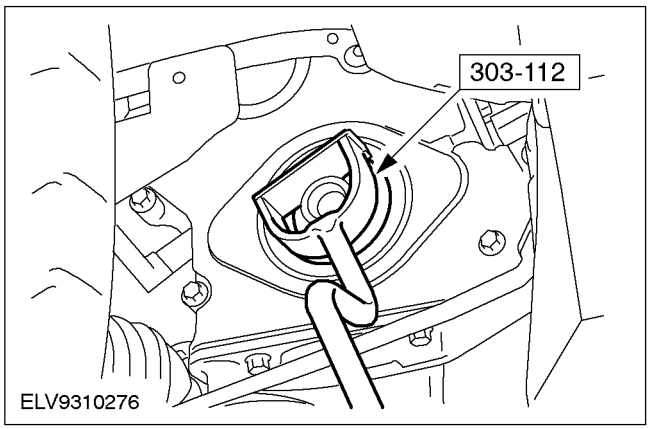


56. Remove the CMP and CKP position sensors.



57. Using the special tool, remove the crankshaft front oil seal.

- Discard the oil seal.

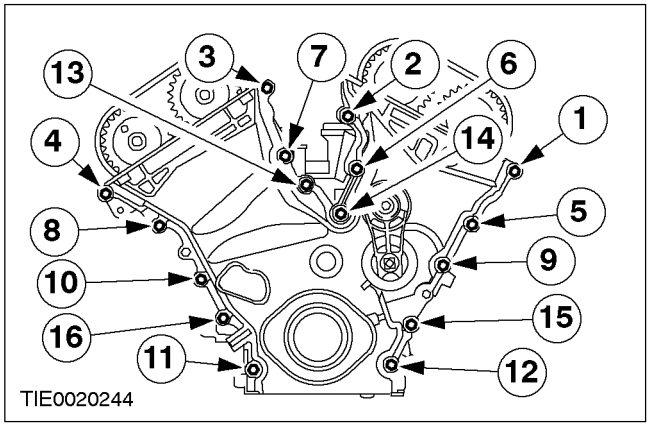


DISASSEMBLY (Continued)

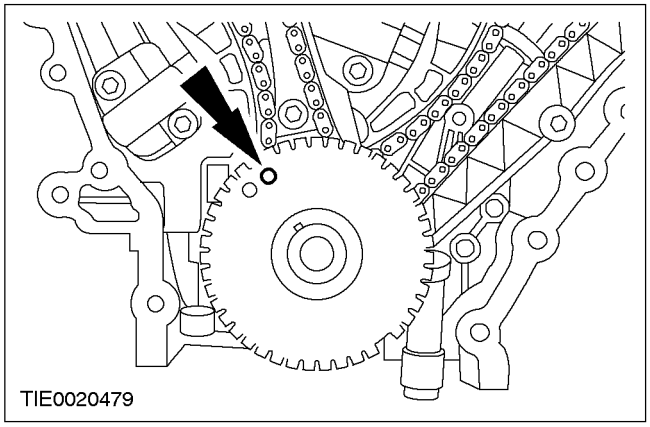
58. **NOTE:** Remove the engine front cover retaining bolts and nuts in the sequence shown.

Remove the engine front cover.

- Discard the gaskets.

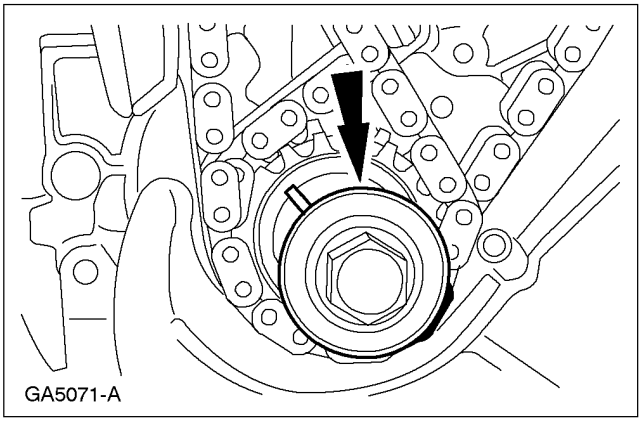


59. **Remove the CKP sensor pulse wheel.**

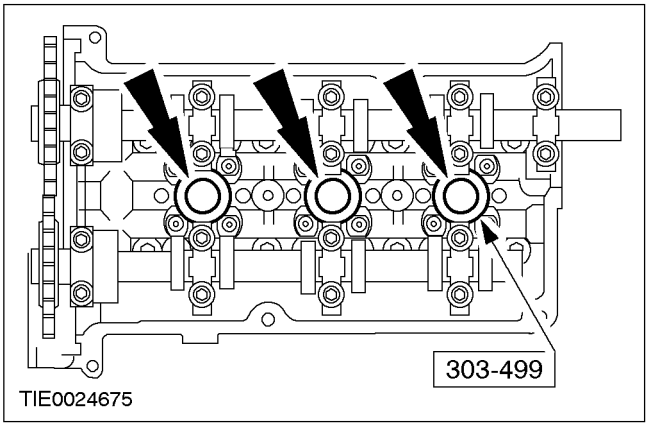


60. **NOTE:** Do not tighten the bolt at this stage.

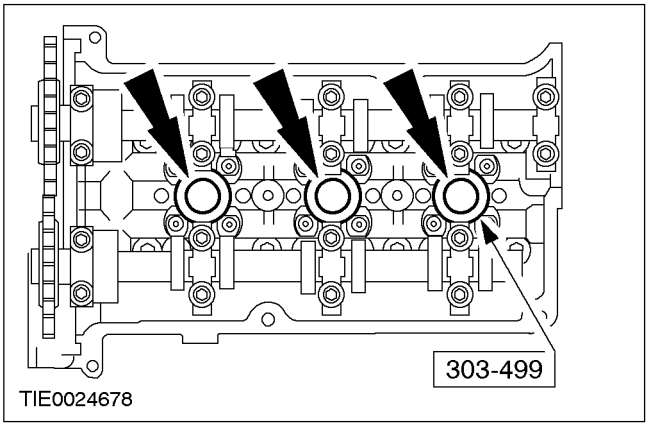
Install the crankshaft pulley retaining bolt.



61. **Using the special tool, remove the right-hand spark plugs.**



62. **Using the special tool, remove the left-hand spark plugs.**

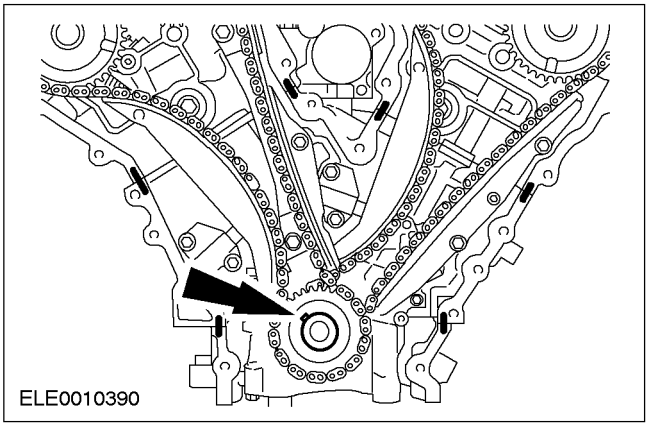


63. **⚠ CAUTION: Only turn the engine in the normal direction of rotation.**

NOTE: The crankshaft keyway will be at the 11 o'clock position when the engine is at top dead center (TDC).

Turn the engine to top dead center (TDC).

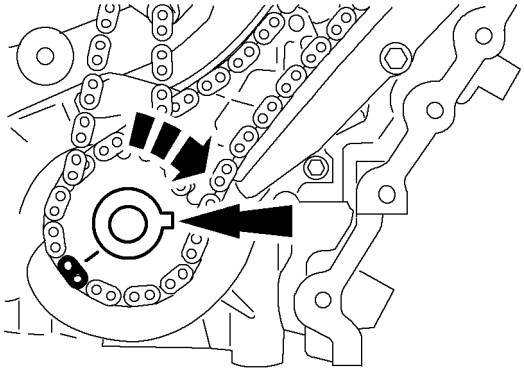
- Rotate the crankshaft keyway clockwise to the 11 o'clock position.



DISASSEMBLY (Continued)

64. Rotate the crankshaft until the crankshaft keyway is in the 3 o'clock position.

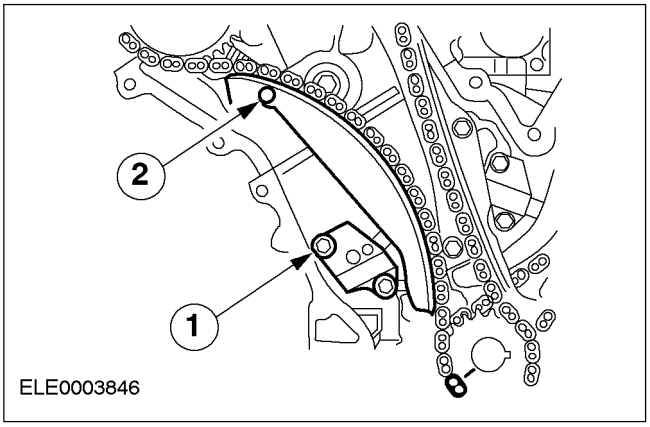
- The right-hand camshafts are in the neutral position.


ELE0004104

65. NOTE: Mark the position of all chain drive components to make sure they are assembled in their original positions.

Remove the right-hand timing chain tensioner and timing chain tensioner arm.

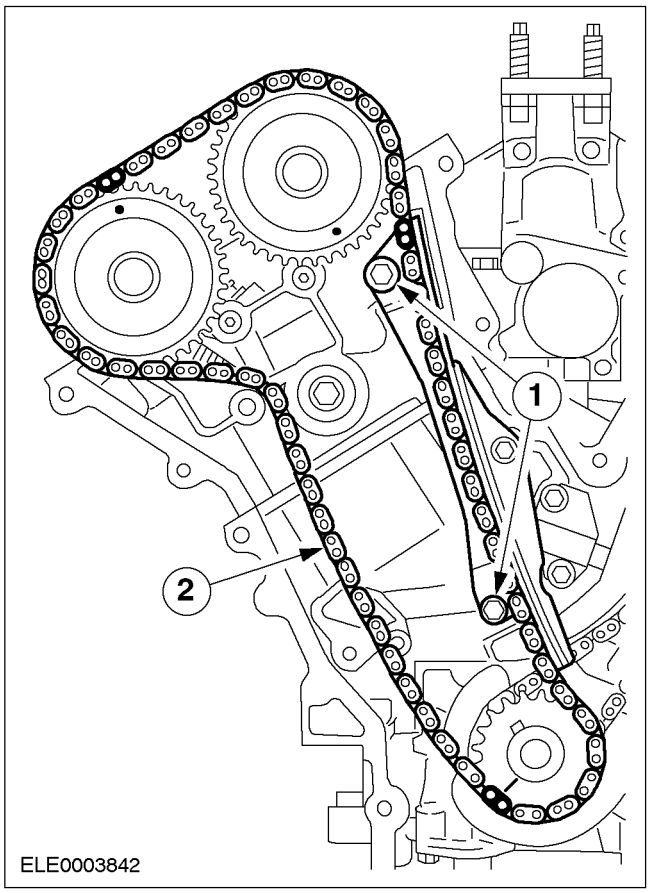
1. Remove the timing chain tensioner and the right-hand tensioner adapter plate (if equipped).
2. Remove the timing chain tensioner arm.



ELE0003846

66. Remove the right-hand timing chain.

1. Remove the fixed timing chain guide.
2. Remove the right-hand timing chain.



ELE0003842

DISASSEMBLY (Continued)

67. **CAUTION: The cylinder head and the camshaft bearing caps are numbered and marked for left-hand and right-hand cylinder heads.**

NOTE: Camshaft bearing caps are dowelled to the cylinder head. If necessary, use a plastic mallet to loosen the caps.

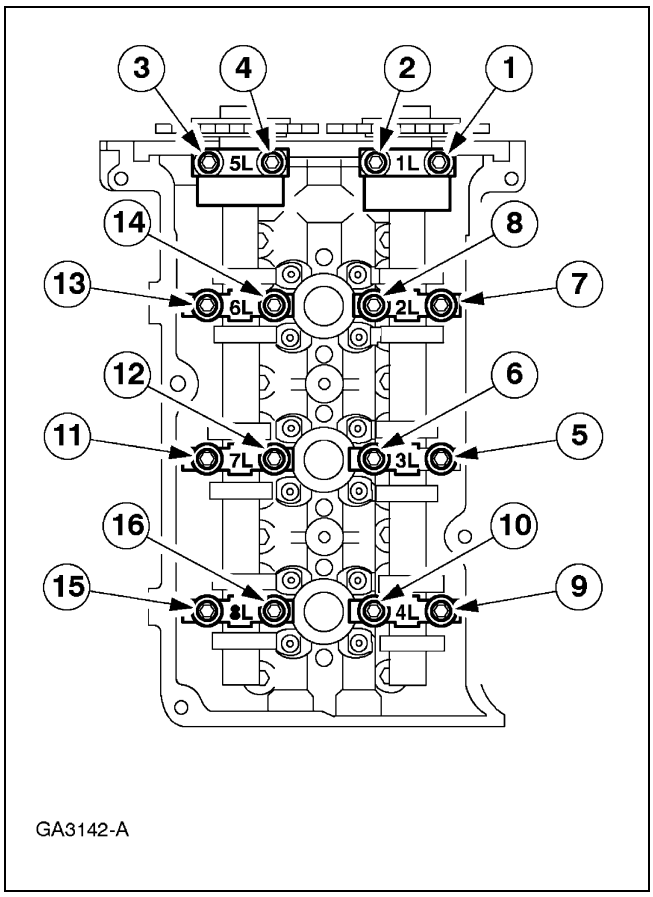
NOTE: Remove camshaft bearing thrust caps No. 1R and 5R first. Do not loosen any other retaining bolts until the thrust caps are removed.

NOTE: Loosen the retaining bolts and bearing caps in the indicated sequence in several passes to allow the camshafts to gradually rise from the cylinder head.

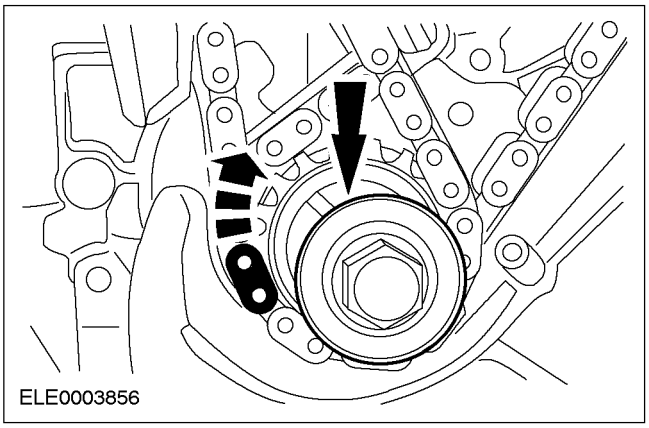
NOTE: If the cam followers and valve tappets are to be re-used, mark their position to make sure they are assembled in the original location.

Remove the right-hand cylinder head camshafts.

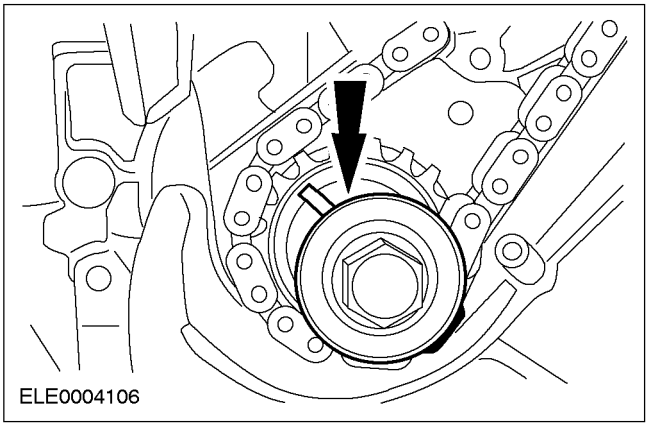
- Remove the cam followers.
- Remove the valve tappets.



68. **Rotate the crankshaft two revolutions until the keyway is in the 11 o'clock position.**



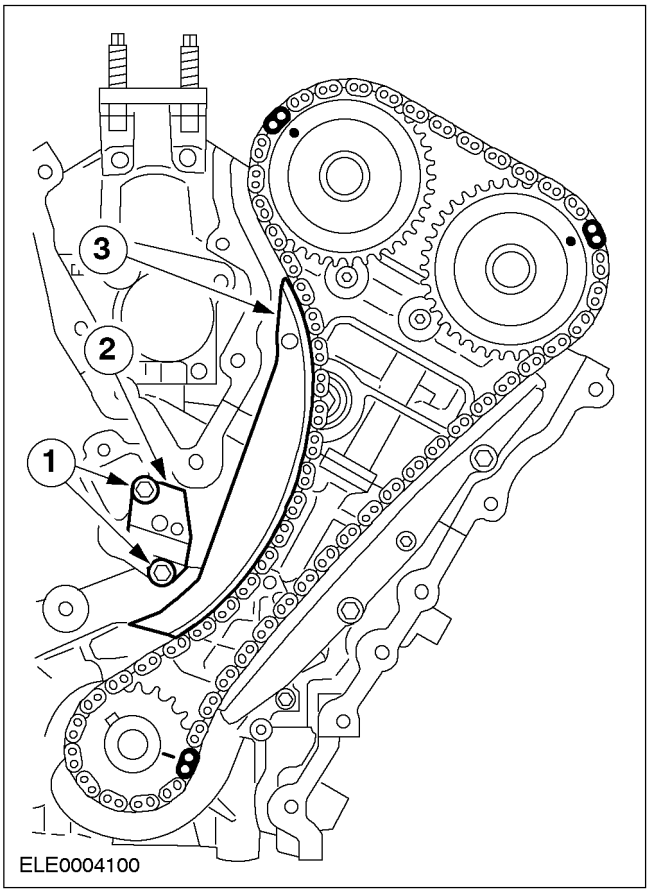
69. **Remove the crankshaft pulley retaining bolt and washer.**



DISASSEMBLY (Continued)

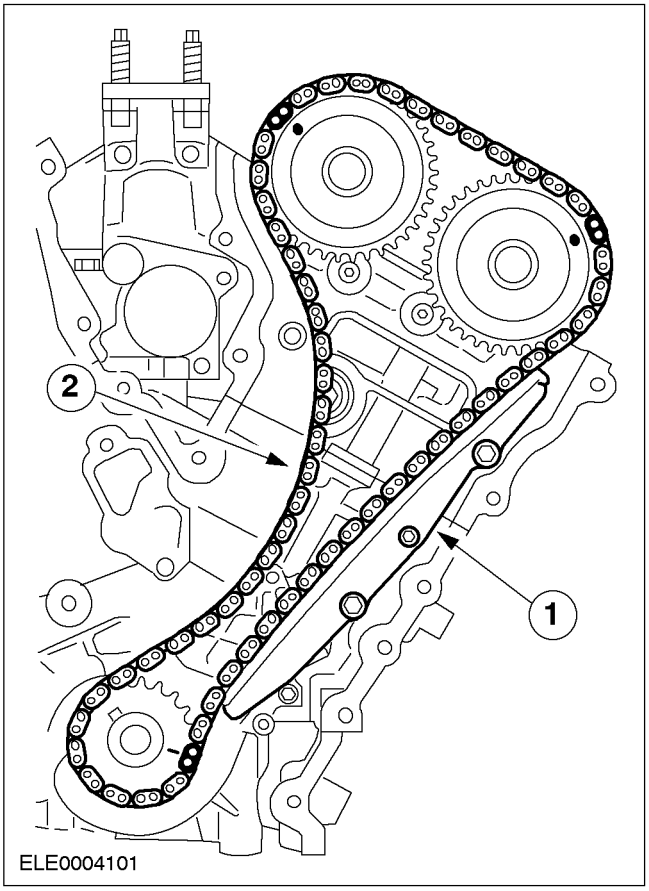
70. Remove the left-hand timing chain tensioner and timing chain tensioner arm.

1. Remove the timing chain tensioner retaining bolts.
2. Remove the timing chain tensioner and the left-hand tensioner adapter plate (if equipped).
3. Remove the timing chain tensioner arm.



71. Remove the left-hand timing chain.

1. Remove the fixed timing chain guide.
2. Remove the left-hand timing chain.



DISASSEMBLY (Continued)

72. **CAUTION: The cylinder head and the camshaft bearing caps are numbered and marked for left-hand and right-hand cylinder heads.**

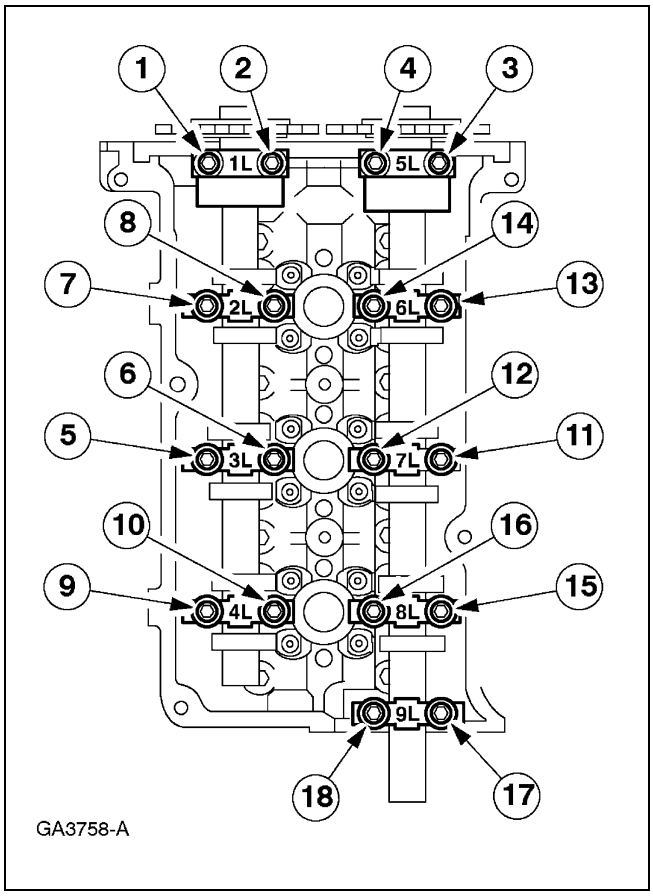
NOTE: Remove camshaft bearing thrust caps No. 1L and 5L first. Do not loosen any of the other retaining bolts until the thrust caps are removed.

NOTE: Loosen the retaining bolts and bearing caps in the sequence shown in several passes to allow the camshafts to gradually rise from the cylinder head.

NOTE: If the cam followers and valve tappets are to be re-used, mark their position to make sure they are assembled in the original location.

Remove the right-hand camshafts.

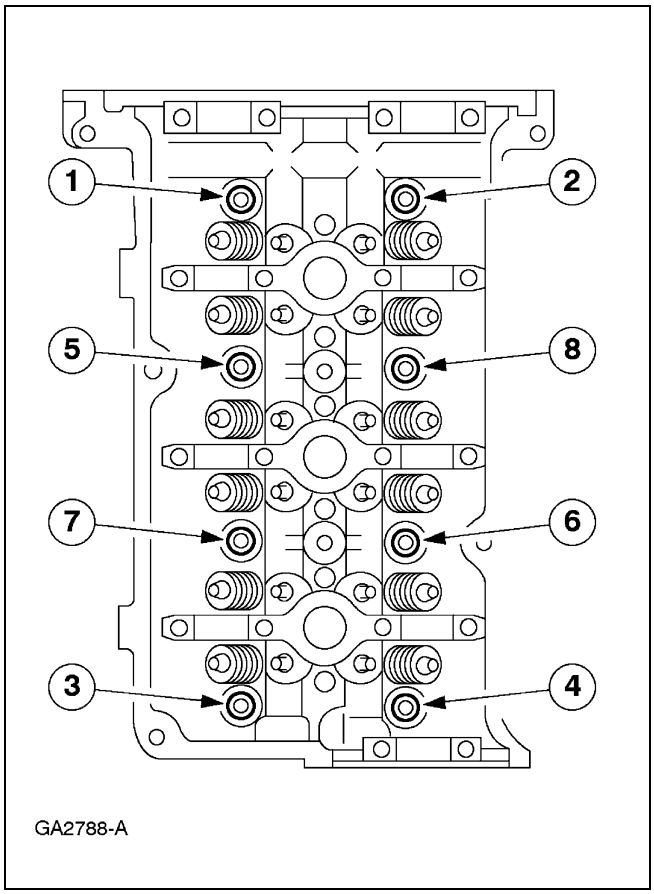
- Remove the cam followers.
- Remove the valve tappets.



73. **CAUTION: Remove the left-hand cylinder head bolts in the sequence shown.**

Remove the left-hand cylinder head.

- Discard the gasket.

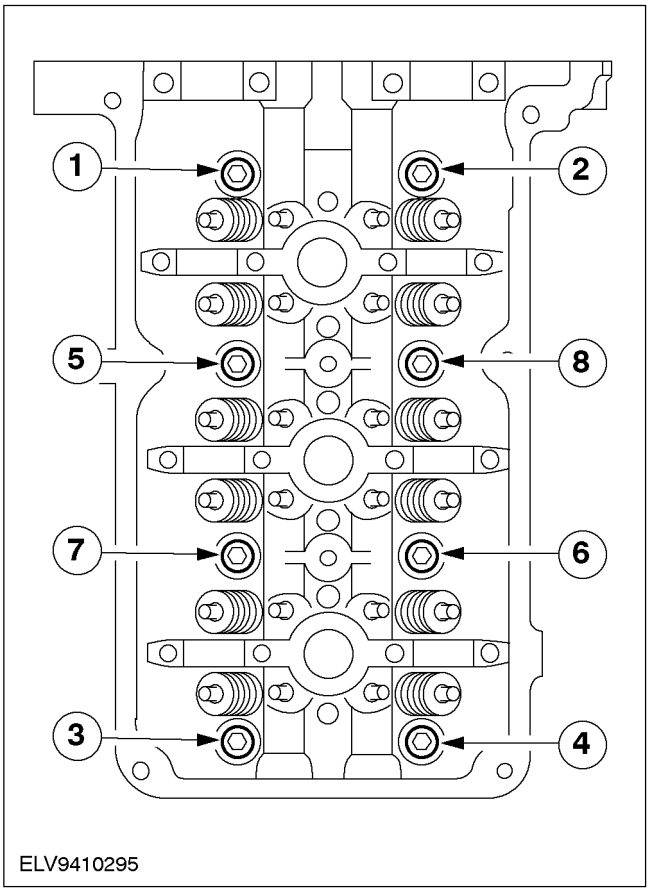


DISASSEMBLY (Continued)

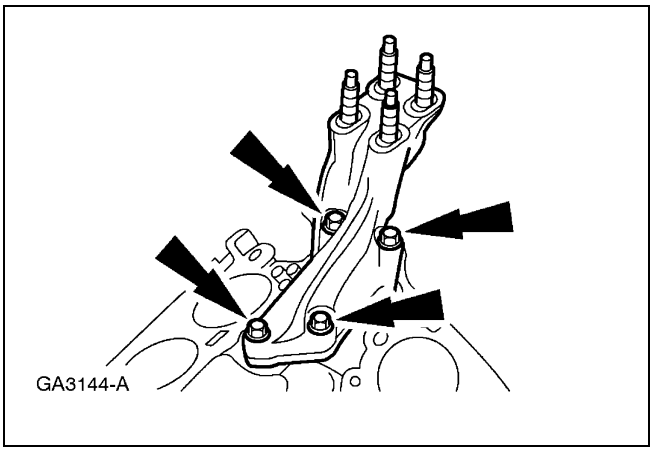
74. **CAUTION: Remove the right-hand cylinder head bolts in the sequence shown.**

Remove the right-hand cylinder head.

- Discard the gaskets.

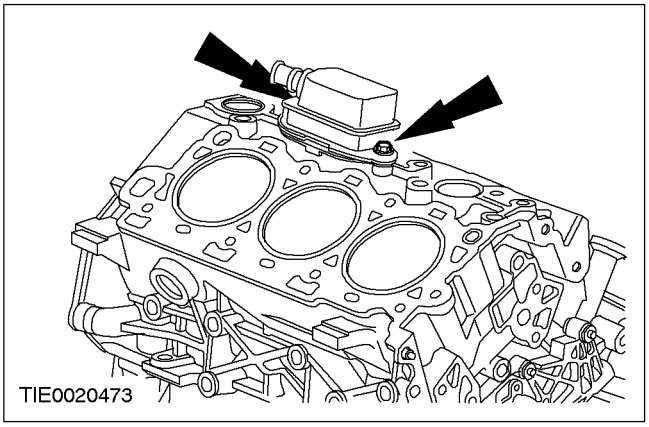


75. **Remove the power steering pump bracket.**



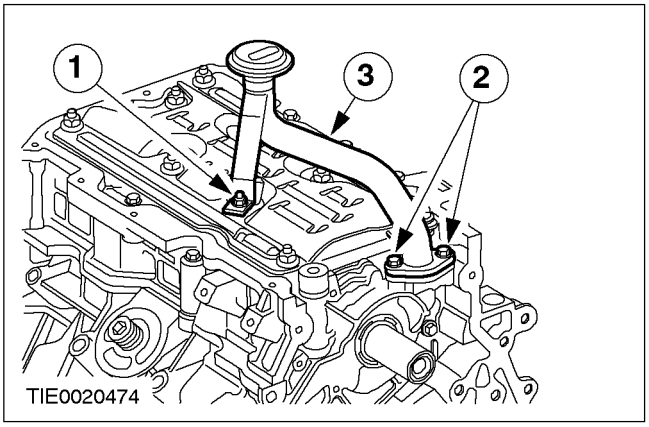
76. **Remove the oil separator.**

- Discard the gasket.

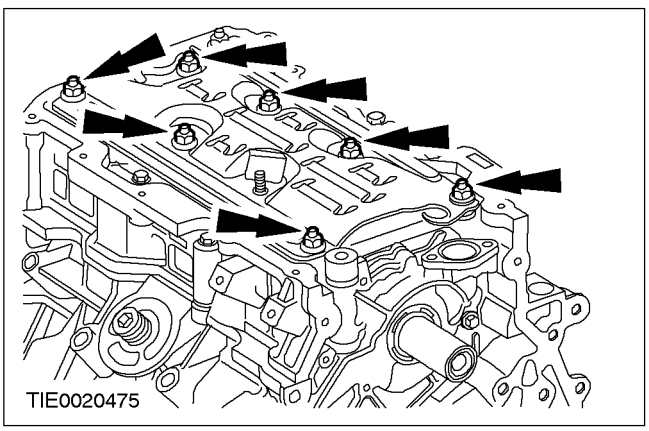


77. **Remove the oil pick-up pipe.**

1. Remove the retaining nut.
2. Remove the retaining bolts.
3. Remove the oil pick-up pipe.



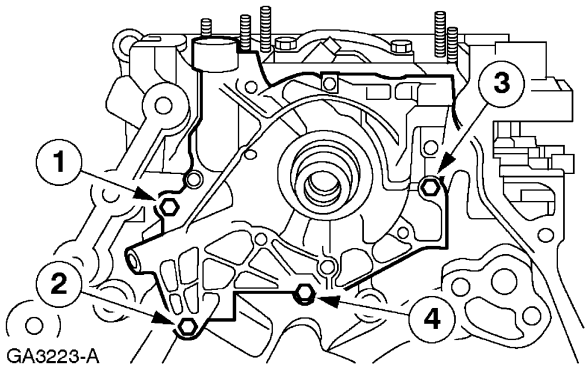
78. **Remove the oil pan baffle.**



DISASSEMBLY (Continued)

79. **CAUTION: Remove the oil pump retaining bolts in the sequence shown.**

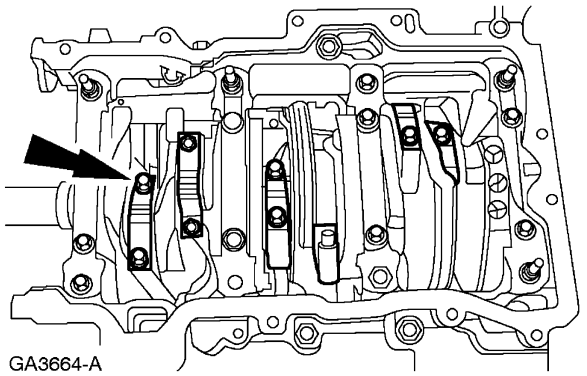
Remove the oil pump.



80. **CAUTION: Mark the position of the connecting rod bearing caps to the connecting rods.**

NOTE: Discard the connecting rod bolts after removal.

Remove the connecting rod bearing caps.

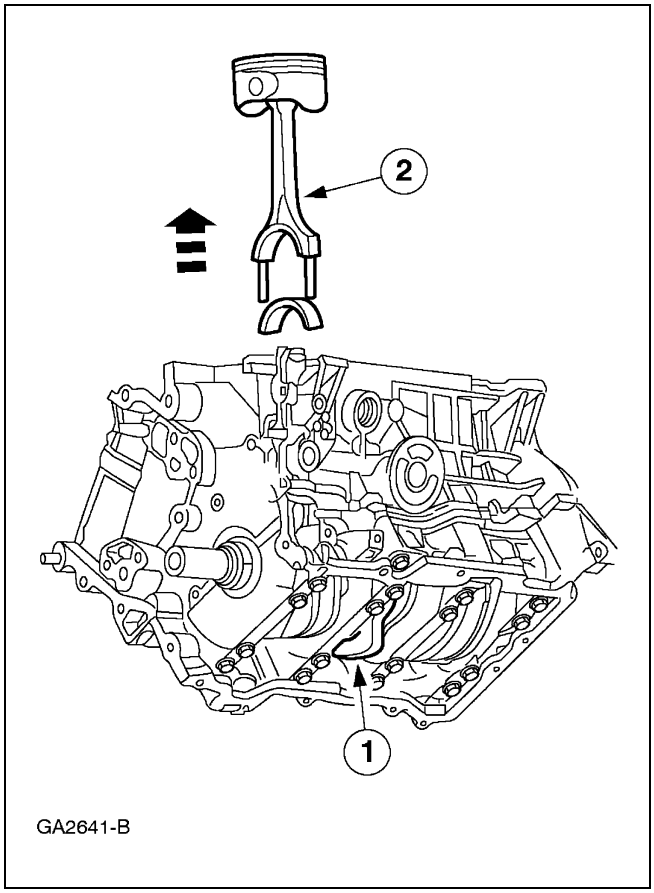


81. **NOTE:** Before removing pistons, inspect the top of the cylinder bores. If necessary, remove the ridge from each cylinder.

NOTE: Re-attach the bearing caps to the connection rods after removal.

Remove the pistons.

1. Rotate the crankshaft to position the pistons at the top of travel.
2. Push the piston, connecting rod and upper bearing through the top of the cylinder.

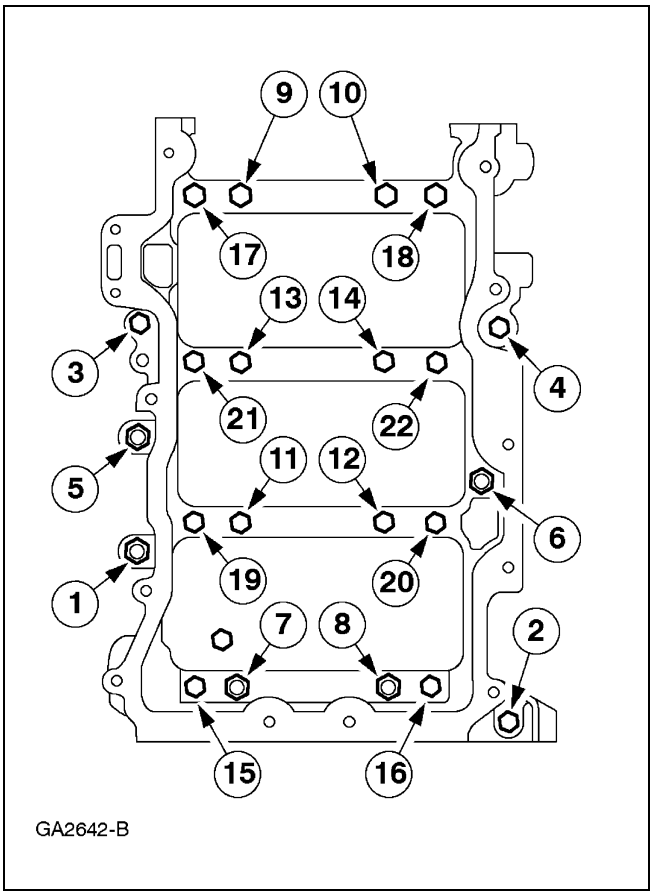


DISASSEMBLY (Continued)

82. CAUTION: Remove the lower cylinder block bolts in the sequence shown.

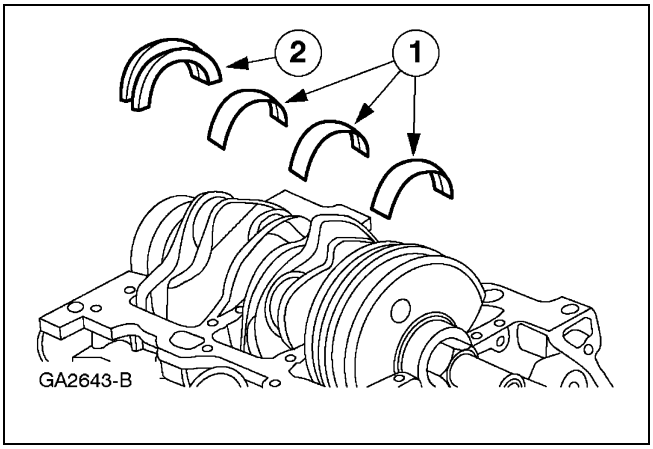
Remove the lower cylinder block.

- Discard the retaining bolts 7 – 22.



83. Remove the lower crankshaft bearings.

1. Remove the lower crankshaft main bearings.
2. Remove the lower crankshaft thrust main bearing.

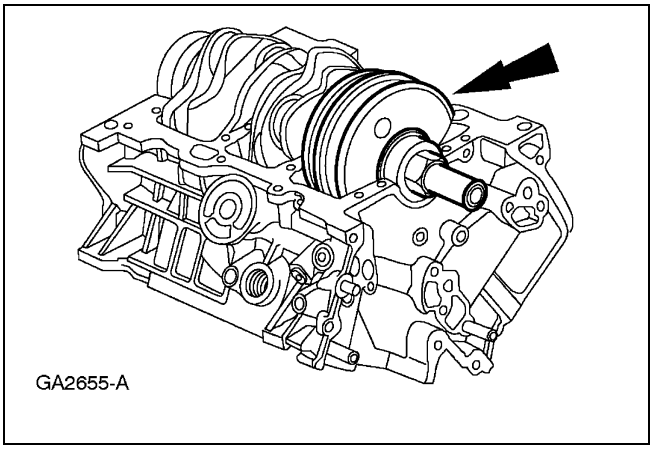


84. CAUTION: Avoid damage to any crankshaft bearing surfaces.

NOTE: Never remove any pipe plugs or dowels unless they are to be replaced or the cylinder block is to be washed.

Remove the crankshaft.

- Remove the main bearing shells.
- Discard the main bearing shells.

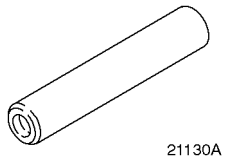
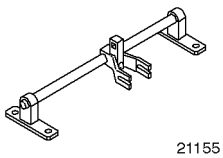
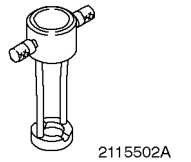
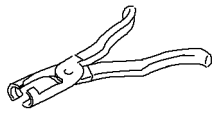


85. WARNING: Eye protection is required during the use of compressed air. Failure to follow these instructions may result in personal injury.

Clean the cylinder block with a soap and water solution. Dry the cylinder block completely with compressed air.

DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

Cylinder Head (21 165 6)

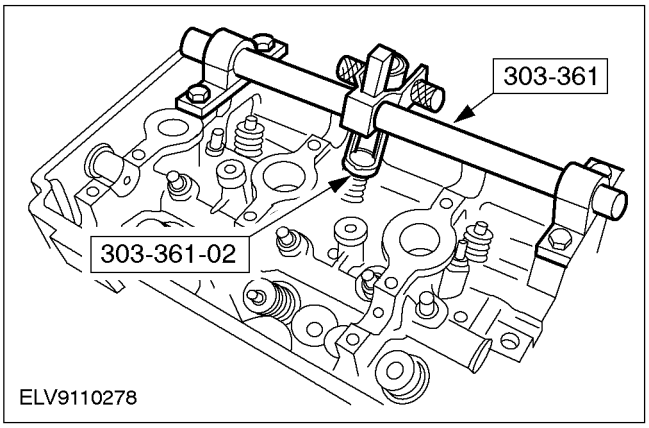
Special Tool(s)	
 21130A	Installer, Intake Valve Stem Oil Seal 303-247 (21-130A)
 21155	Compressor, Valve Spring 303-361 (21-155)
 2115502A	Adapter for 303-361 303-361-02 (21-155-02A)
 PZ21211	Pliers, Valve Stem Oil Seals 303-508 (21-211)

Name	Specification
Vehicles built up to 10/2000:	
Engine oil	WSS-M2C912-A1/ WSS-M2C913-A
Vehicles built 10/2000 onwards:	
Engine oil	WSS-M2C913-A

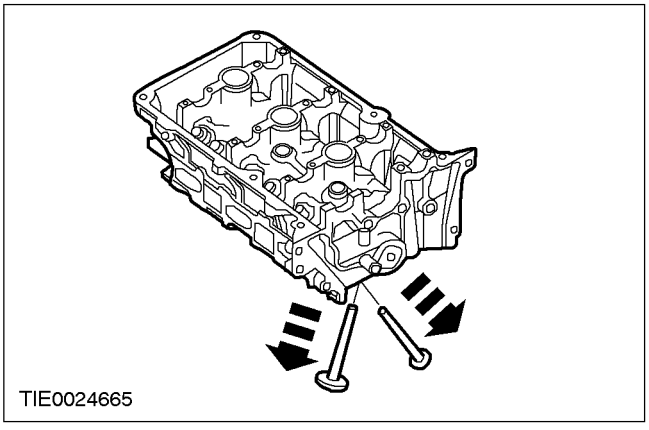
Disassembly

1. **CAUTION: Mark the installation position of any valve train components that are to be re-used so that they are installed in the correct position.**

   Using the special tools, remove the valve collets, the valve springs and the valve spring retainers.

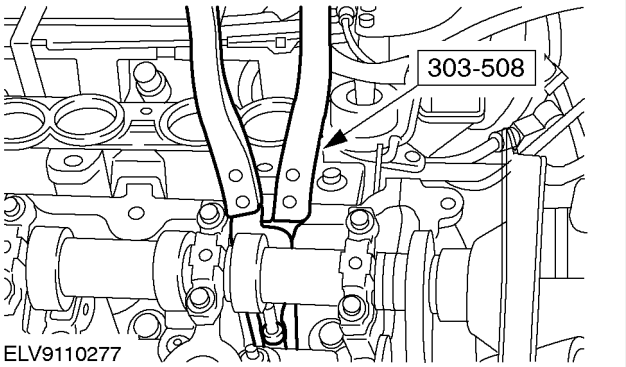


2. **Remove the valves.**



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

3. Using the special tool, remove the valve stem seals.



4. Check the cylinder heads and related components for wear or damage. For additional information, refer to Section 303-00.

- Discard components if damaged.

Assembly

1. WARNING: Use eye protection when using compressed air. Failure to do so may result in personal injury.

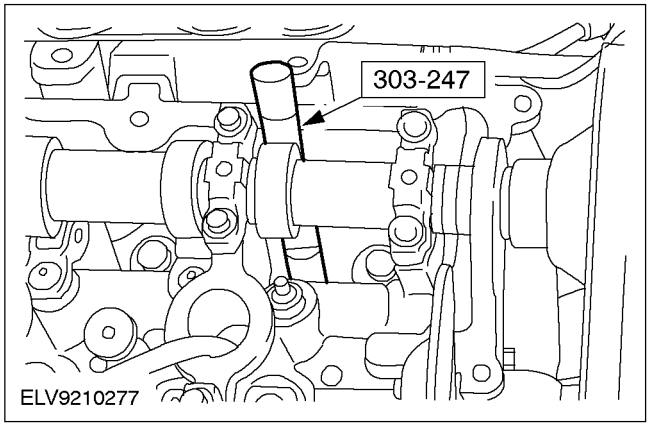
CAUTION: The cylinder head surface is measured in microns. For proper head gasket sealing, avoid any contact of the surface with hard objects.

NOTE: Install new components if necessary.

Remove gasket material, dirt and debris from the cylinder heads. Wash with a suitable soap solution and dry completely using compressed air if the blanking plugs have been removed.

- If gasket material remains on the cylinder head after cleaning, use a plastic scraper to remove the remaining material.

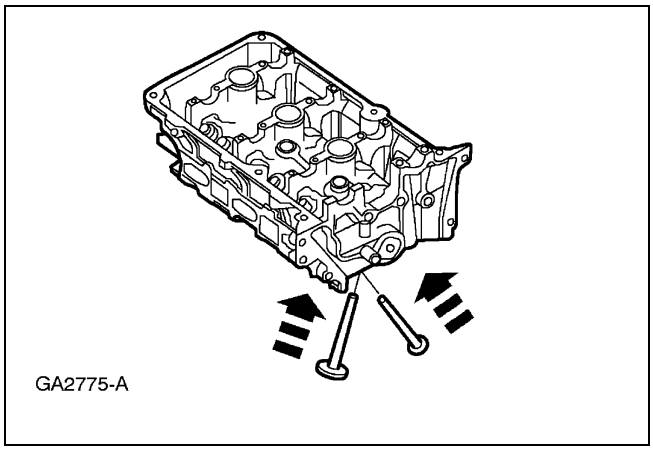
2. Using the special tool, install new valve stem seals.



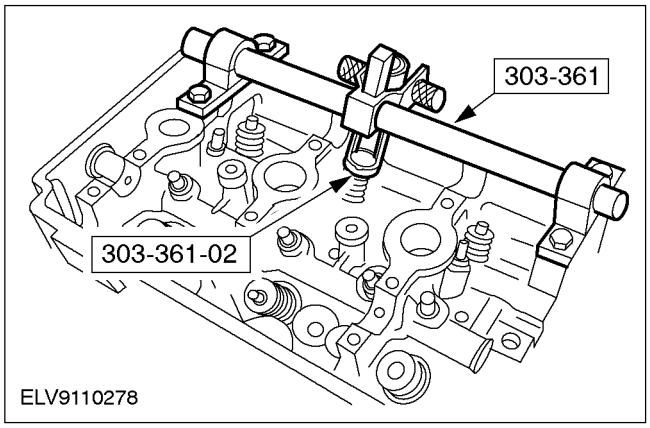
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

3. Install the valves.

- Coat the valve stems and guides with engine oil prior to installation.

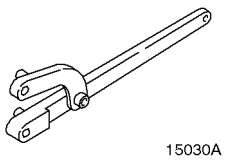
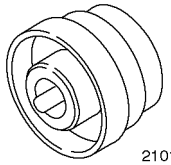
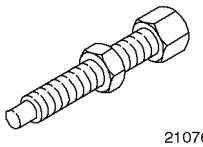
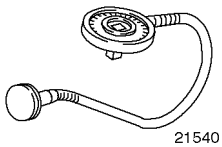
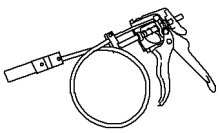
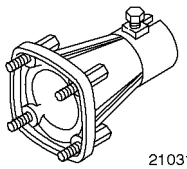
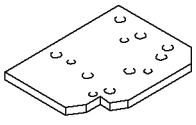
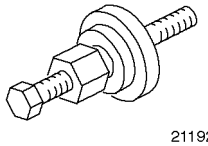


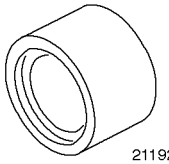
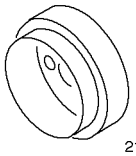
4. Using the special tools, install the valve spring retainers, the valve springs and the valve collets.



ASSEMBLY

Engine (21 134 8)

Special Tool(s)	
 15030A	Flange Holding Wrench, Universal 205-072 (15-030A)
 21017A	Installer/Aligner, Timing Cover Oil Seal 303-055 (21-017A)
 21076	Remover/Installer, Crankshaft Vibration Damper 303-130 (21-076)
 21540	Angle Gauge, Bolt Tightening 303-174 (21-540)
 24003	Remover/Installer, Cooling Hose Clamp 303-397 (24-003)
 21031B	Mounting Bracket for 303-435 303-435-06 (21-031B)
 PZ21146C	Mounting Plate for 303-435-06 303-435-11 (21-146C)
 21192	Installer, Camshaft Pulley 303-458 (21-192)

Special Tool(s)	
 2119201	Adapter for 303-458 303-458-01 (21-192-01)
 21193A	Installer, Crankshaft Rear Oil Seal 303-460 (21-193A)

General Equipment
Suitable strap wrench
Piston ring compressor
Jaw protectors

Name	Specification
Lubricant	ESE-M99B176-A
Lubricant	ESE-M1244-A (Never Sieze)
Sealer	ESE-M99B144-B
Silicone sealer	WSE-M4G323-A6
Engine oil	WSS-M2C913-A
Metal surface cleaner	WSE-M5B392-A

Assembly

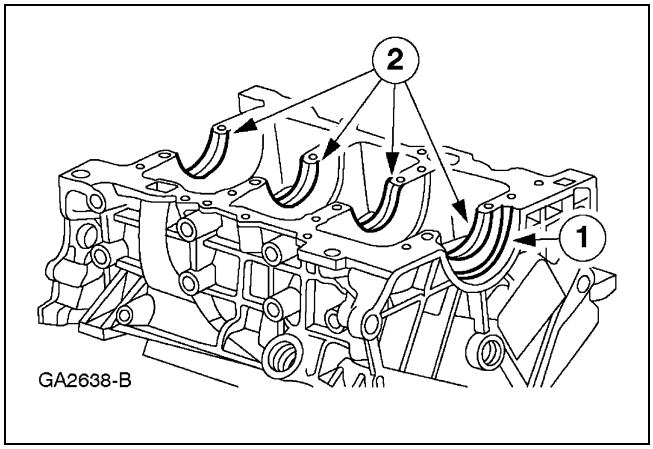
1. **CAUTION: Use only a plastic scraper when removing old gasket material.**

   Clean all the mating faces and reusable parts thoroughly and check for damage.
2. **NOTE:** Never remove pipe plugs or alignment dowels unless they are to be serviced.

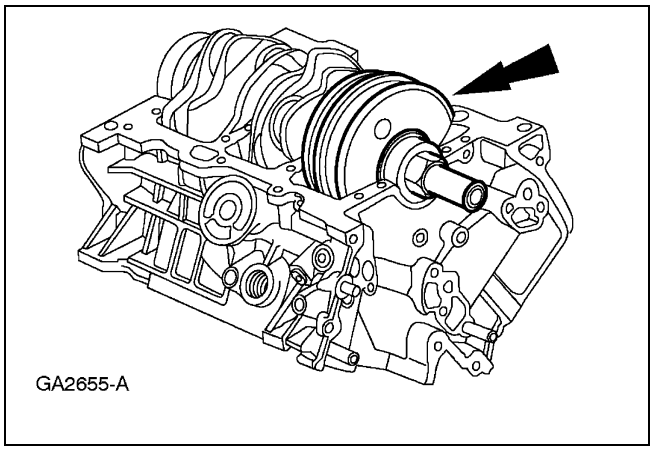
   Reseal oil passage blanking plugs with sealer, as necessary.

ASSEMBLY (Continued)

3. **Select the correct crankshaft main bearing shells.**
   - 11-digit codes are stamped on the rear surface of the cylinder block and on the crankshaft flange to assist in selecting the correct main bearing shells. For additional information, refer to Specifications in this section.
4. **Install the upper crankshaft bearings and thrust washer into the cylinder block.**
   1. Install the upper crankshaft thrust washer.
   2. Install the upper crankshaft main bearing shells.
   - Lubricate the bearing shells and thrust washer with clean engine oil.



5. **Install the crankshaft.**



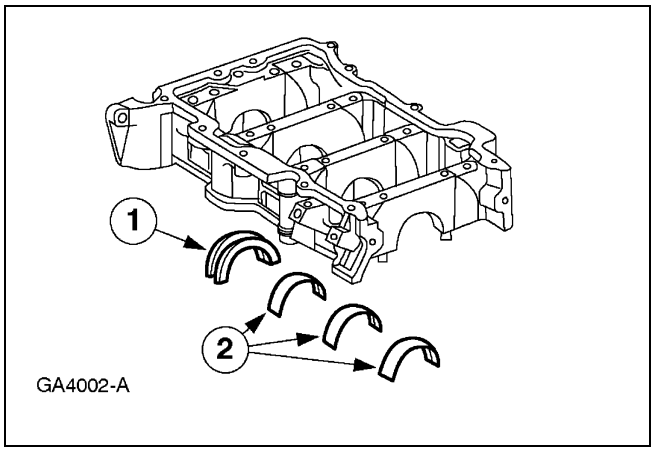
6. **NOTE:** Using a suitable lever or similar tool position the crankshaft rearward before installation of upper thrust bearings.

NOTE: Visually inspect the bearings to verify that the bearing oil holes align with the cylinder block oil feed holes.

NOTE: Align the thrust bearing locating tab to the machined area on cylinder block.

Install the lower crankshaft bearings into the cylinder block.

1. Install the lower crankshaft thrust bearing into the lower cylinder block.
2. Install the lower crankshaft main bearing shells into the lower cylinder block.
   - Lubricate the bearing shells and the thrust washer with clean Engine oil.



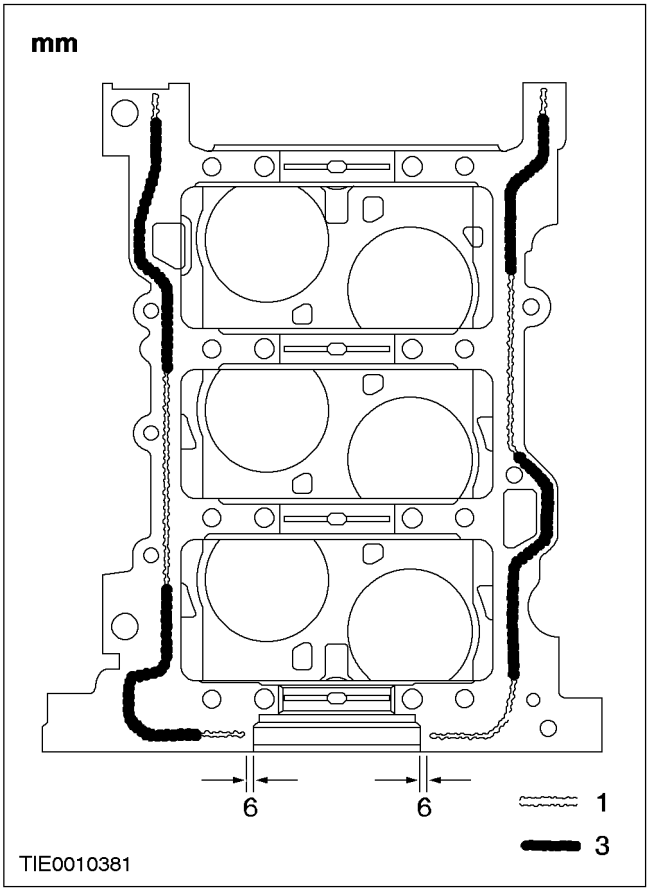
ASSEMBLY (Continued)

7. **NOTE:** Silicone sealer application must stop 6 mm from the rear crankshaft bore on each side.

NOTE: The lower cylinder block should be installed and tightened to specification within six minutes of applying sealer.

Apply a bead of sealer to the cylinder block housing.

- Apply a 3 mm bead to area shown.
- Apply a 1 mm bead to area shown.



8. **CAUTION: Make sure all the dowels are fully seated into the lower cylinder block before tightening the retaining bolts.**

CAUTION: Do not lubricate the lower cylinder block bolts.

CAUTION: Tighten the lower cylinder block bolts in the sequence shown.

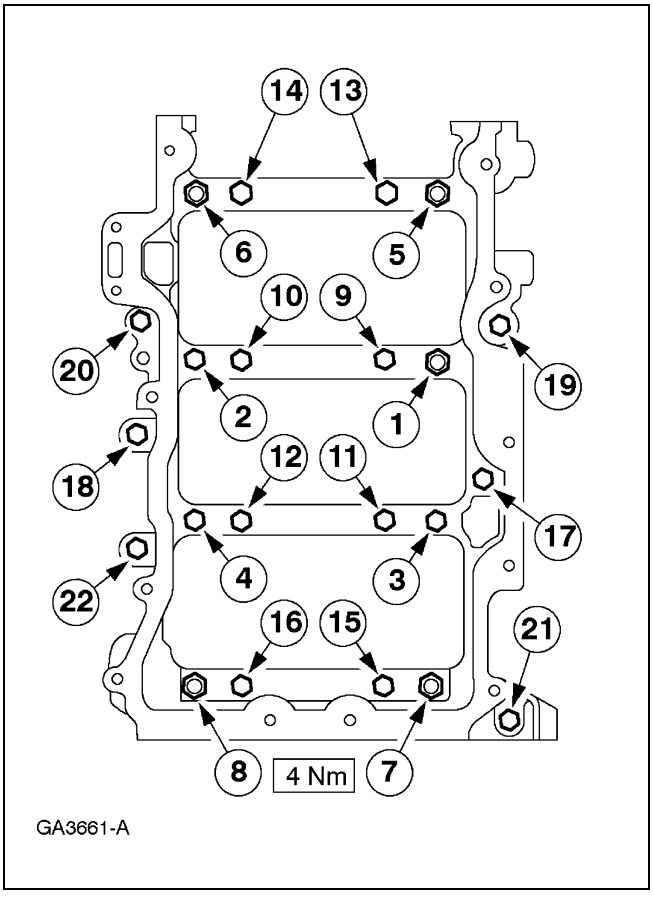
CAUTION: Do not rotate the crankshaft until all retaining bolts are tightened to specification.

NOTE: Before installing the retaining bolts use a lever or similar tool to lightly seat the crankshaft forward.

NOTE: Install new retaining bolts in locations 1-16.

Position the lower cylinder block on the upper cylinder block.

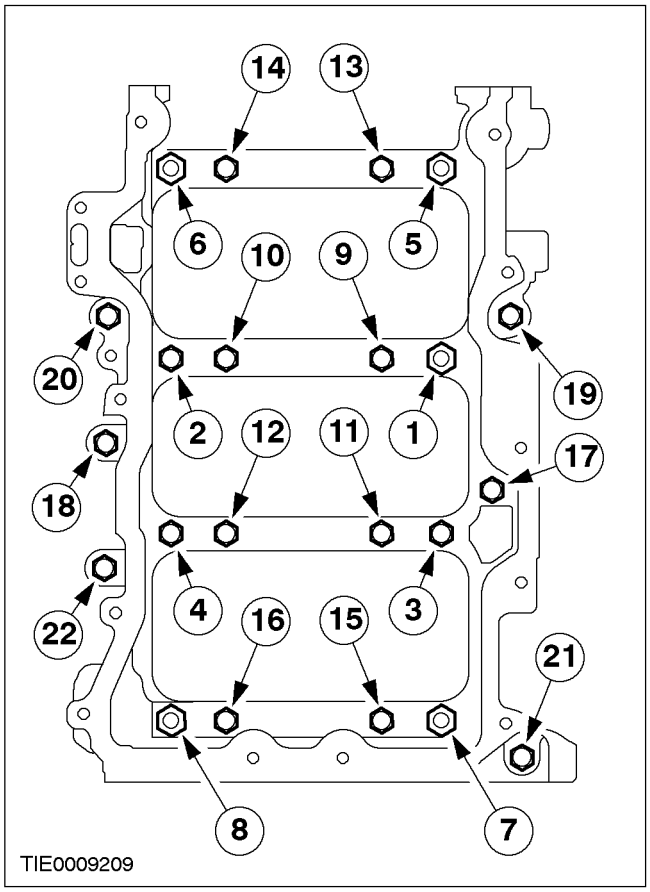
- Gently lever the crankshaft rearward to seat the crankshaft thrust washer.



ASSEMBLY (Continued)

9. **CAUTION: Install new lower cylinder block bolts in locations 1-16.**

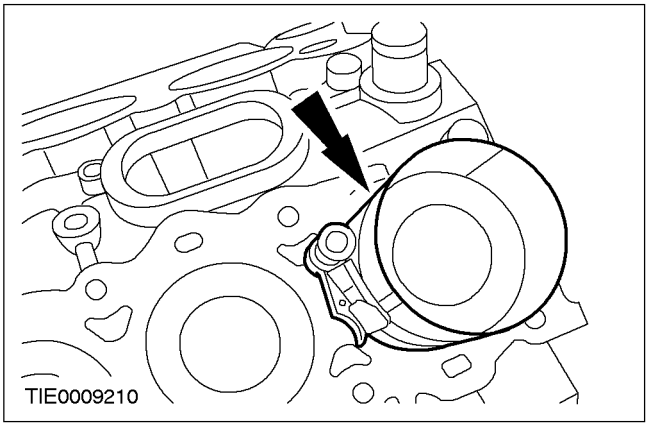
   Install the lower cylinder block bolts.
   - Tighten the lower cylinder block bolts in the sequence shown.
   - Bolts 1-8, 25 Nm
   - Bolts 9-16, 40 Nm
   - Bolts 1-16, 90 degrees
   - Bolts 17-22, 25 Nm
   - Check that the crankshaft rotates freely.



10. **Remove excess sealer which may squeeze out of the front cover sealing surface.**
11. **Rotate the crankshaft until the bearing journal at bottom dead center (BDC).**

12. **CAUTION: Install the pistons with the arrow to front of the engine.**

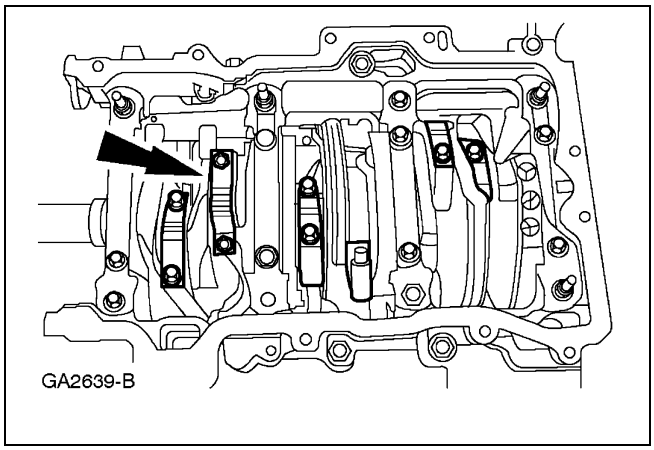
    Using a suitable piston ring compressor, install the pistons.
    - Lubricate the piston and connecting rod bearing with clean engine oil before installation.



13. **CAUTION: Make sure that the bearing location tangs of the connecting rod and bearing cap are on the same side.**

CAUTION: Install new connecting rod retaining bolts.

Install the connecting rod bearing caps.
- Tighten the bolts in three stages:
- Stage 1: 23 Nm
- Stage 2: 43 Nm
- Stage 3: 90 degrees

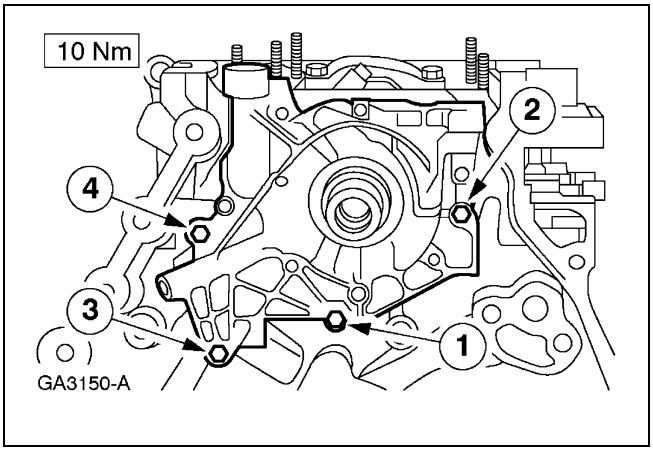


14. **Check the connecting rod side clearance. For additional information, refer to Section 303-00.**
15. **Rotate the crankshaft to make sure the crankshaft and pistons operate freely.**

ASSEMBLY (Continued)

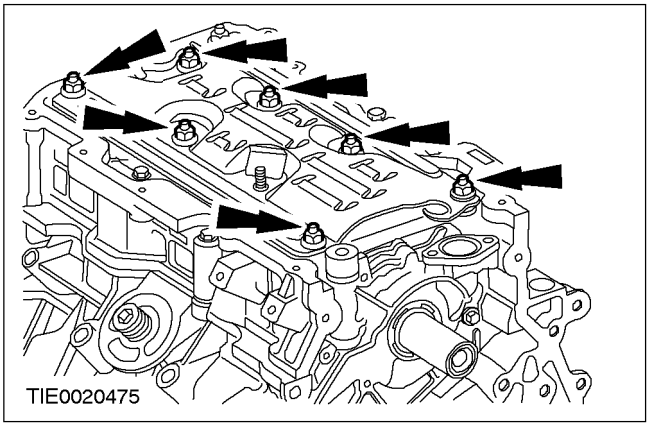
16. Install the oil pump.

- Tighten the bolts in the sequence shown.



17. Install the oil pan baffle.

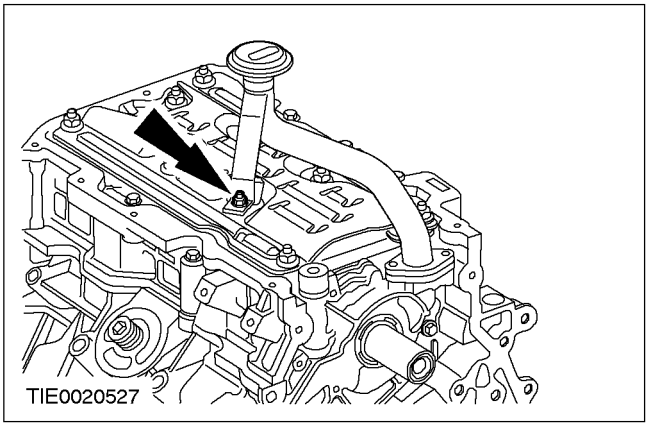
- Tighten the bolts in two stages.
- Stage 1: 5 Nm
- Stage 2: 45 degrees



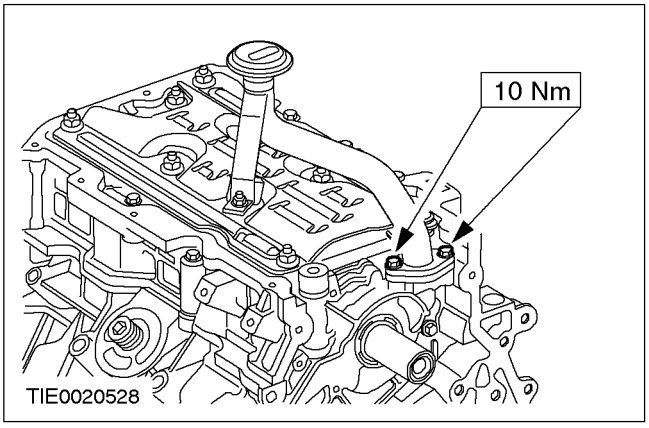
18. NOTE: Apply O-ring lubricant to the O-ring before installation.

Install the oil pick-up pipe retaining nut.

- Tighten the nut in two stages.
- Stage 1: 5 Nm
- Stage 2: 45 degrees

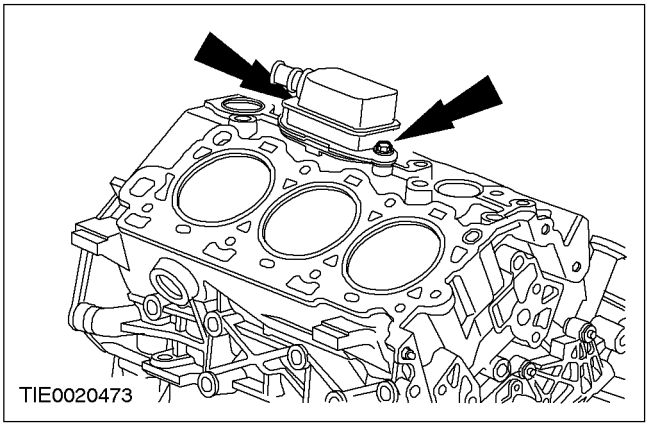


19. Install the oil pick-up pipe retaining bolts.



20. NOTE: Install a new oil separator gasket.

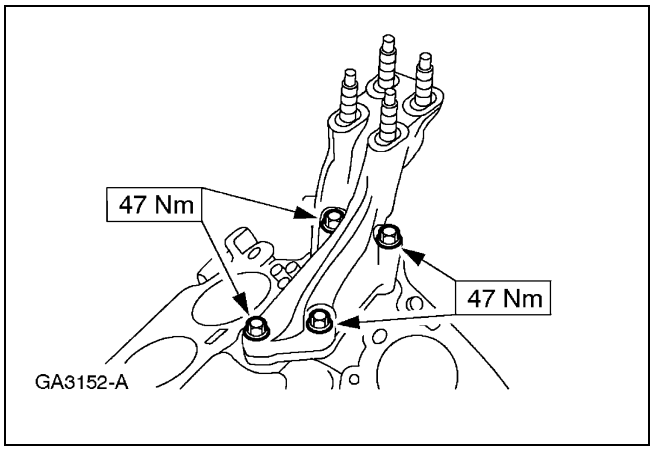
Install the oil separator.



ASSEMBLY (Continued)

21. Install the power steering pump bracket.

- Align the bracket with the locating dowels.



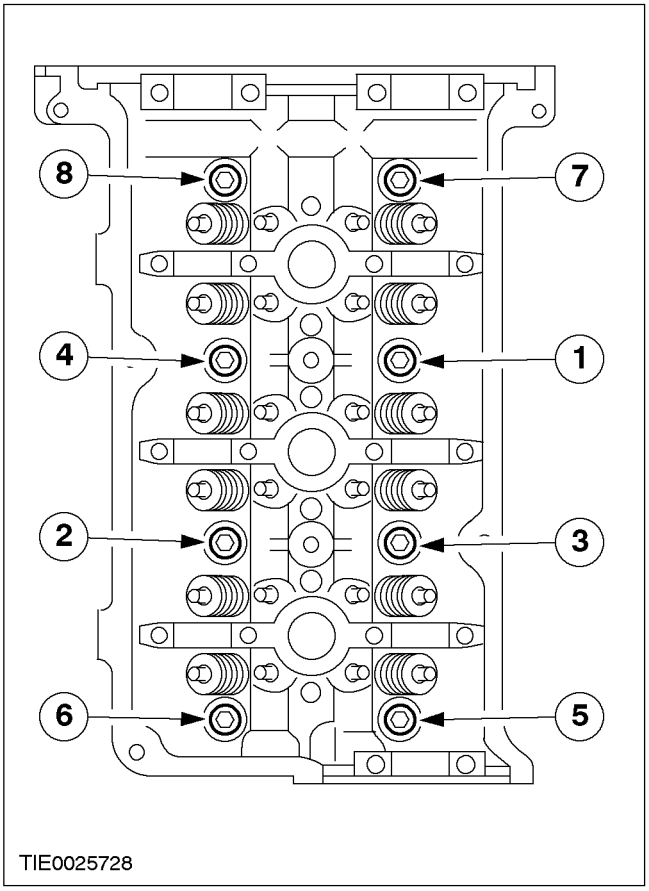
22. NOTE: Install a new cylinder head gasket.

NOTE: Left-hand and right-hand cylinder head gaskets are not interchangeable.

NOTE: Install new cylinder head bolts with washers.

Install the left-hand cylinder head.

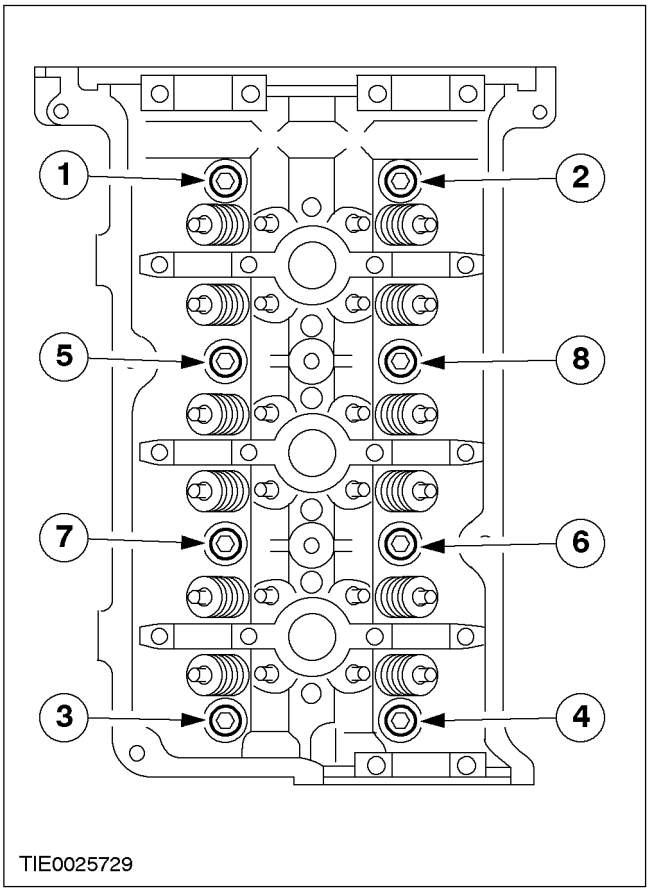
- Align the cylinder head with the locating dowels.
- Tighten the bolts in the sequence shown in two stages.
- Stage 1: 40 Nm
- Stage 2: 90 degrees



ASSEMBLY (Continued)

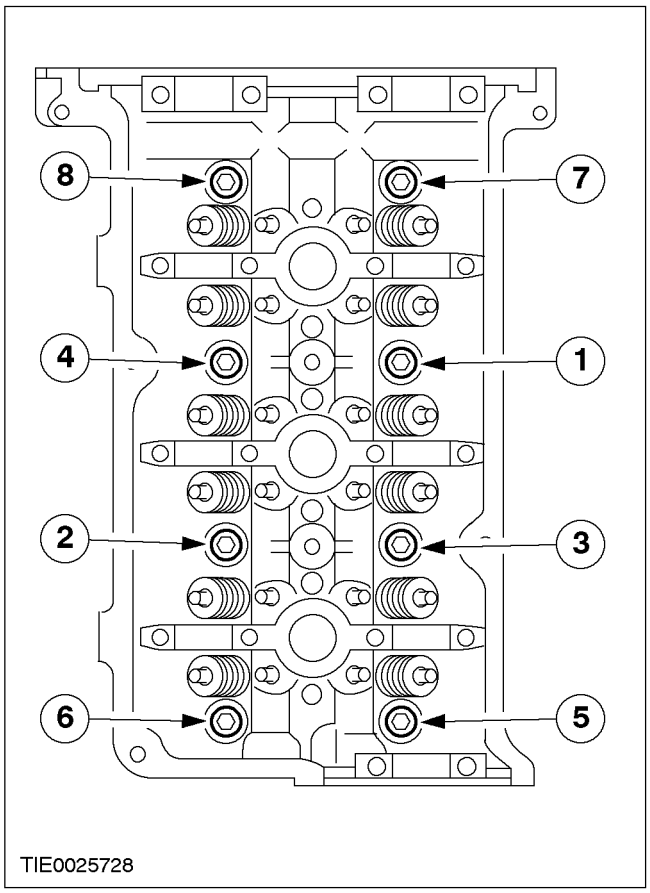
23. Loosen the left-hand cylinder head bolts.

- Loosen the cylinder head bolts in the sequence shown one turn.



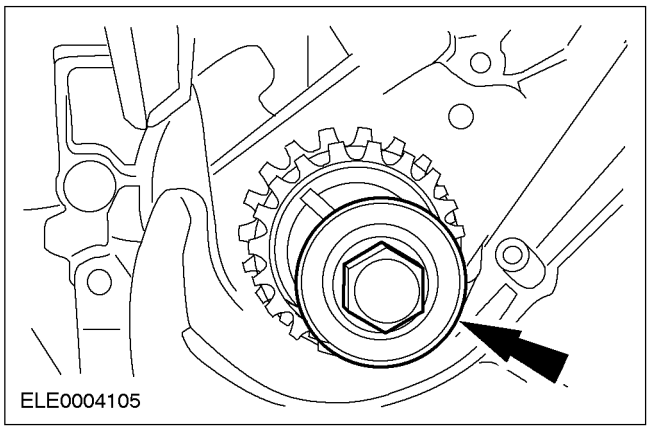
24. Tighten the left-hand cylinder head bolts in the sequence shown in three stages.

- Stage 1: 40 Nm
- Stage 2: 90 degrees
- Stage 3: 90 degrees



25. Check all camshaft specifications. For additional information, refer to Section 303-00.

26. Install the crankshaft pulley washer and retaining bolt.



ASSEMBLY (Continued)

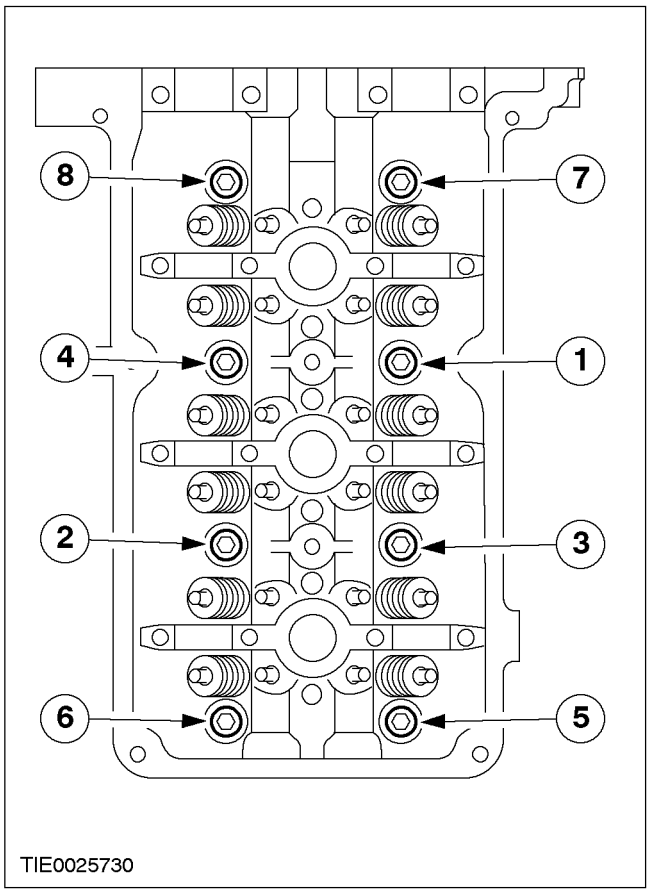
27. NOTE: Install a new cylinder head gasket.

NOTE: Left-hand and right-hand cylinder head gaskets are not interchangeable.

NOTE: Install new cylinder head bolts with washers.

Install the right-hand cylinder head.

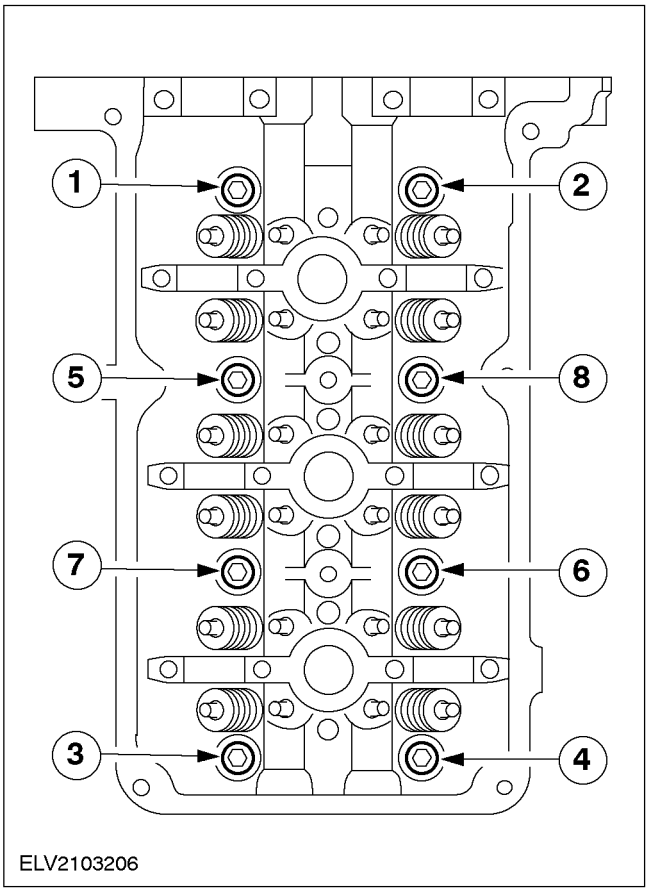
- Align the cylinder head with the locating dowels.
- Tighten the bolts in the sequence shown in two stages.
- Stage 1: 40 Nm
- Stage 2: 90 degrees



TIE0025730

28. Loosen the right-hand cylinder head bolts.

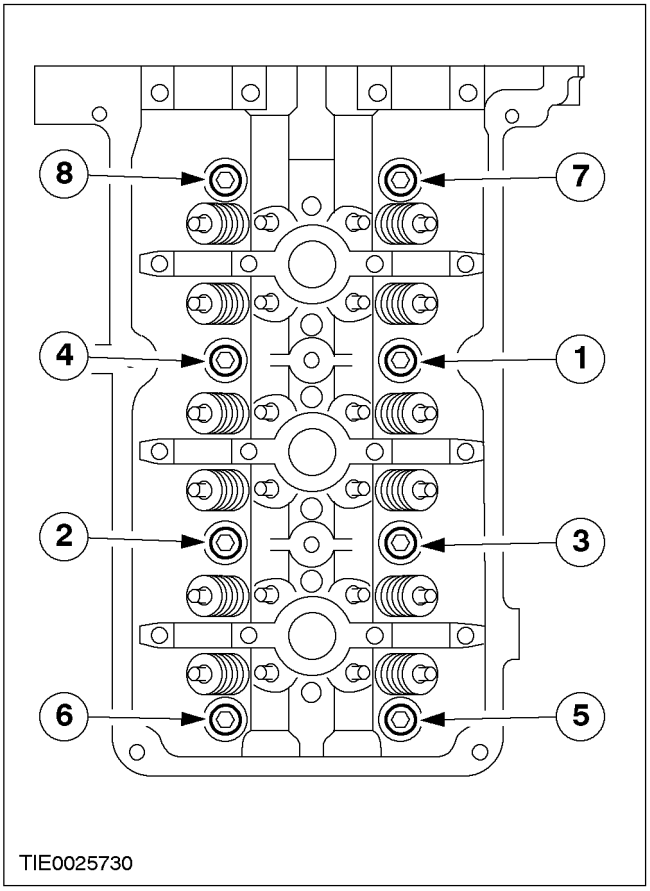
- Loosen the cylinder head bolts in the sequence shown one turn.



ELV2103206

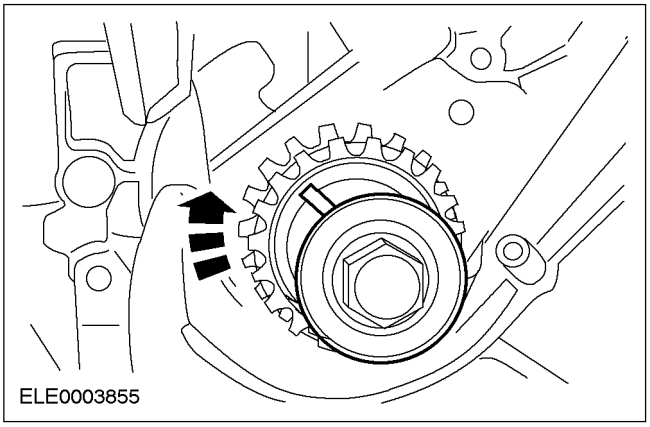
ASSEMBLY (Continued)

29. **Tighten the right-hand cylinder head bolts in the sequence shown in three stages.**
    - Stage 1: 40 Nm
    - Stage 2: 90 degrees
    - Stage 3: 90 degrees

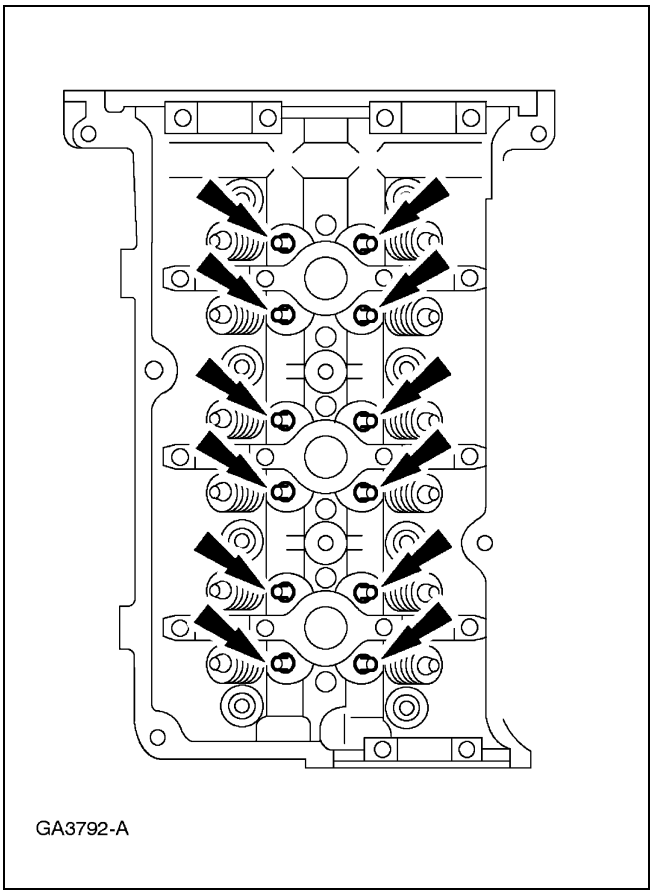


TIE0025730

30. **Rotate the crankshaft until the keyway is in the 11 o'clock position.**


ELE0003855

31. **Install the valve tappets to the left-hand cylinder head.**
    - Lubricate the valve tappets with clean engine oil before installation.


GA3792-A

ASSEMBLY (Continued)

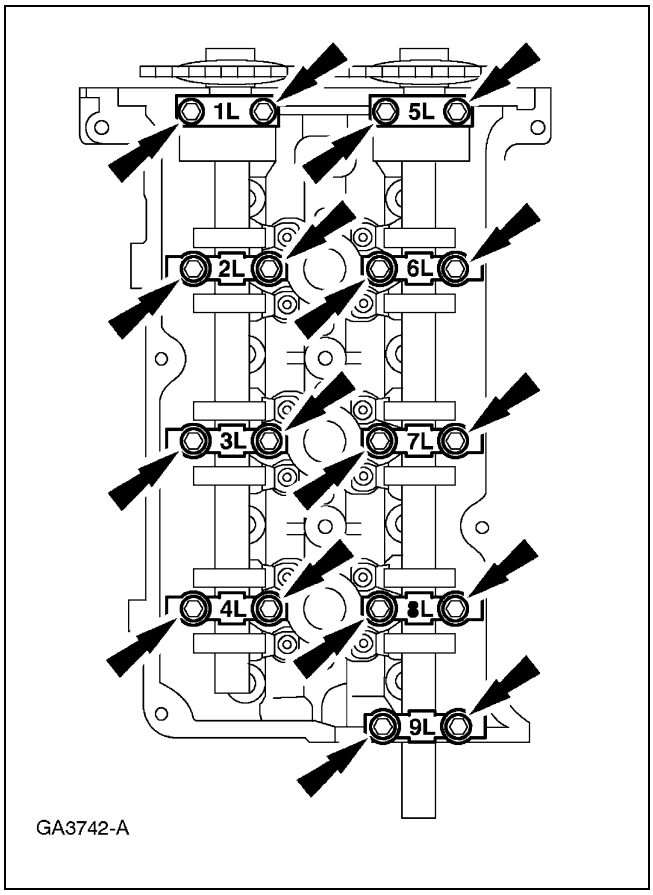
32. Install the left-hand camshafts.

- Lubricate the camshafts with clean engine oil.

33. ⚠ CAUTION: Do not install thrust caps 1L and 5L at this time, or damage to the thrust caps may occur.

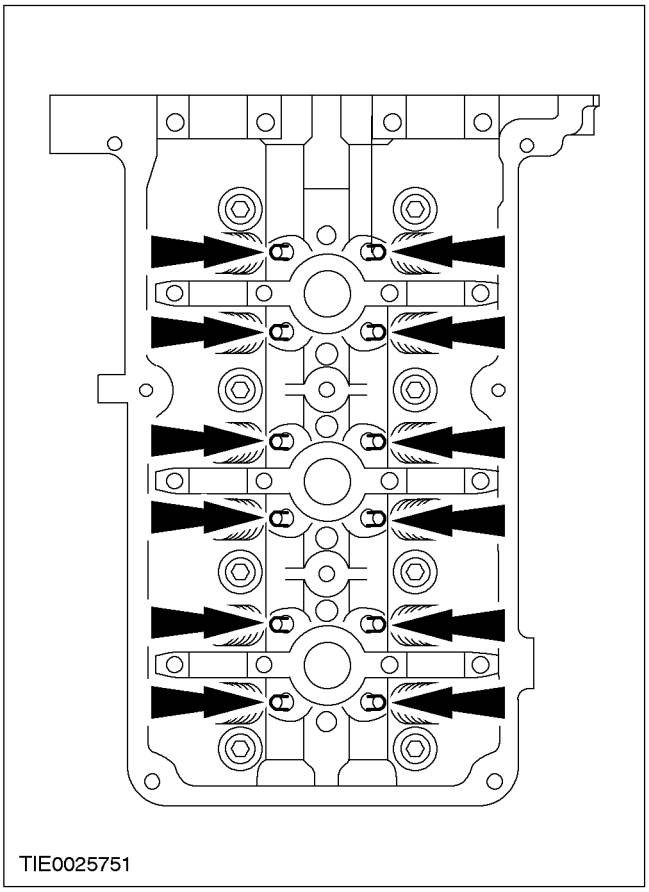
NOTE: Do not tighten the camshaft cap retaining bolts at this stage.

Install the left-hand camshaft caps in their original positions.



34. Install the valve tappets to the right-hand cylinder head.

- Lubricate the valve tappets with clean engine oil before installation.



ASSEMBLY (Continued)

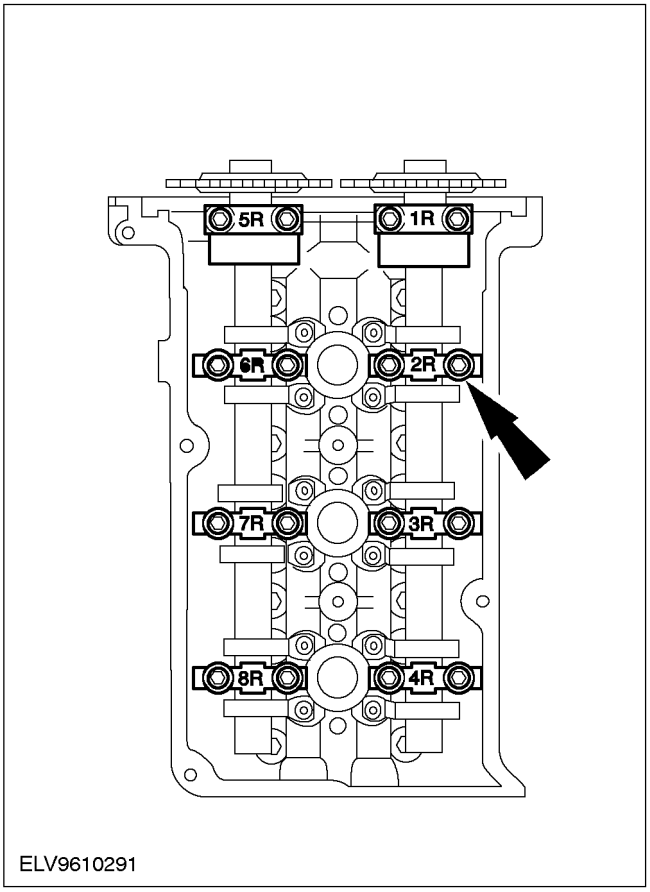
35. Install the right-hand camshafts.

- Lubricate the camshafts with clean engine oil before installation.

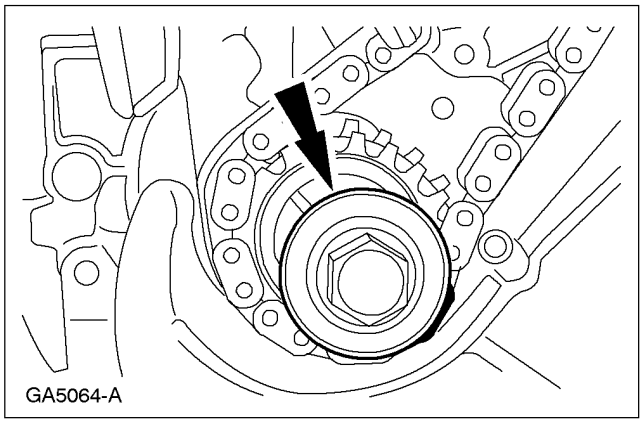
36. CAUTION: Do not install thrust caps 5R and 1R at this time or damage to the thrust caps may result.

NOTE: Do not tighten the camshaft cap retaining bolts of this stage.

Install the right-hand camshaft caps in their original positions.



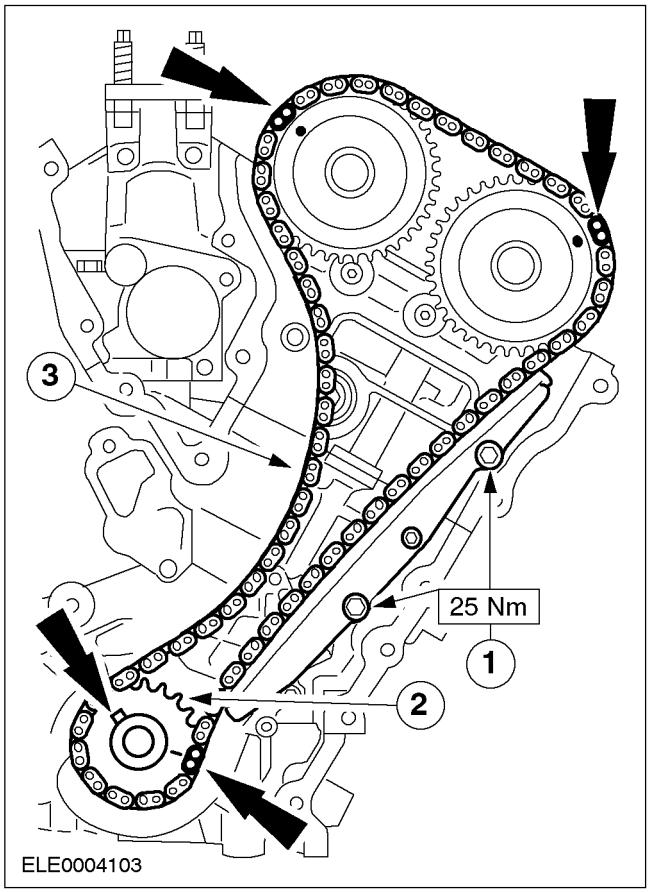
37. Remove the crankshaft pulley retaining bolt and washer.



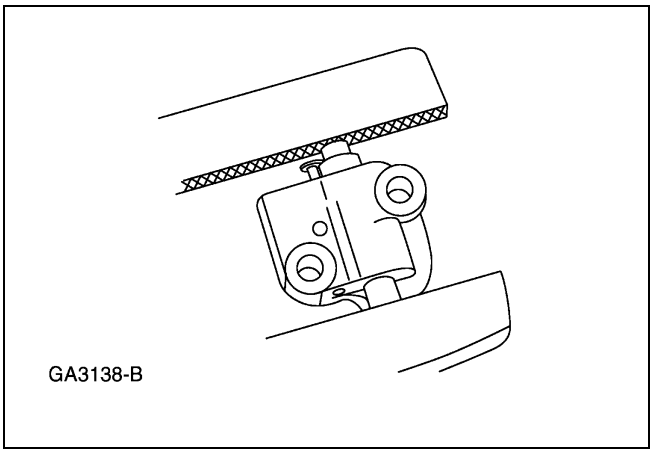
38. NOTE: The colored links of the timing chain and the marks on the timing sprockets must be aligned.

Install the left-hand timing chain.

1. Install the left-hand timing chain guide.
2. Install the crankshaft sprockets.
3. Install the timing chain.



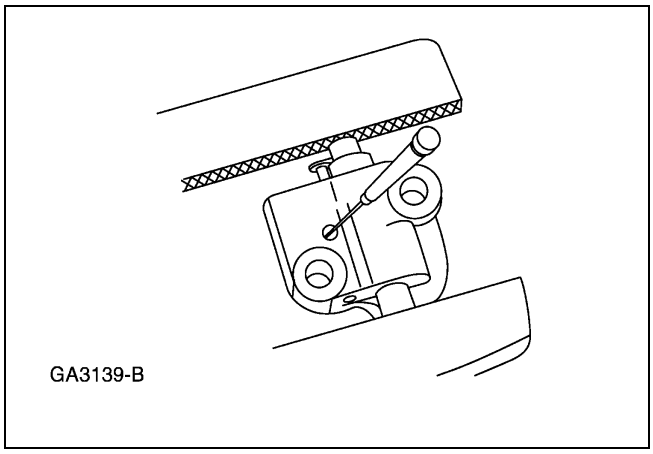
39. Using suitable jaw protector, loosely grip the left-hand timing chain tensioner in a vise.



ASSEMBLY (Continued)

40. **⚠ CAUTION: During tensioner compression, do not release the ratchet stem until the tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.**

    Install a suitable pin.

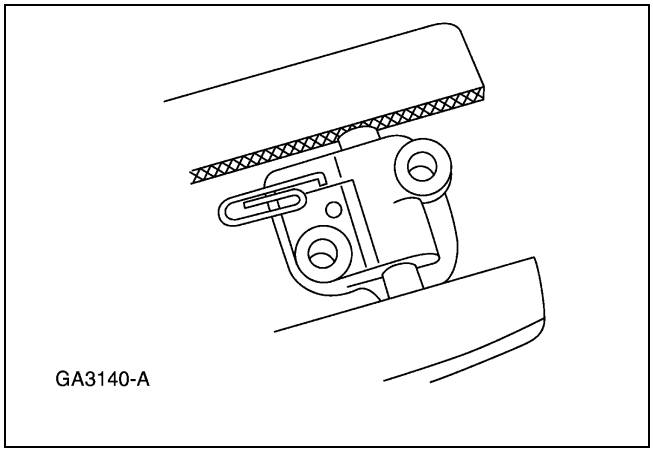


41. **NOTE:** The piston should retract with minimal force. If binding occurs, reposition the tensioner to eliminate side loading.

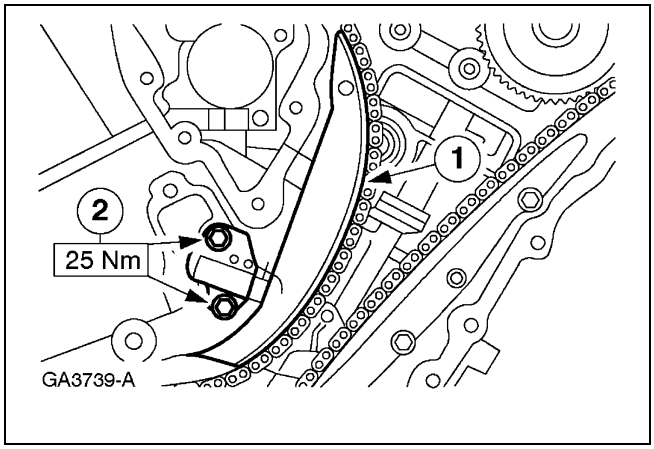
    Slowly compress the left-hand timing chain tensioner, by tightening the vise.

42. **NOTE:** The retaining wire must remain in the timing chain tensioner until the tensioner is installed into the engine with the piston bottomed in the bore.

    Retain piston with a 1.5 mm diameter wire or paper clip.



43. **Install the left-hand timing chain tensioner.**
    1. Install the left-hand timing chain tensioner arm.
    2. Install the left-hand timing chain tensioner adapter plate, the timing chain tensioner and retaining bolts.

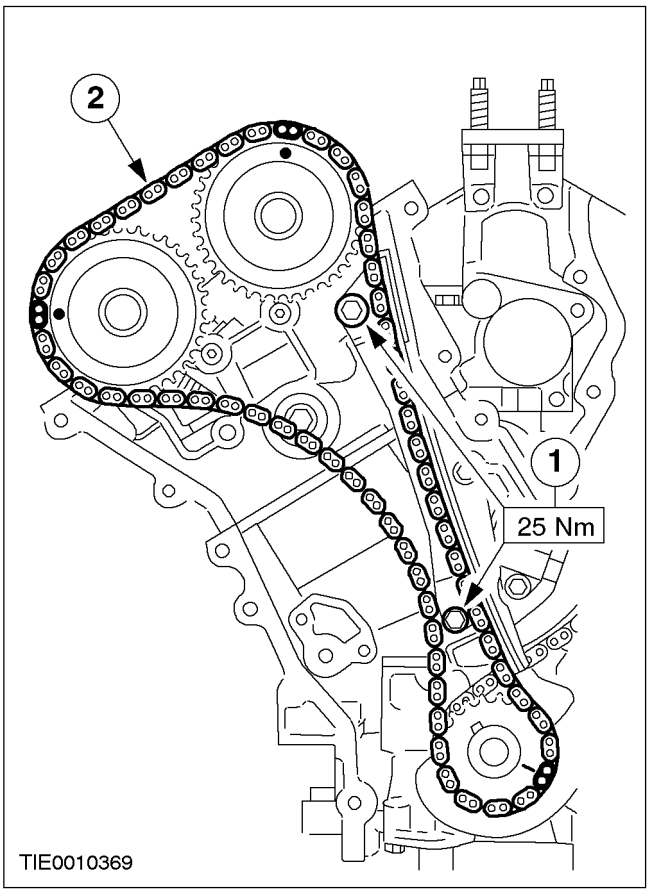


ASSEMBLY (Continued)

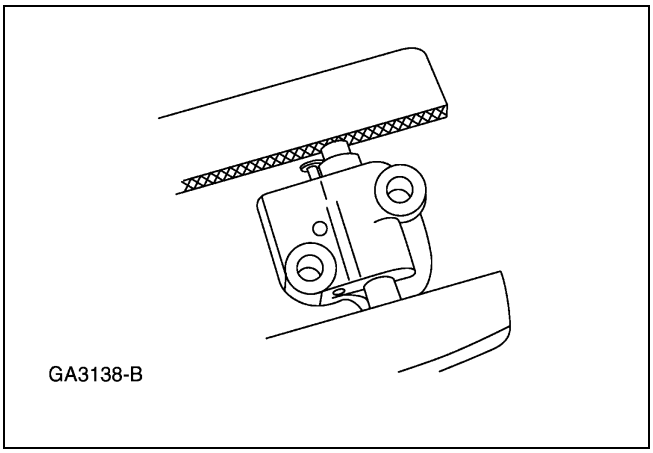
44. NOTE: The colored links of the timing chain and the marks on the sprocket must be aligned.

Install the right-hand timing chain.

1. Install the right-hand timing chain guide.
2. Install the timing chain.

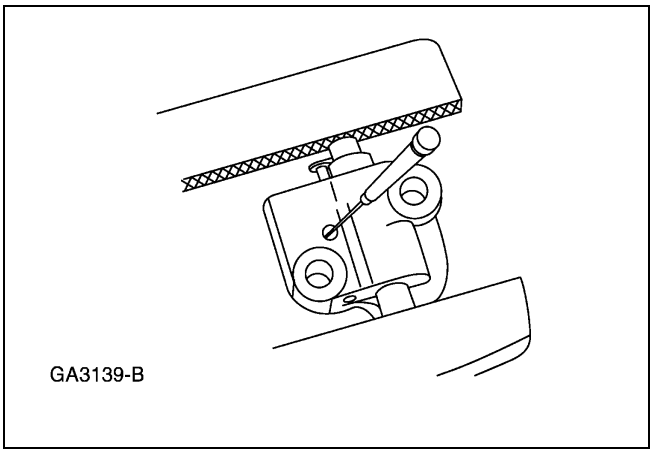


45. Using a suitable jaw protector, loosely grip the right-hand timing chain tensioner in a vise.



46. ⚠ CAUTION: During tensioner compression, do not release the ratchet stem until the tensioner piston is fully bottomed in its bore, or damage to the ratchet stem will result.

Install a suitable pin.

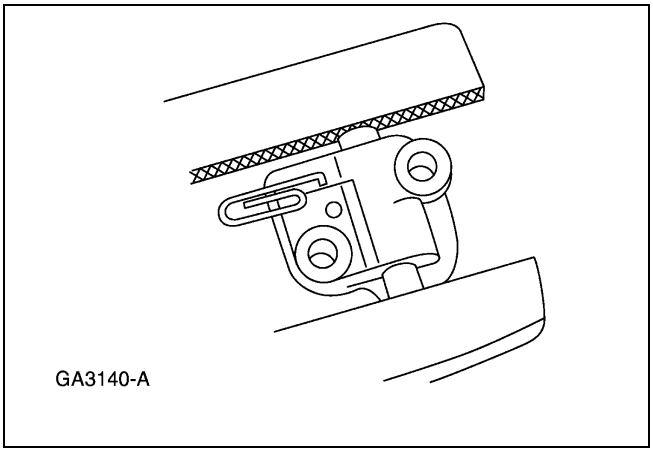


47. NOTE: The piston should retract with minimal force. If binding occurs, reposition the tensioner to eliminate side loading.

Slowly compress the right-hand timing chain tensioner, by tightening the vise.

48. NOTE: The retaining wire must remain in the timing chain tensioner until the tensioner is installed into the engine with the piston bottomed in the bore.

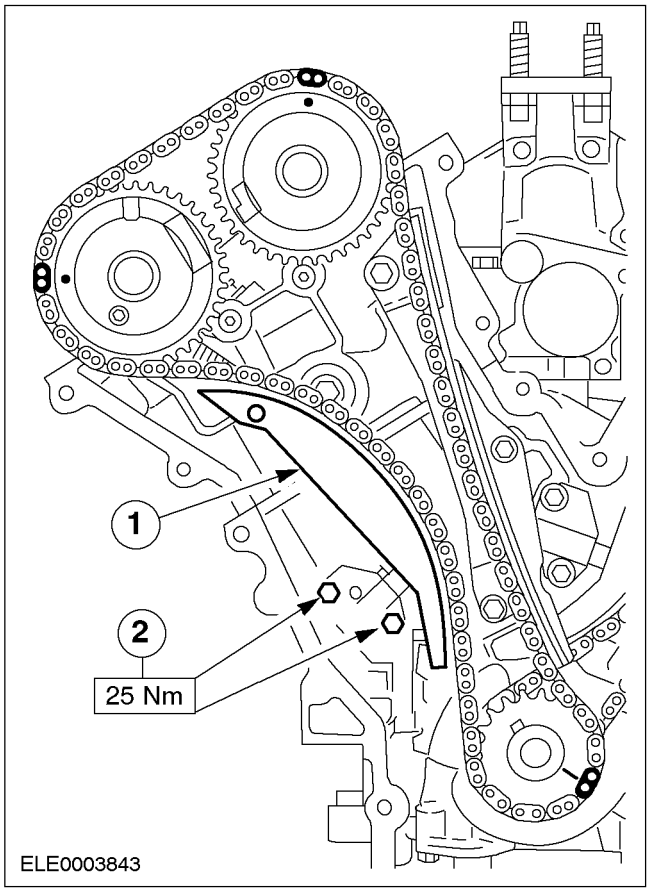
Retain piston with a 1.5 mm diameter wire or paper clip.



ASSEMBLY (Continued)

49. Install the right-hand timing chain tensioner.

1. Install the timing chain tensioner arm.
2. Install the right-hand timing chain tensioner adapter plate, the timing chain tensioner and retaining bolts.

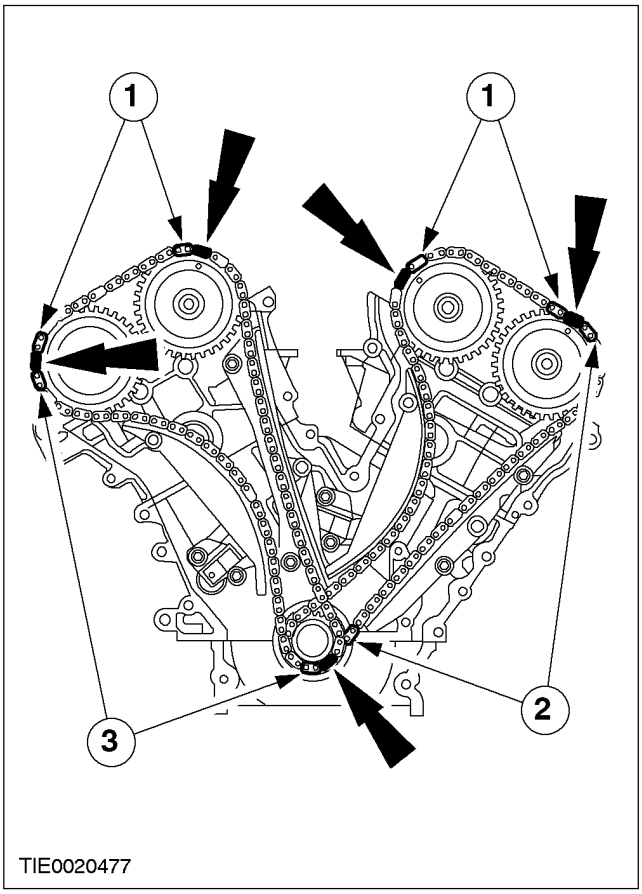


50. NOTE: Ignore the timing flags on the rear of the camshaft sprockets.

NOTE: Check the number of timing chain links between the camshaft front timing marks and the timing marks on the crankshaft sprockets.

Check the camshaft timing.

1. 10 links.
2. 23 links.
3. 25 links.



ASSEMBLY (Continued)

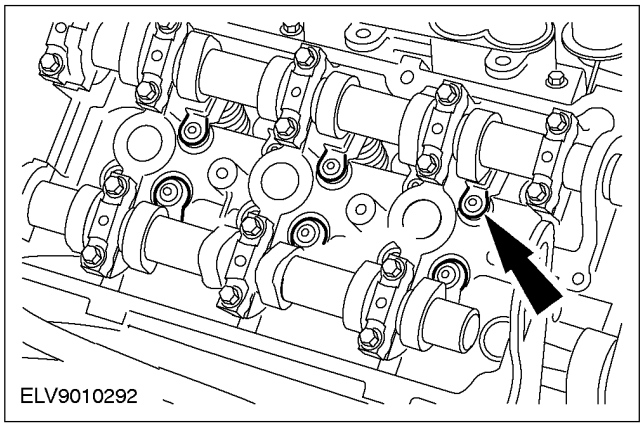
51. **CAUTION: The crankshaft keyway must be in the 11 o'clock position before installation of the left-hand cylinder head cam followers.**

NOTE: Check that all the timing marks and reference flags are in the correct position before installing the cam followers.

NOTE: The cam followers must be installed in their original positions.

Install the left-hand cylinder head cam followers.

- Lubricate the cam followers with clean engine oil before installation.

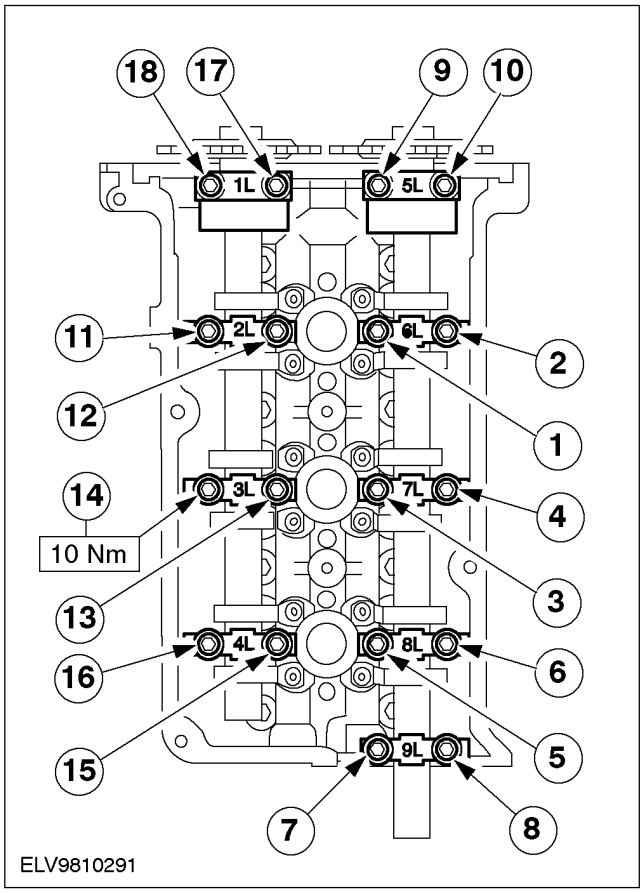


52. **CAUTION: Do not install the left-hand cylinder head camshaft journal thrust caps until the camshaft journal caps are installed or damage to the thrust caps may occur.**

NOTE: With left-hand cylinder head cam followers installed, align camshaft end play using thrust caps as a guide before tightening the journal caps.

Tighten the left-hand camshaft bearing cap retaining bolts.

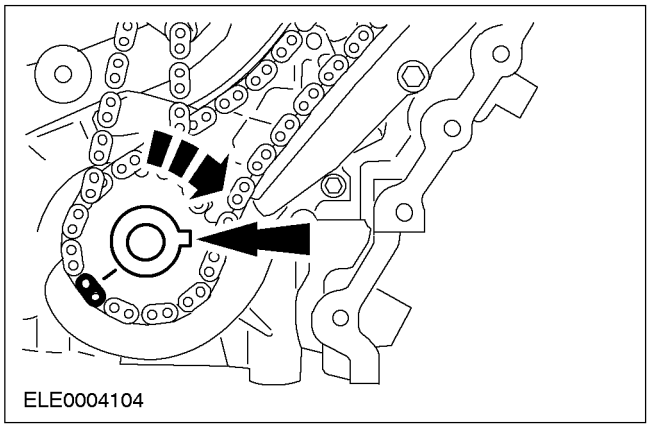
- Tighten the bolts in the sequence shown in several stages.



ASSEMBLY (Continued)

53. **CAUTION: Only turn the engine in the normal direction of rotation.**

Rotate the crankshaft until the keyway is in the 3 o'clock position.

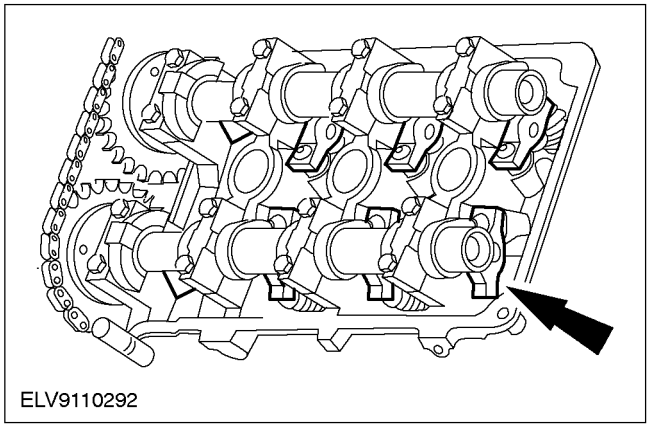


54. **CAUTION: The crankshaft keyway must be in the 3 o'clock position before installation of the right-hand cylinder head cam followers. Failure to do so may lead to engine damage.**

NOTE: The cam followers must be installed in their original locations.

Install the right-hand cylinder head cam followers.

- Lubricate the cam followers with clean engine oil before installation.

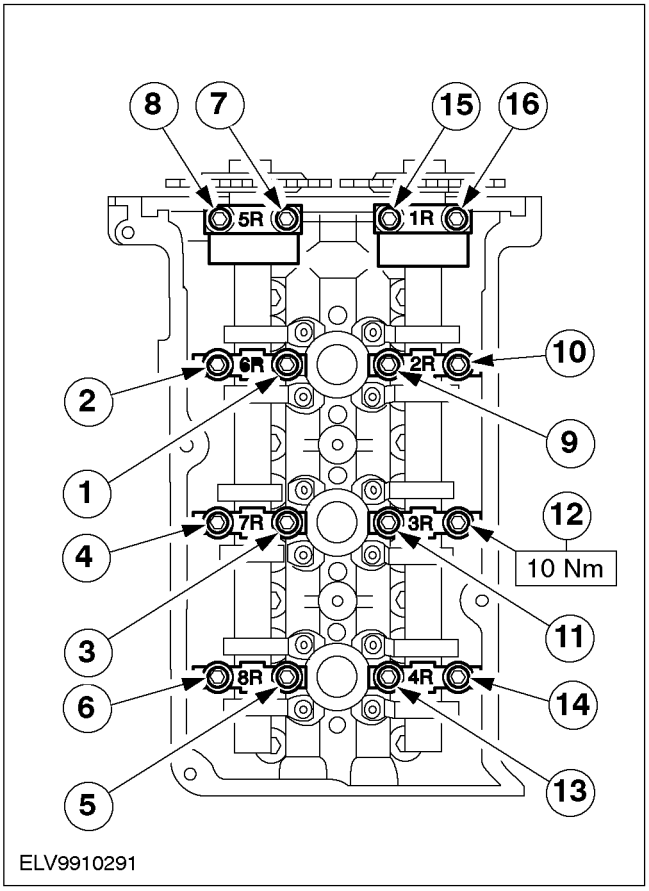


55. **CAUTION: Do not install the right-hand cylinder head camshaft journal thrust caps until the camshaft journal caps are installed, or damage to the thrust caps may occur.**

NOTE: With right-hand cylinder head cam followers installed, align camshaft end play using the thrust caps as a guide before tightening journal caps.

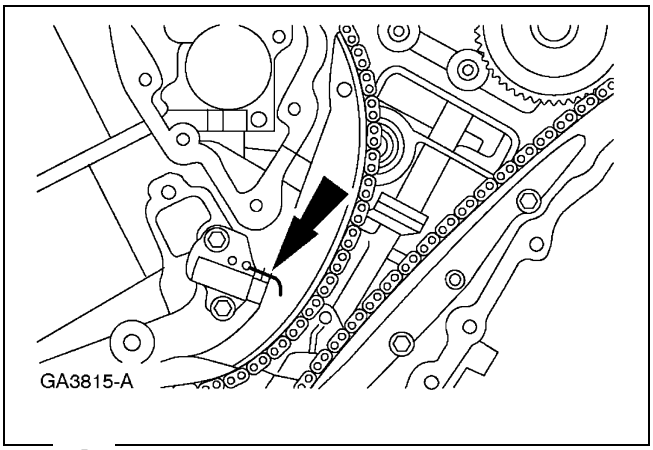
Tighten the right-hand camshaft bearing cap retaining bolts.

- Tighten the bolts in the sequence shown in several stages.



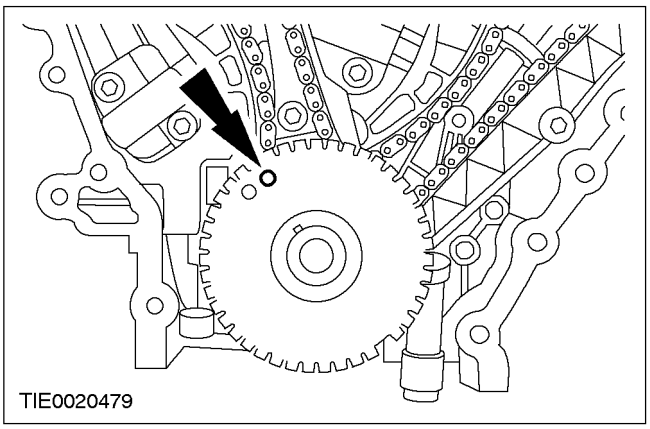
ASSEMBLY (Continued)

56. Remove the iming chain tensioner retaining wires on both sides.



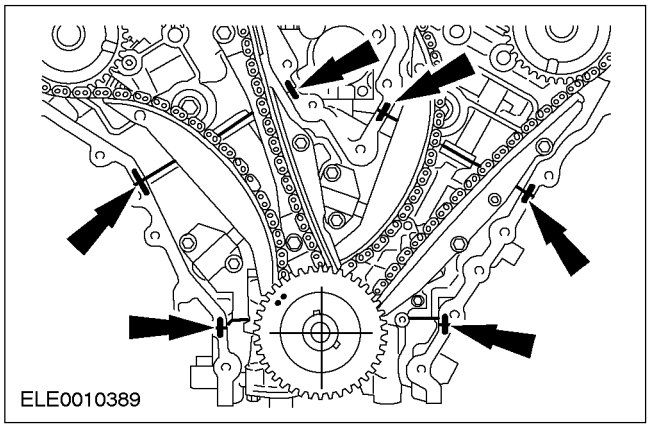
57. ⚠ CAUTION: The pulse wheel has two keyway slots and is used in several different engines.

Install the pulse wheel in the keyway slot stamped 25, color coded blue.



58. NOTE: Install the engine front cover within six minutes of applying the sealer.

Apply a 6 mm dot of sealer to the mating faces in the positions shown.

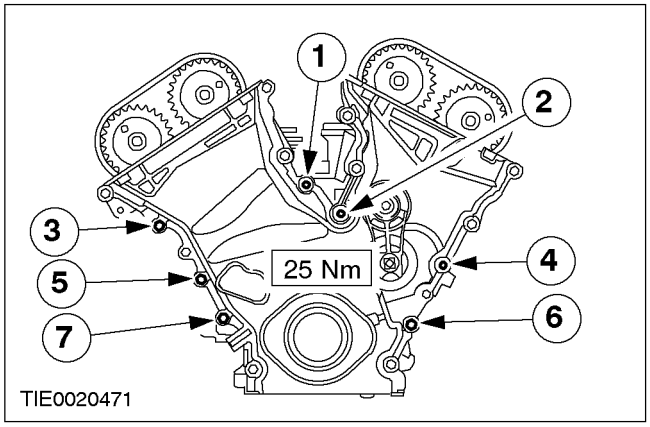


59. ⚠ CAUTION: The engine front cover must be installed in two stages.

NOTE: Install new engine front cover gaskets.

Install the engine front cover.

- Note locating dowels and the locations of the studs.
- Install the engine front cover retaining bolts and studs in the sequence shown.
- Tighten the retaining bolts and studs one-quarter turn after engine front cover contacts cylinder block and cylinder heads.

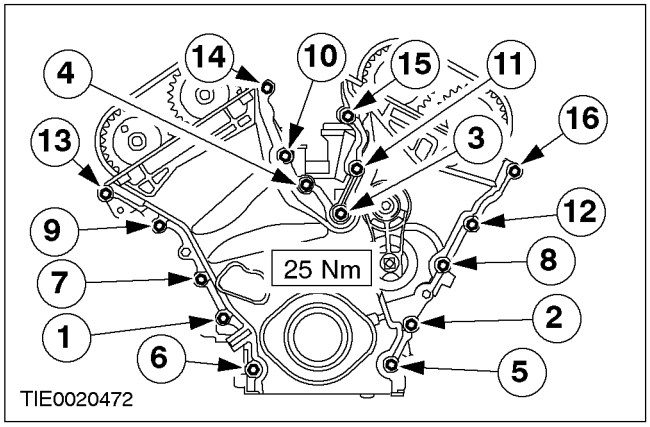


ASSEMBLY (Continued)

60. NOTE: 3, 4, 8, 10, 11, 14, 15,16 are stud locations.

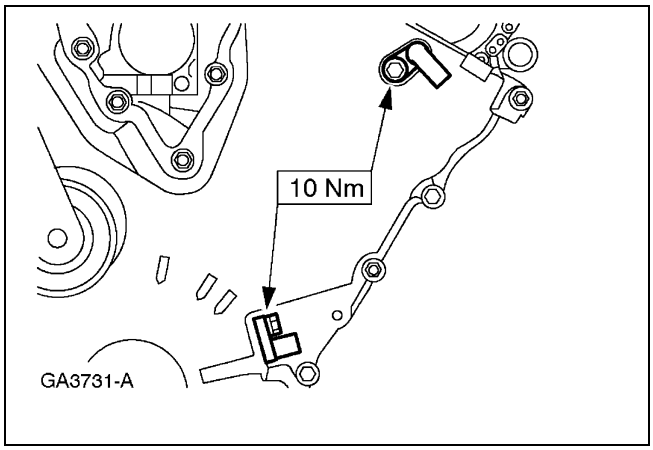
Install the remaining engine front cover retaining bolts and studs.

- Tighten the bolts and studs in the sequence shown.



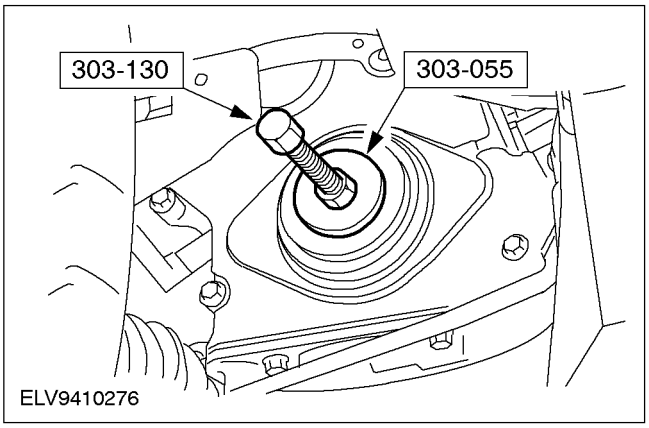
61. Install the crankshaft position sensor (CKP), the camshaft position sensor (CMP) and wiring brackets.

- Lubricate the O-ring with sealer before installation.



62. Using the special tools, install the crankshaft front oil seal.

- Lubricate the outer ring with clean engine oil before installation.

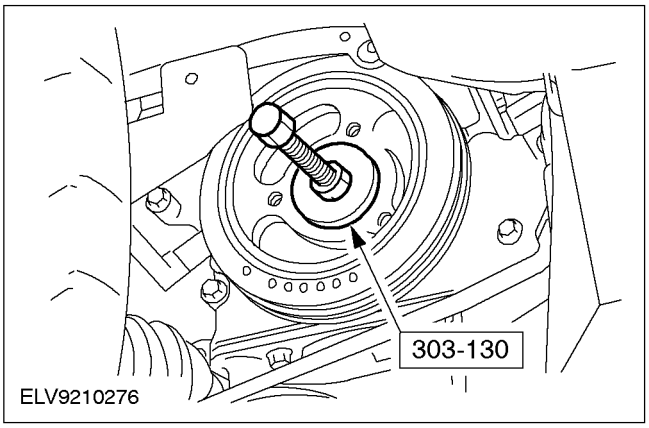


63. Apply sealer to the front of the crankshaft on the inside diameter surface of the crankshaft pulley at the keyway.

- Before applying the sealer, clean the sealing surfaces with metal surface cleaner to remove all residues.

64. NOTE: Use the crankshaft pulley retaining bolt washer for installation.

Using the special tool, install the crankshaft pulley.

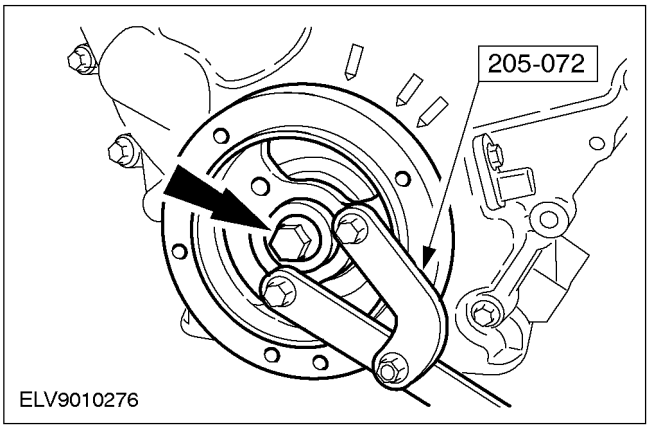


ASSEMBLY (Continued)

65. **⚠ CAUTION: Install a new crankshaft pulley retaining bolt.**

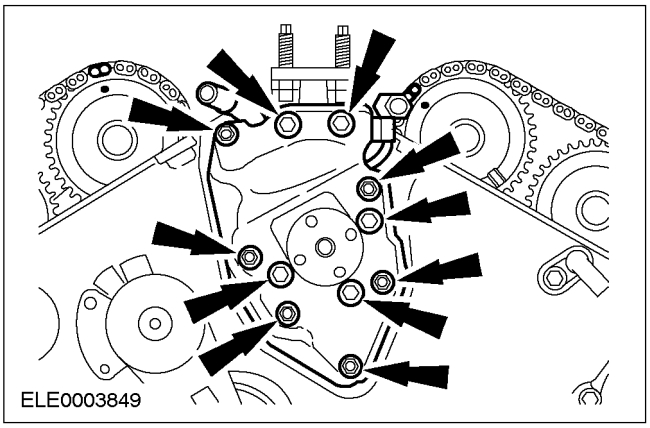
    Using the special tool, install the crankshaft pulley.

    - Tighten the bolt in four stages.
    - Stage 1: 120 Nm
    - Stage 2: Loosen one turn
    - Stage 3: 50 Nm
    - Stage 4: 90 degrees



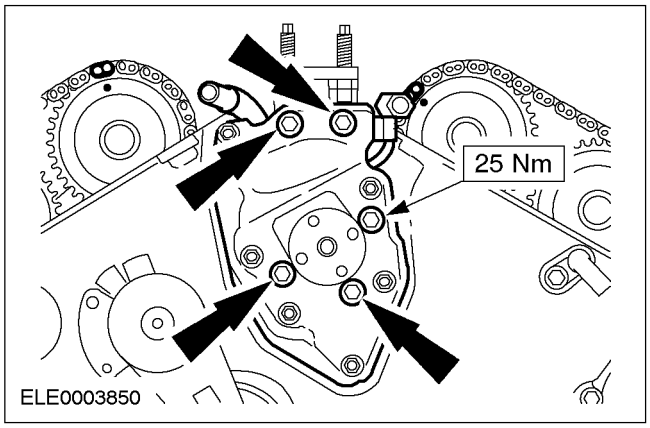
66. **NOTE:** Do not tighten the power steering pump bracket retaining bolts and studs at this stage.

    Install the power steering pump and bracket.

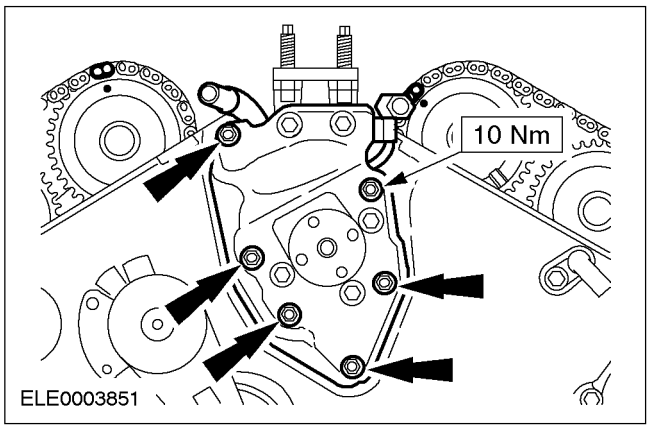


67. **NOTE:** The longer 84 mm retaining bolts should be tightened first.

    Tighten the 84 mm power steering pump retaining bolts.

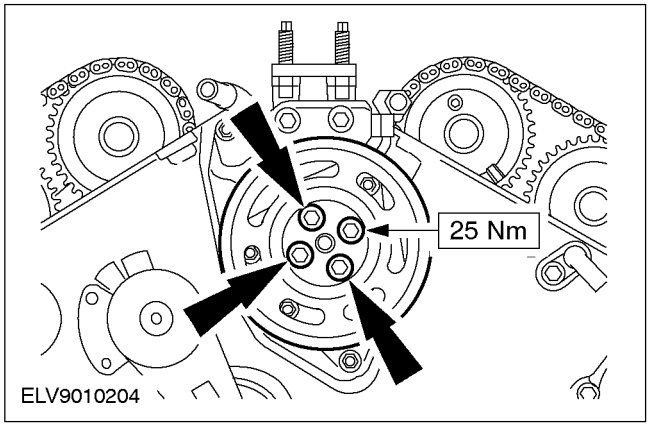


68. **Tighten the power steering pump retaining nuts.**



69. **NOTE:** The dimple on the pulley must face toward the front of the engine.

    Install the power steering pump belt pulley.

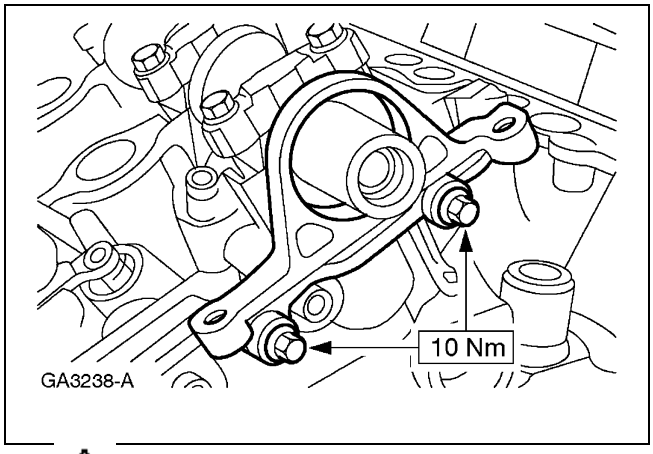


ASSEMBLY (Continued)

70. **NOTE:** Install a new gasket.

Install the camshaft oil seal retainer.

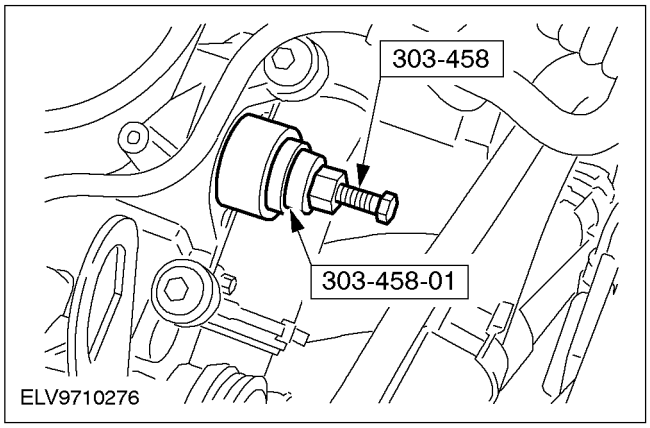
- Align the retainer on the locating dowels and tighten the retaining bolts.



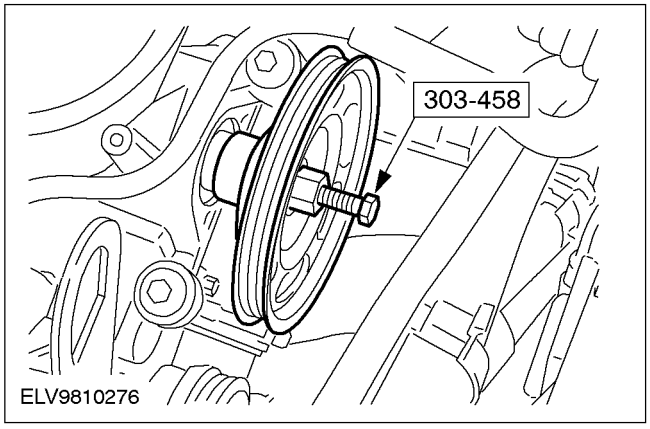
71. ⚠ **CAUTION: The running surface of the camshaft must not be damaged.**

Using the special tools, install the camshaft oil seal.

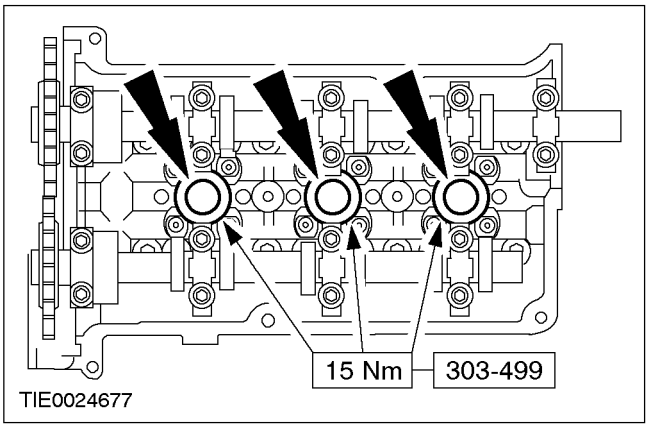
- Lubricate the camshaft oil seal with clean engine oil before installation.



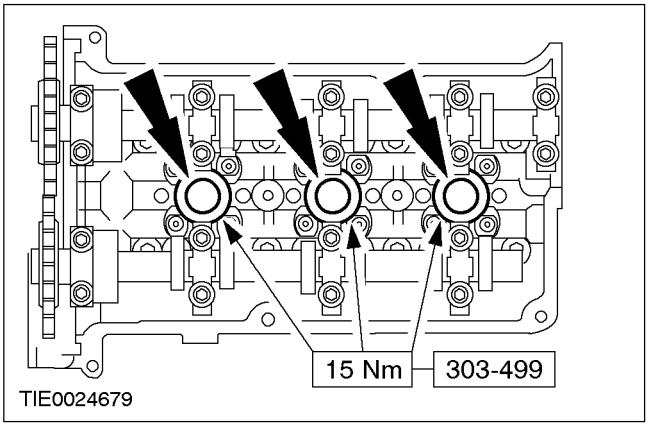
72. **Using the special tool, install the water pump drive pulley.**



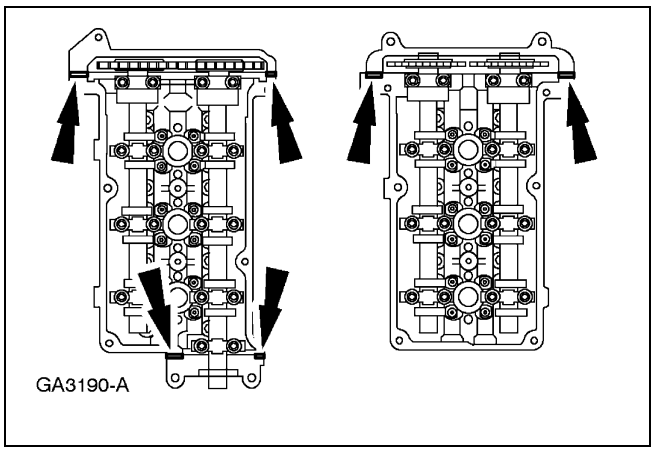
73. **Using the special tool, install the left-hand spark plugs.**



74. **Using the special tool, install the right-hand spark plugs.**



75. **Apply silicone sealer to the mating faces of the cylinder heads.**

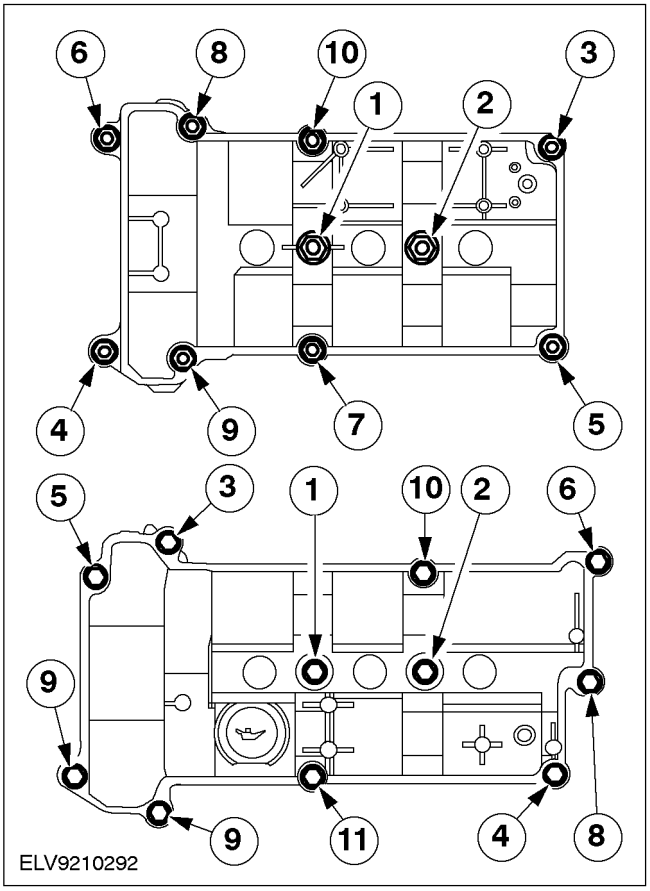


ASSEMBLY (Continued)

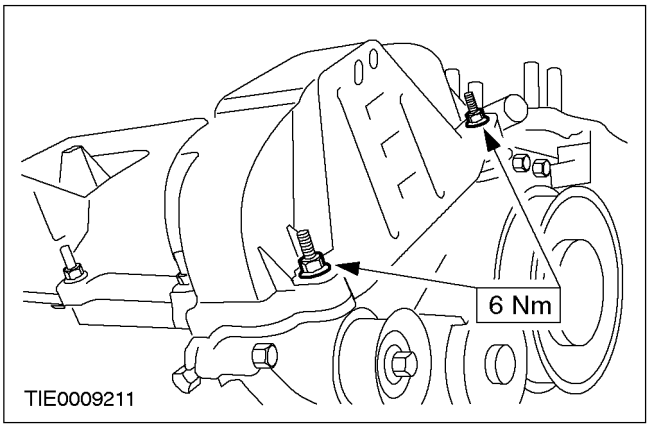
76. NOTE: Install new gaskets.

Install the valve covers.

- Tighten the valve cover retaining bolts in the sequence shown.

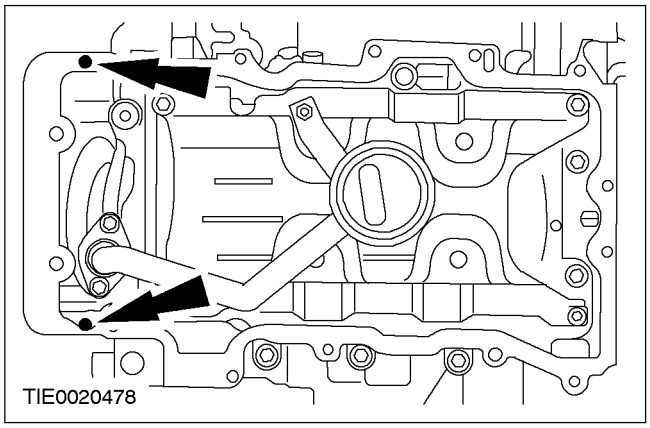


77. Install the wiring harness in-line electrical connector retaining bracket to the valve cover.



78. NOTE: Install the oil pan within six minutes of applying the sealer.

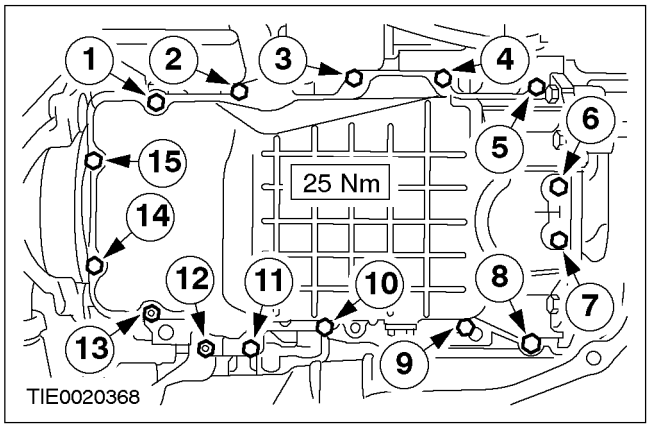
Apply a 10 mm bead of sealer onto the cylinder block at the indicated areas.



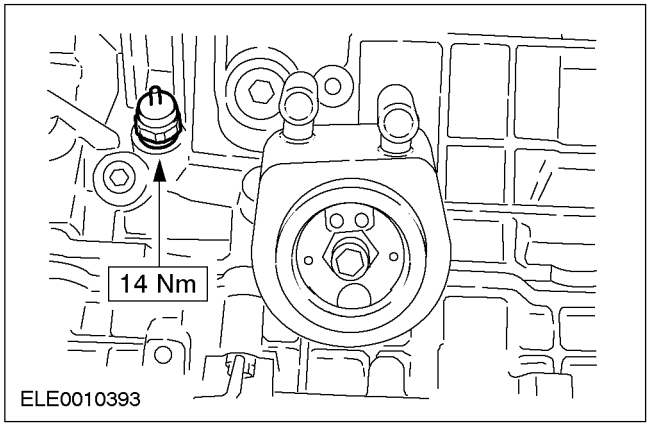
79. NOTE: Note the locations of the studs.

Install the oil pan.

- Tighten the bolts in the sequence shown.



80. Install the oil pressure switch (high output engine shown).



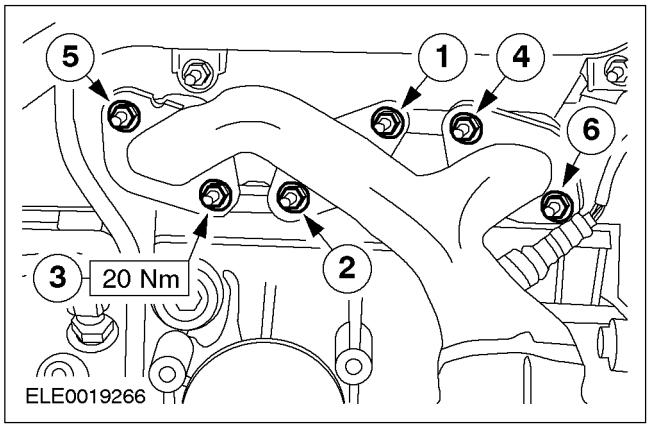
ASSEMBLY (Continued)

81. NOTE: If studs were removed, install short end of studs into the cylinder head.

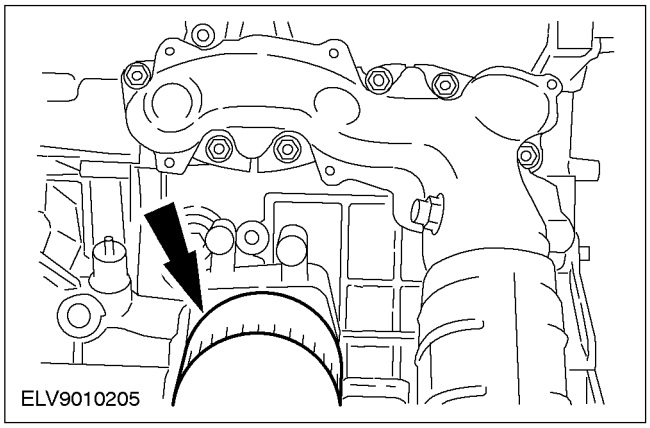
NOTE: Install a new gasket and retaining nuts.

Install the left-hand exhaust manifold.

- Tighten the nuts in the sequence shown.



82. Install a new oil filter.

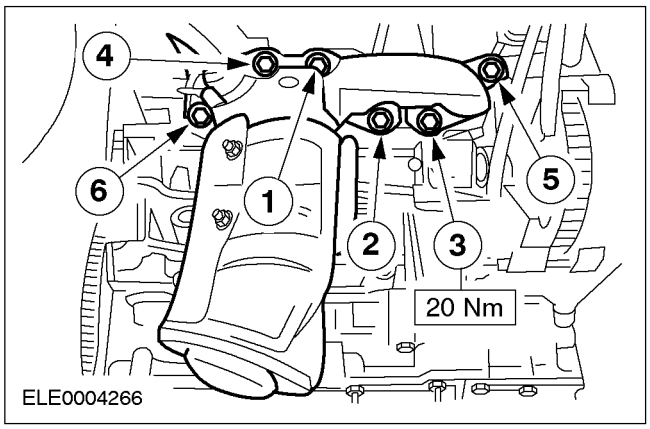


83. NOTE: If studs were removed, install short end of studs into the cylinder head.

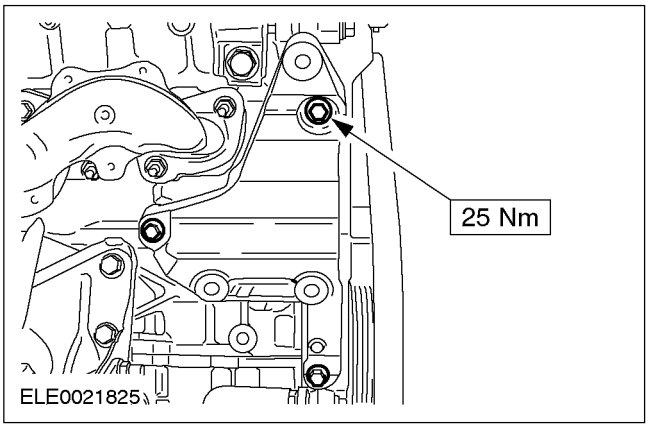
NOTE: Install a new gasket and retaining nuts.

Install the right-hand exhaust manifold.

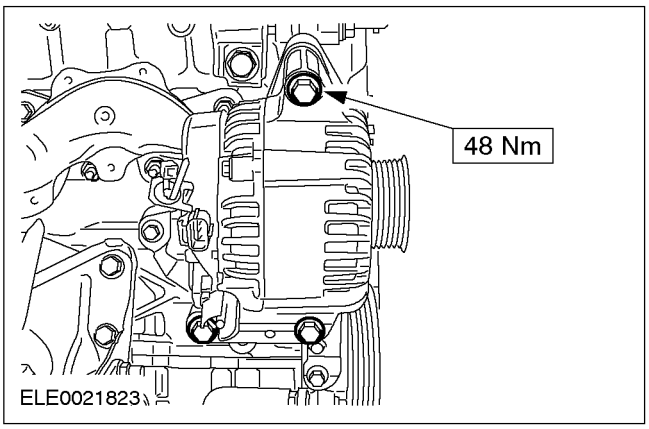
- Tighten the nuts in the sequence shown.



84. Install the generator mounting bracket.



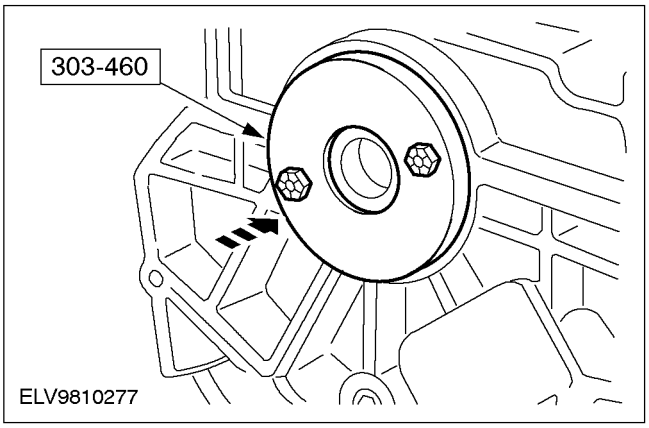
85. Install the generator.



86. ⚠ CAUTION: Tighten the bolts in several stages to correctly seat the crankshaft rear oil seal until it is flush with the cylinder block.

Using the special tool, install the crankshaft rear oil seal.

- Lubricate the outer ring with clean engine oil before installation.



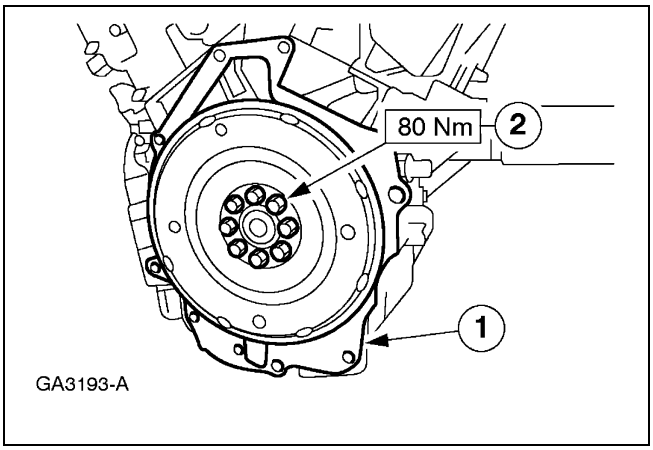
ASSEMBLY (Continued)

87. **NOTE:** Use a suitable strap wrench to hold the crankshaft pulley.

Install the flywheel.

1. Install the adapter plate.
2. Install the flywheel.

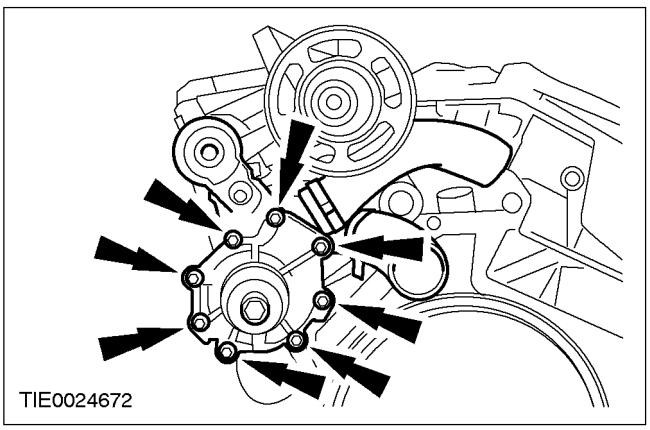
- Tighten the bolts in the sequence shown.



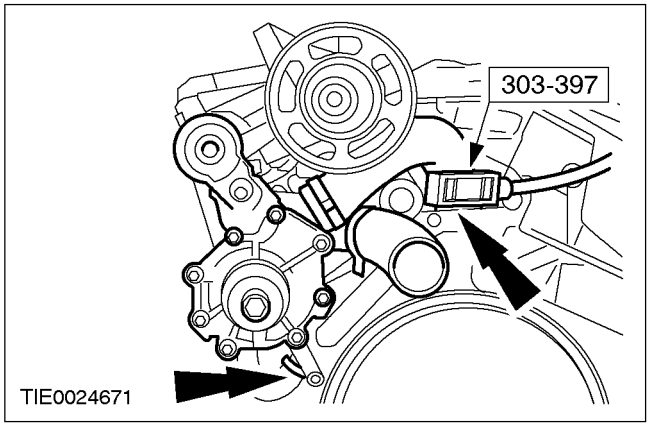
88. **NOTE:** Install a new gasket.

Install the water pump.

- Tighten the bolts in two stages.
- Stage 1: 10 Nm
- Stage 2: 90 degrees



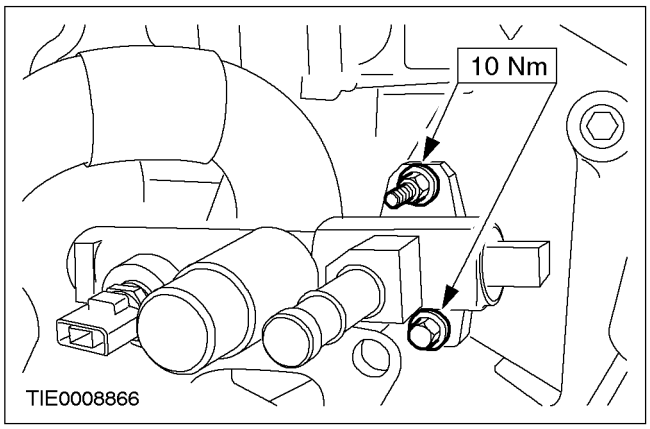
89. **Using the special tool, connect the water pump coolant hoses to the water pump.**



90. **NOTE:** Install new O-ring seals.

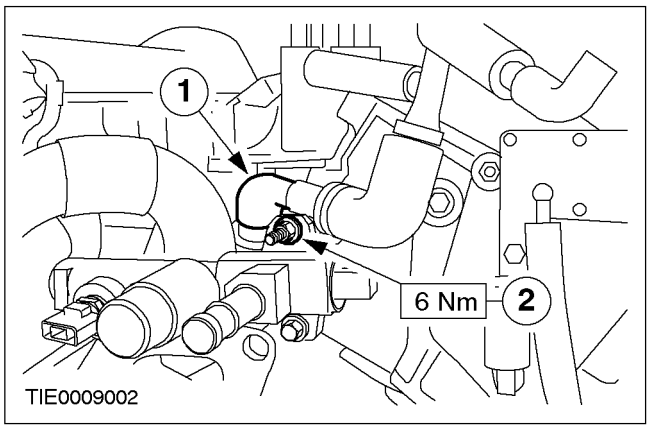
Install the cooling system bypass assembly.

- Lubricate the O-ring seals with sealer before installation.



91. **Install the positive crankcase ventilation (PCV) valve and hoses.**

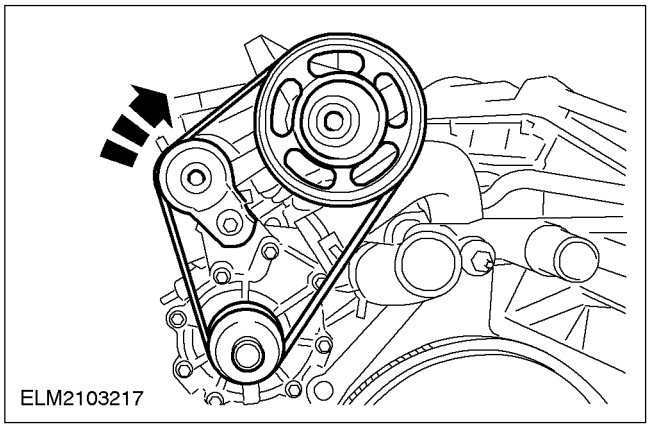
1. Connect the PCV valve and hoses.
2. Install the bracket retaining nut.



ASSEMBLY (Continued)

92. Install the water pump drive belt.

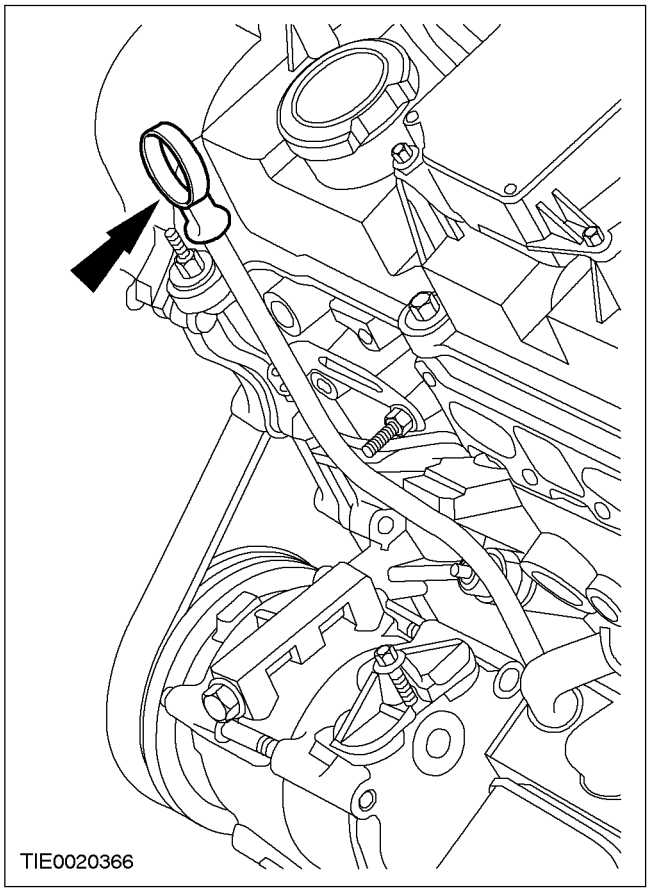
- Rotate the belt tensioner clockwise to release the tension on the belt.



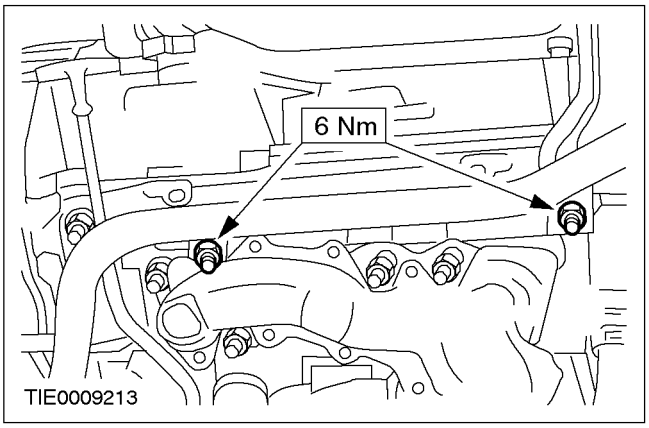
93. NOTE: Install the O-ring seal on the oil level indicator tube and lubricate with clean engine oil before installation.

Install the oil level indicator tube.

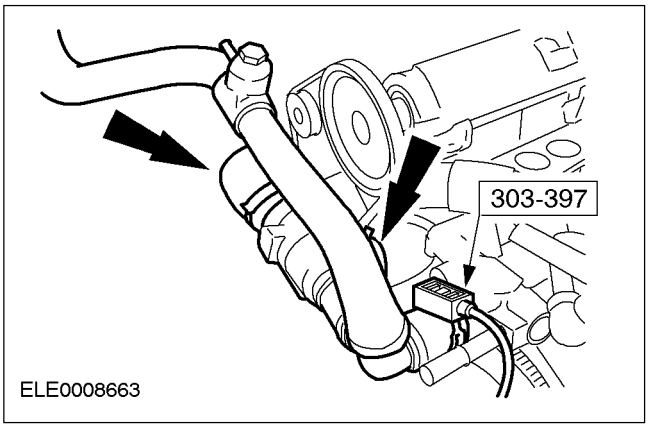
- Locate the oil level indicator tube using a twisting motion.



94. Install the coolant distribution tube.



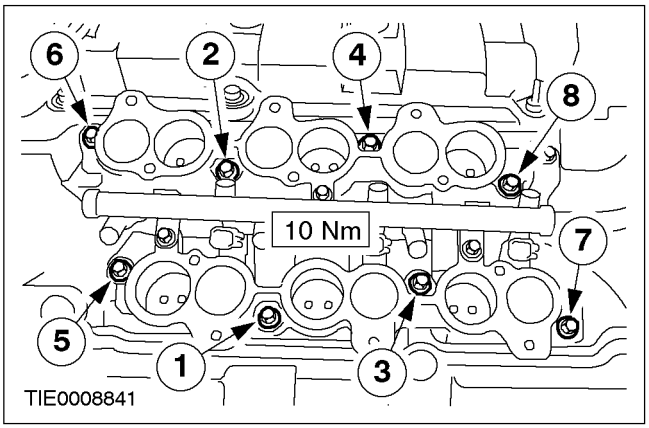
95. Using the special tool, connect the coolant hoses.



96. ⚠ CAUTION: Install new gaskets with the locating lugs facing downwards.

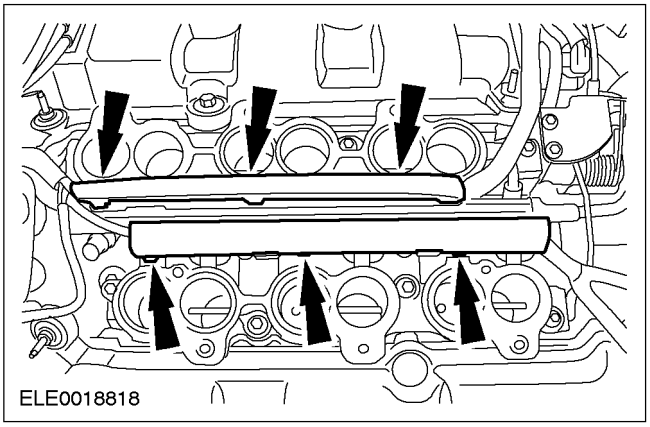
Install the lower intake manifold.

- Tighten the bolts in the sequence shown.



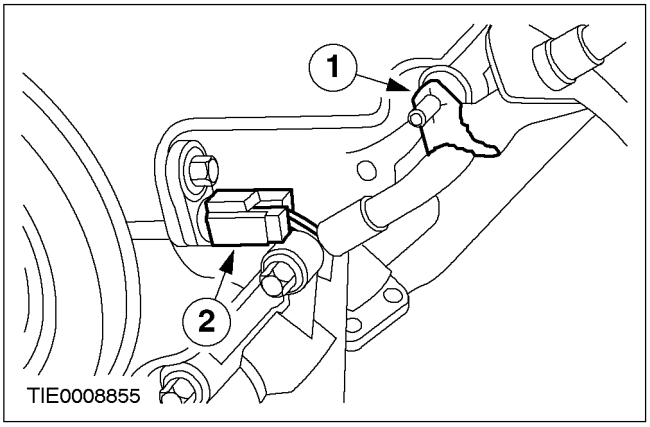
ASSEMBLY (Continued)

97. Connect the fuel injector electrical connectors.



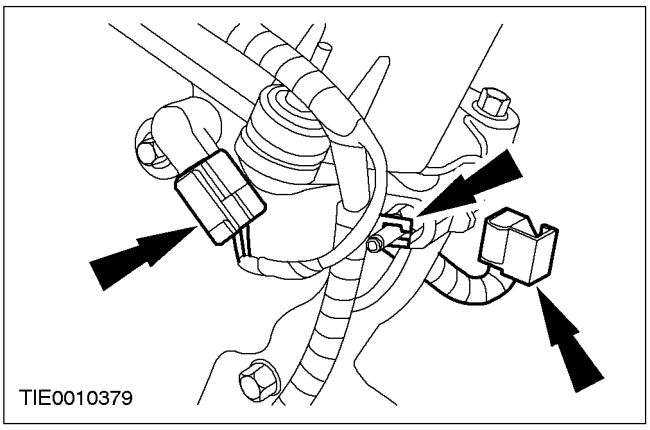
98. Connect the CKP sensor electrical connector.

- Attach the wiring harness to the retaining stud.

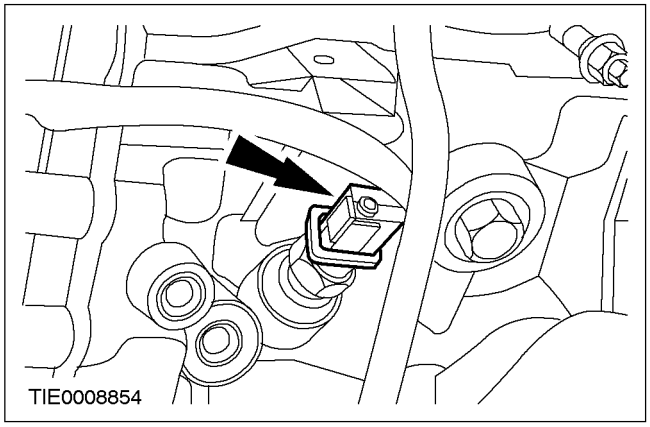


99. Connect the CMP sensor electrical connector.

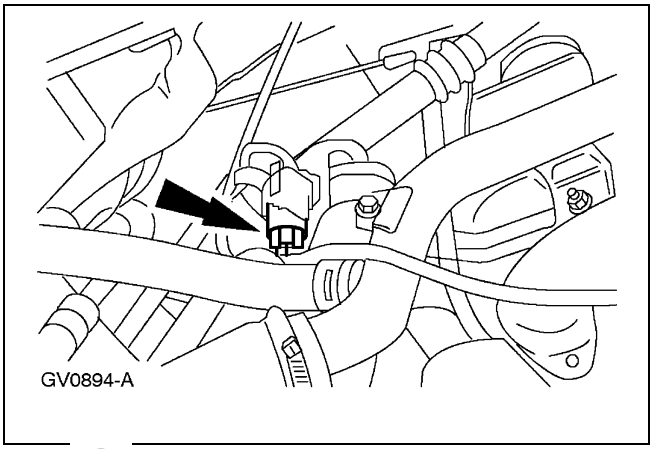
- Attach the wiring harness to the retaining stud.



100. Connect the oil pressure switch electrical connector.



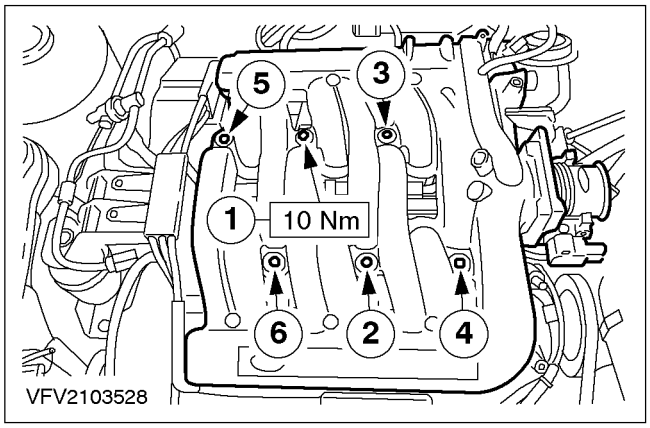
101. Connect the heated oxygen sensor (HO2S) electrical connector.



102. ⚠ CAUTION: Install new gaskets with the locating lugs pointing downwards.

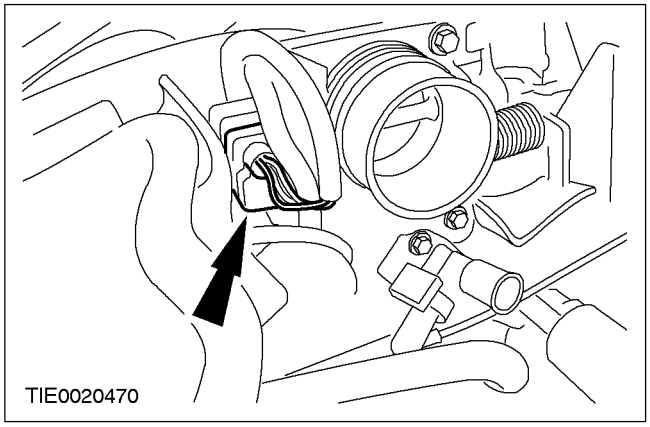
Install the upper intake manifold.

- Tighten the bolts in the sequence shown.

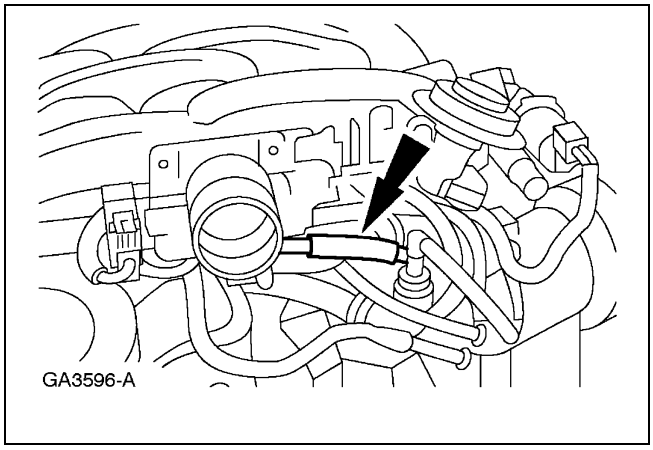


ASSEMBLY (Continued)

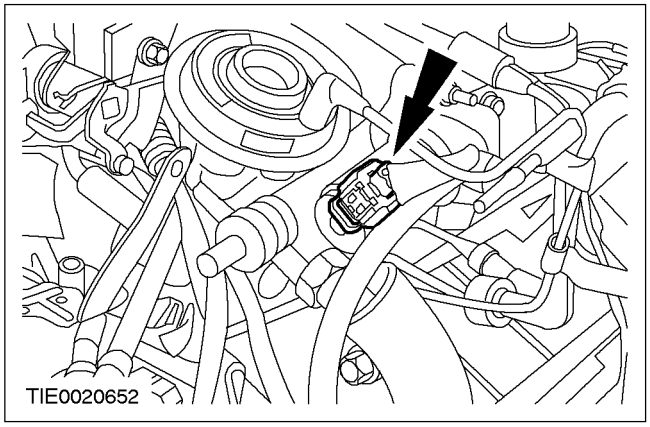
103. Connect the throttle position (TP) sensor electrical connector.



104. Connect the PCV hose to the throttle body.

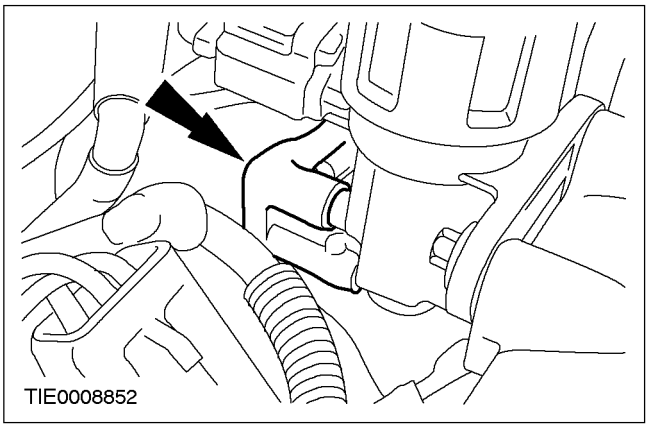


105. Connect the idle air control (IAC) valve electrical connector.

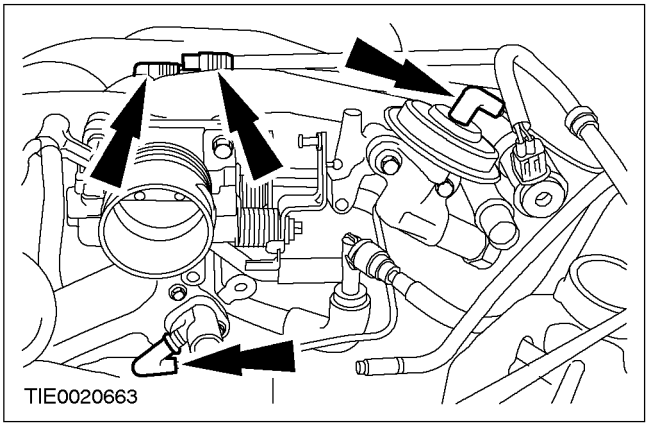


106. Connect the vacuum lines to the electronic vacuum regulator (EVR).

- Install the vacuum harness.

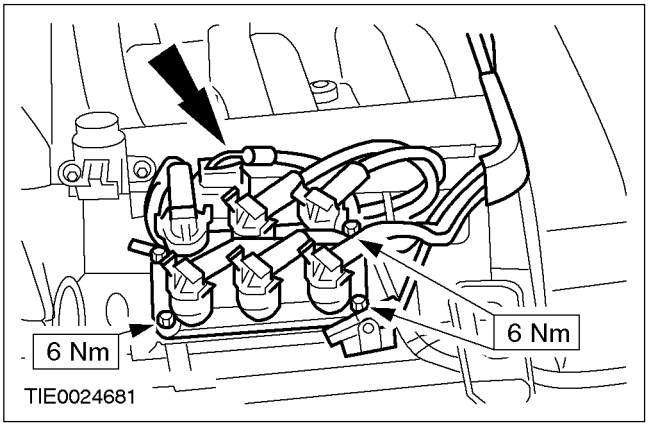


107. Connect the vacuum hoses to the upper intake manifold, the EGR valve and the fuel pressure regulator.



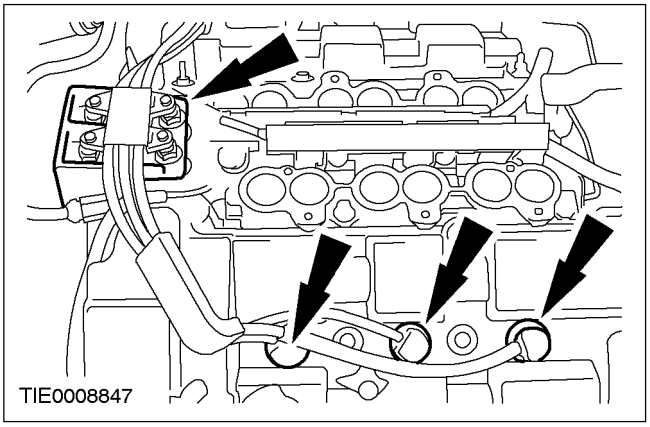
108. Install the electronic ignition (EI) coil.

- Install the EI coil, make sure the radio suppressor and ground cable are connected. Connect the EI coil electrical connector.



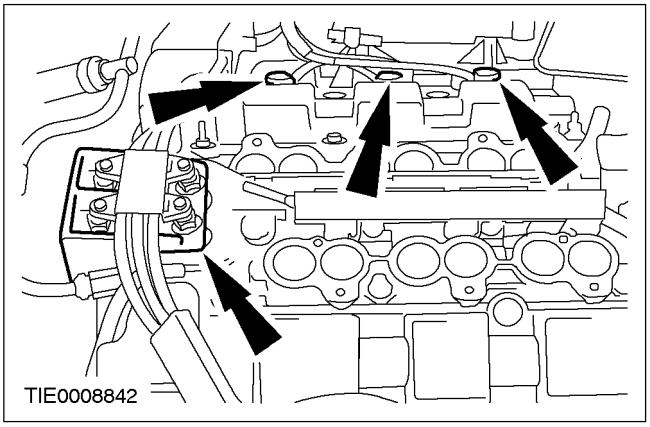
ASSEMBLY (Continued)

109. Connect the left-hand spark plug electrical connectors.



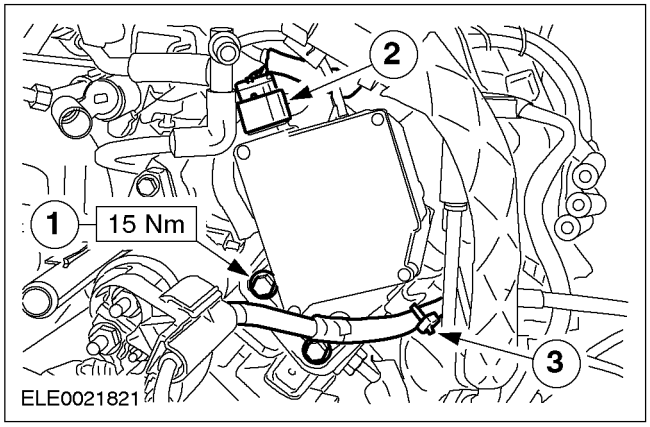
110. Connect the right-hand spark plug electrical connectors.

- Attach the wiring harness to the engine mount.

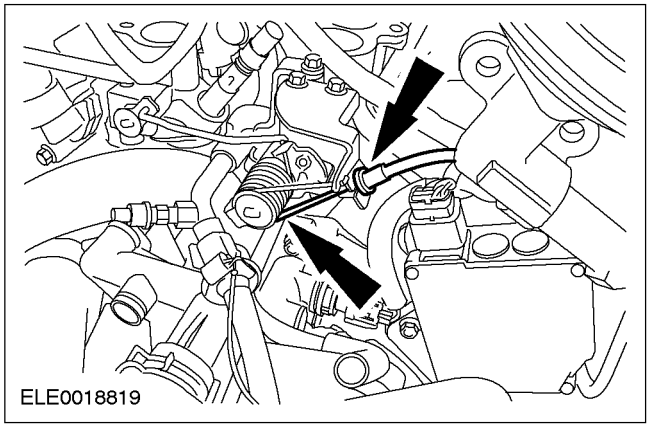


111. Install the intake manifold runner control (IMRC) actuator and mounting bracket.

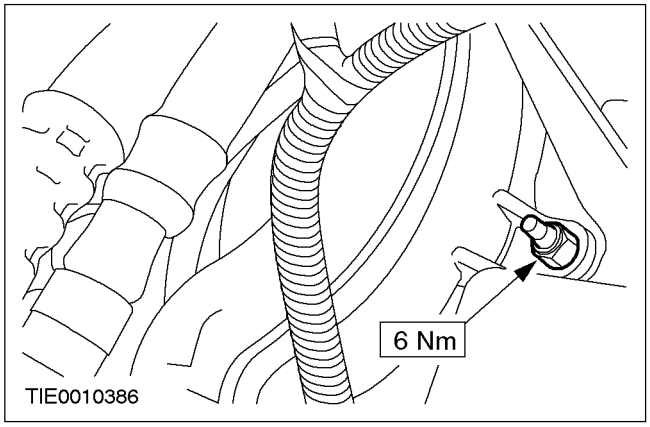
1. Tighten the IMRC actuator bracket retaining bolts.
2. Connect the electrical connector.
3. Install a new cable tie.



112. Attach the IMRC cable to the throttle body.

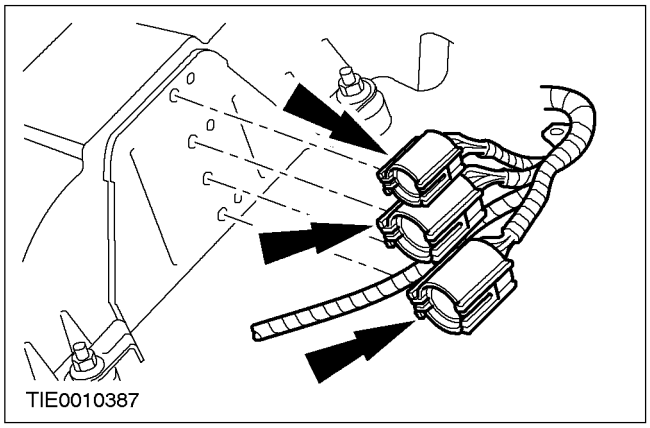


113. Attach the wiring harness bracket to the right-hand valve cover (two nuts).

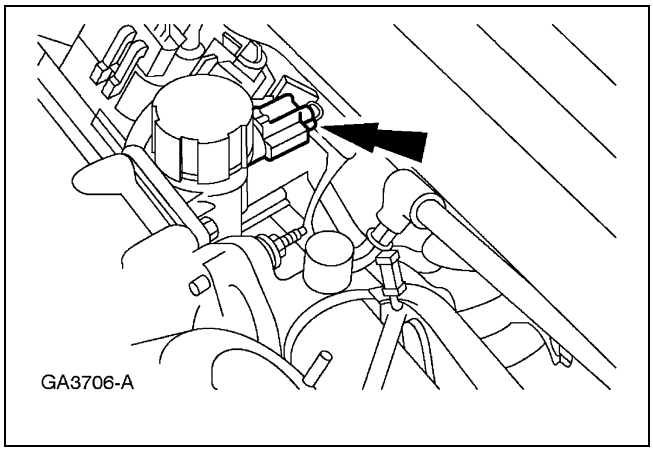


ASSEMBLY (Continued)

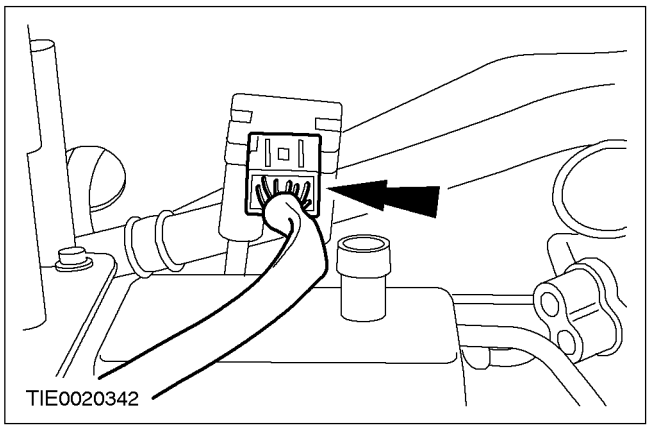
114. Attach the wiring harness in-line electrical connectors to the mounting bracket.



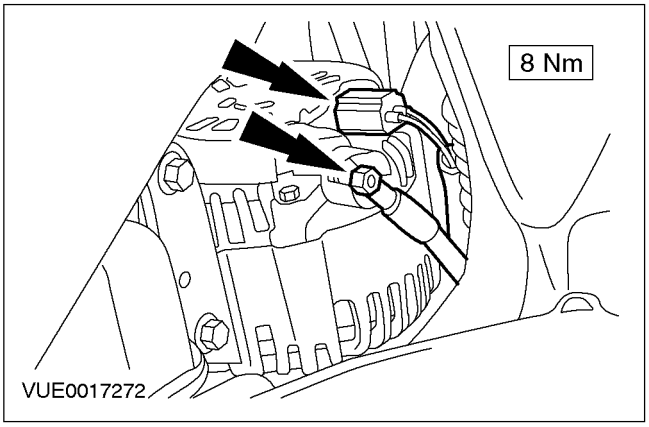
115. Connect the EVR solenoid valve electrical connector.



116. Connect the differential pressure feedback EGR electrical connector.

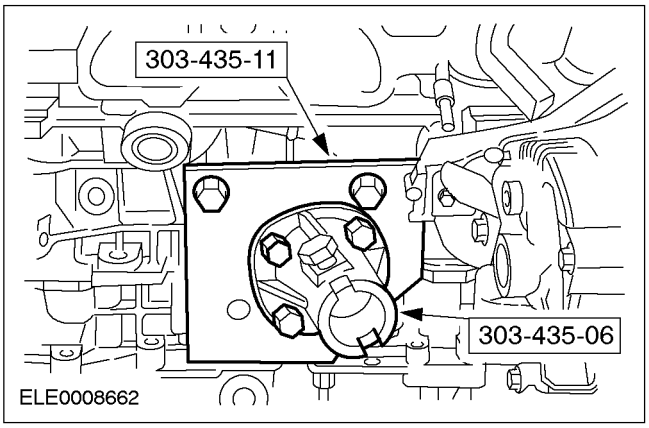


117. Connect the generator electrical connectors.

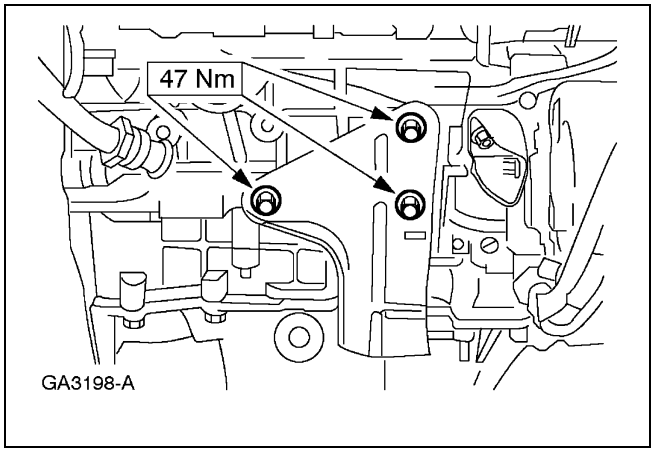


118. Using a suitable engine hoist, remove the engine from the mounting stand.

119. Remove the special tools.



120. Install the intermediate shaft bracket to the cylinder block.

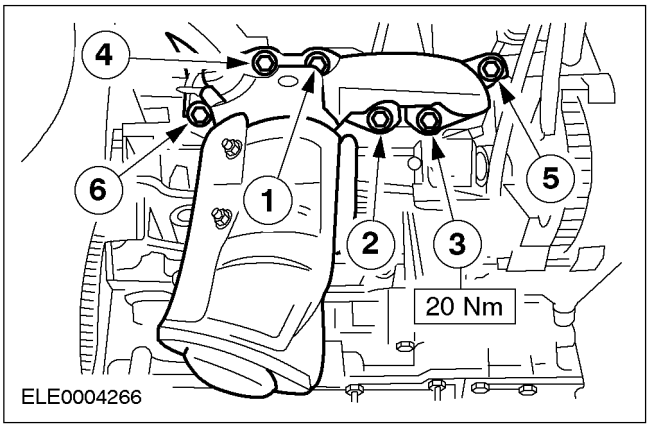


ASSEMBLY (Continued)

121. NOTE: Install a new gasket and retaining nuts.

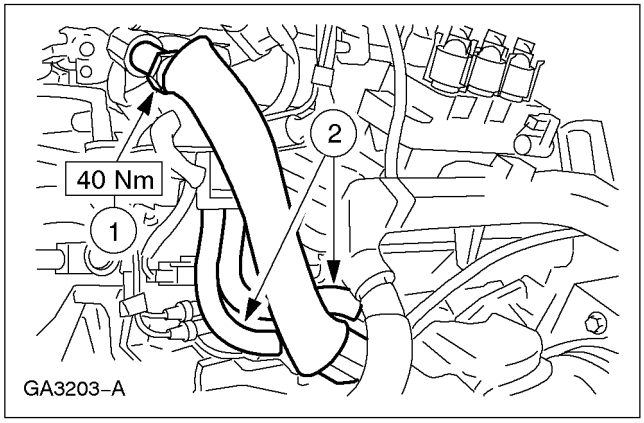
Install the right-hand exhaust manifold.

- Tighten the nuts in the sequence shown.



122. Connect the EGR pipe to the EGR valve.

1. Attach the pipe fitting.
2. Connect the hoses.

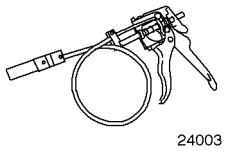


123. Fill the engine with clean engine oil .

124. Install the clutch disc and pressure plate.

INSTALLATION

Engine — Vehicles With: Automatic Transaxle

Special Tool(s)	
 24003	Remover/Installer Cooling Hose Clamp 303-397 (24-003)

General Equipment
Workshop table
Securing straps
Engine hoist
Steel straight edge

Name	Specification
High temperature grease	
Grease, inner tripode joint	WSD-M1C230-A

Installation

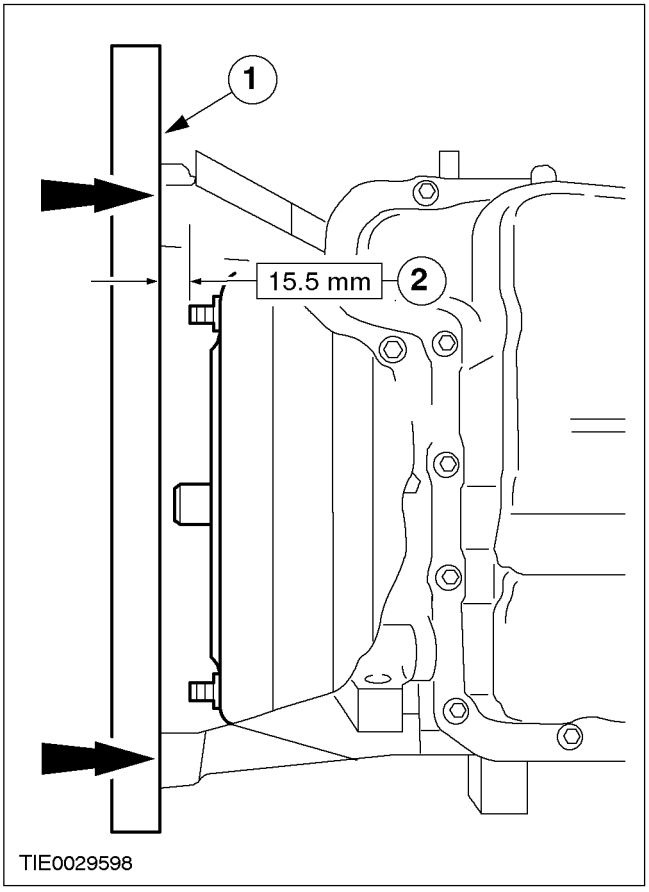
WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

1. CAUTION: The torque converter hub must engage fully in the oil pump drive gear.

Check the installation depth of the torque converter.

1. Lay a steel straightedge across the automatic transaxle flange.
2. Check the installation depth between the steel straight edge and the drive plate stud.

- Apply a thin layer of high-temperature grease to the centering spigot on the torque converter.

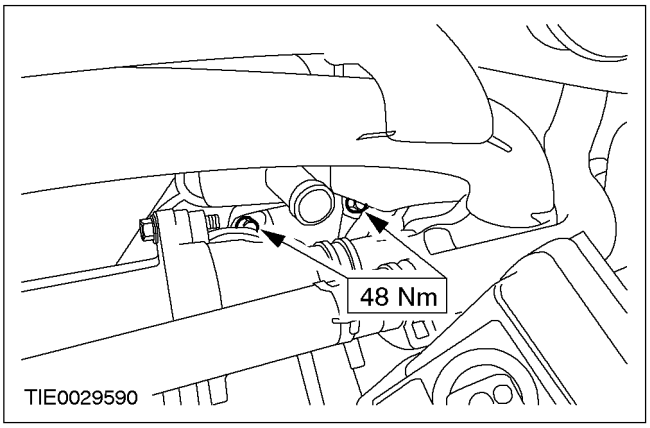


2. NOTE: Do not support directly on the oil pan. Using suitable securing straps, secure the engine to the workshop table.

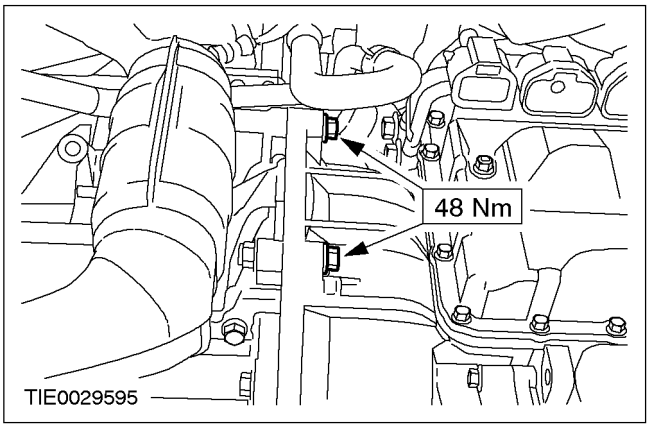
Install the transaxle to the engine.

INSTALLATION (Continued)

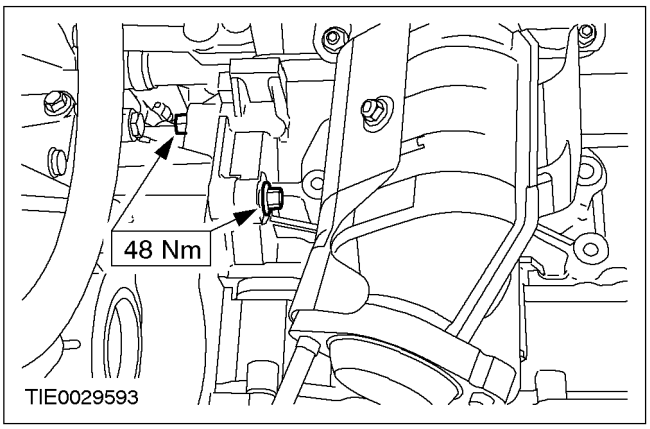
3. Install the transaxle upper retaining bolts.



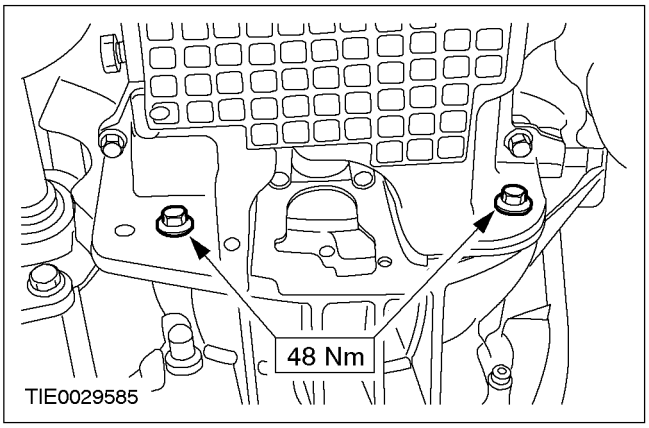
4. Install the transaxle left-hand retaining bolts.



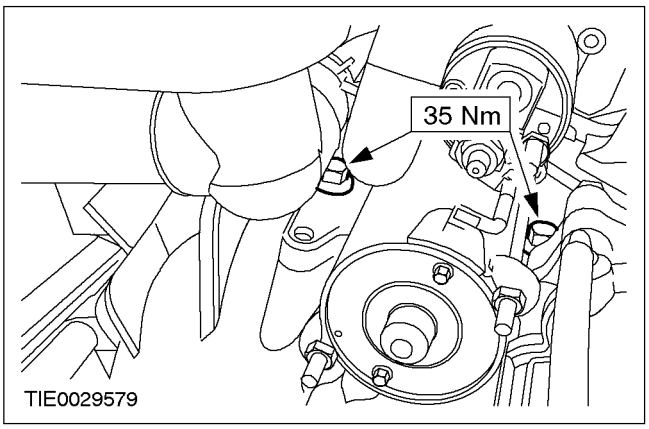
5. Install the transaxle right-hand retaining bolts.



6. Install the transaxle lower retaining bolts.

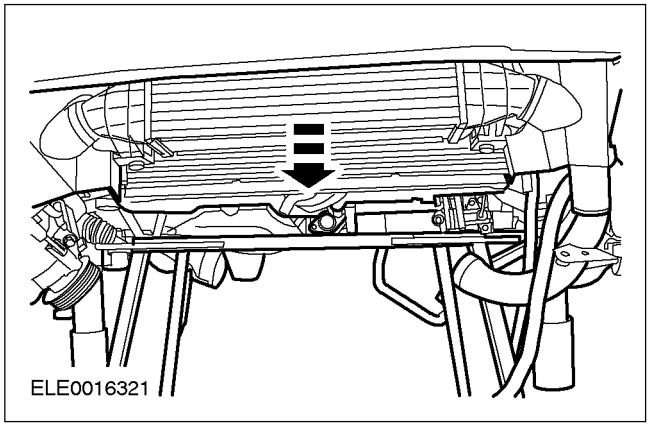


7. Install the starter motor.



8. Using wooden blocks and a securing strap, support the engine and transaxle assembly on the workshop table.
9. Remove the engine hoist.
10. Position the workshop table under the vehicle and carefully lower the vehicle, until the engine and transaxle assembly is in the correct position to install the engine mounts.

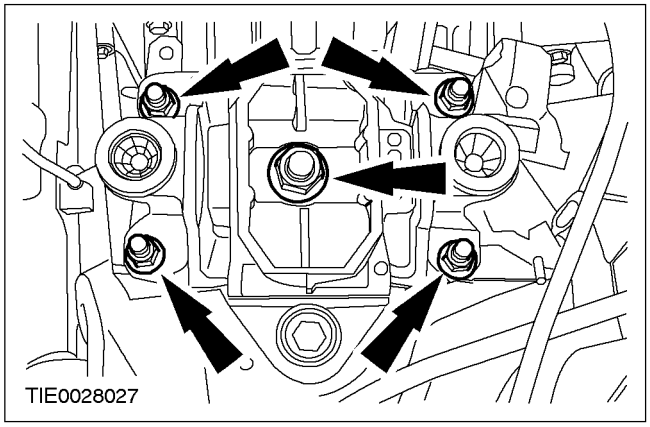
INSTALLATION



11. **NOTE:** Install new engine rear mount retaining nuts.

NOTE: Do not fully tighten the engine rear mount retaining nuts at this stage.

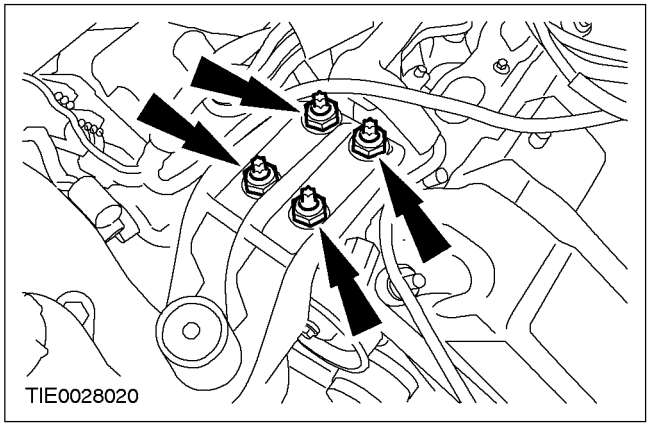
Install the engine rear mount.



12. **NOTE:** Install new engine front mount bracket retaining nuts.

NOTE: Do not fully tighten the engine front mount bracket retaining nuts at this stage.

Install the engine front mount bracket.



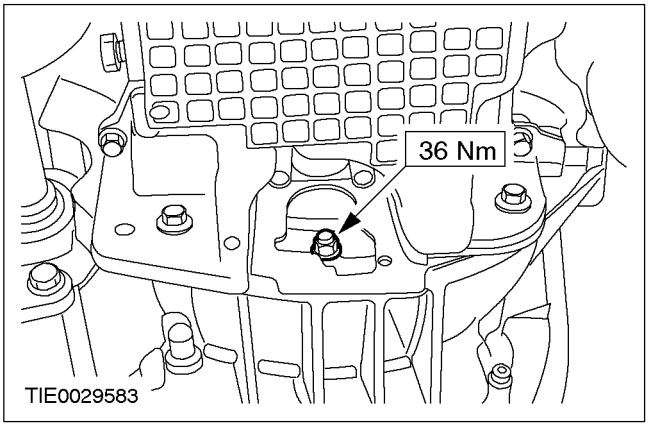
13. **Remove the securing straps.**

14. **Raise and support the vehicle. For additional information, refer to Section 100-02.**

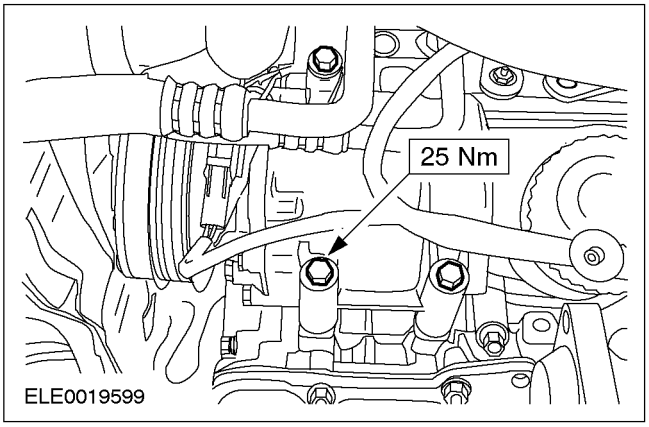
15. **NOTE:** Install new torque converter retaining nuts.

Install the torque converter retaining nuts.

- Rotate the engine to gain access to the nuts.
- Install the cover.

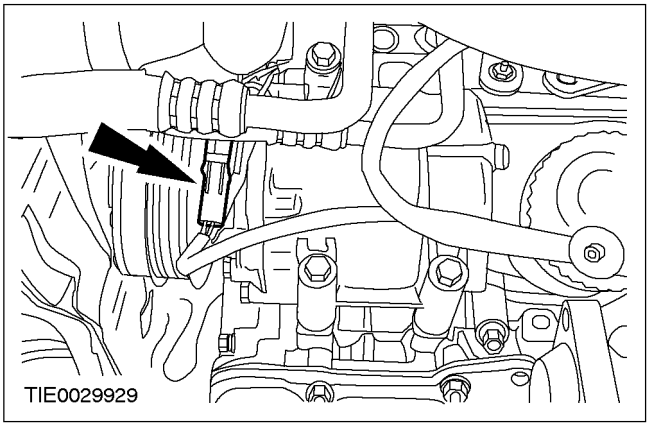


16. **Attach the air conditioning (A/C) compressor to the mounting bracket.**

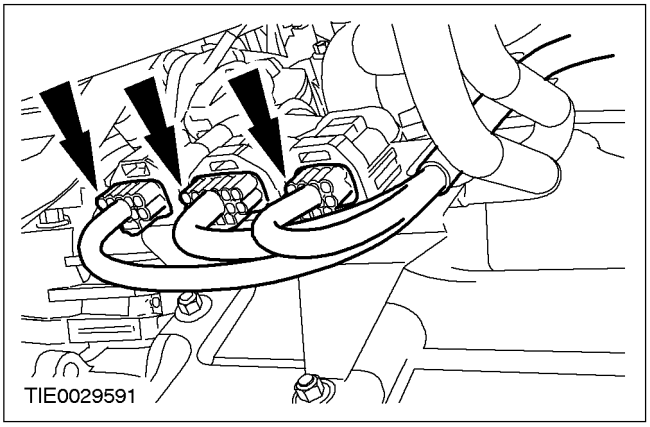


INSTALLATION (Continued)

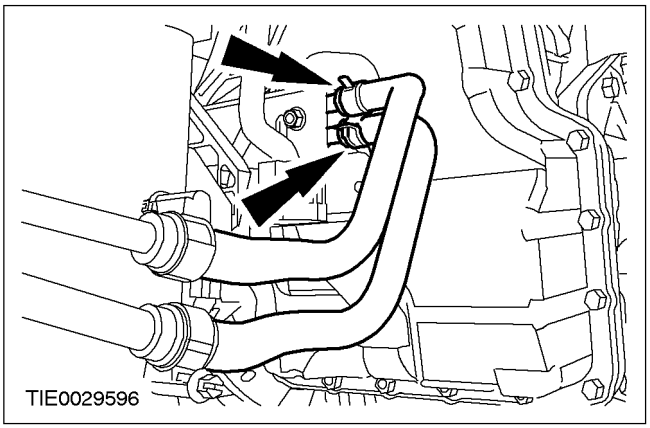
17. **Connect the A/C compressor electrical connector.**



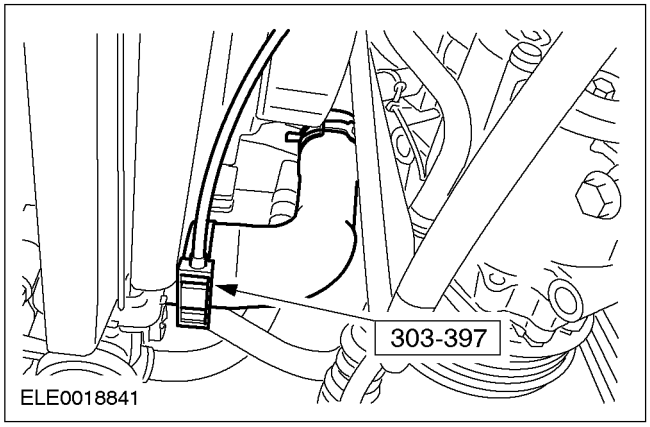
18. **Connect the transaxle electrical connectors.**



19. **Connect the fluid cooler pipes to the transaxle.**



20. **Using the special tool, connect the lower coolant hose to the radiator.**



21. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

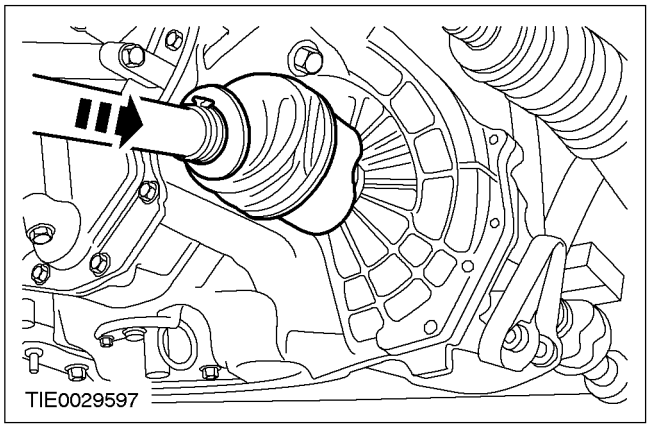
CAUTION: Do not damage the halfshaft oil seal.

CAUTION: Make sure the snap ring is correctly seated.

NOTE: Install a new snap ring.

NOTE: Install a new O-ring seal.

Attach the left-hand halfshaft to the transaxle.



INSTALLATION (Continued)

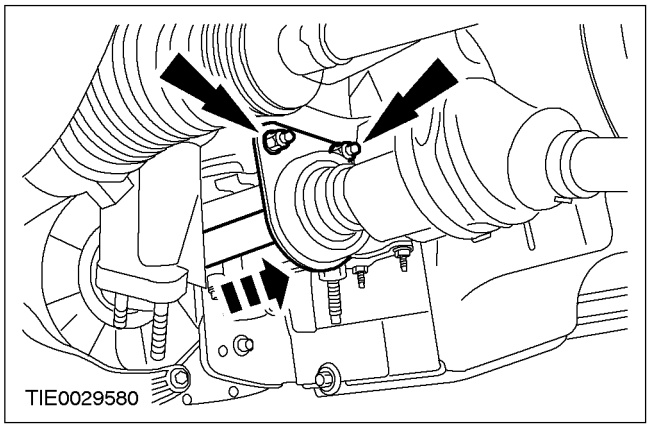
22. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent at more than 45 degrees.**

CAUTION: Do not damage the halfshaft oil seal.

NOTE: Install a new center bearing cap and new retaining nuts.

NOTE: Install a new O-ring seal.

Attach the right-hand halfshaft and the intermediate shaft to the transaxle.

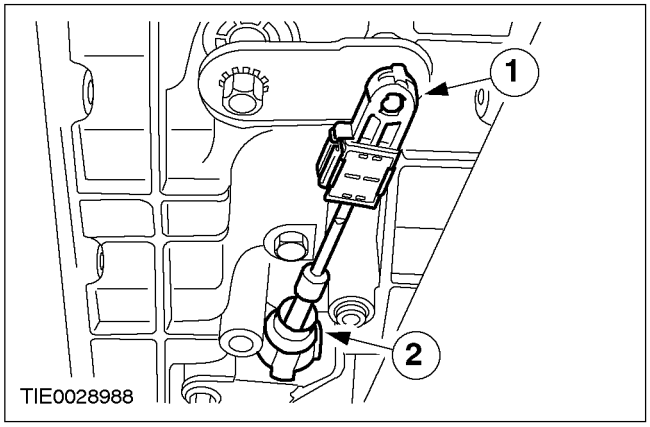


23. **Install the subframe. For additional information, refer to Section 502-00.**

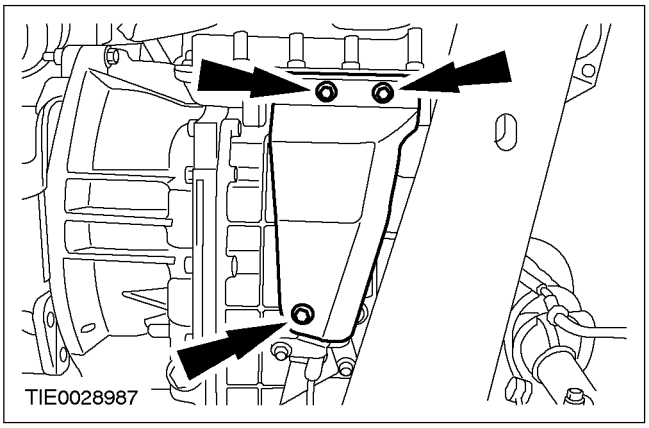
24. **NOTE:** Make sure the transaxle selector lever is in "P" (PARK) position.

Connect the selector lever cable to the transaxle.

1. Attach the selector lever cable to the selector lever.
2. Attach the selector lever cable to the selector shaft.

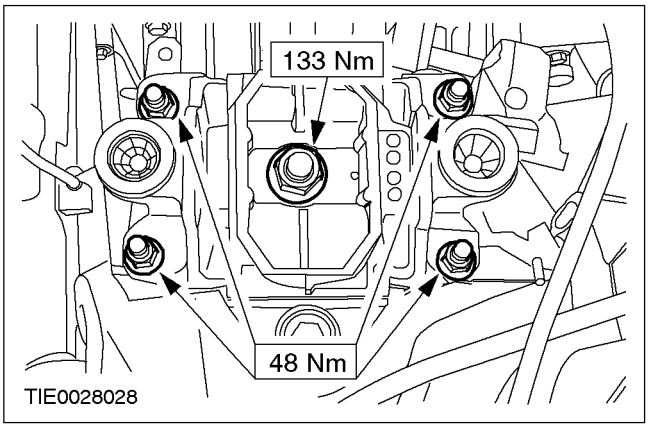


25. **Install the selector lever cable cover.**

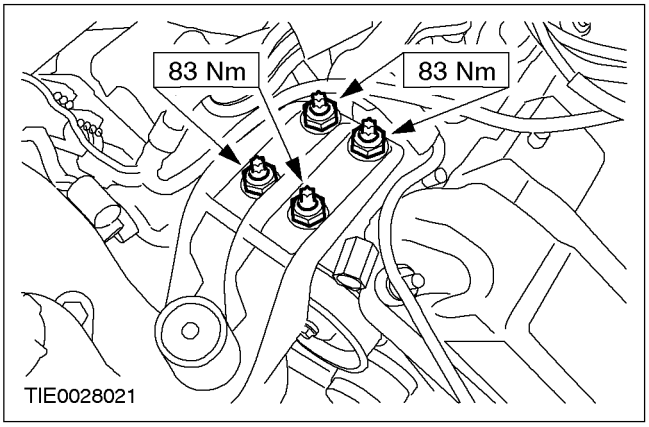


26. **Lower the vehicle.**

27. **Tighten the engine rear mount retaining nuts.**

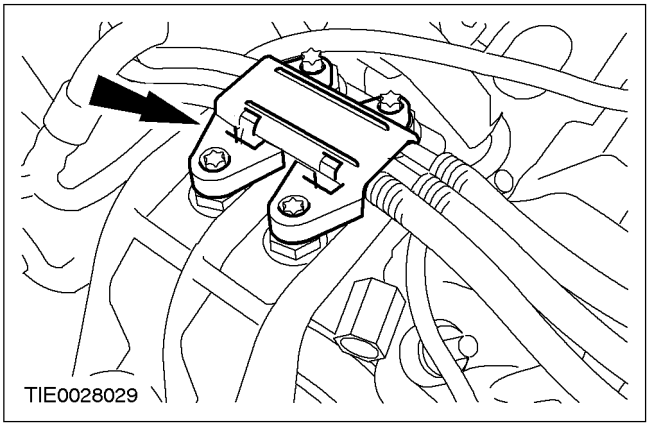


28. **Tighten the engine front mount bracket retaining nuts and bolt.**

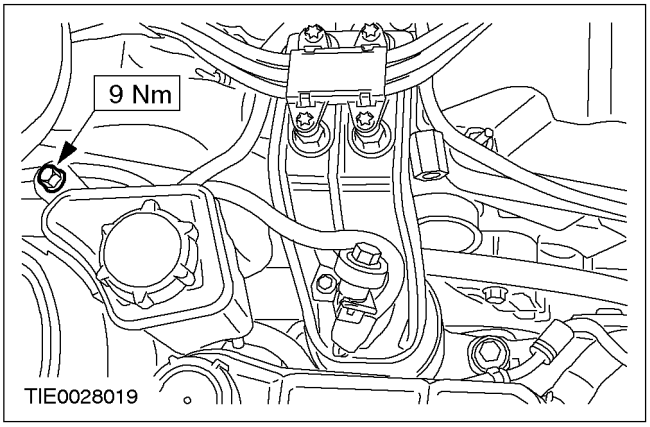


INSTALLATION (Continued)

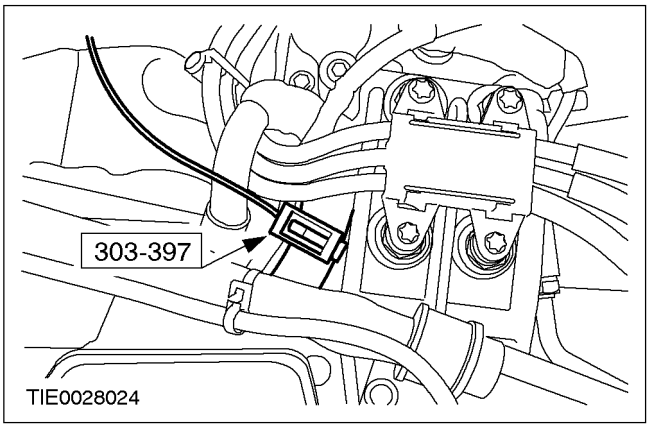
29. **Attach the spark plug cable retaining bracket to the engine front mount.**



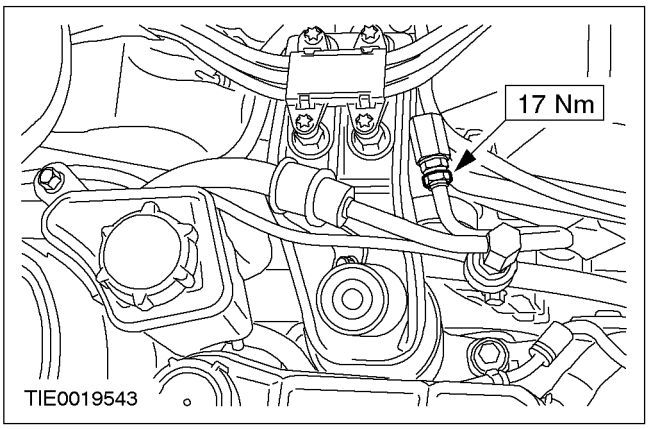
30. **Attach the power steering reservoir to the radiator grille opening panel.**



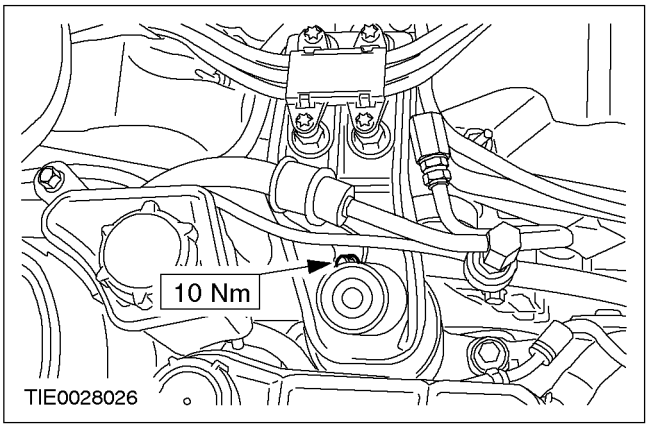
31. **Using the special tool, connect the power steering pump supply hose to the power steering pump.**



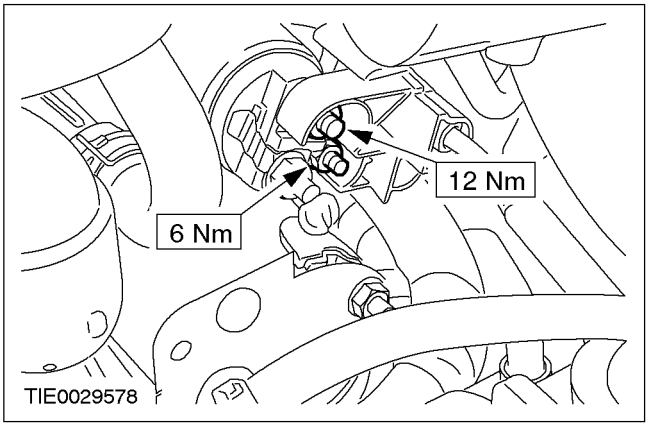
32. **Connect the power steering pipe.**
    - Install the clip.



33. **Attach the power steering line support bracket to the engine front mount.**

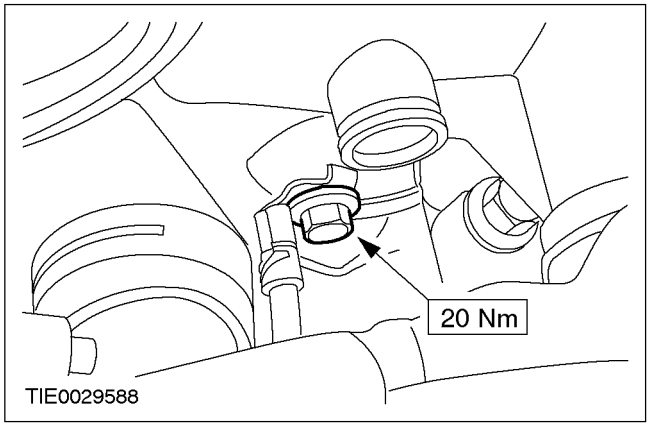


34. **Connect the starter motor electrical connectors.**

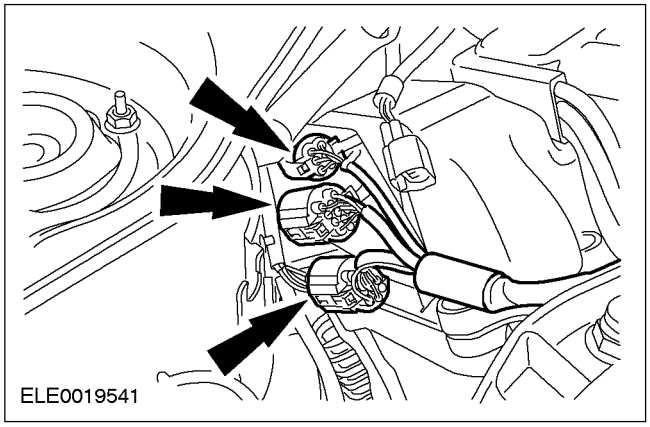


INSTALLATION (Continued)

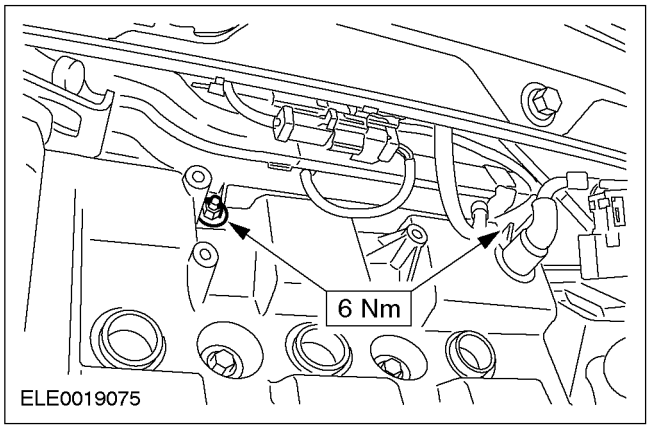
35. Connect the ground cable to the transaxle.



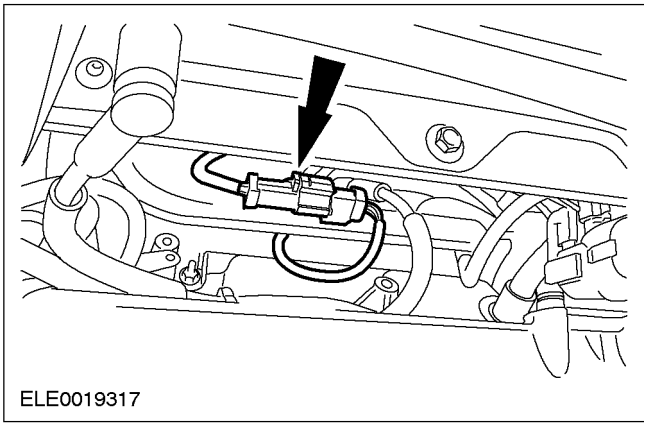
36. Connect the engine wiring harness electrical connectors.



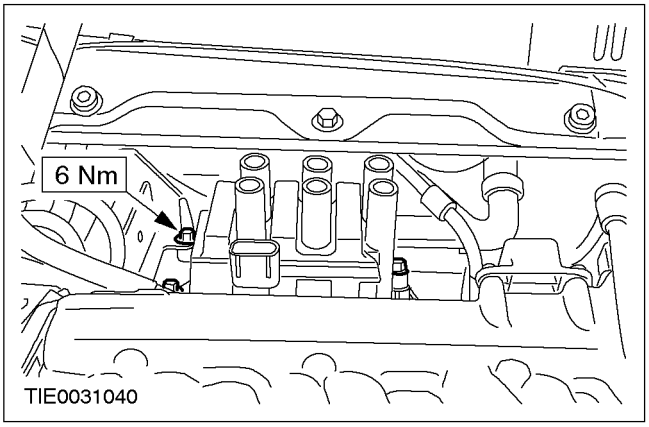
37. Attach the engine wiring harness to the right-hand valve cover.



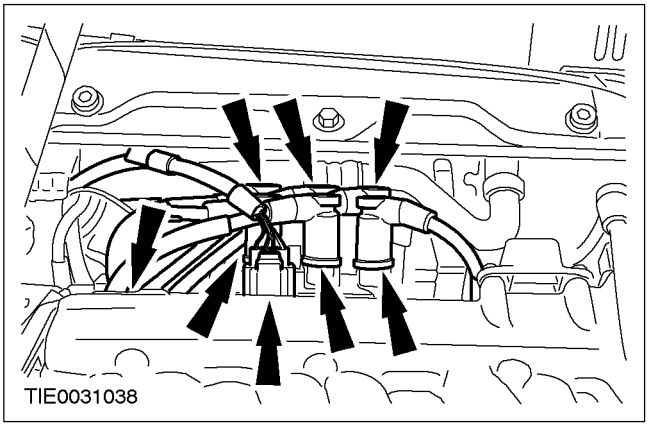
38. Connect the heated oxygen sensor (HO2S) electrical connector.



39. Install the electronic ignition (EI) coil to the right-hand valve cover.

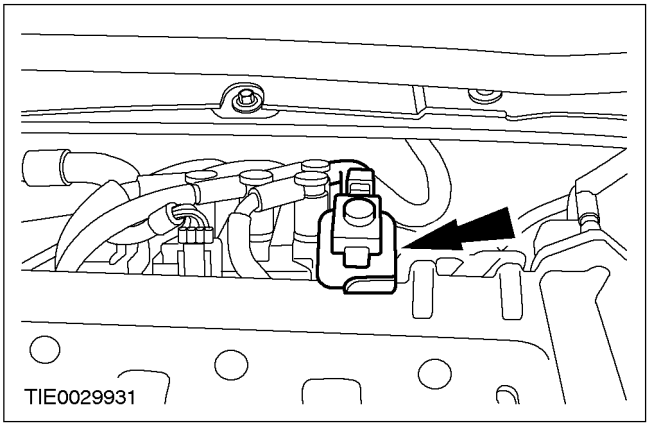


40. Connect the EI electrical connectors.

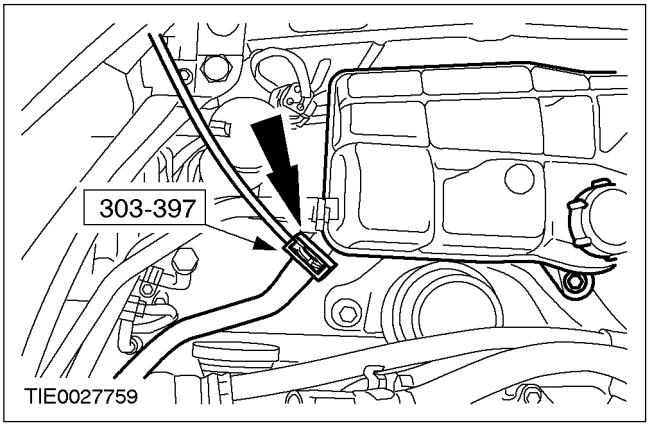


INSTALLATION (Continued)

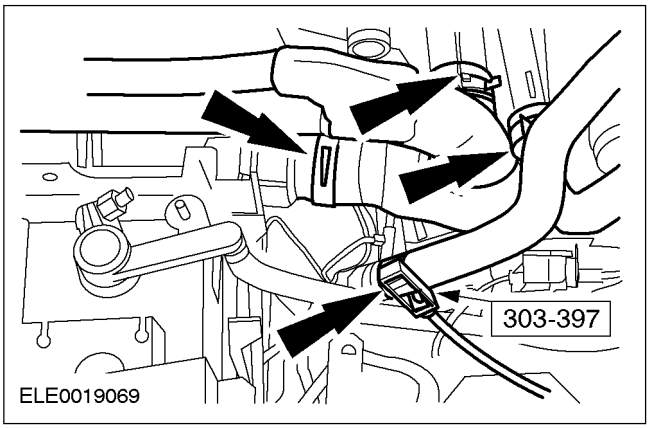
41. Attach the evaporative emissions (EVAP) solenoid valve to the intake manifold.



42. Using the special tool, connect the coolant hose to the coolant expansion tank.

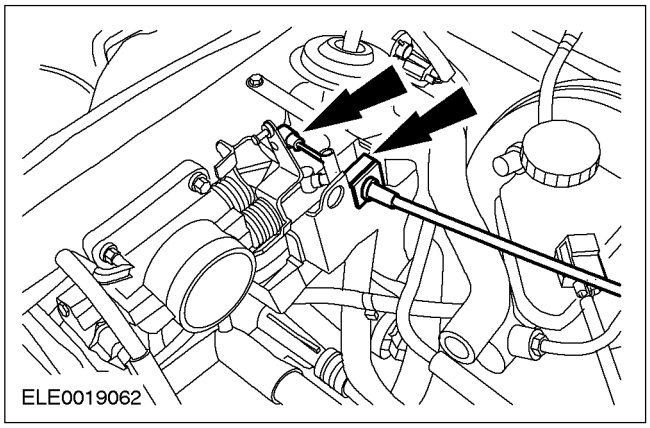


43. Using the special tool, connect the coolant hoses to the coolant connecting pipe.



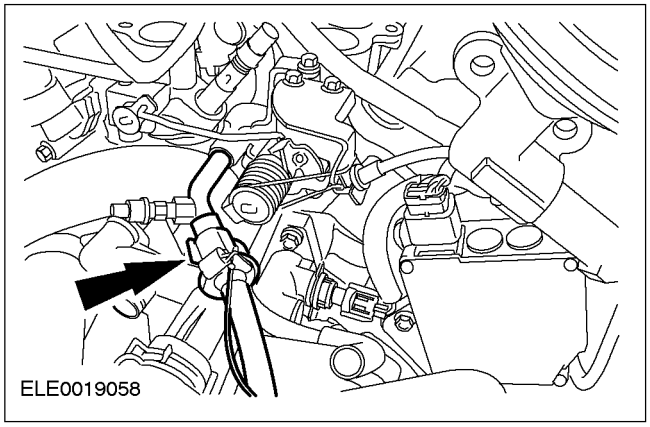
44. Attach the accelerator cable.

- Attach the clips and the accelerator cable to the bracket.



45. Install the accessory drive belt. For additional information, refer to Section 303-05.

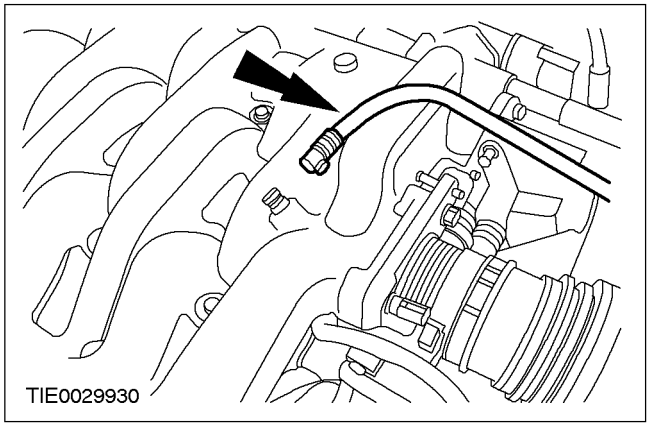
46. Connect the fuel supply line. For additional information, refer to Section 310-00.



47. Adjust the selector lever cable. For additional information, refer to Section 307-05A / 307-05B.

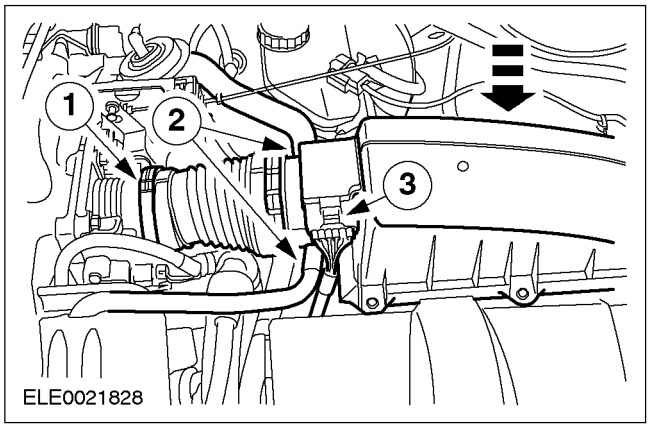
INSTALLATION (Continued)

48. Attach the brake booster vacuum pipe to the intake manifold.

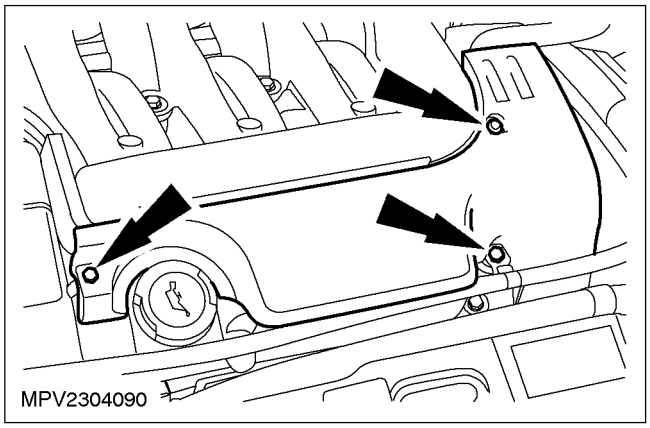


49. Install the air cleaner.

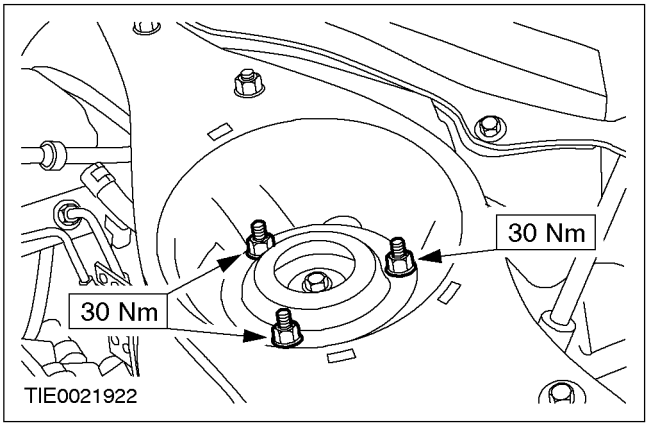
1. Attach the air cleaner outlet hose clamp.
2. Connect the positive crankcase ventilation (PCV) hoses.
3. Connect the mass air flow (MAF) sensor electrical connector.



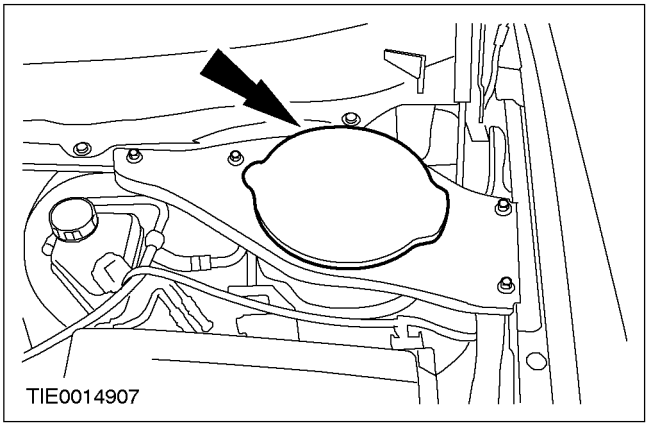
50. Install the engine upper cover.



51. Tighten the strut and spring assembly top mount retaining nuts on both sides.



52. Install the strut and spring assembly top mount brace cover on both sides.



53. Connect the battery ground cable. For additional information, refer to Section 414-01.

54. Fill the cooling system. For additional information, refer to Section 303-03.

55. Fill and bleed the power steering system. For additional information, refer to Section 211-00.

56. Initialize the door window motors. For additional information, refer to Section 501-11.

SECTION 303-03 Engine Cooling

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Motorcraft Super Plus 2000	WSS-M97B44–D

Antifreeze

Specific Gravity (providing no other additive is in coolant)	Approximate percentage of Anti-Freeze (by volume)	Remains Fluid to	Solidifies at
1.061 at +15°C	50%	–25°C (–13°F)	–30°C (–22°F)

Cooling System Refill Capacities

Description	Liters
Cooling system and heater - Vehicles with 1.8L engine	8.3
Cooling system and heater - Vehicles with 2.0L engine	8.1
Cooling system and heater - Vehicles with 2.5L engine and manual transaxle	9.5
Cooling system and heater - Vehicles with 2.5L engine and automatic transaxle	9.7
Cooling system and heater - Vehicles with 3.0L engine and manual transaxle	9.7
Cooling system, heater and fuel fired heater - Vehicles with 2.0L diesel engine	10.4
Cooling system, heater and supplementary heater - Vehicles with 2.0L diesel engine	10.6

Cooling System Pressure Specification

Description	Pressure kpa (psi)
Radiator pressure test	138 (20)
Coolant expansion tank cap release pressure	130 to 150 (18 to 21)

Torque Specifications

Description	Nm	lb-ft	lb-in
Air conditioning condenser retaining bolts	10	-	89
Radiator support bracket retaining bolts	10	-	89
Thermostat housing retaining bolts - Vehicles with 1.8L or 2.0L engine	10	-	89
Thermostat housing retaining bolts - Vehicles with 2.5L or 3.0L engine	18	13	-
Thermostat housing retaining bolts - Vehicles with 2.0L diesel engine	23	17	-
Water pump pulley retaining bolts - Vehicles with 1.8L or 2.0L engine	25	18	-
Water pump retaining bolts - Vehicles with 1.8L or 2.0L engine	10	-	89
Water pump retaining bolts - Vehicles with 2.5L or 3.0L engine	10	-	89
Water pump retaining nut and bolts - Vehicles with 2.0L diesel engine	24	18	-
Engine oil temperature control thermostat retaining bolt - Vehicles with 2.0L diesel engine	10	-	89
Water pump housing retaining bolts - Vehicles with 2.0L diesel engine	10	-	89
Power steering pump supply line bracket retaining nut.	8	-	71

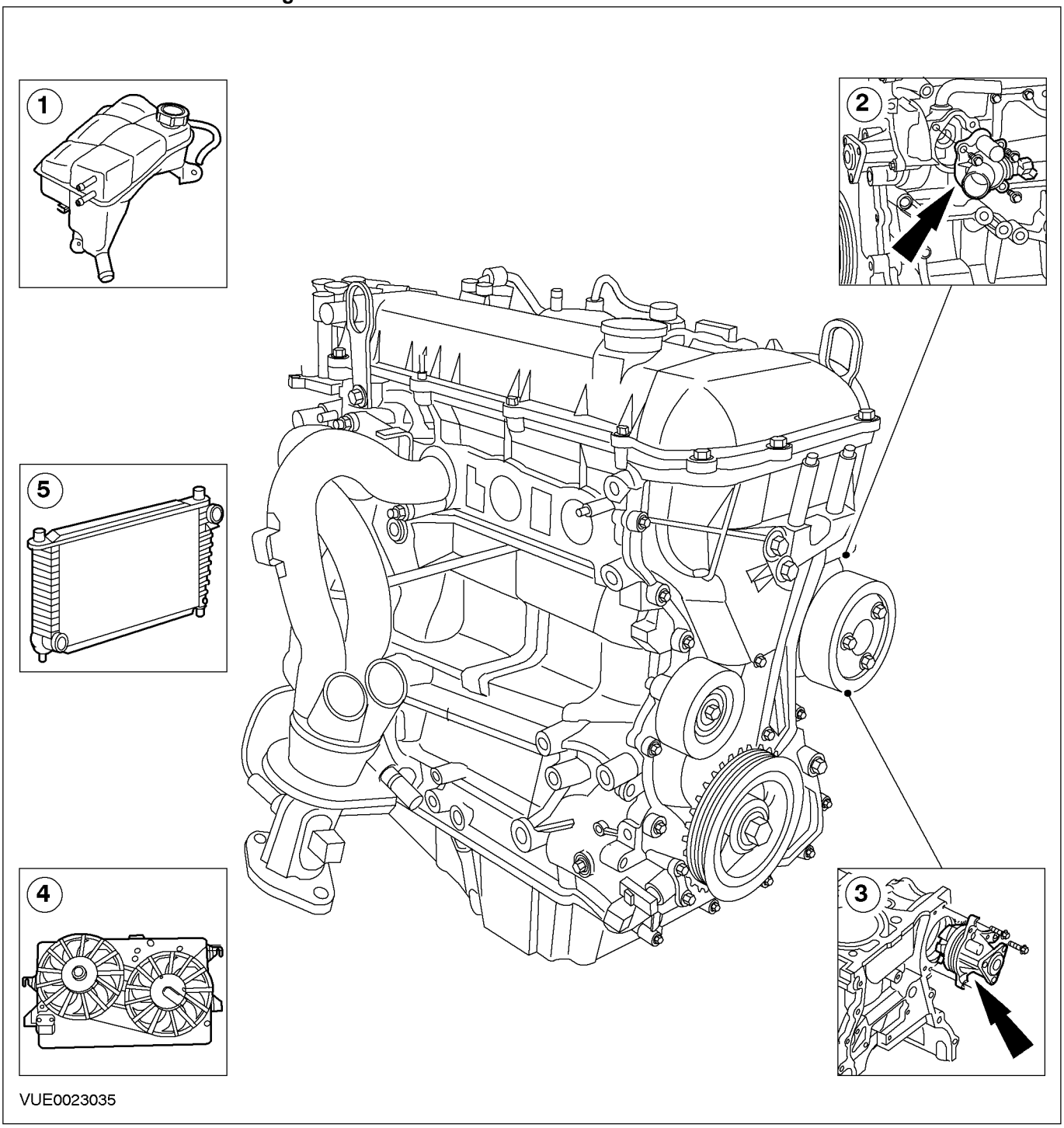
SPECIFICATIONS (Continued)

Description	Nm	lb-ft	lb-in
Bypass tube retaining bolts - Vehicles with 2.5L or 3.0L engine	10	-	89

DESCRIPTION AND OPERATION

Engine Cooling

Vehicles with 1.8L or 2.0L engine



VUE0023035

Item	Part Number	Description
1	-	Coolant expansion tank

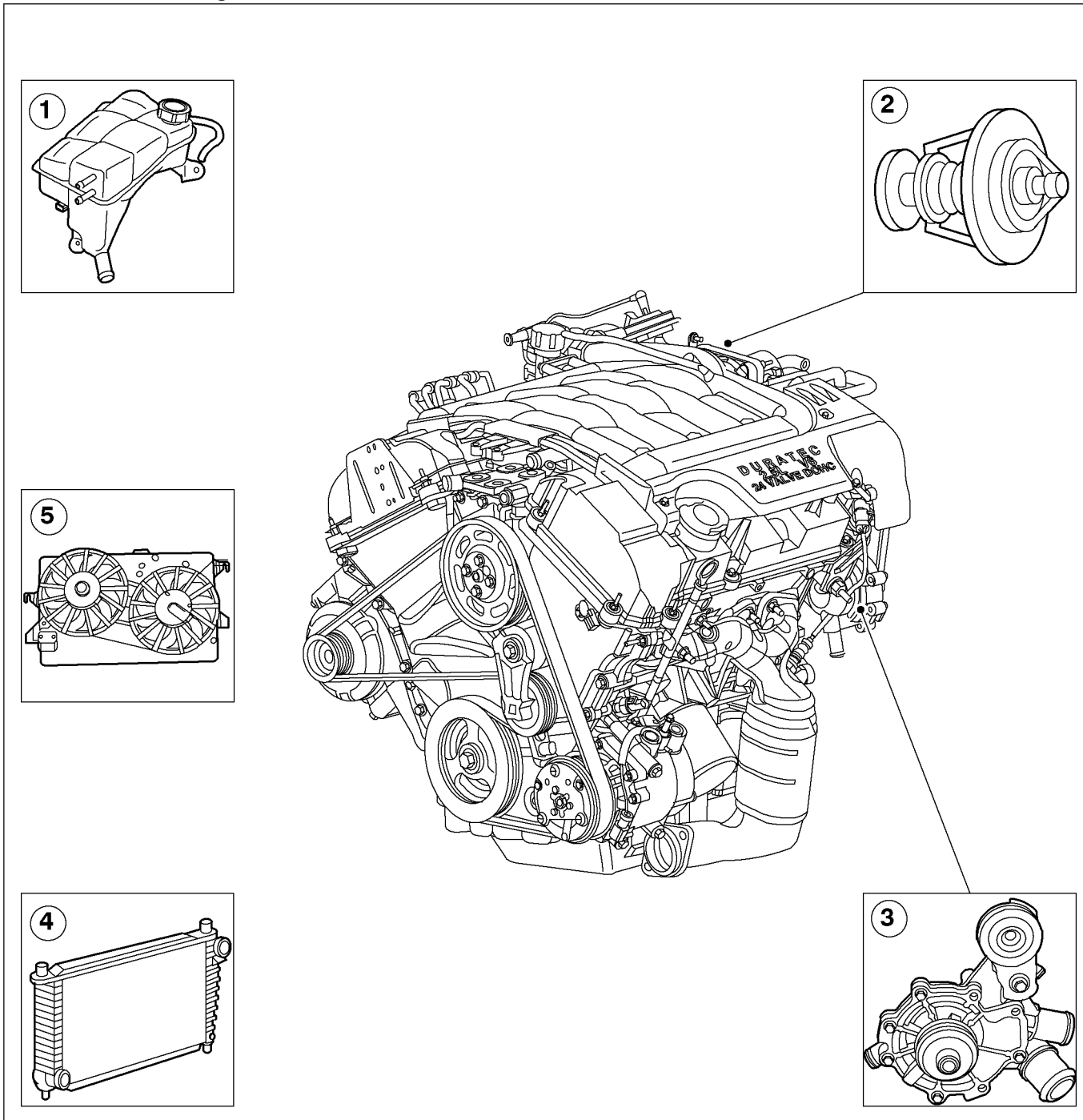
Item	Part Number	Description
2	-	Thermostat
3	-	Water pump

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
4	-	Cooling fan motor and shroud

Item	Part Number	Description
5	-	Radiator

Vehicles with 2.5L engine



VUE0022676

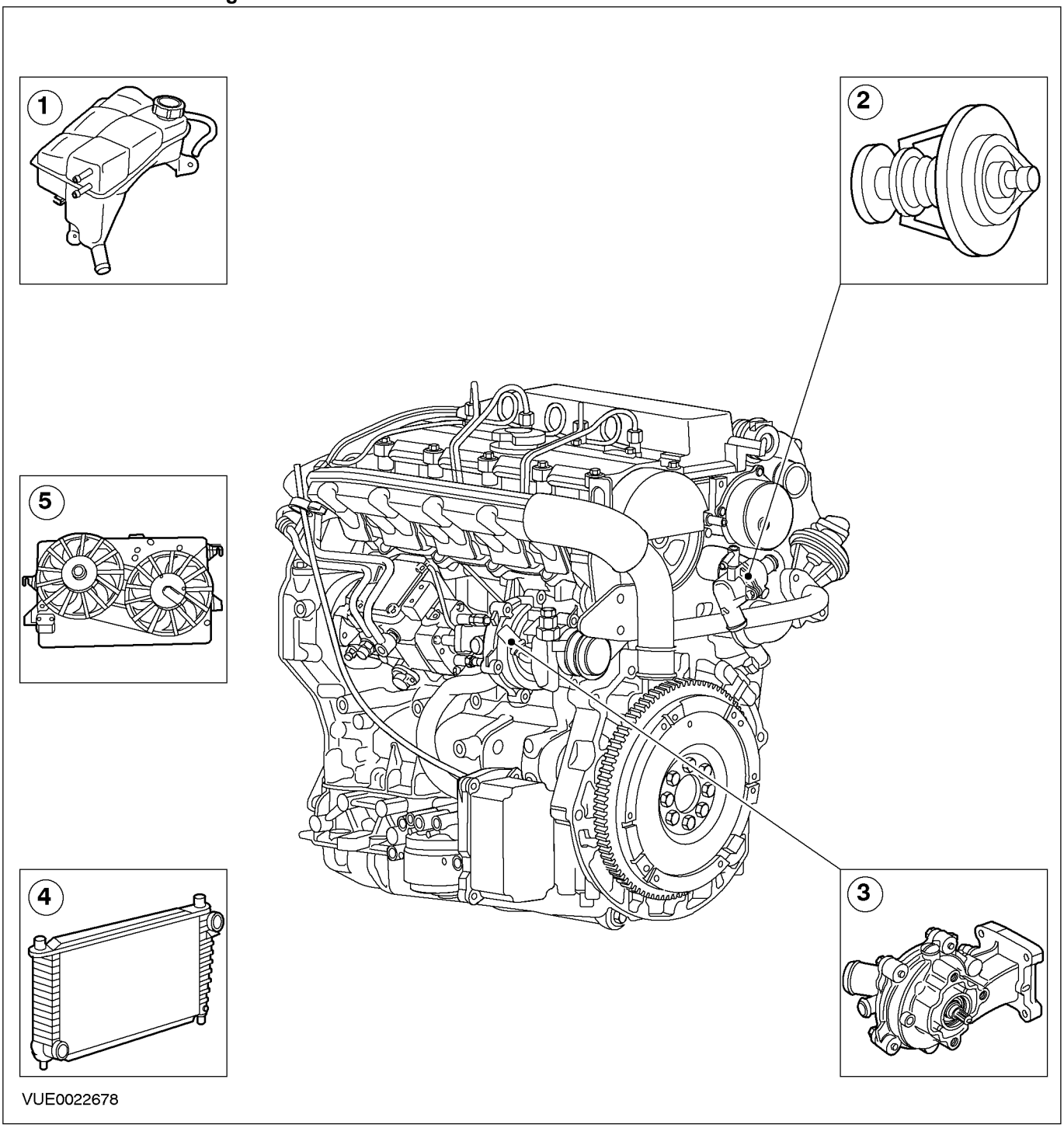
Item	Part Number	Description
1	-	Coolant expansion tank

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
2	-	Thermostat
3	-	Water pump

Item	Part Number	Description
4	-	Radiator
5	-	Cooling fan motor and shroud

Vehicles with diesel engine



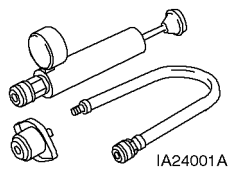
VUE0022678

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1	-	Coolant expansion tank
2	-	Thermostat
3	-	Water pump
4	-	Radiator
5	-	Cooling fan motor and shroud

DIAGNOSIS AND TESTING

Engine Cooling

Special Tool(s)	
 IA24001A	Pressure Tester, Cooling System 303-396 (24-001 A)
 IA2400101A	Adapter for 303-396 303-396-01

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Coolant leak(s) – Gaskets or seals – Hose(s) or hose joints – Coolant expansion tank pressure cap and seal – Coolant expansion tank – Radiator – Water pump – Thermostat – Accessory drive belt - all except vehicles with 2.0L diesel engine – Power steering pump belt - vehicles with 2.0L diesel engine – Exhaust gas recirculation (EGR) cooler - vehicles with 2.0L diesel engine – Engine oil cooler - vehicles with 2.0L diesel engine	– Fuse(s) – Wiring harness – Electrical connector(s) – Engine coolant temperature (ECT) sensor – Cylinder head temperature (CHT) sensor – Powertrain control module (PCM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Condition	Possible Sources	Action
•Loss of coolant	•Hose(s) or hose joint(s).	•INSPECT the hoses and hose joints. INSTALL a new hose(s) as necessary.
	•Radiator.	•INSPECT the radiator for leaks. CARRY OUT the Pressure Test Component Test in this section. INSTALL a new radiator as necessary. REFER to Radiator in this section.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
	•Water pump.	•INSPECT the water pump for leaks. CARRY OUT the Pressure Test Component Test in this section. INSTALL a new water pump or water pump gasket as necessary. REFER to Water Pump - vehicles with 1.8L or 2.0L engine / Water Pump - vehicles with 2.5L or 3.0L engine in this section.
	•Thermostat housing.	•INSPECT the thermostat housing for leaks. CARRY OUT the Pressure Test Component Test in this section. INSTALL a new thermostat housing and thermostat housing gasket as necessary. REFER to Thermostat Housing - vehicles with 1.8L or 2.0L engine / Thermostat - vehicles with 2.5L or 3.0L engine in this section.
	•Coolant expansion tank pressure cap or seal.	•CARRY OUT the Coolant Expansion Tank Pressure Cap Pressure Test Component Test in this section.
	•Coolant expansion tank.	•INSPECT the coolant expansion tank for damage. INSTALL a new coolant expansion tank as necessary.
	•Exhaust gas recirculation (EGR) cooler - vehicles with 2.0L diesel engine.	•INSPECT the EGR cooler for leaks. CARRY OUT the Pressure Test Component Test in this section. INSTALL a new EGR cooler as necessary. REFER to Section 303-08B.
	•Engine oil cooler - vehicles with 2.0L diesel engine.	•INSPECT the engine oil cooler for leaks. CARRY OUT the Pressure Test Component Test in this section. INSTALL a new engine oil cooler as necessary.
	•Heater core.	•CHECK the heater core for leaks.
	•Engine.	•INSPECT the engine, cylinder head, cylinder block and cylinder head gasket. REFER to Section 303-00.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
•The engine overheats (signs of coolant boiling)	•Cooling system does not hold pressure.	•CARRY OUT the Coolant Expansion Tank Pressure Cap Pressure Test Component Test in this section. – INSPECT the coolant expansion tank for damage. INSTALL a new coolant expansion tank as necessary. – INSPECT the water pump or water pump gasket for damage. INSTALL a new water pump or water pump gasket as necessary. REFER to Water Pump - vehicles with 1.8L or 2.0L engine / Water Pump - vehicles with 2.5L or 3.0L engine in this section. – INSPECT the engine, cylinder head, cylinder block and cylinder head gasket. REFER to Section 303-00.
	•Air in system.	•BLEED the cooling system. REFER to Cooling System Draining, Filling and Bleeding - vehicles with 1.8L or 2.0L engine / Cooling System Draining, Filling and Bleeding - vehicles with 2.5L or 3.0L engine in this section.
	•Coolant expansion tank pressure cap or seal.	•CARRY OUT the Coolant Expansion Tank Pressure Cap Pressure Test Component Test in this section.
	•Coolant expansion tank.	•INSPECT the coolant expansion tank for damage. INSTALL a new coolant expansion tank as necessary.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
	•Coolant level or condition.	•CHECK the coolant level. REFILL the cooling system as necessary. REFER to Cooling System Draining, Filling and Bleeding - vehicles with 1.8L or 2.0L engine / Cooling System Draining, Filling and Bleeding - vehicles with 2.5L or 3.0L engine in this section. •CHECK the coolant condition. If the coolant is in poor condition drain and refill with new coolant. REFER to Cooling System Draining, Filling and Bleeding - vehicles with 1.8L or 2.0L engine / Cooling System Draining, Filling and Bleeding - vehicles with 2.5L or 3.0L engine in this section.
	•Coolant concentration.	• REFER to Specifications in this section.
	•Radiator grille.	•INSPECT the radiator grille for air restrictions or damage. REPAIR or INSTALL new parts as necessary.
	•Water pump.	•CARRY OUT the Pressure Test Component Test in this section. INSPECT the water pump for leaks. INSTALL a new water pump or water pump gasket as necessary. REFER to Water Pump - vehicles with 1.8L or 2.0L engine / Water Pump - vehicles with 2.5L or 3.0L engine in this section.
	•Thermostat.	•CARRY OUT the Thermostat Test Component Test in this section. INSTALL a new thermostat as necessary. REFER to Thermostat Housing - vehicles with 1.8L or 2.0L engine / Thermostat - vehicles with 2.5L or 3.0L engine in this section.
	•Accessory drive belt - all except vehicles with 2.0L diesel engine.	•CHECK the accessory drive belt for correct operation. REFER to Section 303-05.
	•Power steering pump belt - vehicles with 2.0L diesel engine.	•CHECK the power steering pump belt for correct operation. REFER to Section 303-05.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
	•Cooling fan.	•CHECK the operation of the cooling fan. REFER to WDS.
	•Engine.	•INSPECT the engine, cylinder head, cylinder block and cylinder head gasket. REFER to Section 303-00.
•The engine does not reach normal operating temperature.	•Thermostat.	•CARRY OUT the Thermostat Test Component Test in this section. INSTALL a new thermostat as necessary. REFER to Thermostat Housing - vehicles with 1.8L or 2.0L engine / Thermostat - vehicles with 2.5L or 3.0L engine in this section.

Component Tests

Pressure Test

WARNING: When releasing the system pressure, cover the coolant expansion tank cap with a thick cloth to prevent the possibility of coolant scalding. Failure to follow this instruction may result in personal injury.

1. Remove the coolant expansion tank pressure cap.
2. Install the special tools to the coolant expansion tank.
3. Pressurize the system to the coolant expansion tank cap release pressure. REFER to Specifications in this section.
4. Observe the cooling system pressure tester gauge reading for approximately two minutes. The pressure should not drop during this time. If the system holds pressure, proceed to step 7. If the system does not hold pressure, check it thoroughly for coolant leaks.
5. On vehicles with 2.0L diesel engine - if a coolant leak cannot be found, check the EGR cooler (this may leak internally), engine oil cooler (this may produce oil in the coolant expansion tank and the engine for cylinder leakage. REFER to Section 303-00. Drain the cooling system, repair any coolant leaks found and fill and bleed the cooling system as necessary.
6. All vehicles except with diesel engine - check the engine for coolant leaks REFER to Section 303-00. Drain the cooling system, repair any coolant leaks found and fill and bleed the cooling system as necessary. REFER to Cooling System Draining, Filling and Bleeding - vehicles with 1.8L or 2.0L engine / Cooling System Draining, Filling and Bleeding - vehicles with 2.5L or 3.0L engine in this section.
7. Recheck the system by repeating steps 3 and 4 at least twice.

Thermostat Test - Vehicles with 2.5L, 3.0L engine or 2.0L diesel engine

Remove the thermostat and immerse it in water. Heat the water until it reaches 88º C (190º F). At this temperature the thermostat should begin to open. If it does not begin to open, install a new thermostat. REFER to Thermostat - vehicles with 2.5L or 3.0L engine in this section.

Radiator Leak Test, Removed From Vehicle

CAUTION: Radiator internal pressure must not exceed 130 kpa (20 psi) or damage may result.

Clean the radiator thoroughly before leak testing it, to prevent contamination of the water in the test tank. Leak test the radiator in clean water with 138 kpa (20 psi) air pressure. Check it thoroughly for air leaks. Install a new radiator if necessary. REFER to Radiator in this section.

DIAGNOSIS AND TESTING (Continued)

Coolant Expansion Tank Pressure Cap Pressure Test

WARNING: When releasing the system pressure, cover the coolant expansion tank cap with a thick cloth to prevent the possibility of coolant scalding. Failure to follow this instruction may result in personal injury.

1. Remove the coolant expansion tank pressure cap.
2. Use water to clean the area of the rubber seal and pressure relief valve. Install the pressure tester and adapter and immerse the coolant expansion tank pressure cap in water .

NOTE: If the plunger of the pump is depressed too quickly, an erroneous pressure reading will result.

3. Slowly depress the plunger of the pressure test pump until the pressure test gauge reading stops increasing, and note the highest pressure reading obtained.
4. Release pressure by turning the pressure relief screw counterclockwise. Tighten the pressure relief screw and repeat step 3 at least twice to make sure the pressure test gauge reading is repeatable and within acceptable gauge reading limits of the coolant expansion tank pressure cap.
5. If the pressure test gauge readings are not within the acceptable gauge reading limits, install a new coolant expansion tank pressure cap.

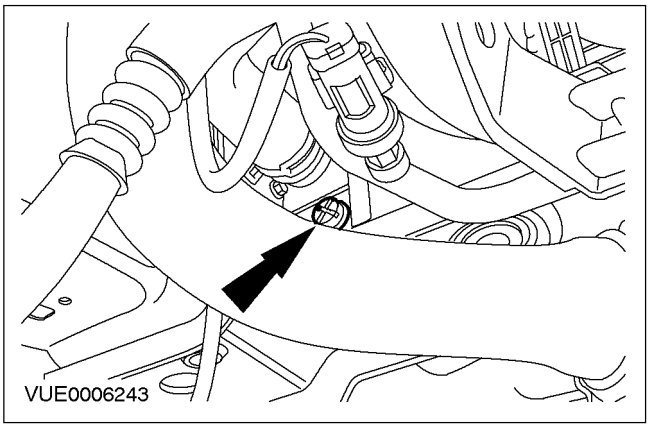
GENERAL PROCEDURES

Cooling System Draining, Filling and Bleeding — 1.8L/2.0L (24 122 0)

Draining

1. **WARNING: When releasing the cooling system pressure, cover the expansion tank cap with a thick cloth to prevent the possibility of scalding. Failure to follow this instruction may result in personal injury.**

   Release the cooling system pressure by slowly turning the coolant expansion tank cap a quarter of a turn.
2. **Remove the coolant expansion tank cap.**
3. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
4. **Drain the cooling system.**
   - Allow the coolant to drain into a suitable container.



5. **Install the radiator drain plug.**
6. **Lower the vehicle.**

Filling and Bleeding

1. **Fill the coolant expansion tank to the MAX mark.**
2. **NOTE:** Do not allow the engine to reach normal operating temperature.

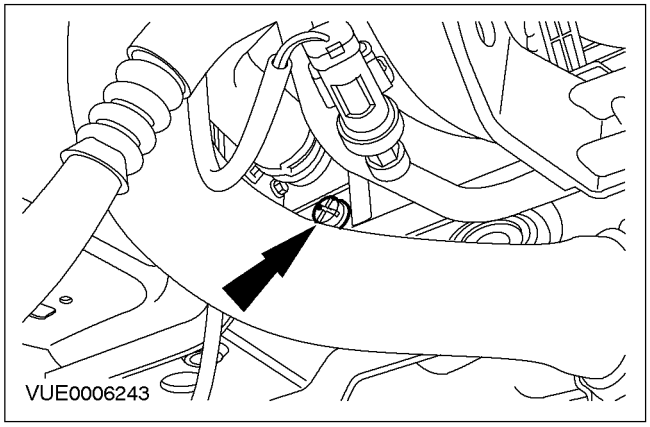
   Start the engine, run the engine briefly at 2500 revolutions per minute (RPM) for 10 seconds to prime the heater circuit.
3. **Switch the engine off.**
4. **Fill the coolant expansion tank 15 mm over the MAX mark.**
5. **Install the coolant expansion tank cap.**
6. **Start the engine, maintain the engine speed at 2500 RPM for eight minutes or until the engine reaches normal operating temperature.**
7. **Maintain the engine speed at 2500 RPM for three minutes after the engine has reached normal operating temperature.**
8. **Increase the engine speed to 4000 RPM for five seconds.**
9. **Decrease the engine speed to 2500 RPM for three minutes.**
10. **Increase the engine speed to 4000 RPM for five seconds.**
11. **Decrease the engine speed to 2500 RPM for three minutes.**
12. **Switch the engine off.**
13. **Check the cooling system for leaks.**
14. **Allow the engine to cool.**
15. **Fill the coolant expansion tank to the MAX mark.**

GENERAL PROCEDURES

Cooling System Draining, Filling and Bleeding — 2.5L/3.0L (24 122 0)

1. **WARNING: When releasing the cooling system pressure, cover the expansion tank cap with a thick cloth to prevent the possibility of scalding. Failure to follow this instruction may result in personal injury.**

   Release the cooling system pressure by slowly turning the coolant expansion tank cap a quarter of a turn.
2. **Remove the coolant expansion tank cap.**
3. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
4. **Drain the cooling system.**
   - Allow the coolant to drain into a suitable container.



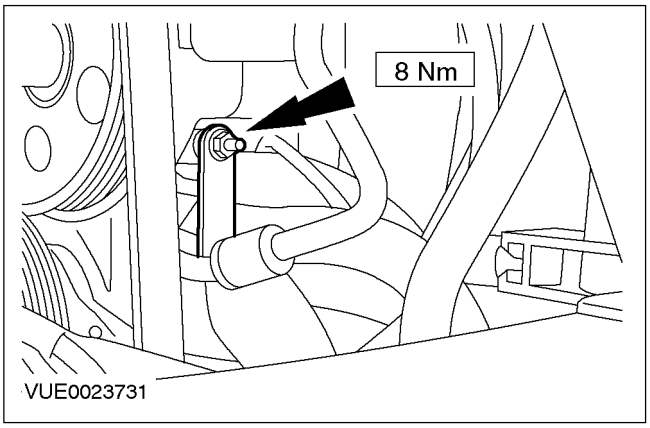
5. **Install the radiator drain plug.**
6. **Lower the vehicle.**
7. **Fill the coolant expansion tank to the MAX mark.**
8. **Start the engine and allow it to idle until it reaches normal operating temperature.**
9. **Allow the engine to idle for a further five minutes.**
10. **Switch the engine off.**
11. **Allow the engine to cool.**
12. **Fill the coolant expansion tank to the MAX mark.**
13. **Install the coolant expansion tank cap.**

REMOVAL AND INSTALLATION

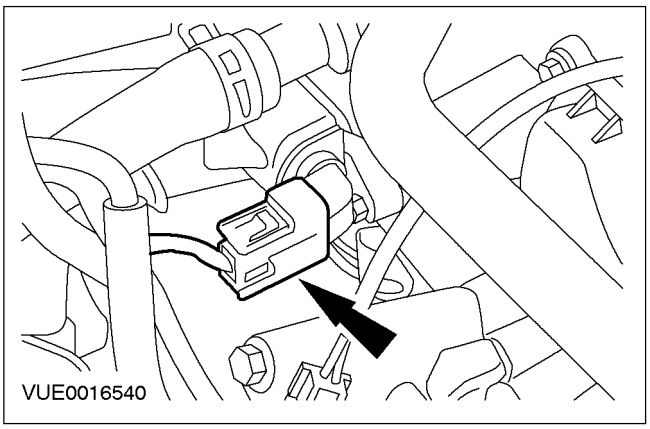
Thermostat Housing — 1.8L/2.0L (24 001 0)

Removal

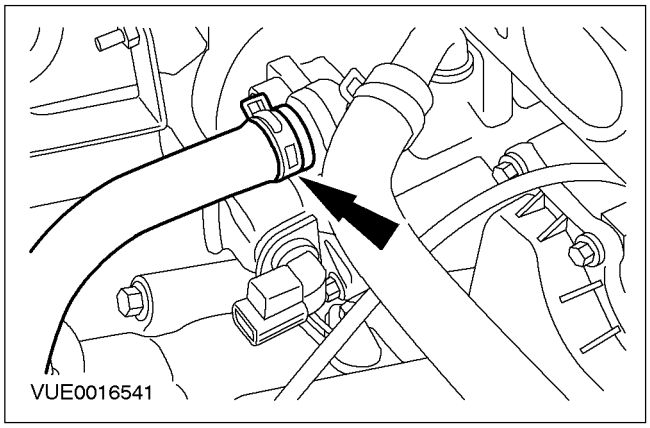
1. Remove the right-hand headlamp assembly. For additional information, refer to Section 417-01.
2. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.
3. Detach the power steering pump supply line bracket.



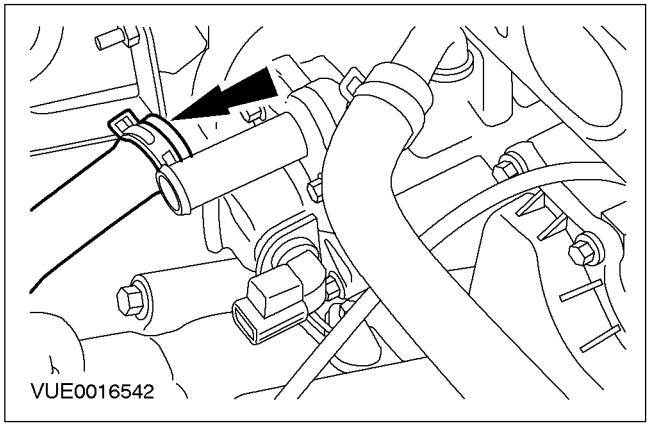
4. Disconnect the electrical connector from the thermostat housing (intake manifold shown removed for clarity).



5. Disconnect the coolant hose from the thermostat housing (intake manifold shown removed for clarity).



6. Disconnect the coolant hose from the thermostat housing (intake manifold shown removed for clarity).

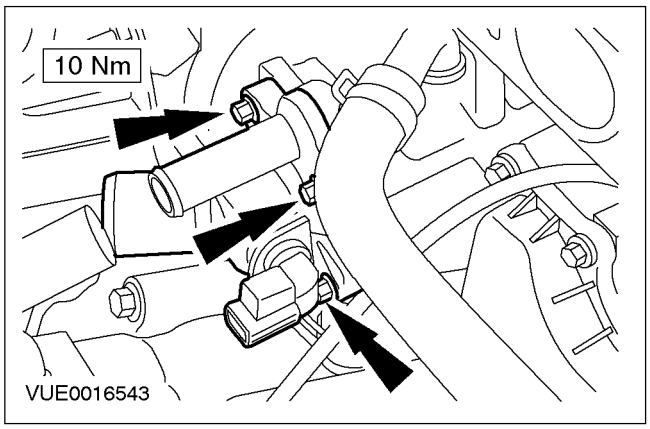


REMOVAL AND INSTALLATION (Continued)

7. **NOTE:** The thermostat cannot be removed from the thermostat housing.

   Remove the thermostat housing retaining bolts and remove the thermostat housing (intake manifold shown removed for clarity).

   - Discard the O-ring seal.



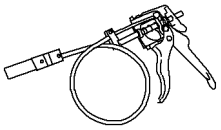
Installation

1. **NOTE:** Install a new thermostat housing O-ring seal.

   To install, reverse the removal procedure.

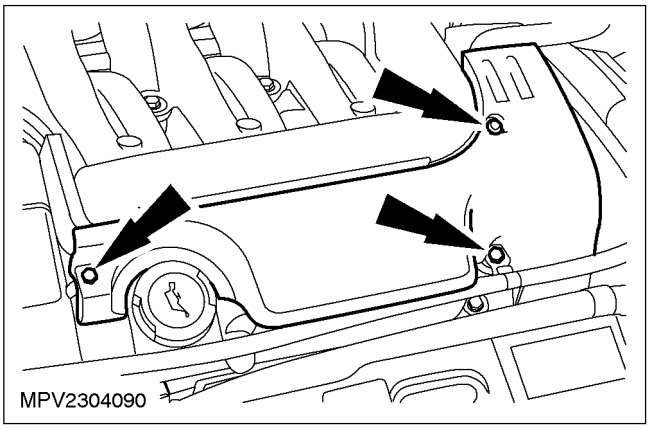
REMOVAL AND INSTALLATION

Thermostat — 2.5L/3.0L (24 454 0)

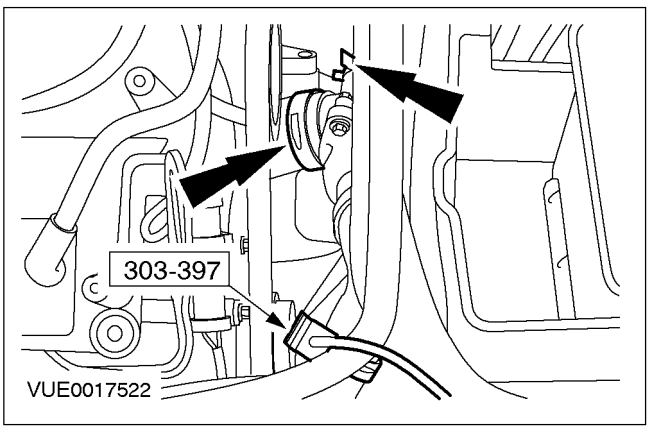
Special Tool(s)	
 24003	Remover/Installer, Cooling Hose Clamp 303-397 (24-003)

Removal

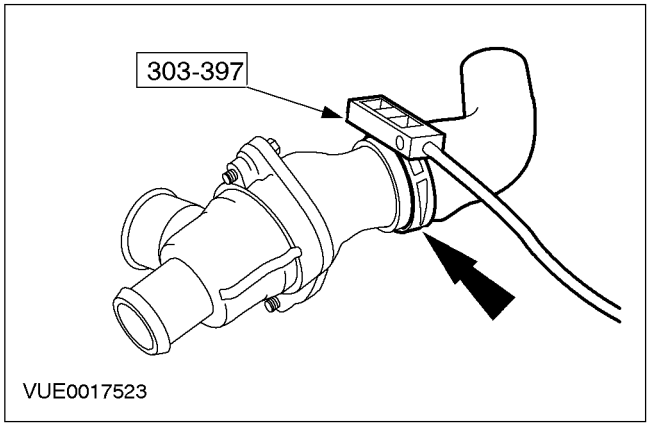
1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.**
3. **Remove the water pump pulley cover.**



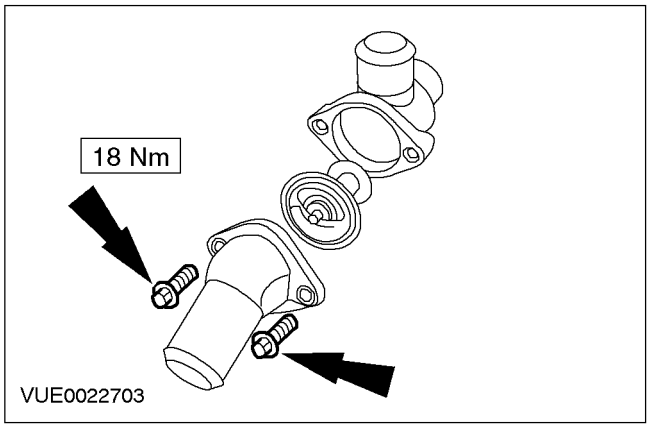
4. **Using the special tool, disconnect the coolant hoses and remove the thermostat housing and the radiator lower coolant hose.**



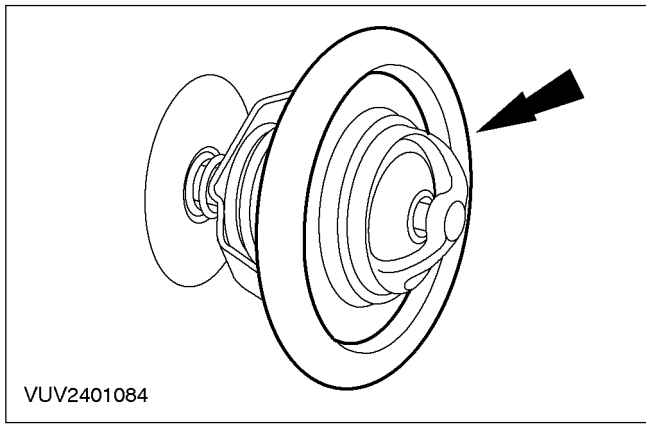
5. **Using the special tool, remove the radiator lower coolant hose from the thermostat housing.**



6. **Remove the thermostat housing retaining bolts and separate the thermostat housing.**



7. **Remove the thermostat.**
   - Discard the O-ring seal.



REMOVAL AND INSTALLATION (Continued)

Installation

1. **NOTE:** Install a new O-ring seal.

   To install, reverse the removal procedure.

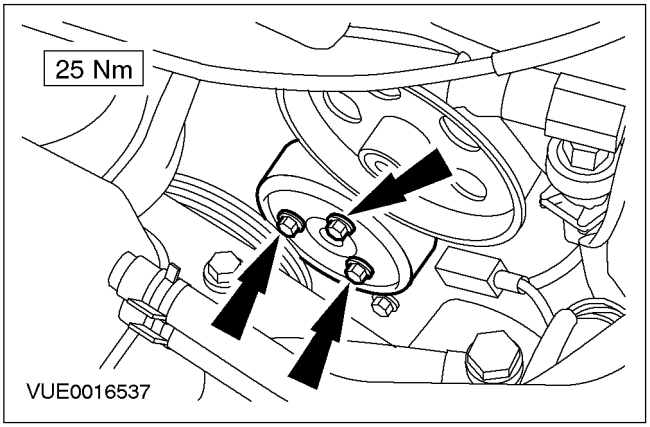
REMOVAL AND INSTALLATION

Water Pump — 1.8L/2.0L (24 404 0)

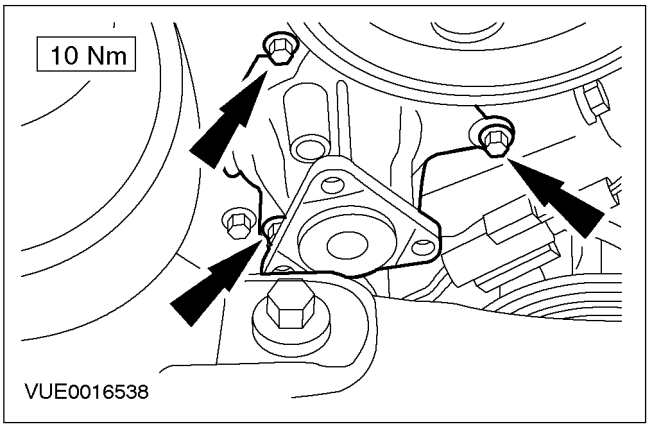
Name	Specification
Merpol grease	ESE-M99M144-B

Removal

1. **Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.**
2. **Loosen the water pump pulley retaining bolts.**



3. **Remove the accessory drive belt. For additional information, refer to Section 303-05.**
4. **Lower the vehicle.**
5. **Remove the water pump pulley.**
6. **Remove the water pump retaining bolts and remove the water pump (coolant expansion tank removed for clarity).**
   - Discard the O-ring seal.



Installation

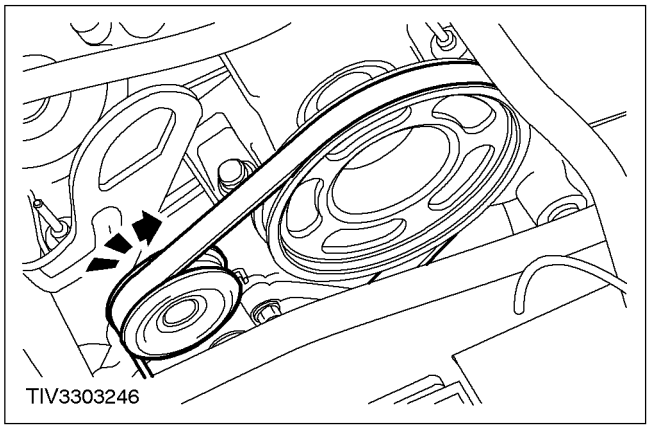
1. **To install, reverse the removal procedure.**
   - Install a new O-ring seal and lubricate with merpol grease.

REMOVAL AND INSTALLATION

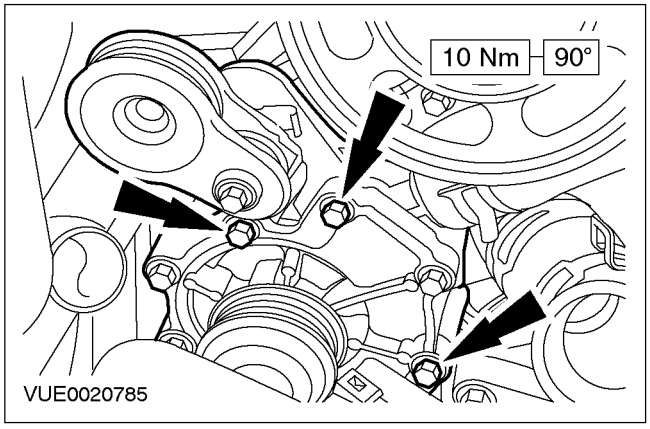
Water Pump — 2.5L/3.0L (24 404 0)

Removal

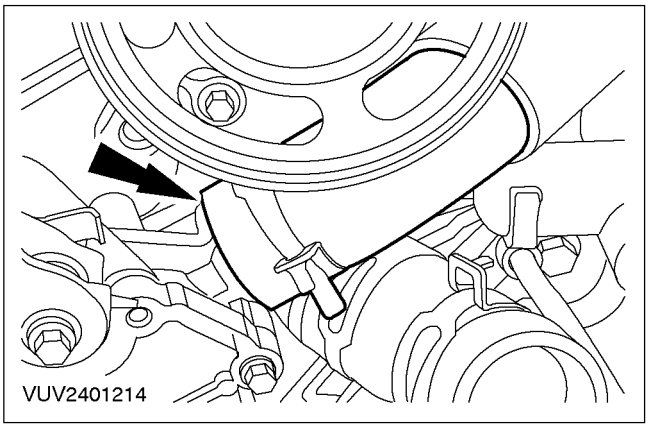
1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Remove the air cleaner. For additional information, refer to Section 303-12.**
3. **Remove the thermostat housing. For additional information, refer to Thermostat - Vehicles with 2 in this section.**
4. **Remove the water pump drive belt.**
   - Rotate the water pump drive belt tensioner clockwise.



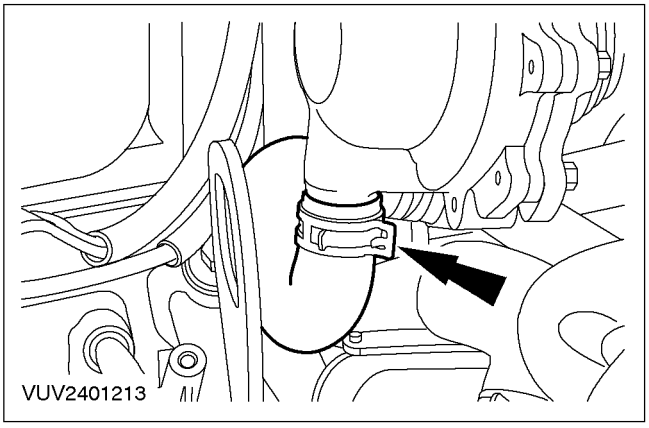
5. **Remove the water pump retaining bolts.**



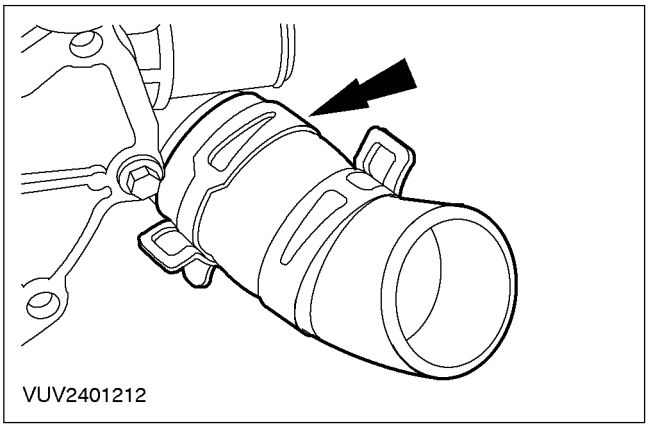
6. **Disconnect the coolant hose from the water pump.**



7. **Disconnect the heater hose and remove the water pump and coolant hose assembly.**



8. **Remove the coolant hose from the water pump.**



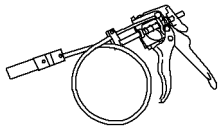
REMOVAL AND INSTALLATION (Continued)

Installation

1. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

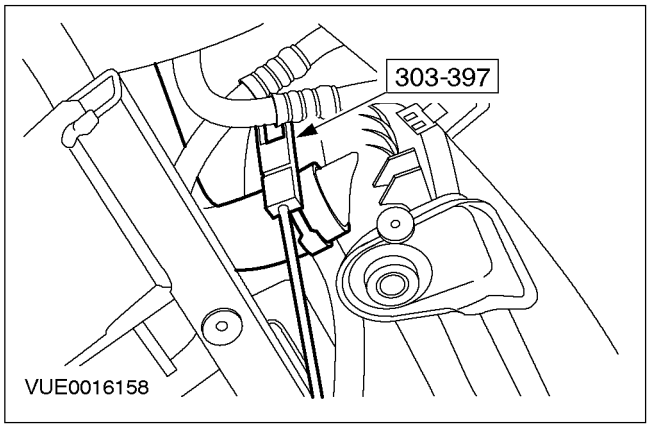
Radiator (24 254 0)

Special Tool(s)	
 24003	Remover/Installer, Cooling Hose Clamp 303-397 (24-003)

Removal

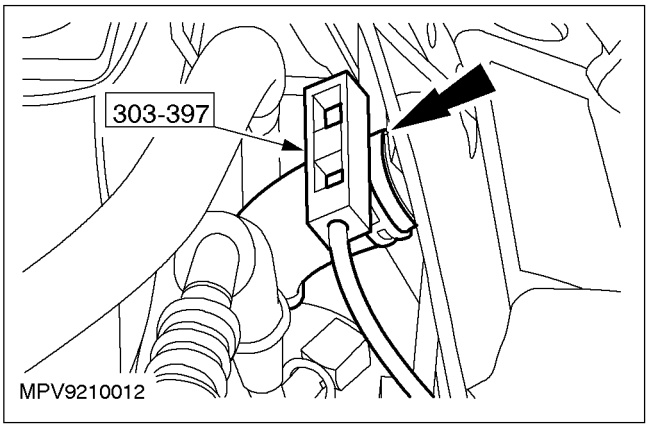
All vehicles

1. **Drain the cooling system.** **For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.**
2. **Remove the cooling fan motor and shroud.** **For additional information, refer to Cooling Fan Motor and Shroud in this section.**
3. **Using the special tool, disconnect the radiator lower hose.**

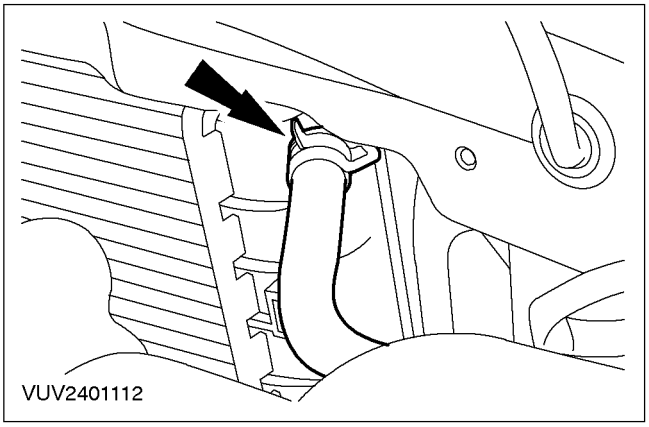


Vehicles with 2.5L or diesel engine

4. **Lower the vehicle.**
5. **Using the special tool, disconnect the radiator upper hose.**



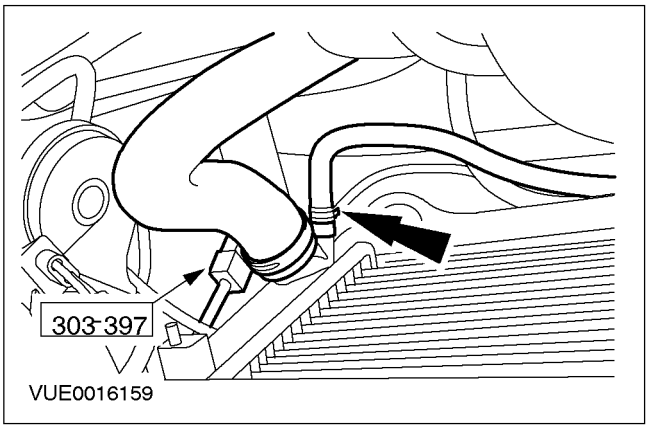
6. **Disconnect the coolant expansion tank hose.**



7. **Raise the vehicle**

Vehicles with 1.8L or 2.0L engine

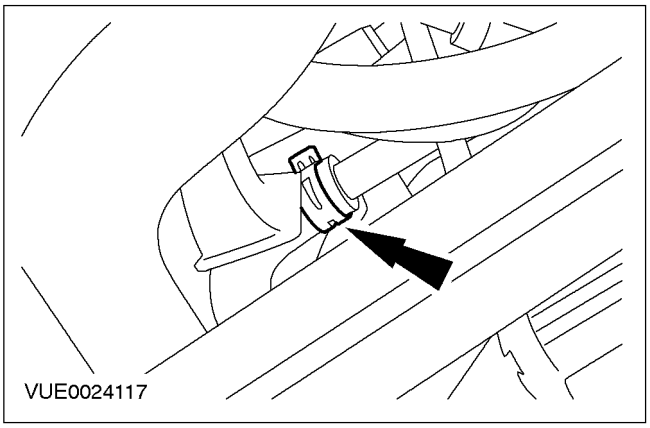
8. **Using the special tool, disconnect the coolant expansion tank hose and the radiator upper hose.**



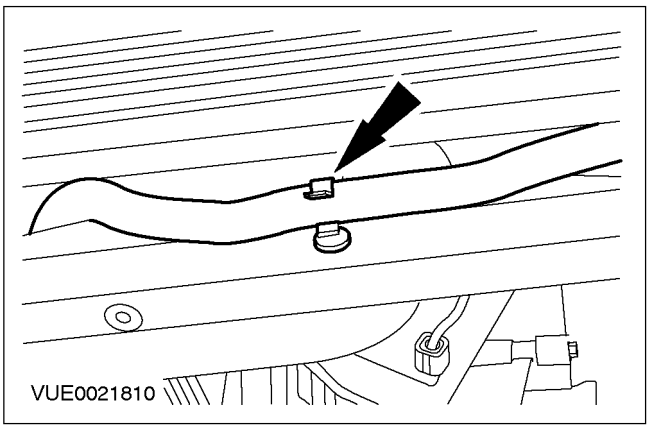
REMOVAL AND INSTALLATION (Continued)

Vehicles with 2.0L diesel engine

9. Disconnect the oil cooler coolant hose from the radiator.



10. Detach the oil cooler coolant hose from the retaining clip and remove the retaining clip from the subframe.

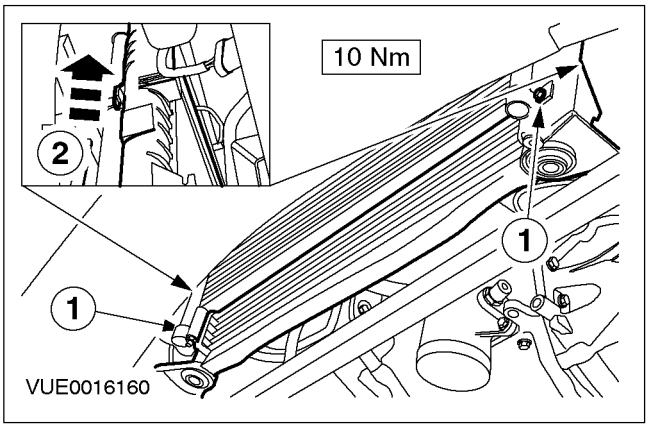


All vehicles

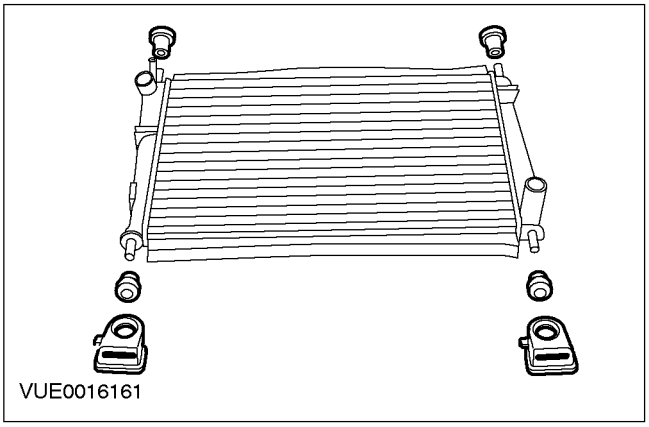
11. NOTE: Support the air conditioning condenser.

Remove the radiator.

1. Remove the air conditioning condenser retaining bolts.
2. Slide the cooling fan motor and shroud upwards out of the retaining brackets and downwards to remove the radiator.



12. Remove the radiator rubber insulators.



Installation

1. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

Cooling Fan Motor and Shroud — 1.8L/2.0L/2.5L, Vehicles With: Manual Transaxle/4-Speed Automatic Transaxle/5-Speed Automatic Transaxle (24 222 0)

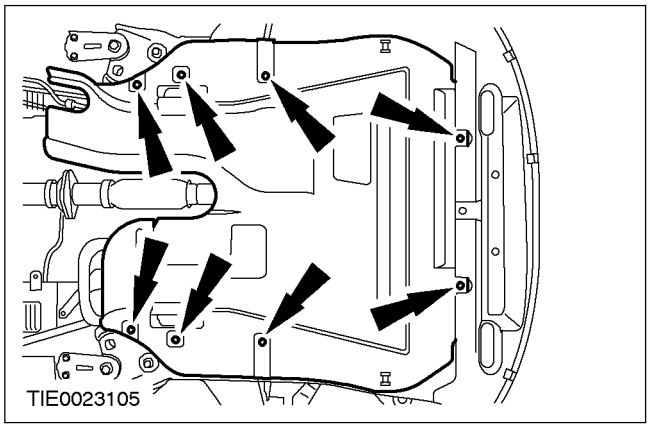
Removal

All vehicles

1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Raise and support the vehicle. For additional information, refer to Section 100-02.**

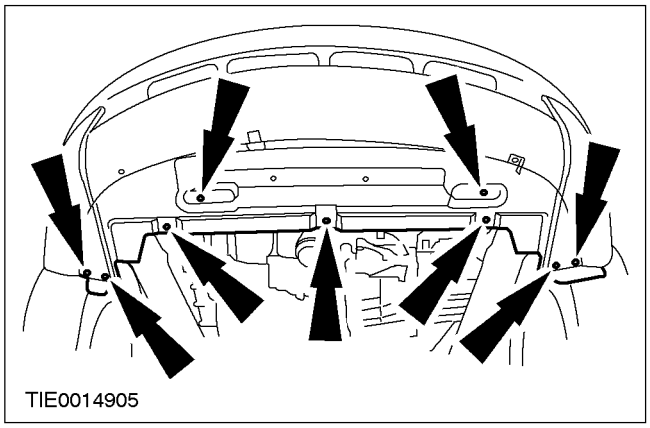
Vehicles with 2.0L diesel engine

3. **Remove the engine undershield.**

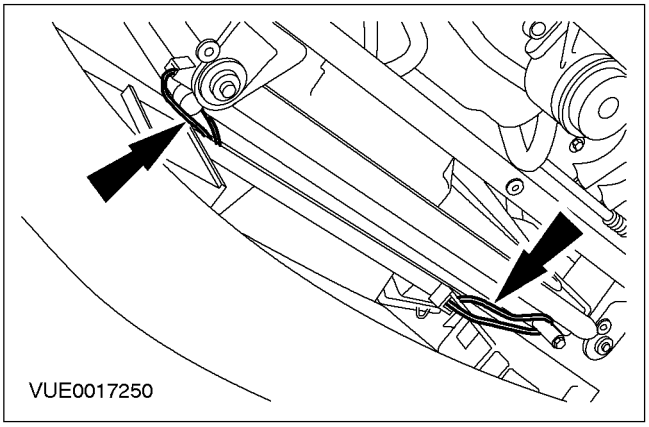


All vehicles

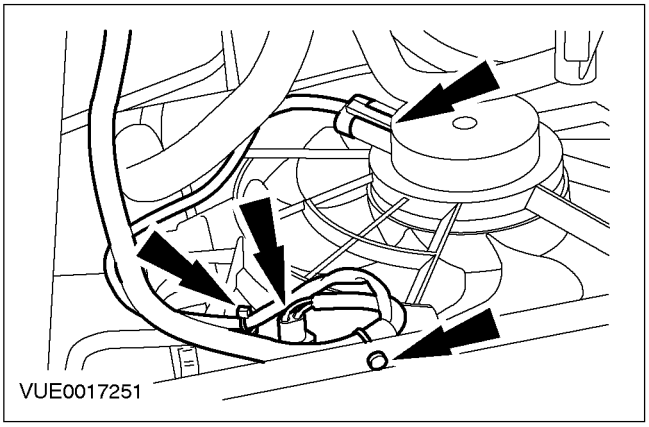
4. **Remove the splash shield.**



5. **Using suitable pieces of wire support the radiator.**

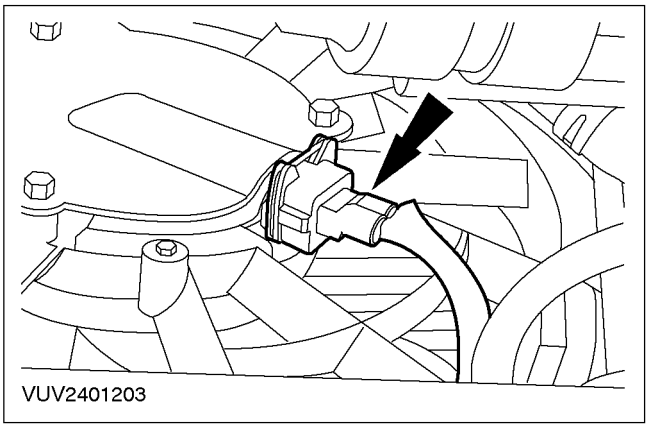


6. **Disconnect the cooling fan motor electrical connectors and detach the wiring harness from the radiator support bracket.**



Vehicles with 2.5L engine

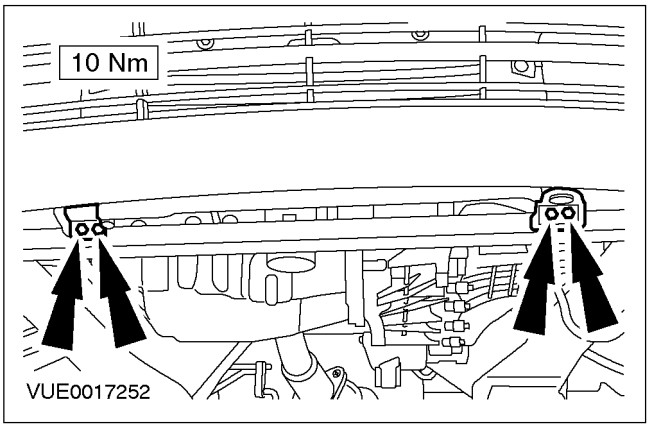
7. **Disconnect the cooling fan motor electrical connector.**



REMOVAL AND INSTALLATION (Continued)

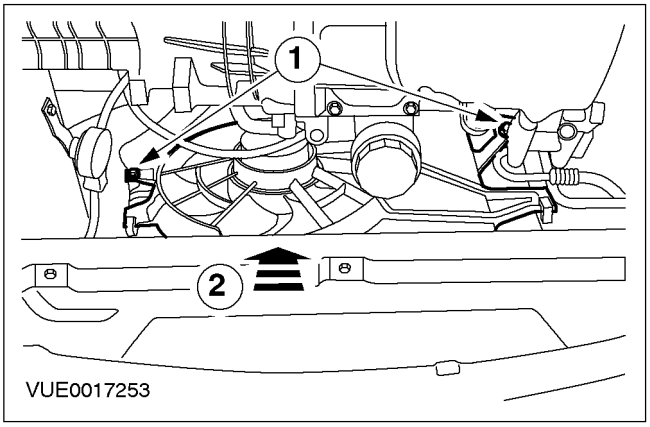
All vehicles

8. Remove the radiator support bracket retaining bolts.



9. Remove the cooling fan motor and shroud.

1. Remove the cooling fan motor and shroud retaining nuts.
2. Slide the cooling fan motor and shroud upwards out of the retaining brackets and then downwards to remove.



Installation

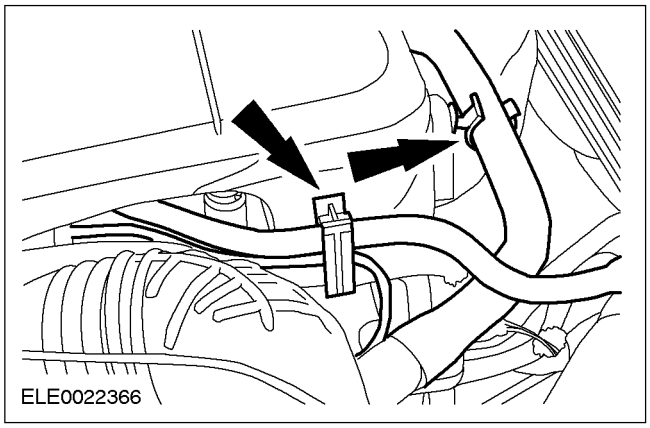
1. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

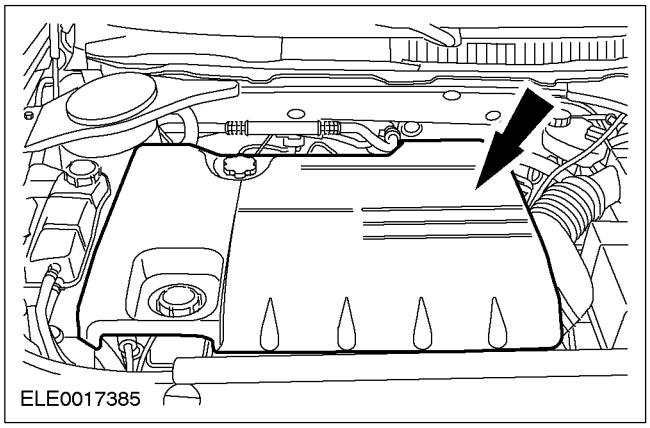
Coolant Outlet Connector — 1.8L/2.0L

Removal

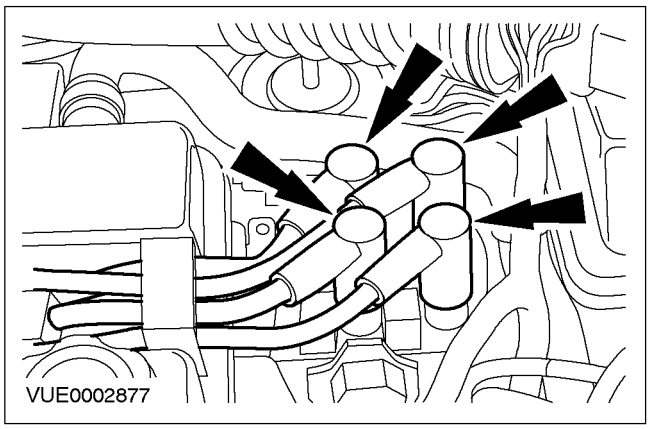
1. Detach the pipes and hoses from the engine upper cover.



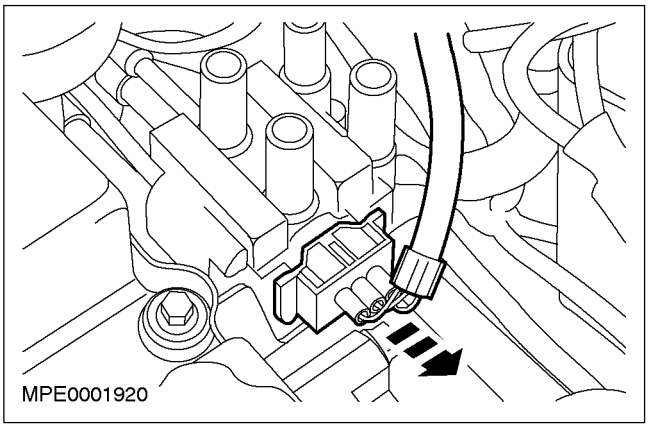
2. Remove the engine upper cover.



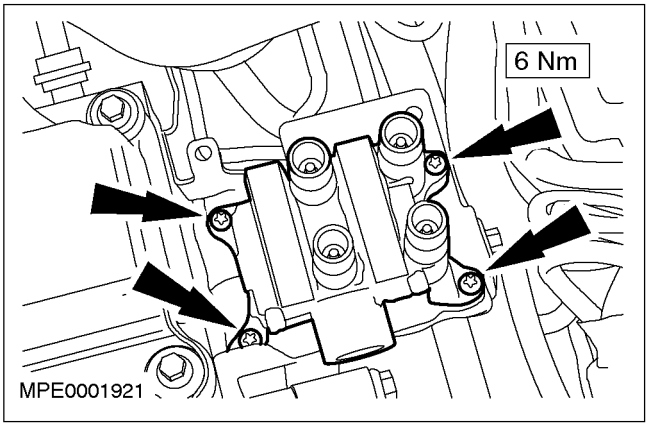
3. Disconnect the spark plug wires from the ignition coil pack.



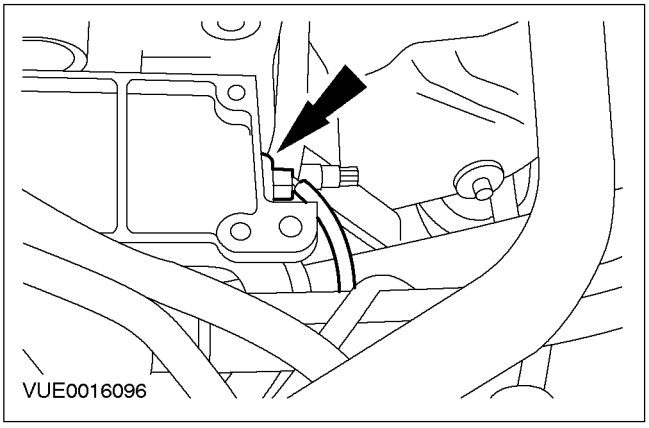
4. Disconnect the ignition coil pack electrical connector.



5. Remove the ignition coil pack.

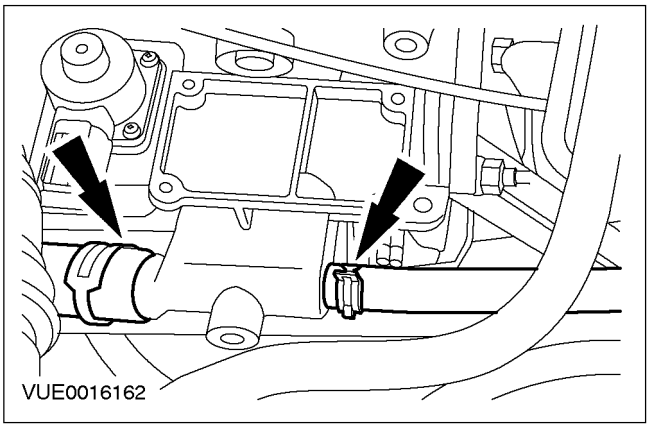


6. Drain the cooling system. For additional information, refer to Section 303-03.
7. Disconnect the engine coolant temperature (ECT) sensor electrical connector.

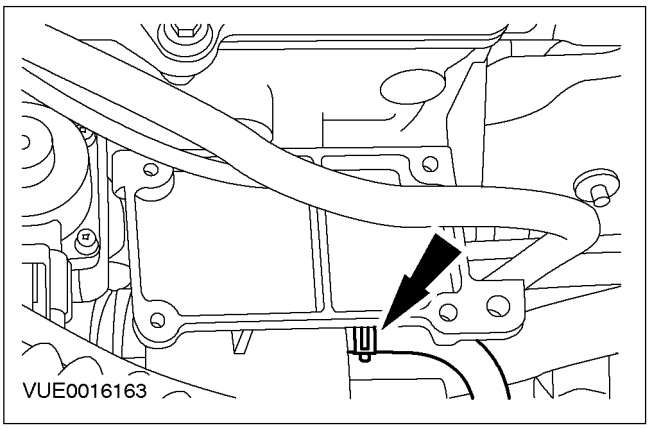


REMOVAL AND INSTALLATION (Continued)

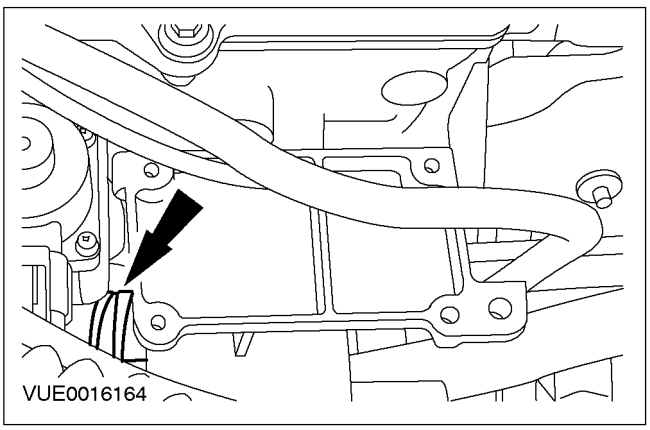
8. Disconnect the radiator hose and the heater hose from the coolant outlet connector.



9. Disconnect the coolant expansion tank hose from the coolant outlet connector.

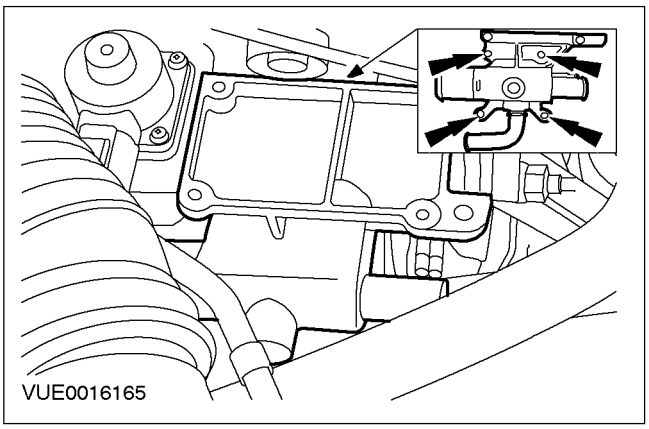


10. Disconnect the thermostat housing coolant hose from the coolant outlet connector.



11. Remove the coolant outlet connector.

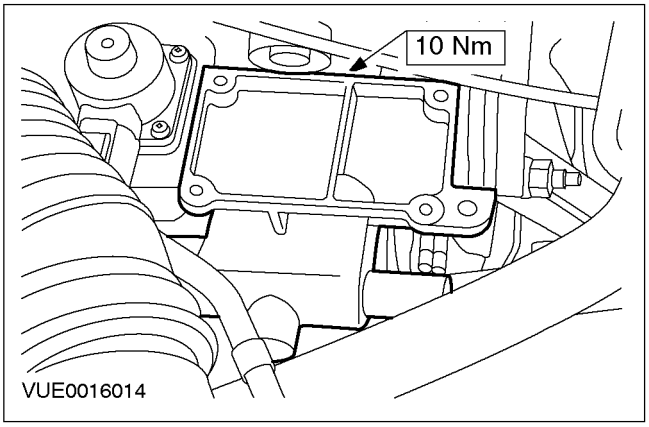
- Discard the gasket.



Installation

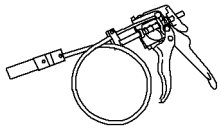
1. NOTE: Install a new coolant outlet connector gasket.

To install, reverse the removal procedure.



REMOVAL AND INSTALLATION

Bypass Tube — 2.5L/3.0L

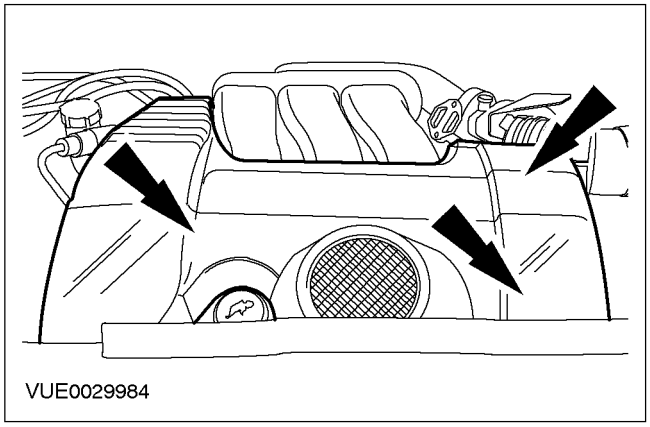
Special Tool(s)	
 24003	Remover/Installer, Cooling Hose Clamp 303-397 (24-003)

Name	Specification
Lubricant ESE-M99B176-A	

Removal

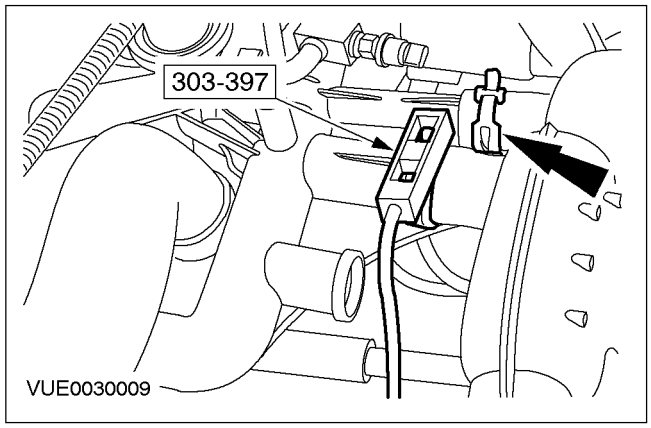
Vehicles with 3.0L engine

1. **Remove the engine cover.**
   - Detach the retaining clips.

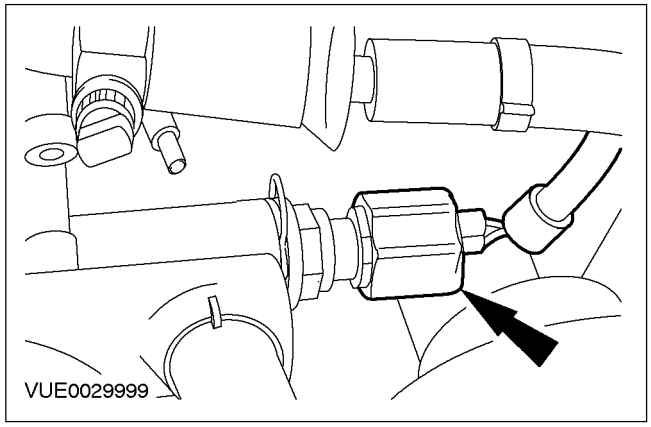


All vehicles

2. **Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.**
3. **Using the special tool, disconnect the coolant hoses.**

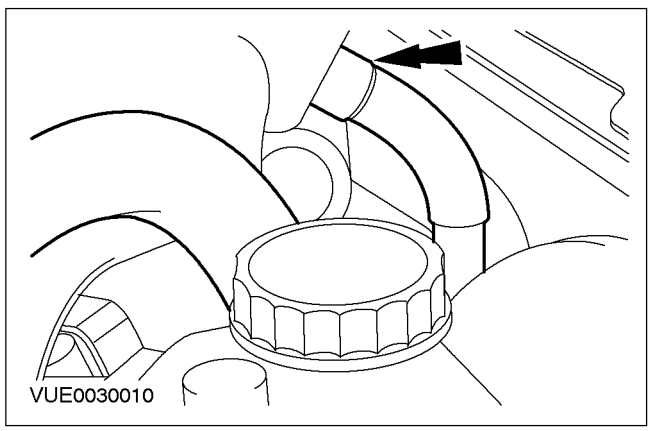


4. **Disconnect the engine coolant temperature (ECT) sensor electrical connector.**



Vehicles with 3.0L engine

5. **Disconnect the positive crankcase ventilation (PCV) hose from the intake manifold and position it to one side.**

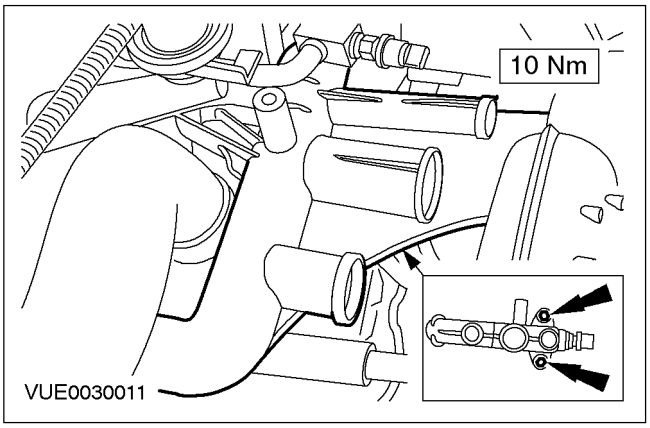


REMOVAL AND INSTALLATION (Continued)

All vehicles

6. Remove the bypass tube.

- Discard the bypass tube O-ring seal.



Installation

NOTE: Before installing the bypass tube lubricate the bypass tube O-ring seal.

1. To install, reverse the removal procedure.

SECTION 303-04A Fuel Charging and Controls

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

Specifications 303-04-2

DESCRIPTION AND OPERATION

Fuel Charging and Controls 303-04-3

DIAGNOSIS AND TESTING

Fuel Charging and Controls 303-04-5
Inspection and Verification 303-04-5

REMOVAL AND INSTALLATION

Fuel Injection Supply Manifold ..... (23 450 0) 303-04-6
Fuel Charging Wiring Harness ..... (36 437 0) 303-04-9
Throttle Body ..... (23 198 0) 303-04-11

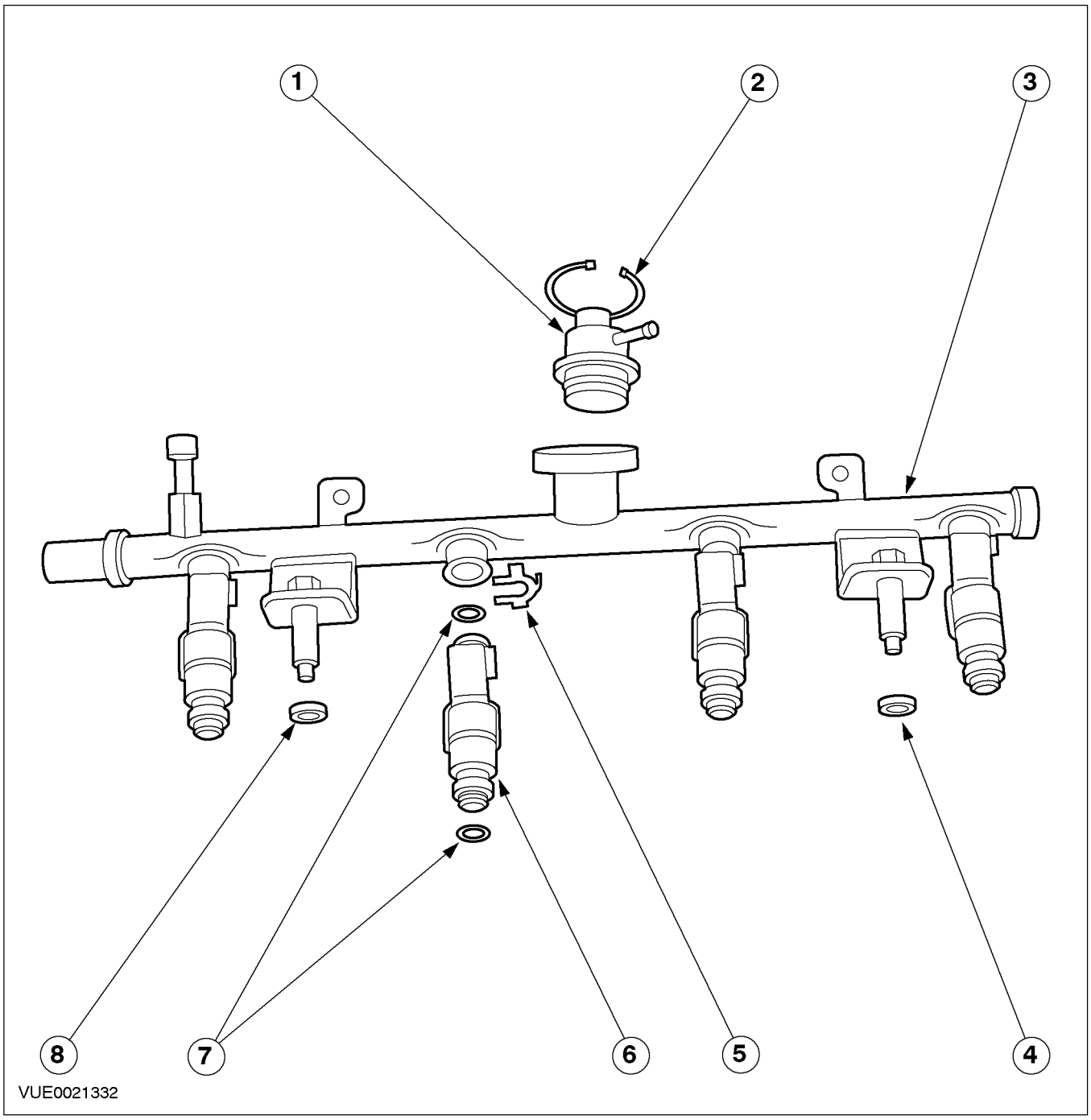
SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Throttle body retaining bolts	10	—	89
Fuel injection supply manifold retaining bolts	25	18	—

DESCRIPTION AND OPERATION

Fuel Charging and Controls



Item	Part Number	Description
1	-	Fuel pulse damper
2	-	Fuel pulse damper snap ring

Item	Part Number	Description
3	-	Fuel injection supply manifold
4	-	Fuel injection supply manifold spacer

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
5	-	Fuel injector retaining clip
6	-	Fuel injector
7	-	Fuel injector O-ring seals
8	-	Fuel injection supply manifold spacer

DIAGNOSIS AND TESTING

Fuel Charging and Controls

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Fuel leak(s) – Vacuum line – Gasket(s)/seal(s) – Fuel injector(s) – Fuel pulse damper – Throttle body – Fuel injection supply manifold	– Wiring harness – Electrical connector(s) – Fuel injector(s)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to WDS to diagnose the system.

REMOVAL AND INSTALLATION

Fuel Injection Supply Manifold (23 450 0)

Name	Specification
Engine oil	WSS-M2C913-A or WSS-M2C912-A1

Removal

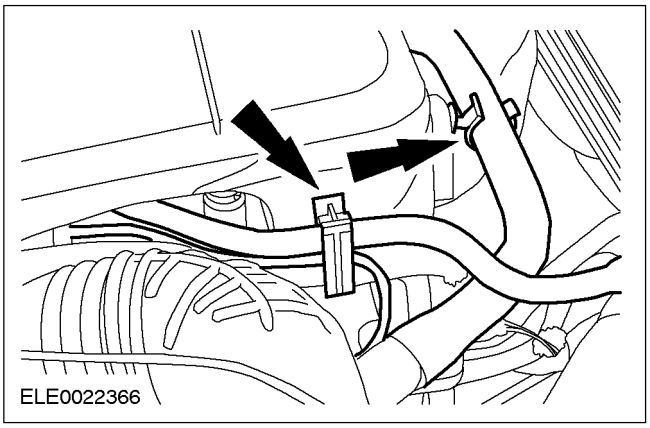
All vehicles

1. **WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.**

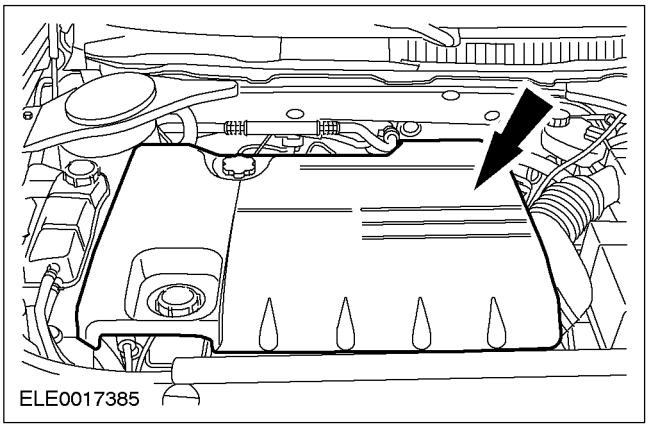
WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

Release the fuel system pressure. For additional information, refer to Section 310-00.

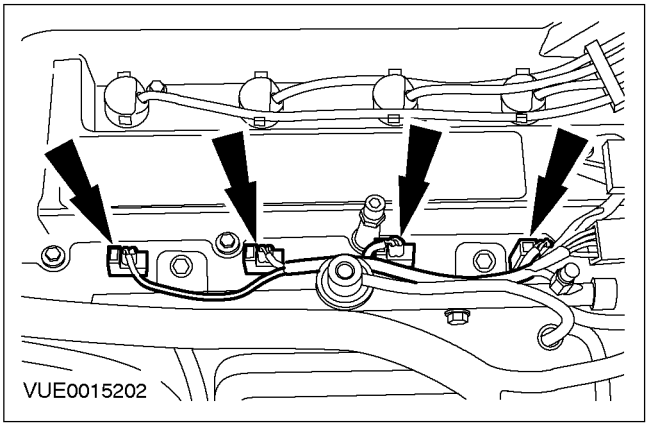
2. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
3. **Detach the positive crankcase ventilation (PCV) hose and the vacuum hose from the engine upper cover.**



4. **Remove the engine upper cover.**

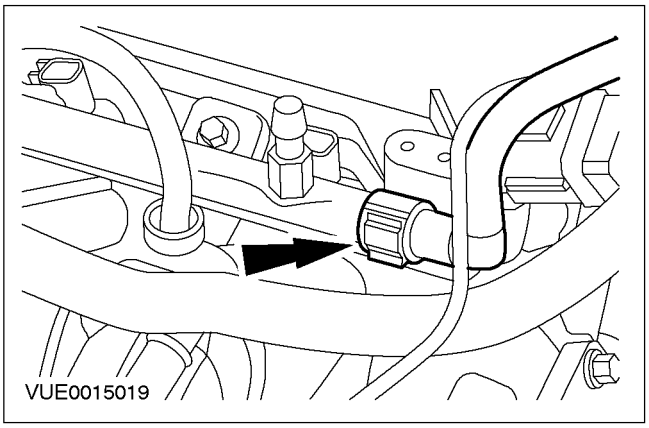


5. **Disconnect the fuel injector electrical connectors.**



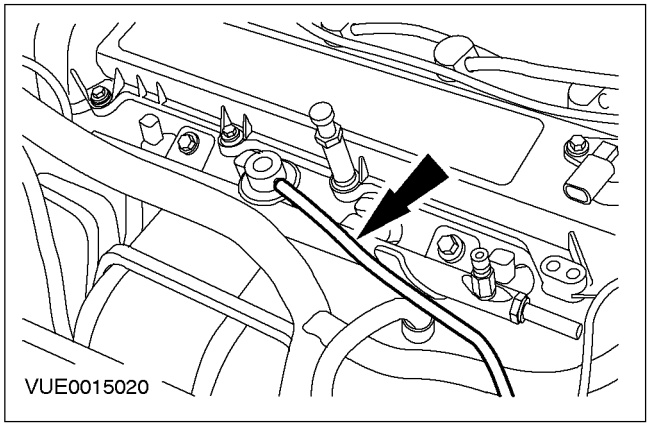
6. **NOTE:** Fuel supply line connectors are white or are identified by a white band. Fuel return line connectors are red or are identified by a red band.

Disconnect the fuel supply line from the fuel injection supply manifold. For additional information, refer to Section 310-00.

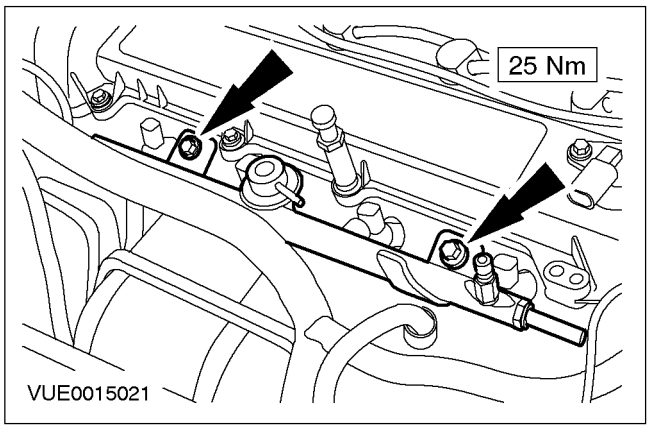


REMOVAL AND INSTALLATION (Continued)

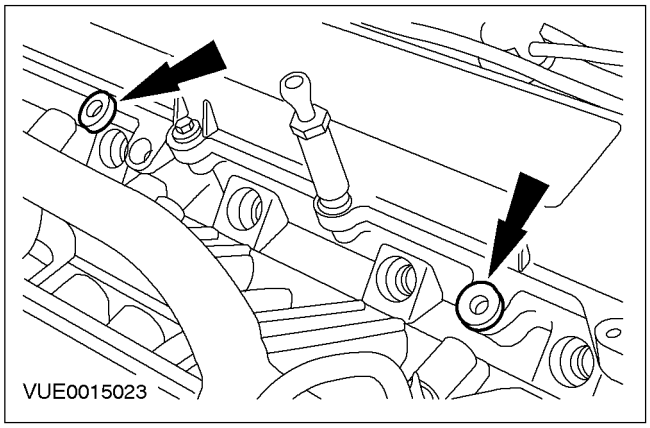
7. Disconnect the vacuum line from the fuel pulse damper.



8. Remove the fuel injection supply manifold retaining bolts and remove the fuel injection supply manifold.



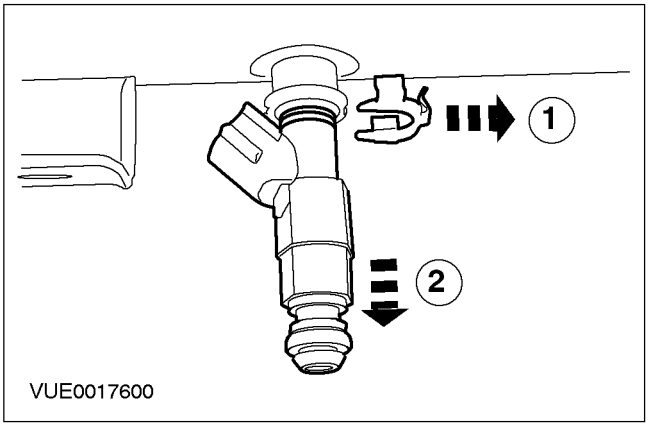
9. Remove the fuel injection supply manifold spacers.



Vehicles built up to 03/2002

10. Remove the fuel injectors.

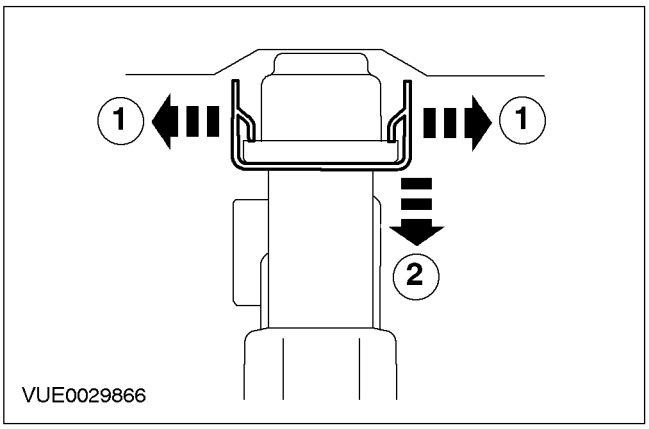
1. Remove and discard the fuel injector retaining clips.
2. Remove the fuel injectors.
   - Discard the O-ring seals.



Vehicles built 03/2002 onwards

11. Detach the fuel injector retaining clips.

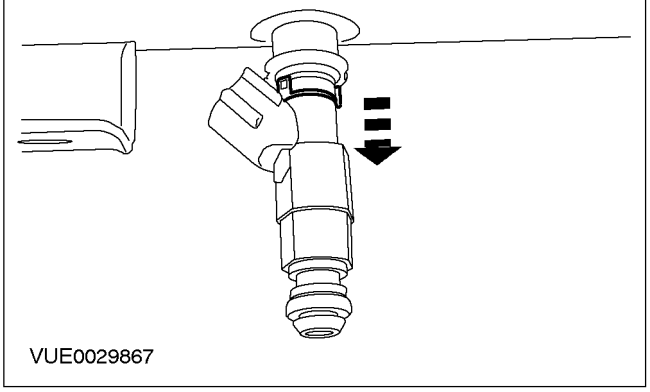
1. Release the locking tangs.
2. Remove the fuel injector retaining clips from the fuel injection supply manifold.



REMOVAL AND INSTALLATION (Continued)

12. Remove the fuel injectors.

- Remove and discard the fuel injector retaining clips from the fuel injectors.
- Remove and discard the O-ring seals.



Installation

1. WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

NOTE: Install new O-ring seals.

NOTE: Install new fuel injector retaining clips.

To install, reverse the removal procedure.

- Lubricate the fuel injector O-ring seals with clean engine oil to aid installation.

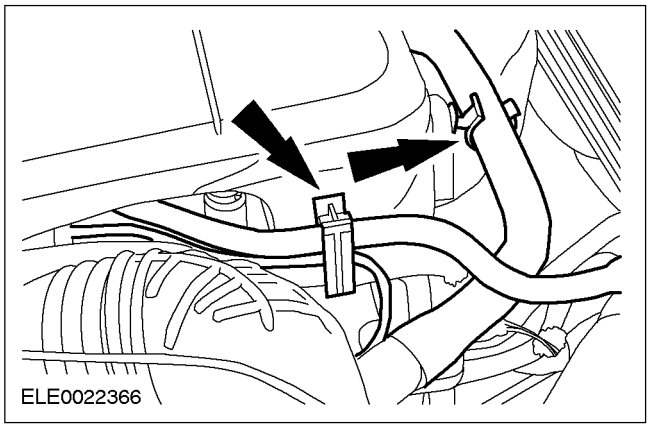
2. Initialize the door window motors. For additional information, refer to Section 501-11.

REMOVAL AND INSTALLATION

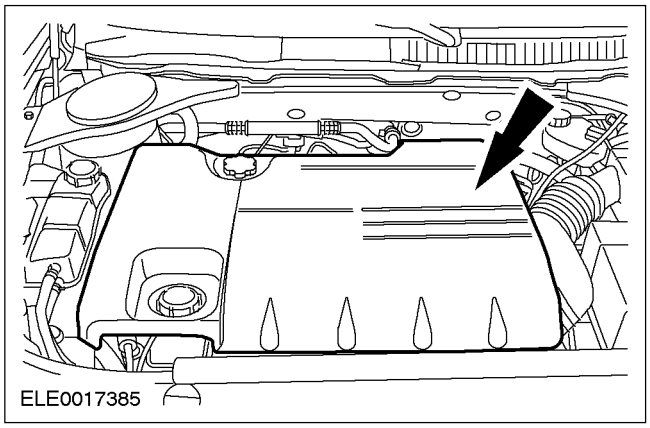
Fuel Charging Wiring Harness (36 437 0)

Removal

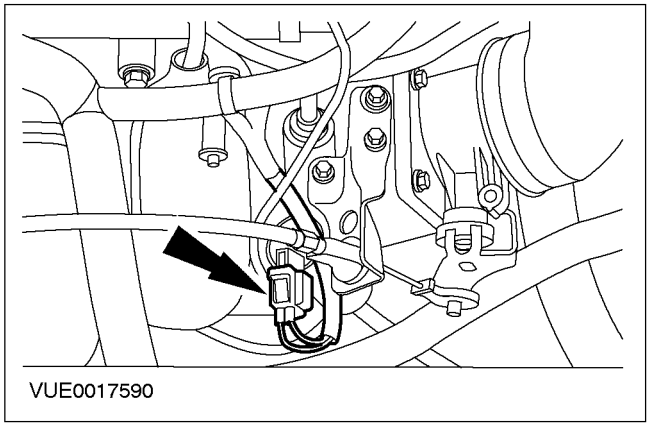
1. **Detach the pipes and hoses from the engine upper cover.**



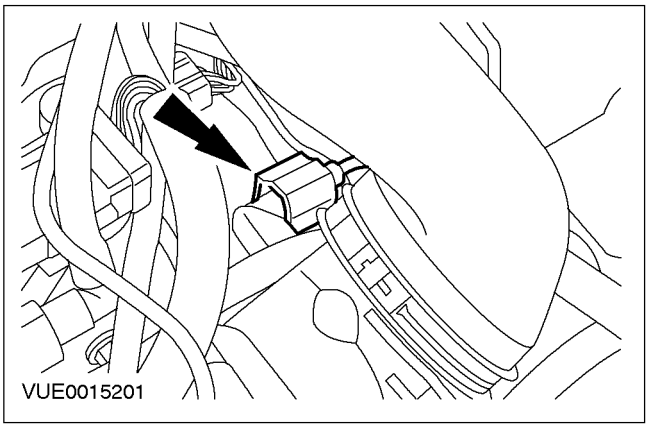
2. **Remove the engine upper cover.**



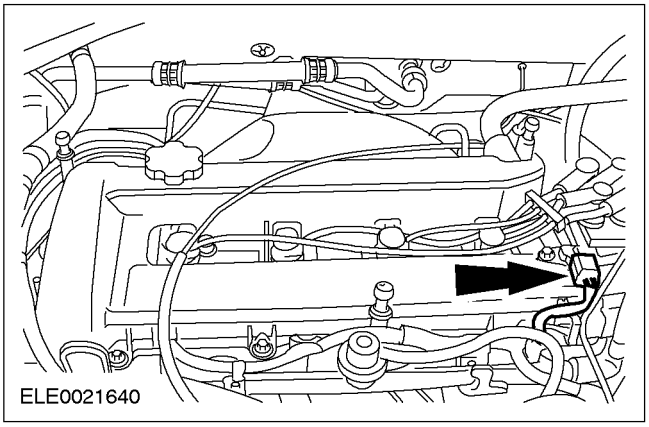
3. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
4. **Disconnect the idle air control (IAC) valve electrical connector.**



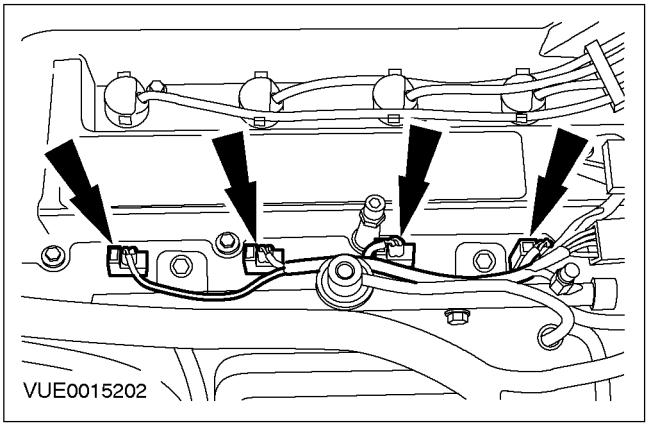
5. **Disconnect the throttle position (TP) sensor electrical connector.**



6. **Disconnect the camshaft position (CMP) sensor electrical connector.**

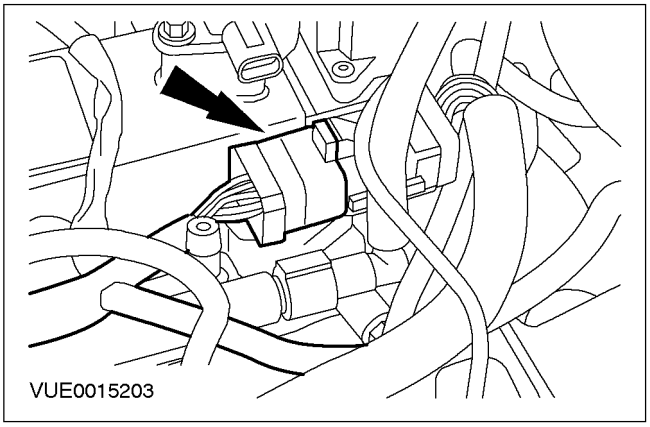


7. **Disconnect the fuel injector electrical connectors.**

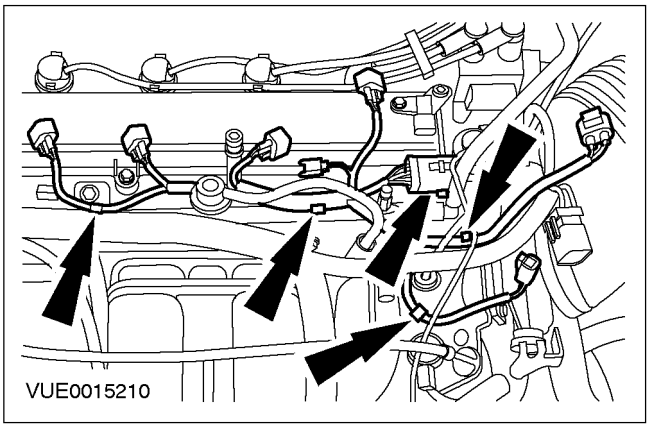


REMOVAL AND INSTALLATION (Continued)

8. Disconnect the fuel charging wiring harness electrical connector.



9. Remove the fuel charging wiring harness.



Installation

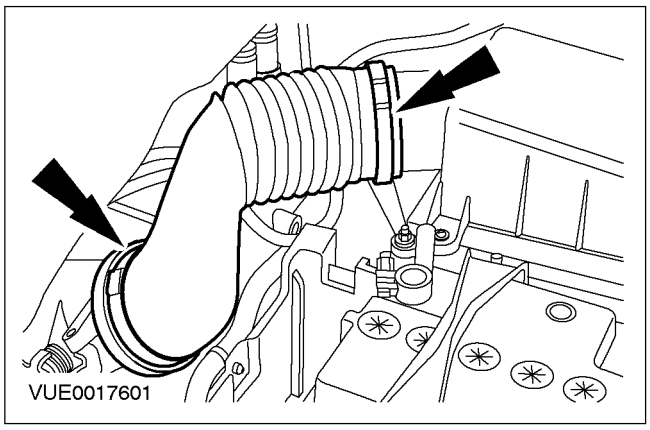
1. **To install, reverse the removal procedure.**
2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

REMOVAL AND INSTALLATION

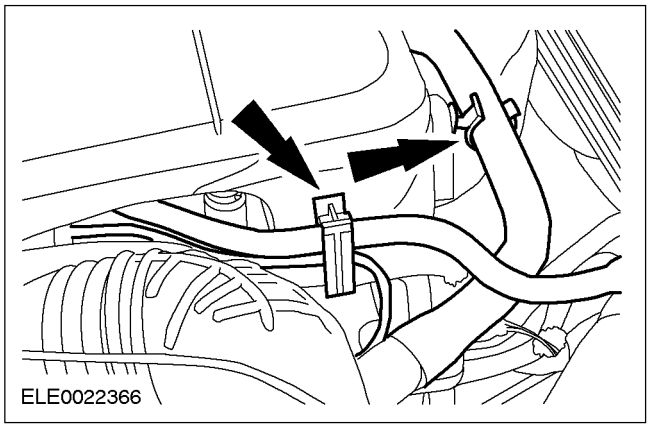
Throttle Body (23 198 0)

Removal

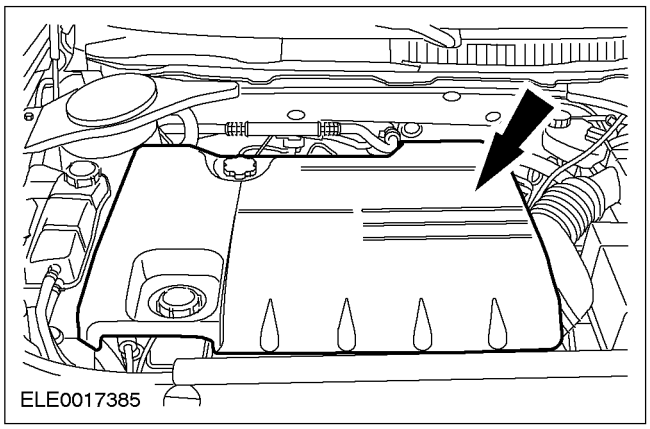
1. Remove the air cleaner outlet pipe.



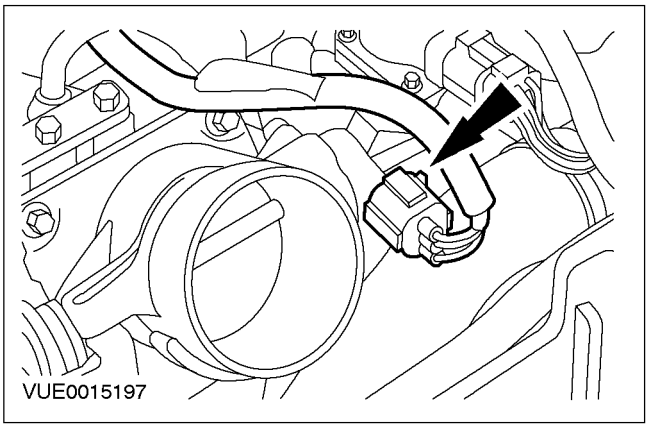
2. Detach the pipes and hoses from the engine upper cover.



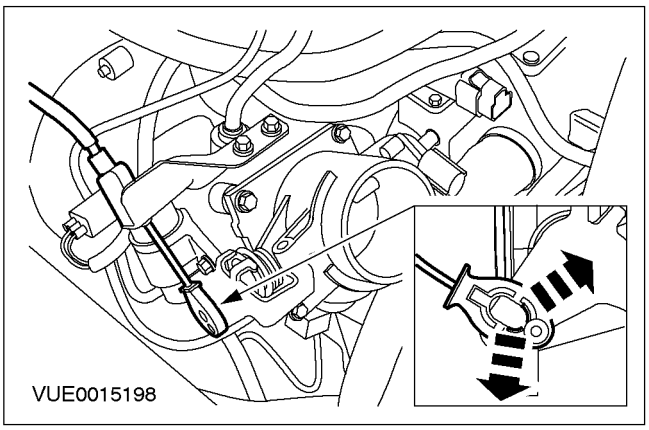
3. Remove the engine upper cover.



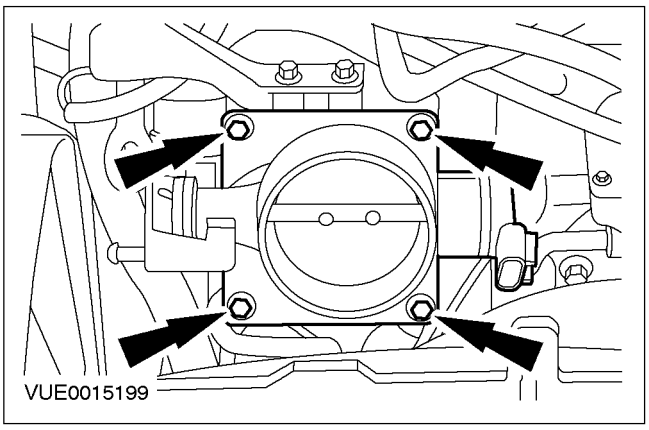
4. Disconnect the throttle position (TP) sensor electrical connector.



5. Detach the accelerator cable from the throttle body.



6. Remove the throttle body.
   - Discard the gasket.

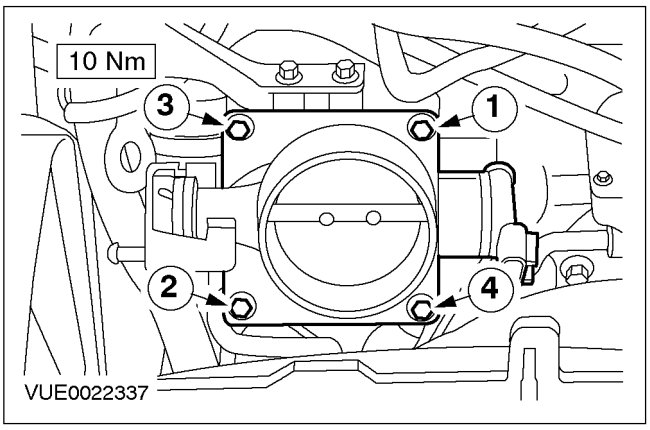


REMOVAL AND INSTALLATION (Continued)

Installation

1. NOTE: Install a new gasket.

To install, reverse the removal procedure.



SECTION 303-04B Fuel Charging and Controls

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

SPECIFICATIONS

Specifications 303-04-2

DESCRIPTION AND OPERATION

Fuel Charging and Controls 303-04-3

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Fuel Charging and Controls 303-04-5
Inspection and Verification 303-04-5

REMOVAL AND INSTALLATION

Throttle Body — 2.5L ..... (23 198 0) 303-04-6
Fuel Injection Supply Manifold — 2.5L ..... (23 450 0) 303-04-8
Fuel Charging Wiring Harness — 2.5L ..... (36 437 0) 303-04-10

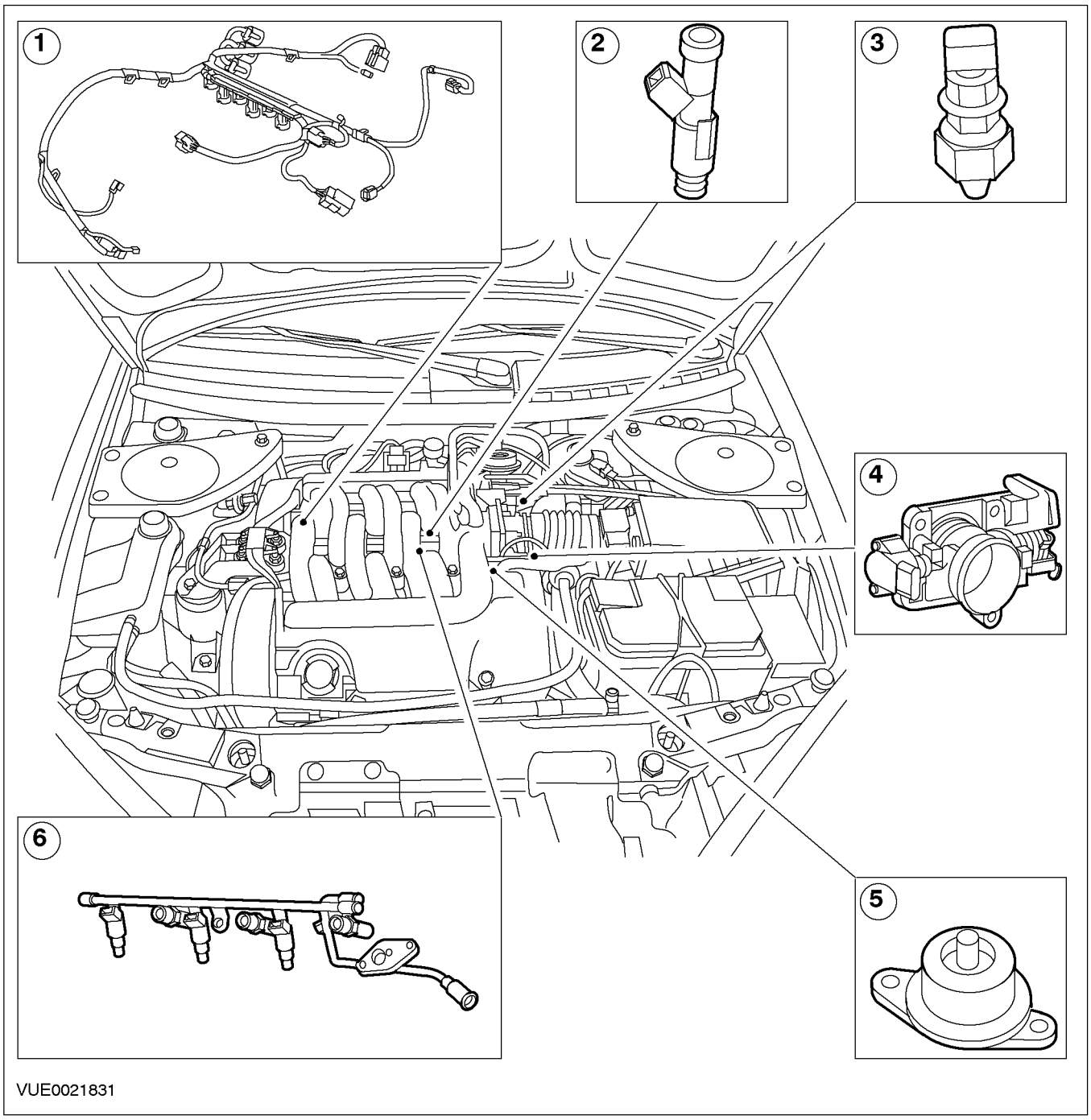
SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Throttle body retaining bolts	10	—	89
Fuel injection supply manifold retaining bolts	10	—	89

DESCRIPTION AND OPERATION

Fuel Charging and Controls



Item	Part Number	Description
1	-	Fuel charging wiring harness
2	-	Fuel injector
3	-	Fuel system pressure release Schrader valve
4	-	Throttle body
5	-	Fuel pressure regulator

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
6	-	Fuel injection supply manifold

DIAGNOSIS AND TESTING

Fuel Charging and Controls

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Fuel leak(s) – Gasket(s)/seal(s) – Fuel injector(s) – Throttle body – Fuel injection supply manifold	– Wiring harness – Electrical connector(s) – Fuel injector(s)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to WDS to diagnose the system.

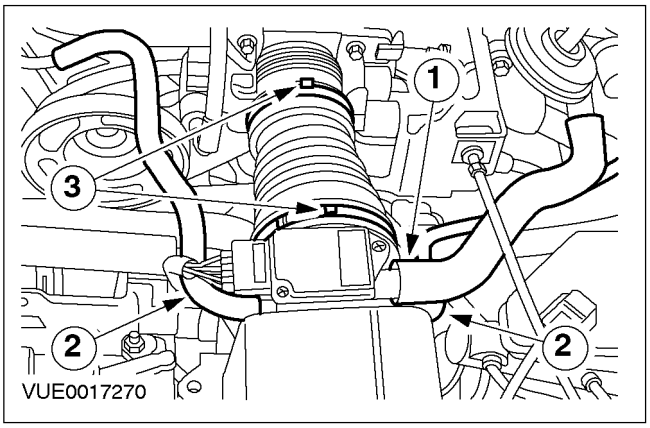
REMOVAL AND INSTALLATION

Throttle Body — 2.5L (23 198 0)

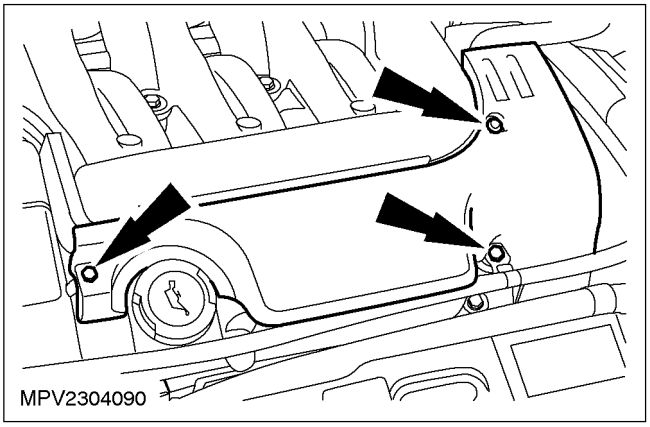
Removal

1. Remove the air cleaner outlet tube.

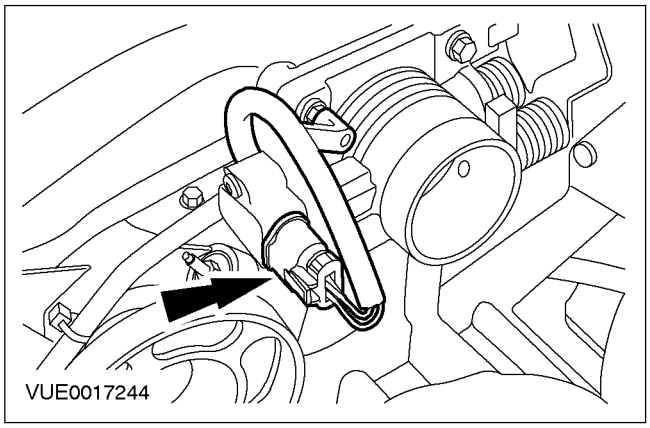
1. Disconnect the intake air bypass hose.
2. Disconnect the positive crankcase ventilation (PCV) hoses.
3. Detach the air cleaner outlet tube retaining clips.



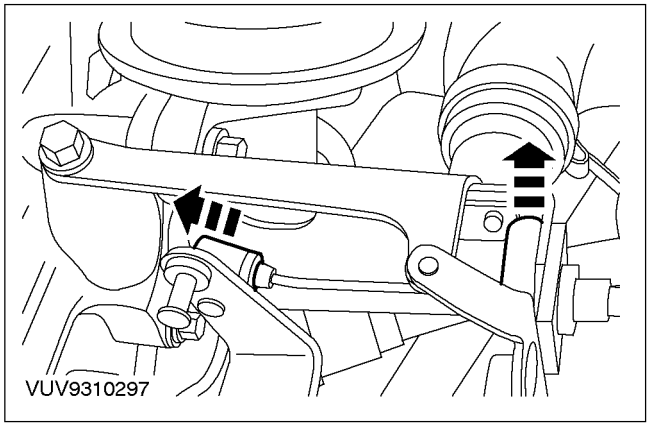
2. Remove the engine cover.



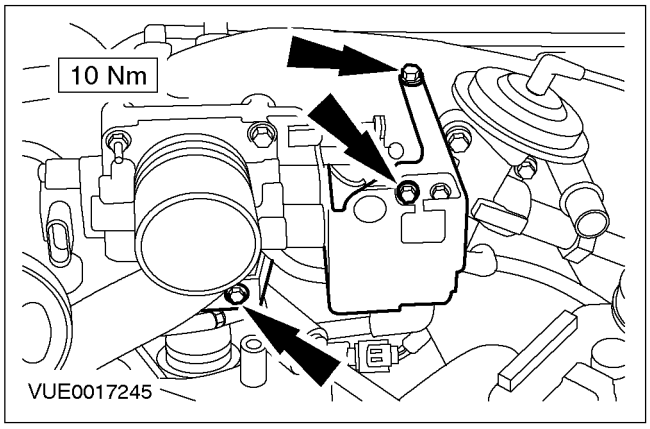
3. Detach the wiring harness from the throttle body and disconnect the throttle position (TP) sensor electrical connector.



4. Disconnect the accelerator cable from the throttle body and remove the accelerator cable retaining clip.



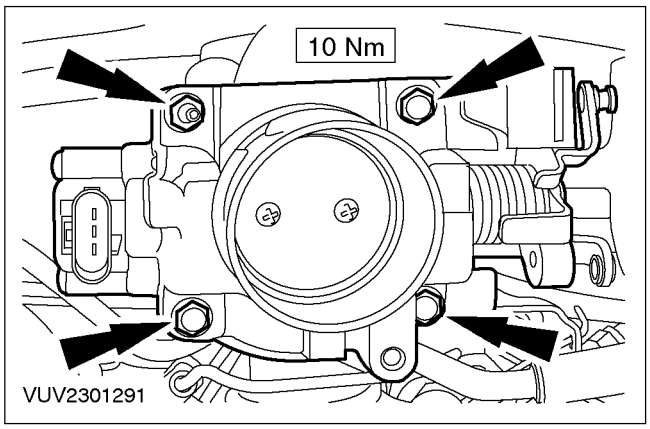
5. Detach the accelerator cable bracket.



REMOVAL AND INSTALLATION (Continued)

6. Remove the throttle body.

- Discard the gasket.



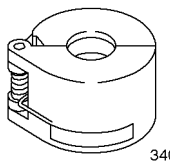
Installation

1. NOTE: Install a new gasket.

To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

Fuel Injection Supply Manifold — 2.5L (23 450 0)

Special Tool(s)	
 34001	Disconnect Tool, Spring-Lock Coupling 310-D004 (23-039)

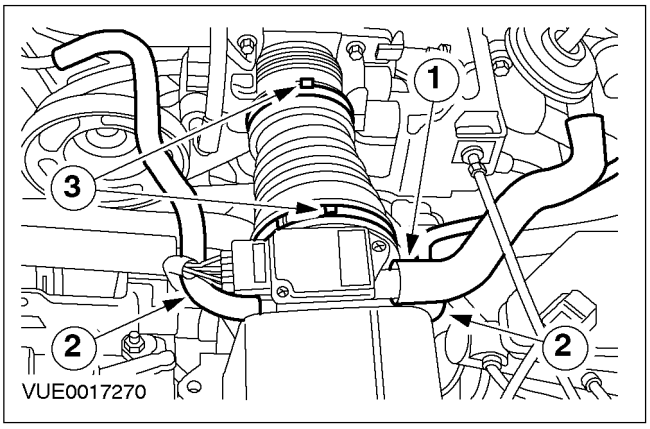
Removal

1. **WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.**

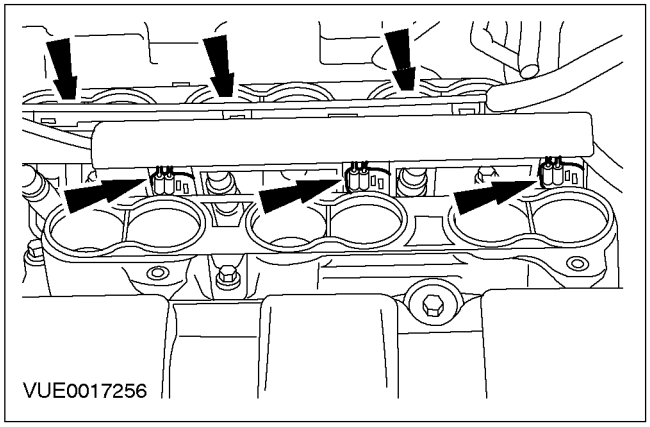
WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

Disconnect the battery ground cable. For additional information, refer to Section 414-01.

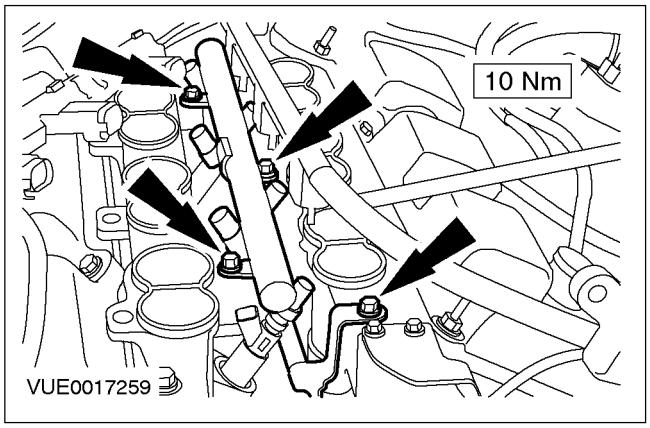
2. **Remove the air cleaner outlet pipe.**
   1. Disconnect the air intake bypass hose.
   2. Disconnect the positive crankcase ventilation (PCV) hoses.
   3. Remove the air cleaner outlet pipe retaining clips.



3. **Release the fuel system pressure. For additional information, refer to Section 310-00.**
4. **Remove the upper intake manifold. For additional information, refer to Section 303-01A / 303-01B.**
5. **Disconnect the fuel injector electrical connectors.**



6. **Disconnect the fuel supply line from the fuel injection supply manifold. For additional information, refer to Section 310-00.**
7. **Remove the fuel injection supply manifold.**



REMOVAL AND INSTALLATION (Continued)

8. **Remove the fuel injectors from the fuel injection supply manifold.**
   - Discard the O-ring seals.

Installation

1. **WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.**

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

CAUTION: Never use silicone grease to lubricate the O-ring seals as it will clog the injectors.

NOTE: Install new O-ring seals.

To install, reverse the removal procedure.

- Lubricate the fuel injector O-ring seals with clean engine oil to aid installation.
- When installing the fuel injection supply manifold begin at the front of the engine and install sequentially working toward the rear.

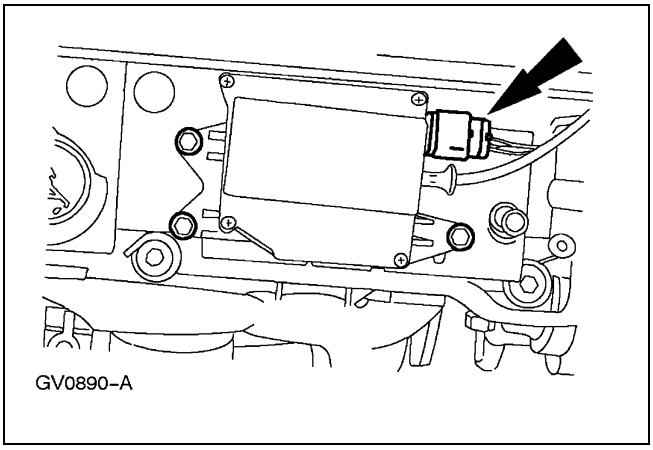
2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

REMOVAL AND INSTALLATION

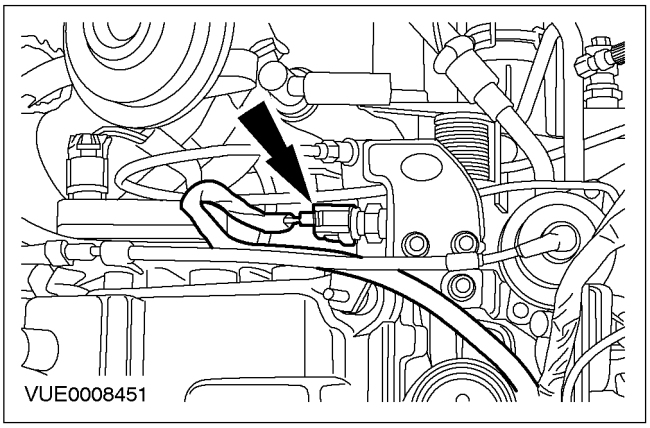
Fuel Charging Wiring Harness — 2.5L (36 437 0)

Removal

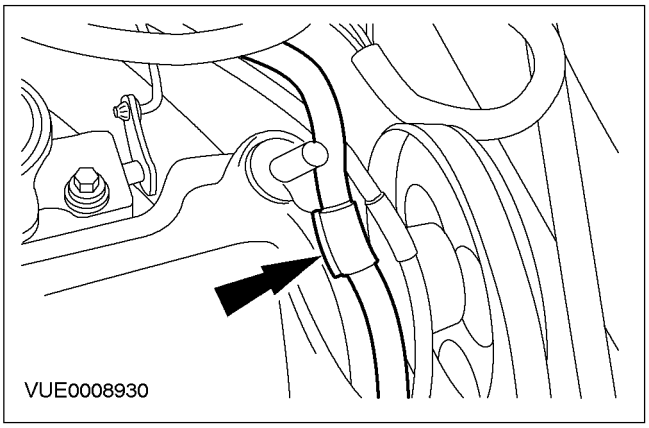
1. **Remove the upper intake manifold. For additional information, refer to Section 303-01A / 303-01B.**
2. **Disconnect the intake manifold runner control (IMRC) actuator electrical connector.**



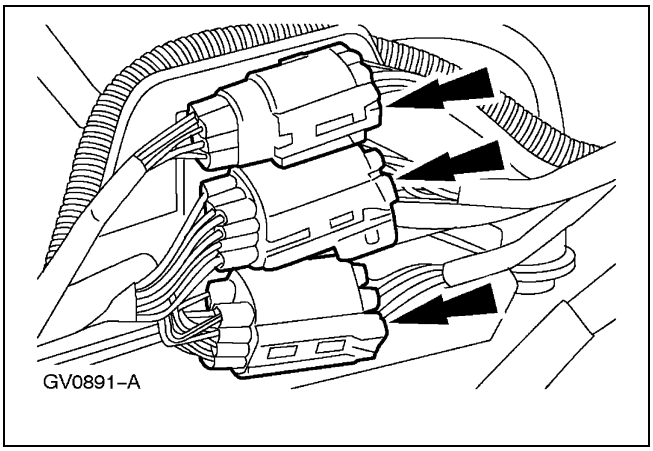
3. **Disconnect the engine coolant temperature (ECT) sensor electrical connector.**



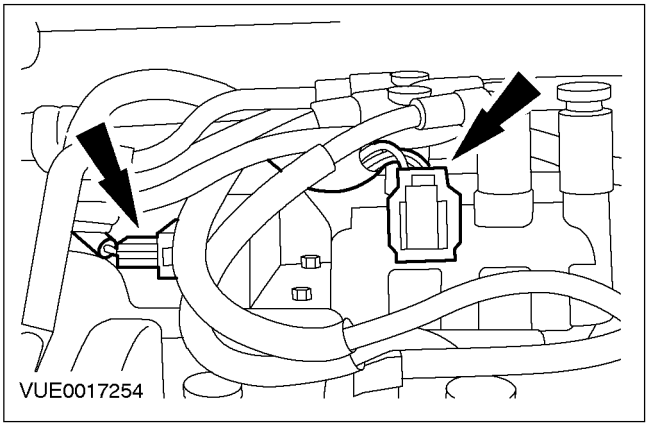
4. **Detach the fuel charging wiring harness from the valve cover.**



5. **Detach and disconnect the fuel charging wiring harness electrical connectors.**

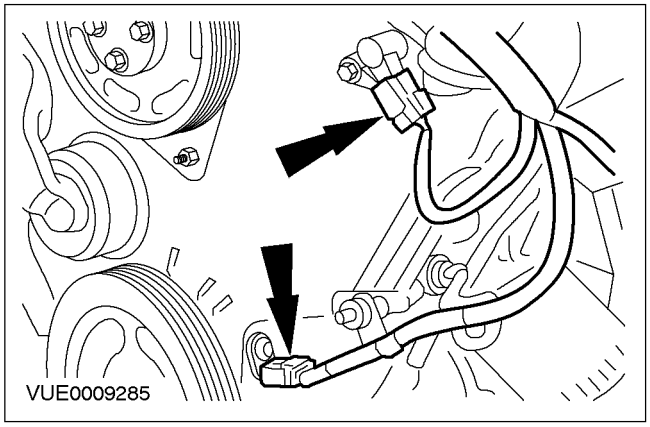


6. **Disconnect the ignition coil pack and audio unit capacitor electrical connectors.**
   - Remove the ground wire from the ignition coil pack retaining bolt.

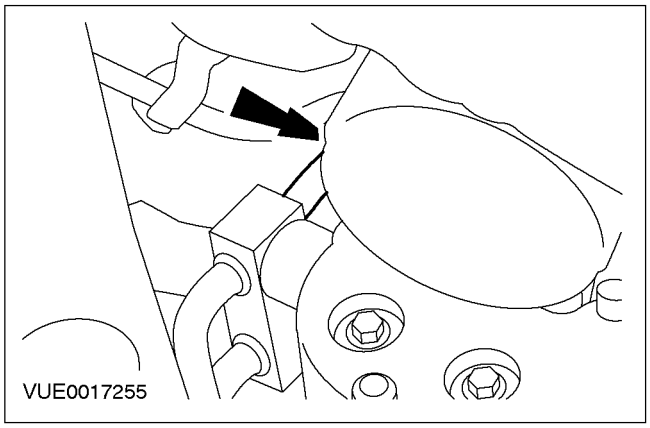


REMOVAL AND INSTALLATION (Continued)

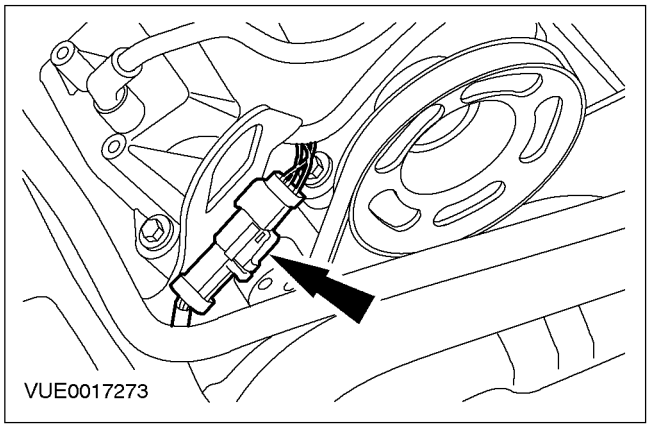
7. **Disconnect the crankshaft position (CKP) sensor and the camshaft position (CMP) sensor electrical connectors (Accessory drive belt shown removed for clarity).**



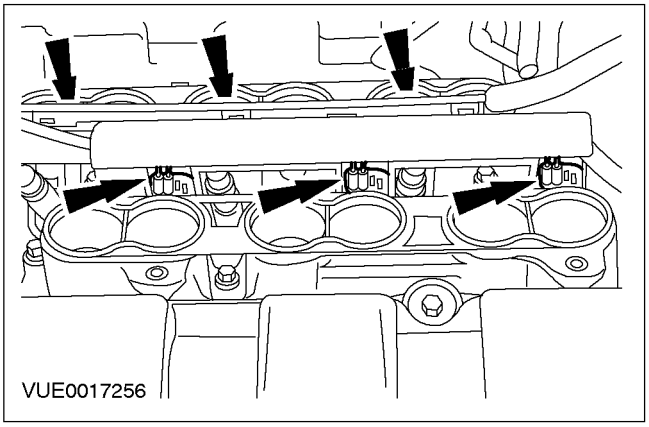
8. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
9. **Disconnect the oil pressure switch electrical connector.**



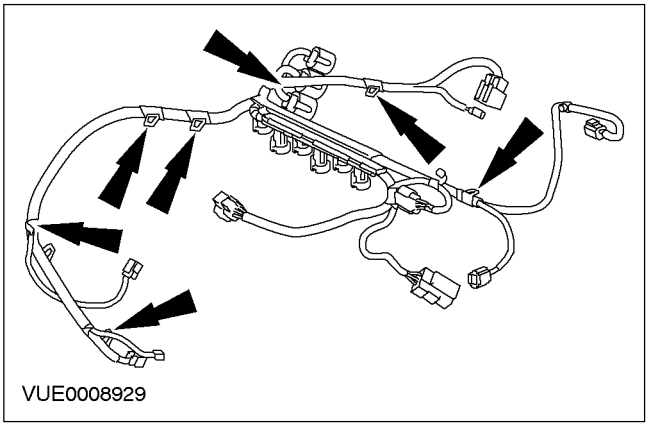
10. **Lower the vehicle.**
11. **Disconnect the heated oxygen sensor (HO2S) electrical connector.**



12. **Disconnect the fuel injector electrical connectors.**



13. **Remove the fuel charging wiring harness (fuel charging wiring harness shown removed for clarity).**



Installation

1. **NOTE:** When installing the fuel injector electrical connectors, begin at the front of the engine, and install sequentially working toward the rear.

   To install, reverse the removal procedure.
2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

SECTION 303-05 Accessory Drive

VEHICLE APPLICATION: 2003.0 Mondeo

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Accessory Drive Belt Routing - Vehicles with 2.0L diesel engine 303-05-4
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Accessory Drive Belt — 1.8L/2.0L ..... (31 413 0) 303-05-14
Accessory Drive Belt — 2.5L/3.0L ..... (31 413 0) 303-05-15

SPECIFICATIONS

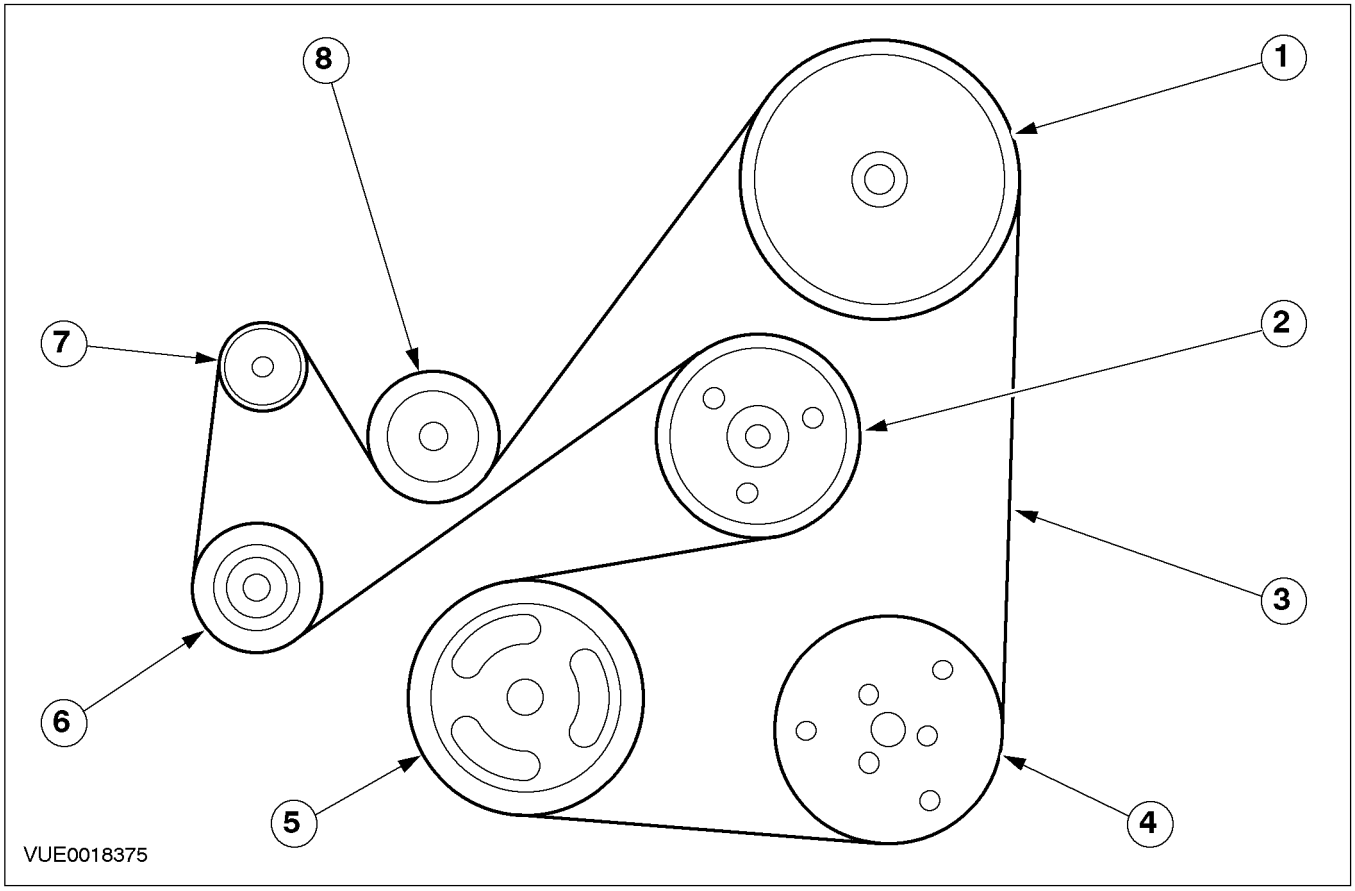
Torque Specifications

Description	Nm	lb-ft	lb-in
Accessory drive belt tensioner retaining bolt - Vehicles with 1.8L or 2.0L engine	25	18	-
Accessory drive belt idler retaining bolt - Vehicles with 1.8L or 2.0L engine	25	18	-
Accessory drive belt tensioner retaining bolt - Vehicles with 2.5L engine	25	18	-
Accessory drive belt tensioner retaining bolt - Vehicles with 2.0L diesel engine	23	17	-
Accessory drive belt tensioner to generator bracket retaining bolt - Vehicles with 2.0L diesel engine	55	41	-
Accessory drive belt idler retaining bolt - Vehicles with 2.0L diesel engine	48	35	-
Air intake pipe and exhaust gas recirculation (EGR) tube retaining bolts - Vehicles with 2.0L diesel engine	23	17	-

DESCRIPTION AND OPERATION

Accessory Drive

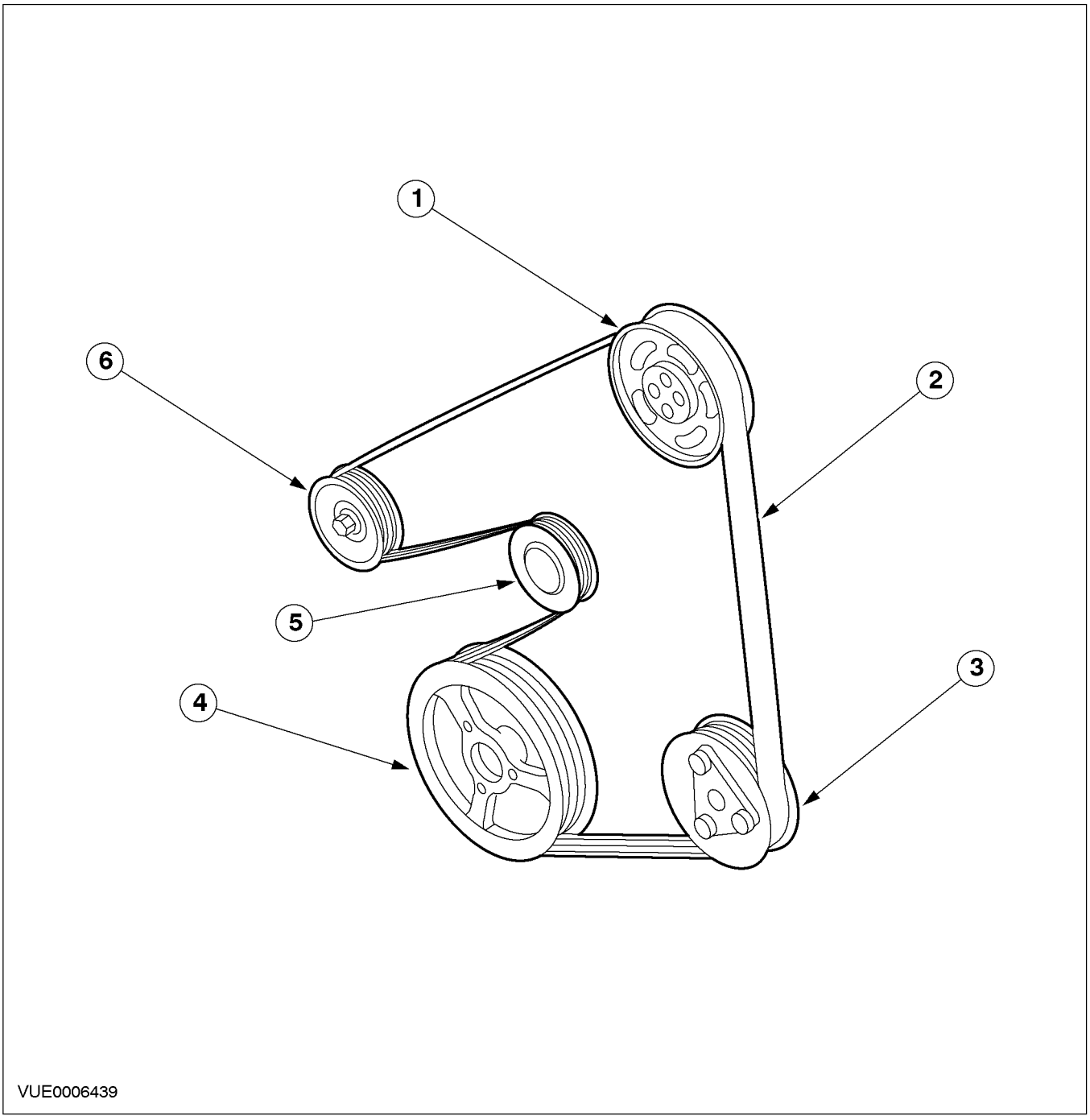
Accessory Drive Belt Routing - Vehicles with 1.8L or 2.0L engine



Item	Part Number	Description
1	–	Power steering pump pulley
2	–	Water pump pulley
3	–	Accessory drive belt
4	–	Air conditioning (AC) compressor pulley
5	–	Crankshaft pulley
6	–	Accessory drive belt tensioner pulley
7	–	Generator pulley
8	–	Accessory drive belt idler pulley

Accessory Drive Belt Routing - Vehicles with 2.5L engine

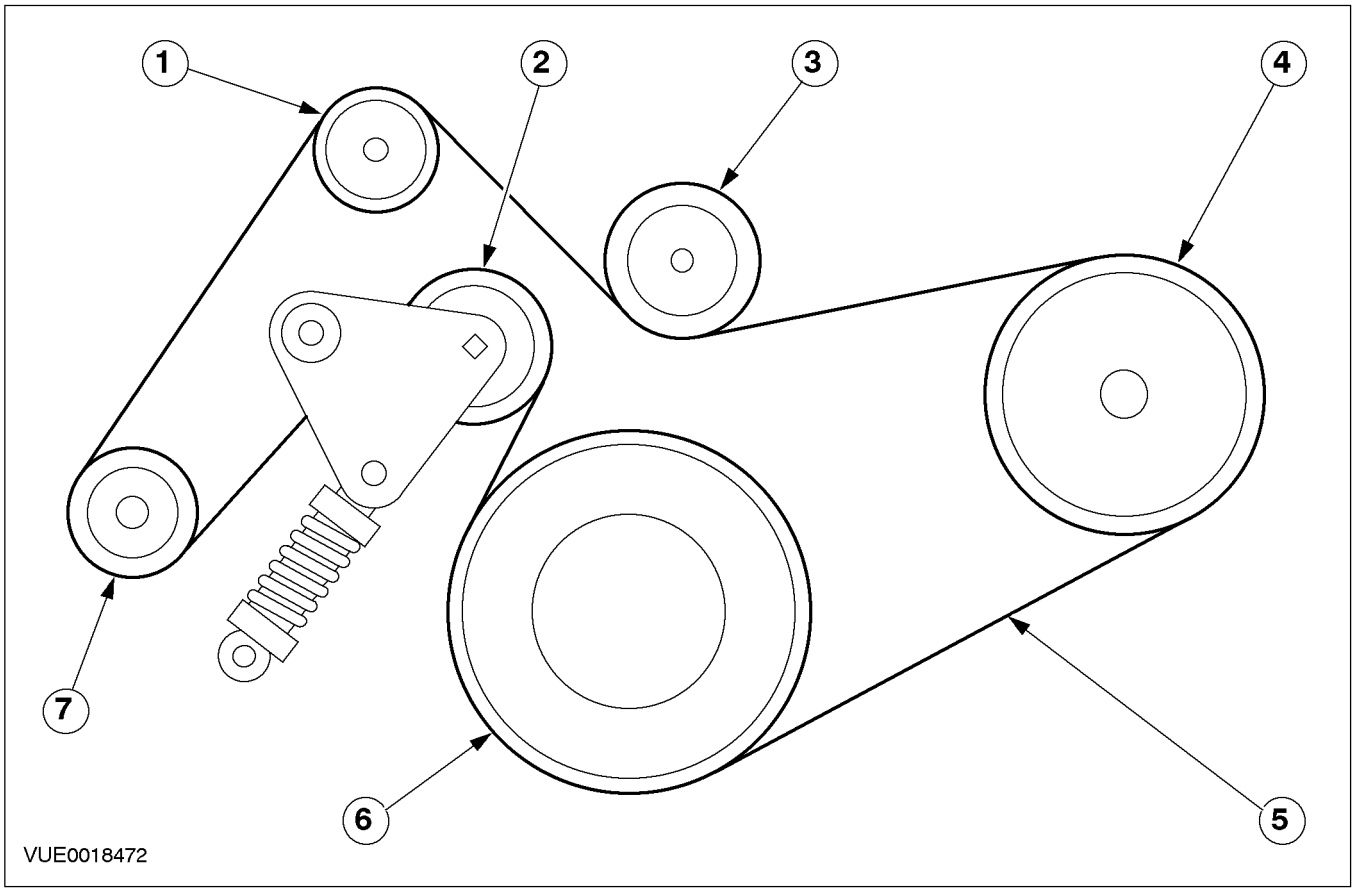
DESCRIPTION AND OPERATION



Item	Part Number	Description
1	–	Power steering pump pulley
2	–	Accessory drive belt
3	–	Air conditioning (AC) compressor pulley
4	–	Crankshaft pulley
5	–	Accessory drive belt tensioner pulley
6	–	Generator pulley

Accessory Drive Belt Routing - Vehicles with 2.0L diesel engine

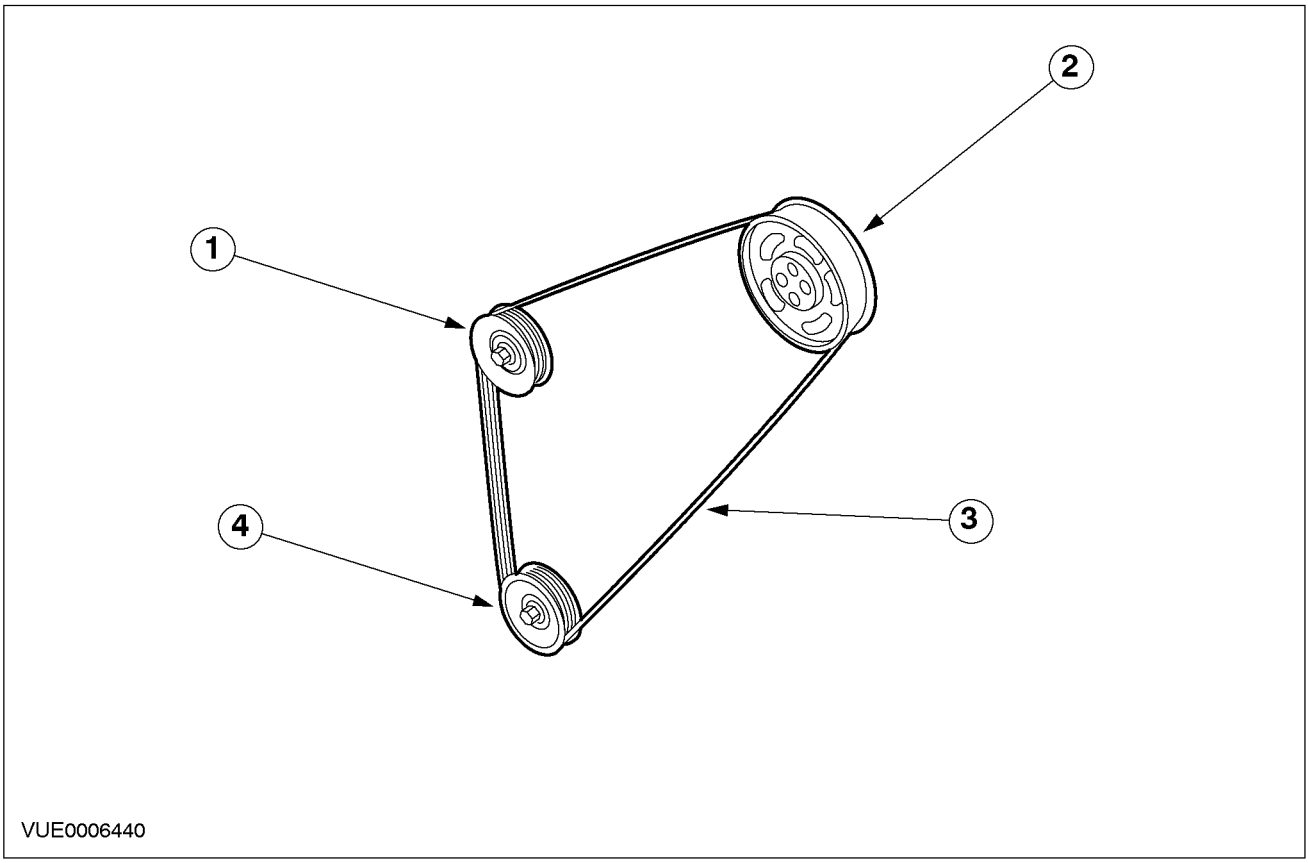
DESCRIPTION AND OPERATION



Item	Part Number	Description
1	–	Accessory drive belt idler pulley
2	–	Accessory drive belt tensioner pulley
3	–	Accessory drive belt idler pulley
4	–	Air conditioning (AC) compressor pulley
5	–	Accessory drive belt
6	–	Crankshaft pulley
7	–	Generator pulley

Remote Water Pump Routing - Vehicles with 2.5L engine

DESCRIPTION AND OPERATION

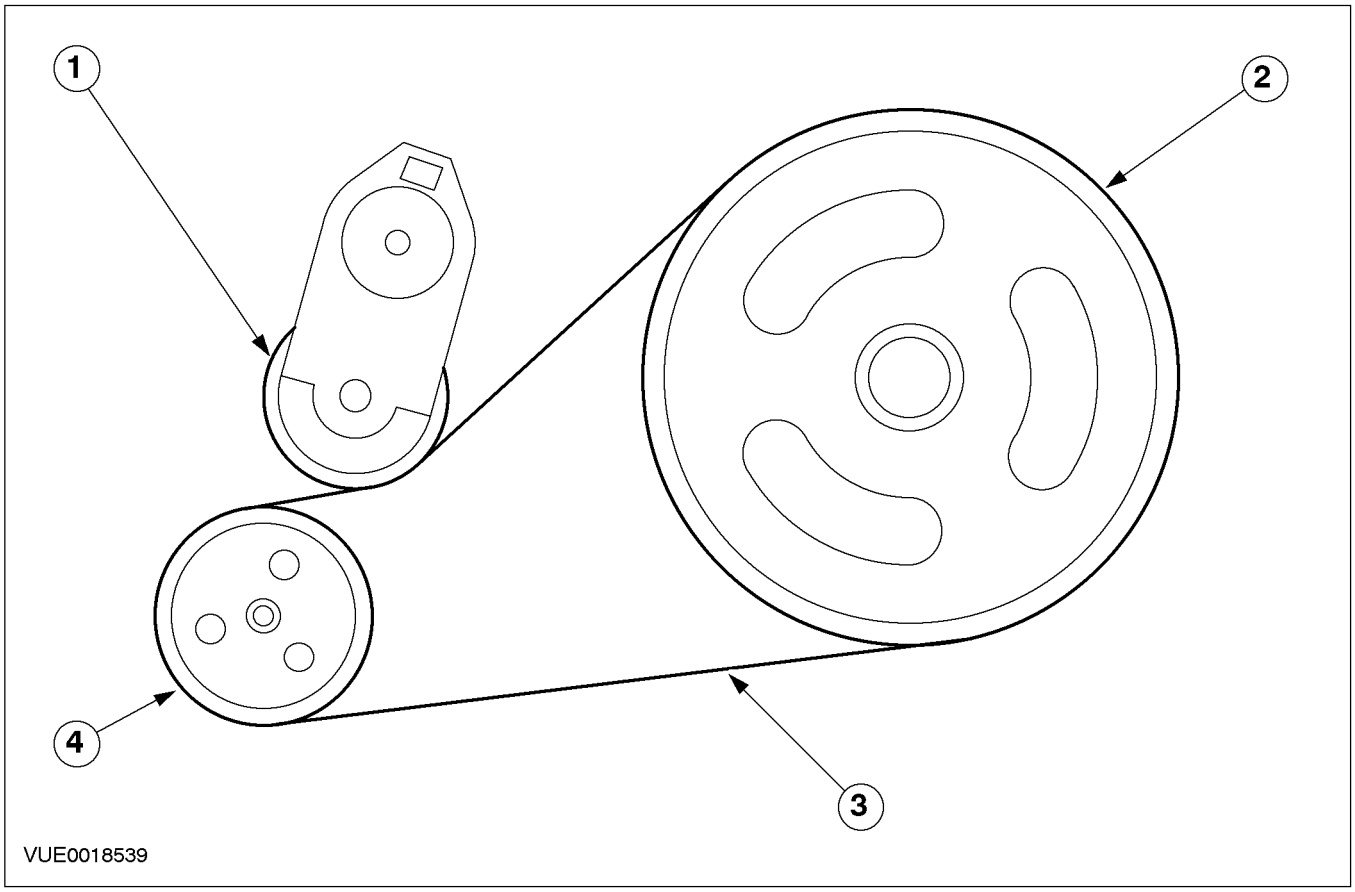


Item	Part Number	Description
1	–	Water pump belt tensioner
2	–	Camshaft pulley
3	–	Water pump drive belt

Item	Part Number	Description
4	–	Water pump pulley

Power Steering Pump Belt Routing - Vehicles with 2.0L diesel engine

DESCRIPTION AND OPERATION



Item	Part Number	Description
1	–	Power steering pump belt tensioner pulley
2	–	Camshaft pulley
3	–	Accessory drive belt
4	–	Power steering pump pulley

DIAGNOSIS AND TESTING

Accessory Drive

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

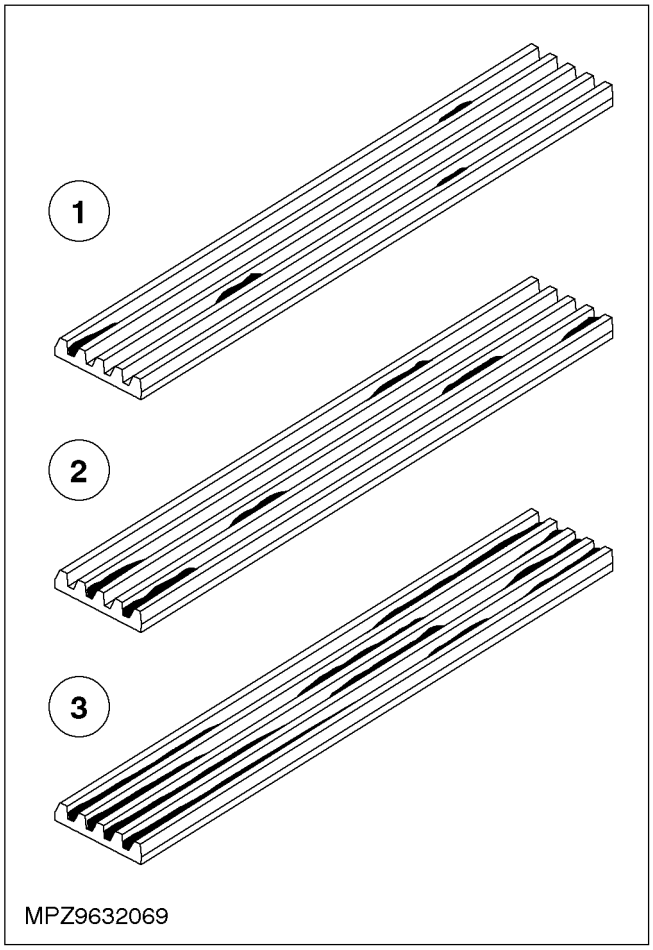
Visual Inspection Chart

Mechanical
– Damaged or contaminated accessory drive belt
– Incorrect accessory drive belt
– Accessory drive belt tensioner
– Accessory drive belt idler pulley
– Generator
– Power steering pump
– Air conditioning (A/C) compressor
– Pulley(s)
– Loose hardware

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

CAUTION: Do not lubricate the accessory drive belt, accessory drive belt tensioner or idler pulley(s) as potential damage to the accessory drive material construction, accessory drive belt tensioner damping mechanisam, accessory drive belt tensioner pulley bearing and idler pulley(s) bearing may occur.

NOTE: Up to 15 cracks in a accesory drive belt rib over a distance of 100 mm may be considered acceptable. If the cracks exceed the acceptable limit or any chunks are found to be missing, install a new accessory drive belt.

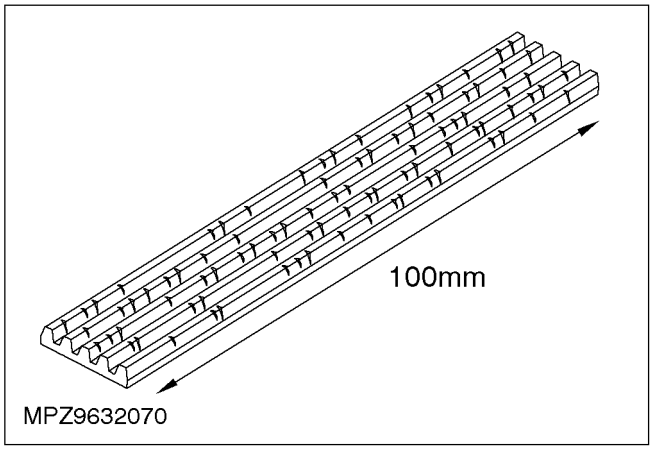


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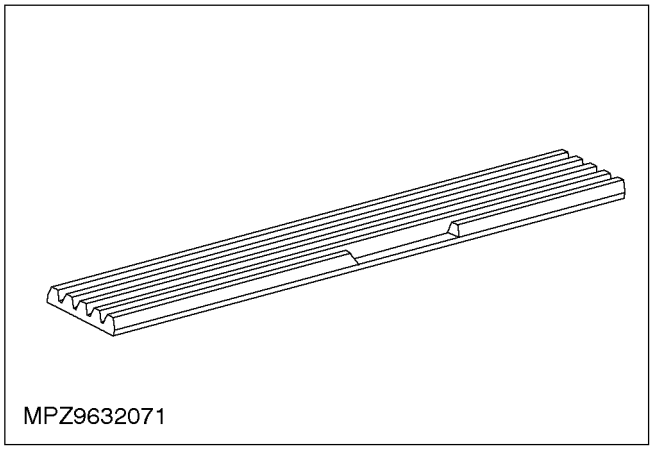
4. The condition of the accessory drive belt should be compared against the illustration and appropriate action taken.
   1. Small scattered deposits of rubber debris is not a concern and therefore a new accessory drive belt should not be installed.
   2. Longer deposits of rubber debris building up to 50% of the accessory drive belt rib height is not a concern but may result in excessive noise. If excessive noise is apparent, install a new accessory drive belt. REFER to Accessory Drive Belt - 1.8L/2.0L / Accessory Drive Belt - 2.5L/3.0L in this section.
   3. Large deposits of rubber debris building up along the grooves are a concern and may result in excessive noise and a accessory drive belt stability concern. If large deposits or excessive accessory drive belt noise is apparent, install a new accessory drive belt. REFER to Accessory Drive Belt -

DIAGNOSIS AND TESTING (Continued)

1.8L/2.0L / Accessory Drive Belt - 2.5L/3.0L in this section.

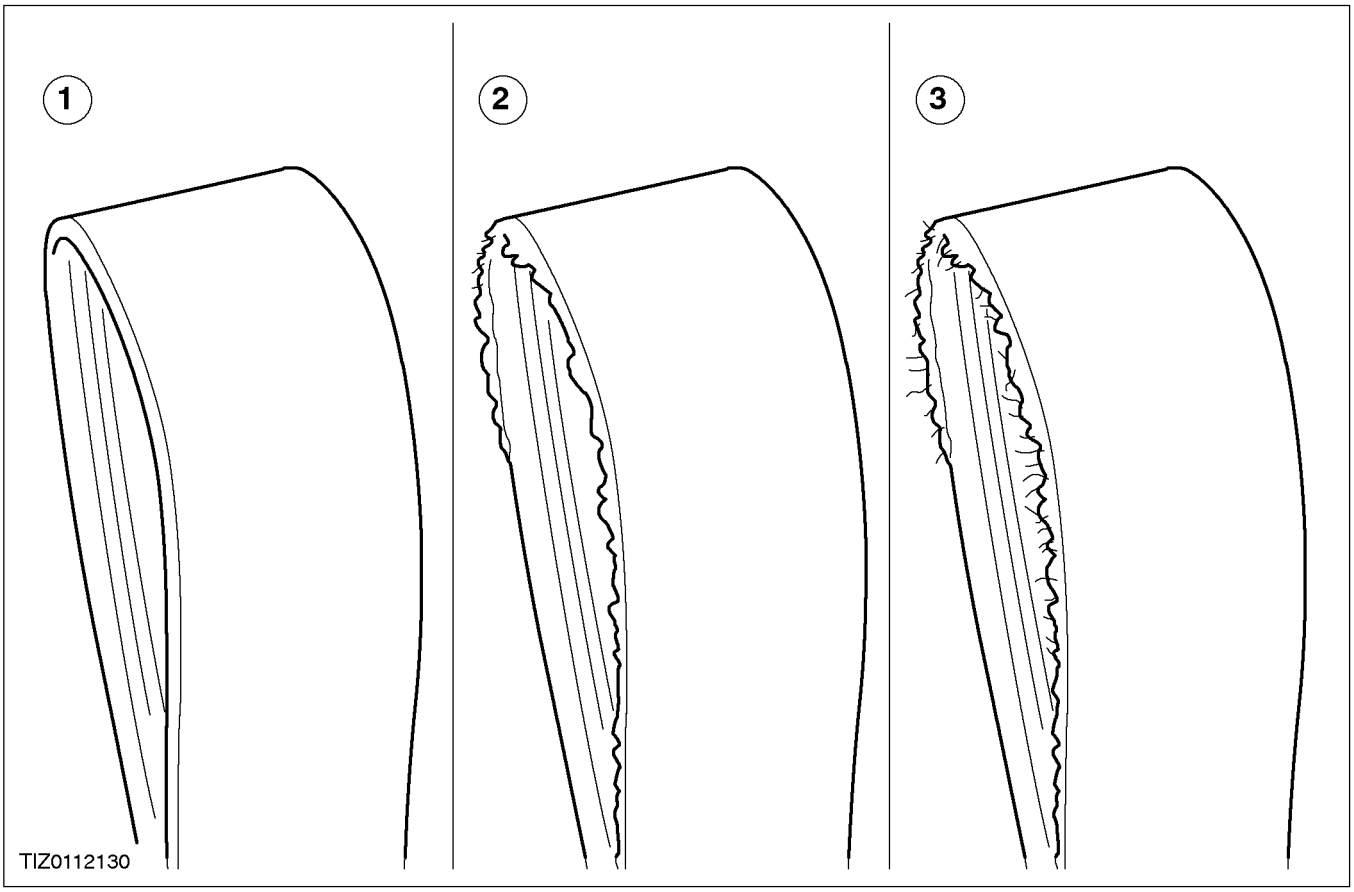


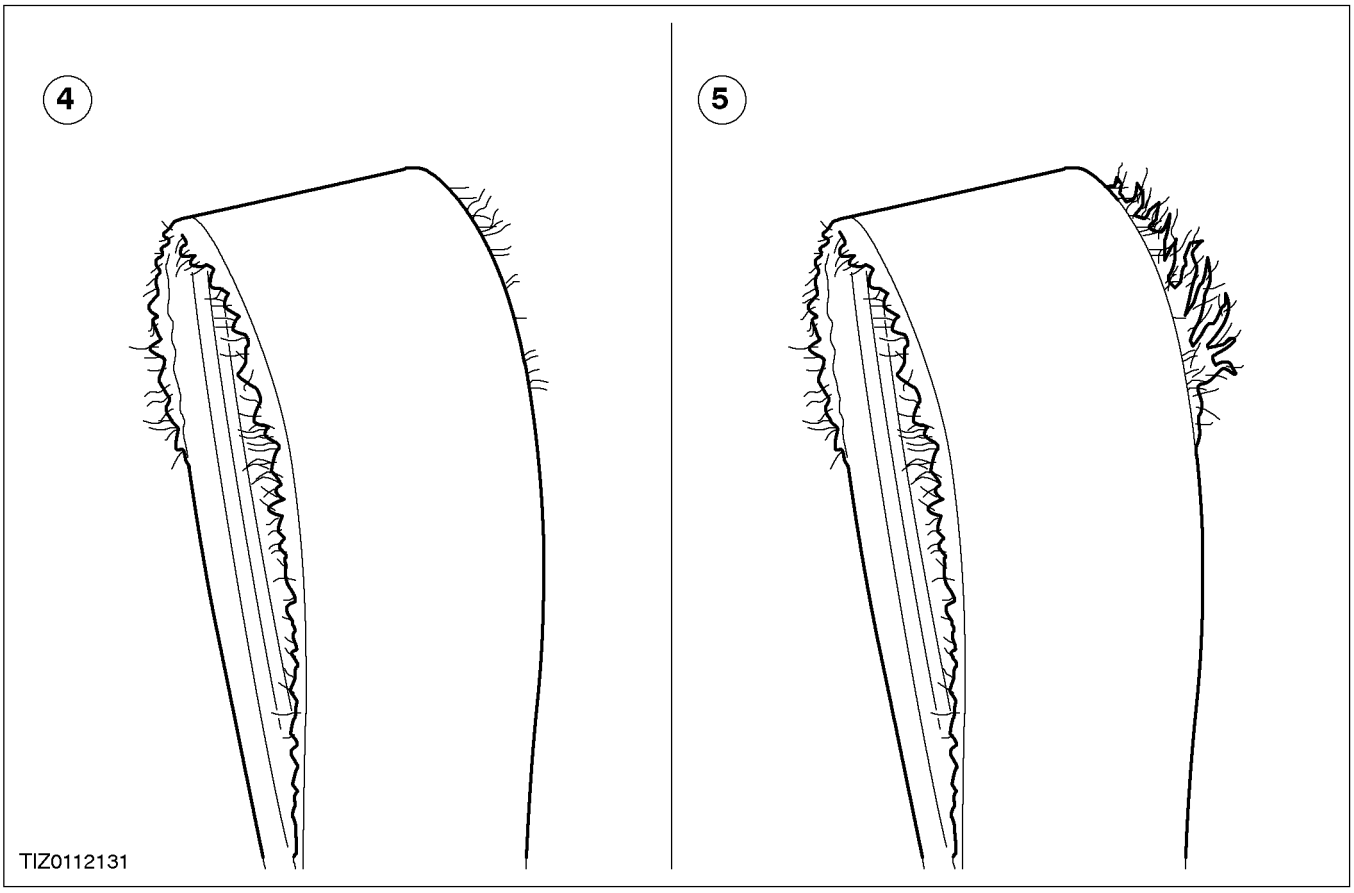
5. Check the accessory drive belt for cracks. If the damage exceeds the acceptable limit, install a new accessory drive belt REFER to Accessory Drive Belt - 1.8L/2.0L / Accessory Drive Belt - 2.5L/3.0L in this section.



6. Check the accessory drive belt for damage. If any chunks are found to be missing, install a new accessory drive belt. REFER to Accessory Drive Belt - 1.8L/2.0L / Accessory Drive Belt - 2.5L/3.0L in this section.
7. Check the accessory drive belt for fraying. The condition of the accessory drive belt should be compared against the illustrations. For levels 1 to 3, the accessory drive belt DOES NOT require changing. For levels 4 and 5 INSTALL a new accessory drive belt. REFER to Accessory Drive Belt - 1.8L/2.0L / Accessory Drive Belt - 2.5L/3.0L in this section.
   1. No fraying (new belt)
   2. Fraying just starting
   3. Slight fraying
   4. High amount of fraying without cord cuts
   5. High amount of fraying with cord cuts

DIAGNOSIS AND TESTING





DIAGNOSIS AND TESTING

8. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Condition	Possible Sources	Action
•Accessory drive belt noise or squeal	•Accessory drive components worn or damaged.	•CHECK the system with the engine running and the accessory drive belt removed (only run the engine for a very short period). If a noise is apparent, the cause is not the accessory drive system. If a noise is not apparent, the cause is the accessory drive system. CHECK where the noise is coming from and INSTALL new components as necessary.
	•Accessory drive components incorrectly installed.	•CHECK the accessory drive components are correctly installed. REPAIR as necessary.
	•Accessory drive belt incorrectly installed.	•CHECK the accessory drive belt is correctly installed in the pulley grooves. INSTALL a new accessory drive belt as necessary. REFER to Accessory Drive Belt - 1.8L/2.0L / Accessory Drive Belt - 2.5L/3.0L in this section.
	•Pulley(s).	•CHECK the pulley(s) for damage, freedom of rotation and alignment. INSTALL new components as necessary.
	•Lubricant or other contamination.	•CHECK the accessory drive belt for contamination or damage. REMOVE the accessory drive belt and wash with detergent and water. If the accessory drive belt will not clean or is damaged, INSTALL a new accessory drive belt. REFER to Accessory Drive Belt - 1.8L/2.0L / Accessory Drive Belt - 2.5L/3.0L in this section.
	•Accessory drive belt.	•CHECK the accessory drive belt for correct application. INSTALL a new accessory drive belt. TEST the system for normal operation. REFER to Accessory Drive Belt - 1.8L/2.0L / Accessory Drive Belt - 2.5L/3.0L in this section.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
•Accessory drive belt fraying	•Accessory drive belt. •Pulley(s). •Generator. •Power steering pump. •A/C compressor.	•CHECK the pulley(s) for damage, freedom of rotation and alignment. INSTALL new components as necessary.
•Accessory drive belt does not hold tension	•Accessory drive belt cracked or damaged.	•INSPECT the accesory drive belt for cracks or damage. If the cracks are within the acceptable limit, the accessory drive belt is OK. If the cracks exceed the acceptable limit, INSTALL a new accessory drive belt. REFER to Accessory Drive Belt - 1.8L/2.0L / Accessory Drive Belt - 2.5L/3.0L in this section.
	•Accessory drive belt tensioner worn or damaged.	•CHECK the accessory drive belt tensioner for correct operation or damage. INSTALL a new accessory drive belt tensioner as necessary.

Component Tests

Accessory Drive Belt Tensioner - Static Check

The accessory drive belt tensioner may be checked statically as follows:

1. Detach the accessory drive belt in the area of the accessory drive belt tensioner.
2. Using the correct tool, move the accessory drive belt tensioner from its relaxed position through its full stroke and back to the relaxed position to make sure there is no stick, grab or bind, and to make sure there is tension on the accessory drive belt tensioner spring.
3. Rotate the accessory drive belt tensioner pulley and check for damage, freedom of rotation and alignment. Install a new accessory drive belt tensioner as necessary.
4. Inspect the area surrounding the accessory drive belt tensioner for lubricant or other contamination. Rectify any leaks before installing a new accessory drive belt tensioner. If the accessory drive belt tensioner is contaminated, do not attempt to clean it as the damping mechanism inside may be damaged. Install a new accessory drive belt tensioner as necessary.
5. If the accessory drive belt tensioner meets the above criteria proceed to test the accessory drive belt tensioner dynamically. If the accessory drive belt tensioner does not meet the above criteria install a new accessory drive belt tensioner.

Accessory Drive Belt Tensioner - Dynamic Check

The accessory drive belt tensioner may be checked dynamically as follows:

DIAGNOSIS AND TESTING (Continued)

1. With the engine running, observe the accessory drive belt tensioner movement. The accessory drive belt tensioner should move (respond) when the engine is accelerated rapidly or when the A/C clutch cycles. If the accessory drive belt tensioner movement is not constant without engine acceleration or A/C clutch cycling, a pulley or shaft is possibly bent, out of round, or the damping mechanism inside the accessory drive belt tensioner may be damaged. Excessive accessory drive belt rideout (uneven depth of grooves in the accessory drive belt) may cause excessive accessory drive belt tensioner movement. Check the condition by installing a new accessory drive belt. REFER to Accessory Drive Belt - 1.8L/2.0L / Accessory Drive Belt - 2.5L/3.0L in this section.

Generator Decoupler - Vehicles with 1.8L or 2.0L engine with manual transaxle

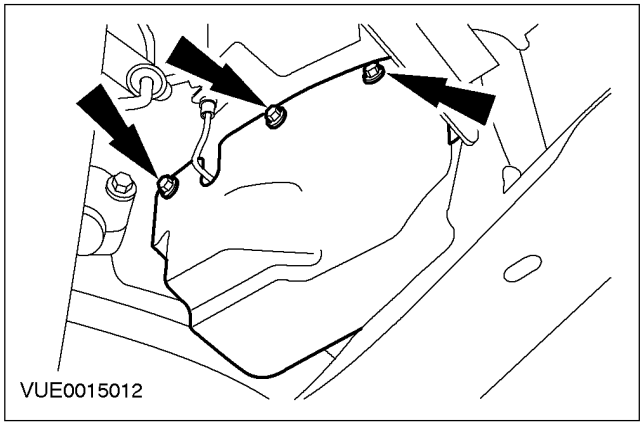
1. Remove the accessory drive belt. REFER to Accessory Drive Belt - 1.8L/2.0L in this section.
2. Using an Allen key to prevent the generator center shaft from rotating, rotate the generator decoupler clockwise and counterclockwise.
3. Make sure the generator decoupler rotates freely in the counterclockwise direction and is locked in the clockwise direction. If the generator decoupler is seized or rotates freely in both directions, INSTALL a new generator. REFER to Section 414-02.

REMOVAL AND INSTALLATION

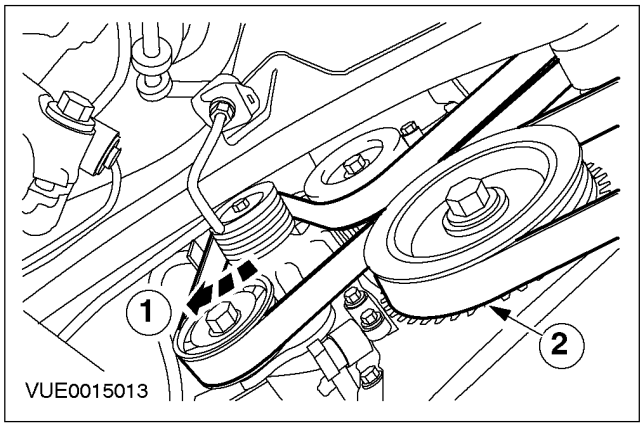
Accessory Drive Belt — 1.8L/2.0L (31 413 0)

Removal

1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
3. **Remove the splash shield.**



4. **Remove the accessory drive belt.**
   1. Rotate the accessory drive belt tensioner clockwise.
   2. Remove the accessory drive belt.



Installation

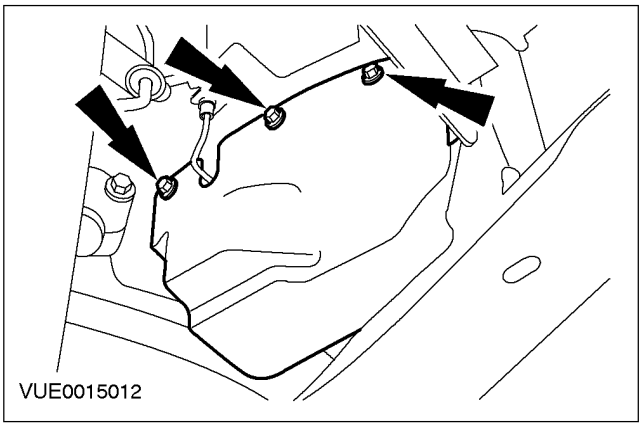
1. **To install, reverse the removal procedure.**
2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

REMOVAL AND INSTALLATION

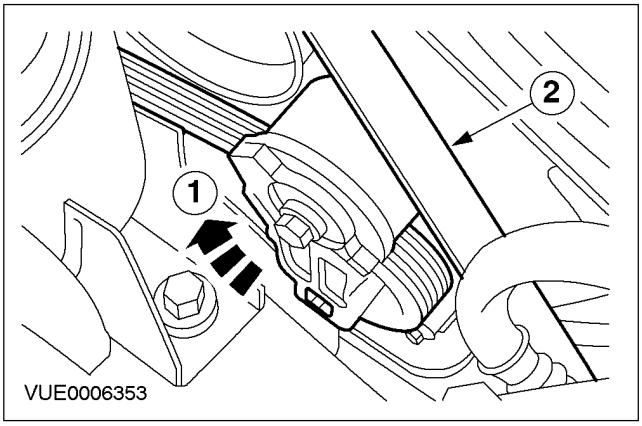
Accessory Drive Belt — 2.5L/3.0L (31 413 0)

Removal

1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
3. **Remove the splash shield.**



4. **Remove the accessory drive belt.**
   1. Rotate the accessory drive belt tensioner clockwise.
   2. Remove the accessory drive belt.



Installation

1. **To install, reverse the removal procedure.**
2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

SECTION 303-06 Starting System

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

SPECIFICATIONS

Specifications 303-06-2

DESCRIPTION AND OPERATION

Starting System 303-06-3

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REMOVAL AND INSTALLATION

Starter Motor — 1.8L/2.0L/2.0L Diesel, Vehicles With: Manual Transaxle/4-Speed Automatic Transaxle ..... (26 204 0) 303-06-14
Starter Motor — 2.5L ..... (26 204 0) 303-06-18

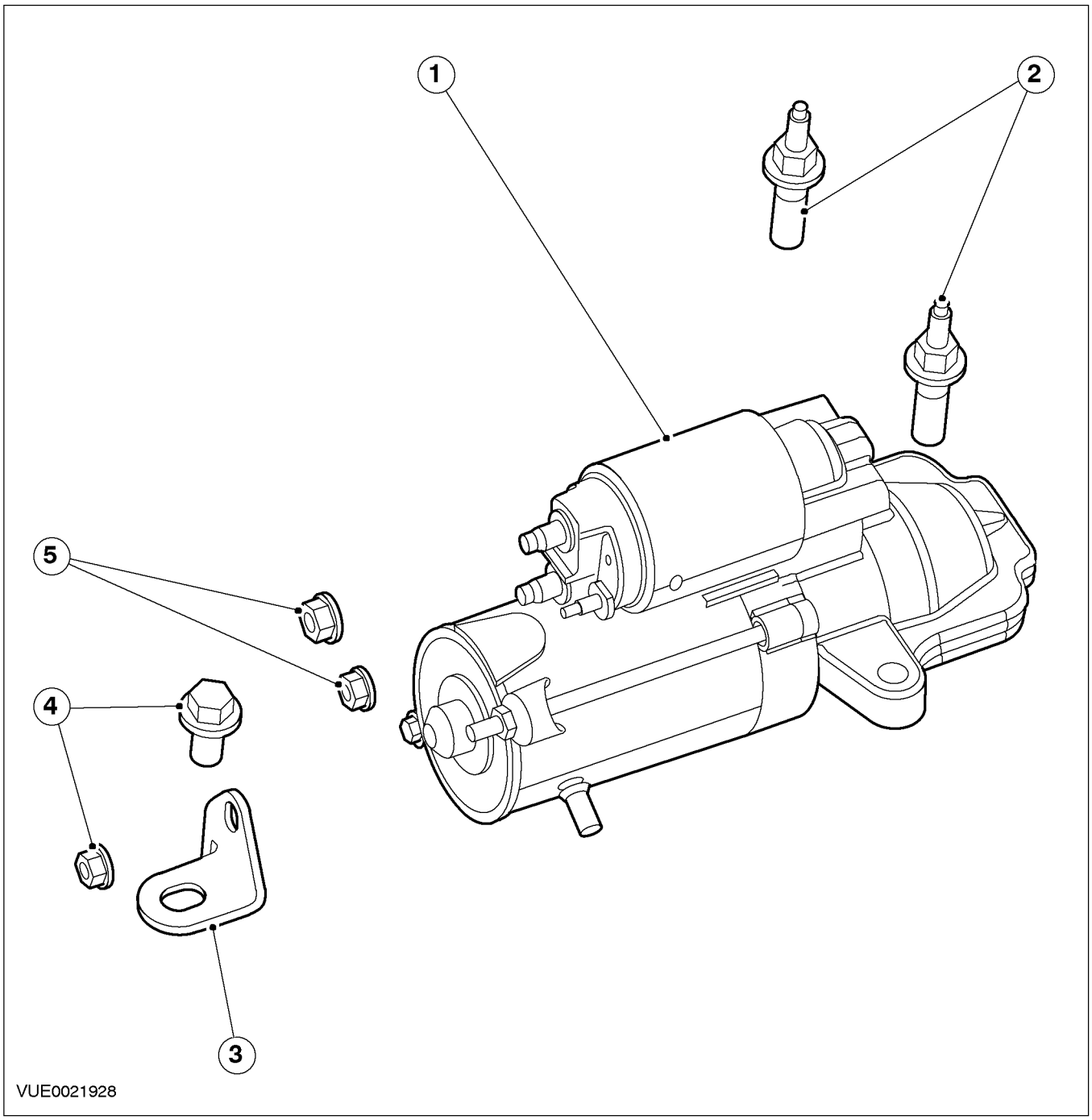
SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Starter motor retaining bolts - vehicles with 2.5L or 3.0L engine	35	26	-
Starter motor retaining bolts - vehicles with 1.8L, 2.0L or 2.0L diesel	25	18	-
Starter motor rear support bracket retaining bolt - vehicles with 1.8L or 2.0L engine	35	26	-
Starter motor rear support bracket retaining nut - vehicles with 1.8L or 2.0L engine	6	-	53
Starter motor positive cable retaining nut	12	9	-
Ignition switch to starter motor cable retaining nut	6	-	53

DESCRIPTION AND OPERATION

Starting System



Item	Part Number	Description
1	-	Starter motor and starter motor solenoid
2	-	Starter motor retaining bolts

Item	Part Number	Description
3	-	Starter motor rear support bracket - Vehicles with 1.8L or 2.0L engine

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
4	-	Starter motor rear support bracket retaining nut and bolt - Vehicles with 1.8L or 2.0L engine
5	-	Starter motor solenoid electrical connector retaining nuts

DIAGNOSIS AND TESTING

Starting System

Refer to Wiring Diagrams Section 303-06 for schematic and connector information.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
– Fuse(s) – Wiring harness – Electrical connector(s) – Relay – Battery junction box (BJB) – Switch(es) – Battery – Starter motor

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Condition	Possible Sources	Action
•The engine does not crank/the relay does click	•Battery.	•REFER to Section 414-00.
	•Starter motor.	•CARRY OUT the starter motor Component Test using WDS.
	•Transmission range sensor - Vehicles with automatic transaxle.	•REFER to WDS.
	•Relay.	•CARRY OUT the relay Component Test. REFER to the wiring diagrams.
	•Circuit(s).	• GO to Pinpoint Test A.
•The engine does not crank/the relay does not click	•Battery.	•REFER to Section 414-00.
	•Fuse.	•INSTALL a new fuse as required. If the fuse fails again, check for short to ground.
	•Passive anti-theft system (PATS).	•REFER to Section 419-01B.
	•Starter motor.	•CARRY OUT the starter motor Component Test using WDS.
	•Ignition switch.	• GO to Pinpoint Test B.
	•Relay.	•CARRY OUT the relay Component Test. REFER to the wiring diagrams.
	•Circuit(s).	• GO to Pinpoint Test B.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
•The engine cranks slowly	•Battery.	•REFER to Section 414-00.
	•Starter motor.	•CARRY OUT the starter motor Component Test using WDS.
	•Circuit(s).	• GO to Pinpoint Test C.
•Unusual starter noise	•Starter motor.	•REMOVE the starter motor. REFER to Starter Motor - 1.8L/2.0L/2.0L Diesel, Vehicles With: Manual Transaxle/4-Speed Automatic Transaxle in this section. Or REFER to Starter Motor - 2.5L in this section. Or INSPECT the starter motor gear for damage. INSTALL a new starter motor as necessary.
	•Flywheel ring gear.	•INSPECT the flywheel for damage. REFER to Section 303-00.
•The starter spins but the engine does not crank	•Starter motor.	•REMOVE the starter motor. REFER to Starter Motor - 1.8L/2.0L/2.0L Diesel, Vehicles With: Manual Transaxle/4-Speed Automatic Transaxle in this section. Or REFER to Starter Motor - 2.5L in this section. Or INSPECT the starter motor gear for damage. INSTALL a new starter motor as necessary.
	•Flywheel ring gear.	•INSPECT the flywheel for damage. REFER to Section 303-00.

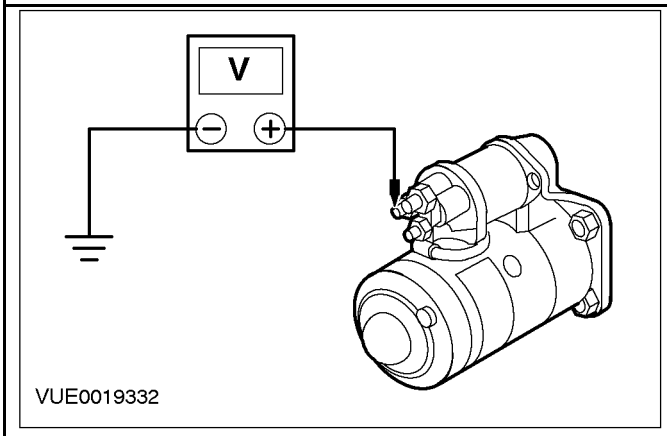
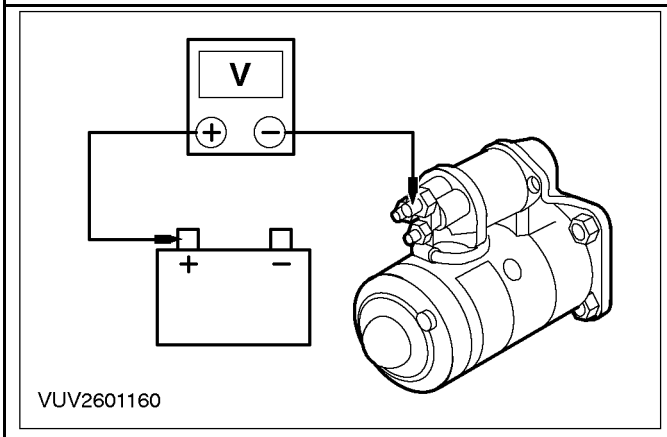
Pinpoint Tests

NOTE: Use a digital multimeter for all electrical measurements.

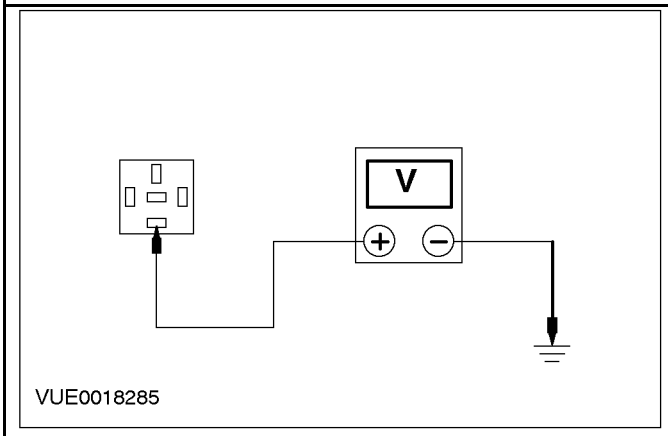
PINPOINT TEST A: THE ENGINE DOES NOT CRANK/THE RELAY DOES CLICK

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK VOLTAGE TO STARTER SOLENOID	
	1 Key in START position.

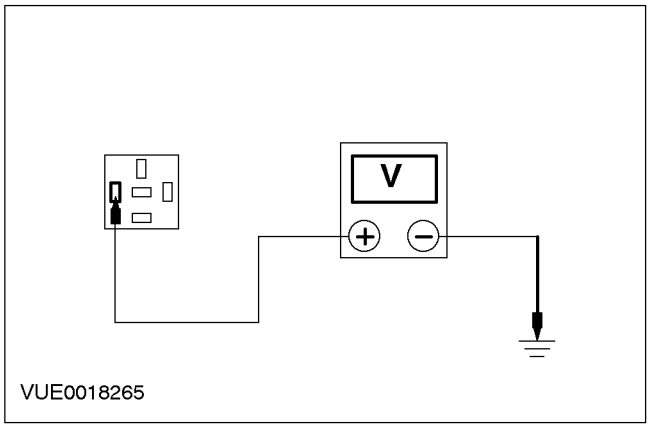
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VUE0019332	**2** Measure the voltage between starter motor terminal 50, harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **A2**. → **No** GO to **A3**.
A2: CHECK STARTER MOTOR FEED	
 VUV2601160	**1** Measure the voltage between starter motor terminal 30, component side and the battery positive terminal. • Is the voltage less than 0.5 volts? → **Yes** REPAIR circuit 50-BB10 (GY/BK). TEST the system for normal operation. → **No** CLEAN and TIGHTEN all battery positive cable connections. TEST the system for normal operation. If the concern persists, INSTALL a new starter motor. REFER to Starter Motor - 1.8L/2.0L/2.0L Diesel, Vehicles With: Manual Transaxle/4-Speed Automatic Transaxle in this section. Or REFER to Starter Motor - 2.5L in this section. Or
A3: CHECK CIRCUIT 30-DB1 (RD) FOR OPEN	
	1 Key in OFF position. **2** Disconnect Starter Relay C910.

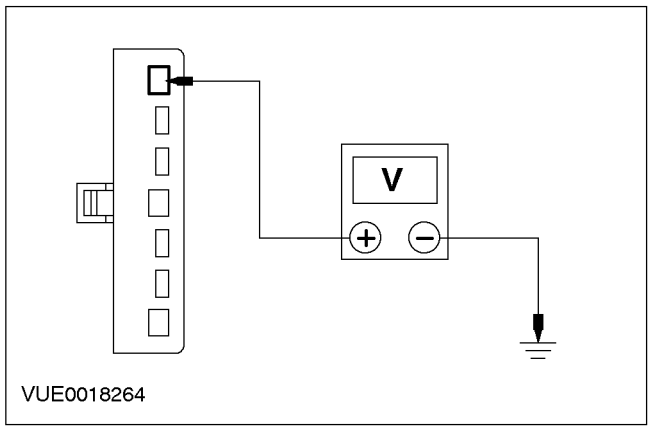
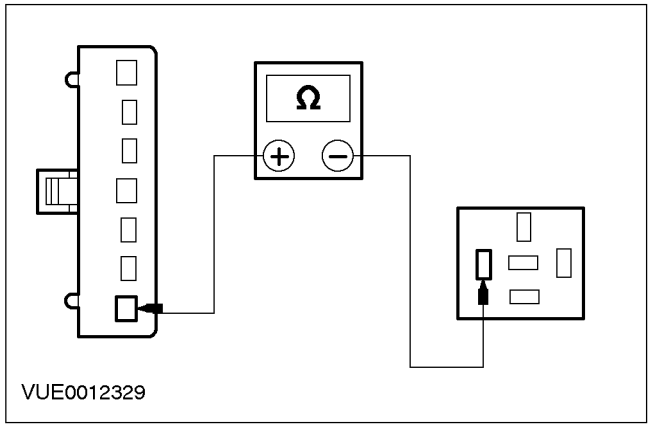
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	3 Measure the voltage between starter relay C910 pin 5, circuit 30-DB1 (RD), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** REPAIR circuit 50-BB10 (GY/BK). TEST the system for normal operation. → **No** REPAIR the circuit. CHECK fuse F29 (30A). INSTALL a new fuse as necessary. If the fuse fails again for check for a short to ground. TEST the system for normal operation.

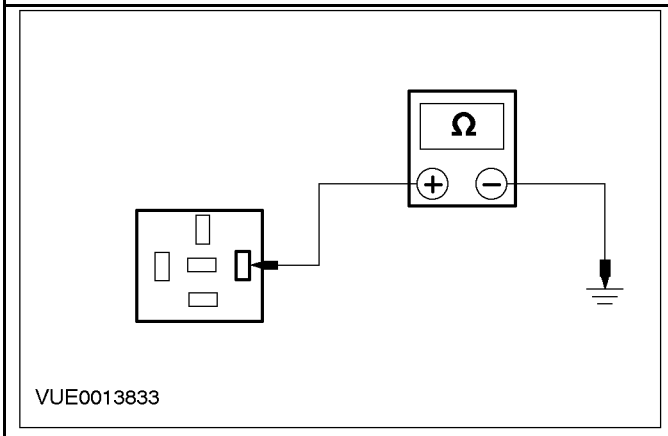
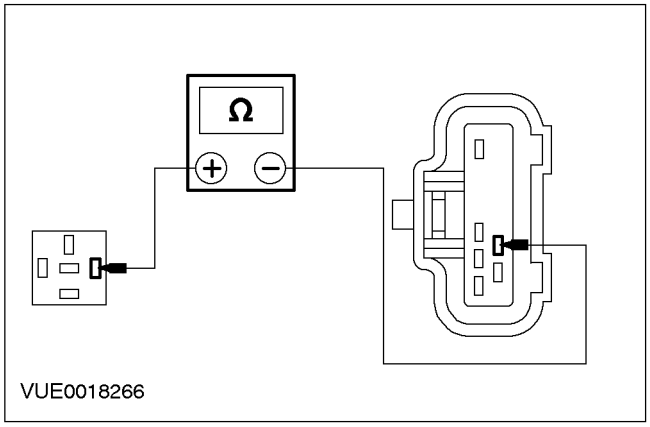
PINPOINT TEST B: THE ENGINE DOES NOT CRANK/RELAY DOES NOT CLICK

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK SWITCHED POWER TO THE STARTER RELAY	
	1 Disconnect Starter Relay C910. 2 Key in START position. 3 Measure the voltage between starter motor relay C910 pin 1, harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **B4**. → **No** GO to **B2**.
B2: CHECK VOLTAGE AT IGNITION SWITCH CIRCUIT 50-BB12 (GY)	
	1 Disconnect Ignition Switch C400.

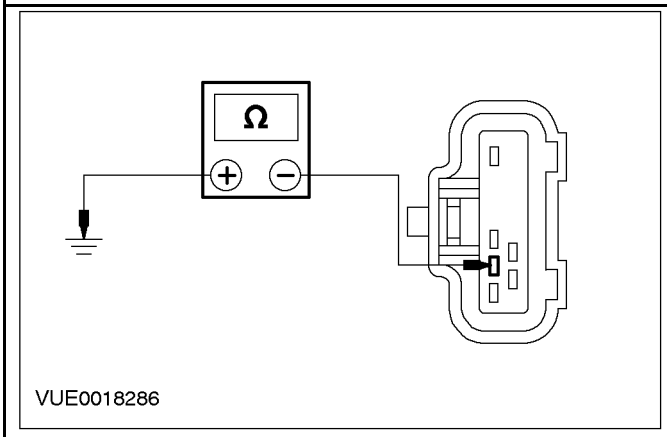
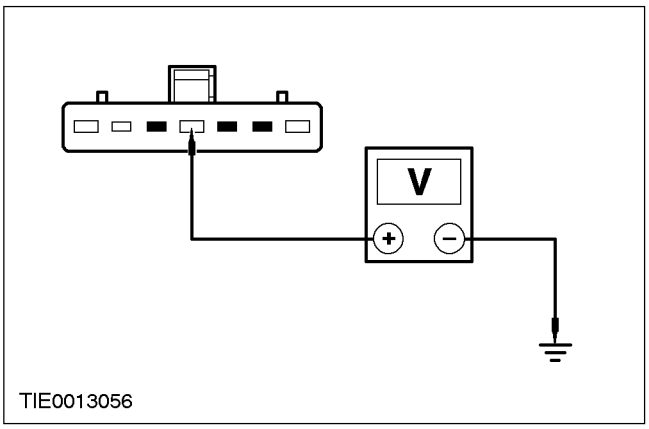
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VUE0018264	2 Key in START position. 3 Measure the voltage between ignition switch C400 pin 7, circuit 50-BB12 (GY), component side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **B3**. → **No** CARRY OUT the Ignition Switch Component Test, REFER to the wiring diagrams. If the concern persists, GO to **B7** .
B3: CHECK CIRCUIT 30-BB12 (GY) FOR OPEN	
 VUE0012329	1 Key in OFF position. 2 Measure the resistance between ignition switch C400 pin 7, circuit 30-BB12 (GY), harness side and starter relay C910 pin 1, circuit 30-BB12 (GY), harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **B4**. → **No** REPAIR the circuit. TEST the system for normal operation.
B4: CHECK CIRCUIT 31S-BB12 (BK/YE) FOR OPEN	
NOTE: Make sure that the transaxle is in the PARK position before carrying out this test - (vehicles with automatic transaxle).	
	1 Key in OFF position.

DIAGNOSIS AND TESTING (Continued)

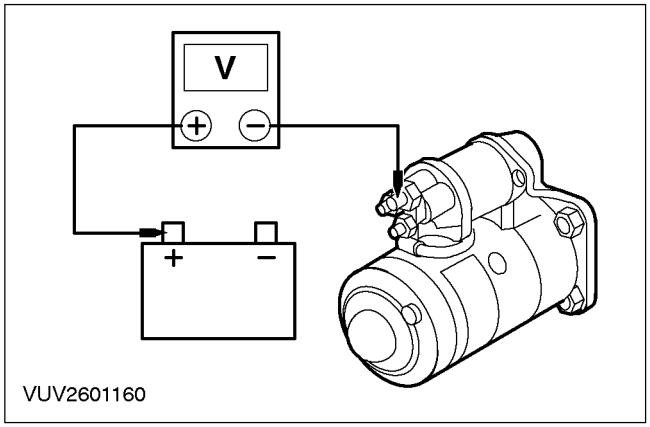
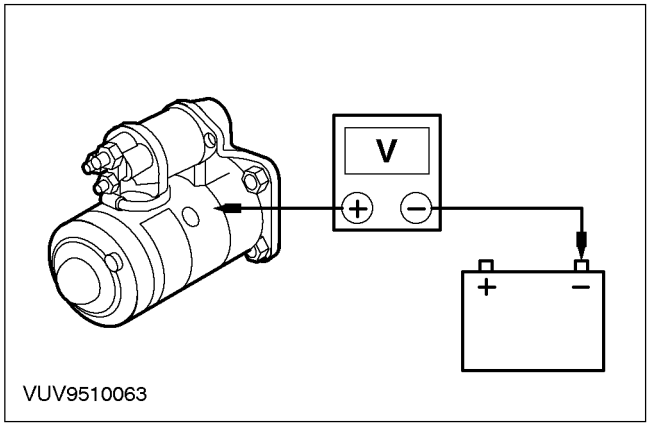
CONDITIONS	DETAILS/RESULTS/ACTIONS
	**2** Measure the resistance between starter relay C910 pin 2, harness side and ground. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new starter relay. TEST the system for normal operation. → **No** For vehicles with manual transaxle, REPAIR the circuit. TEST the system for normal operation. For vehicles with automatic transaxle, GO to **B5** .
B5: CHECK CIRCUIT 31S-BB12 (BK/YE) FOR OPEN	
	**1** Disconnect Transmission Range (TR) Sensor C187. **2** Measure the resistance between transmission range (TR) sensor C187 pin 9, circuit 31S-BB12 (BK/YE), and the starter relay C910 pin 2, circuit 30-BB12 (GY/YE), harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **B6**. → **No** REPAIR the circuit. TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
B6: CHECK CIRCUIT 31S-BB12A (BK/YE) FOR OPEN	
 VUE0018286	**1** Measure the resistance between TR sensor C187 pin 4, circuit 31S-BB12A (BK/YE), harness side and ground. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new TR sensor. For vehicles with 4-speed automatic transaxle, REFER to Section 307-01A / 307-01B. Or for vehicles with 5-speed automatic transaxle, TEST the system for normal operation. → **No** REPAIR the circuit. TEST the system for normal operation.
B7: CHECK FOR POWER TO IGNITION SWITCH	
 TIE0013056	**1** Key in OFF position. **2** Measure the voltage between ignition switch C400 pin 4, circuit 30-BB9 (RD), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** REPAIR circuit 50-BB12 (GY). TEST the system for normal operation. → **No** CHECK Fuse F28 (20A). INSTALL a new fuse as necessary. If the fuse fails again for check for a short to ground. REPAIR circuit 30-BB9 (RD). TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST C: THE ENGINE CRANKS SLOWLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK THE VOLTAGE DROP	
 VUV2601160	1 Key in START position. 2 Measure the voltage between starter motor terminal 30, component side and the battery positive terminal. • Is the voltage less than 0.5 volts? → **Yes** GO to **C2**. → **No** CLEAN and TIGHTEN all battery positive cables connections. TEST the system for normal operation. If the concern persists, INSTALL a new battery to starter motor solenoid cable. REFER to Section 414-01. TEST the system for normal operation.
C2: CHECK FOR GROUND CONNECTION	
 VUV9510063	1 Key in START position. 2 Measure the voltage between starter motor case and the battery ground cable. • Is the voltage less than 0.5 volts? → **Yes** CHECK the battery charging system. REFER to Section 414-00. TEST the system for normal operation. → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	CLEAN and TIGHTEN all battery negative cable connections, starter motor mounting and body to ground straps. TEST the system for normal operation. If the concern persists, INSTALL a new battery negative cable. TEST the system for normal operation.

REMOVAL AND INSTALLATION

Starter Motor — 1.8L/2.0L/2.0L Diesel, Vehicles With: Manual Transaxle/4-Speed Automatic Transaxle (26 204 0)

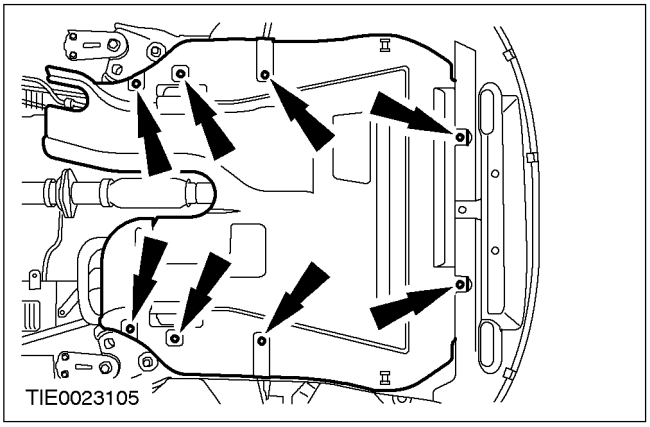
Removal

All vehicles

1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Raise and support the vehicle. For additional information, refer to Section 100-02.**

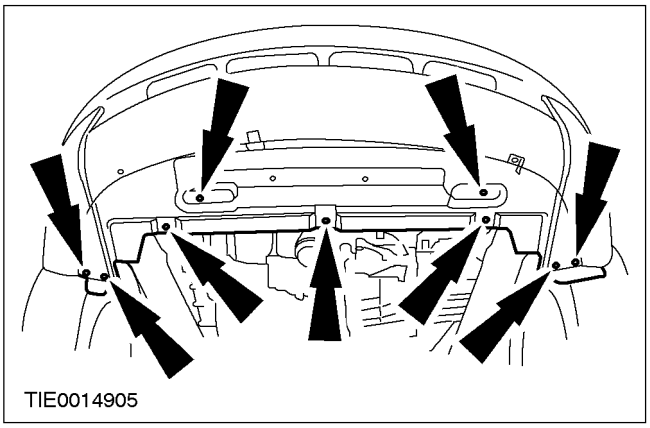
Vehicles with 2.0L diesel engine

3. **Remove the engine undershield.**



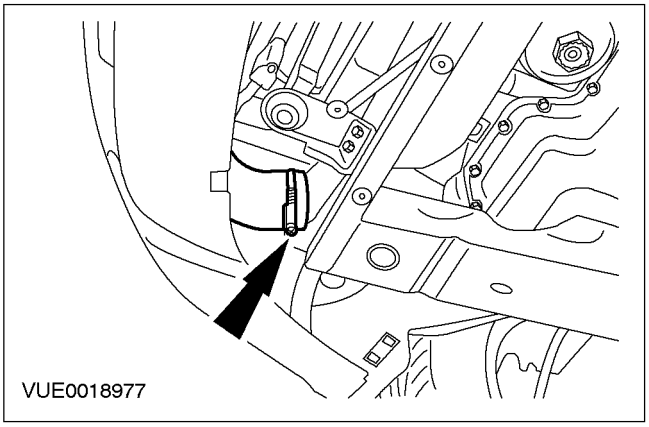
All vehicles

4. **Remove the splash shield.**

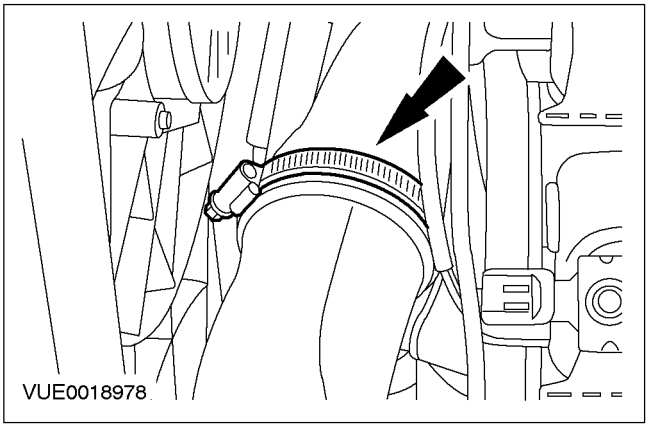


Vehicles with 2.0L diesel engine

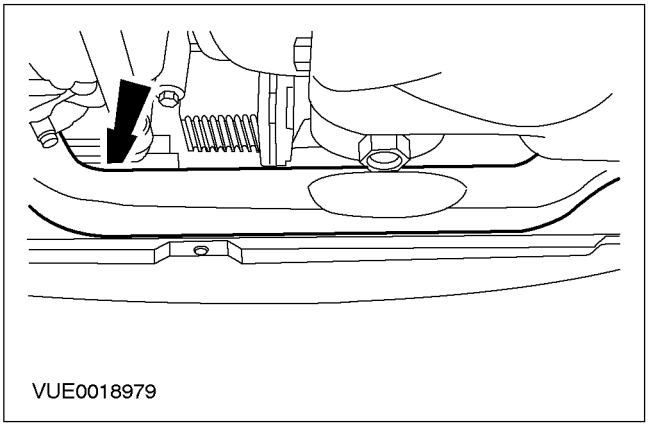
5. **Disconnect the charge air cooler intake pipe from the air intake pipe.**



6. **Disconnect the air intake hose from the air intake pipe and exhaust gas recirculation (EGR) tube.**

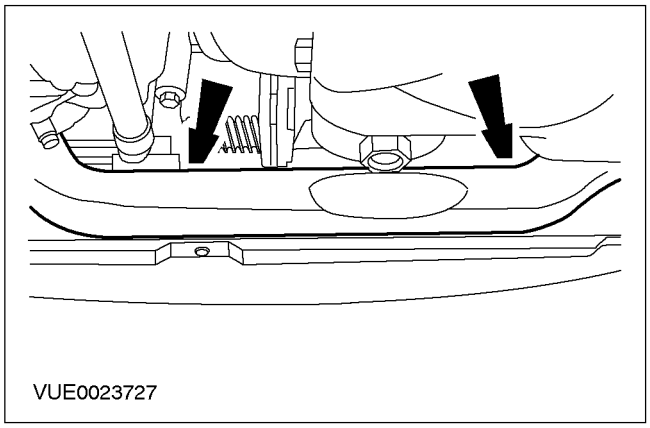


7. **Disconnect the temperature and manifold absolute pressure (T-MAP) sensor electrical connector.**



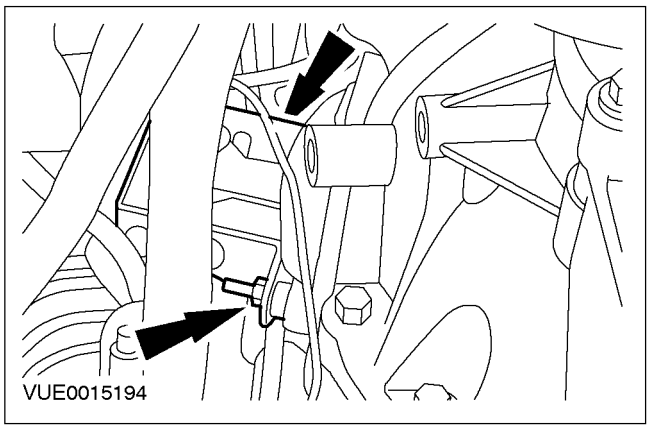
REMOVAL AND INSTALLATION (Continued)

8. Remove the air intake pipe retaining bolts and remove the air intake pipe.

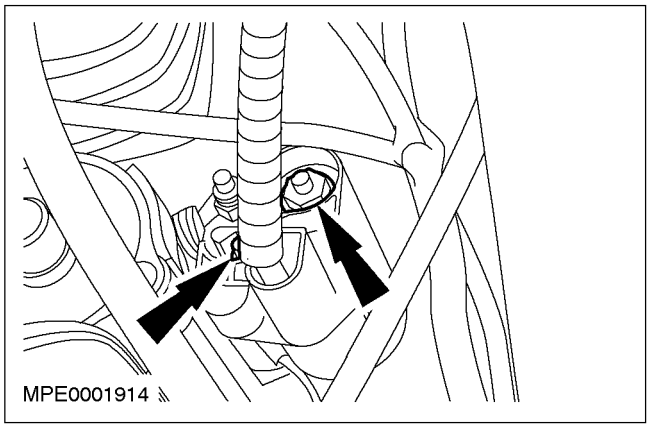


All vehicles

9. Remove the wiring harness support bracket retaining nuts and position the support bracket to one side.

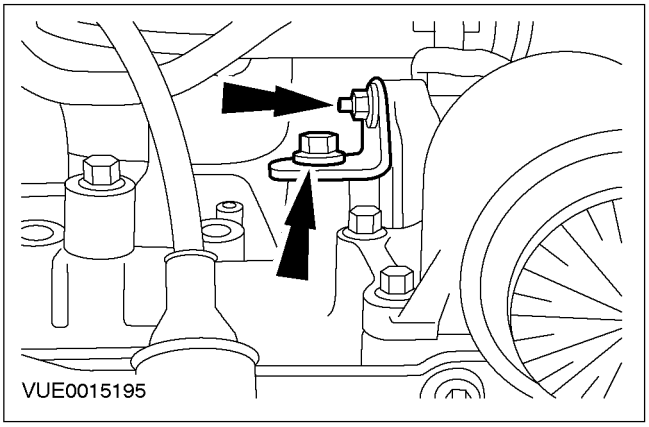


10. Disconnect the ignition switch and battery to starter motor solenoid cables.



Vehicles with 1.8L or 2.0L engine

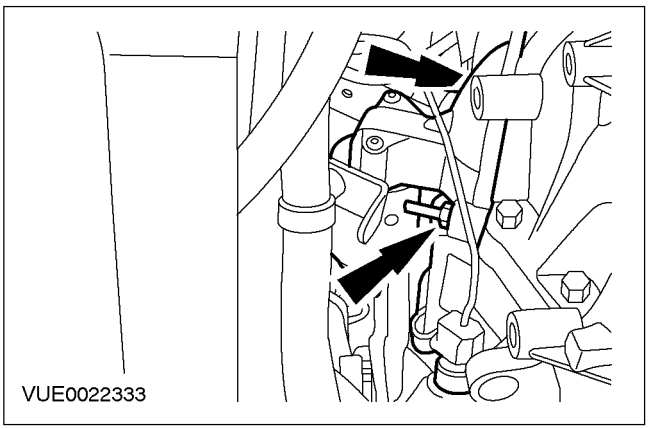
11. Remove the starter motor rear support bracket retaining nut and bolt and remove the starter motor support bracket.



All vehicles

12. Remove the starter motor.

- Discard the gasket.



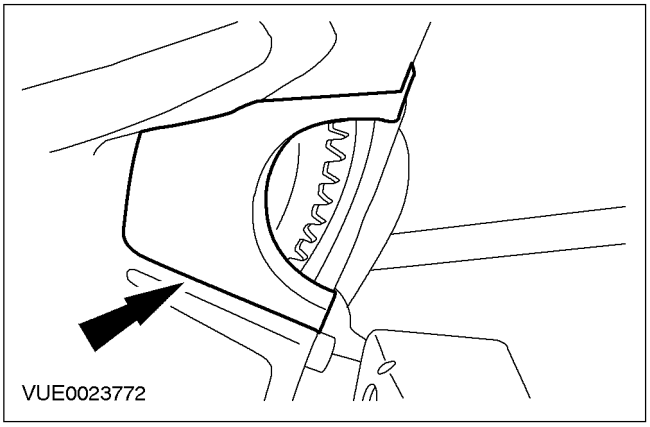
Installation

Vehicles with 1.8L or 2.0L engine

1. Install the starter motor rear support bracket to the starter motor and hand tighten the retaining nut.

REMOVAL AND INSTALLATION (Continued)

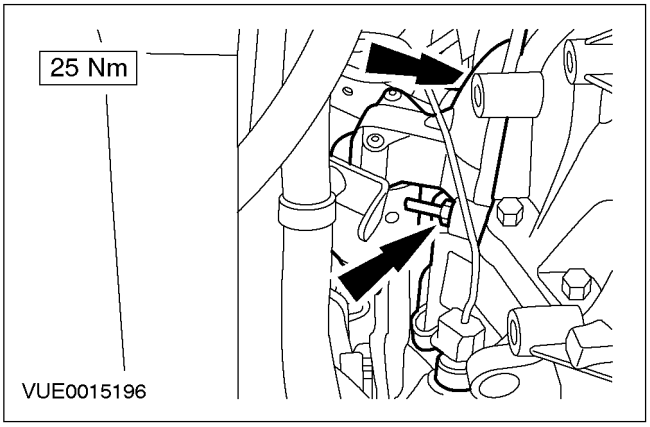
2. Make sure the protective cover is correctly installed into the transmission housing.



All vehicles

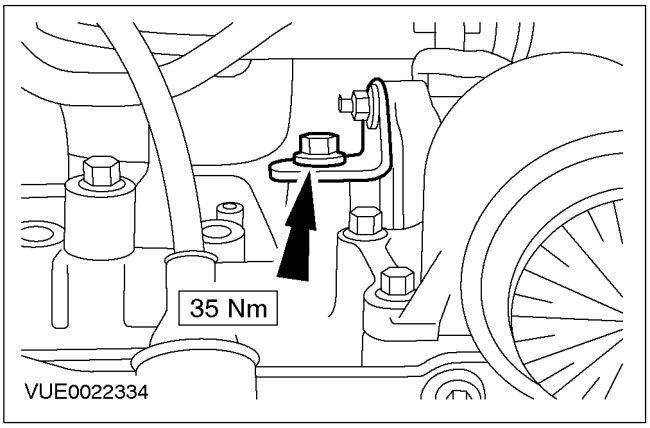
3. NOTE: Install a new gasket.

Install the starter motor.

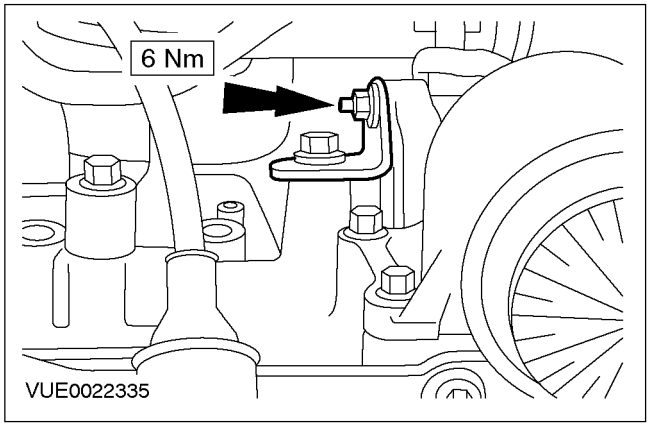


Vehicles with 1.8L or 2.0L engine

4. Install the starter motor rear support bracket retaining bolt.

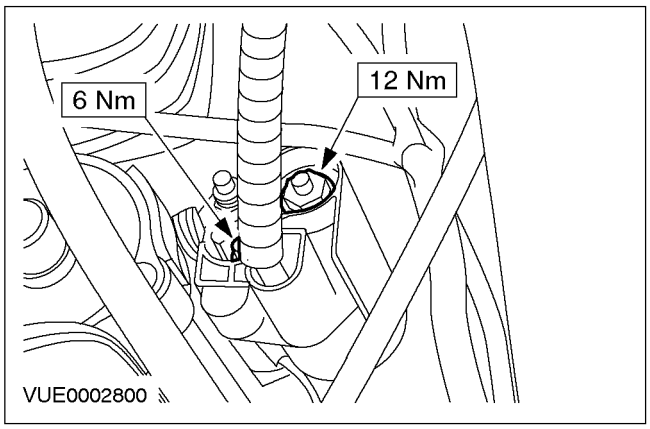


5. Tighten the starter motor rear support bracket retaining nut.

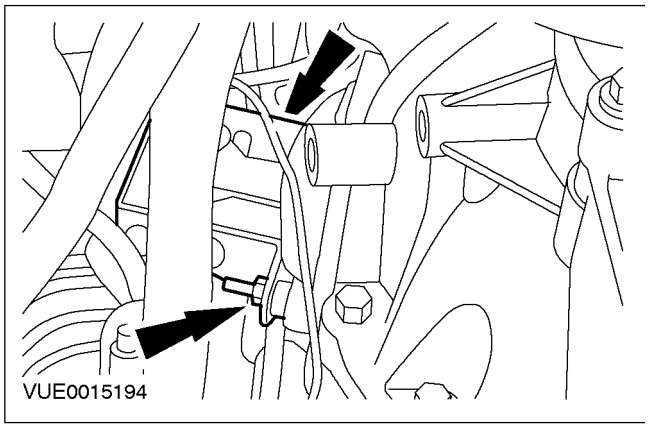


All vehicles

6. Connect the ignition switch and battery to starter motor solenoid cables.



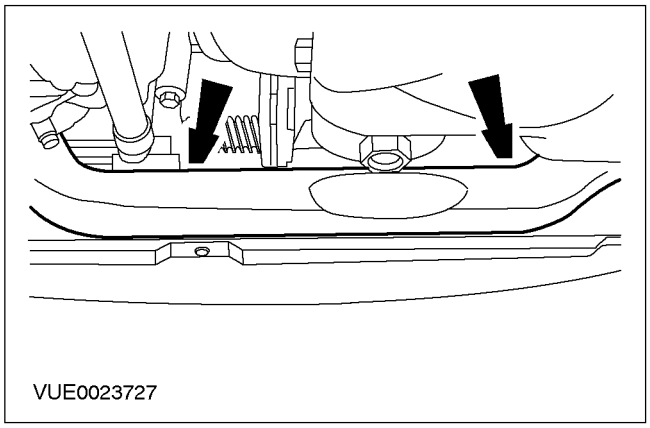
7. Attach the wiring harness support bracket and install the support bracket retaining nuts.



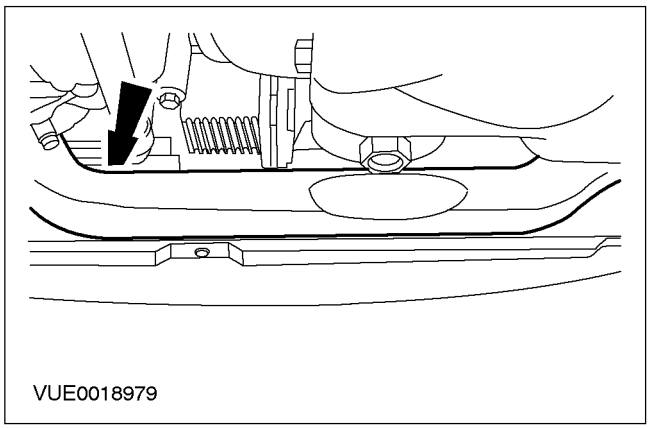
REMOVAL AND INSTALLATION (Continued)

Vehicles with 2.0L diesel engine

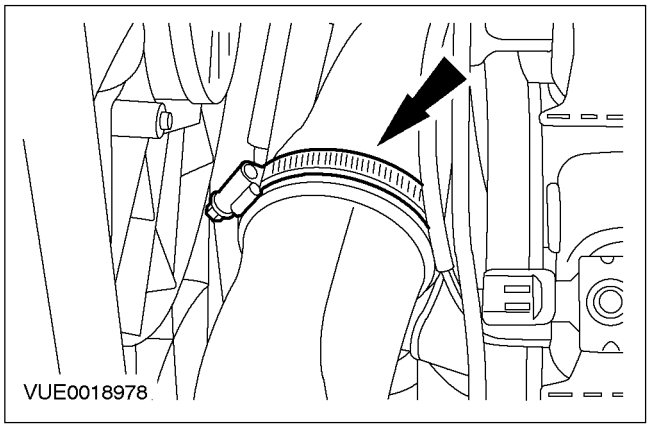
8. **Install the air intake pipe and install the air intake pipe retaining bolts.**



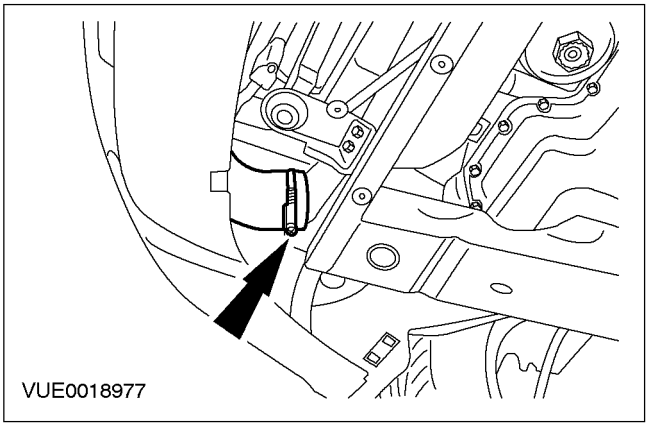
9. **Connect the T-MAP sensor electrical connector.**



10. **Connect the air intake hose to the air intake pipe and EGR tube.**



11. **Connect the charge air cooler intake pipe to the air intake pipe.**



All vehicles

12. **Connect the battery ground cable. For additional information, refer to Section 414-01.**
13. **Initialize the door window motors. For additional information, refer to Section 501-11.**

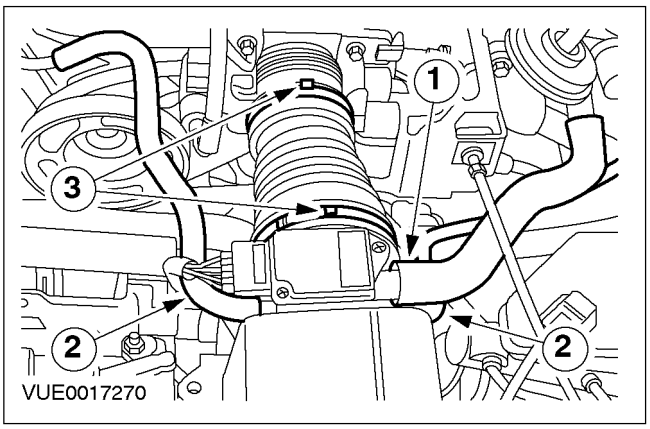
REMOVAL AND INSTALLATION

Starter Motor — 2.5L (26 204 0)

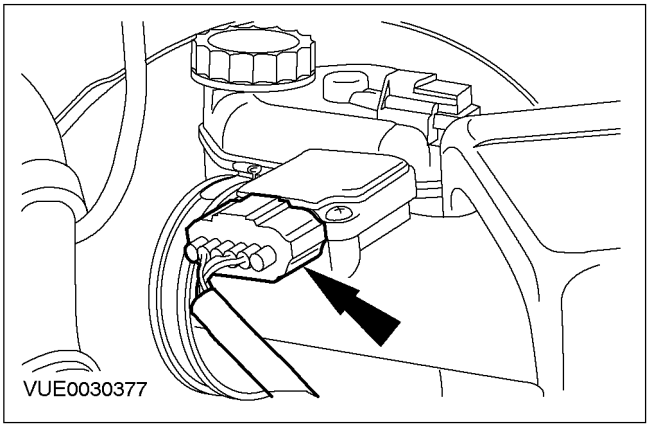
Removal

All vehicles

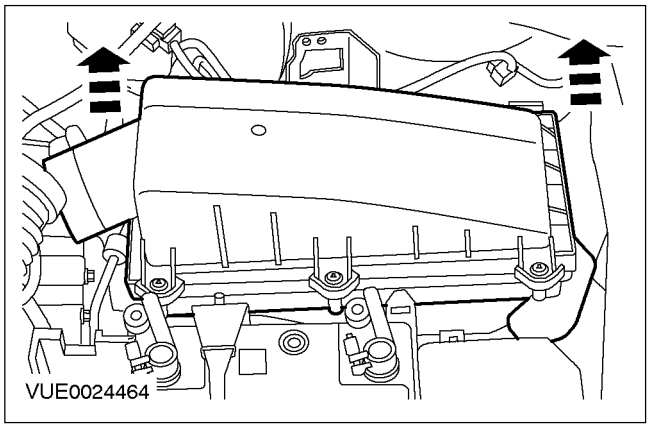
1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Remove the air cleaner outlet pipe.**
   1. Disconnect the intake air bypass hose.
   2. Disconnect the positive crankcase ventilation (PCV) hoses.
   3. Detach the air cleaner outlet pipe retaining clips.



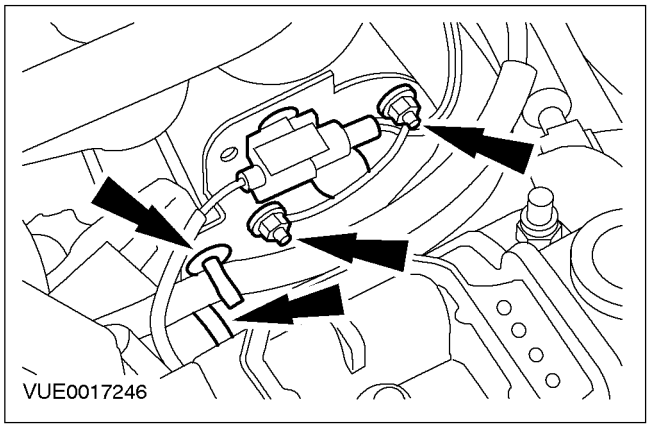
3. **Disconnect the Mass Air Flow (MAF) sensor electrical connector.**



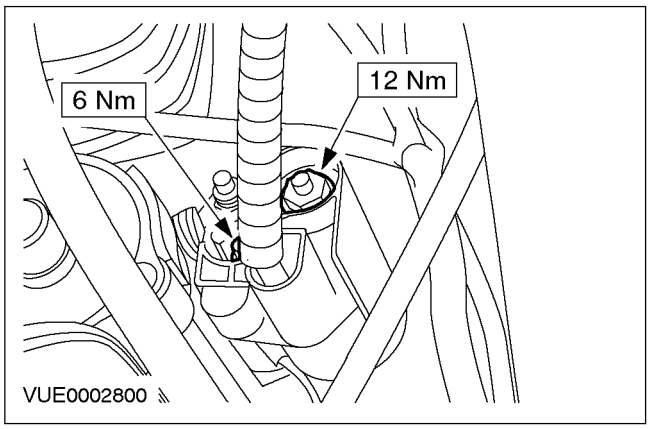
4. **Remove the air cleaner.**



5. **Detach the wiring harness support bracket.**
   - Detach the wiring harness retaining clips from the support bracket.
   - Remove the wiring harness support bracket retaining nuts.



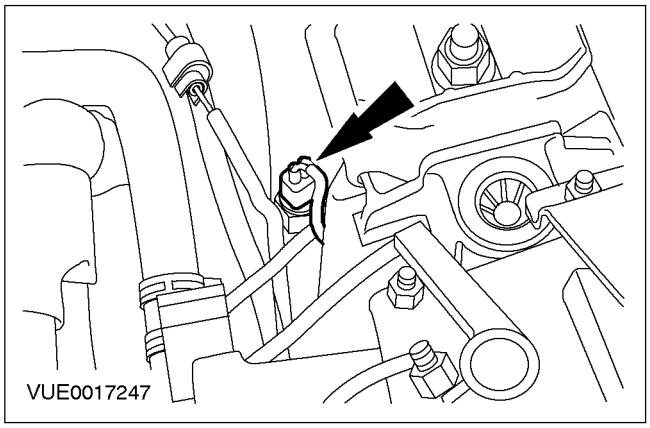
6. **Disconnect the ignition switch and battery to starter motor solenoid cables.**



REMOVAL AND INSTALLATION (Continued)

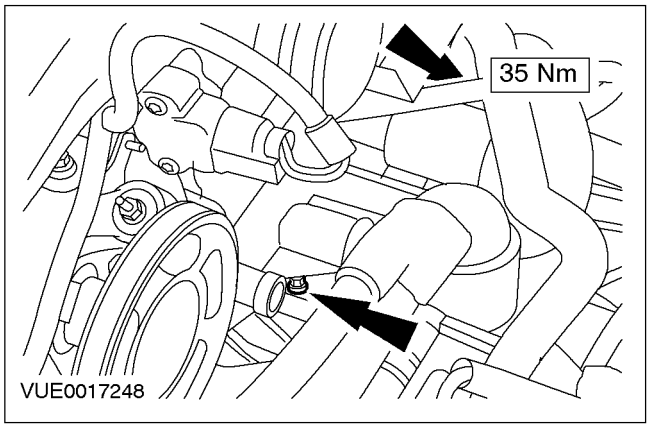
Vehicles with manual transaxle

7. **Disconnect the reversing lamp switch electrical connector.**



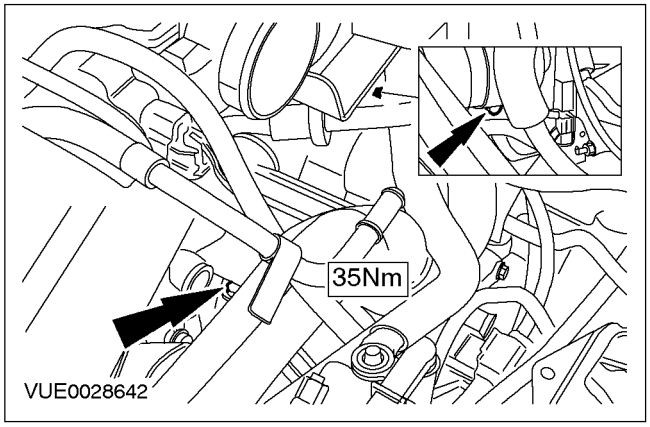
Vehicles with manual transaxle or 4-speed automatic transaxle

8. **Remove the starter motor retaining bolts and remove the starter motor.**



Vehicles with 5-speed automatic transaxle

9. **Remove the starter motor retaining bolts and remove the starter motor.**



Installation

1. **To install, reverse the removal procedure.**
2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

SECTION 303-07A Engine Ignition

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

SPECIFICATIONS

Specifications 303-07-2

DIAGNOSIS AND TESTING

Engine Ignition..... 303-07-3
Inspection and Verification 303-07-3
Symptom Chart 303-07-3

SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Ignition coil bracket bolts	10	–	89
Ignition coil pack retaining bolts	6	–	53

DIAGNOSIS AND TESTING

Engine Ignition

General Equipment
Worldwide Diagnostic System (WDS)

Electrical
• Wiring harness • Electrical connector(s) • Spark plug(s) • Spark plug wire(s) • Ignition coil pack • Powertrain control module (PCM)

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Visual Inspection Chart

Symptom Chart

Condition	Possible Sources	Action
•Engine misfire	•Spark plug(s). •Spark plug wire(s).	•CARRY OUT a KV test using WDS.
	•Ignition coil pack. •PCM. •PCM calibration.	•REFER to WDS.
•Engine stumbling	•Spark plug(s). •Spark plug wire(s).	•CARRY OUT a KV test using WDS.
	•Ignition coil pack. •PCM. •PCM calibration.	•REFER to WDS.
•Engine lacks power	•Spark plug(s). •Spark plug wire(s).	•CARRY OUT a KV test using WDS.
	•Ignition coil pack.	•REFER to WDS.

SECTION 303-07B Engine Ignition

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

SPECIFICATIONS

Specifications 303-07-2

DIAGNOSIS AND TESTING

Engine Ignition..... 303-07-3
Inspection and Verification 303-07-3
Symptom Chart 303-07-3

REMOVAL AND INSTALLATION

Ignition Coil Pack — 2.5L ..... (22 414 0) 303-07-4

SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Ignition coil bracket	6	—	53

DIAGNOSIS AND TESTING

Engine Ignition

General Equipment
Worldwide Diagnostic System (WDS)

Electrical
• Wiring harness • Electrical connector(s) • Spark plug(s) • Spark plug wire(s) • Ignition coil pack • Powertrain control module (PCM)

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Visual Inspection Chart

Symptom Chart

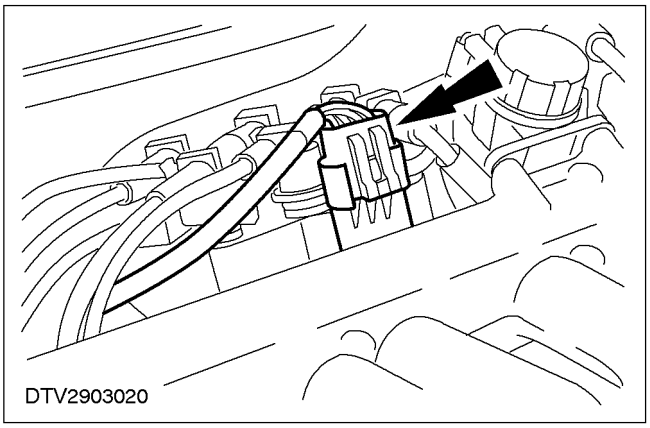
Condition	Possible Sources	Action
•Engine misfire	•Spark plug(s). •Spark plug wire(s).	•CARRY OUT a KV test using WDS.
	•Ignition coil pack. •PCM. •PCM calibration.	•REFER to WDS.
•Engine stumbling	•Spark plug(s). •Spark plug wire(s).	•CARRY OUT a KV test using WDS.
	•Ignition coil pack. •PCM. •PCM calibration.	•REFER to WDS.
•Engine lacks power	•Spark plug(s). •Spark plug wire(s).	•CARRY OUT a KV test using WDS.
	•Ignition coil pack.	•REFER to WDS.

REMOVAL AND INSTALLATION

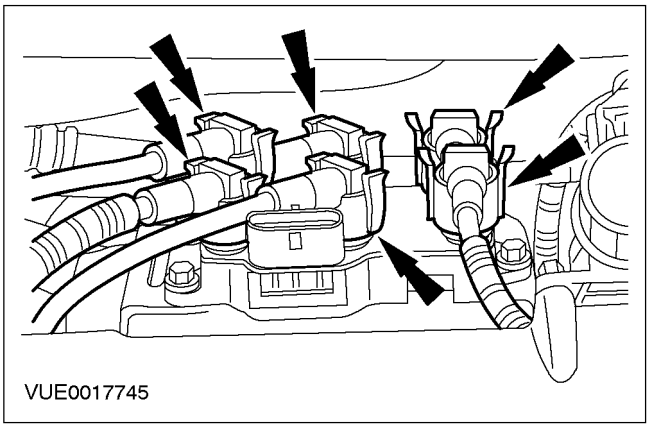
Ignition Coil Pack — 2.5L (22 414 0)

Removal

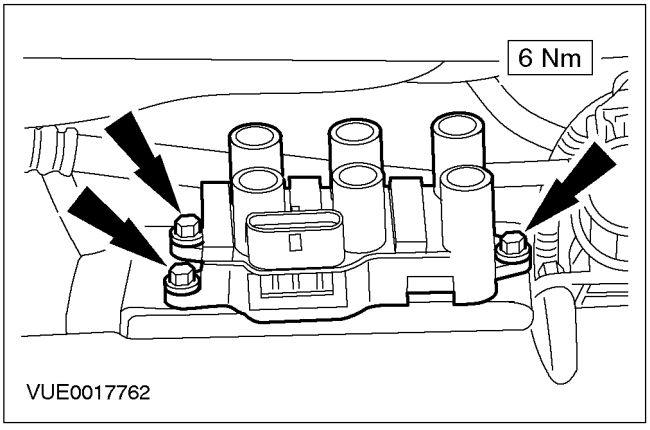
1. **Disconnect the ignition coil pack electrical connector.**



2. **Disconnect the spark plug wires from the ignition coil pack.**



3. **Remove the ignition coil pack.**
   - Remove the ground wire from the ignition coil pack retaining bolt.



Installation

1. **NOTE:** Make sure the ground wire is connected to the ignition coil retaining bolt.

   To install, reverse the removal procedure.

SECTION 303-08 Engine Emission Control

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

SPECIFICATIONS

Specifications 303-08-2

DESCRIPTION AND OPERATION

Engine Emission Control 303-08-3

DIAGNOSIS AND TESTING

Engine Emission Control 303-08-5
Inspection and Verification 303-08-5

REMOVAL AND INSTALLATION

Exhaust Gas Recirculation (EGR) Valve..... (23 312 0) 303-08-6
Crankcase Vent Oil Separator 303-08-8

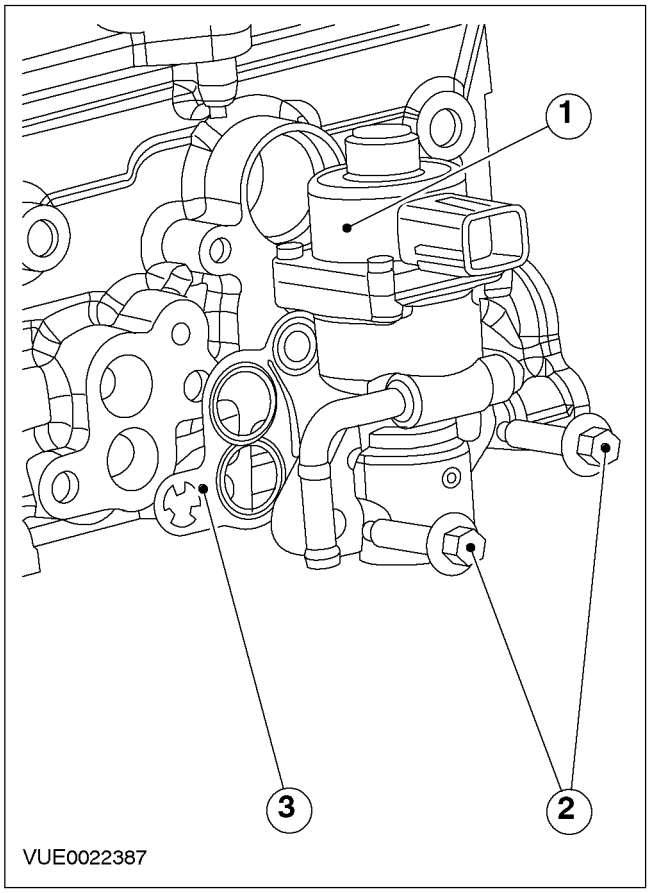
SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Exhaust gas recirculation (EGR) valve bolts	25	18	–
EGR valve outlet tube union	55	41	–
Crankcase vent oil separator retaining bolts	10	–	89

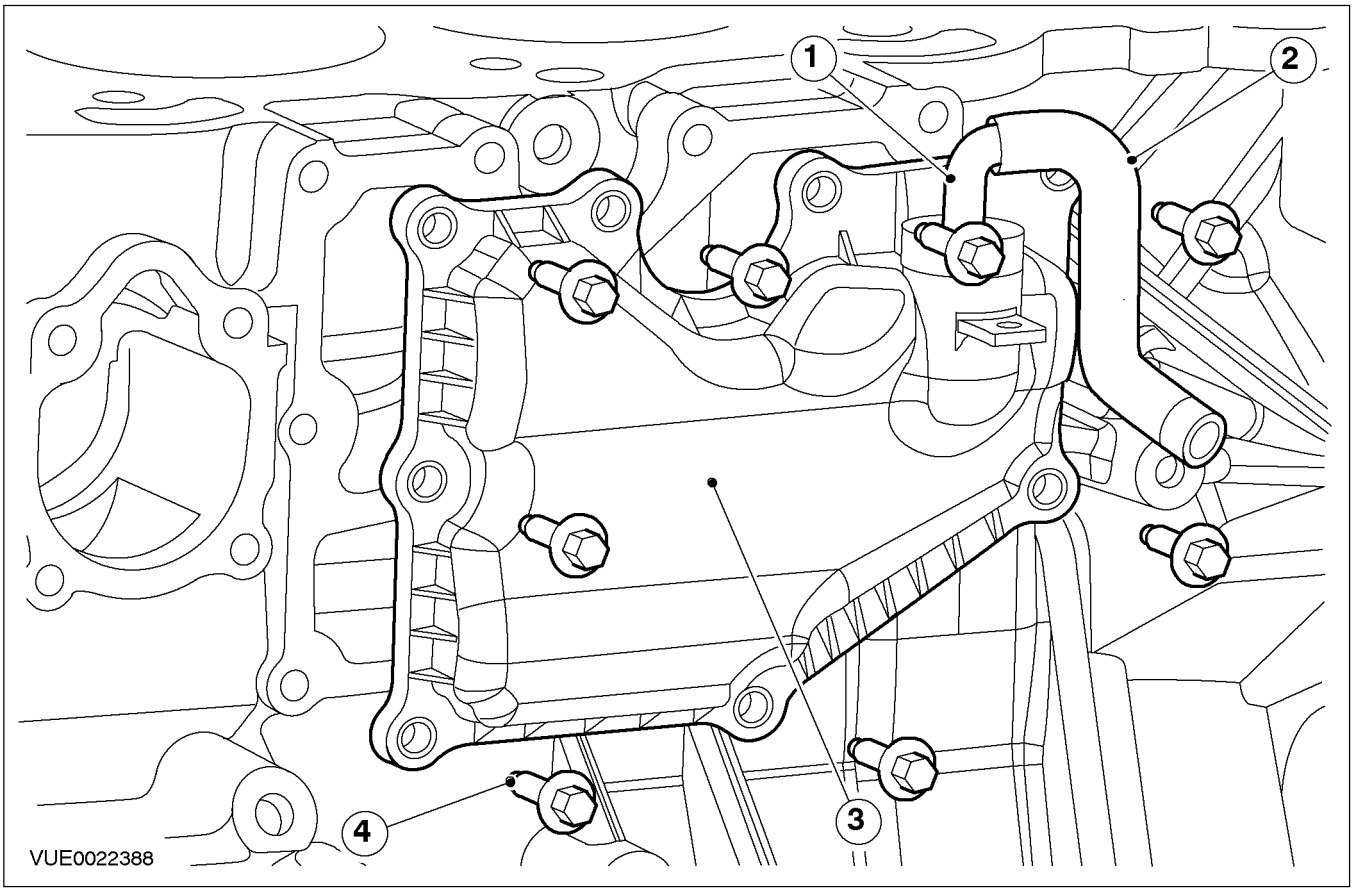
DESCRIPTION AND OPERATION

Engine Emission Control



Item	Part Number	Description
1	-	Exhaust gas recirculation (EGR) valve
2	-	EGR valve retaining bolts
3	-	EGR valve gasket

DESCRIPTION AND OPERATION



Item	Part Number	Description
1	-	Positive crankcase ventilation (PCV) valve
2	-	PCV hose
3	-	Crankcase vent oil separator
4	-	Crankcase vent oil separator retaining bolt

DIAGNOSIS AND TESTING

Engine Emission Control

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Vacuum line(s) – Hose(s)/hose joints – Gasket(s) – PCV valve – PCV separator – EGR valve – EGR tube	– Electrical connector(s) – Wiring harness – Fuse(s) – Relay – EGR valve

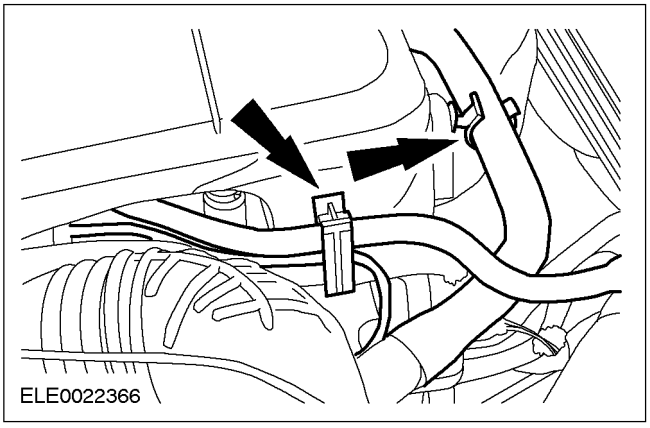
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to WDS to diagnose the system.

REMOVAL AND INSTALLATION

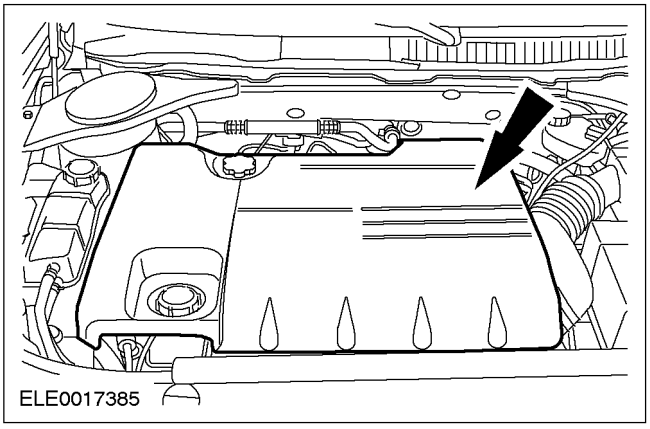
Exhaust Gas Recirculation (EGR) Valve (23 312 0)

Removal

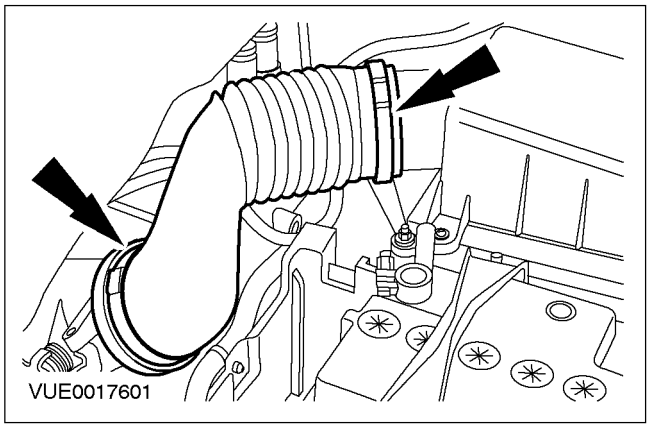
1. Drain the cooling system. For additional information, refer to Section 303-03.
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01.
3. Detach the pipes and hoses from the engine upper cover.



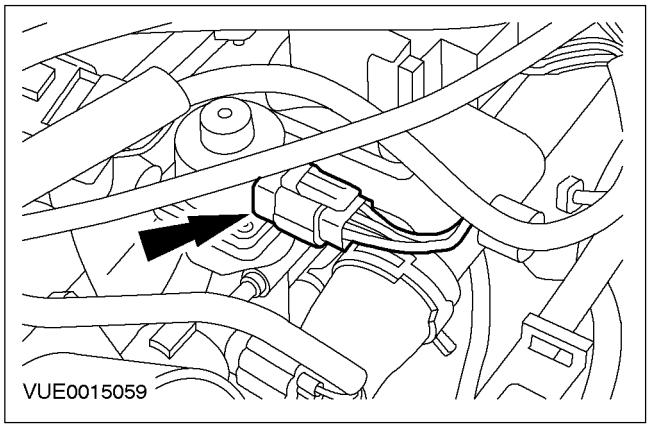
4. Remove the engine upper cover.



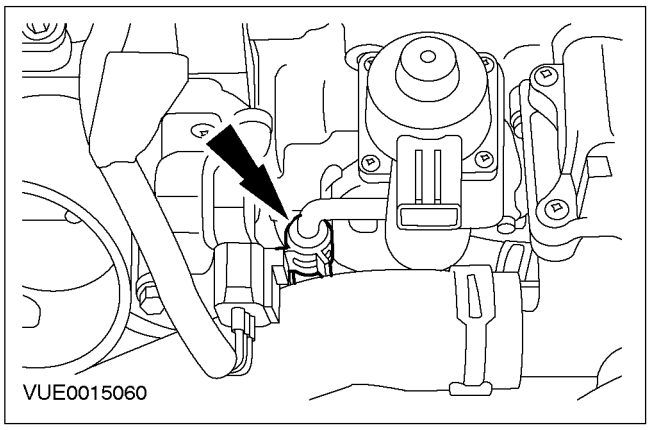
5. Remove the air cleaner outlet pipe.



6. Disconnect the EGR valve electrical connector.



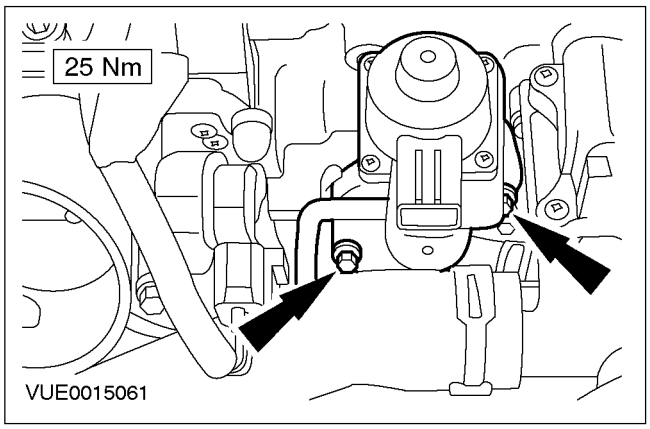
7. Disconnect the coolant hose from the EGR valve.



REMOVAL AND INSTALLATION (Continued)

8. Remove the EGR valve.

- Discard the gasket.



Installation

1. NOTE: Install a new EGR valve gasket.

To install, reverse the removal procedure.

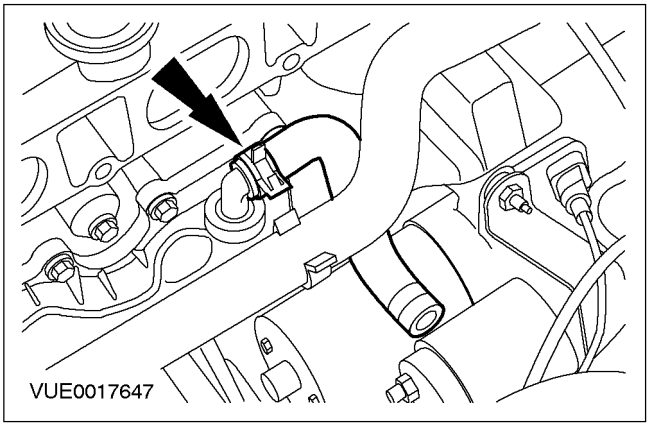
2. Initialize the door window motors. For additional information, refer to Section 501-11.

REMOVAL AND INSTALLATION

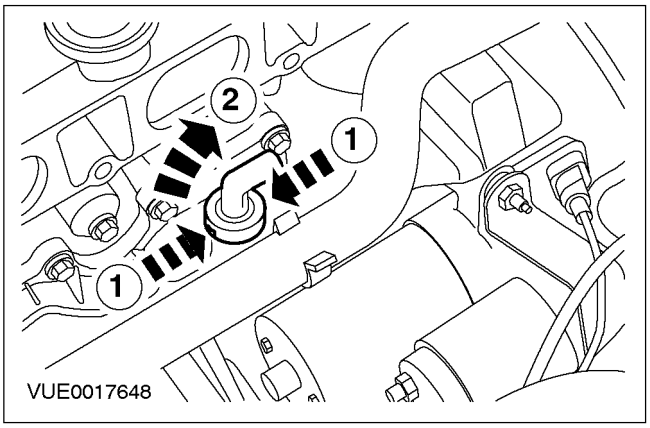
Crankcase Vent Oil Separator

Removal

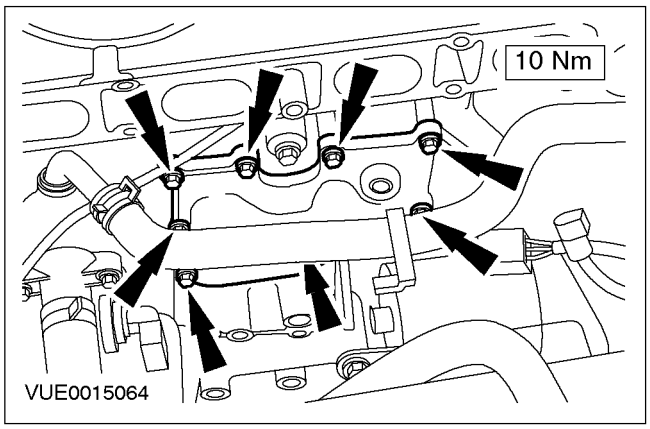
1. **Remove the intake manifold. For additional information, refer to Section 303-01A / 303-01B.**
2. **Disconnect the positive crankcase ventilation (PCV) hose from the PCV valve.**



3. **Remove the PCV valve from the crankcase vent oil separator.**
   1. Push in the locking tangs.
   2. Twist the PCV valve to remove.



4. **Remove the crankcase vent oil separator.**
   - Discard the gasket.



Installation

1. **NOTE:** Install a new crankcase vent oil separator gasket.

   To install, reverse the removal procedure.

SECTION 303-12 Intake Air Distribution and Filtering

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

DESCRIPTION AND OPERATION

Intake Air Distribution and Filtering 303-12-2

DIAGNOSIS AND TESTING

Intake Air Distribution and Filtering 303-12-6
Inspection and Verification 303-12-6

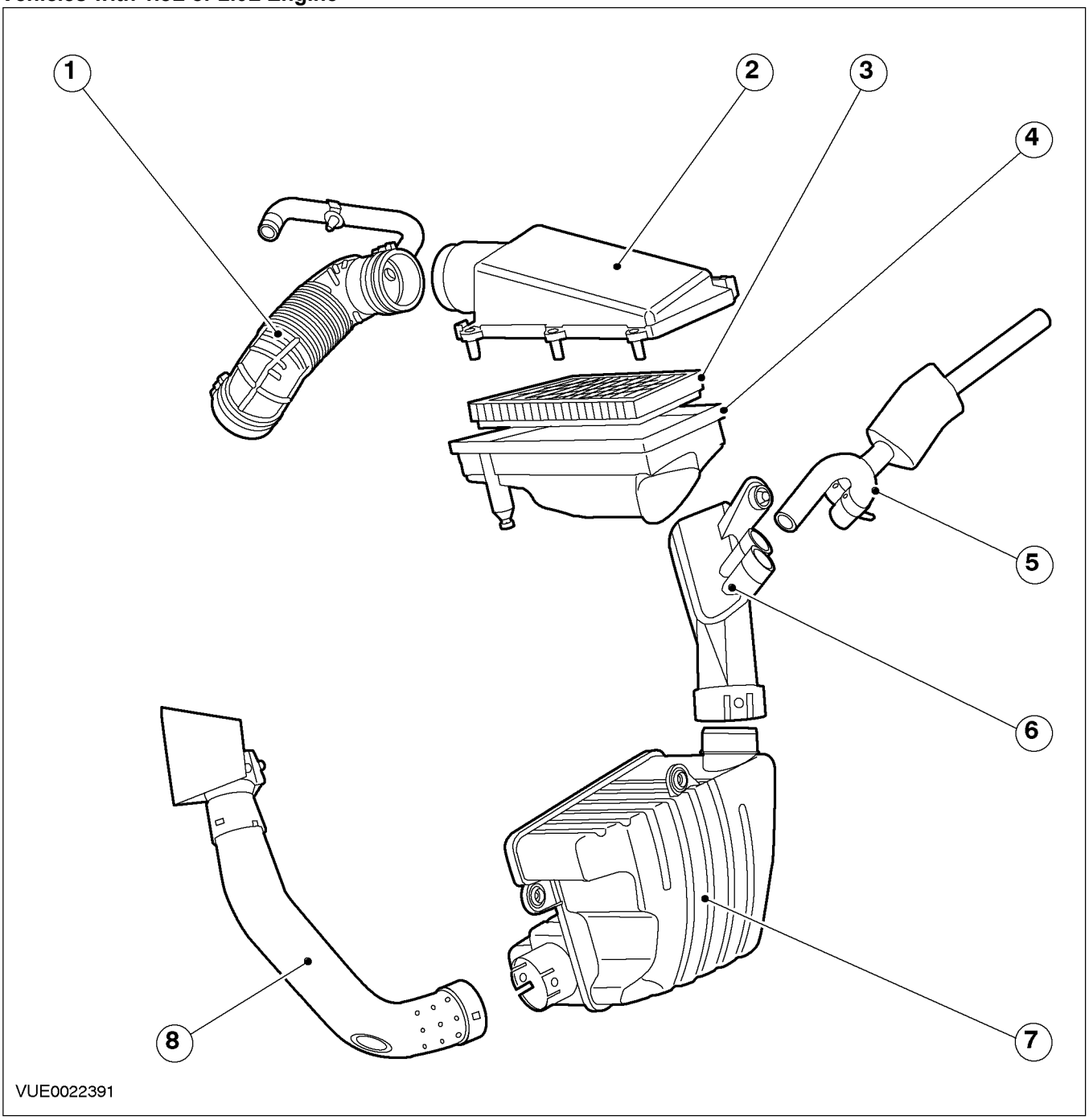
REMOVAL AND INSTALLATION

Air Cleaner Intake Pipe — 1.8L/2.0L..... (23 175 0) 303-12-7
Air Cleaner Intake Pipe — 2.5L/2.0L Diesel..... (23 175 0) 303-12-9

DESCRIPTION AND OPERATION

Intake Air Distribution and Filtering

Vehicles with 1.8L or 2.0L Engine



Item	Part Number	Description
1	-	Air cleaner outlet pipe
2	-	Air cleaner housing cover

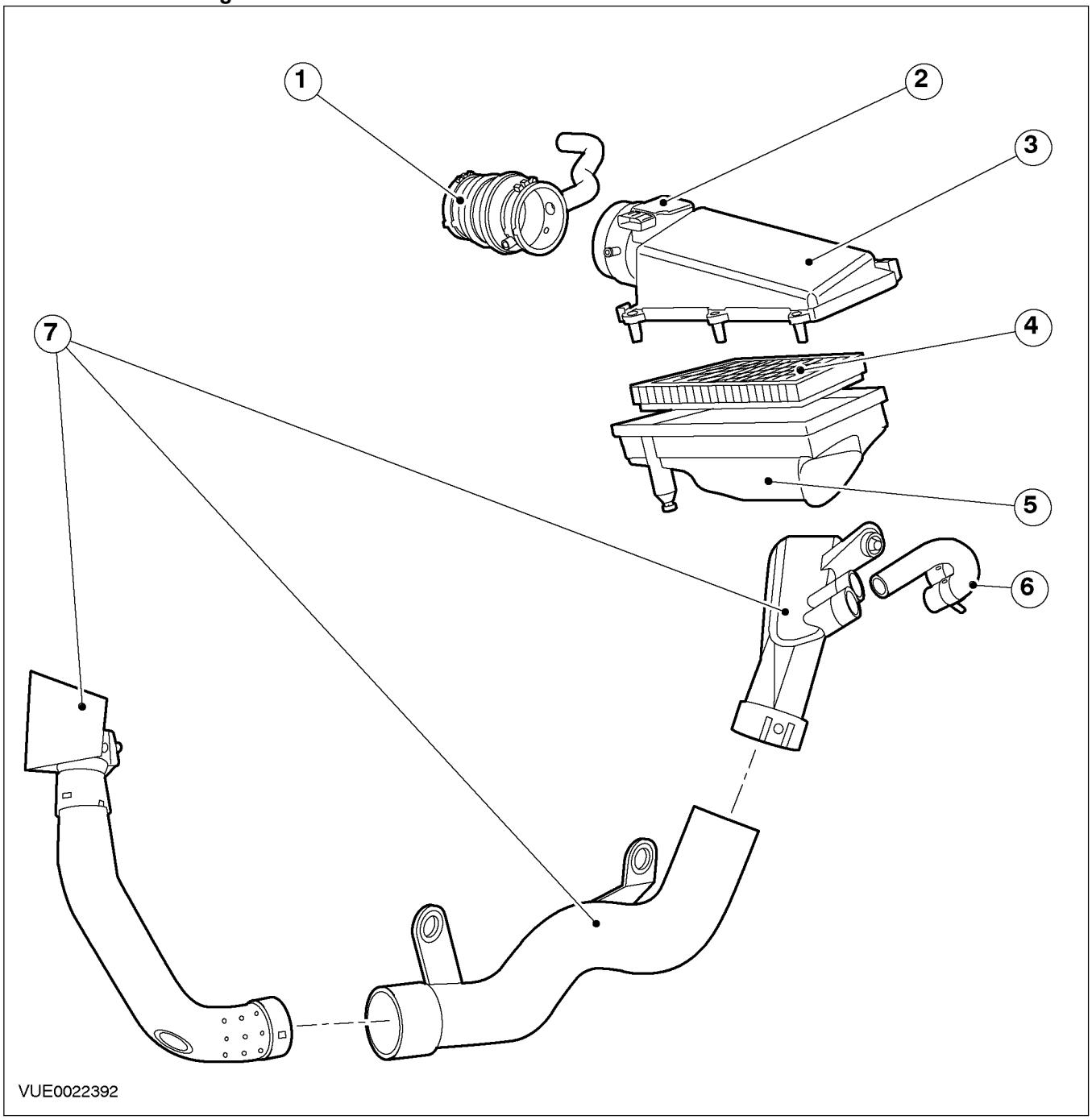
Item	Part Number	Description
3	-	Air cleaner element
4	-	Air cleaner housing
5	-	Air intake tuning pipe

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
6	-	Air cleaner intake pipe
7	-	Intake air resonator box

Item	Part Number	Description
8	-	Air cleaner intake pipe

Vehicles with 2.5L Engine



Item	Part Number	Description
1	-	Air cleaner outlet pipe

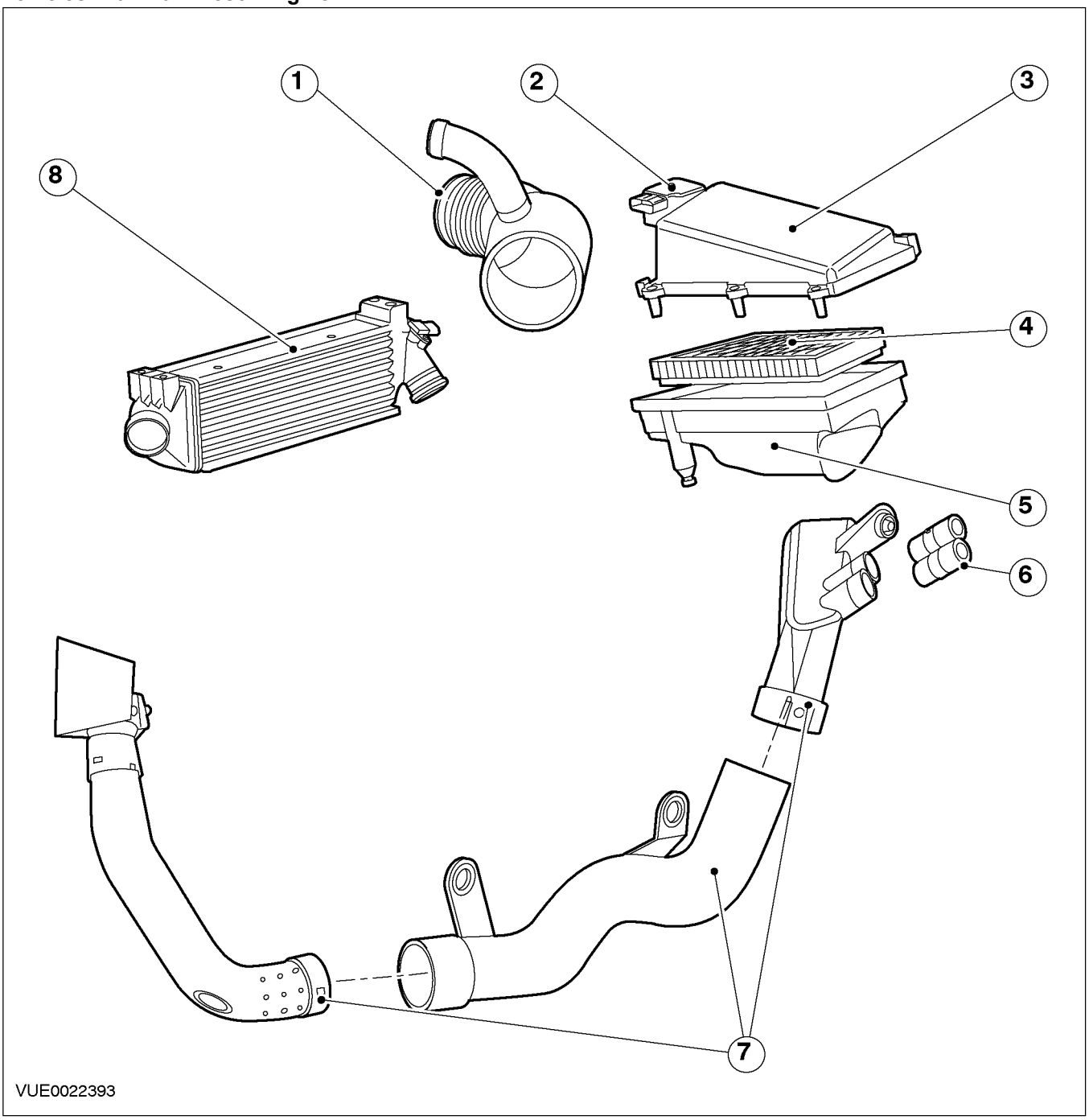
Item	Part Number	Description
2	-	Mass air flow (MAF) sensor

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
3	-	Air cleaner housing cover
4	-	Air cleaner element
5	-	Air cleaner housing

Item	Part Number	Description
6	-	Air intake tuning pipe
7	-	Air cleaner intake pipe

Vehicles with 2.0L Diesel Engine



DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1	-	Air cleaner outlet pipe
2	-	Mass air flow (MAF) sensor
3	-	Air cleaner housing cover
4	-	Air cleaner element
5	-	Air cleaner housing
6	-	Air cleaner intake pipe blanking cap
7	-	Air cleaner intake pipe
8	-	Charge air cooler

DIAGNOSIS AND TESTING

Intake Air Distribution and Filtering

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
– Air leak(s)
– Collapsed pipe(s)
– Air cleaner
– Air cleaner element
– Charge air cooler

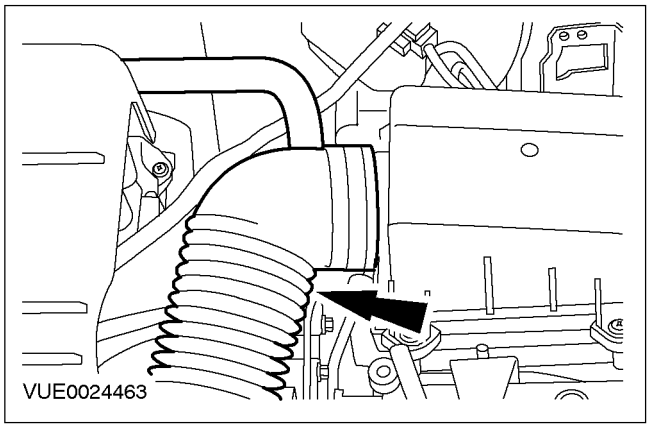
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to WDS to diagnose the system.

REMOVAL AND INSTALLATION

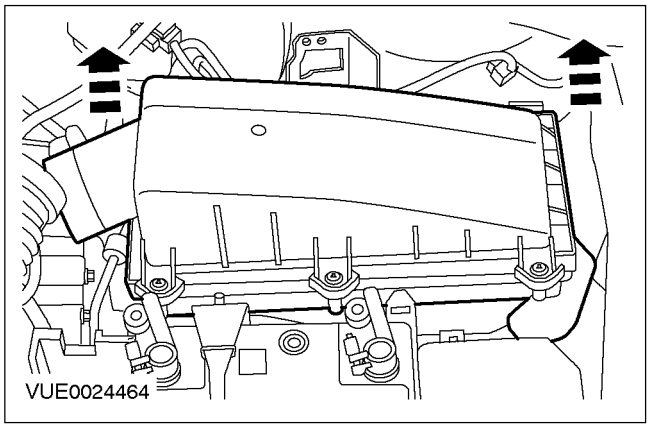
Air Cleaner Intake Pipe — 1.8L/2.0L (23 175 0)

Removal

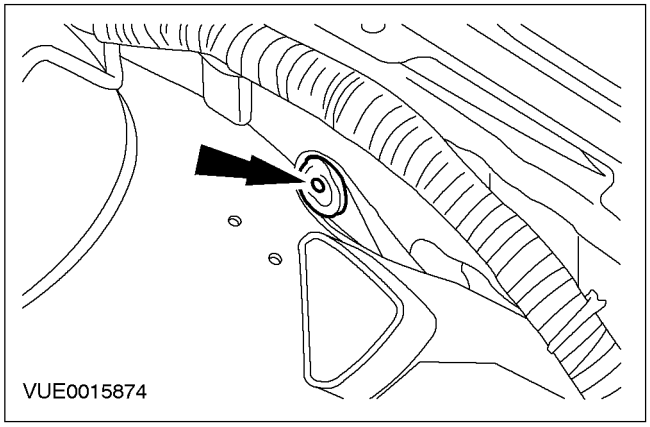
1. **Disconnect the air cleaner outlet pipe and the breather hose from the air cleaner housing.**



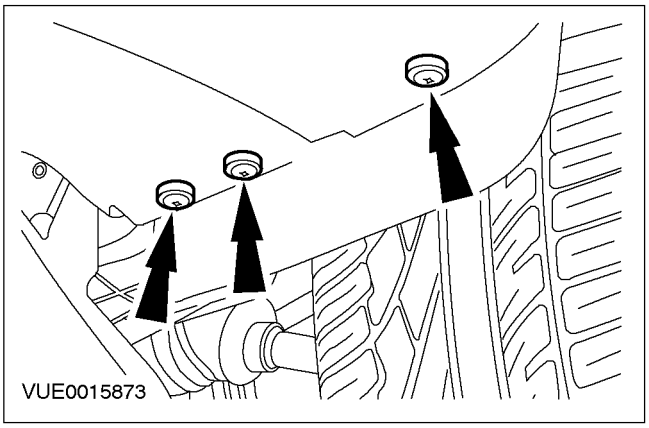
2. **Remove the air cleaner housing.**



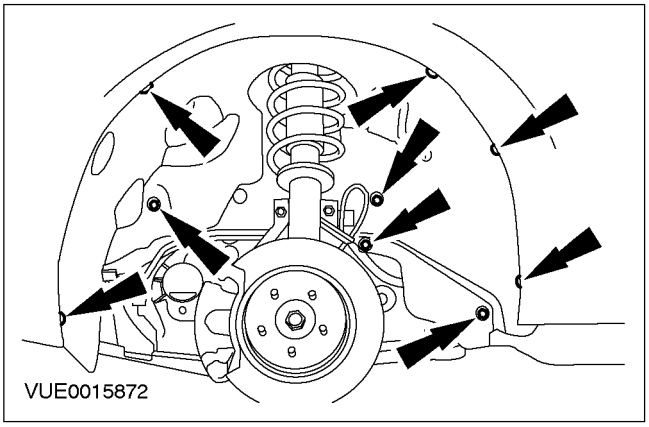
3. **Remove the air cleaner intake pipe upper retaining bolt from the front inner fender.**



4. **Remove the left-hand radiator undershield retaining screws.**



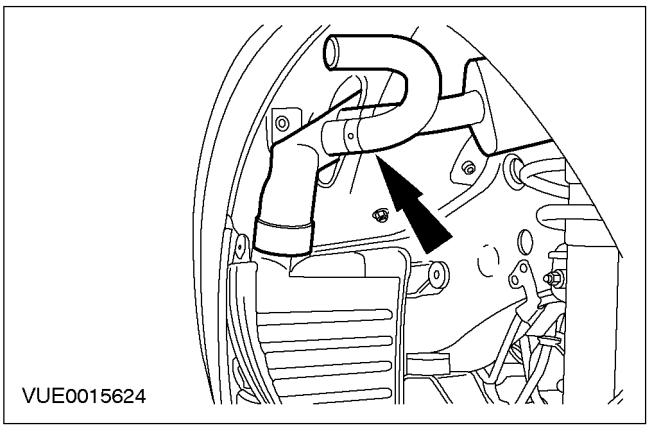
5. **Remove the left-hand front road wheel. For additional information, refer to Section 204-04.**
6. **Remove the left-hand front fender splash shield.**



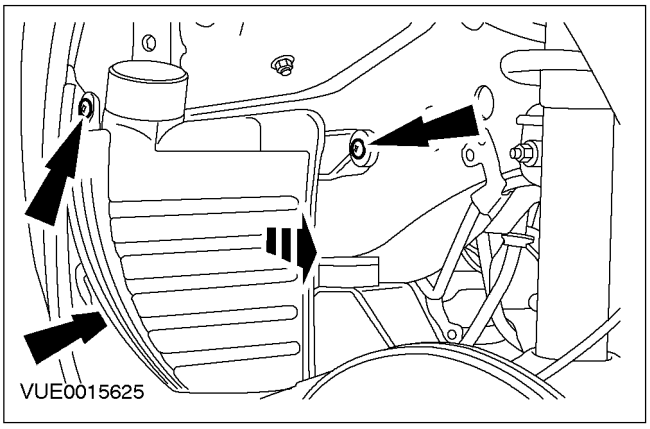
REMOVAL AND INSTALLATION (Continued)

7. Remove the upper air cleaner intake pipe.

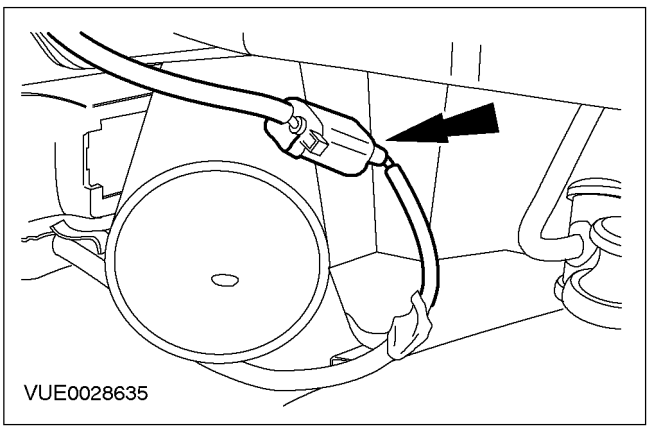
- Disconnect the upper air cleaner intake pipe from the intake air resonator.
- Disconnect the air intake tuning pipe from the upper air cleaner intake pipe.



8. Remove the intake air resonator.

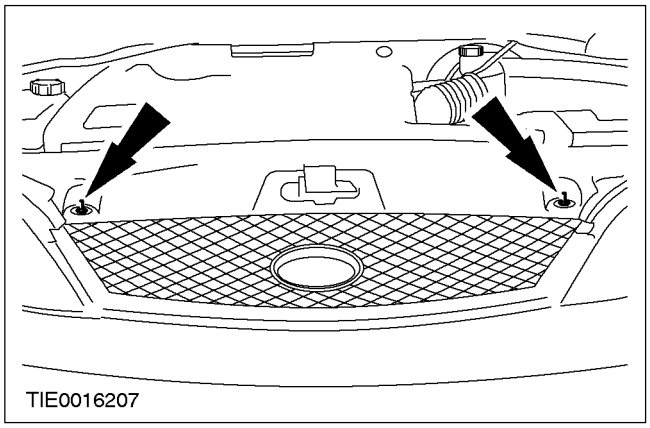


9. Detach the fog lamp wiring harness from the lower air cleaner intake pipe (if equipped).

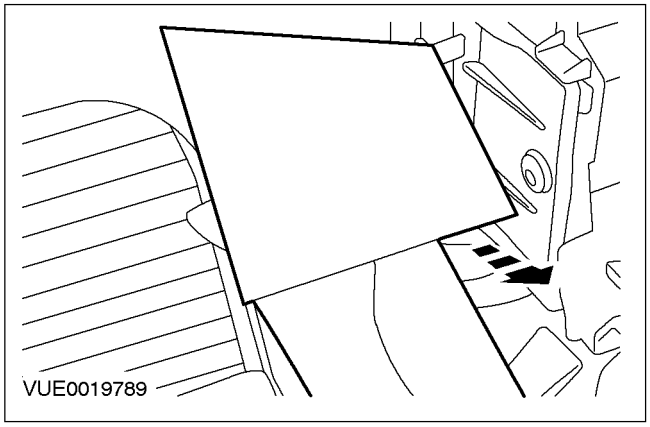


10. Lower the vehicle.

11. Remove the radiator grille.



12. Remove the lower air cleaner intake pipe.



Installation

1. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

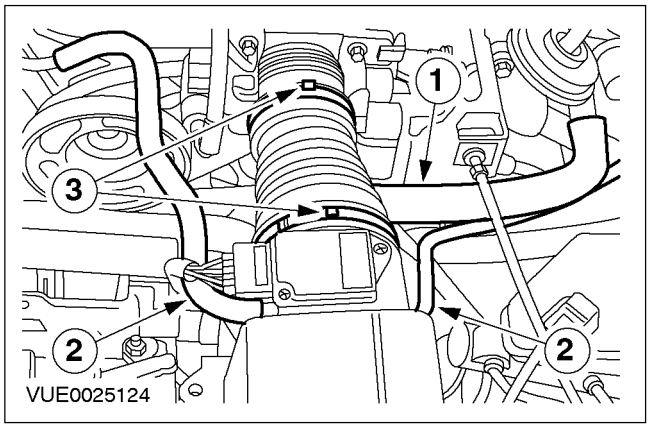
Air Cleaner Intake Pipe — 2.5L/2.0L Diesel (23 175 0)

Removal

Vehicles with 2.5L engine

1. Remove the air cleaner outlet pipe.

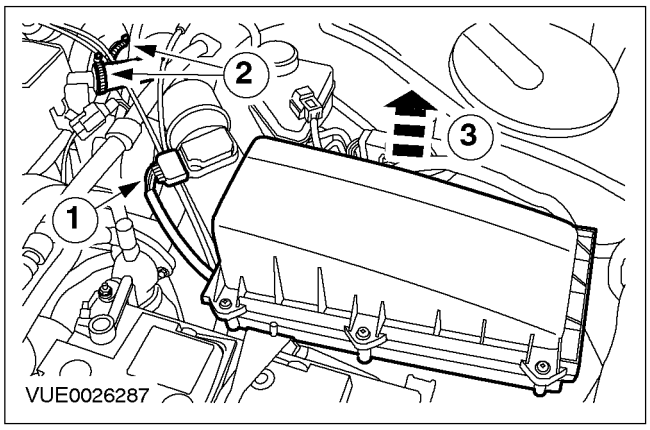
1. Disconnect the intake air bypass hose.
2. Disconnect the positive crankcase ventilation (PCV) hoses.
3. Remove the air cleaner outlet pipe retaining clips.



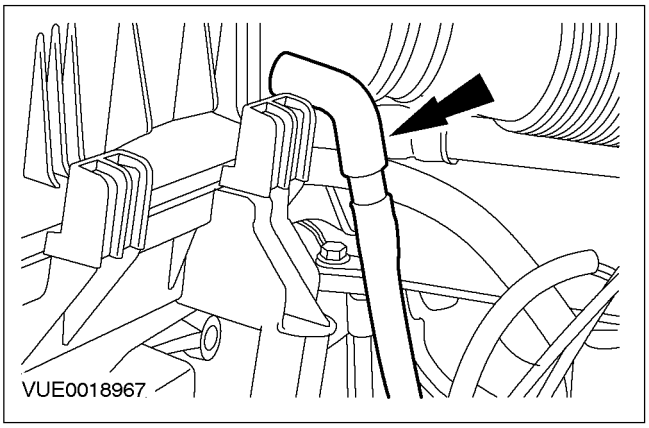
Vehicles with 2.0L diesel engine

2. Detach the air cleaner housing and the air cleaner outlet pipe.

1. Disconnect the electrical connector.
2. Disconnect the hoses.
3. Lift the air cleaner housing to detach it from the retaining clips.

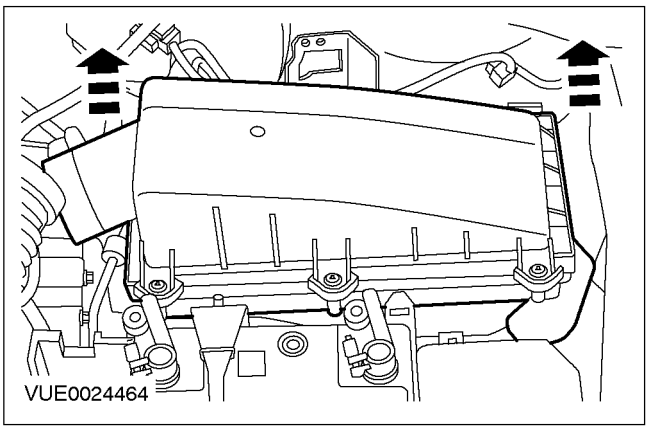


3. Disconnect the clean air hose from the air cleaner housing.

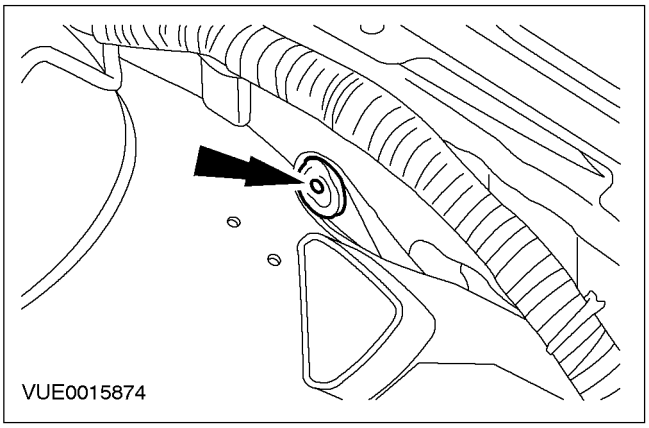


All vehicles

4. Remove the air cleaner housing.

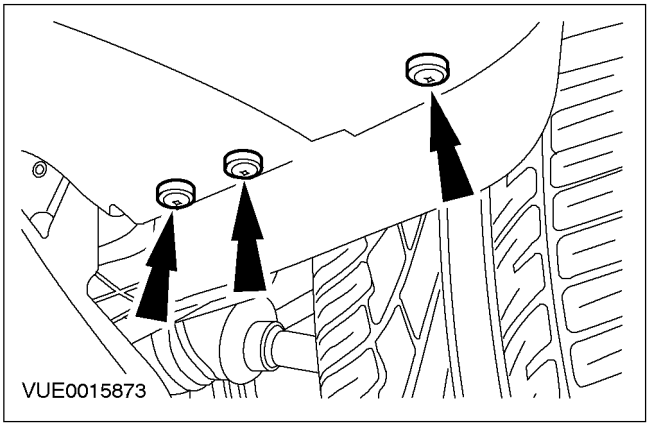


5. Remove the air cleaner intake pipe upper retaining bolt from the front inner fender.

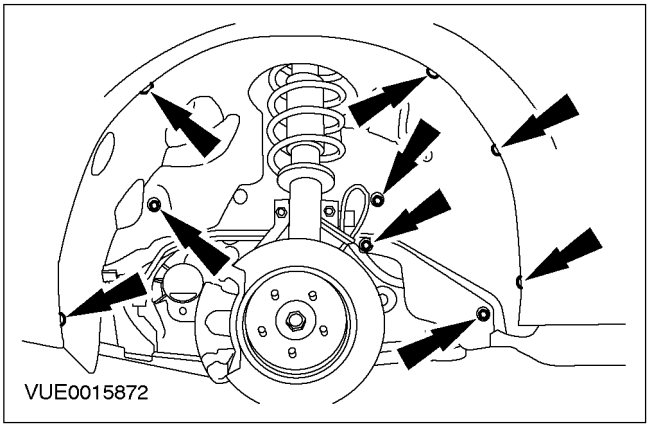


REMOVAL AND INSTALLATION (Continued)

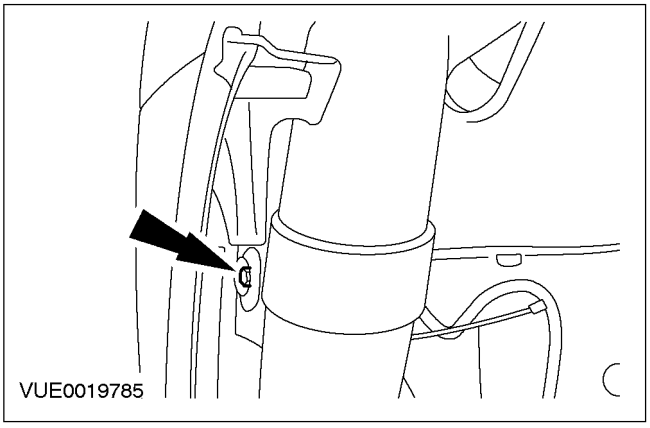
6. Remove the left-hand radiator undershield retaining screws.



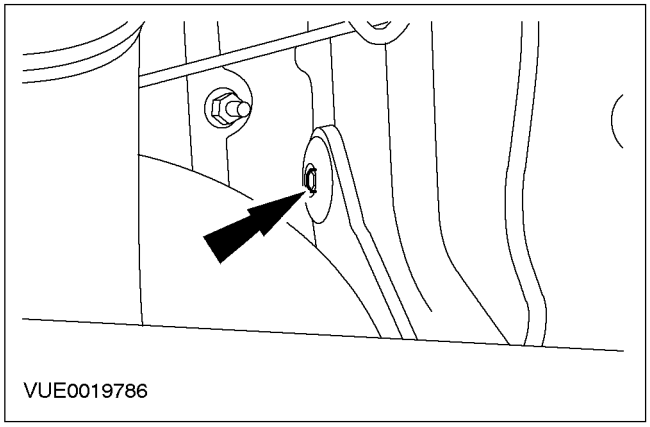
7. Remove the left-hand front road wheel and tyre. For additional information, refer to Section 204-04.
8. Remove the left-hand front fender splash shield.



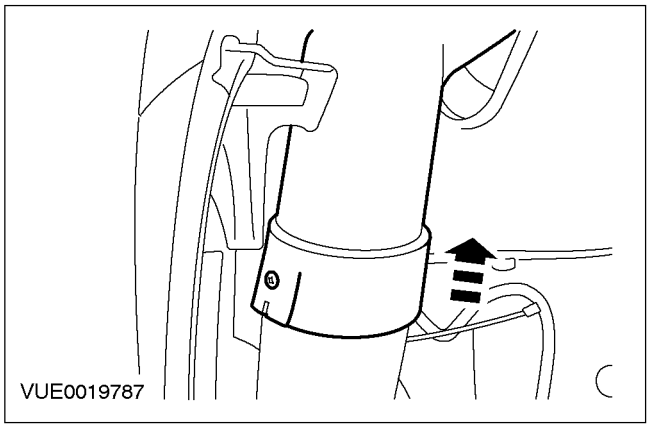
9. Remove the center air cleaner intake pipe retaining bolt.



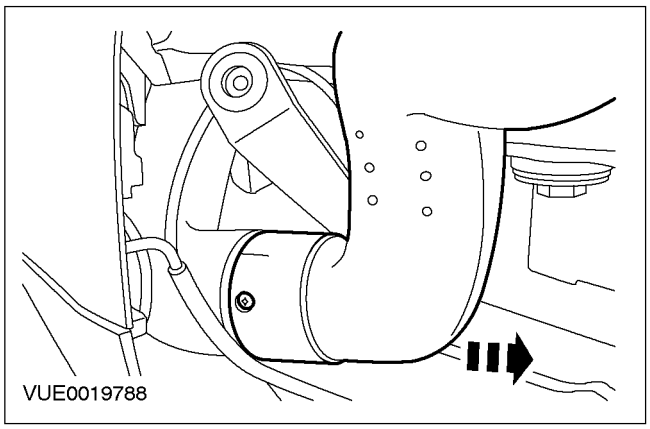
10. Remove the lower air cleaner intake pipe retaining bolt.



11. Remove the upper air cleaner intake pipe.

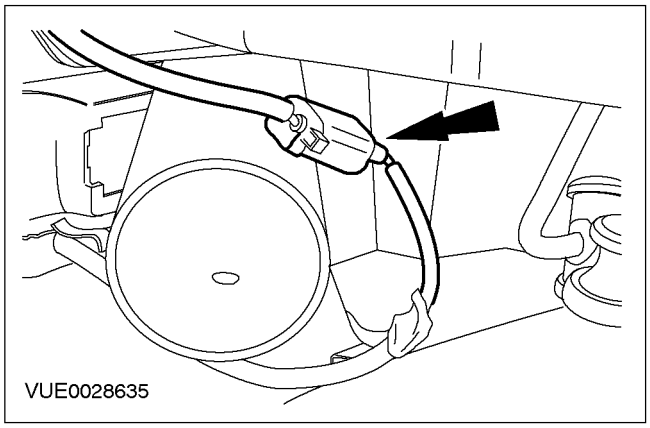


12. Remove the center air cleaner intake pipe.

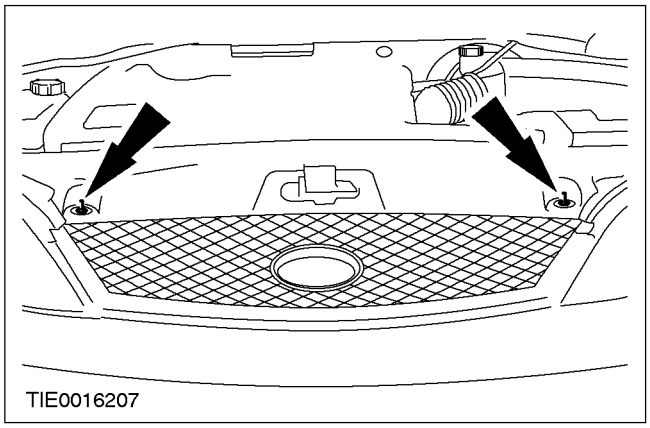


REMOVAL AND INSTALLATION (Continued)

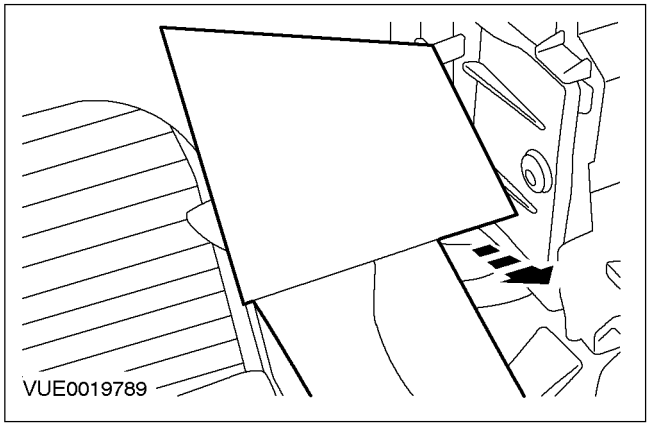
13. **Detach the fog lamp wiring harness from the lower air cleaner intake pipe (if equipped).**



14. **Lower the vehicle.**
15. **Remove the radiator grille.**



16. **Remove the lower air cleaner intake pipe.**



Installation

1. **To install reverse the removal procedure.**

SECTION 303-13 Evaporative Emissions

VEHICLE APPLICATION: 2003.0 Mondeo

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DESCRIPTION AND OPERATION

Evaporative Emissions 303-13-2

DIAGNOSIS AND TESTING

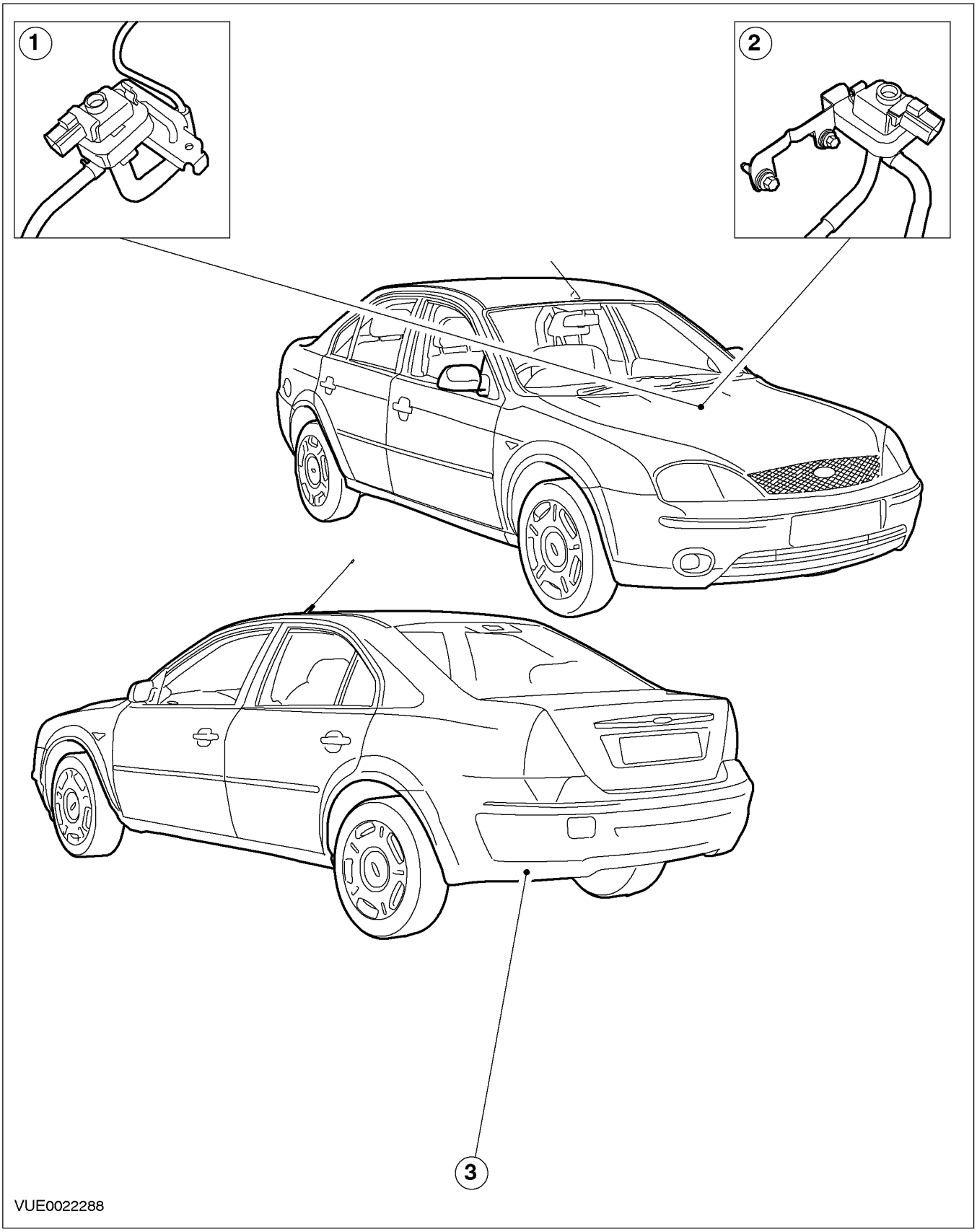
Evaporative Emissions 303-13-4
Inspection and Verification 303-13-4

REMOVAL AND INSTALLATION

Evaporative Emission Canister — 4-Door/5-Door ..... (29 250 0) 303-13-5
Evaporative Emission Canister — Wagon ..... (29 250 0) 303-13-10

DESCRIPTION AND OPERATION

Evaporative Emissions

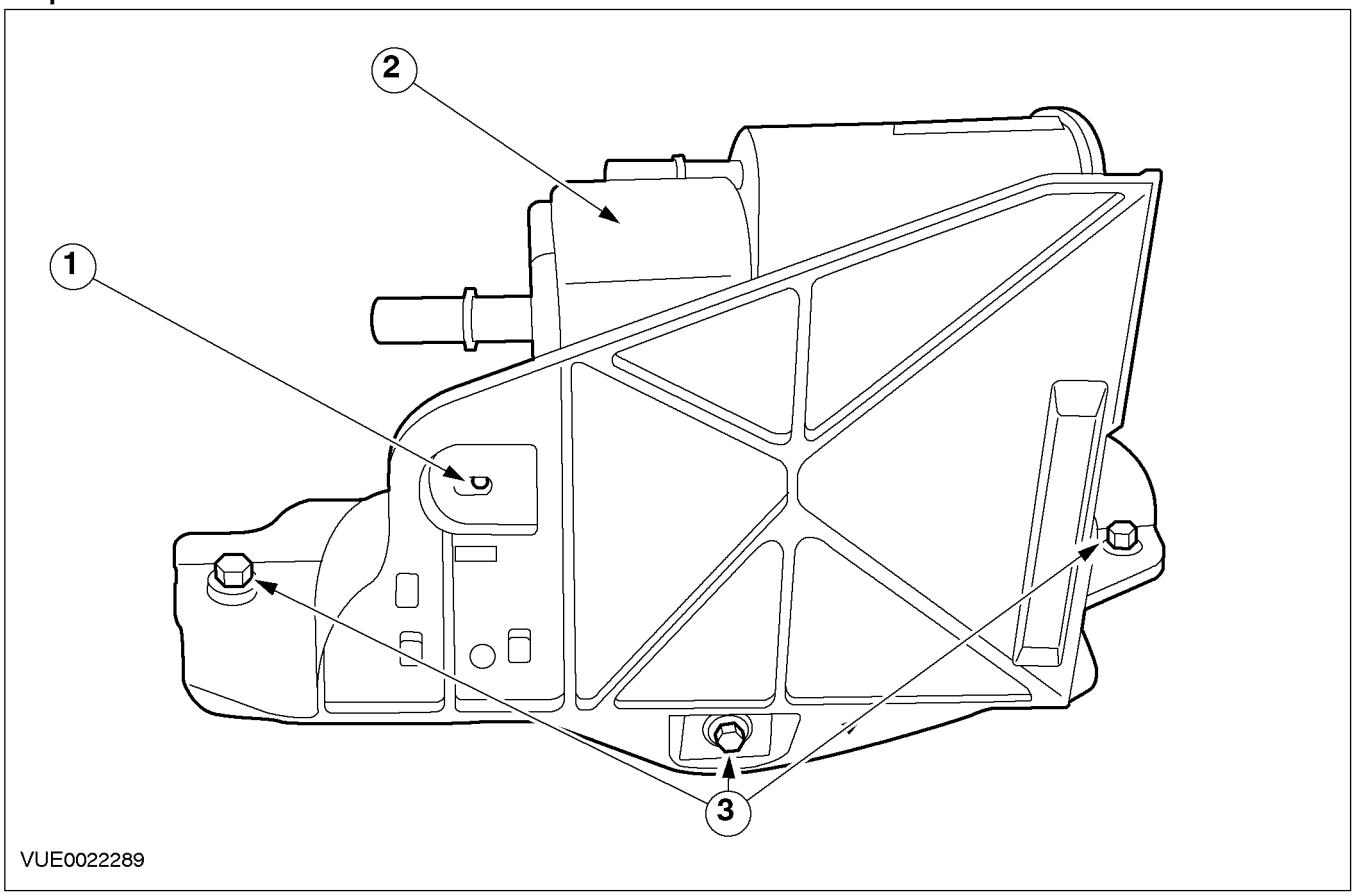


DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1	-	Evaporative emissions canister purge valve - Vehicles with 1.8L or 2.0L engine

Item	Part Number	Description
2	-	Evaporative emissions canister purge valve - Vehicles with 2.5L engine
3	-	Evaporative emissions canister

Evaporative Emissions Canister



Item	Part Number	Description
1	-	Evaporative emissions canister retaining clip
2	-	Evaporative emissions canister
3	-	Evaporative emissions canister retaining bolts

DIAGNOSIS AND TESTING

Evaporative Emissions

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

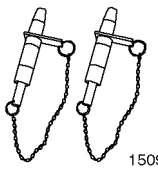
Visual Inspection Chart

Mechanical	Electrical
– Vacuum line(s) – Evaporative emission (EVAP) system canister – EVAP system hose(s) – EVAP system canister purge valve	– Fuse(s) – Wiring harness – Electrical connector(s)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to WDS to diagnose the system.

REMOVAL AND INSTALLATION

Evaporative Emission Canister — 4-Door/5-Door (29 250 0)

Special Tool(s)	
 15097A	Alignment pins, subframe 205-316 (15-097-A)

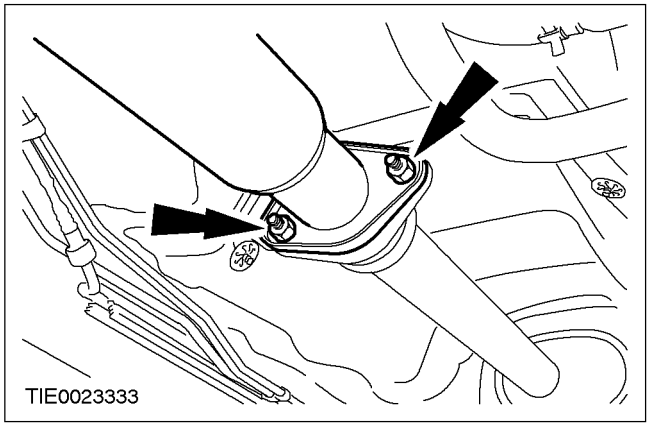
General Equipment
Transmission jack

Removal

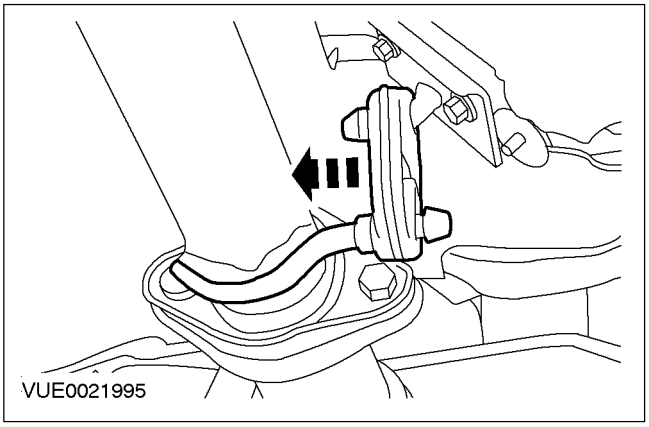
All vehicles

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

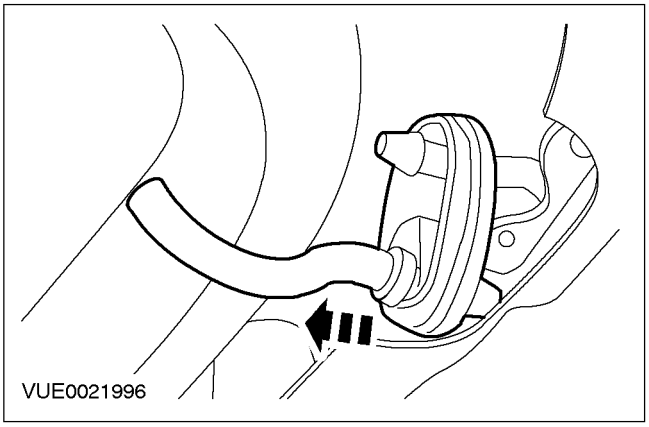
1. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
2. **Detach the exhaust flexible pipe from the front muffler pipe.**
   - Discard the nuts and the gasket.


TIE0023333

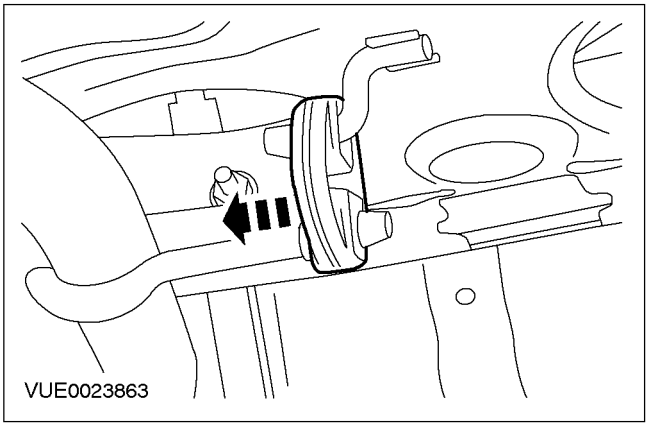
3. **Detach the exhaust system from the front exhaust hanger insulator.**


VUE0021995

4. **Detach the exhaust system from the middle exhaust hanger insulator.**

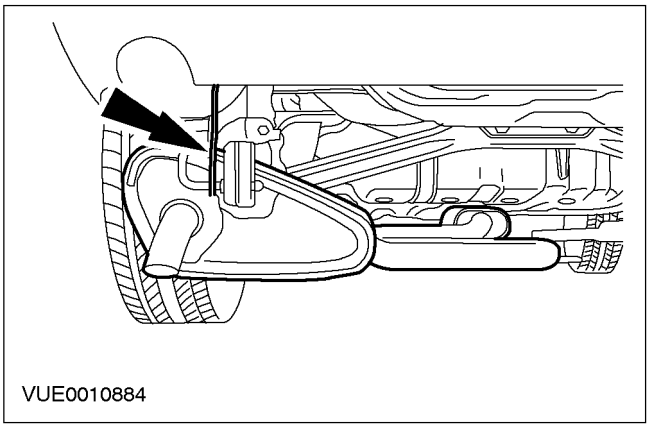

VUE0021996

5. **Detach the exhaust system from the crossmember exhaust hanger insulator (if equipped).**


VUE0023863

REMOVAL AND INSTALLATION (Continued)

6. **Detach the exhaust system from the rear exhaust hanger insulator and remove the exhaust system.**

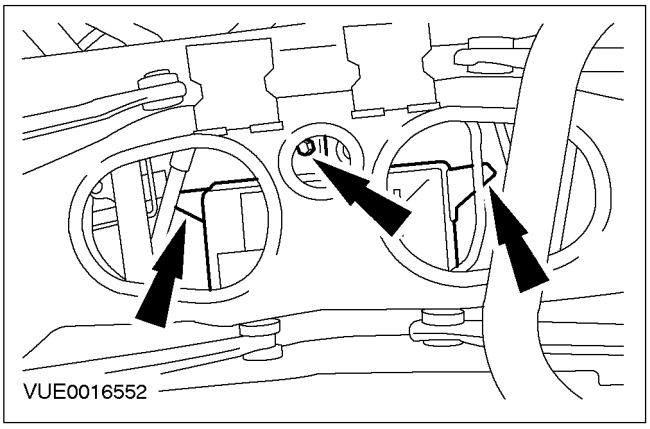


Vehicles with xenon headlamps

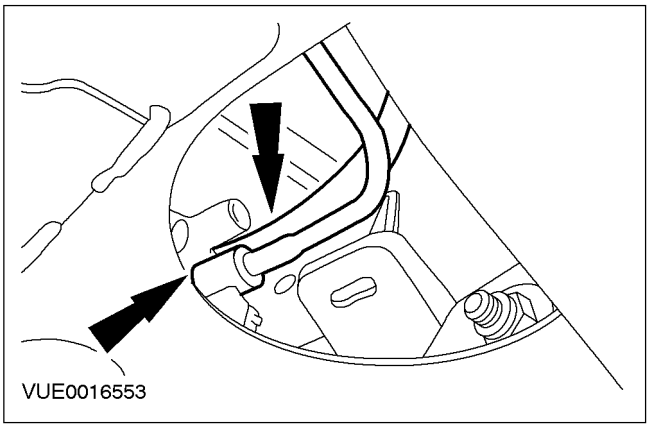
7. **Remove the rear headlamp levelling sensor. For additional information, refer to Section 417-01.**

All vehicles

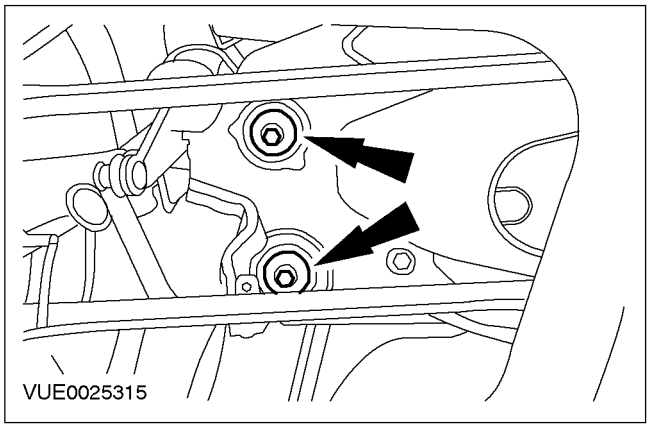
8. **Remove the evaporative emission canister housing retaining bolts.**



9. **Disconnect the fuel tank vent pipe and the evaporative emission purge valve pipe from the evaporative emission canister.**

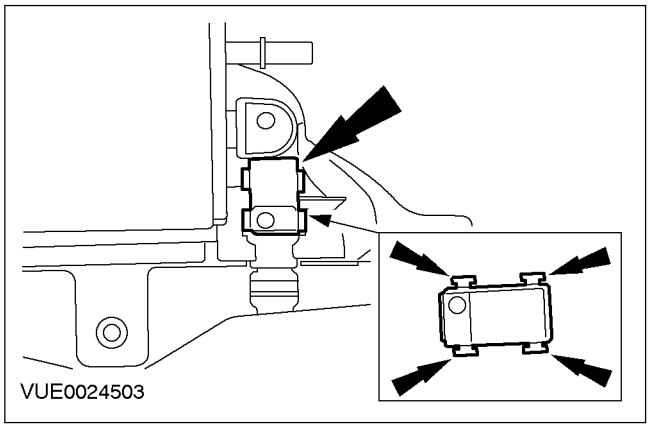


10. **Using a suitable transmission jack, support the crossmember.**
11. **Detach the crossmember (two bolts each side).**



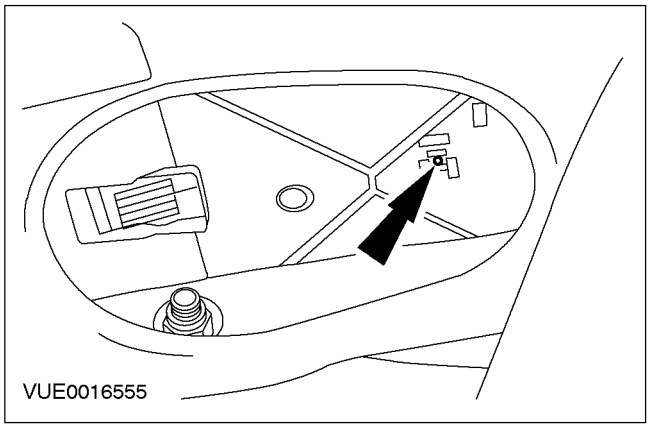
12. **CAUTION: Do not place excessive strain on the brake hoses and suspension components.**

    Partially lower the crossmember.
13. **Detach the water separator box cover from the evaporative emission canister water separator box.**



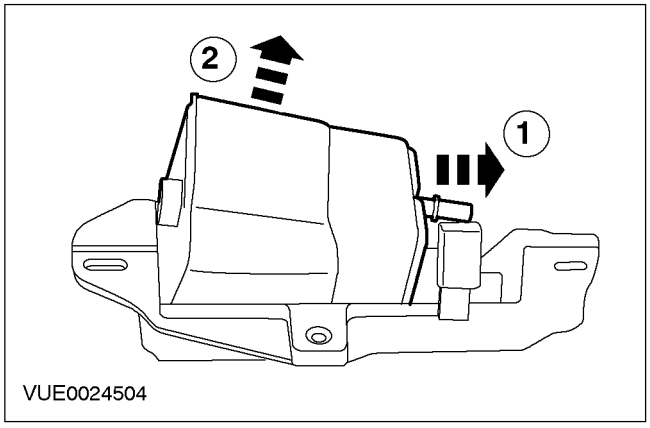
REMOVAL AND INSTALLATION (Continued)

14. Detach the evaporative emission canister from the evaporative emission canister housing.



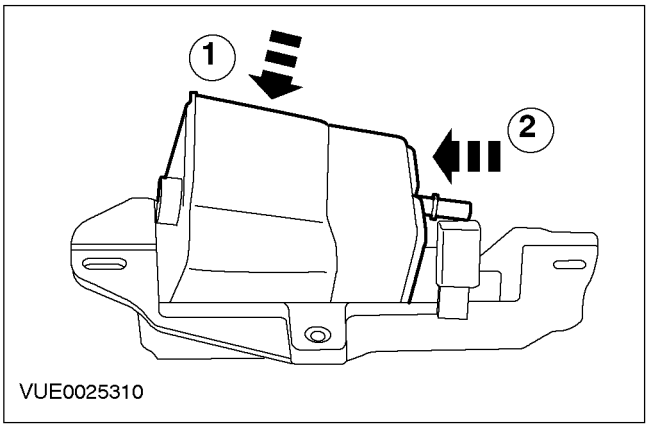
15. Remove the evaporative emission canister from the evaporative emission canister housing.

1. Push the evaporative emission canister forward.
2. Lift the evaporative emission canister up and remove.

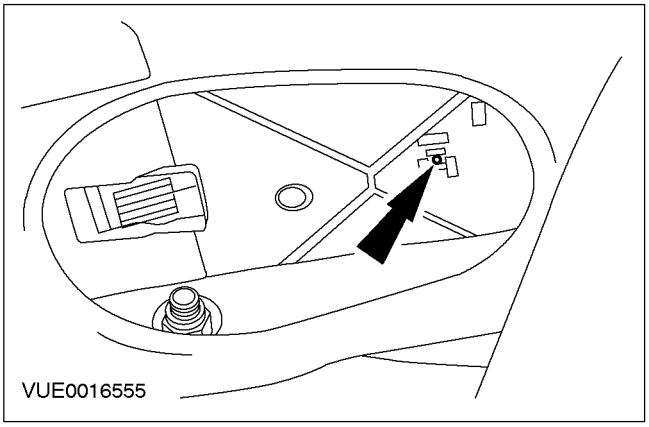


1. Install the evaporative emission canister into the evaporative emission canister housing.

1. Lower the evaporative emission canister into the evaporative emission canister housing.
2. Push the evaporative emission canister backwards to lock it into place.



2. Attach the evaporative emission canister to the evaporative emission canister housing.



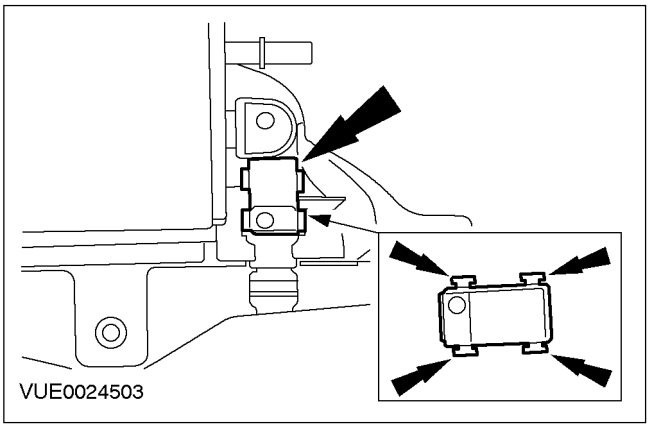
Installation

All vehicles

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

REMOVAL AND INSTALLATION (Continued)

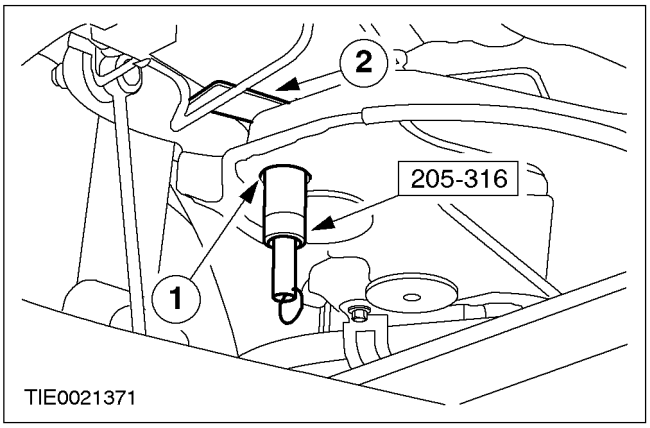
3. **Attach the water separator box cover to the evaporative emission canister water separator box.**



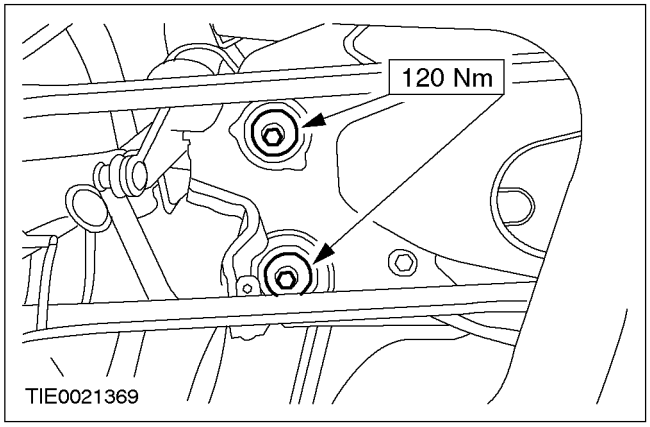
4. **WARNING: Do not place excessive strain on the brake hoses and suspension components.**

   Raise the crossmember.

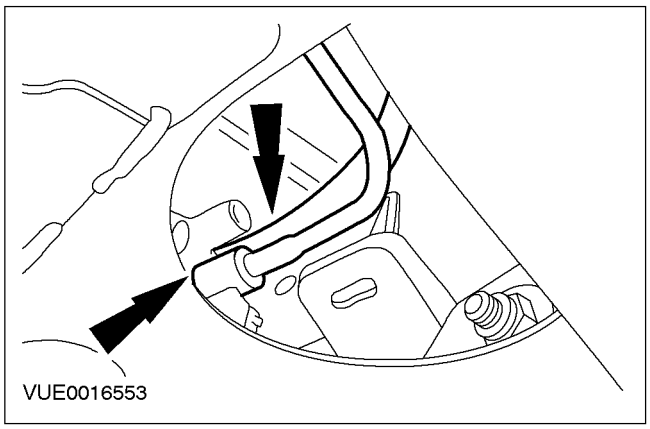
5. **Using the special tools, align the crossmember.**
   1. Insert the alignment pins through the crossmember alignment holes.
   2. Slide the locking plates into the groove and tighten the alignment pin sleeve.



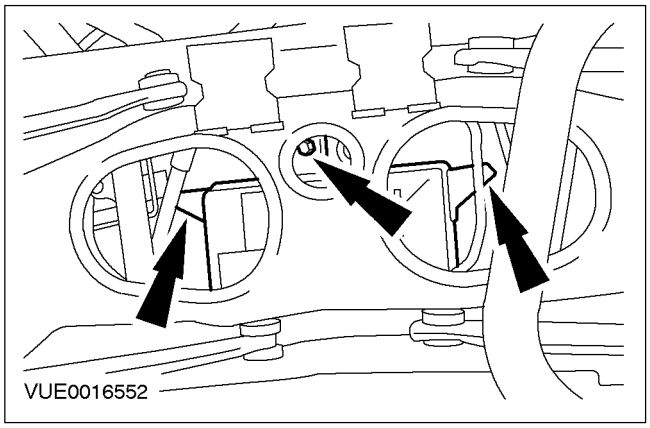
6. **Install the crossmember (two bolts each side).**



7. **Connect the fuel tank vent pipe and the evaporative emission canister purge valve pipe to the evaporative emission canister.**



8. **Install the evaporative emission canister housing retaining bolts.**



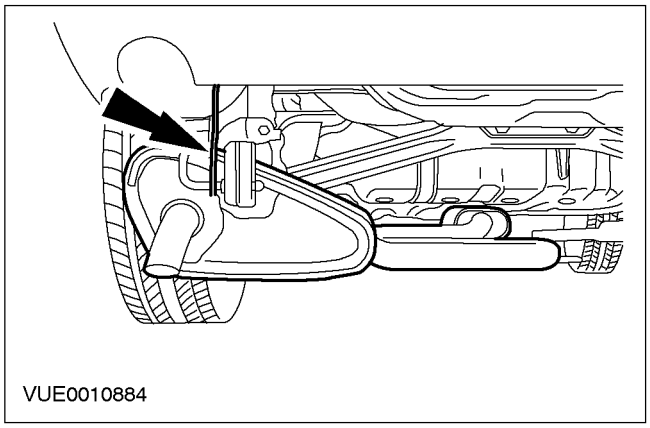
Vehicles with xenon headlamps

9. **Remove the rear headlamp levelling sensor. For additional information, refer to Section 417-01.**

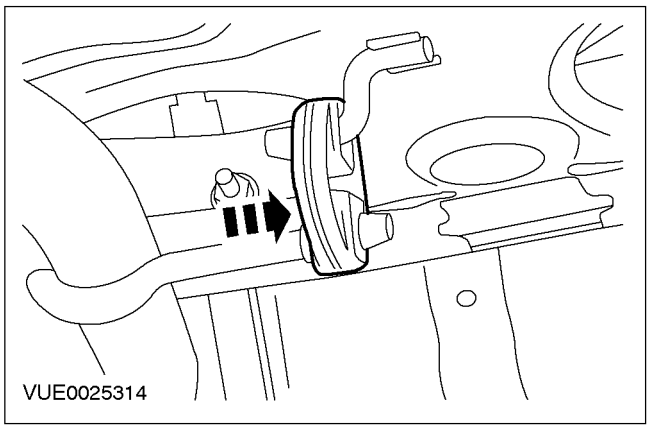
REMOVAL AND INSTALLATION (Continued)

All vehicles

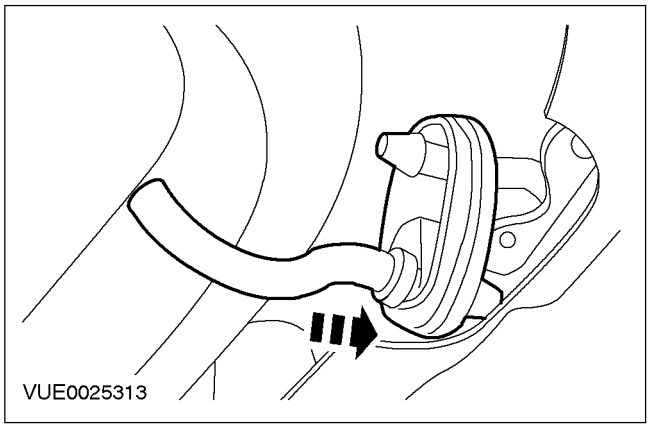
10. **Attach the exhaust system to the rear exhaust hanger insulator.**



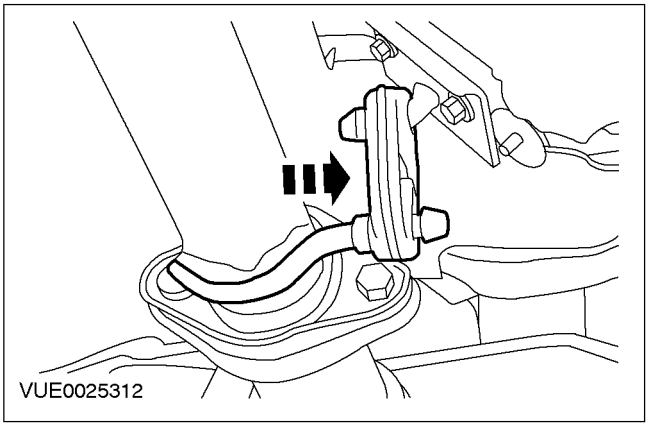
11. **Attach the exhaust system to the crossmember exhaust hanger insulator (if equipped).**



12. **Attach the exhaust system to the middle exhaust hanger insulator.**

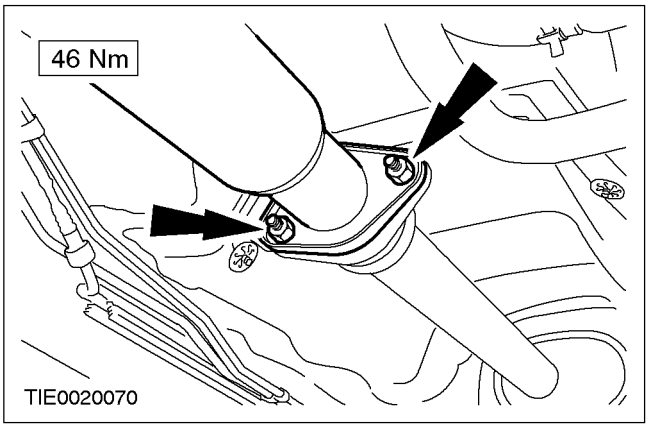


13. **Attach the exhaust system to the front exhaust hanger insulator.**



14. **NOTE:** Install a new gasket and retaining nuts.

    Attach the exhaust flexible pipe to the front muffler pipe.



Vehicles with xenon headlamps

15. **Initialize the headlamp levelling system using WDS.**

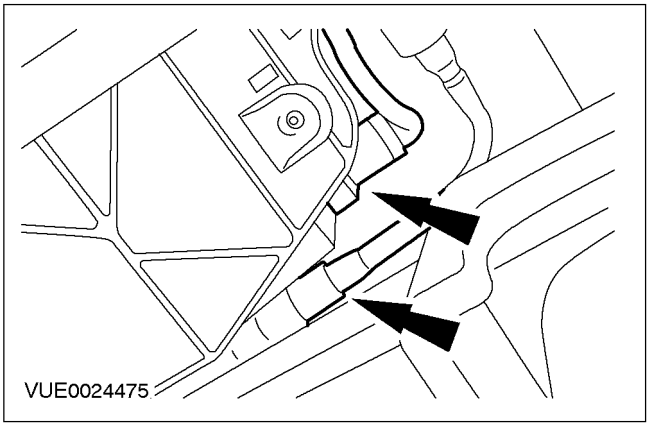
REMOVAL AND INSTALLATION

Evaporative Emission Canister — Wagon (29 250 0)

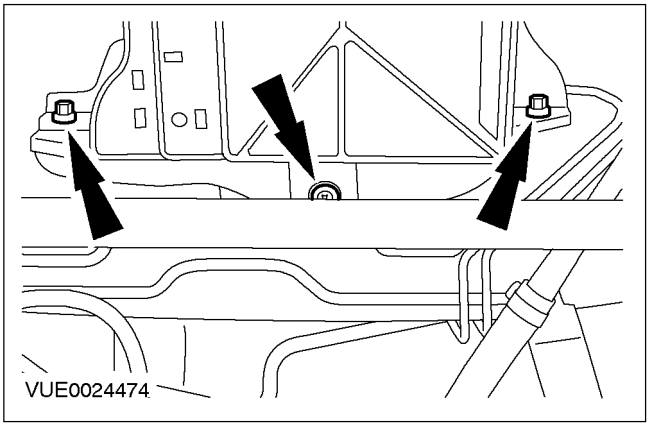
Removal

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

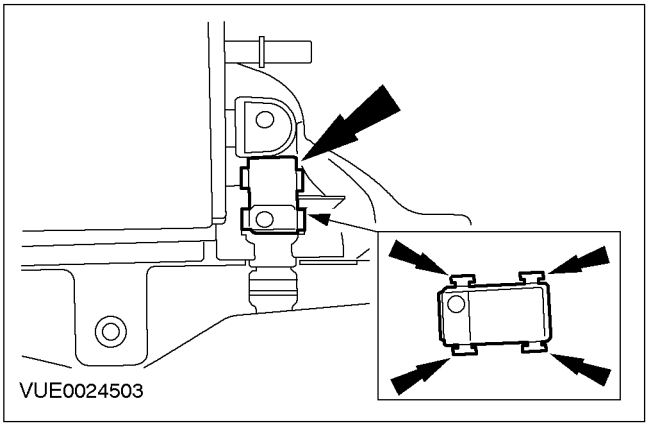
1. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
2. **Disconnect the fuel tank vent pipe and evaporative emission purge valve pipe from the evaporative emission canister.**



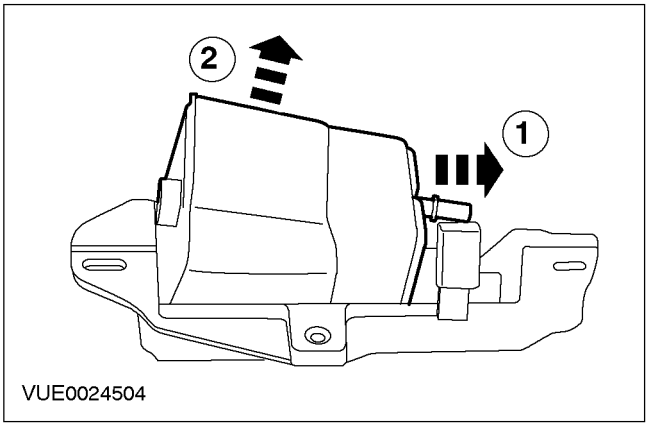
3. **Remove the evaporative emission canister housing retaining bolts.**



4. **Detach the water separator box cover from the evaporative emission canister water separator box.**



5. **Remove the evaporative emission canister from the evaporative emission canister housing.**
   1. Push the evaporative emission canister forward.
   2. Lift the evaporative emission canister up and remove.



Installation

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

1. **To install, reverse the removal procedure.**

SECTION 303-14 Electronic Engine Controls

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

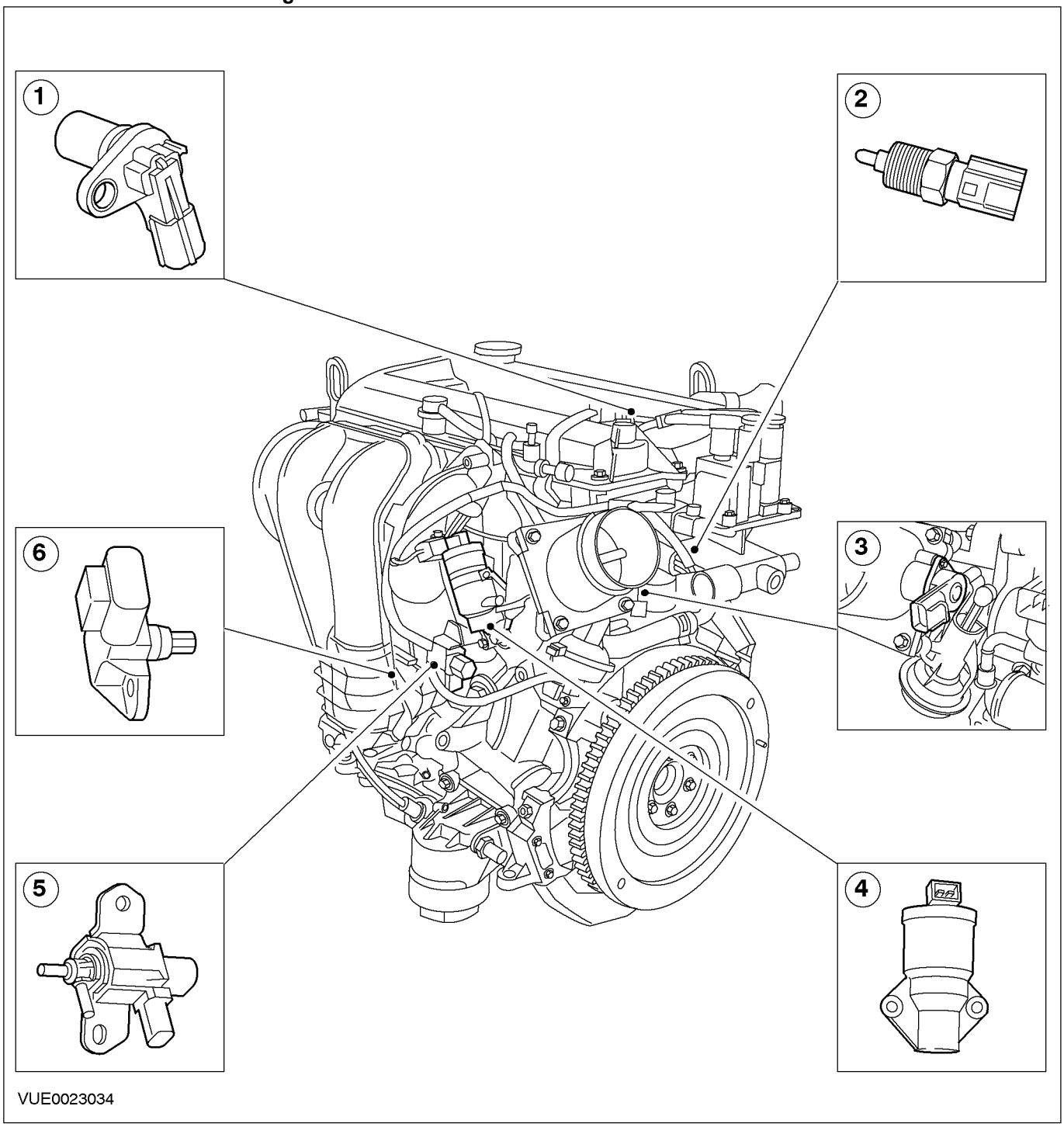
Torque Specifications

Description	Nm	lb-ft	lb-in
Heated oxygen sensor (HO2S) - all except vehicles with diesel engine	48	35	-
Catalyst monitor sensor - all except vehicles with diesel engine	48	35	-
Intake manifold tuning (IMT) valve retaining bolts - vehicles with 1.8L or 2.0L engine	10	-	89
Knock sensor (KS) retaining nut - vehicles with 1.8L or 2.0L engine	20	15	-
Camshaft position (CMP) sensor retaining bolt - vehicles with 1.8L or 2.0L engine	6	-	53
Cylinder head temperature (CHT) sensor retaining bolt - vehicles with 1.8L or 2.0L engine	12	9	-
Idle air control (IAC) valve retaining bolts - vehicles with 1.8L or 2.0L engine	10	-	89
Temperature and manifold absolute pressure (T-MAP) sensor retaining bolt - vehicles with 1.8L or 2.0L engine	3	-	27
Throttle position (TP) sensor retaining bolt - vehicles with 1.8L or 2.0L engine	1	-	9
Powertrain control module (PCM) electrical connector retaining bolt	4	-	35
Crankshaft position (CKP) sensor - vehicles with diesel engine	7	-	62
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DESCRIPTION AND OPERATION

Electronic Engine Controls

Vehicles with 1.8L or 2.0L engine



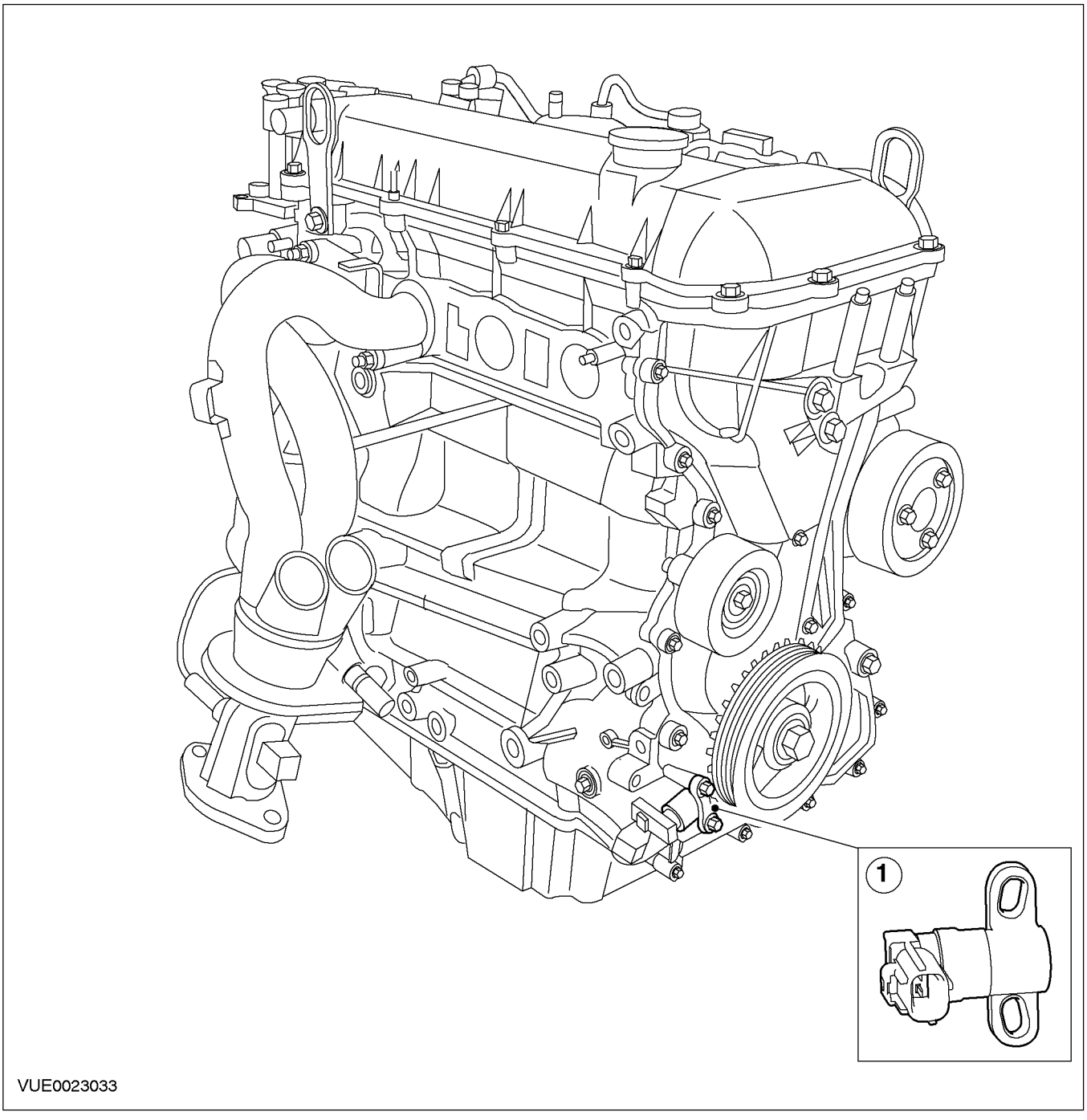
Item	Part Number	Description
1	-	Camshaft position (CMP) sensor

Item	Part Number	Description
2	-	Engine coolant temperature (ECT) sensor

DESCRIPTION AND OPERATION (Continued)

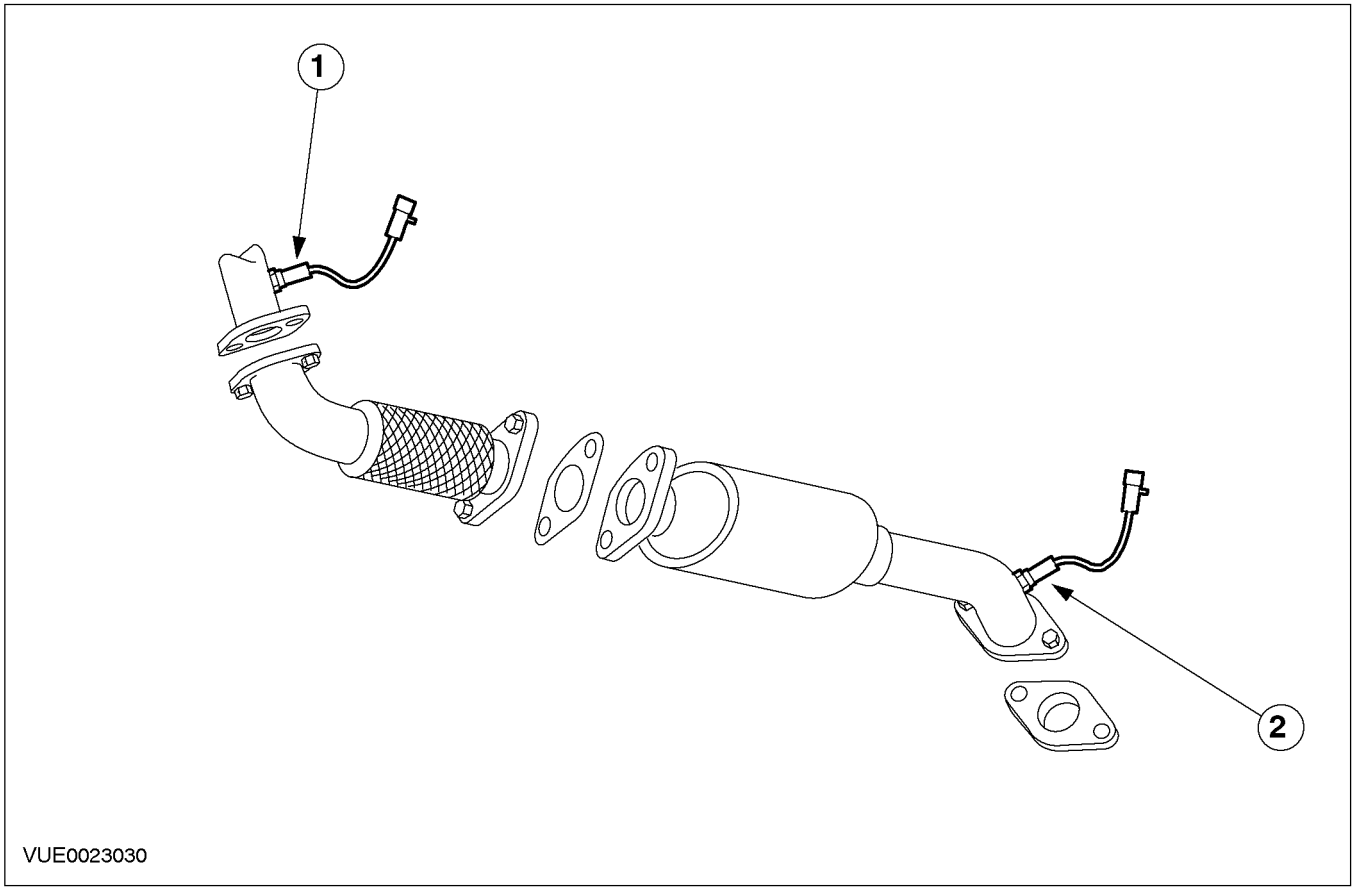
Item	Part Number	Description
3	-	Intake manifold runner control (IMRC) actuator
4	-	Idle air control (IAC) valve
5	-	Intake manifold tuning valve

Item	Part Number	Description
6	-	Temperature and manifold absolute pressure (T-MAP) sensor



DESCRIPTION AND OPERATION (Continued)

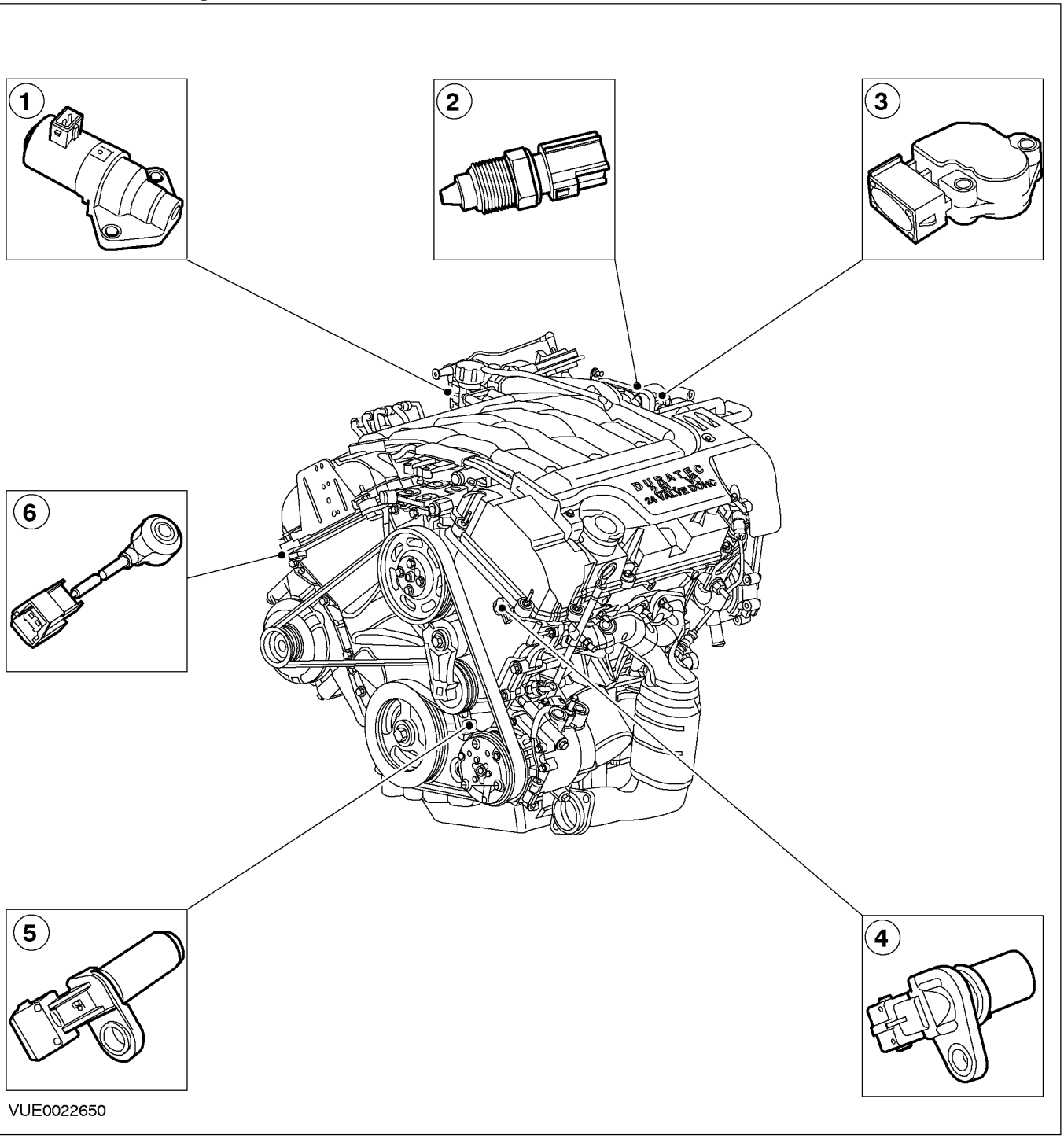
Item	Part Number	Description
1	-	Crankshaft position (CKP) sensor



Item	Part Number	Description
1	-	Heated oxygen sensor (HO2S)
2	-	Catalyst monitor sensor

DESCRIPTION AND OPERATION

Vehicles with 2.5L engine

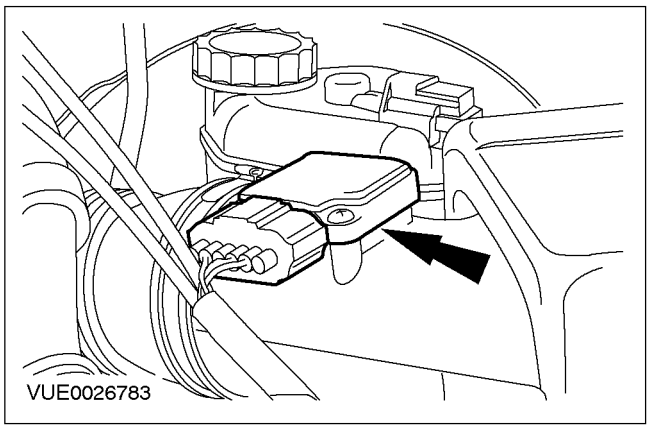


VUE0022650

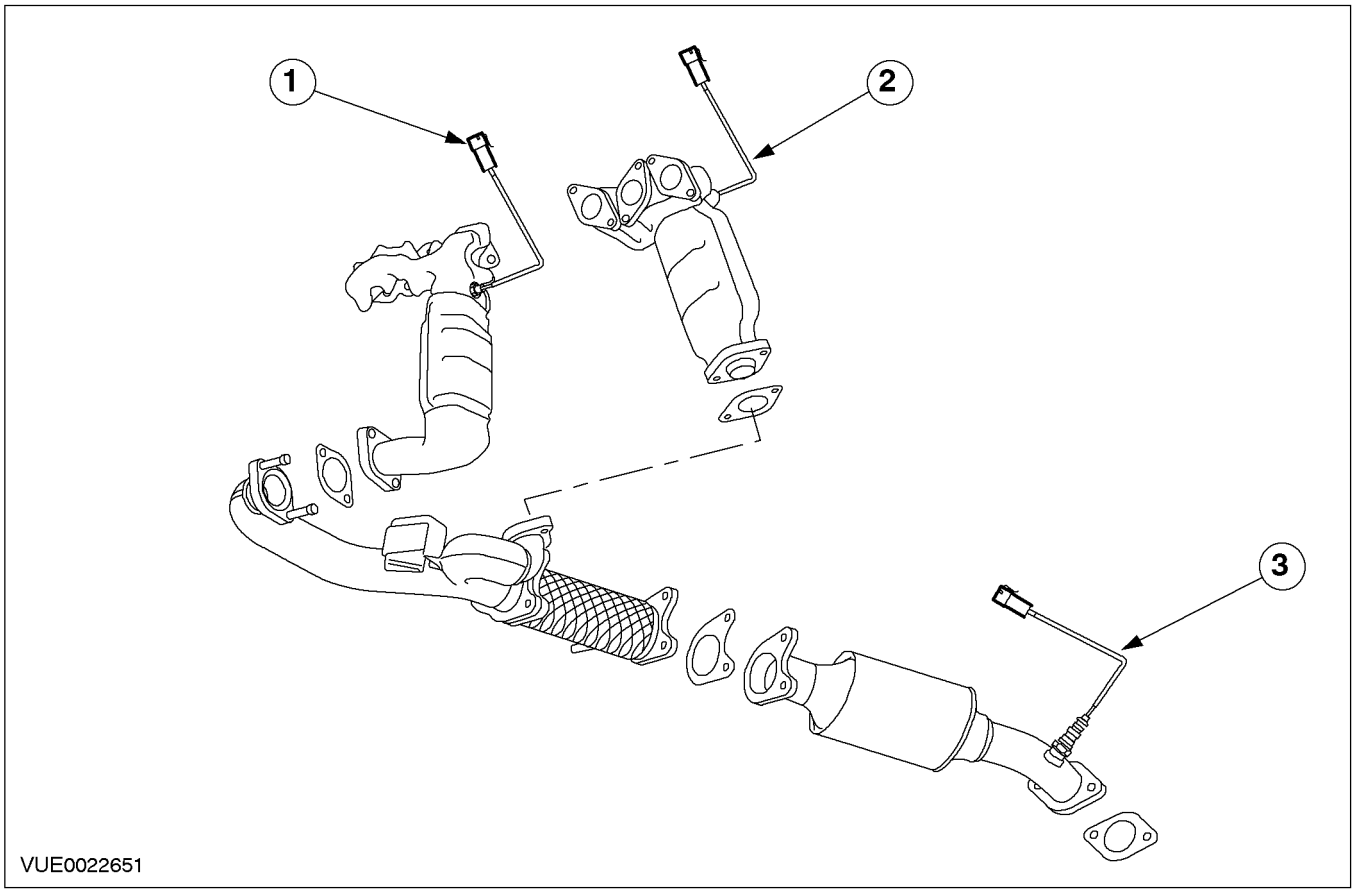
Item	Part Number	Description
1	-	IAC valve
2	-	ECT sensor
3	-	Throttle Position (TP) sensor

Item	Part Number	Description
4	-	CMP sensor
5	-	CKP sensor
6	-	Knock sensor (KS)

DESCRIPTION AND OPERATION (Continued)



Item	Part Number	Description
1	-	Mass air flow (MAF) sensor

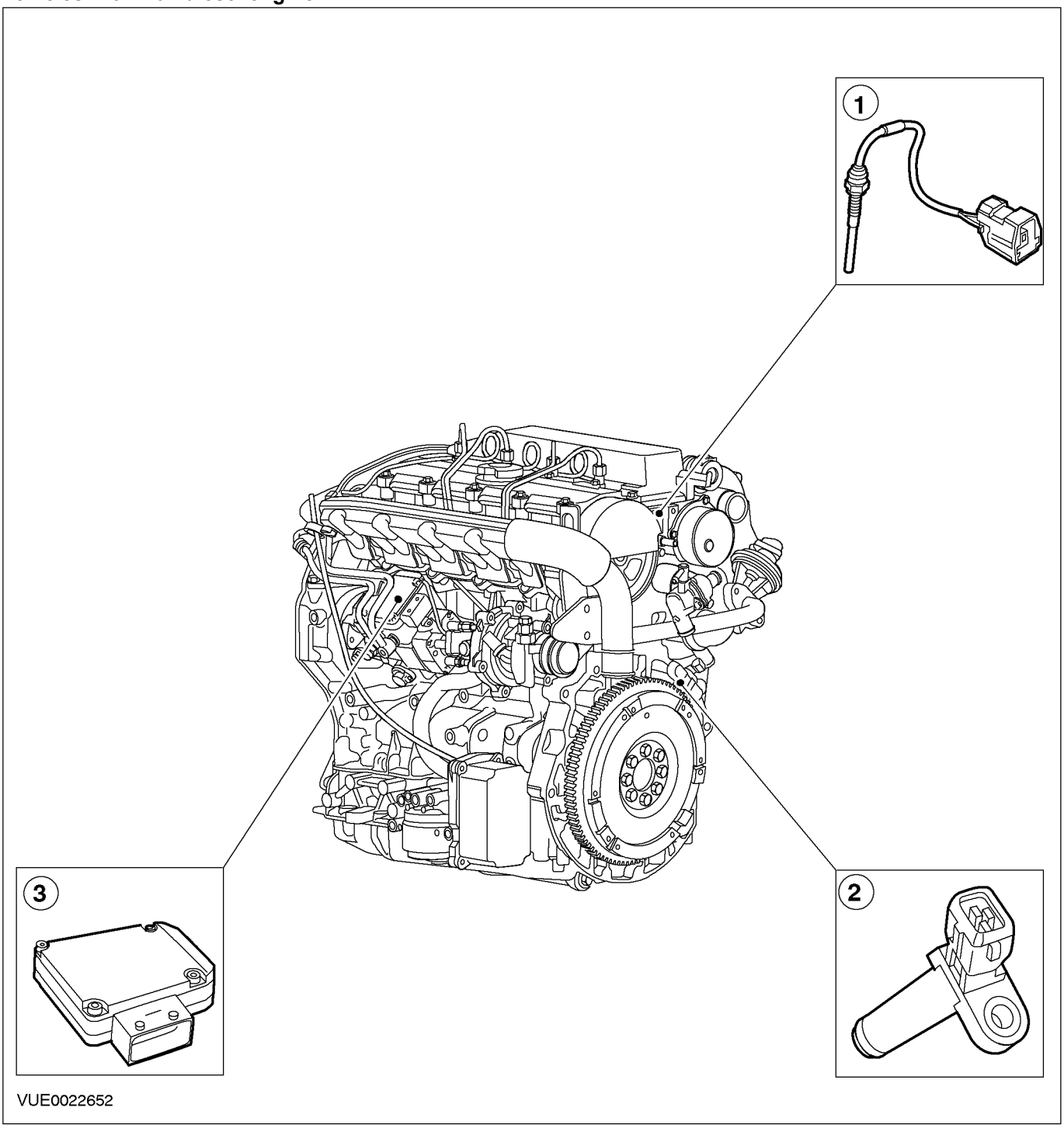


Item	Part Number	Description
1	-	HO2S LH

Item	Part Number	Description
2	-	HO2S RH
3	-	Catalyst monitor sensor

DESCRIPTION AND OPERATION

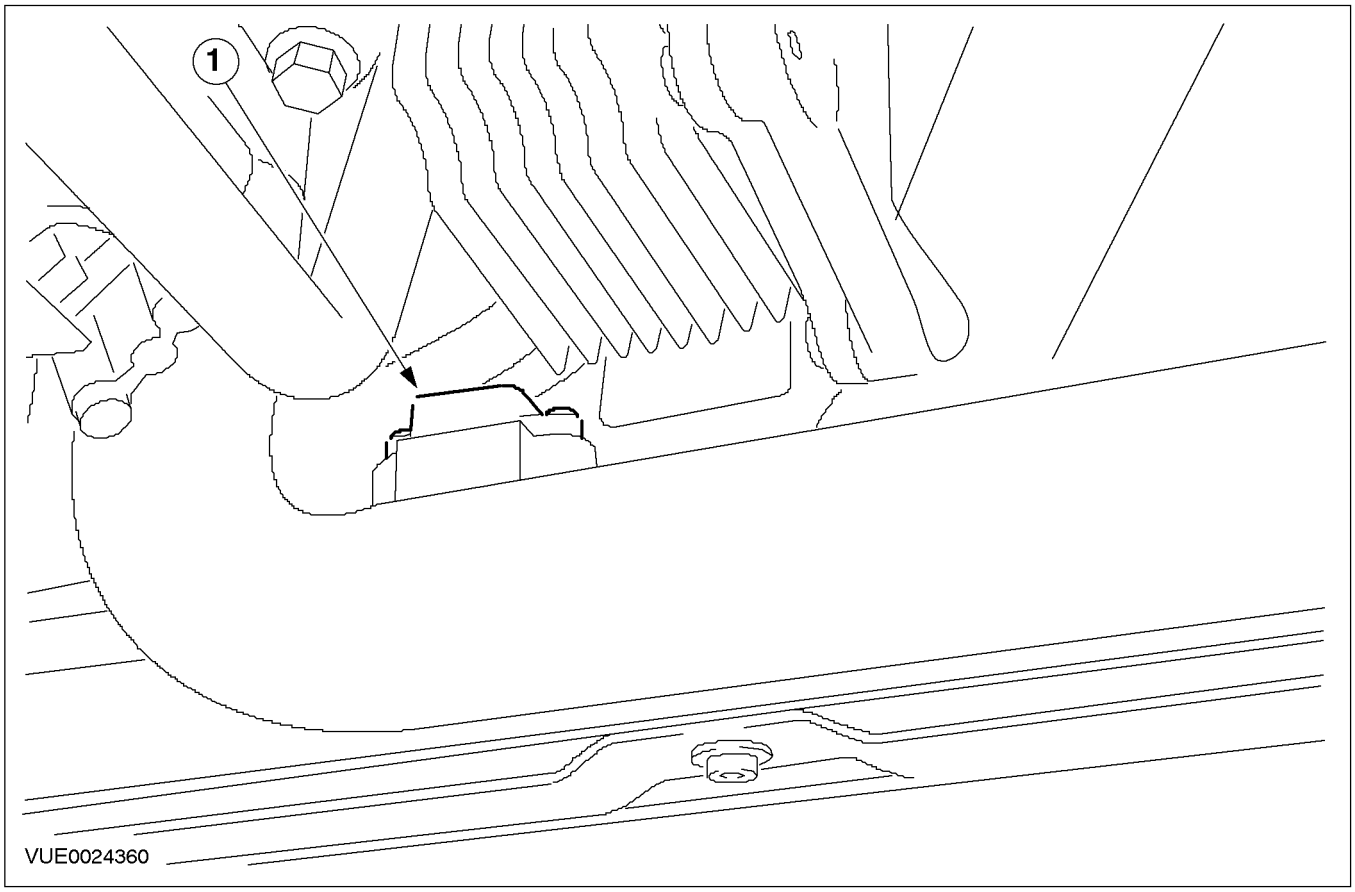
Vehicles with 2.0L diesel engine



Item	Part Number	Description
1	-	Cylinder head temperature (CHT) sensor
2	-	CKP sensor

Item	Part Number	Description
3	-	Fuel injection pump control unit

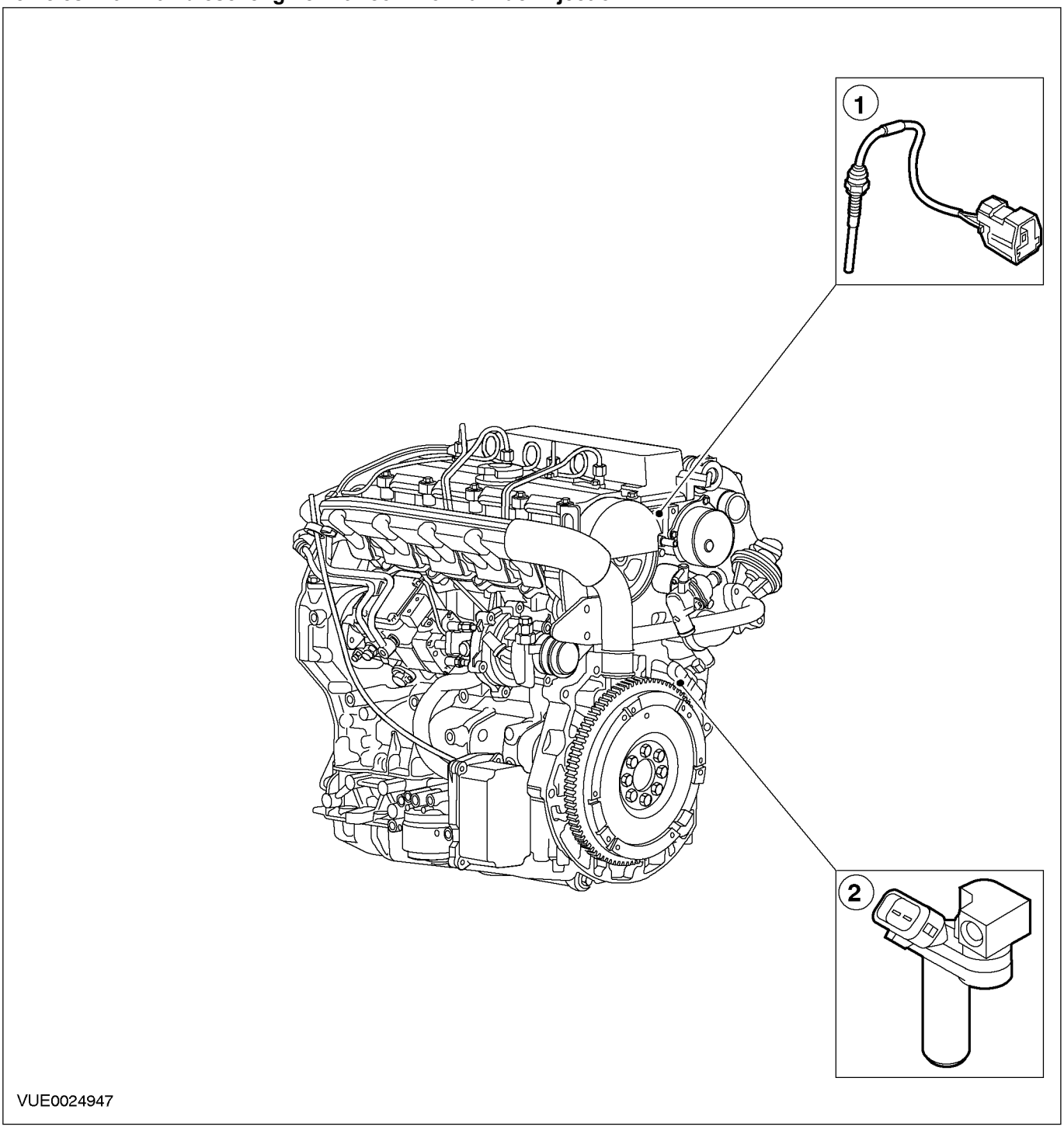
DESCRIPTION AND OPERATION



Item	Part Number	Description
1	-	T-MAP sensor

DESCRIPTION AND OPERATION

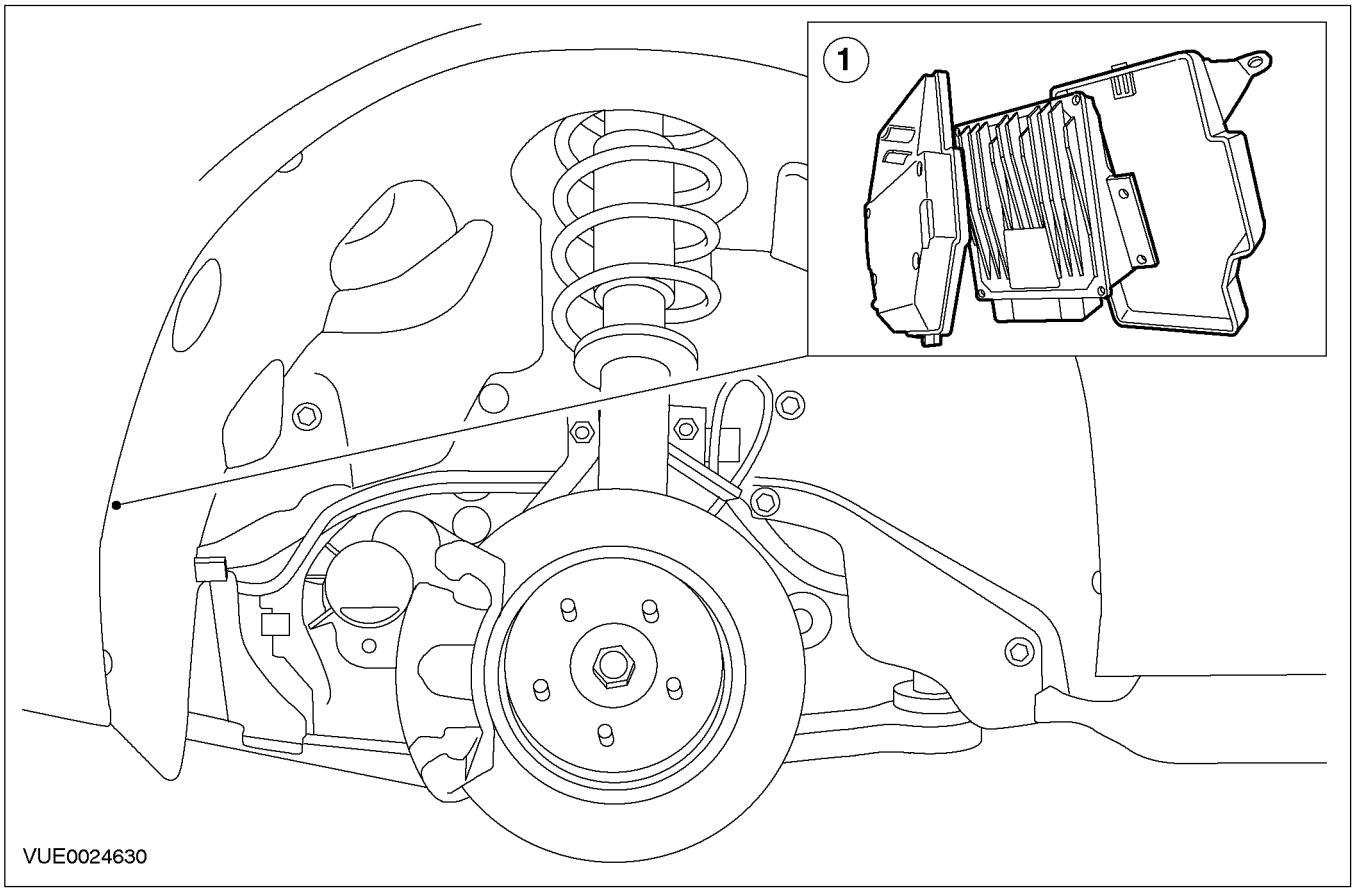
Vehicles with 2.0L diesel engine with common rail fuel injection



Item	Part Number	Description
1	-	CHT sensor

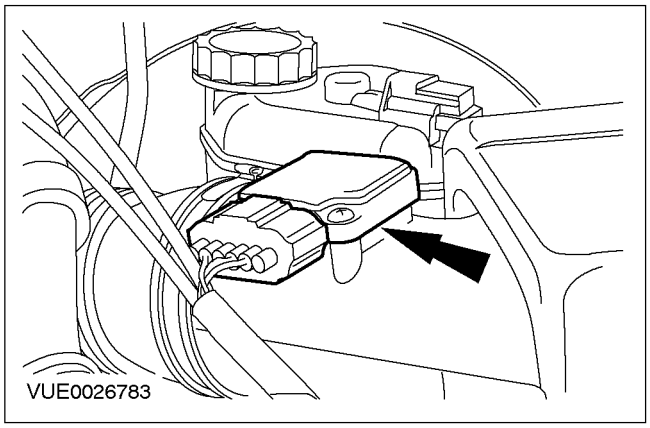
Item	Part Number	Description
2	-	CKP sensor

DESCRIPTION AND OPERATION



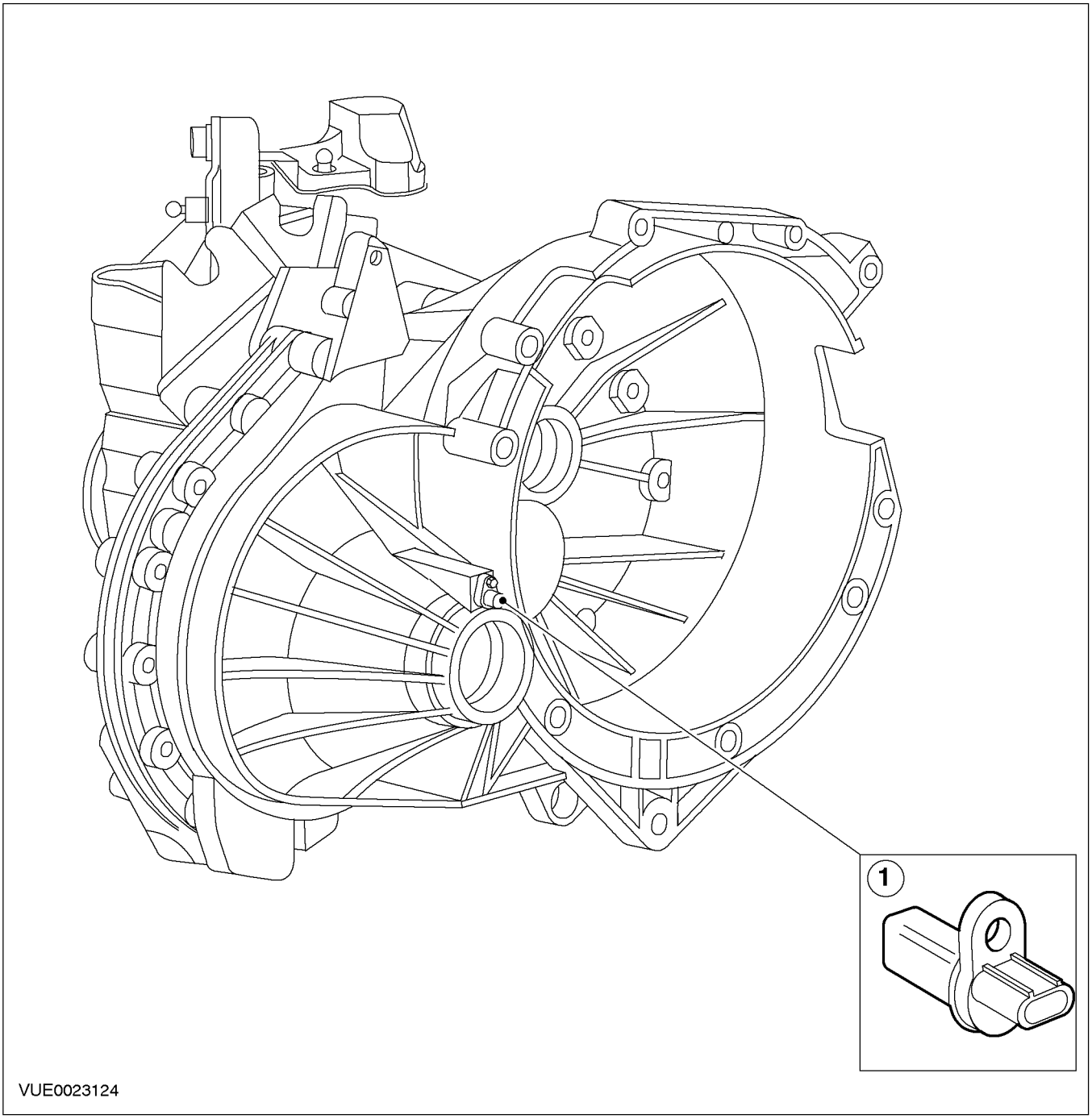
Item	Part Number	Description
1	-	Injector Driver Module (IDM)

Item	Part Number	Description
1	-	MAF sensor



DESCRIPTION AND OPERATION

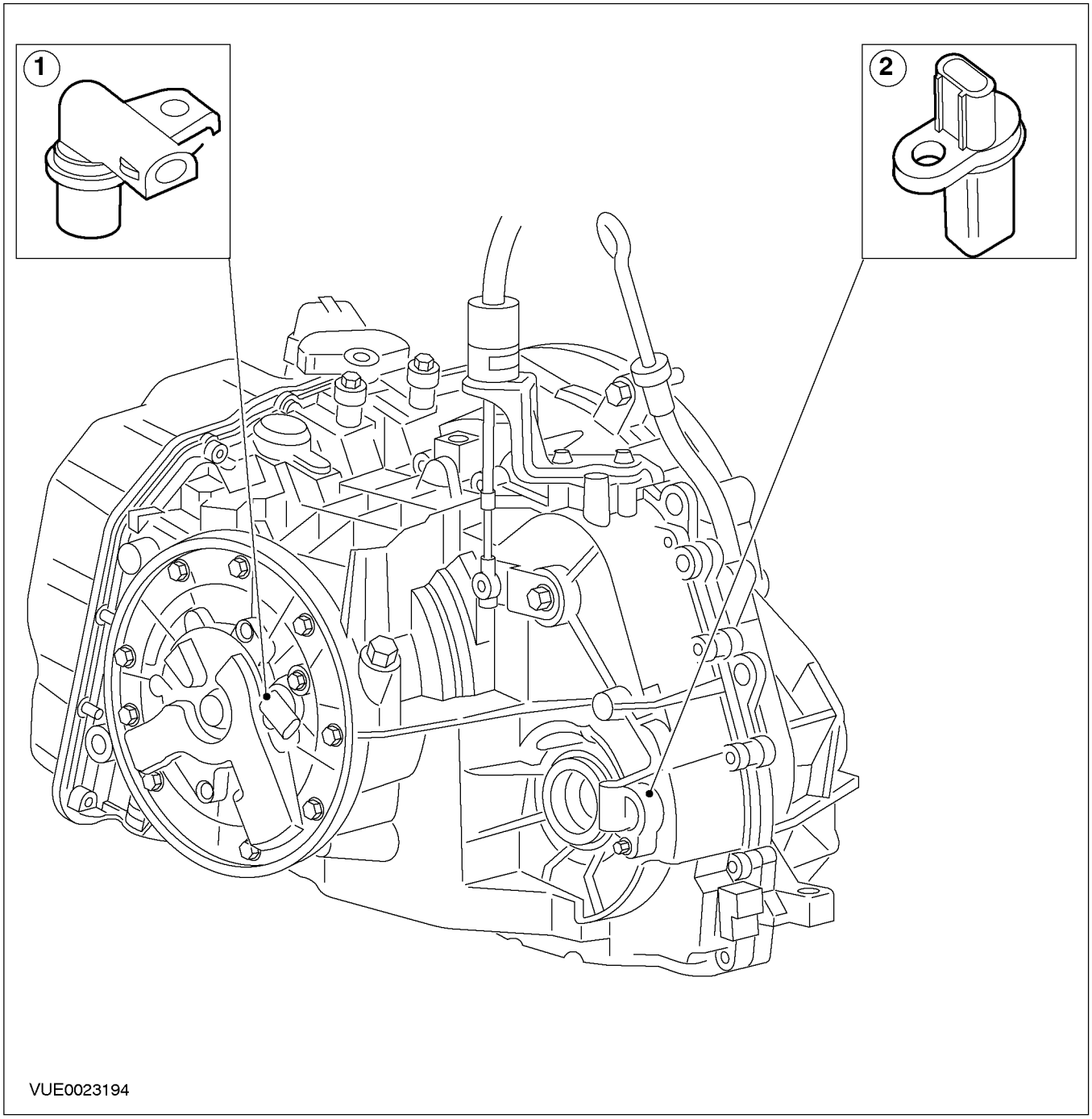
Vehicles with manual transaxle



Item	Part Number	Description
1	-	Vehicle speed sensor (VSS)

DESCRIPTION AND OPERATION

Vehicles with automatic transaxle

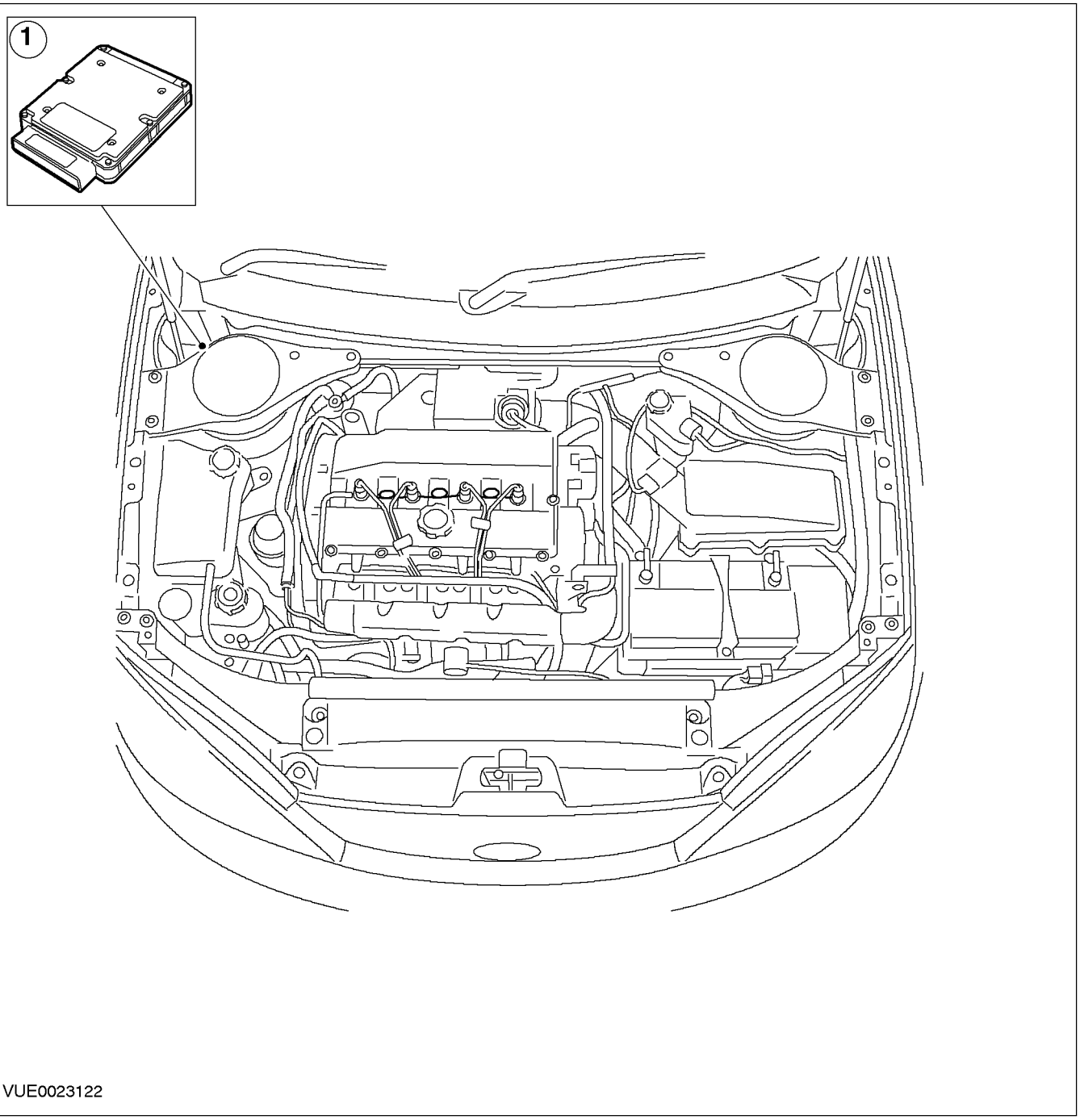


Item	Part Number	Description
1	-	Turbine speed sensor (TSS)

Item	Part Number	Description
2	-	VSS

DESCRIPTION AND OPERATION

All vehicles



Item	Part Number	Description
1	-	Powertrain control module (PCM)

DIAGNOSIS AND TESTING

Electronic Engine Controls

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
– Fuse(s) – Wiring harness – Electrical connector(s) – Relay(s) – Sensor(s) – Switch(es) – Powertrain control module (PCM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to WDS to diagnose the system.

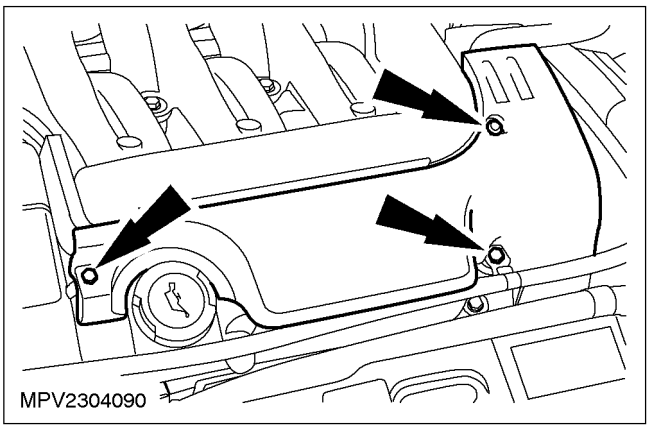
Condition	Possible Sources	Action
•Engine speed will not exceed 3000 RPM	•Clutch actuation switch.	•REFER to WDS.

REMOVAL AND INSTALLATION

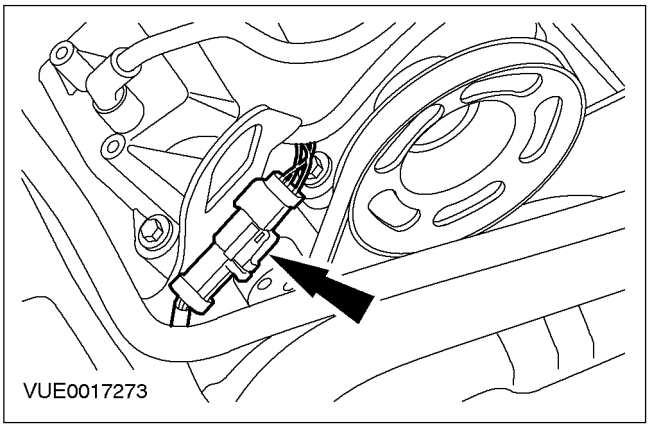
Heated Oxygen Sensor (HO2S) LH — 2.5L

Removal

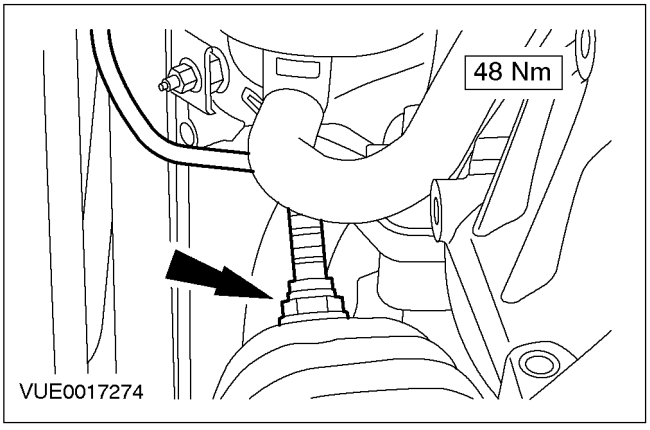
1. **Remove the engine cover.**



2. **Disconnect the left-hand HO2S electrical connector.**



3. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
4. **Remove the left-hand HO2S.**



Installation

CAUTION: When installing a new HO2S, it is possible that the new component will be supplied with a longer cable than the one removed. It is important that the cable is routed and secured in such a way that it cannot be damaged by heat or moving components and will not cause a noise, vibration or harshness (NVH) issue.

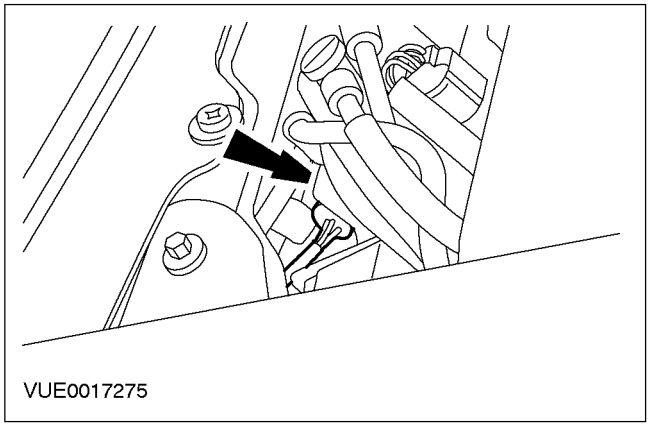
1. **To install, reverse the removal procedure.**

REMOVAL AND INSTALLATION

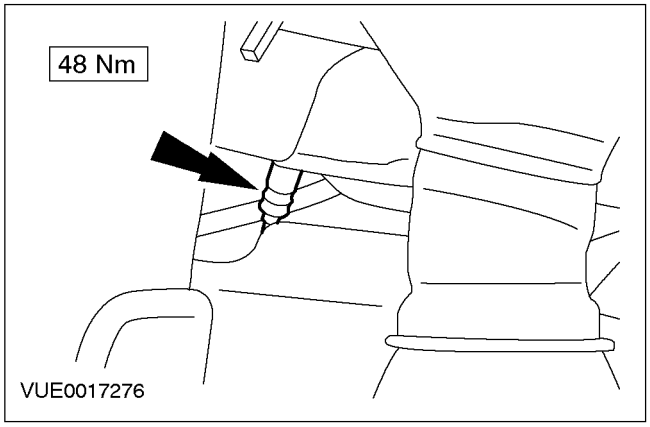
Heated Oxygen Sensor (HO2S) RH — 2.5L

Removal

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01.
2. Disconnect the right-hand HO2S electrical connector.



3. Raise and support the vehicle. For additional information, refer to Section 100-02.
4. Remove the right-hand HO2S.



Installation

CAUTION: When installing a new HO2S, it is possible that the new component will be supplied with a longer cable than the one removed. It is important that the cable is routed and secured in such a way that it cannot be damaged by heat or moving components and will not cause a noise, vibration or harshness (NVH) issue.

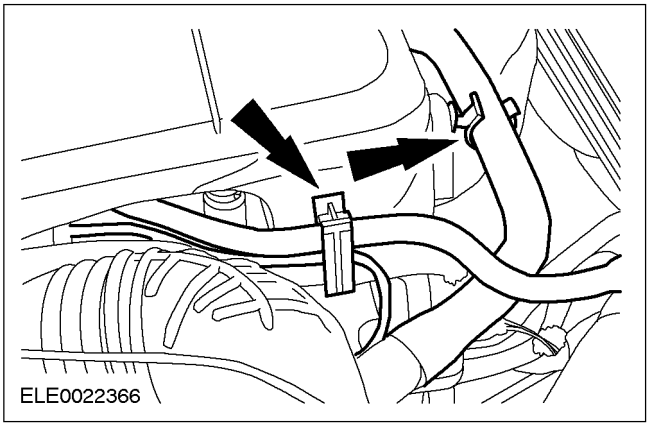
1. To install, reverse the removal procedure.
2. Initialize the door window motors. For additional information, refer to Section 501-11.

REMOVAL AND INSTALLATION

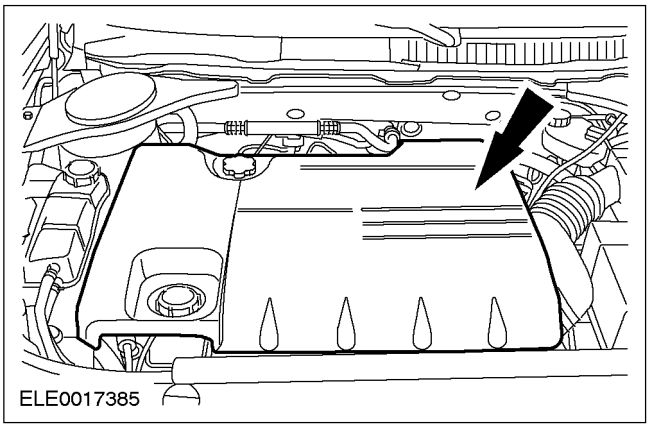
Intake Manifold Runner Control (IMRC) Actuator — 1.8L/2.0L

Removal

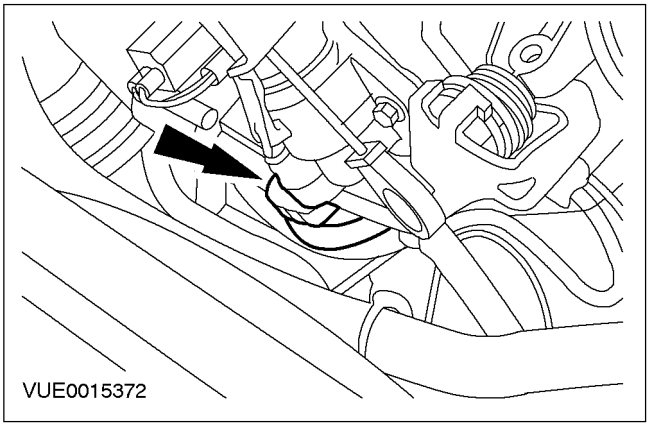
1. Disconnect the battery ground cable. For additional information, refer to Section 414-01.
2. Detach the pipes and hoses from the engine upper cover.



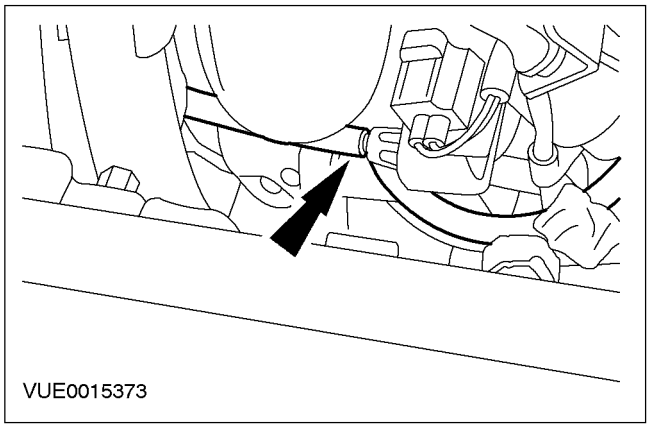
3. Remove the engine upper cover.



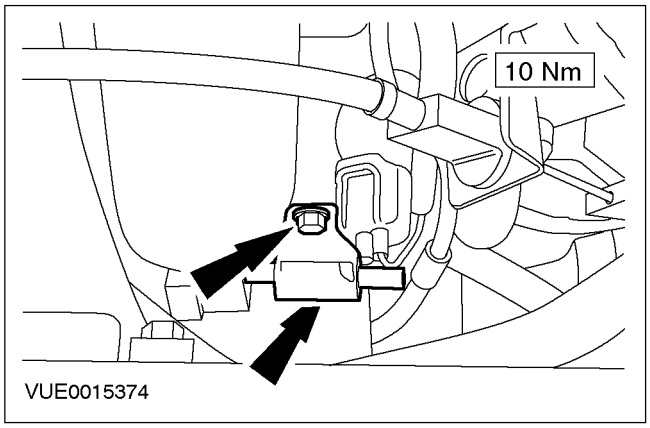
4. Disconnect the IMRC actuator electrical connector.



5. Disconnect the vacuum lines from the IMRC actuator.



6. Remove the IMRC actuator.



Installation

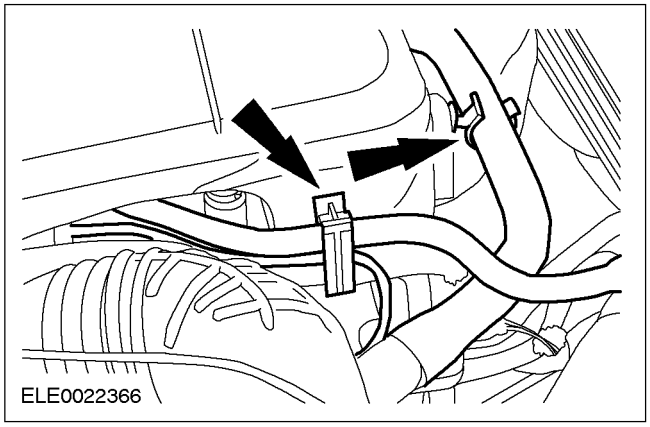
1. To install, reverse the removal procedure.
2. Initialize the door window motors. For additional information, refer to Section 501-11.

REMOVAL AND INSTALLATION

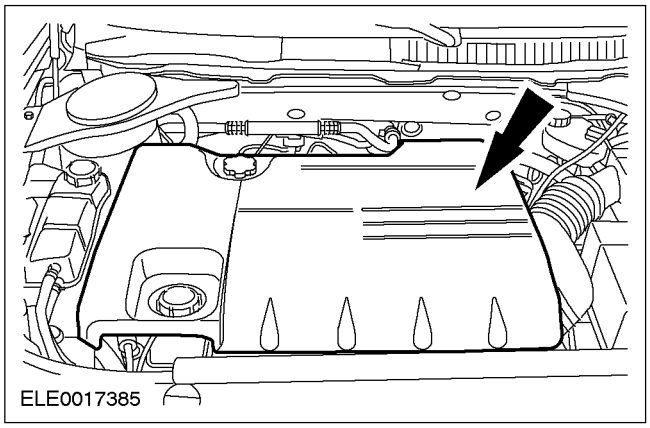
Intake Manifold Tuning (IMT) Valve — 1.8L/2.0L

Removal

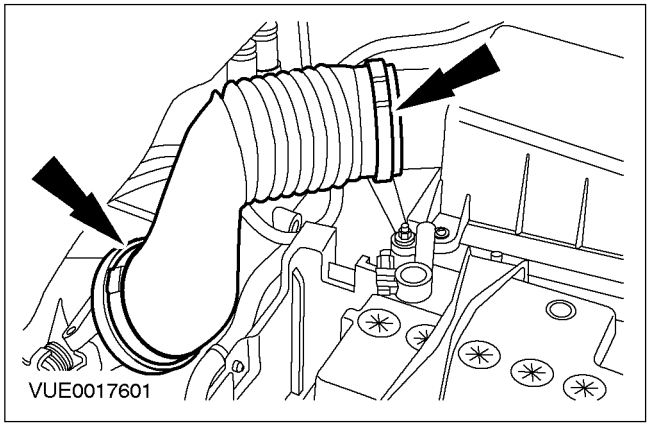
1. Disconnect the battery ground cable. For additional information, refer to Section 414-01.
2. Detach the pipes and hoses from the engine upper cover.



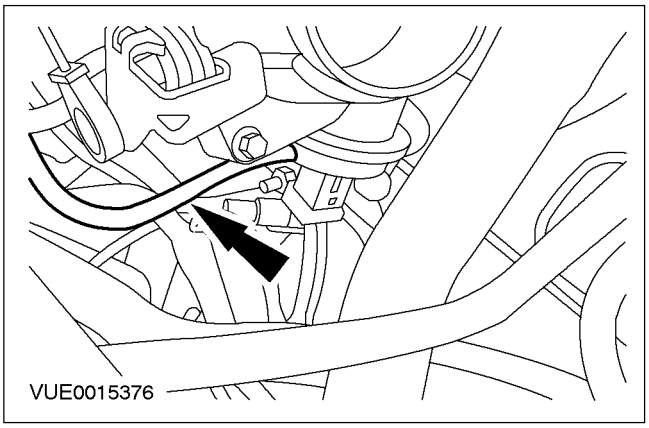
3. Remove the engine upper cover.



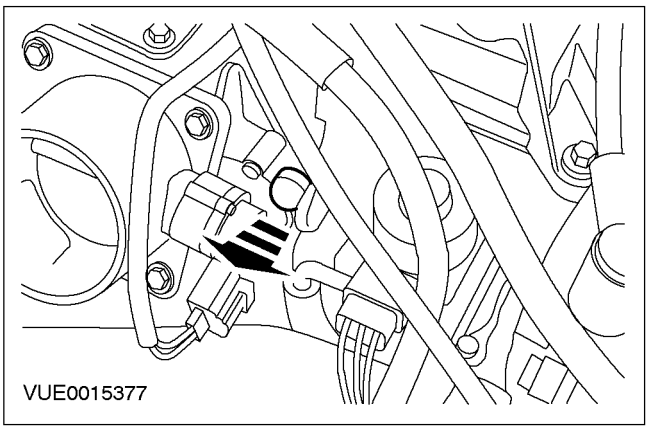
4. Remove the air cleaner outlet pipe.



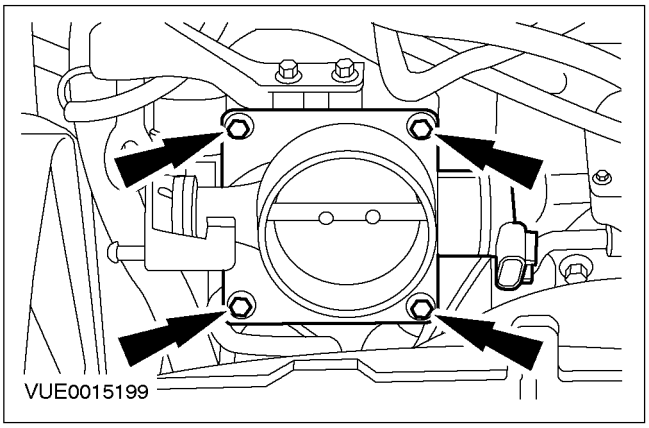
5. Disconnect the vacuum line from the IMT valve.



6. Disconnect the actuator arm from the IMT valve.

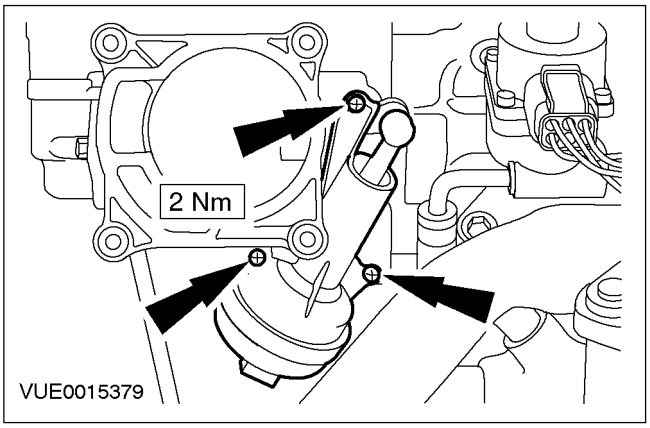


7. Detach the throttle body.



REMOVAL AND INSTALLATION (Continued)

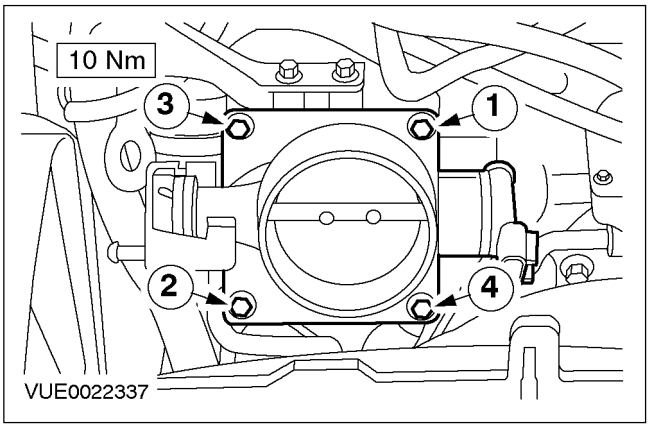
8. Remove the IMT valve.



Installation

1. To install, reverse the removal procedure.

- Tighten the throttle body retaining bolts in the sequence shown.



2. Initialize the door window motors. For additional information, refer to Section 501-11.

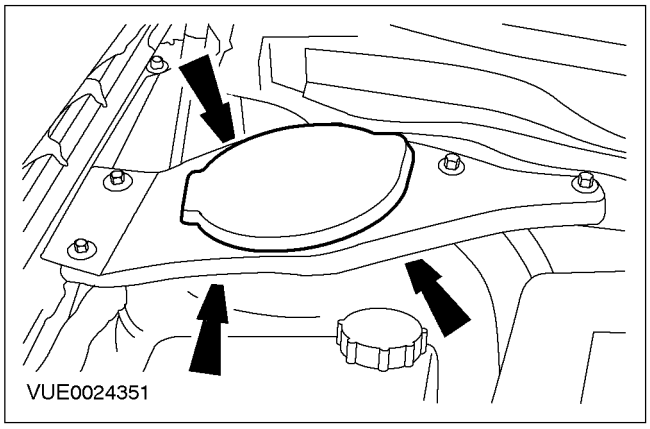
REMOVAL AND INSTALLATION

Powertrain Control Module (PCM) (29 200 0)

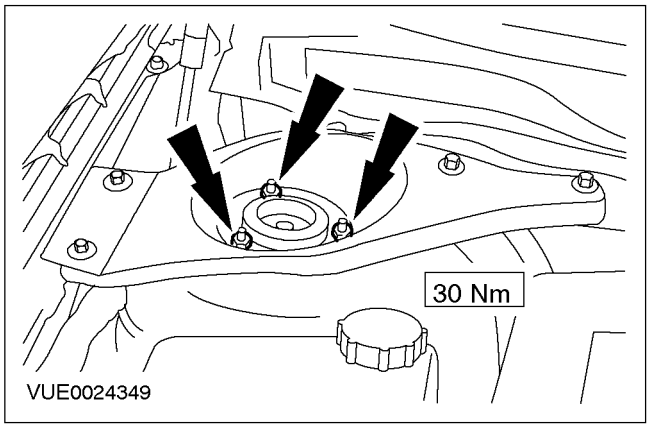
General Equipment
Tie straps

Removal

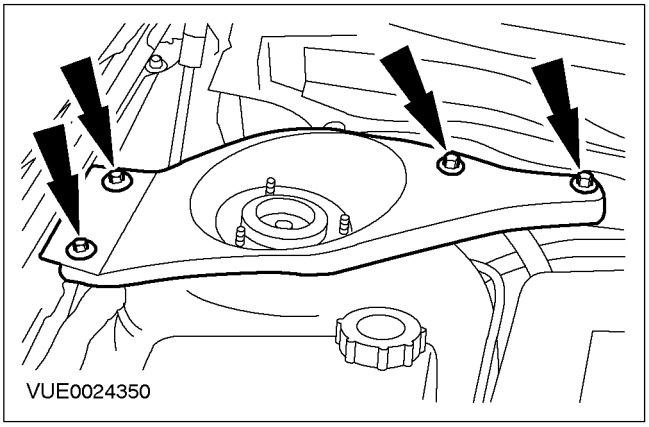
1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Remove the strut and spring assembly top mount brace cover.**



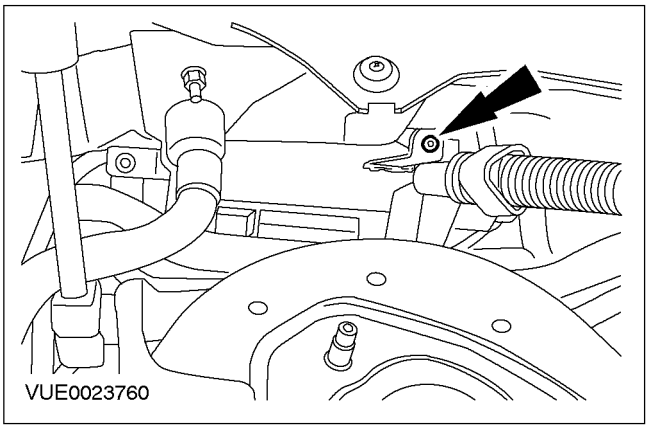
3. **Remove the strut and spring assembly top mount retaining nuts.**



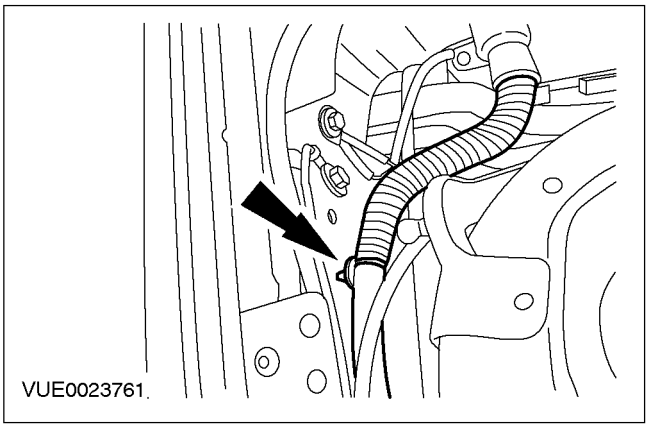
4. **Remove the strut and spring assembly top mount brace.**



5. **Remove the PCM security shield rivet.**

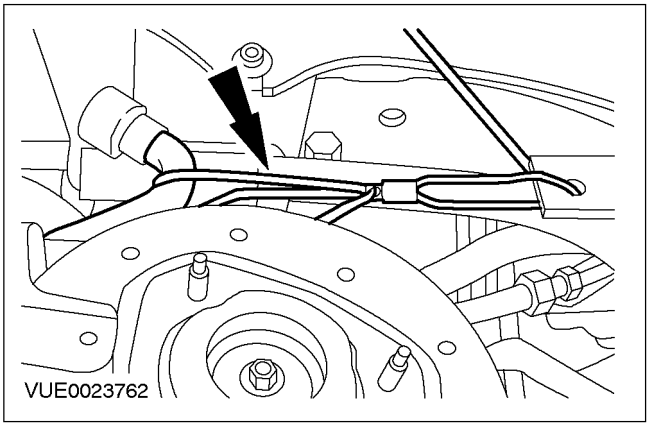


6. **Detach the engine wiring harness from the front inner fender.**



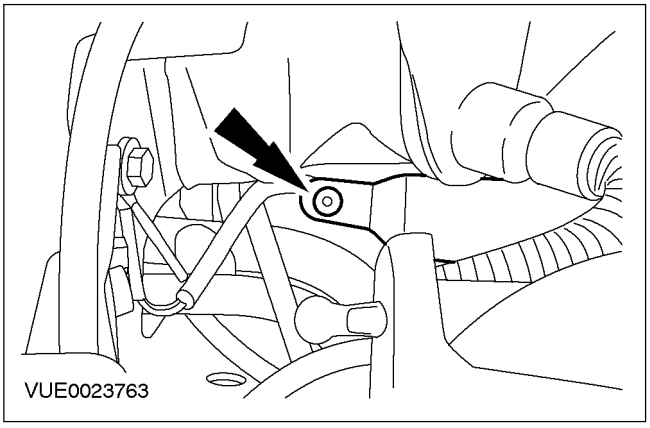
REMOVAL AND INSTALLATION (Continued)

7. Using suitable tie straps, position the engine wiring harness to one side.

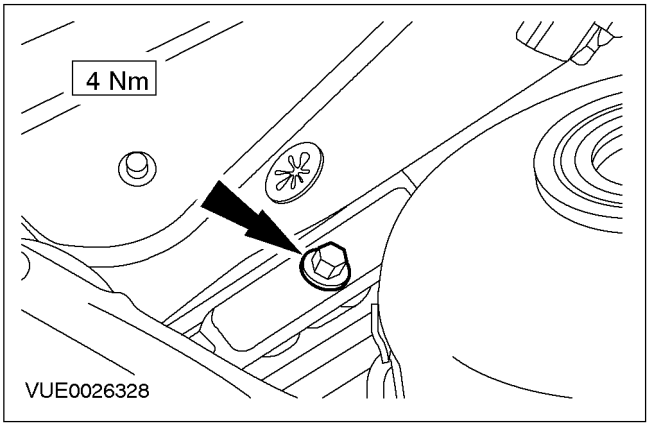


8. CAUTION: The PCM electrical connector ground cable is located behind the PCM security shield rivet. Care must be taken when drilling through the PCM security shield rivet not to drill through the ground cable.

Remove the PCM security shield from the PCM.

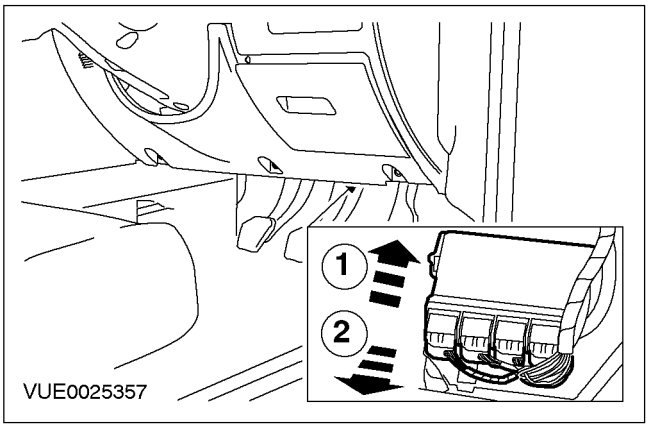


9. Disconnect the PCM electrical connector.

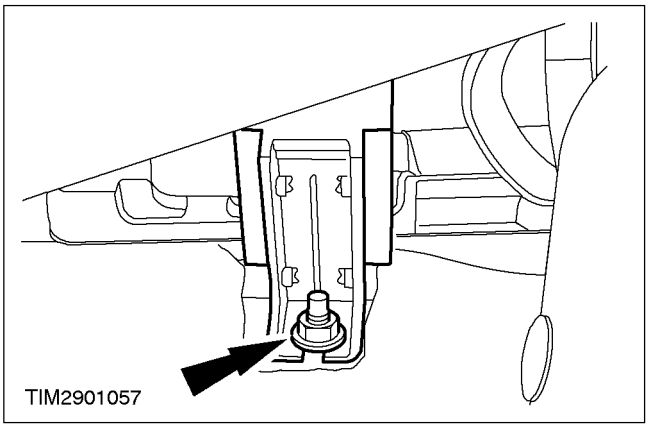


10. Detach the generic electronic module (GEM) from the PCM bracket (right-hand drive shown).

1. Release the GEM retaining clip and slide the GEM upwards.
2. Slide the GEM downwards to detach.



11. Remove the PCM.



Installation

1. To install, reverse the removal procedure.

2. Initialize the door window motors. For additional information, refer to Section 501-11.

SECTION 307-01A Automatic Transmission/Transaxle

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

Lubricants, Fluids, Sealers and Adhesives

	Specification
Automatic transmission fluid	ESP-M2C166-H
Pipe sealant with Teflon D8AZ-19554-A	WSK-M2G350-A2
High-temperature grease	ESD-M1C220-A

Capacities

	Litres
2.0L engine	7.5
2.0L engine refill capacity (except remaining oil in torque converter)	6.0
2.5L engine	9.6
2.5L engine refill capacity (except remaining oil in torque converter)	6.29

Low-intermediate carrier assembly pinion gear

Description	mm
End play	0.15 – 0.72

Reverse clutch pack clearance

Description	mm
Clutch plate to retaining ring	0.33 – 0.89
Retaining ring thickness	1.39 – 1.49
Retaining ring thickness	1.53 – 1.63
Retaining ring thickness	1.68 – 1.78

Forward/coast clutch pack clearance

Description	mm
Clutch pack clearance	0.23 – 0.96
Retaining ring thickness	1.43 – 1.53
Retaining ring thickness	1.59 – 1.69
Retaining ring thickness	1.75 – 1.85
Retaining ring thickness	1.92 – 2.02

Direct clutch pack clearance

Description	mm
Clutch plate to retaining ring	0.52 – 1.12
Retaining ring thickness	1.28 – 1.38
Retaining ring thickness	1.39 – 1.49
Retaining ring thickness	1.52 – 1.62
Retaining ring thickness	1.65 – 1.75

Pump gear end clearance

Description	mm
Drive gear clearance	0.04 – 0.08

Pump assembly rotating torque

Description	Nm
Drive shaft rotational torque	0.3

SPECIFICATIONS (Continued)

Torque converter

Description	
Turbine torque check	13.5 Nm
End play check	greater than 1.27 mm

Low/reverse clutch pack clearance

Description	mm
Clutch plate to retaining ring	0.54 – 1.17
Pressure plate sizes	2.57 – 2.47
Pressure plate sizes	2.36 – 2.26
Pressure plate sizes	2.16 – 2.06

Intermediate and overdrive servo

Description	mm
Servo travel (narrow groove)	2.4 – 4.9
Serco travel (wide groove)	2.4 – 4.9

Intermediate/overdrive servo apply rod

Description	Number of rings	Rod length
F3RP-74188-CB	0	108.1 mm
F3RP-74188-BB	1	107.1 mm
F3RP-74188-AB	2	105.7 mm

Reverse/overdrive carrier assembly pinion gear end-play

Description	mm
End play	0.15 – 0.72

Low-intermediate carrier assembly pinion gear end-play

Description	mm
End play	0.15 – 0.72

Final drive carrier assembly pinion gear end-play

Description	mm
End play	0.17 – 0.65

Gear ratios

Description	Ratio
First	2.889:1
Second	1.571:1
Third	1:1
Fourth	0.689:1
Reverse	2.31:1
Final Drive	4.23:1

Driven sprocket alignment no. 10 thrust washer

Description	mm
Drive sprocket to converter housing thrust washer (sizes)	1.51 – 1.41
Drive sprocket to converter housing thrust washer (sizes)	1.77 – 1.67
Drive sprocket to converter housing thrust washer (sizes)	2.03 – 1.93

SPECIFICATIONS (Continued)

Description	mm
Drive sprocket to converter housing thrust washer (sizes)	2.29 – 2.19
Distance measured during gauging procedure and appropriate thrust washer:	1.12 – 0.86
Distance measured during gauging procedure and appropriate thrust washer:	0.85 – 0.60
Distance measured during gauging procedure and appropriate thrust washer:	0.59 – 0.34
Distance measured during gauging procedure and appropriate thrust washer:	0.33 – 0.08

Drive sprocket alignment no. 11 shim

Description	mm
Drive sprocket alignment no. 11 shim Transaxle case to driven sprocket/final drive sun gear thrust bearing shim AB (sizes)	2.20 – 2.10
Transaxle case to driven sprocket/final drive sun gear thrust bearing shim BB (sizes)	2.02 – 1.92
Transaxle case to driven sprocket/final drive sun gear thrust bearing shim BB (sizes). Transaxle case to driven sprocket/final drive sun gear thrust bearing shim CB (sizes)	1.85 – 1.75
Transaxle case to driven sprocket/final drive sun gear thrust bearing shim DB (sizes)	1.67 – 1.57
Transaxle case to driven sprocket/final drive sun gear thrust bearing shim EB (sizes)	1.50 – 1.40
Transaxle case to driven sprocket/final drive sun gear thrust bearing shim FB (sizes)	1.32 – 1.22
Distance measured during gauging procedure and appropriate thrust bearing shim AB:	14.34 – 14.17
Distance measured during gauging procedure and appropriate thrust bearing shim BB:	14.16 – 14.00
Distance measured during gauging procedure and appropriate thrust bearing shim CB:	13.99 – 13.83
Distance measured during gauging procedure and appropriate thrust bearing shim DB:	13.82 – 13.66
Distance measured during gauging procedure and appropriate thrust bearing shim EB:	13.65 – 13.49
Distance measured during gauging procedure and appropriate thrust bearing shim FB:	13.48 – 13.32

Differential end play no. 14 shim

Description	mm
Differential case-to-converter housing thrust bearing shim AA (sizes)	1.08 – 0.98
Differential case-to-converter housing thrust bearing shim BA (sizes)	1.38 – 1.28
Differential case-to-converter housing thrust bearing shim CA (sizes)	1.67 – 1.57
Differential case-to-converter housing thrust bearing shim DA (sizes)	1.97 – 1.86
Differential case-to-converter housing thrust bearing shim FA (sizes)	2.27 – 2.17
Distance measured during gauging procedure and appropriate thrust bearing shim AA	130.76 – 130.46
Distance measured during gauging procedure and appropriate thrust bearing shim BA	130.45 – 130.16
Distance measured during gauging procedure and appropriate thrust bearing shim CA	130.15 – 129.87

SPECIFICATIONS (Continued)

Description	mm
Distance measured during gauging procedure and appropriate thrust bearing shim DA	129.88 – 129.57
Distance measured during gauging procedure and appropriate thrust bearing shim FA	129.56 – 129.27

Torque Specifications

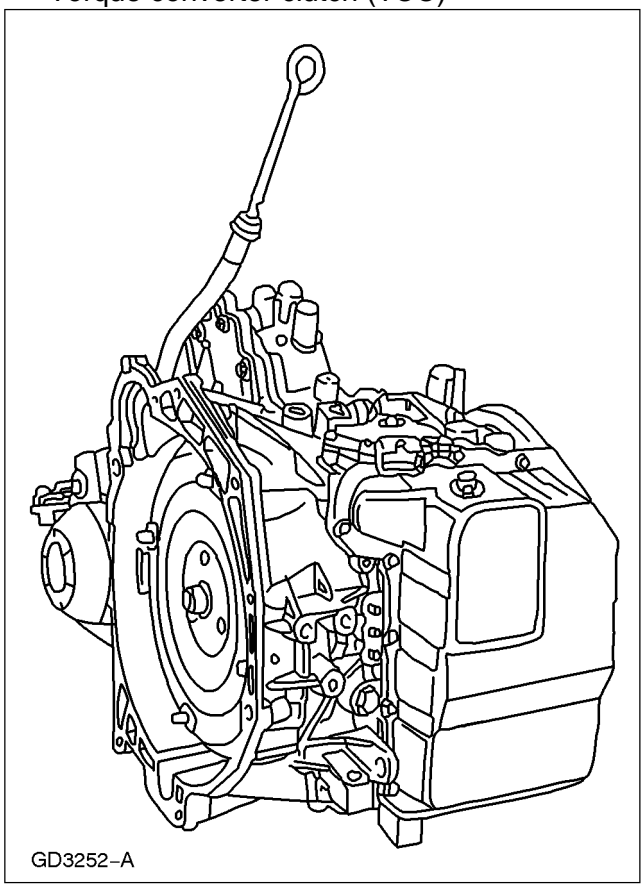
Description	Nm	lb-ft	lb-in
Drain plug	27	20	-
Main control valve body to transfer plate retaining bolts	12	9	-
Oil cooler pipe adapter	40	30	-
Differential lubrication tube retaining bolt	13	10	-
Oil filler tube retaining bolt	8	-	71
Line pressure port plug	24	18	-
Manual control lever retaining bolt	27	20	-
Shift cable to control lever bolts	23	17	-
Manual valve detent lever ball stud nut	12	9	-
Parking pawl shaft retaining bolt	8	-	71
Manual control lever shaft	74	55	-
Pressure tap plate bolts	8	-	71
Pump assembly bolts	13	10	-
Pump support bolts	13	10	-
Solenoid valve body bolts	10	-	89
Thermostatic fluid level control valve bolt	12	9	-
Transmission range (TR) sensor retaining bolts	12	9	-
Transaxle case to engine bolts	48	35	-
Turbine shaft speed (TSS) sensor retaining bolt	13	10	–
Vehicle speed sensor (VSS) retaining bolt	5	-	44
Solenoid body to case bolts	10	-	89
Case pressure taps	8	-	71
Transaxle support bracket bolts	48	35	-
Engine rear support insulator bolt	80	59	-
Transaxle oil cooler pipes	23	17	-
Steering knuckle ball joint retaining nut	28	21	-
Power steering gear retaining bolts	50	37	-
Torque converter retaining nuts	36	27	-
Driveshaft stub nut	290	214	-
Torque converter housing to transaxle case	22	16	-
Main control valve cover bolts	20	15	-
Output shaft speed (OSS) sensor retaining bolt	13	10	-

DESCRIPTION AND OPERATION

Transaxle Description

The CD4E automatic transaxle is a four-speed, front wheel drive automatic transmission with electronic controls for:

- Electronic pressure control (EPC) for improved shift quality.
- Gearshift control
- 3-2 shift timing
- Coast braking
- Torque converter clutch (TCC)



View of the automatic transmission

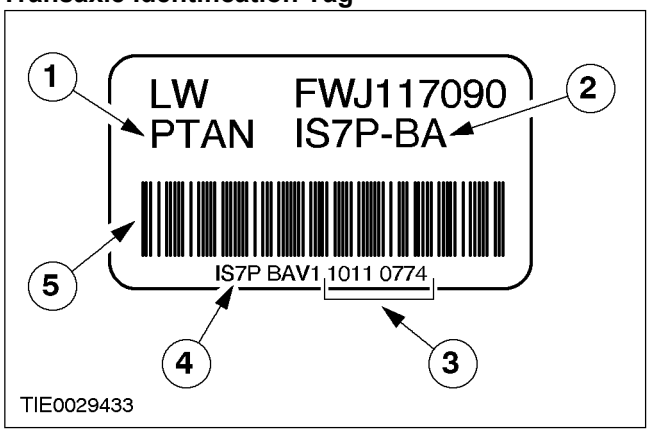
The automatic transmission consists of a four-part torque converter with lock-up clutch as well as the following components:

- Planetary gearset
- Chain drive
- Planetary gearset final drive
- Differential pinion and side gears

The hydraulic control system of the CD4E has five solenoids that control:

- Gearshift pressure (through line pressure control).
- Gearshift control (through shift valve position control).
- Modulated actuation of the torque converter clutch
- Control of 3-2 shifts
- Engine braking during coast operation

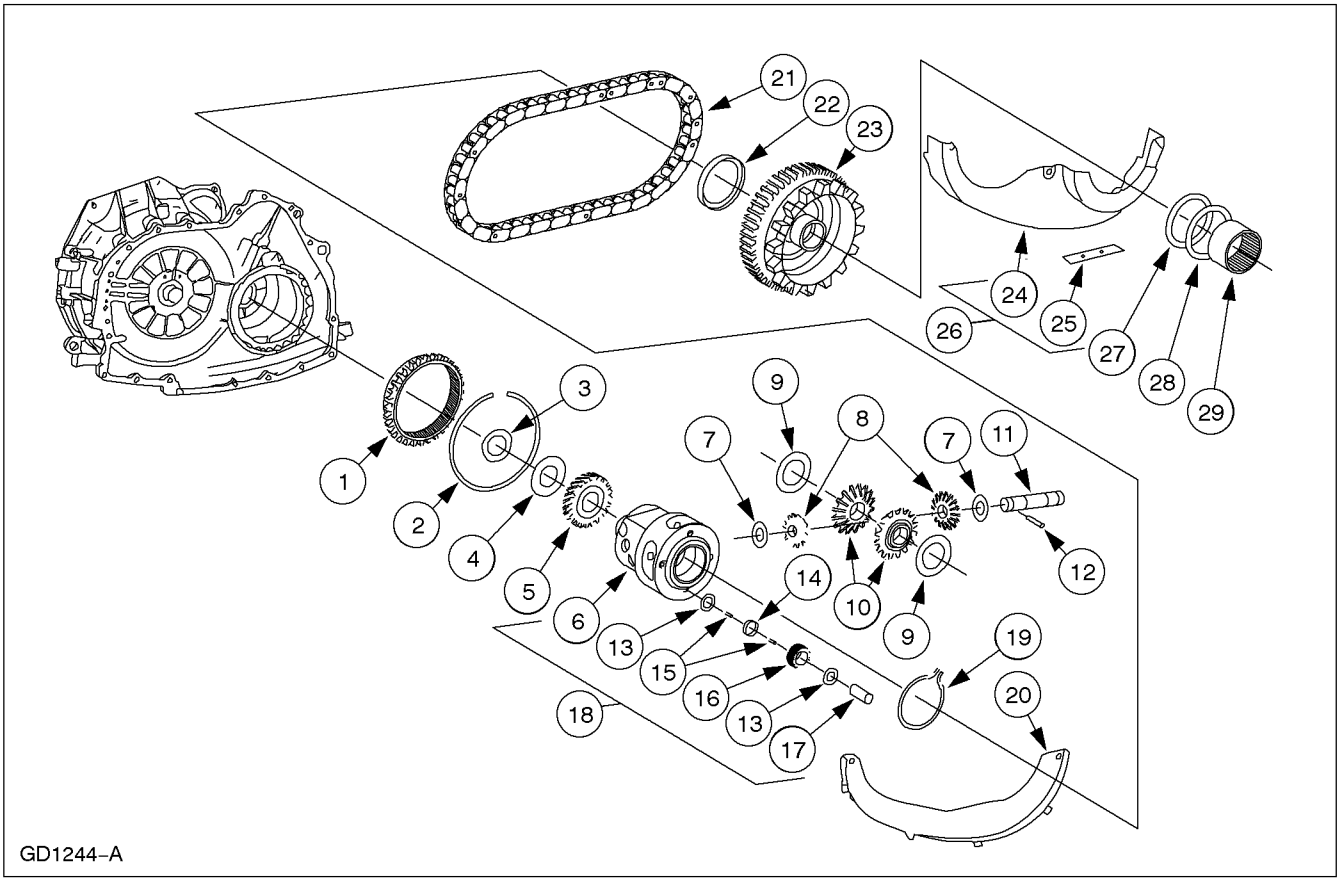
Transaxle Identification Tag



Item	Part Number	Description
1	-	Model number
2	-	Assembly number
3	-	Serial number (contains the build date)
4	-	Part number
5	-	Bar code

DESCRIPTION AND OPERATION

Final drive, chain drive, differential



Item	Part Number	Description
1	-	Final drive ring gear
2	-	Final drive ring gear snap-ring
3	-	Differential carrier bearing, no. 15
4	-	Thrust washer, no.14 (selective fit)
5	-	Speedometer drive gear
6	-	Differential housing
7	-	Thrust washer
8	-	Differential pinion gear
9	-	Thrust washer
10	-	Differential side gear
11	-	Differential pinion shaft
12	-	Roll pin
13	-	Final drive planet gear thrust washer (8 req'd)

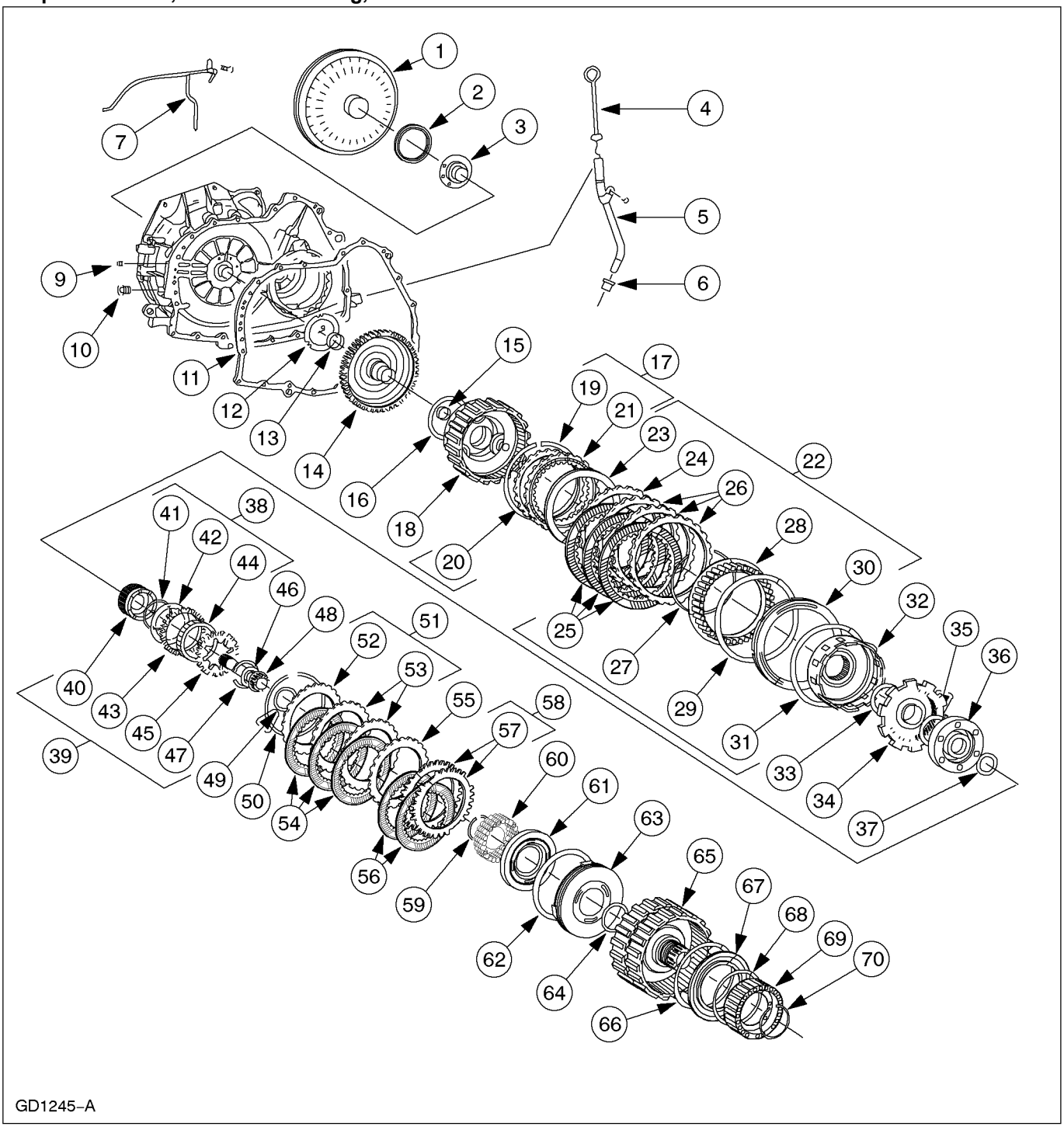
Item	Part Number	Description
14	-	Final drive planet gear spacer (4 req'd)
15	-	Final drive planet gear needle bearing (4 req'd)
16	-	Final drive planet gear (4 req'd)
17	-	Final drive pinion shaft
18	-	Final drive planetary gearset and carrier
19	-	Final drive pinion shaft snap-ring
20	-	Cover - drive chain
21	-	Drive chain
22	-	Drive chain sprocket thrust bearing, no. 13
23	-	Drive chain sprocket
24	-	Cover - rear drive chain
25	-	Magnet

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
26	-	Cover - rear drive chain
27	-	Drive chain sprocket bearing, no.12

Item	Part Number	Description
28	-	Shim - drive chain sprocket, no. 11 (selective fit)
29	-	Drive chain sprocket bearing, no.18

Torque converter, converter housing, clutches



DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1	-	Torque converter
2	-	Torque converter hub seal
3	-	Stator support
4	-	Fluid level indicator
5	-	Fluid filler tube
6	-	Fluid filler tube grommet
7	-	Differential line
8	-	Torque converter housing
9	-	Pipe plug, 1/8-27 dry seal
10	-	Fluid line connector
11	-	Transaxle flange gasket
12	-	Drive sprocket thrust washer, no.10 (selective fit)
13	-	Stator support bearing, no.17
14	-	Reverse/overdrive ring gear assembly
15	-	Drive sprocket bearing, no.16
16	-	Reverse/overdrive ring gear thrust bearing
17	-	Low one-way clutch
18	-	Reverse/overdrive carrier assembly (with captured no. 8 thrust bearing)
19	-	One-way clutch snap-ring
20	-	One-way clutch thrust washer
21	-	One-way clutch assembly
22	-	Low/reverse clutch
23	-	Low/reverse wave spring
24	-	Low/reverse clutch pressure plate
25	-	Low/reverse clutch internal spline clutch plates (friction plates) (3 req'd)
26	-	Low/reverse clutch external spline clutch plates (steel) (3 req'd)

Item	Part Number	Description
27	-	Low/reverse clutch return spring snap-ring
28	-	Low/reverse clutch return spring assembly
29	-	Low/reverse clutch piston outer seal (large)
30	-	Low/reverse clutch piston
31	-	Inner seal - lower/reverse clutch piston (small)
32	-	Reverse/overdrive sun gear and housing
33	-	Reverse/overdrive sun gear thrust bearing, no. 7
34	-	Low-intermediate ring gear assembly
35	-	Low-intermediate carrier thrust bearing, no. 6
36	-	Low-intermediate carrier
37	-	Low-intermediate sun gear thrust bearing, no. 5
38	-	Forward one-way clutch
39	-	Forward one-way clutch and sun gear assembly
40	-	Low-intermediate sun gear assembly
41	-	Snap-ring (2 req'd)
42	-	Forward one-way clutch snap-ring
43	-	Forward one-way clutch outer race
44	-	Forward one-way clutch (sprag)
45	-	Coast clutch hub
46	-	Turbine shaft thrust bearing, no.4
47	-	Coast clutch hub snap-ring
48	-	Turbine shaft
49	-	Forward/coast/direct clutch cylinder hub seal
50	-	Forward/direct clutch pressure plate snap-ring

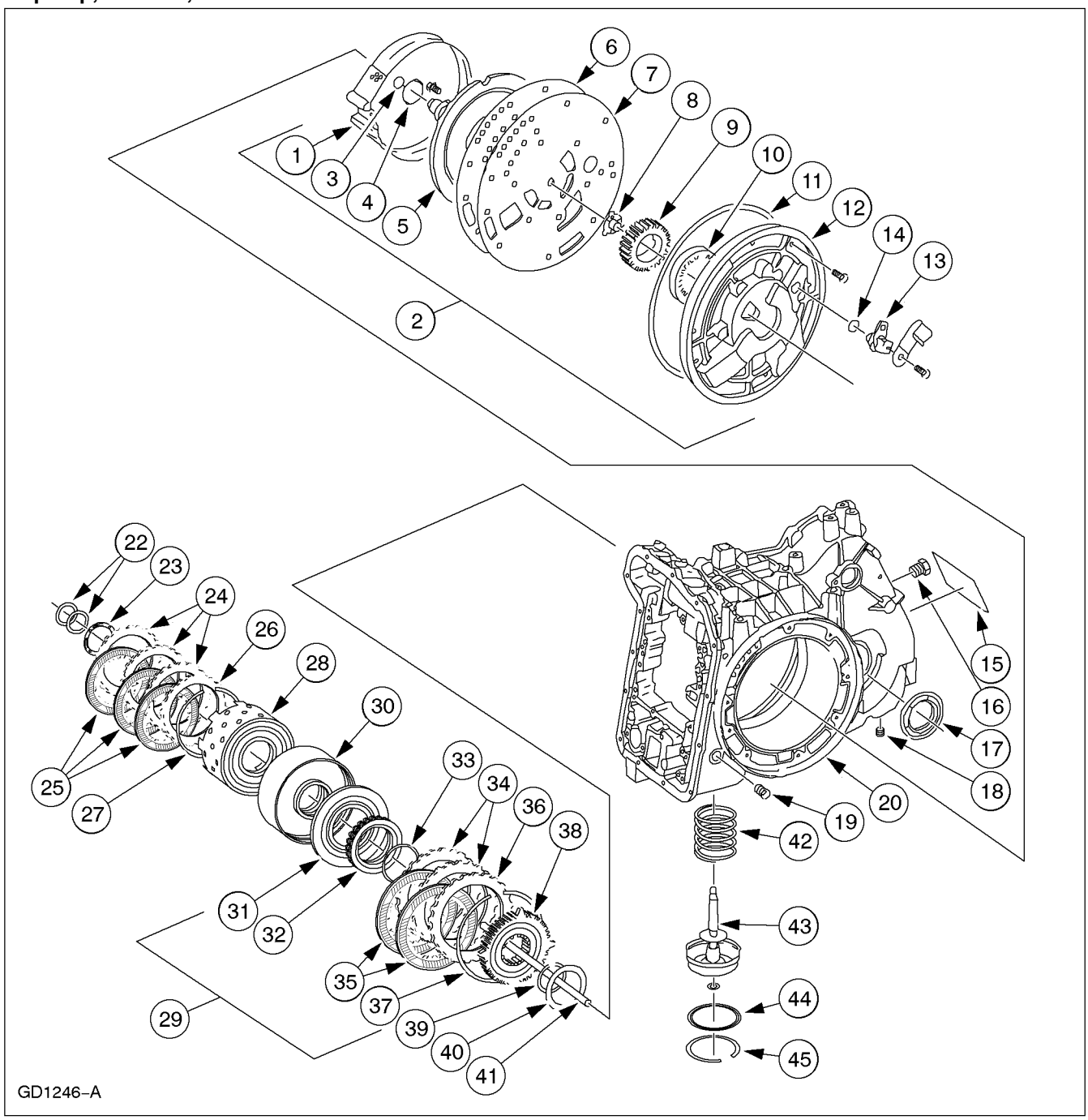
DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
51	-	Forward clutch
52	-	Forward clutch pressure plate
53	-	Forward clutch external spline clutch plates (steel)(2 req'd)
54	-	Forward clutch internal spline clutch plates (friction)(3 req'd)
55	-	Coast clutch pressure plate
56	-	Coast clutch internal spline clutch plates (friction)(2 req'd)
57	-	Coast clutch external spline clutch plates (steel)(2 req'd)
58	-	Coast clutch
59	-	Forward clutch spring snap-ring
60	-	Forward/coast clutch return spring

Item	Part Number	Description
61	-	Coast clutch piston and seal assembly
62	-	Forward clutch piston outer seal
63	-	Forward clutch piston assembly
64	-	Forward clutch piston inner seal
65	-	Forward/coast/direct clutch cylinder assembly
66	-	Direct clutch piston outer seal
67	-	Direct clutch piston assembly
68	-	Direct clutch piston inner seal
69	-	Direct clutch return spring
70	-	Direct clutch spring snap-ring

DESCRIPTION AND OPERATION

Oil pump, sensors, clutches



Item	Part Number	Description
1	-	Intermediate and overdrive band assembly
2	-	Pump assembly
3	-	Pump support seal ring
4	-	Pump support seal ring (6 req`d)

Item	Part Number	Description
5	-	Pump support assembly
6	-	Pump body separator plate gasket
7	-	Pump body separator plate
8	-	Pump drive gear insert
9	-	Pump drive gear

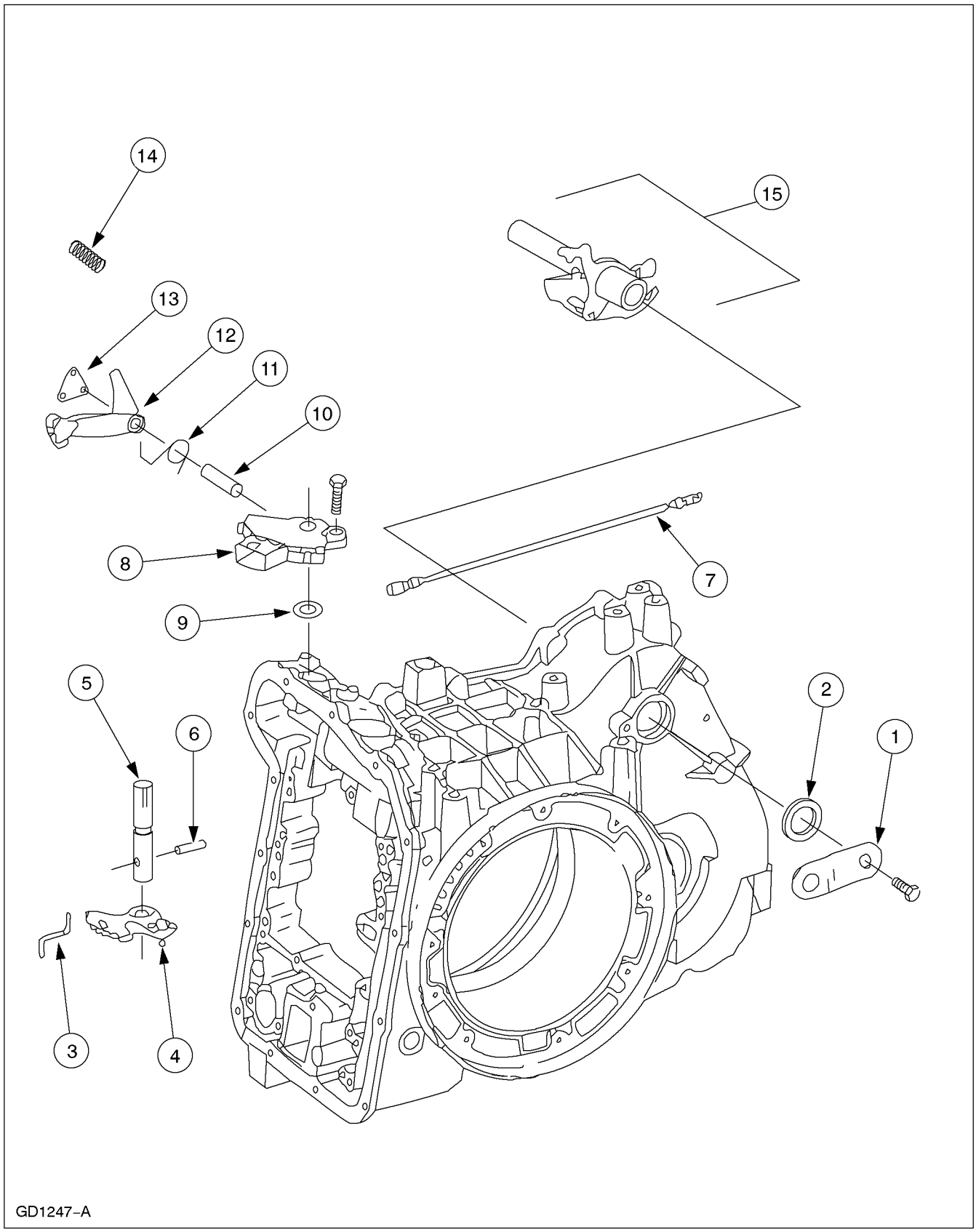
DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
10	-	Pump driven gear
11	-	Pump seal
12	-	Pump body
13	-	Turbine shaft speed sensor (TSS sensor)
14	-	Seal - TSS sensor
15	-	Transaxle identification tag
16	-	Fluid pipe connector
17	-	Differential seal (2 req'd)
18	-	Transaxle drain plug
19	-	Line pressure port plug
20	-	Transaxle case
21	-	Direct clutch
22	-	Reverse clutch cylinder seals (2 req'd)
23	-	Direct clutch thrust washer, no.2
24	-	Direct clutch external spline clutch plates (steel)(3 req'd)
25	-	Direct clutch internal spline clutch plates (friction)(3 req'd)
26	-	Direct clutch pressure plate
27	-	Direct clutch pressure plate snap-ring
28	-	Direct clutch shell
29	-	Reverse clutch

Item	Part Number	Description
30	-	Drum - reverse clutch
31	-	Piston - reverse clutch
32	-	Return spring - reverse clutch
33	-	Snap-ring
34	-	External spline clutch plates (steel) - reverse clutch (2 req'd)
35	-	Internal spline clutch plates (friction plates) - reverse clutch (2 req'd)
36	-	Pressure plate - reverse clutch
37	-	Snap-ring - reverse clutch pressure plate (selective fit)
38	-	Hub - reverse clutch
39	-	Snap-ring - reverse clutch hub
40	-	Pump support thrust bearing, no. 1
41	-	Pump drive shaft
42	-	Intermediate/overdrive servo return spring
43	-	Intermediate/overdrive servo piston and rod assembly
44	-	Intermediate/overdrive servo cover
45	-	Intermediate/overdrive servo cover snap-ring

DESCRIPTION AND OPERATION

Selector lever, TR switch

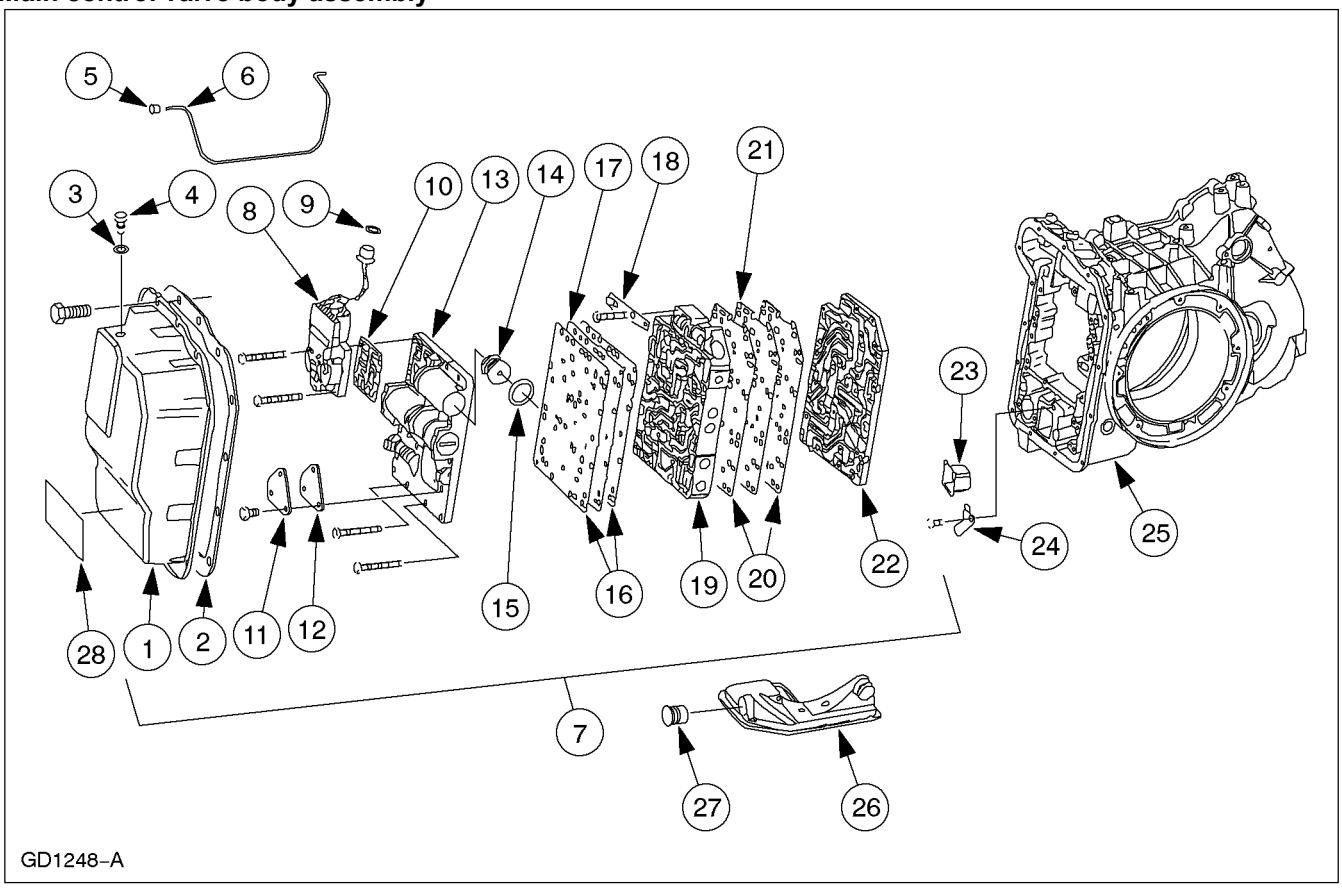


DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1	-	Manual control lever
2	-	Manual control lever seal
3	-	Manual valve actuator rod (Z link)
4	-	Manual valve detent lever
5	-	Manual valve detent lever shaft
6	-	Shaft retaining pin (2 req'd)
7	-	Manual valve detent lever actuating rod
8	-	Transmission range switch

Item	Part Number	Description
9	-	Seal - manual control lever shaft
10	-	Parking pawl shaft
11	-	Parking pawl return spring
12	-	Parking pawl
13	-	Retainer and bolt - parking pawl shaft
14	-	Parking pawl ratchet spring
15	-	Manual control lever assembly

Main control valve body assembly



Item	Part Number	Description
1	-	Main control cover
2	-	Gasket - main control cover
3	-	Grommet - main control cover vent

Item	Part Number	Description
4	-	Vent - main control cover
5	-	Seal - final drive oil line
6	-	Final drive oil line

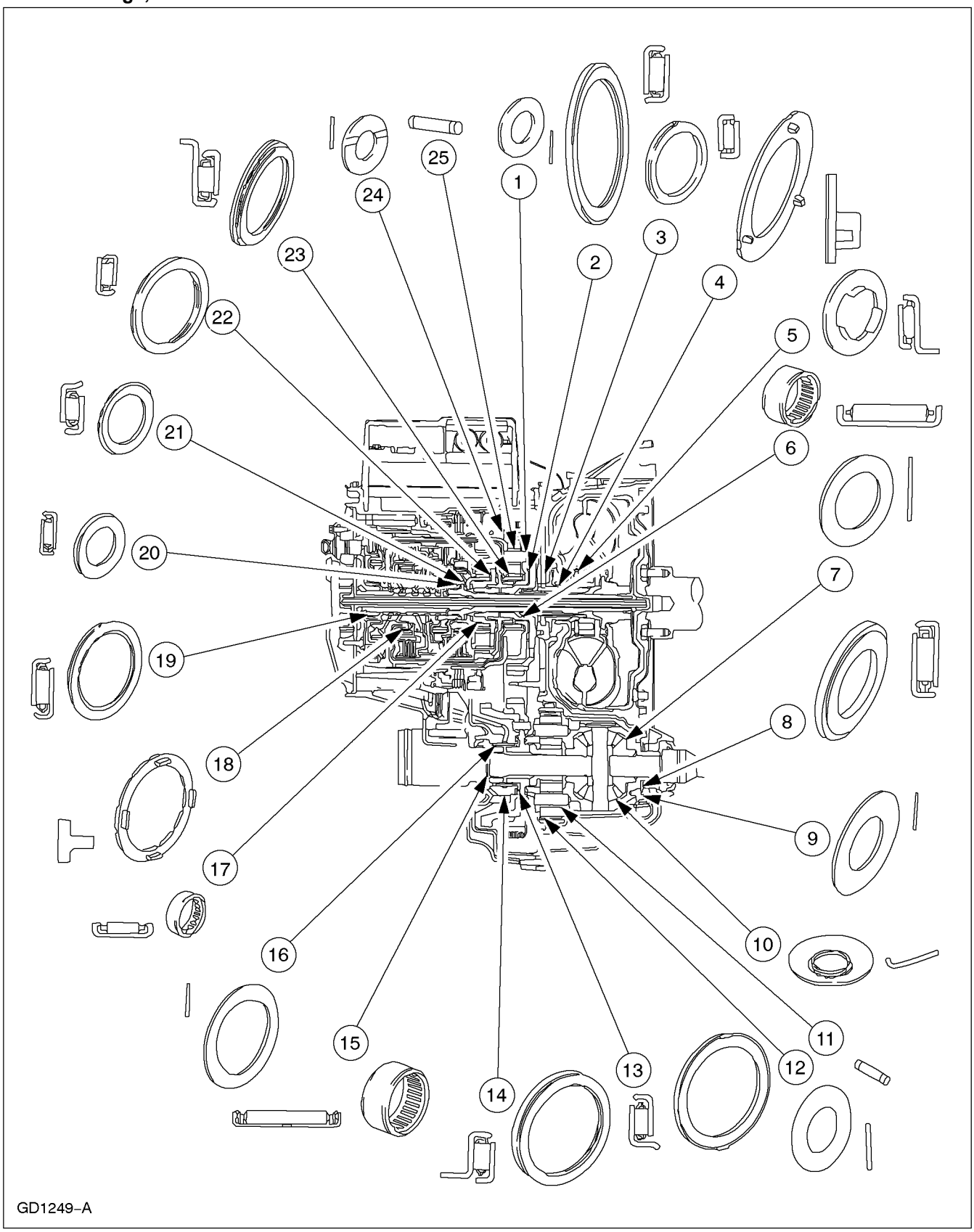
DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
7	-	Main control valve body assembly
8	-	Solenoid valve body (transaxle control)
9	-	Solenoid valve body retaining clip
10	-	Solenoid valve body gasket
11	-	Pressure tap plate
12	-	Pressure tap plate gasket
13	-	Servo body assembly
14	-	Intermediate and overdrive servo valve plug
15	-	Intermediate and overdrive servo plug seal
16	-	Servo body separator gaskets (2 req'd)
17	-	Servo body separator plate

Item	Part Number	Description
18	-	Manual valve detent spring
19	-	Main control valve body
20	-	Solenoid housing separator plate gasket (2 req'd)
21	-	Solenoid housing separator plate
22	-	Transfer plate
23	-	Fluid level control valve
24	-	Fluid level control valve bracket
25	-	Transaxle case
26	-	Filter and seal
27	-	Filter recirculating regulator exhaust seal
28	-	Transaxle identification tag

DESCRIPTION AND OPERATION

Thrust bearings, thrust washers



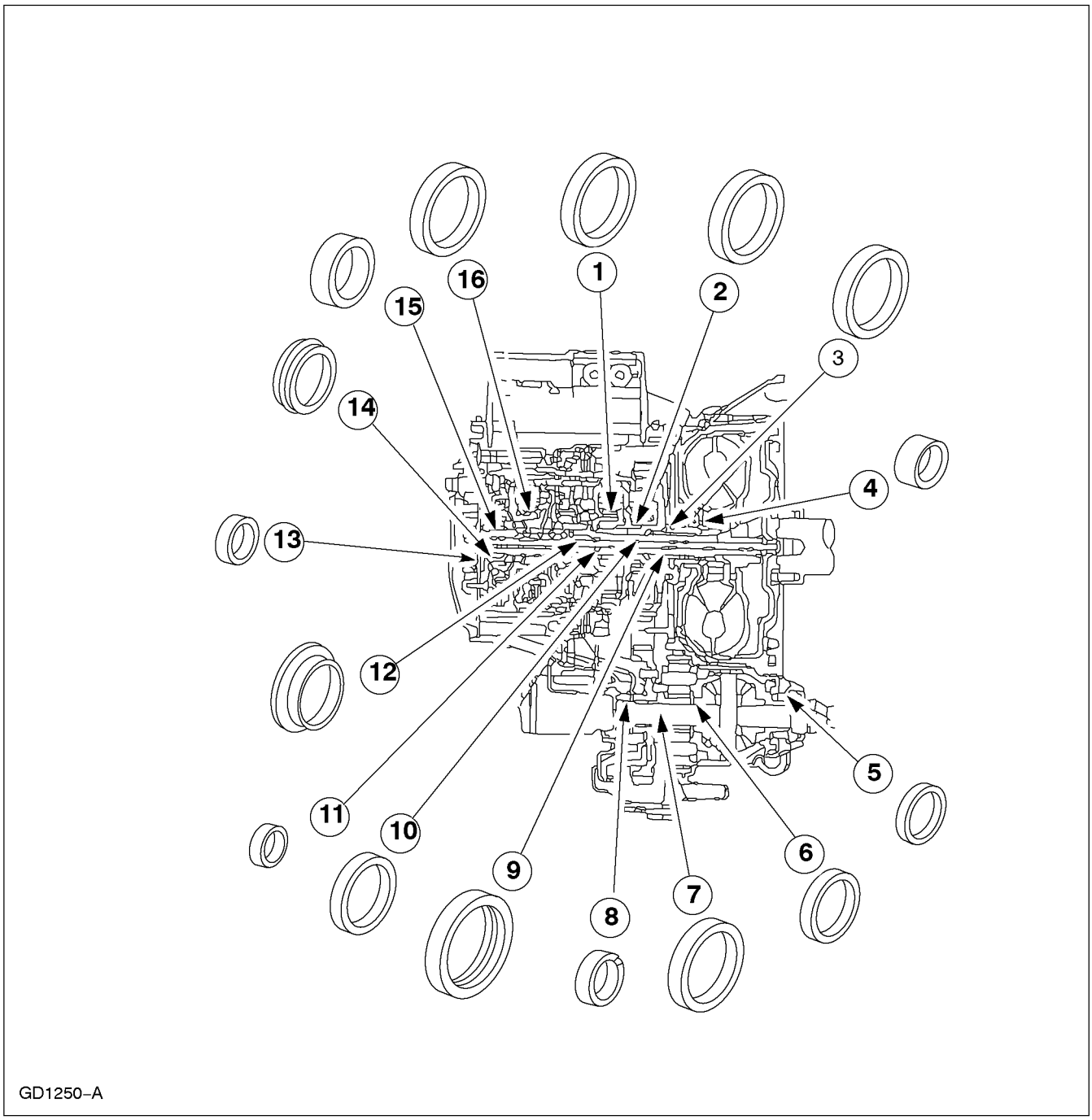
DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1	-	Low-intermediate planet washer
2	-	Thrust bearing no. 9 - reverse/overdrive ring gear
3	-	Thrust bearing no. 8 - reverse/overdrive planet carrier
4	-	Drive sprocket thrust washer, no. 10
5	-	Converter stator bearing
6	-	Stator support bearing, no.17
7	-	Thrust washer - differential side gear
8	-	Bearing no. 15 - differential pinion gear
9	-	Shim no. 14 - differential pinion gear bearing
10	-	Thrust washer
11	-	Final drive planet gear needle bearing
12	-	Final drive planet gear thrust washer

Item	Part Number	Description
13	-	Driven sprocket thrust washer, no. 13
14	-	Driven sprocket bearing, no. 12
15	-	Driven sprocket bearing, no. 18
16	-	Shim no. 11 - driven sprocket
17	-	Bearing no. 16 - reverse/overdrive ring gear
18	-	Direct clutch thrust washer, no. 2
19	-	Pump support thrust bearing, no.1
20	-	Thrust bearing no. 4 - turbine shaft
21	-	Low-intermediate sun gear thrust bearing, no.5
22	-	Low-intermediate planet carrier thrust bearing, no.6
23	-	Thrust bearing no. 7 - reverse/overdrive sun gear
24	-	Planet gear washer
25	-	Planet gear needle bearing

DESCRIPTION AND OPERATION

Bushes



Item	Part Number	Description
1	-	Low-intermediate sun gear bush
2	-	Bush - reverse/overdrive hub plate
3	-	Converter impeller hub bush
4	-	Stator support bush

Item	Part Number	Description
5	-	Case bush
6	-	Rear bush - final drive differential pinion gear
7	-	Front bush - final drive differential pinion gear
8	-	Final drive sun gear bush

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
9	-	Bush - reverse/overdrive drum gear
10	-	Low-intermediate gear hub bush
11	-	Turbine shaft bush
12	-	Direct clutch bush
13	-	Pump assembly drive bush
14	-	Bush - reverse clutch drum support
15	-	Forward/direct clutch cylinder bush
16	-	Bush - reverse clutch drum

Transaxle Range Selection

The selector lever has six settings: P, R, N, D, 2, 1. A transmission control switch allows the driver to prevent a shift into fourth gear (overdrive). The engine braking effect can be used in second and third gear.

(P) Park

In the PARK position, no powerflow is transferred through the transaxle. A shift lever connected to a set of cams presses the parking pawl into the park gear on the driven sprocket. This locks the final drive and prevents the vehicle from rolling. For safety reasons, always apply the parking brake whenever the vehicle is parked.

(R) Reverse

REVERSE allows the vehicle to be operated in a rearward direction, at a reduced gear ratio. Engine braking is provided in REVERSE.

(N) Neutral

As in PARK, there is no power transferred through the transaxle in NEUTRAL. However, the final drive is not locked by the parking pawl, so the wheels are free to rotate. The vehicle may be started in NEUTRAL.

(D) Drive

The DRIVE position provides all automatic shifts (first through fourth), the engagement and disengagement of the torque converter clutch and optimum fuel economy during normal operation. Engine braking is provided in the fourth gear. Fourth gear (overdrive) may be disabled by actuating the transmission control switch located on the transmission range selector. Engine braking is available in second and third gear if the transmission control switch is switched on (O/D deactivated, TCIL display on).

(2) "2"

In position "2", second gear remains engaged if the transmission is shifted manually or automatically up or down. If position "2" is selected while the vehicle is stationary, the vehicle will pull away in second gear to provide maximum traction on slippery surfaces. In position "2" engine braking is available in second gear.

(1) "1"

In position "1", first gear remains engaged if the transmission is downshifted manually or automatically. The transaxle is prevented from down shifting into first gear above a specific speed - approximately 48 km/h (30 mph) - to protect the powertrain from over-speeding. Engine braking is also available in position "1", which can be particularly useful on steep descents.

Transaxle Shift Patterns

Upshifts

The powertrain control module (PCM) controls transmission upshifts. The PCM receives signals from various sensors and inputs from the driver which it uses to control gearshifts, gearshift pressure and actuation of the lock-up clutch

Downshifts

Under certain conditions the transaxle will downshift automatically to a lower gear range (without moving the transaxle range selector lever). There are three categories of automatic downshifts: coastdown, torque demand, and forced or kickdown shifts.

Coastdown

The coastdown downshift occurs when the vehicle is coasting down to a halt.

Torque Demand

The torque demand downshift occurs automatically during part throttle acceleration when the demand for torque is greater than the engine can provide at that gear ratio. The engaged torque converter clutch will be disengaged to provide additional acceleration, if required.

Kickdown

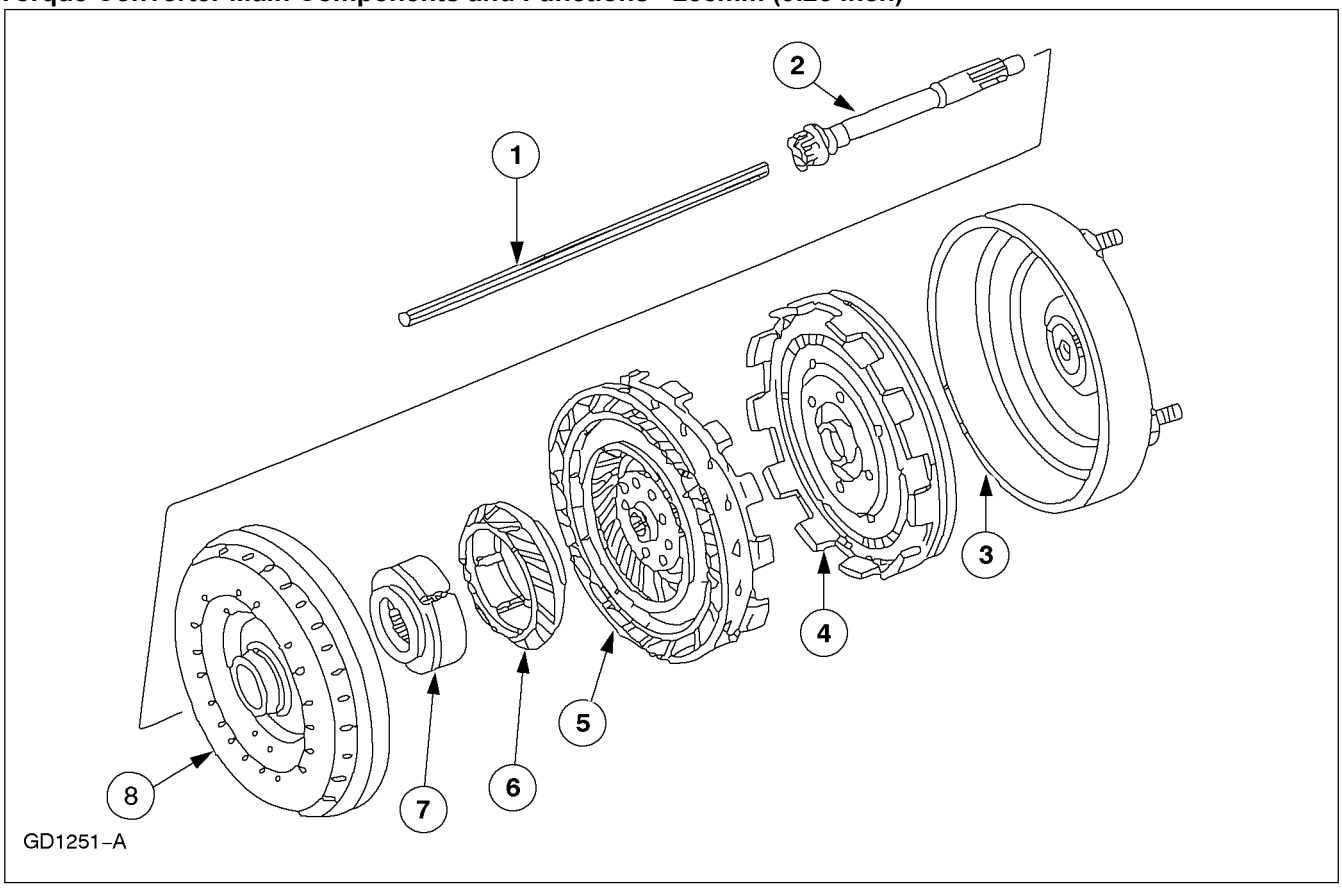
DESCRIPTION AND OPERATION (Continued)

Maximum acceleration is achieved when the driver forces a downshift by flooring the accelerator pedal. Forced kickdown into second gear is only possible below 88 km/h. At speeds less than 40 km/h kickdown causes the transmission to downshift into first gear. These specifications are subject to modification due to changes in tire size and engine settings.

Transmission Control Switch and Lamp Operation

Overdrive (O/D) may be cancelled by actuating the transmission control switch in the transaxle range selector lever. The system automatically engages the O/D mode if the ignition switch is turned to RUN. O/D mode is disabled if the transmission control switch is operated with the ignition switch turned to RUN. Pressing the transmission control switch again reverts to the O/D mode. The transmission control indicator lamp switches alternately on and off when the transmission control switch is cycled.

Torque Converter Main Components and Functions - 235mm (9.25 inch)

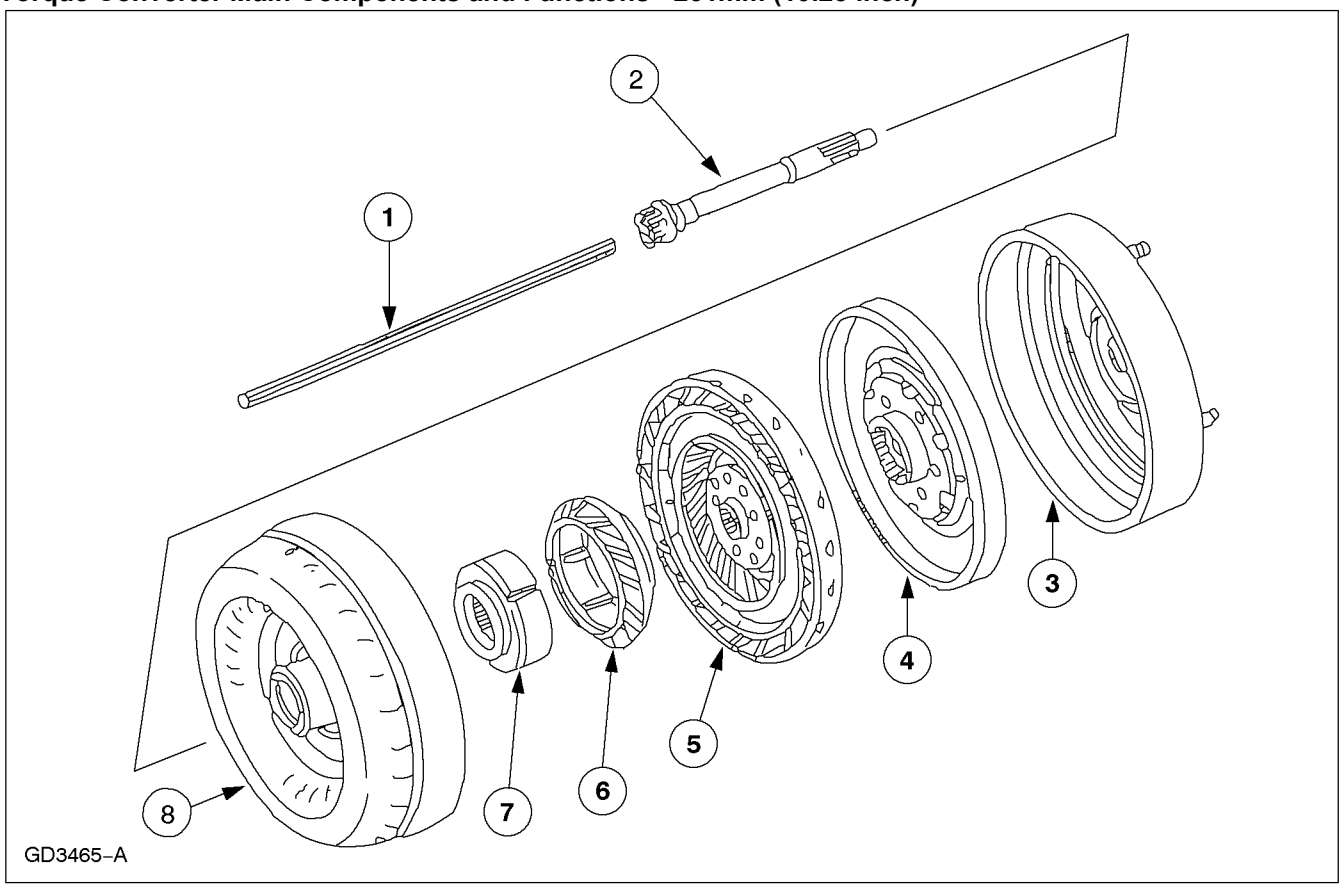


Item	Part Number	Description
1	-	Shaft pump drive
2	-	Shaft assembly, turbine
3	-	Cover
4	-	Plate, torque converter lock-up clutch

Item	Part Number	Description
5	-	Turbine
6	-	Stator
7	-	Thrust bearing
8	-	Impeller

DESCRIPTION AND OPERATION

Torque Converter Main Components and Functions - 261mm (10.25 inch)



Item	Part Number	Description
1	-	Shaft pump drive
2	-	Shaft assembly, turbine
3	-	Cover
4	-	Plate, torque converter lock-up clutch
5	-	Turbine
6	-	Stator
7	-	Thrust bearing
8	-	Impeller

The CD4E torque converter is a four-element assembly. The torque converter contains an impeller, a turbine, a stator and a torque converter lock-up clutch to reduce fuel consumption. It couples the engine to the turbine shaft assembly, provides torque multiplication and absorbs engine shock of gear shifting.

Impeller and Cover

The impeller and cover assembly drives the impeller blades and pump assembly. The impeller is primarily responsible for driving the turbine with hydraulic fluid by means of centrifugal force. The cover provides a mating surface for the torque converter clutch piston plate and damper.

Turbine

The impeller drives the turbine with hydraulic fluid by means of centrifugal force. The turbine transmits the input torque via the turbine shaft to the drive chain and the driven sprocket.

Stator

The stator directs the flow of fluid back from the turbine to the impeller so that the fluid rotates in the same direction as the impeller. This process also serves to multiply torque.

Torque Converter Clutch (TCC)

The torque converter clutch (TCC) provides a mechanical link or direct drive between the engine crankshaft and the turbine shaft when it is engaged. The application of the torque converter clutch is controlled by the powertrain control module (PCM). Under certain conditions the PCM

DESCRIPTION AND OPERATION (Continued)

sends the corresponding signal to the TCC solenoid valve. As a result, the pressure of the fluid in the torque converter forces the piston plate and damper against the cover and creates a mechanical link between the engine and the transmission.

Geartrain

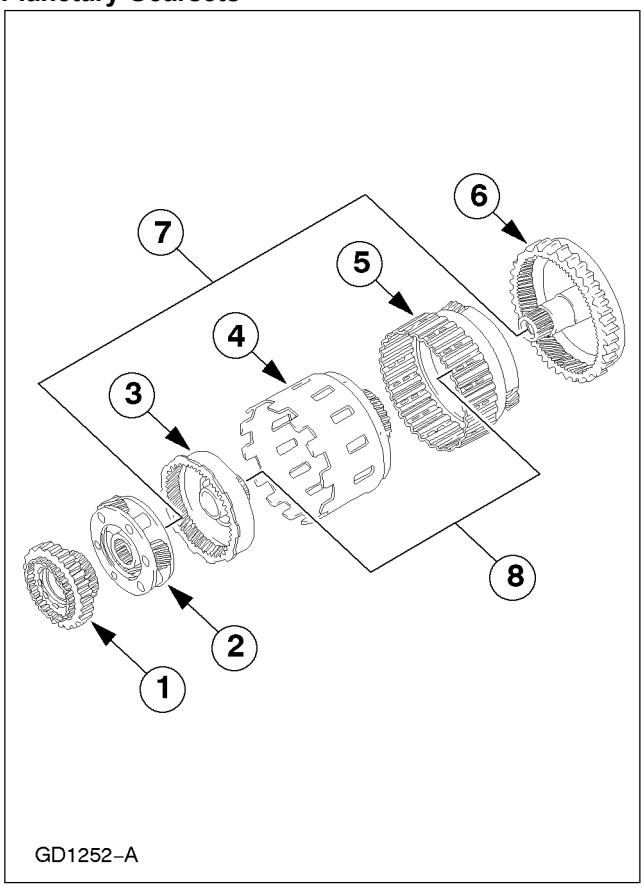
The geartrain includes the planetary gearsets, the actuating components and the final drive gearset and differential.

Planetary Gearsets

The CD4E transmission has two planetary gearsets for reverse drive and the four forward gears. The planetary gearsets consist of the following components:

- Low-intermediate sun gear assembly
- Low-intermediate planet carrier
- Low-intermediate ring gear assembly
- Reverse/overdrive sun gear and shell assembly
- Reverse/overdrive planet carrier assembly
- Reverse/overdrive ring gear assembly

Planetary Gearsets



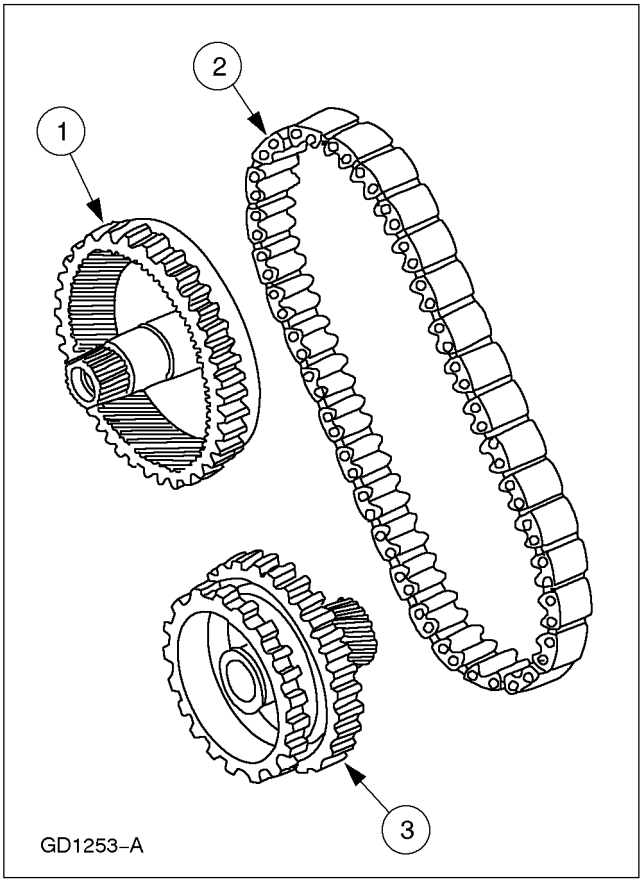
Item	Part Number	Description
1	-	Low-intermediate sun gear assembly
2	-	Low-intermediate planet carrier
3	-	Low-intermediate ring gear assembly
4	-	Reverse/overdrive sun gear and shell assembly
5	-	Reverse/overdrive planet carrier assembly
6	-	Reverse/overdrive ring gear assembly
7	-	Splined together
8	-	Splined together

Turbine Shaft

The turbine shaft connects the torque converter stator with the forward/coast/direct clutch cylinder. When engaged, the forward/coast/direct clutch cylinder transmits the input torque to the reverse/overdrive ring gear, which also acts as a drive sprocket. This allows input torque to be transmitted from the torque converter to the drive chain and driven sprocket.

DESCRIPTION AND OPERATION (Continued)

Drive chain



Item	Part Number	Description
1	-	Drive sprocket (with reverse/overdrive ring gear)
2	-	Drive chain
3	-	Driven sprocket assembly (with park gear and final drive sun gear)

Drive Chain and Sprockets

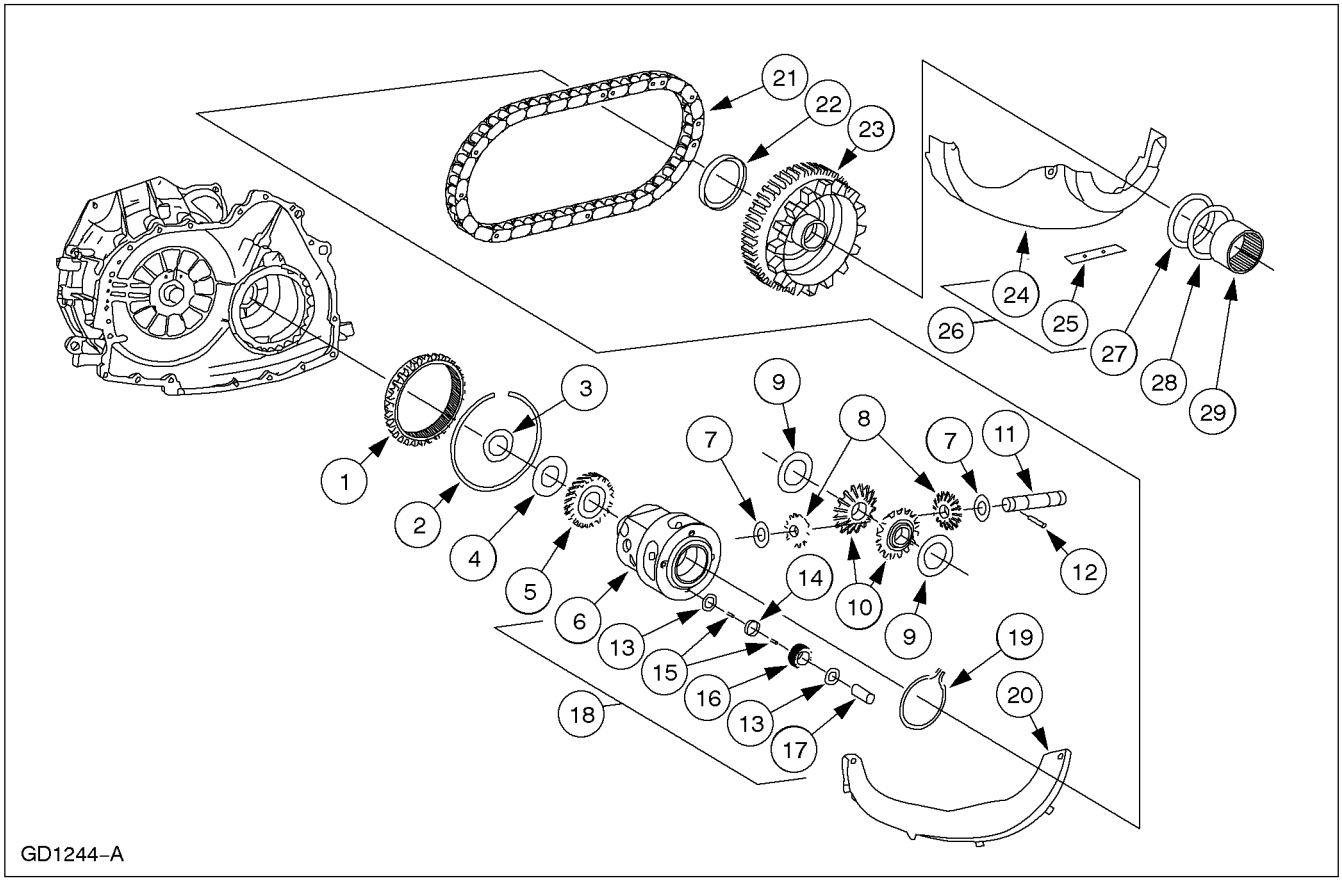
A drive chain transfers the torque from the turbine to the planetary gearsets. The drive chain consists of the following components:

- Reverse/overdrive ring gear assembly which also acts as a drive sprocket,
- Driven sprocket
- Drive chain

The drive chain connects the reverse/overdrive sun gear with the driven sprocket. The final drive sun gear located on top of the driven sprocket meshes with the final drive gearset.

DESCRIPTION AND OPERATION

Final Drive Gearset



Item	Part Number	Description
1	-	Differential ring gear
2	-	Snap-ring, differential ring gear
3	-	Differential bearing (no. 15)
4	-	Shim for differential bearing (no. 14)
5	-	Speedometer drive gear
6	-	Differential gear case
7	-	Pinion thrust washer
8	-	Pinion gear
9	-	Thrust washer for differential side gear
10	-	Differential side gear
11	-	Differential pinion shaft
12	-	Pinion shaft roll pin
13	-	Thrust washer of differential planet gear

Item	Part Number	Description
14	-	Shim for differential planet gear
15	-	Bearing for differential planet gear
16	-	Differential planet gear
17	-	Planet gear shaft
18	-	Differential
19	-	Snap-ring
20	-	Lower chain cover
21	-	Drive chain
22	-	Thrust bearing, driven sprocket (no. 13)
23	-	Driven sprocket
24	-	Upper chain cover
25	-	Magnet
26	-	Complete upper chain cover

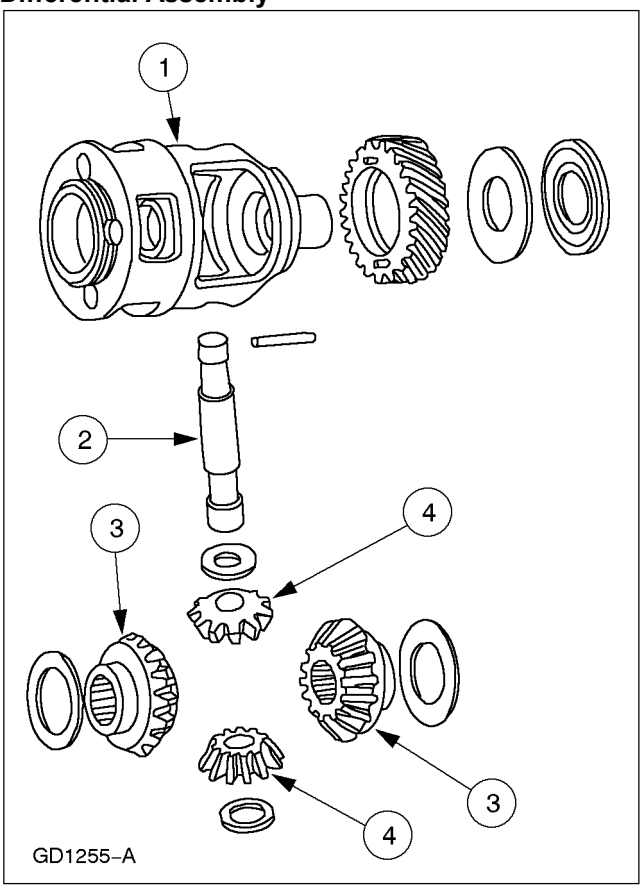
DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
27	-	Driven sprocket bearing, no.12
28	-	Shim (no .11) for driven sprocket
29	-	Driven sprocket bearing, no.18

The final drive consists of a planetary gearset that transfers and multiplies torque from the planetary gearsets to the differential. The final drive consists of the following components:

- Final drive sun gear: is chain driven by the reverse/overdrive ring gear assembly and transfers torque to the final drive carrier.
- Final drive carrier: the final drive carrier acts as the driven member and is part of the differential case.
- Final drive ring gear: is located in the converter housing and is always the held member of the final drive planetary gearset.

Differential Assembly



Item	Part Number	Description
1	-	Differential case (with final drive carrier)
2	-	Differential pinion shaft
3	-	Differential side gear
4	-	Differential pinion gear

The differential assembly drives the differential pinion gears and the differential side gears which in turn drive the front wheel driveshaft and joints. It provides differential action if the driving wheels are turning at different speeds. The differential assembly consists of the following components:

- Differential case (part of the final drive carrier)
- Two pinion gears supported by a pinion shaft
- Two side gears supported by the differential case and halfshafts

Apply Components:

Band - intermediate and overdrive

The intermediate and overdrive brake band assembly holds the reverse clutch drum assembly to the transaxle case in second and fourth gear. This action causes the reverse/overdrive sun gear and shell assembly to be held stationary in second and fourth gears.

Intermediate and Overdrive Servo

The intermediate and overdrive servo is the hydraulic actuator for the intermediate and overdrive band assembly. Line pressure is applied through the servo apply circuit where it works on one side of the servo piston. This forces the piston to move up the servo bore in the transaxle case, which moves the servo apply rod against one side of the intermediate and overdrive band assembly. Because the other side of the intermediate and overdrive band assembly is anchored to the transaxle case, the sides of the intermediate and overdrive band assembly are squeezed around the reverse clutch drum assembly, holding the reverse clutch drum assembly stationary.

Clutch - Forward

The forward clutch connects the turbine shaft to the outer race of the forward one-way clutch which in turn drives the low/intermediate sun gear in all forward gear ranges. However, in fourth gear, the forward clutch transmits no power because the forward one-way clutch is overrunning. The forward clutch is a multi-disc

DESCRIPTION AND OPERATION (Continued)

clutch and is contained in the forward/coast/direct clutch cylinder assembly.

Clutch - Direct

The direct clutch connects the turbine shaft to the low/intermediate ring gear assembly when the vehicle is in third and fourth gears. It is a multi-disc clutch and is contained in the forward/coast/direct clutch cylinder assembly.

Clutch - Reverse

The reverse clutch connects the turbine shaft to the reverse/overdrive sun gear and shell assembly when the vehicle is in reverse gear. It is a multi-disc clutch and is contained in the reverse clutch drum assembly.

Clutch - Coast

The coast clutch is a multi-disc clutch located beneath the forward clutch in the forward/coast/direct clutch cylinder assembly. It connects the low/intermediate sun gear assembly to the turbine shaft assembly when the transmission control switch is on and in the DRIVE position or when a gear has been selected manually.

Clutch - Low/Reverse

The low/reverse clutch holds the reverse/overdrive carrier assembly to the transaxle case when the transaxle is shifted into the R and 1 positions. The low/reverse clutch is a multi-disc clutch. It is splined to the transaxle case.

Clutch - Forward One-Way

The forward one-way clutch is a sprag-type, one-way clutch. The forward one-way clutch combines with the forward clutch to connect the turbine shaft assembly to the low/intermediate sun gear assembly in first, second and third gears. The forward one-way clutch always overruns in all coasting operations and in fourth gear.

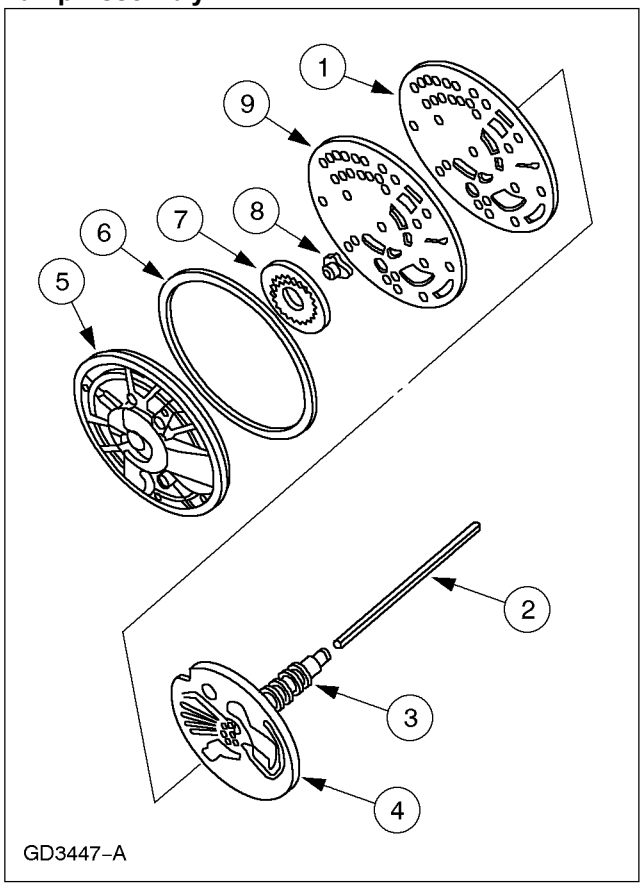
Clutch - Low One-Way

The low one-way clutch is a roller type one-way clutch which enables the transaxle case to hold the reverse/overdrive carrier stationary when the transaxle is in first gear. The low one-way clutch holds the reverse/overdrive carrier assembly during acceleration. When coasting, the low one-way clutch will overrun, disconnecting the final drive from the planetary gearset.

Hydraulic System

The hydraulic system uses transmission fluid to cool, to lubricate, and to provide hydraulic pressure to the hydraulic circuits within the transaxle.

Pump Assembly



Item	Part Number	Description
1	-	Gasket, pump body separator
2	-	Shaft, pump drive
3	-	Seal, pump support (6 req'd)
4	-	Support assy, pump
5	-	Body, pump assy
6	-	Seal, pump
7	-	Gears, pump
8	-	Insert, pump drive gear
9	-	Plate, pump body separator

Pump

The pump provides the volume of liquid required to charge the torque converter, main control valve body, cooling system, lubrication system

DESCRIPTION AND OPERATION (Continued)

and hydraulic actuating components. The transaxle uses a positive displacement gear and crescent-type pump which is shaft-driven by the torque converter.

Fluid Level and Filter

Fluid from the oil pan area (formed by the transaxle case and converter housing) flows through a filter to the oil pump. The filter has a recirculation port connected to the main control area of the case. It receives fluid from the main regulator exhaust. This provides fluid under pressure to aid the pump in higher efficiency operation. A fluid control valve prevents foaming of fluid by maintaining an oil pan level below the rotating components. The two piece chain drive cover prevents foaming by not allowing the chain to rotate in the fluid. A magnet on the underside of the chain cover collects unwanted magnetic material.

Main Control

The main control body contains the hydraulic solenoid valves. These valves direct fluid flow, restrict fluid flow and change fluid pressure. The main control receives signals from the solenoid valve body and changes those signals into hydraulic actions. These actions control the operation of the hydraulic clutches and the intermediate and overdrive band assembly. They also supply lubrication to the transaxle.

Servo - Low/Reverse

The low/reverse servo cushions the application of the low/reverse clutch when the transaxle is shifted to reverse gear.

Servo - 2-4

The 2-4 servo cushions the shift feel during intermediate and overdrive band applications.

Servo - Forward

The forward servo cushions the application of the forward clutch when the transaxle is shifted into D2 or 1.

Transaxle Electronic Control System

Electronic System Description

The gearshift timing, gearshift pressure (line pressure) and the solenoid valves of the torque converter lock-up clutch (TCC solenoid valve) in the CD4E transmission are controlled electronically by the powertrain control module (PCM) with its network of inputs and outputs. The transaxle control is separate from the engine control strategy in the PCM, although some of the input signals are shared. Some inputs come from sensors (mass air flow meter, coolant temperature sensor etc.) and inform the PCM about the load status and the operating conditions of the engine. Other inputs are based on driver inputs, such as accelerator pedal position which is relayed to the PCM by the throttle position (TP) sensor. Other inputs again come from the transmission itself, from sensors like the vehicle speed sensor (VSS), the transmission range sensor (TR) (controlled by the position of the gear lever) and the transmission fluid temperature sensor (TFT)

Using all these input signals, the PCM can determine when the time and conditions are right for a shift or converter clutch application. The PCM can also determine the line pressure needed to optimize shift feel. In order to carry out these functions, the PCM controls five electronic solenoid valves - two ON/OFF solenoid valves for switching, one pulse-width modulated (PWM) solenoid valve for controlling the lock-up clutch, one electronic pressure control (EPC) solenoid valve for regulating the line pressure and a 3-2 shift timing/coast clutch solenoid valve for controlling the disengagement of the coast clutch and the co-ordinated disengagement of the direct clutch and the actuation of the low-intermediate brake band during a 3-2 shift.

Powertrain Control Module (PCM) - Inputs

- Transmission fluid temperature (TFT) sensor
- Transmission range (TR) sensor
- Brake on/off (BOO) switch
- Electronic ignition (EI) system
  - Crankshaft position (CKP) sensor
  - Ignition control module
- Mass air flow (MAF) sensor
- Throttle position (TP) sensor
- Vehicle speed sensor (VSS)
- Transmission control switch (TCS)
- Air conditioning (A/C) Clutch
- Engine coolant temperature (ECT) sensor
- Turbine shaft speed (TSS) sensor

Powertrain Control Module (PCM) - Outputs

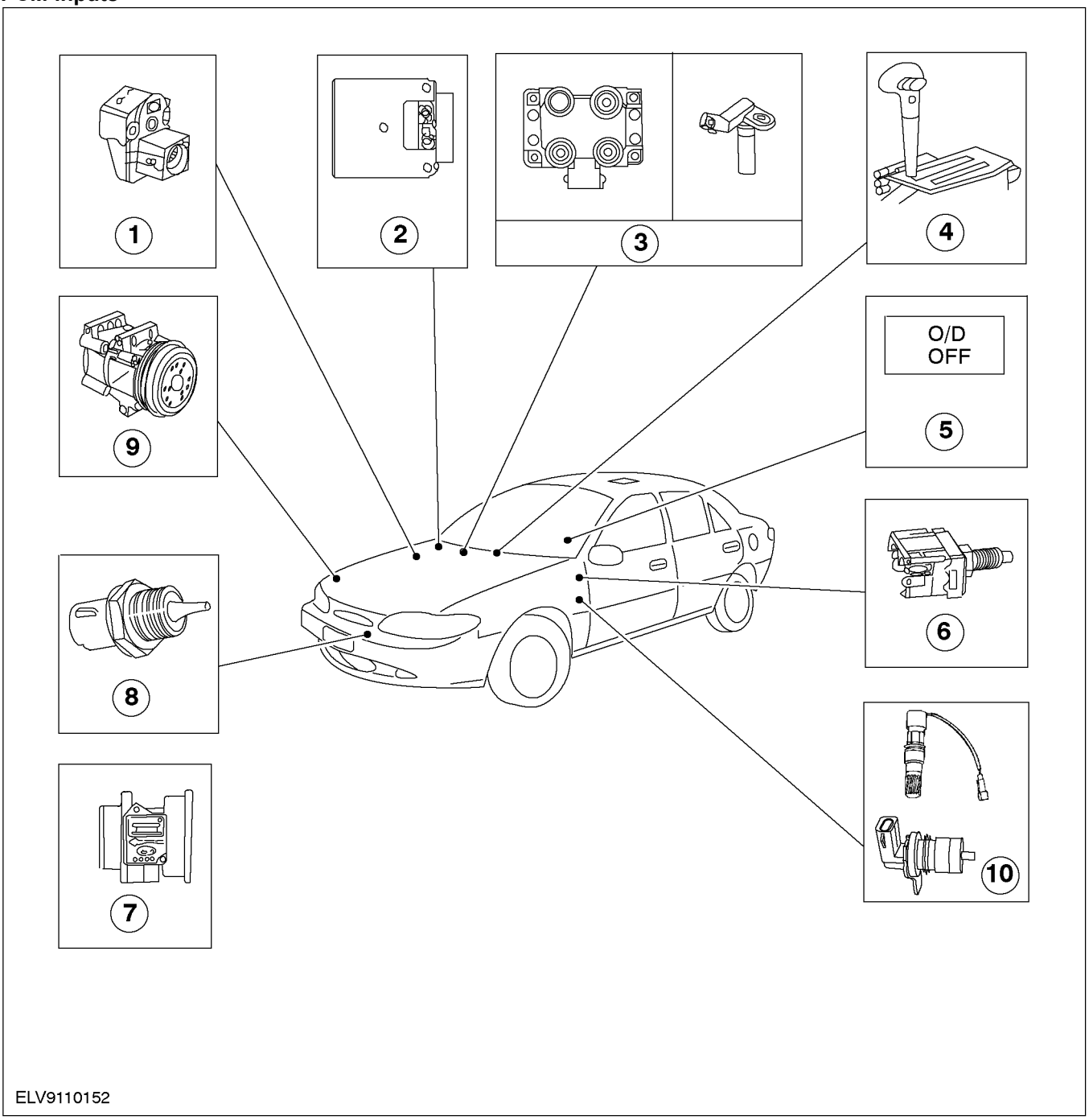
- Transaxle solenoid body assembly

DESCRIPTION AND OPERATION (Continued)

- Shift solenoid 1 (SS1)
- Shift solenoid 2 (SS2)
- Solenoid valve, electronic pressure control (EPC solenoid)
- Solenoid valve, torque converter lock-up clutch (TCC solenoid)
- 3-2 Timing/coast clutch solenoid (3-2T/CCS)

– Transmission control indicator lamp (TCIL).

PCM inputs



Item	Part Number	Description
1		Throttle position sensor

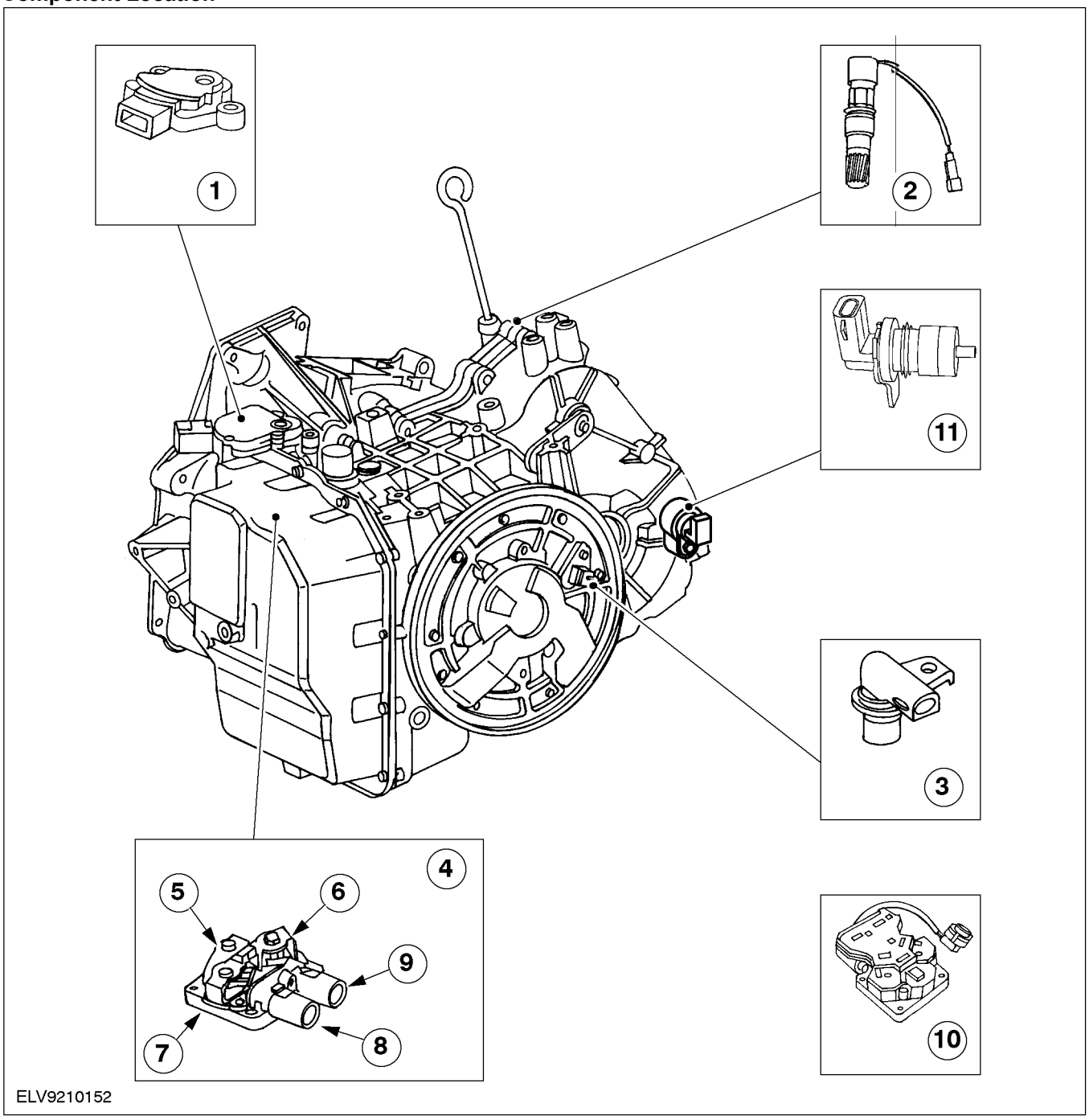
Item	Part Number	Description
2		Powertrain control module (PCM)

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
3		Electronic ignition (EI)
4		Transmission control switch (TCS)
5		Transmission control indicator lamp (TCIL)
6		Stop lamp switch

Item	Part Number	Description
7		Mass air flow (MAF) sensor
8		Engine coolant temperature (ECT) sensor
9		Air conditioning clutch
10		Output speed sensor (OSS), vehicle speed sensor (VSS)

Component Location



DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1	-	Transmission range (TR) sensor
2	-	Vehicle speed sensor (VSS)
3	-	Turbine shaft speed (TSS) sensor
4	-	Shift solenoid assembly
5	-	Shift solenoid 1 (SS1)
6	-	Shift solenoid 2 (SS2)
7	-	Solenoid valve, torque converter lock-up clutch (TCC solenoid)
8	-	3-2 Timing/coast clutch solenoid (3-2T/CCS)
9	-	Solenoid valve, electronic pressure control (EPC solenoid)
10	-	Transmission fluid temperature (TFT) sensor
11		Output speed sensor (OSS)

Powertrain Control Module (PCM)

The operation of the transmission is controlled by the PCM. Input sensors send information to the PCM. The PCM then controls the solenoid valves that influence the operation of the transmission.

DTCs:P0300 through P0308, P0320, P0340, and P1351 through P1364

Air conditioning (A/C) clutch

The A/C switch is located on the suction accumulator/drier of a factory-installed air conditioning system. When the air conditioning clutch cycling switch contacts close, the PCM receives a signal voltage from the A/C switch indicating that the A/C compressor clutch is engaged. The PCM uses the A/C clutch cycling switch signal to adjust line pressure to compensate for the additional engine load.

Symptoms: With a faulty (closed) air conditioning compressor clutch switch, the line pressure with the air conditioning switched off is slightly low. If there is a malfunction in the opening of the air conditioning compressor clutch switch, the line pressure with the air conditioning switched on is slightly high.

DTC: P1460

Brake, on/off (BOO) switch

The BOO switch signals the PCM when the brakes are applied. The BOO switch is closed when the brakes are depressed and open when they are released. The BOO switch will also disengage the torque converter clutch (TCC) when the brake is applied.

Symptoms: Failed ON - TCC will not engage at less then 1/3 throttle.

Failed OFF or not connected - TCC will not disengage when brake is applied.

DTC: P0703, P1703

Engine Coolant Temperature (ECT) Sensor

The ECT sensor detects the engine coolant temperature and sends this information to the PCM. The PCM uses the ECT sensor to control the operation of the torque converter lock-up clutch (TCC).

Symptoms: TCC will always be OFF if ECT sensor reads colder than normal, resulting in reduced fuel economy.

DTCs: P0116, P0117 and P0118

Electronic Ignition (EI) System

The electronic ignition system consists of the PCM, a crankshaft position (CKP) sensor and one multi-tower ignition coil. The CKP sensor sends a crankshaft position signal to the PCM. The PCM then sends the appropriate ignition signal to the ignition coil. The PCM uses this signal in the transaxle shift strategy, as well as torque converter clutch (TCC) control and electronic pressure control. Wide open throttle (WOT) shift control is also affected by the EI system input.

Symptoms: Harsh engagements and shifts, late WOT shifts, and no TCC engagement.

DTCs: P0300 through P0308, P0320, P0340, P1351,P1357 through P1364

Mass Air Flow (MAF) Sensor

The MAF directly measures the air mass flowing into the engine. The output from the MAF sensor is an analog DC signal between approx. 0,5 and 5,0 V, and it is used by the PCM to calculate the injection pulse duration for the air/fuel mixture. For transmission operations the MAF is used for the electronic pressure control (EPC), the control of the gearshift timing and the control of the torque converter lock-up clutch.

DESCRIPTION AND OPERATION (Continued)

Symptoms: Incorrect gearshift timing, EPC pressure high or low, incorrect engagement of the TCC, as well as symptoms that are similar to a fault on the throttle position (TP) sensor. Malfunction indicator lamp (MIL) on.

DTCs: P0102, P0103, P1100, P1101

Transmission Control Switch (TCS)

The transmission control switch is a push-button switch. When the transmission control switch is pressed, a signal is sent to the PCM. The PCM then energizes the transmission control indicator lamp (TCIL) and engages or disengages fourth gear operation and provides coast braking in second and third.

Symptoms: No overdrive cancel when switch is cycled.

DTC: P1780

Transmission Control Indicator Lamp (TCIL)

The TCIL is located in the instrument panel and is labeled O/D OFF. The transmission controls switch (TCS) controls the ON/OFF operation of the TCIL. When the driver initially presses the TCS button, the TCIL comes ON to indicate that transaxle operation in fourth gear is disabled. When the driver presses the TCS again, the TCIL goes off.

Symptoms: If the TCIL fails ON or OFF, the driver may have an incorrect indication of transaxle operation.

DTCs: None

Throttle Position (TP) Sensor

The TP sensor is a potentiometer mounted on the throttle body. The TP sensor detects the position of the throttle plate and sends this information to the PCM as a varying voltage signal.

If there is a fault in the circuit of the TP sensor then the PCM detects that the TP sensor signal is outside the measuring range. The PCM then operates the transmission with a higher EPC pressure to prevent damage to the transmission. The PCM also uses this signal to determine the gearshift timing and for control of the EPC and the TCC.

Symptoms: Harsh engagement, fixed gearshift pressure, abnormal gearshift timing, TCC will not engage, TCC switchover. Malfunction indicator lamp (MIL) on.

DTCs: P0122, P0123, P1120, P1121, P1124, P1125

Vehicle Speed Sensor (VSS)

The VSS is a magnetic pickup that sends a signal to the PCM. This VSS signal informs the PCM about the vehicle speed. It is used to determine the gearshift timing and the electronic pressure control (EPC).

Symptoms: Fixed shift feel, abnormal gearshift timing and possibly unexpected downshifts with the throttle valve closed. No fourth gear. No engine braking in second or third gear. No engagement of the torque converter lock-up clutch (TCC). May flash the transmission control indicator lamp (TCIL).

DTC: P0500,P0503, P1500, P1501, P1503

Transmission Fluid Temperature (TFT) Sensor

The TFT sensor is a thermistor (temperature dependent resistor) which is located on the solenoid valve body. The resistance value of the TFT sensor will vary with temperature. The PCM monitors the voltage across the TFT sensor to determine the temperature of the transmission fluid. The PCM uses this signal to determine the gearshift timing and to regulate the line pressure for operation under hot and cold temperatures. In addition, the PCM disables the operation of the torque converter lock-up clutch (TCC) at low transmission temperatures and adjusts the pressure of the electronic pressure control (EPC) to the temperature.

Symptoms: Improper TCC operation and EPC pressure.

DTCs: P0712, P0713, P1711, P1783

Transmission range (TR) sensor

The PCM sends a voltage signal to the TR sensor. The TR sensor contains a series of resistors that act as a voltage divider. The PCM monitors this voltage which corresponds to the position of the transmission range selector lever (P, R, N, D, 2, 1) to determine desired gear and electronic pressure control (EPC) pressure. The TR sensor is located on the transmission and also incorporates the circuits for neutral/start and the reversing lamps.

Symptoms: Harsh engagement and fixed gearshift pressure. Engine will possibly not crank. Possible downshift. Operation in second or third gear. Transmission does not display the correct gear. No operation in fourth gear, no manual first gear.

DTCs: P0707, P0708, P1705

Turbine Shaft Speed (TSS) Sensor

DESCRIPTION AND OPERATION (Continued)

The TSS sensor is an inductive sensor which sends a signal to the PCM indicating the input speed of the turbine shaft. This signal is used to control the torque converter lock-up clutch (TCC). It is also used to determine the setting of the static pressure of the electronic pressure control (EPC) during gearshifts.

Symptoms: No power flow through the torque converter or harsh shifts. No fourth gear operation and engine braking in second and third gear. May flash the TCIL.

DTC: P0715

Output speed sensor (OSS)

The OSS sensor is an inductive sensor that detects the speed of the park gear or the drive sprocket. The signal describes the speed of the output shaft of the automatic transmission and is evaluated by the PCM. The PCM uses the output shaft speed together with other signals to determine the gearshift timing.

Solenoid Valve Body Assembly

The solenoid valve body assembly contains the transmission fluid temperature sensor (TFT) sensor, as well as five PCM controlled output devices:

- Electronic pressure control (EPC) solenoid
- Shift solenoid 1 (SS1)
- Shift solenoid 2 (SS2)
- 3-2 timing/coast clutch solenoid (3-2 T/CCS)
- Torque converter lock-up clutch (TCC) solenoid valve

The PCM controls the operation of the transaxle through wiring to the solenoid valve body assembly mounted on the main control assembly. The PCM cable is connected to the solenoid valve body on the top of the transmission housing. In the event of faulty components the solenoid valve body should always be renewed as an entire unit.

Electronic pressure control (EPC) solenoid

The EPC solenoid is a variable force style (VFS) solenoid. The VFS solenoid is an electro-hydraulic actuator combining a solenoid and a regulating valve. The solenoid provides electronic pressure control (EPC) which regulates line pressure (LP) and the line modulator pressure (LM). This is controlled by producing a resisting pressure to the main regulator and line modulator circuits. The LP and LM pressures control the clutch application pressures.

Symptoms: Failed ON - minimum EPC pressure (minimum transmission torque capacity). May flash the TCIL.

Failed OFF - maximum EPC pressure, harsh engagements and harsh shifts.

Fault codes: P1746, P1747 - Check output circuit; is only caused by electrical fault.

Torque converter lock-up clutch (TCC) solenoid valve

The TCC solenoid valve is controlled by pulse-width modulation (PWM). It controls the engagement and disengagement of the bypass clutch in the torque converter. The pressure in the S4 circuit varies due to the pulse width modulation of the TCC solenoid valve, thus modulating engagement and disengagement of the bypass clutch in the torque converter.

Symptoms: Failed ON - Engine stalls in manual second. Engine lugging, poor performance at low engine speeds, harsh shifts.

Failed OFF - Poor fuel economy, overheating, TCC will not engage.

DTCs: P0741, P1742, P1743, P1744 May also be generated by other non-electronic related transmission hardware conditions.

Fault codes: P0743, P1767 - Check output circuit; is only caused by electrical fault.

3-2 Timing/Coast Clutch Solenoid (3-2 T/CCS)

The 3-2 T/CCS is a variable force style (VFS) solenoid. The VFS type solenoid is an electro-hydraulic actuator combining a solenoid and a regulating valve. It supplies pressure to the S3 circuit to control the release of the direct clutch and to apply the intermediate and overdrive band during a 3-2 downshift. The solenoid also regulates the pressure in the S3 circuit to control the application and release of the coast clutch.

Symptoms: Failed ON - no engine braking (except in fourth gear), delayed 3-2 downshifts.

Failed OFF - engine braking in second/third gears, firm or flared 3-2 downshifts, harsh 4-3 downshifts.

Fault codes: P1788, P1789 - Check output circuit; is only caused by electrical fault.

Shift Solenoid Assembly (SS1, SS2,SS3)

Shift solenoids 1 and 2 provide gear selection of first through fourth gears by providing ON/OFF pressure control to the shift valves.

DESCRIPTION AND OPERATION (Continued)

SS1 Symptoms: Improper gear selection depending on failure mode and transaxle range selector lever position; refer to Shift Solenoid Application Chart No. 701.

Fault codes: P0731, P0734, P0750, P0751, P1751 - Check output circuit; is caused by electrical fault. May also be generated by other non-electrical related transmission hardware conditions.

SS2 symptoms: Incorrect choice of gear depending on fault mode and position of the gear lever; refer to table "Shift Solenoid Operation Chart".

Fault codes: P0733, P0755, P0756, P1756 - Check output circuit; is caused by electrical fault. May also be generated by other non-electrical related transmission hardware conditions.

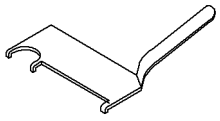
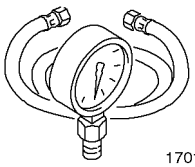
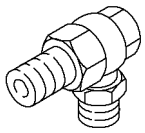
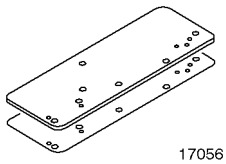
OTHER CONCERNS: SHIFT SOLENOID OPERATION CHART

Solenoid Operation

The following solenoid operation chart shows normal solenoid operation for given operating modes.

DIAGNOSIS AND TESTING

Diagnostic Strategy

Special Tool(s)	
 17050A	Alignment Gauge, Transmission Range Switch 307-271 (17050A)
 17014	Hydraulic Pressure Gauge 307-132 (17014)
 1701402	Connector, Pressure Test 307-132-02 (1701402)
 17056	Plate, Compressed Air Transmission Test 307-301 (17056)

NOTE: Do not take short cuts or assume that critical adjustments have already been made.

NOTE: Follow the procedure as written to avoid missing critical components or steps.

To properly diagnose a concern have the following publications available:

- OASIS massages
- Technical Service Bulletins (TSBs)
- Wiring Diagram

Preliminary Inspections and Diagnosis:

Proceed according to the following diagnosis flow chart.

- Know and understand the customer's concern.
- Verify the concern by operating the vehicle.
- Check fluid level and condition.
- Check the adjustment of the TR sensor.
- Check whether any additional accessories have been installed after the vehicle was sold (and whether they have been installed correctly), for instance air conditioning, car telephone, cruise control system, trip computer, additional stop lamp.
- Check shift linkages for proper adjustment.
- Check TSBs and OASIS messages for the concern.
- Interrogate the trouble codes both in a test with the engine running (KOER) and in an engine-OFF test (KOEO). Note the displayed trouble codes.

Test	Result	Remedial action
1) Were any current trouble codes recorded?	Yes	Rectify the cause(s) for the trouble code(s) (follow the menu in WDS or FDS2000).
	No	Proceed to the Symptom Chart. Then continue with step 5.
2) Were any stored trouble codes displayed?	Yes	Delete the trouble codes and road test the vehicle.
	No	Continue with step 4.
3) Are any stored trouble codes displayed?	Yes	Rectify the cause(s) for the trouble code(s) (follow the menu in WDS or FDS2000), then continue with step 4.
	No	Continue with step 4.
4) Is the fault rectified?	Yes	Repeat the test with the engine running and the engine-OFF test and verify that no trouble codes are displayed. Delete any stored trouble codes. Deliver the vehicle.
	No	Proceed with the symptom chart.
5) Is the fault is temporarily rectified while FDS2000 or WDS is connected up?	Yes	Switch the diagnostic unit to the ""Data Logger" function and locate any intermittent faults.
	No	Continue with step 6.

DIAGNOSIS AND TESTING (Continued)

Test	Result	Remedial action
6) Is the fault rectified?	Yes	Repeat the test with the engine running and the engine-OFF test and verify that no trouble codes are displayed. Delete any stored trouble codes. Deliver the vehicle.
	No	Inform the Hotline.

DIAGNOSIS AND TESTING

Preliminary Inspection

Preliminary Inspection

WARNING: Apply the handbrake and move the selector lever to "P" when

- the vehicle is parked;
- any checks or adjustments are carried out in the engine compartment;
- the vehicle is left with the engine running.

Know and Understand the Concern

The customer concern must be clearly understood before diagnosing the cause of the fault. Therefore it is important to check the details with the customer. The conditions under which the concern arises must be understood. For example:

- Engine cold or at operating temperature
- hot or cold ambient temperature
- vehicle operating conditions

verify customer concern by driving the vehicle

NOTE: If noise/vibration is a concern, check for dependency on: rpm, vehicle speed, shift, gear range or temperature.

NOTE: Some CD4E automatic transmissions may give rise to concern over the way the engine runs. For example, it can cause the engine to stall if the torque converter lock-up clutch does not disengage.

- Engine cold or at operating temperature
- Hot or cold ambient temperature
- Type of road
- Vehicle loaded/unloaded
- City/highway driving
- Upshift
- Downshift
- Coasting
- Shift quality
- Noise/vibration

Fluid Level Check

NOTE: If the vehicle has been operating for an extended period at high speeds or in city traffic during hot weather or pulling a trailer, the engine should be turned off for about 30 minutes to allow the fluid to cool before checking.

The fluid levels should preferably be checked at operating temperature (60-70°C) after a drive of approx. 30 km. If necessary, it is also possible to check the fluid levels without driving 30 km, provided the ambient temperature is above 10°C.

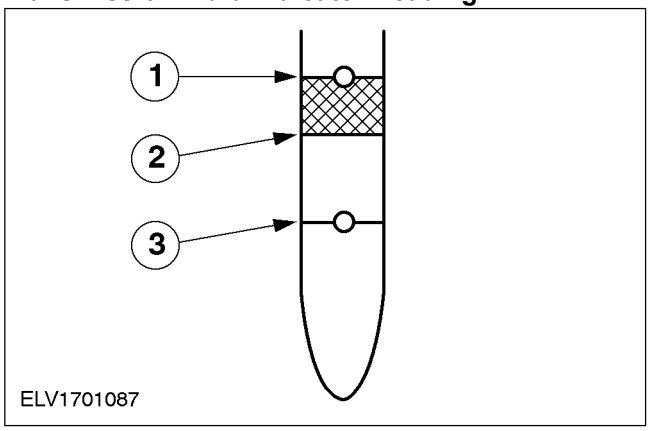
With the vehicle on a level surface, start the engine and move the transmission range selector lever through all of the gear ranges, allowing sufficient time for each position to engage. Engage the transmission range selector lever in the PARK position, fully set the parking brake and leave the engine running at idle.

Wipe off the fluid level indicator cap, pull the fluid level indicator out and wipe clean. Put the fluid level indicator back into the guide tube and make sure it is seated properly. Pull out the fluid level indicator and read the fluid level.

When checking the fluid levels at operating temperature (60-70°C), the fluid level should be in the shaded range on the dipstick. When the vehicle has been driven, and the outside temperature is above 10 °C, the fluid level should be between the hole and the lower edge of the shaded area on the fluid level indicator.

DIAGNOSIS AND TESTING (Continued)

Transmission Fluid Indicator Reading



Item	Part Number	Description
1	-	Max. mark
2	-	Min. mark
3	-	Lower hole mark, DO NOT DRIVE

High or Low Fluid Level

If the fill level is too high, transmission components may cause the fluid to foam. Foamed oil causes variable operating pressure, with the following consequences:

- harsh/delayed shifts or engagements
- damage to the clutch material
- incorrect torque converter operation
- fluid emission from the vent

If fluid level is too high, excess fluid must be removed. Refer to Fluid Change - Drain/Refill in this section for proper procedures.

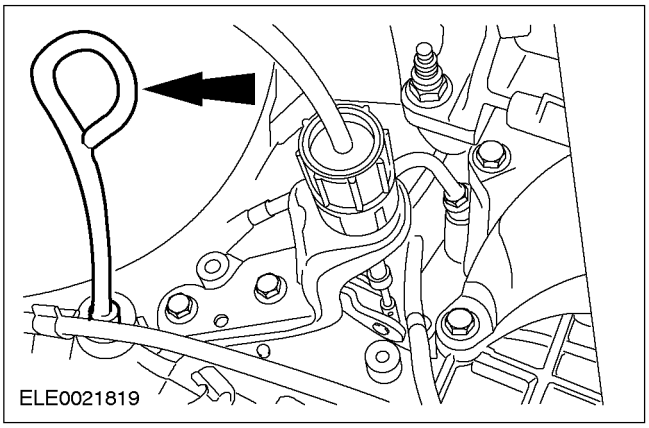
A fluid level that is too low will affect transmission operation, as follows:

- slipping
- delayed engagement
- damage to transmission components

Low levels may also indicate that a leak is present in the fluid system.

If the fluid level is too low, fluid must be added. Refer to Add Fluid in this section.

Add Fluid



CAUTION: Use of any fluid other than that specified could result in transmission malfunction or failure.

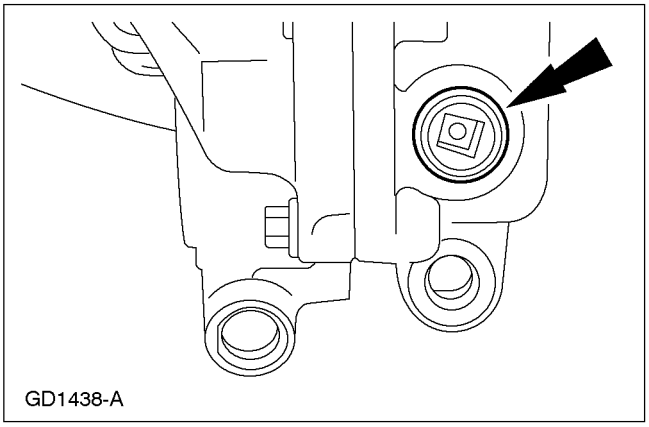
Before adding any fluid, be sure that the correct type (ESP-M2C166-H) will be used.

Add transmission fluid through the filler tube in amounts of 0,25 l, each time checking the fill level on the fluid dipstick. Drain automatic transmission fluid if too much is filled.

Fluid Change - Drain/Refill

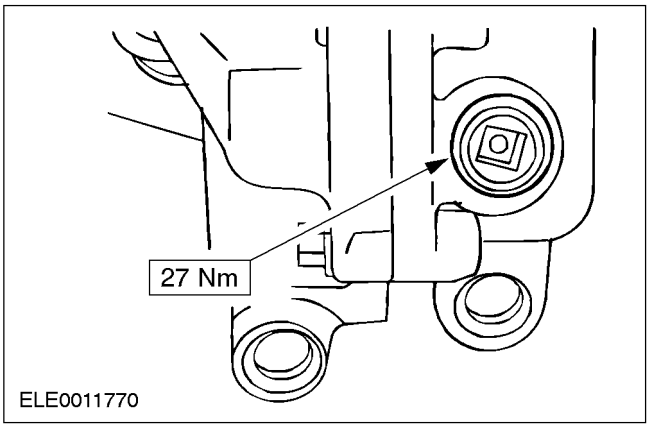
1. Raise the vehicle.
2. Place a suitable container under the transmission drain plug.

NOTE: If internal damage to the transmission is suspected, drain the fluid through a paper filter. A small amount of abraded clutch particles is a sign of normal wear. If however a larger amount of particles of abraded clutch or metallic pieces are found, then a transmission repair is necessary.



DIAGNOSIS AND TESTING (Continued)

3. Remove the transmission drain plug and drain the transmission fluid.
4. Install the transmission drain plug.
5. Lower the vehicle.
6. Fill the automatic transmission with automatic transmission fluid according to Ford specification ESP-M2C166-H. For further information, refer to the following operation in this section: Specifications
7. Apply the handbrake. Start the engine and run it at idle speed for five minutes while shifting through all shift lever positions. Switch off the engine.
8. Raise the vehicle.
9. Place a suitable container under the transmission drain plug.
10. Remove the transmission drain plug and drain the transmission fluid.
11. After the fluid has been drained, clean the drain plug thread and apply a thin coat of Teflon Sealant meeting Ford specification WSK-M2G350-A2.



12. Install the transmission drain plug.
13. Remove the drain pan, tools and materials and lower the vehicle.
14. Fill the automatic transmission with automatic transmission fluid according to Ford specification ESP-M2C166-H.
15. Start the engine and move the shift lever through all positions. Check the fluid level and top up if necessary.

Fluid Condition Check

NOTE: Evidence of fluid contamination or incorrect fluid can cause poor shift quality. If the transmission fluid condition is suspect, drain the transmission and refill with automatic transmission fluid to Ford specification ESP-M2C166-H .

- Make the normal fluid level check as described in Fluid Level Check in this section.
- Observe the color and odor of the fluid. It should be red, not brown or black. If there is an odor, this may indicate overheating or damage to a clutch disc or band.
- Wipe the dipstick with a clean lint-free cloth. Check the resulting mark for signs of solid particles or anti-freeze (sticky residues on the dip-stick).

If particles are present in the fluid or there is evidence of contamination, the transmission drain plug should be removed and a sample of filtered through a paper filter examined. If transmission failure is confirmed by further evidence of coolant or excessive particles in the fluid, the transmission must be completely cleaned and repaired. This includes cleaning and flushing the torque converter and transmission cooling system. During disassembly and assembly, all overhaul checks and adjustments of clearances and end play must be made.

After repairing the transmission, all diagnostic tests and adjustments listed in the diagnosis section must be completed to make sure that the problem has been eliminated.

Transmission range (TR) sensor

Check the adjustment of the TR sensor.

DIAGNOSIS AND TESTING (Continued)

Road Test

The road test verifies that the shift control system is operating correctly.

1. Run the engine and automatic transmission up to normal operating temperature.
2. Move selector lever to "D".
3. Gently depress the accelerator pedal and check the vehicle speed at which the automatic transmission upshifts and the converter lock-up clutch engages.
4. If the transmission is in 4th gear (overdrive), actuate the O/D shut-off. The transmission should downshift to 3rd gear. Remove foot from accelerator. Engine braking should occur while coasting.
5. Depress the accelerator pedal to the floor. The transmission should downshift into 1st gear or 2nd gear, depending on vehicle speed.
6. With the selector lever in position "D", driving at a speed greater than 80 km/h and with the accelerator pedal pressed about 1/3 of the way down, move the selector lever to position "2" and lift the foot from the accelerator pedal. The transmission must immediately change down into 2nd gear.
7. With the vehicle in 2nd gear, move the selector lever to range "1". Release the accelerator pedal. The transmission should downshift to 1st gear at speeds below 48 to 56 km/h.

Shift Points in relationship to Vehicle Speed

Gearshift	Max. Speed km/h	Min. Speed km/h
Min 1-2	24	15
Min 2-3	34	24
Min 3-4	56	47
CT 4-3	53	44
CT 3-2	23	13
CT 3-1	23	13
CT 2-1	23	13
PT 1-2	34	24
PT 2-3	60	50
PT 3-4	85	72
WOT 1-2	61	50
WOT 2-3	110	100
WOT 3-4	169	159

Min = accelerator pedal depressed slightly, CT = Closed Throttle, PT = Part Throttle (half way down) WOT = Wide Open Throttle

Check shift linkages for proper adjustment.

REFER to Section 307-05A / 307-05B.

DIAGNOSIS AND TESTING

Diagnostics

On-Board Diagnosis with the Diagnostic Tool

NOTE: All engine checks must be completed and any faults rectified before any transmission checks may be carried out.

When using the roller test stand, make sure that the vehicle is secured.

Preparation

⚠ **WARNING: Do not carry out the test on a lift as the vehicle may move out of position as result of sudden gearshifts.**

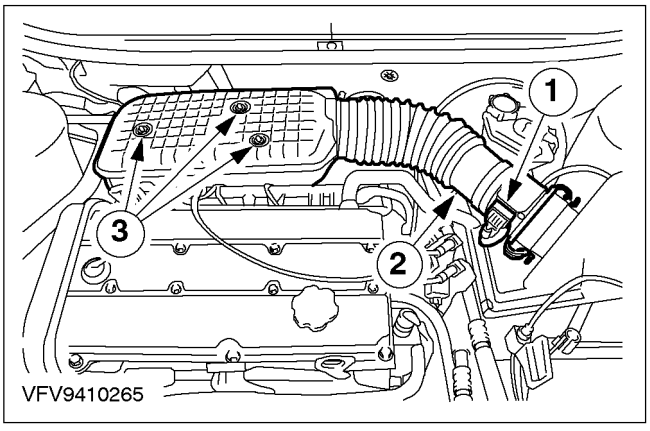
Down-load the required software according to the manufacturer's instruction.

To carry out the diagnosis, follow the user guide instructions on the PDU display.

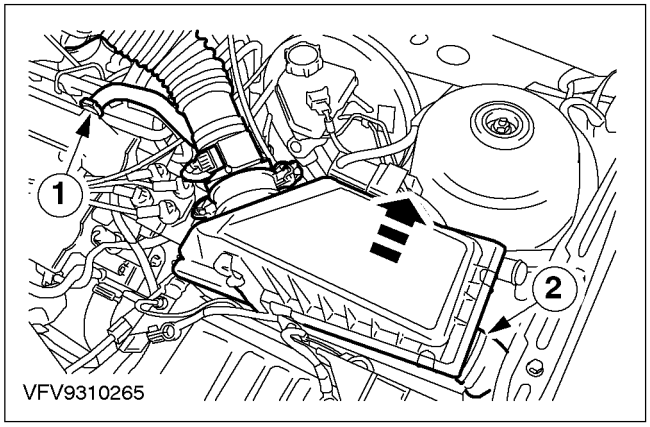
Connecting the Diagnostic Tool

⚠ **CAUTION: All wiring, including that of the pressure test gauge, should be laid at a safe distance from any source of heat.**

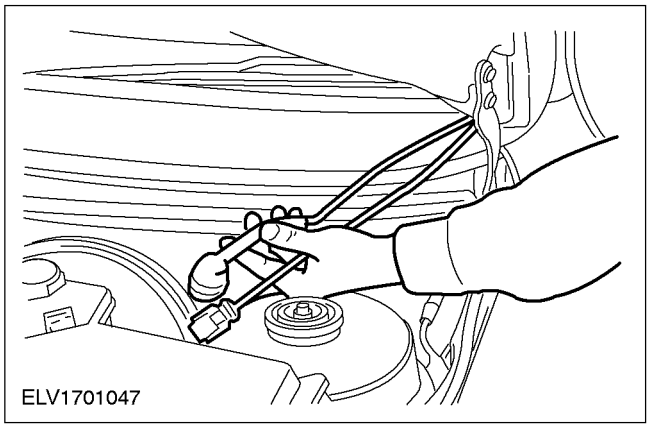
1. Remove the intake pipe together with the air filter housing.
   1. Disconnect the mass air flow (MAF) sensor plug.
   2. Disconnect the intake air temperature (IAT) sensor plug.
   3. One bolt, two nuts.



2. Remove the intake pipe with the air cleaner.
   1. Detach the positive crankcase ventilation hose.
   2. Disconnect the air cleaner outlet pipe.
   - Pull the air cleaner housing out of the rubber bush.

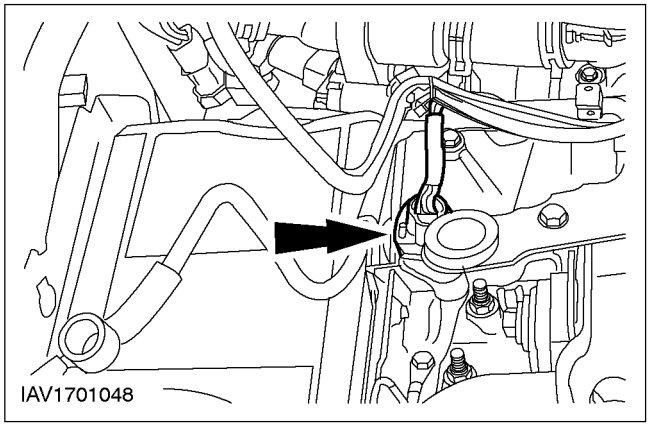


3. Lay the wiring so that it is not caught when the bonnet is closed.

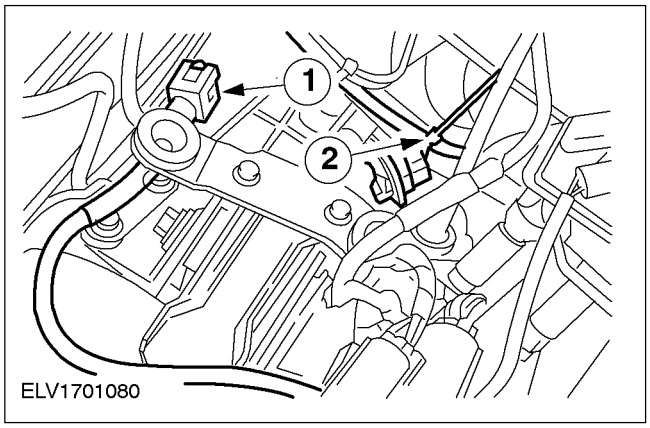


DIAGNOSIS AND TESTING (Continued)

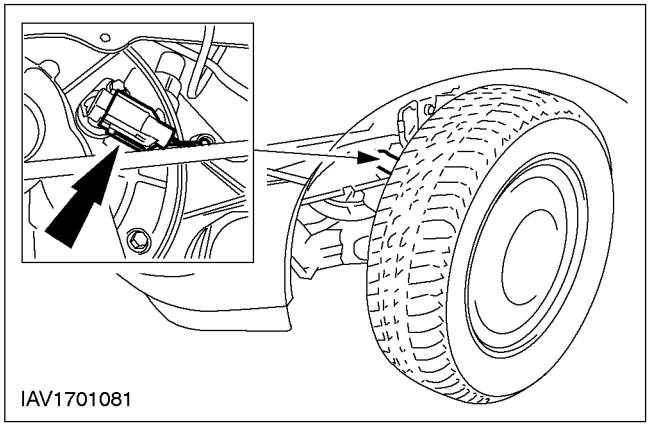
4. Disconnect the CD4E transmission plug.



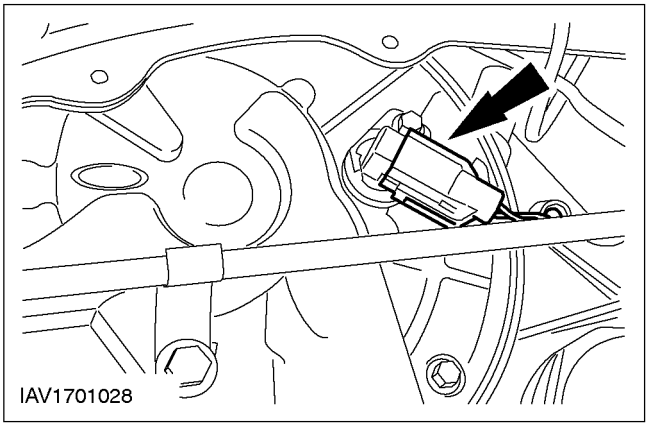
5. Connect the test lead to the automatic transmission.
   1. Connect test lead.
   2. Secure the wiring loom plug with a retaining strap.



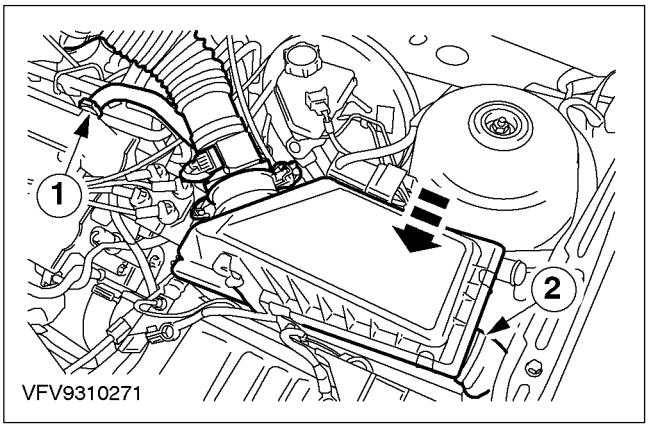
6. Pull out the plug of the turbine shaft speed (TSS) sensor.



7. Connect the test lead to TSS sensor and secure the wiring loom plug with a suitable retaining strap.

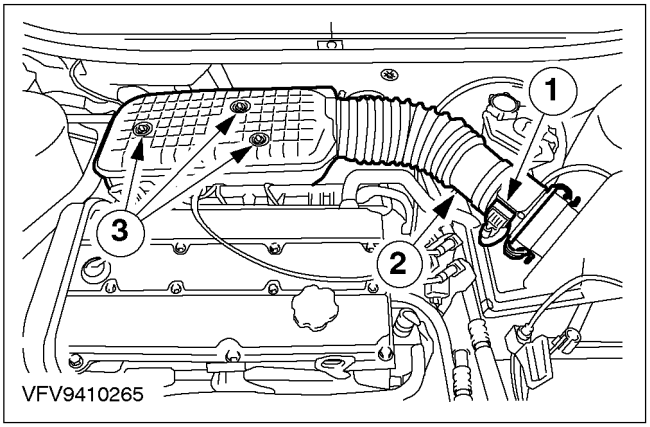


8. Install the intake pipe together with the air filter housing.
   1. Fit the PCV hose.
   2. Connect the intake hose.

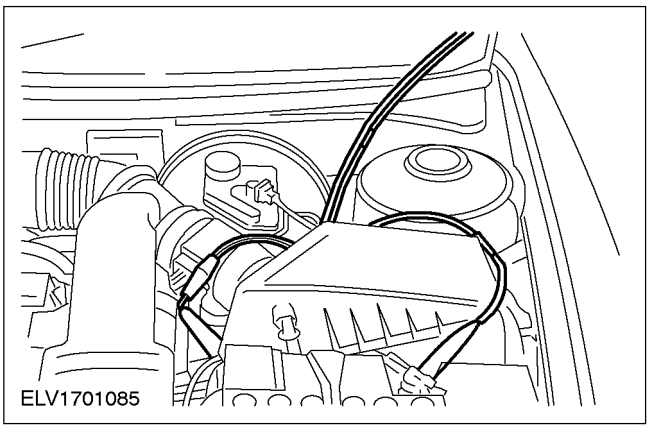


DIAGNOSIS AND TESTING (Continued)

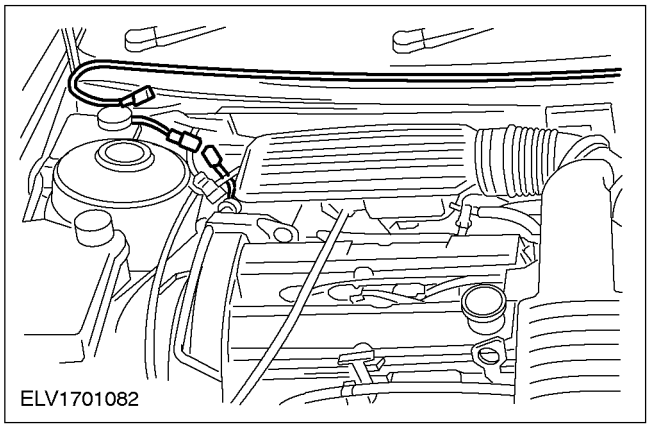
9. Install the intake pipe together with the air filter housing.
   1. Connect the mass air flow (MAF) sensor multiplug.
   2. Connect the intake air temperature (IAT) sensor multiplug.
   3. Fit the bolt and the two nuts.



10. Connect the VBA extension lead to the vehicle battery.

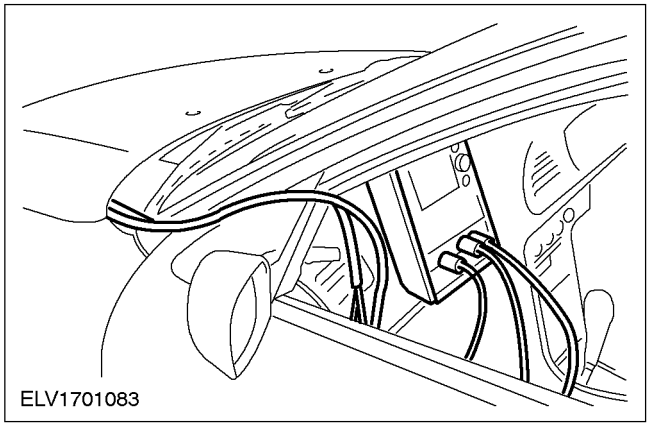


11. Connect the Diagnostic Tool interface cable to the engine management serial communications link (SCL) plug.



NOTE: The software must be loaded.

12. Lay all the wiring in the vehicle, connect it and close the hood (right-hand side shown).



13. Connect the red test probe lead to the switch.

Perform On-board Diagnosis

A passenger is necessary because the screen data must be read from the PDU during the journey.

During diagnostics with the Diagnostic Tool, the electrical connection between the transmission and the PCM is disconnected. All gear changes are then controlled by the Diagnostic Tool.

DIAGNOSIS AND TESTING (Continued)

CAUTION: The operating pressure will drop to a minimum during certain test steps. The PDU will interrupt some tests during acceleration in order to prevent transmission damage.

The checks may be interrupted at any time by switching the PDU off (red button). The transmission then changes automatically to 3rd gear, and the coast clutch is disengaged. Other gears may be selected as required.

Continue the diagnostic procedure until its completion, then carry out any rectification work and re-verify the condition (by a road test if necessary).

DIAGNOSTIC TROUBLE CODE CHART

DIAGNOSTIC TROUBLE CODE CHART

DTC:	Component	Possible cause	Symptom
P1116	ECT sensor.	Voltage of ECT sensor not within tolerance range.	Repeat self-test at operating temperature.
P0117	ECT sensor.	ECT sensor signals 125 °C (254 °F).	Torque converter lock-up clutch permanently disengaged.
P0118	ECT sensor.	ECT sensor signals -40 °C (-40 °F).	Torque converter lock-up clutch permanently disengaged.
P1124	TP sensor.	Voltage of TP sensor not within tolerance range.	TP sensor not in the correct position during the self-test (repeat self-test).
P0122, P0123, P1120, P1121, P1125	TP sensor.	See Engine Management VSTM.	Harsh gearshifts, incorrect gearshift timing, converter lock-up clutch permanently disengaged
P0102, P0103, P1100, P1101	MAF	See Engine Management VSTM.	Incorrect gearshift timing, faulty operating pressure, converter lock-up clutch engages at incorrect time, same symptoms as for faulty TP sensor
P0300, P0308, P0320, P0340, P1351, P1364	Engine Ignition	See Engine Management VSTM.	Converter lock-up clutch not engaging, delayed downshift at full throttle.
P1705	TR sensor	TR sensor not in position ""P" during self-test	Repeat self-test as required.
P1703	BPP switch	BPP switch not activated during self-test (possibly open circuit).	Torque converter lock-up clutch not engaging with throttle valve less than 1/3 open.
P1703	BPP switch	Faulty BPP switch circuit.	Torque converter lock-up clutch not disengaging under braking.
P1460	A/C switch	A/C clutch switched on during self-test	Faulty operating pressure.
P0750*	SSA solenoid	SSA solenoid circuit	Incorrect gear selection (see Solenoid Operation Chart).
P0755*	SSB solenoid	SSB solenoid circuit	Incorrect gear selection (see Solenoid Operation Chart).
P1747*, P1760	EPC solenoid	Voltage fluctuations in EPC solenoid circuit, short circuit to ground	If short circuit to ground: engine speed limitation (partial fuel shut-off, heavy misfiring)

DIAGNOSIS AND TESTING (Continued)

DTC:	Component	Possible cause	Symptom
P1746*	EPC solenoid	Voltage fluctuations in EPC solenoid circuit, open circuit	Open circuit causes high operating pressure, juddering gearshifts and engagement.
P1711	TFT sensor		Transmission not at operating temperature during self-test (bring up to operating temperature and repeat self-test as required).
P0713	TFT sensor signals temperature below -40 °C (-40 °F) or open circuit.	Abnormal engagement and disengagement of converter lock-up clutch, faulty operating pressure control.	
P0712	TFT sensor	TFT sensor signals temperature above 150 °C (302 °F) or short circuit.	Abnormal engagement and disengagement of converter lock-up clutch, faulty operating pressure control
P0715	TSS sensor	PCM detects missing signal from TSS sensor.	No engagement of converter lock-up clutch, harsh gearshifts. No 4th gear and no engine braking in 2nd or 3rd gear.
P0731**	SSA, SSB solenoid or mechanical components.	None. 1st gear	Incorrect gear selection (see Solenoid Operation Chart).
P0732**	SSA, SSB solenoid or mechanical components.	No 2nd gear.	Incorrect gear selection (see Solenoid Operation Chart).
P0733**	SSA, SSB solenoid or mechanical components.	No 3rd gear.	Incorrect gear selection (see Solenoid Operation Chart).
P0734**	SSA, SSB solenoid or mechanical components.	No 4th gear.	Incorrect gear selection (see Solenoid Operation Chart).
P0743*	TCC solenoid	No voltage at TCC solenoid during self-test.	If switched on incorrectly: engine stalls in manual 2nd gear, engine does not reach high engine speeds, poor performance at low engine speeds, harsh gearshifts.
P1780	O/D switch	No switchover signal from O/D switch during self-test.	Repeat self-test.
P1783	TFT sensor	TFT sensor signals temperature above 132 °C (270 °F).	Operating pressure too high
P0707	TR sensor	Short circuit in TR sensor circuit.	No operation in 4th gear, fixed gearshift pressure. No manual 1st gear
P0708	TR sensor	Open circuit in TR sensor circuit.	No operation in 4th gear, fixed gearshift pressure, no manual 1st gear.
P1789*	3-2T/CCS solenoid	Short circuit in 3-2T/CCS solenoid circuit during self-test.	No engine braking (except in 4th gear), delayed 3-3 downshift.
P1788*	3-2T/CCS solenoid	Open circuit in 3-2T/CCS solenoid circuit during self-test.	Engine braking function in 2nd and 3rd gear, abrupt or rough 3-2 downshifts, harsh 4-3 downshifts.
P1742	TCC solenoid	TCC solenoid permanently engaged	Harsh gearshifts. Engine stalls at low vehicle speeds.
P1744	TCC solenoid	Lock-up clutch slipping despite TCC solenoid being switched on.	Torque converter lock-up clutch not engaging, minimal operating pressure.

DIAGNOSIS AND TESTING (Continued)

DTC:	Component	Possible cause	Symptom
P1751	SSA solenoid	Mechanical or hydraulic fault in the SSA solenoid.	Incorrect gear selection depending fault mode and position of selector lever (TCIL flashing).
P1756	SSB solenoid	Mechanical or hydraulic fault in the SSB solenoid.	Incorrect gear selection depending on fault mode and position of selector lever (TCIL flashing).
P0756	SSB solenoid	Mechanical or hydraulic fault in the SSB solenoid.	Incorrect gear selection depending on fault mode and position of selector lever (MIL flashing).
P0751	SSA solenoid	Mechanical or hydraulic fault in the SSA solenoid.	Incorrect gear selection depending on fault mode and position of selector lever (MIL flashing).
P0721	OSS sensor	PCM receiving faulty OSS signal.	Harsh gearshifts, incorrect gearshift timing.
P0720	OSS sensor	PCM receiving no signal from OSS sensor.	Harsh gearshifts, incorrect gearshift timing.
P0722	OSS sensor	PCM intermittently receiving no signal from OSS sensor.	Harsh gearshifts, incorrect gearshift timing.
P1714	SSA solenoid	Mechanical fault in the SSA solenoid.	Incorrect selection of gear depending on fault mode and position of the gear lever (see Solenoid Operation Chart).
P1715	SSB solenoid	Mechanical fault in the SSB solenoid.	Incorrect selection of gear depending on fault mode and position of the gear lever (see Solenoid Operation Chart).
P0718	TSS sensor	PCM receiving faulty signal from TSS sensor.	Harsh gearshifts, no power flow through torque converter.
P1702	TRS sensor	PCM intermittently receiving no signal from TRS sensor.	Possibly incorrect gear selection by the PCM.
P1713	TFT sensor	Signal from TFT sensor too low (= temperature too high).	High operating pressure, incorrect gear selection, harsh gearshifts, harsh engagement.
P1718	TFT sensor	Signal from TFT sensor too low (= temperature too low).	High operating pressure, incorrect gear selection, harsh gearshifts, harsh engagement.
P1636	Induction strip labeling		See Engine Management VSTM.
P1782	P/E switch	P/E switch not operated during self-test or open or short circuit in P/E switch circuit	See Engine Management VSTM.

* Tests of output circuits are only triggered by electrical symptoms. ** Can also be caused by other non-electrical transmission components.

Special Testing Procedures

Line Pressure Test

WARNING: When performing the stall speed test, apply the handbrake fully and press hard on the foot brake pedal. Failure to observe these instructions can result in an accident causing death or serious injury.

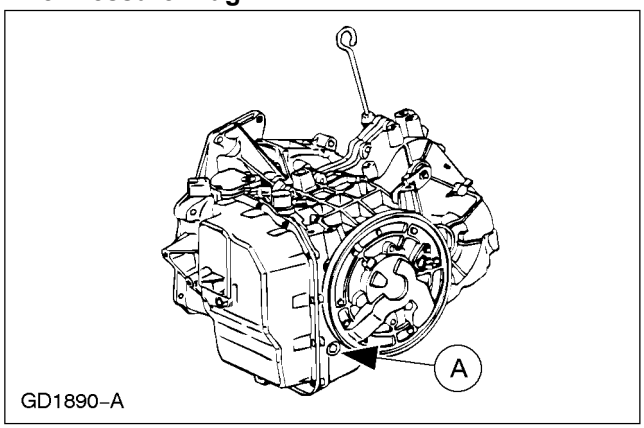
DIAGNOSIS AND TESTING (Continued)

CAUTION: Perform line pressure test prior to performing static test. If line pressure is low at stall, do not perform static test or further transmission damage will occur. Do not maintain WOT in any gear range for more than five (5) seconds.

The transmission fluid level and engine coolant level must be correct. Both fluids must be at normal operating temperature. Before carrying out the check, make sure the gearshift linkage is set correctly.

1. Remove the main line plug and connect test gauge 307-132 (17-014) with adapter.

Line Pressure Plug



Item	Part Number	Description
A	-	Line Pressure Plug

2. Start the engine and measure the line pressure (see table).

Operating pressure

Transmission Range Selector Lever Position	Operating pressure at idle speed (bar)	Operating pressure at stall speed (bar)
P-N	4,4-5,2	-
R	4,4-5,2	18-20
D	3,1-3,6	11,6-12,7
2	3,1-3,6	11,6-12,7
1	3,1-3,6	11,6-12,7

If the line pressure at idle speed is too low, check the following items:

- Fluid level
- Restricted inlet filter
- Loose main body
- Solenoid body
- Accumulator body to case bolts
- Excessive leakage in pump
- Sticking main regulator valve
- Damaged inlet tube seal on inlet filter
- Damaged gaskets
- Damaged separator plate

Line pressure at idle speed too high:

- Carry out a visual check of the transmission wiring loom.
- Carry out diagnosis using the Diagnostic Tool.

Static Test

CAUTION: If the operating pressure at idle is too low, do not carry out the static test.

The static test checks the operation of the following components:

- Forward clutch
- Low/Reverse Clutch Assembly
- Reverse clutch
- Engine power output

Transmission fluid level and engine coolant level must be correct. Both fluids must be at normal operating temperature.

CAUTION: This test must not be continued for longer than 5 seconds after the engine speed reading has stabilized.

CAUTION: If engine rpm recorded by the tachometer exceeds maximum specified rpm, release accelerator pedal immediately. Clutch or band slippage is indicated.

Permitted stall speed

DIAGNOSIS AND TESTING (Continued)

Engine	Stall speed (1/min)
1,8 Zetec	2150-2560
2,0 Zetec	2315-2700
2,5 Duratec-VE	2325-2710

1. Connect the digital rev counter so that it can be easily read from the driver's seat. Apply the handbrake fully and depress the footbrake.
2. Start the engine.
3. Move the selector to "D" and hold the accelerator pedal in the full throttle position (WOT) until the tachometer reading stabilizes (max. 5 seconds).
4. Read off the stall speed.

CAUTION: After testing move transmission range selector lever to NEUTRAL (N) and run the engine at least 30 seconds with idle speed to allow torque converter to cool.

Stall speed too high:

– Selector lever position "D": Check forward clutch.
– Selector lever position "R": Check reverse clutch or low/reverse clutch

Stall speed too low:

– Check the powertrain control system.

A no-drive condition can exist even with correct transmission fluid pressure because of inoperative clutches or bands. Refer to the clutch/band application chart to determine which components may be responsible. A clutch concern may be located by substituting air pressure for oil pressure to determine the location of the malfunction.

When the transmission range selector lever is in a forward gear range (D, 2, 1), a no-drive condition may be caused by an inoperative forward clutch.

Test Procedures

Air Pressure Test

CAUTION: Perform this test only if the transmission has been removed.

NOTE: Only perform this test when other test procedures have brought you to this one.

1. Drain off automatic transmission fluid. Remove main control cover.
2. Remove the main control as an assembly with the solenoid body assembly.
3. The inoperative clutches may be located by applying air pressure into the appropriate clutch port; refer to Air Pressure Test Port Locations.
4. Fit plate 307-301 (17-056) for the transmission air pressure test with six bolts.

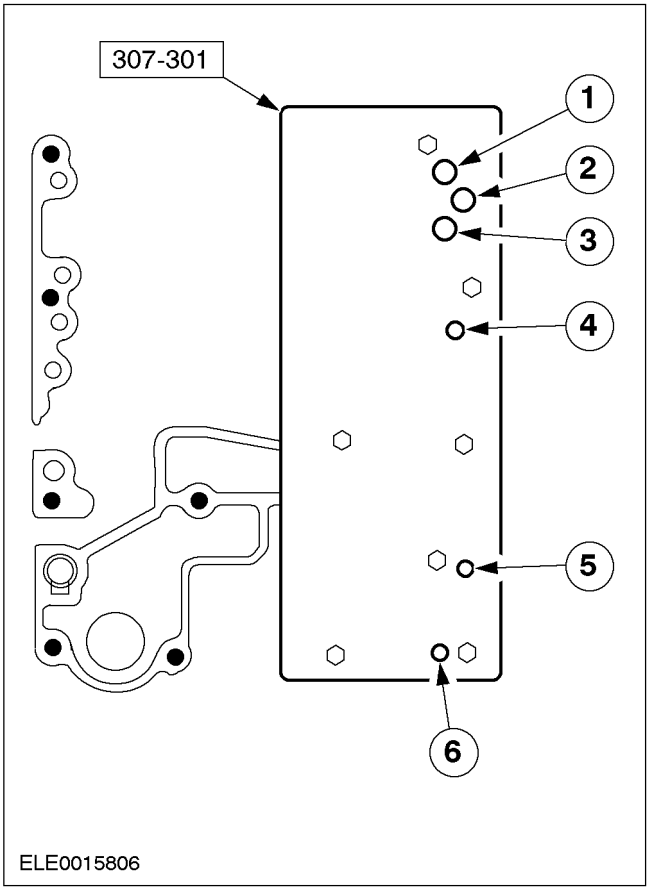
CAUTION: Compressed air must not be applied to the coast clutch circuit at the same time as it is applied to the forward clutch circuit. Failure to observe this instruction can lead to the coast clutch piston coming out of the forward clutch piston.

NOTE: "Clutch/brake band operation" table in this sub-section.

DIAGNOSIS AND TESTING (Continued)

5. Apply compressed air at 2,75 bar to the relevant clutch connection (see 'Installation positions of compressed air test connections'). Either a dull knock can be heard or the piston movement can be felt. If the clutch seals are leaking or the return valve balls leaking, a hissing noise will be heard.

Air Pressure Test Port Locations



Item	Part Number	Description
1	-	Reverse Clutch Test Port
2	-	Forward Clutch Test Port
3	-	Direct Clutch Test Port
4	-	Test connection - loosened position of 2/4 brake band
5	-	Test connection - tightened position of 2/4 brake band
6	-	Servo Apply Test Port

Air Pressure Test Results

If the clutch pistons are not working, clean them and search for the cause of the fault.

If a clutch is not operated when compressed air is applied to the corresponding bore, or if clutches operate together, check the oil bores in the housing.

If application of air pressure to the pressure reservoir produces no operation, remove the pressure reservoir and check the housing bores and the pistons.

Leakage Inspection

Pull out the fluid level indicator and check the color of the transmission fluid. The original factory fill is red. This will make it easier to determine whether the leak is on the engine or the transmission. As long as the transmission has not been topped up often and as long as no fluid change has been performed, the red color of the transmission fluid filled in production makes location of leaks easier.

Leaks at the main control cover gasket can often be cured by tightening the bolts of the main control cover to 16 Nm. If necessary, renew the main control cover gasket.

Check the fluid filler tube connection at the transmission case. If leakage is found, install a new fluid filler tube grommet.

Check the cooler lines and fittings between the transmission and the cooler in the radiator for looseness, wear or damage. If leakage cannot be stopped by tightening a tube nut, renew the damaged parts. When fluid is found to be leaking between the case and the fluid tube connector, check for a missing or damaged O-ring. Tighten the fitting to the maximum specification.

⚠ CAUTION: Do not try to stop the fluid leak by increasing the torque beyond specification. This may cause damage to the case threads.

If the leak continues, renew the fluid tube connector and tighten to specification. Follow the same procedure to eliminate fluid leaks between the oil cooler and the fluid tube connector.

Check the engine coolant in the radiator. If transmission fluid is present in the coolant, the cooler in the radiator is probably leaking.

DIAGNOSIS AND TESTING (Continued)

The cooler can also be checked by disconnecting the fluid tubes from the tube connectors and applying no more than 345 kPa of air pressure to the tube connectors. Remove the radiator cap to relieve the pressure build up at the exterior of the fluid cooler tank. If the oil cooler leaks and/or it does not hold the pressure applied, install a new oil cooler.

If leakage is found at the transmission range selector lever shaft, renew the shaft seal.

Check for fluid leaking from the differential seal. Leakage may result from a damaged seal, missing garter spring or worn front wheel driveshaft or joint. Renew the seal and/or front wheel driveshaft and joint, as necessary.

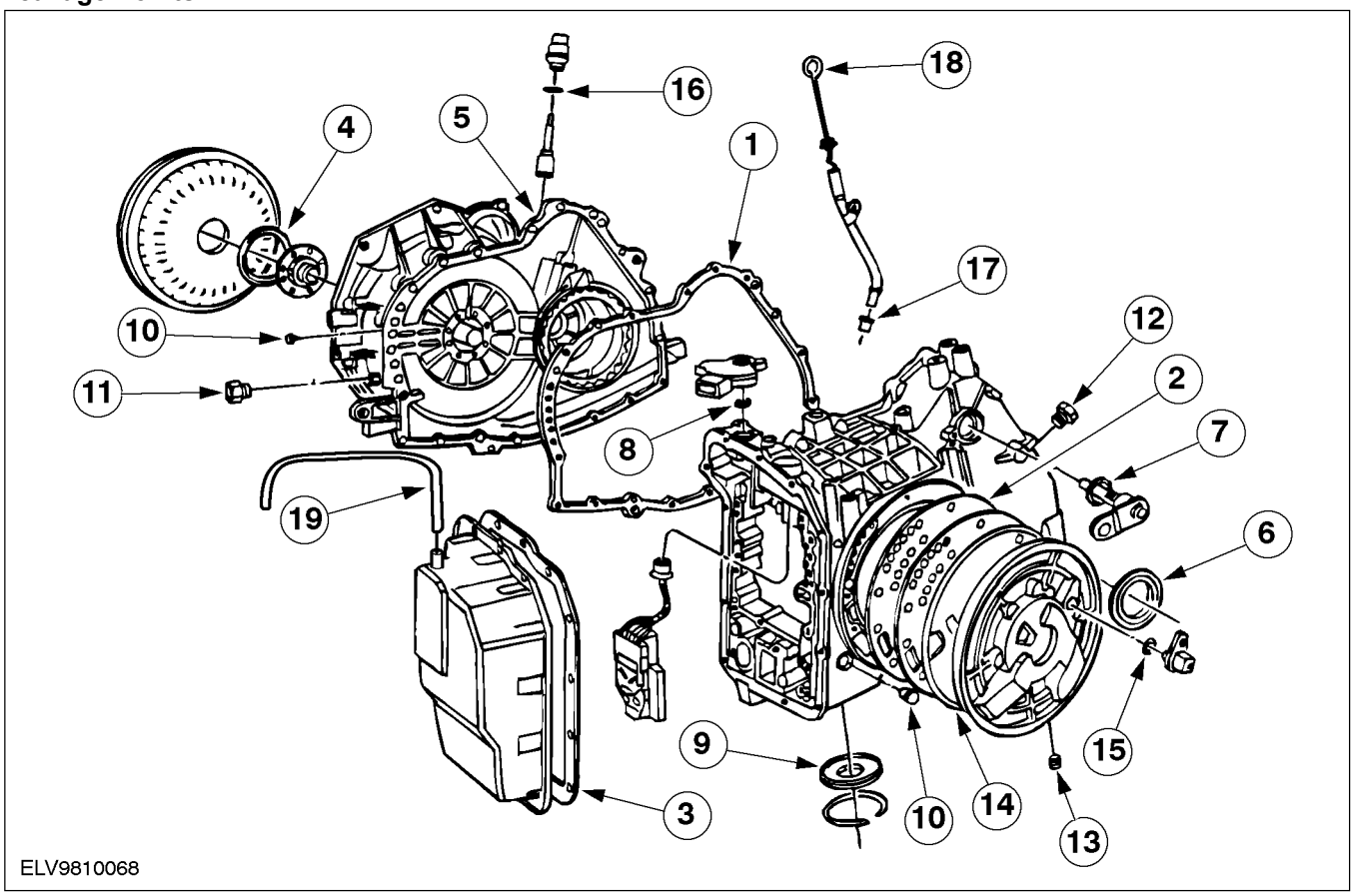
Check for fluid leaks between the pump and the transmission case. A leak may be due to a rolled pump lip seal or a damaged seal. If necessary, repair the oil pump.

External Sealing

The following components prevent external leakage of transmission fluid from the CD4E automatic transmission:

- Gaskets
- Lip type seals
- O-rings
- Seal rings.

Leakage Points



Item	Part Number	Description
1	-	Gasket - transmission Split Flange
2	-	Gasket - Pump Body Separator
3	-	Gasket - Main Control Cover

Item	Part Number	Description
4	-	Seal Assembly - Converter Impeller Hub
5	-	Seal - differential - converter housing
6	-	Seal - differential - transmission case

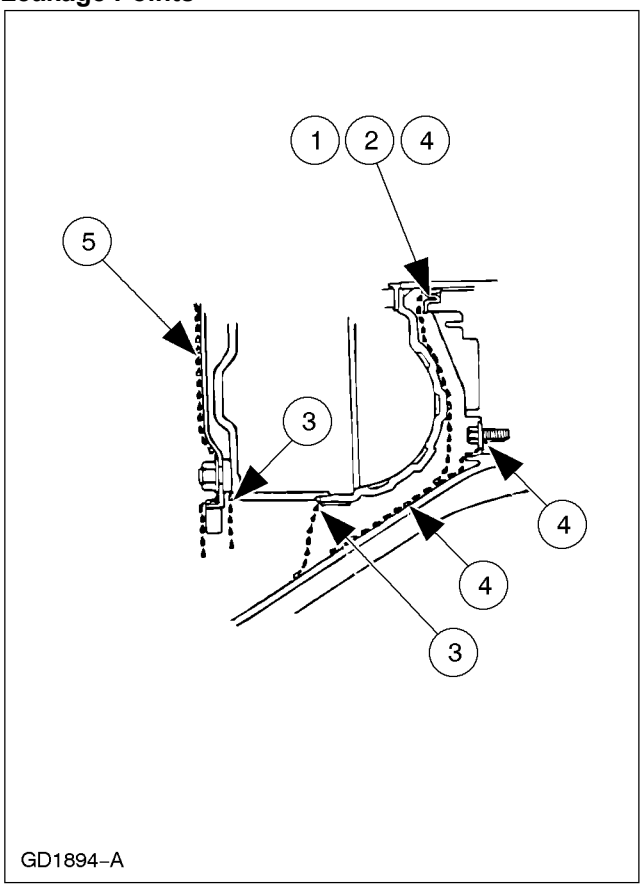
DIAGNOSIS AND TESTING (Continued)

Item	Part Number	Description
7	-	Seal - transmission range selector lever shaft
8	-	Seal - transmission range switch
9	-	Cover Assembly - Intermediate/ Overdrive Servo
10	-	Plugs (1/4-18 conical thread) (line pressure)
11	-	Connector Assembly - 3/8-18 Cooler Line Fitting (2 Req'd)
12	-	Connector Assembly - 3/8-18 Cooler Line Fitting (2 Req'd)
13	-	Plug -1/2-14 Socket Square Head (Drain Plug)
14	-	Seal - Pump Assembly (O-Ring)
15	-	O-Ring - Torque Converter Speed Sensor
16	-	Seal - Speedo Retainer
17	-	Grommet - Fluid Filler Tube
18	-	Indicator Assembly - Fluid Level
19	-	Vent Ring

Fluid Leakage in Torque Converter Area

Locate leaks near the torque converter in the following way. Leakage at the front of transmission, as evidenced by fluid around the converter housing, may have several sources. The cause can often be established before the automatic transmission is removed from the vehicle. The paths which the fluid can take to reach the bottom of the converter housing are as follows (numbers on illustration relate to items below):

Leakage Points



1. Fluid leaking by the converter impeller hub seal lip will tend to move along the drive hub and onto the back of the impeller housing. Unless the seal is totally destroyed, the fluid leaking from around the seal lip will deposit near to the outer side of the case.
2. Fluid leaking around the outside of the converter hub seal will follow the same path as that leaking from the seal lip.
3. Fluid leakage from the welded metal reinforcements for the converter-to-drive plate threaded pins will be evident on the outside of the converter, on the back of the drive plates and in the converter housing, near to the drive plate. If leakage is suspected in these areas, remove the torque converter and carry out a pressure test.
4. Fluid leakage from the pump will flow down the back of the converter housing. Leakage can be caused by loose or missing pump bolts, a torn or damaged seal between the pump and the housing and/or a worn pump bearing bush.
5. Engine oil leaks are sometimes improperly diagnosed as transmission pump seal leaks. The following areas of possible leakage

DIAGNOSIS AND TESTING (Continued)

should be checked to determine if engine oil leakage is causing the concern.

1. Oil leakage at the cylinder head cover means that oil flows to the converter housing or leaks between the converter housing and the cylinder block, so that oil is then found on or in the lower part of the converter housing.
2. Oil leakage at the oil gallery plugs can cause oil at the back of the cylinder block to flow to the converter housing.
3. Oil leakage and the rear crankshaft seal can cause oil to get to the drive plate and from there into the converter housing.

Further leakage tests

If the previous leakage tests have not clearly shown the cause of the leak, perform the following.

1. Remove the converter housing. Remove traces of oil from the top and bottom of the front side of the converter housing, the rear of the engine and the oil sump. Clean the torque converter area with suitable non-flammable solvent and dry with compressed air.
2. Wash out or down the converter housing and the front side of the drive plates. The converter housing can be washed out using an oil can filled with a suitable detergent. Blow dry all washed areas with compressed air.
3. Start the engine and run it until the automatic transmission fluid has reached operating temperature. Check the back of the cylinder block and the top of the converter housing for signs of leaks. Raise the vehicle. Run the engine at fast speeds at first, then let it idle. Increase the fluid pressure by frequently putting the selector lever into DRIVE and REVERSE. Observe the front of the drive plate, the back of the cylinder block (if possible) and all sides of the converter housing. Run the engine until fluid leakage is evident and the source of leakage can be determined.

Leak Check Test With Black Light

Aniline and luminous dyes that can be dissolved in the transmission fluid have been useful in finding leaks. These are mixed in proportions of 2.5 ml (1/2 teaspoon) of dye powder to 0.23 liters of transmission fluid. These dyes help to determine whether the leaks are of transmission fluid or engine oil, or whether the transmission fluid is leaking from the cooler into the coolant. A UV lamp is used to determine the presence of the dyed transmission fluid.

Transmission Fluid Cooler

CAUTION: If the automatic transmission was dismantled to renew components or to remove foreign bodies from valves in the valve body, then the torque converter and the transmission fluid cooler must be cleaned with converter/oil cooler cleaner no. 014-00028 or similar. Under no circumstances should an attempt be made to clean the converter by hand with solvent.

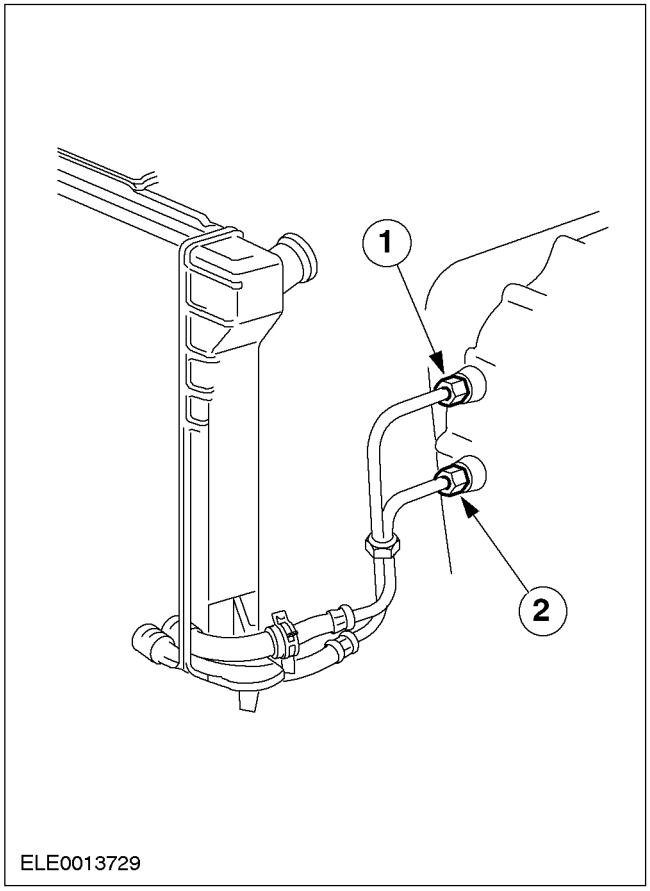
If the transmission is worn or damaged internally, abraded or metal particles from the clutch friction plates or bands can get into the converter or cooler. These foreign bodies are one of the main causes of automatic transmission faults. All contaminants must be removed from the system before a repaired automatic transmission is re-installed.

Transmission Fluid Cooler Flow Test

NOTE: The transmission linkage adjustment, fluid level and line pressure must be within specification before performing this test. Refer to transmission linkage adjustment procedure. For transmission fluid level checking procedures, refer to Check Fluid Level and Condition. For transmission line pressure testing procedures, refer to Line Pressure Test.

DIAGNOSIS AND TESTING (Continued)

1. Pull the fluid level indicator out of the fluid filler tube.
2. Place funnel in fluid filler tube.
3. Raise the vehicle.
4. Disconnect the oil cooler return line from the transmission (rear fitting).
5. Connect one end of the hose to the oil cooler return pipe and guide the other end so far upwards to enable it to be hooked into the funnel later on.
6. Lower the vehicle. Hook the free end of the hose onto the funnel.
7. Start the engine and let it idle. The selector lever is in NEUTRAL.
8. As soon as the fluid coming out of the hose is no longer viscous, check the fluid. About 1/2 liter of automatic transmission fluid must flow through in 30 seconds. If the flow is sufficient, the test is complete.
9. If the flow is not sufficient, stop the engine. Disconnect the hose from the oil cooler and connect it to the output line of the converter housing (front connection).
10. Repeat Steps 7 and 8. If adequate fluid flow is now measured, carry out the steps described for back flushing/cleaning in "Cleaning and Testing"; see also "Diagnosis of the Automatic Transmission Fluid Cooler". If the fluid flow is insufficient, repair the pump and/or torque converter.



ELE0013729

Item	Part Number	Description
1	-	Out
2	-	In

Transmission Fluid Cooler Tubes

Transaxle Cooler Backflushing/Cleaning

1. For rinsing, use Converter/Oil Cooler Cleaner number 014-00028 or equivalent. Before starting work, check the equipment to determine whether large quantities of fluid can flow freely/are present. If the flow is weak, renew the filter.
2. To aid in connecting the cleaner to the transmission steel cooler lines, connect two additional rubber hoses to the transmission end of the steel transmission cooler lines:
- Connect the cleaner pressure line to the oil cooler return line (longer line).
- Connect the cleaner return line to the oil cooler pressure line (shorter line).
3. Turn on the solvent pump and allow the solvent to circulate a minimum of five minutes (cycling the switch on and off will

DIAGNOSIS AND TESTING (Continued)

help dislodge contaminants in the cooler system).

4. Switch off the cleaner pump and disconnect the cleaner pressure line from the oil cooler return line.
5. Connect the air line hose to the oil cooler return line. Blow compressed air through the oil cooler and lines until all the cleaner has been removed.
6. Disconnect the second rubber hose from the other oil cooler line.

Fluid Cooler Tube - Remove and Install

If the oil cooler is leaking, it must be renewed. REFER to Section 307-02A / 307-02B.

If one or more oil cooler lines have to be renewed, each new steel tube must have the same diameter as the line it is replacing.

Using the oil cooler line which was removed as a template, bend the replacement line as necessary. Attach the necessary connections and install the oil cooler line.

After tightening the connections, fill up with transmission fluid as necessary and check for leaks.

DIAGNOSIS AND TESTING

Diagnosis By Symptom

Starting with a symptom, the mechanic is provided with diagnostic information from the Symptom Chart. In addition, the diagnosis direction is indicated and possibly the component causing the fault is named.

The Symptom Charts are divided into two categories: the electrical routines, indicated by 200 series numbers, and hydraulic/mechanical routines, indicated by 300 series numbers. In the electrical routines, the electrical components are listed. The hydraulic/mechanical routines list the hydraulic or mechanical components which could possibly cause the symptom described.

Diagnosis by Symptom Chart Directions

1. Consult the symptom chart table and select the symptom/concern.
2. Move on to the diagnostic procedures given in the symptom chart.
3. Always begin diagnosis of a symptom by using the following:
   - Preliminary inspections
   - Verification of condition
   - Fluid level check
   - Test procedures according to details in the table
4. If indicated, start with the electrical routine. Follow the instructions given under Reference/Action. If required, always perform the tests using the Diagnostic Tool. Never skip tests. Carry out the necessary repairs. If the concern is still present after electrical diagnosis, proceed to the hydraulic/mechanical routine listed.

NOTE: Make sure that all the electrical components are working correctly before proceeding to the hydraulic/mechanical routine listed.

5. The hydraulic/mechanical routines list the possible hydraulic or mechanical components which could possibly cause the concern described. These components are listed in the removal sequence and by their likelihood of being the cause. All components listed must be inspected so that proper servicing is guaranteed.

Symptom Chart

Title	Electrical*	Hydraulic/ Mechanical
Engagement Concerns		
No Forward	1)	301
No Reverse	202	302
Harsh Reverse or Forward Engagement	203	303
Delayed Engagement of Forward or Reverse	1)	305
No Forward Engagement or Reverse	1)	307
Shift Concerns		
Some or All Shifts Missing	210	310
Shift Timing - Early/Late	211	311
Shift Timing - Erratic/Surging	212	312
Feel - Soft/Slipping	213	313
Feel - Harsh	214	314
No 1st Gear, Engages in Higher Gear	215	315
No Manual 1st Gear	216	316
1-2 shift (automatic)	220	320

DIAGNOSIS AND TESTING (Continued)

Title	Electrical*	Hydraulic/ Mechanical
2-3 shift (automatic)	221	321
3-4 shift (automatic)	222	322
Only 1-2 shift soft/slipping (automatic)	226	326
Only 2-3 shift soft/slipping (automatic)	227	327
Only 3-4 shift soft/slipping (automatic)	228	328
Only 4-3 shift soft/slipping (automatic)	229	329
Only 3-2 shift soft/slipping (automatic)	230	330
Only 2-1 shift soft/slipping (automatic)	231	331
Only 1-2 shift abrupt (automatic)	232	332
Only 2-3 shift abrupt (automatic)	233	333
Only 3-4 shift abrupt (automatic)	234	334
Only 4-3 shift abrupt (automatic)	235	335
Only 3-2 shift abrupt (automatic)	236	336
Torque Converter Lock-Up Clutch		
No Apply	240	340
Always Applied/Stalls Vehicle	241	341
Other Shift Concerns		
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External Leaks	1)	352
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Reference: Pressure Chart		401
Reference Table: Clutch/Band Application		601
Reference Table: Solenoid Application Chart		701

Perform electrical routine first. 1) not caused by an electrical component

Routines

ENGAGEMENT CONCERN: NO FORWARD

301 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Internal or External Shift Linkages	
- Damaged, out of adjustment, incorrectly assembled	Check and repair if necessary. Ensure correct adjustment of the gear shift; refer to the adjustment procedure. After completing the repair, make sure that the transmission range sensor (TR sensor) is correctly adjusted.
Pump Assembly	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
Damaged gaskets	- Check for damage. Renew as necessary.
- Porosity/crossleaks and/or ball plug missing or leaking, or a plugged hole	- Check for porosity and leaks. Renew as necessary.

DIAGNOSIS AND TESTING (Continued)

301 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
- Pump hub seal ring, no 3 or no 4, damaged	- Check for damage and repair as necessary.
Main Control Valve Body Assembly	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Gaskets damaged or leaking	- Check for damage and repair as necessary.
- Pressure plate damaged or leaking	- Check for damage and repair as necessary.
- Separator plates damaged	- Check for damage and repair as necessary.
- Hydraulic passages damaged	- Check for damage and repair as necessary.
- Main regulator valve stuck, damaged or incorrectly assembled	- Check for damage and repair as necessary.
- Forward accumulator leaking	- Check for damage and repair as necessary.
Forward Clutch and Coast Clutch Assembly	
- Seals or pistons damaged	- Perform Air Pressure Test.
	- Check for damage and repair as necessary.
- Forward clutch return springs damaged	- Check for damage and repair as necessary.
- Ball check valve damaged	- Check for incorrect positioning, poor seating, damage. Renew the piston if necessary.
- Friction plates severely damaged or worn	- Check for excessive wear or damage and repair as necessary.
- Forward/coast/direct clutch cylinder damaged, leaking, incorrectly assembled or sticking	- Check for damage and repair as necessary.
- Cylinder to hub weld broken or splines damaged	- Check for damage and repair as necessary.
Clutch - Low One-Way	
- Worn, damaged, incorrectly assembled	- Check for damage and repair as necessary.
Forward One-Way Clutch	
- Worn, damaged, incorrectly assembled	- Check for damage and repair as necessary.
Low-Intermediate Carrier	
- Damaged, incorrectly assembled	- Check for damage and repair as necessary.

ENGAGEMENT CONCERN: NO REVERSE

202 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs, vehicle wiring looms, PCM, solenoid valve 1 (SS1) activated, transmission range sensor (TR sensor)	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

ENGAGEMENT CONCERN: NO REVERSE

302 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
External Shift Linkage	
- Damaged, out of adjustment	- Check and repair as necessary. Ensure correct adjustment of the gear shift; refer to the adjustment procedure. After completing the repair, make sure that the transmission range sensor (TR sensor) is correctly adjusted.
Incorrect pressures	

DIAGNOSIS AND TESTING (Continued)

302 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
- Low line pressure	- Measure the operating pressure using a pressure connection at the mainline pressure blanking plug. Test the operating pressure and perform a stall speed test; for data refer to reference table no. 401, transmission fluid pressures. If the operating pressure is low, check the following components which may be the cause: Valve body, transmission fluid pump, reverse clutch, low/reverse clutch.
Internal Shift Linkage	
- Damaged, out of adjustment	- Check and repair as necessary. Make sure the gear shift is correctly adjusted; refer to Adjustment. After completing the repair, make sure that the transmission range sensor (TR sensor) is correctly adjusted.
Main Controls	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Gasket damaged	- Check for damage and repair as necessary.
- 1-2 shift valve, SS1, main regulator valve, low/reverse modulator valve, low/reverse accumulator piston, pressure plate damaged, missing, stuck, incorrectly assembled	- Check for damage and repair as necessary.
- Separator plates damaged	- Check for damage and repair as necessary.
- Hydraulic passages damaged	- Check for damage and repair as necessary.
Pump Assembly	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Gasket damaged	- Check for damage. Renew as necessary.
- Porosity/crossleaks/ball plug missing or leaking, plugged hole	- Renew pump assembly.
- Pump hub seal rings no. 6 or no. 7 damaged	- Check for damage and repair as necessary.
Clutch - Reverse	
- Seals or pistons damaged	- Perform Air Pressure Test.
- Ball check valve damaged	- Check for damage and repair as necessary.
- Friction plates worn, severely damaged or incorrectly assembled	- Check for damage and repair as necessary.
- Piston return spring damaged	- Check for damage and repair as necessary.
- Reverse clutch hub to forward/coast/direct hub splines damaged	- Check for damage and repair as necessary.
Low/Reverse Clutch Assembly	
- Seals or piston damaged	- Perform Air Pressure Test.
- Friction plates worn or severely damaged	- Check for damage and repair as necessary.
- Piston return spring damaged	- Check for damage and repair as necessary.
- Waved washer missing	- Check for damage and repair as necessary.
- Piston bore damaged	- Check for damage and repair as necessary.
Forward/Coast/Direct Clutch Cylinder	
- Reverse seal rings damaged, missing, incorrectly assembled	- Check for damage and repair as necessary.
Case	- Perform Air Pressure Test.
- Reverse clutch supply lines at low /reverse clutch heavily leaking or porous.	- Perform Air Pressure Test.
	- Check for damage and repair as necessary.
Reverse/Overdrive Gear Set	

DIAGNOSIS AND TESTING (Continued)

302 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
- Damaged	- Check for damage and repair as necessary.

ENGAGEMENT CONCERN: HARSH REVERSE OR FORWARD

203 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
Electrical inputs/outputs, vehicle wiring looms, PCM, mainline pressure control (EPC) solenoid valve, transmission fluid temperature (TFT) sensor	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

ENGAGEMENT CONCERN: HARSH REVERSE OR FORWARD

303 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Fluid	
- Level	- Adjust fluid to correct level.
- Condition	- Inspect; refer to Transmission Fluid Condition Check.
CV Joints/Front axle driveshaft and Joint	
- Splines damaged	- Check for damage. Repair where necessary.
Powertrain bearing	
- Loose, broken, missing or misaligned	- Check the bearing and repair as necessary.
- Powertrain touching other vehicle components	- Check for contact and resolve as necessary.
External Shift Linkage	
- Damaged, out of alignment	- Check and repair as necessary. Ensure correct adjustment of the gear shift; refer to the adjustment procedure. After completing the repair, make sure that the transmission range sensor (TR sensor) is correctly adjusted; refer to the procedure for adjustment.
Incorrect pressures	
- Incorrect line pressure	- Measure the operating pressure using a pressure connection at the mainline pressure blanking plug. Test the operating pressure and perform a stall speed test; for data refer to reference table no. 401, transmission fluid pressures. If the operating pressure is high, test the engagement at the lowest operating pressure using the transmission testing equipment. If the operating pressure remains high, check the following components: Valve body
Internal Shift Linkages	
- Damaged, out of adjustment	- Check and repair as necessary. Ensure correct adjustment of the gear shift; refer to the adjustment procedure. After completing the repair, make sure that the transmission range sensor (TR sensor) is correctly adjusted; refer to the procedure during adjustment.
Fluid Filter and Seal Assembly	
- Filter/seal damaged, plugged	- Renew filter and seal assembly.
- Recirculation seal damaged, blocked or out of position	- Renew recirculation seal.

DIAGNOSIS AND TESTING (Continued)

303 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Main Controls	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Gasket damaged	- Check for damage and repair as necessary.
- Low/reverse accumulator piston and spring (reverse), main regulator valve, forward accumulator piston and spring incorrectly assembled, stuck or damaged	- Check for damage and repair as necessary.
- Mainline pressure solenoid (EPC) stuck or damaged	- Check for damage or contamination. Operate the solenoid valve using the transmission testing equipment, repair as necessary.
Forward Clutch Assembly (Forward Only)	
- Forward clutch housing damaged	- Perform Air Pressure Test.
	- Check for damage and repair as necessary.
- Piston bore damaged	- Check for damage and repair as necessary.
- Friction plates damaged, worn	- Check for damage and repair as necessary.
- Forward clutch return spring damaged or missing	- Check for damage and repair as necessary.
- Ball check damaged	- Check for damage and repair as necessary.
- Piston or seal damaged	- Check for damage and repair as necessary.
Reverse Clutch Assembly (Reverse Only)	
- Seal or piston damaged	- Perform Air Pressure Test.
	- Check for damage and repair as necessary.
- Reverse piston damaged	- Check for damage and repair as necessary.
- Friction plates damaged, worn, incorrectly assembled	- Check for damage and repair as necessary.
- Return spring assembly damaged, worn	- Check for damage and repair as necessary.
- Ball check damaged, missing	- Check for damage and repair as necessary.
Low/Reverse Clutch Assembly (Reverse Only)	
- Seals or reverse clutch piston damaged	- Perform Air Pressure Test.
	- Check for damage and repair as necessary.
- Waved washer damaged	- Check for damage and repair as necessary.
- Friction plates damaged, worn, incorrectly assembled	- Check for damage and repair as necessary.
- Return spring assembly damaged, worn	- Check for damage and repair as necessary.
- Check ball damaged, missing	- Check for damage and repair as necessary.
Direct Clutch Assembly (Reverse Only)	
- Friction plates severely damaged	- Perform Air Pressure Test.
	- Check for damage and repair as necessary.

ENGAGEMENT CONCERN: DELAYED/SOFT REVERSE OR FORWARD

305 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Automatic transmission fluid	
- Not filled to correct level	- Adjust fluid to correct level.
- Condition	- Inspect; refer to Preliminary Inspection, Check Fluid Level and Condition.
External Shift Linkages	

DIAGNOSIS AND TESTING (Continued)

305 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
- Damaged, incorrectly adjusted or incorrectly assembled	- Check and repair as necessary. Ensure correct adjustment of the gear shift; refer to the adjustment procedure. After completing the repair, make sure that the transmission range sensor (TR sensor) is correctly adjusted; refer to Automatic Transmission, Assembly.
Incorrect pressures	
- Low line pressure	- Measure the operating pressure using a pressure connection at the mainline pressure blanking plug. Test the operating pressure and perform a stall speed test; for data refer to reference table no. 401, transmission fluid pressures. If the operating pressure is low, check the following components which may be the cause: Valve body, transmission fluid pump, clutches, transmission fluid filter and seal, recirculation sealing ring.
Internal Shift Linkages	
- Damaged, out of adjustment or incorrectly assembled	- Check and repair as necessary. Ensure correct adjustment of the gear shift; refer to the adjustment procedure. After completing the repair, make sure that the transmission range sensor (TR sensor) is correctly adjusted; refer to Transmission, Assembly.
Pump Assembly	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
Damaged gaskets	- Check for damage. Renew as necessary.
- Porosity/cross leaks/ball plug missing or leaking, or passage blockage	- Renew pump assembly.
- Damaged oil seals: nos. 3 or 4 (forwards) or nos. 6 or 7 (reverse) - oil pump hub	- Check for damage and repair as necessary.
- Pump gear/pocket damaged	- Check for damage and repair as necessary.
Damaged separator plate	- Check for damage and repair as necessary.
Fluid Filter and Seal Assembly	
- Filter/seal damaged, plugged	- Renew filter and seal assembly.
- Recirculation seal damaged or out of position	- Renew/reseat recirculation seal.
Main Controls	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
Damaged gaskets	- Check for damage. Renew as necessary.
- Manual shift valve, main regulator valve, modulator valve for low /reverse gear stuck, damaged or incorrectly assembled	- Check for damage and repair as necessary.
- Separator plates damaged	- Check for damage and repair as necessary.
- Pressure plate/gasket leaks, damaged, incorrectly installed	- Check for damage and repair as necessary.
Low/Reverse Clutch Assembly (Reverse Only)	
- Piston or seals damaged	- Perform Air Pressure Test.
	- Check for damage and repair as necessary.
- Friction plates damaged, worn	- Check for damage and repair as necessary.
- Return spring damaged	- Check for damage and repair as necessary.
- Piston bore damaged	- Check for damage and repair as necessary.
- Excessive clutch pack end clearance	- Check for damage and repair as necessary.

DIAGNOSIS AND TESTING (Continued)

305 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Reverse Clutch Assembly (Reverse Only)	
- Seals or piston damaged	- Perform Air Pressure Test.
	- Check for damage and repair as necessary.
- Check ball damaged	- Check for damage and repair as necessary.
- Friction plates damaged, worn	- Check for damage and repair as necessary.
- Return spring worn, damaged	- Check for damage and repair as necessary.
- Piston bore damaged	- Check for damage and repair as necessary.
- Excessive clutch pack end clearance	- Check for damage and repair as necessary.
Forward Clutch Assembly (Forward Only)	
- Seals or piston damaged	- Perform Air Pressure Test.
	- Check for damage and repair as necessary.
- Ball check damaged, missing or not seating correctly	- Check for damage and repair as necessary.
- Friction plates damaged, worn or excessive end clearance	- Check for damage and repair as necessary.
Forward/Coast/Direct Clutch Cylinder	
- Reverse seal ring damaged or missing	- Check for damage and repair as necessary.
- Cylinder damaged or leaking	- Check for damage and repair as necessary.

ENGAGEMENT CONCERN: NO FORWARD AND NO REVERSE

307 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Fluid	
- Not filled to correct level	- Adjust fluid to correct level.
External Shift Linkages	
- Damaged, out of adjustment or incorrectly assembled	- Check and repair as necessary. Ensure correct adjustment of the gear shift; refer to the adjustment procedure. After completing the repair, make sure that the transmission range sensor (TR sensor) is correctly adjusted; refer to Transmission, Assembly.
Incorrect pressures	
- Low/no line pressure	- Measure the operating pressure using a pressure connection at the mainline pressure blanking plug. Perform the operating pressure test and the stall speed test. For data refer to reference table no. 401, Transmission Fluid Pressures. If the operating pressure is low, check the following components which may be the cause: Transmission fluid filter and gasket, valve body, transmission fluid pump. If OK continue with the turbine shaft.
Internal Shift Linkages	
- Damaged, out of adjustment or incorrectly assembled	- Check and repair as necessary. Ensure correct adjustment of the gear shift; refer to the adjustment procedure. After completing the repair, make sure that the transmission range sensor (TR sensor) is correctly adjusted; refer to Automatic Transmission, Assembly.
Pump Assembly	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Gasket damaged, missing	- Check for damage. Renew as necessary.

DIAGNOSIS AND TESTING (Continued)

307 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
- Porosity/cross leaks or passage(s) blocked	- Check for porosity, leaks and blockages. Renew the pump if necessary.
- Pump hub seal ring missing	- Check for damage and repair as necessary.
- Pump shaft broken, damaged	- Check for damage and repair as necessary.
Fluid Filter and Seal Assembly	
- Filter/seal damaged, blocked, or missing	- Renew filter and seal assembly.
- Recirculation seal damaged or out of position	- Renew/reseat recirculation seal.
Main Controls	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
Damaged gaskets	- Check for damage. Renew as necessary.
- Pressure plate damaged or missing	- Check for damage and repair as necessary.
- Main regulator valve, manual valve stuck, damaged, plugged, missing, "Z" link not connected	- Check for damage and repair as necessary.
Engine drive plate (starter ring gear)	
- Damaged, broken	- Check for damage and repair as necessary.
Torque Converter	
- Pump drive shaft insert damaged	- Check for damage and repair as necessary.
- Studs broken or damaged	- Check for damage and repair as necessary.
- Splines damaged	- Check for damage and repair as necessary.
- Internal blades damaged, broken	- Check the torque converter. If damaged, renew.
Turbine Shaft to Forward/Coast/Direct Clutch Cylinder Housing	
- Splines damaged	- Check for damage. Repair where necessary.
Chain and Sprocket Assembly	
- Broken, damaged	- Check for damage and repair as necessary.
Park Mechanism	
- Parking pawl return spring damaged, missing incorrectly installed	- Check for damage and repair as necessary.
Front Wheel Drive Shafts and Joints	
- Broken or splines damaged	- Check for damage and repair as necessary.
Final Drive and Differential Assembly	
- Splines damaged	- Check for damage and repair as necessary.
- Gearset damaged	- Check for damage and repair as necessary.
Planetary Gearset	
- Gear teeth, carriers, splines damaged, or broken	- Check for damage and repair as necessary.

SHIFT CONCERNS: SOME OR ALL SHIFTS MISSING

210 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs. vehicle wiring looms, PCM, shift valves, transmission range sensor (TR sensor), throttle position sensor (TPS), VSS, TCS	- Perform Shift Point Road Test; refer to Road Test Vehicle.
	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

SHIFT CONCERNS: SOME OR ALL SHIFTS MISSING

DIAGNOSIS AND TESTING

310 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Fluid	
Internal and External Shift Linkages	- Check and repair as necessary. Ensure correct adjustment of the gear shift; refer to the adjustment procedure. After completing the repair, make sure that the transmission range sensor (TR sensor) is correctly adjusted; refer to Automatic Transmission, Assembly.
Speedometer drive pinion	- Check for damage and repair as necessary.
Go to Reference/Action to diagnose specific missing shifts	

SHIFT CONCERNS: SHIFT TIMING - EARLY/LATE

211 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs. vehicle wiring looms, PCM, shift valves, transmission range sensor (TR sensor), throttle position sensor (TPS), VSS, TCS	- Perform Shift Point Road Test; refer to Road Testing Vehicle.
	- perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

SHIFT CONCERNS: SHIFT TIMING - EARLY/LATE

311 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Other	
- Tire size change	- Refer to the specification plate on the door panel and make sure that the original vehicle equipment is installed. A change of tire size or the speedometer drive pinion affects the shift timing.
- Speedometer gear broken or otherwise incorrect	- Check for damage and repair as necessary.
- Speedometer worm gear damaged	- Check for damage and repair as necessary.

SHIFT CONCERNS: TIMING - ERRATIC/HUNTING

212 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Engine concerns	- Refer to the specification plate on the door panel and make sure that the original vehicle equipment is installed. A change of try size or the speedometer drive pinion affects the shift timing.
	- Check for damage and repair as necessary.

DIAGNOSIS AND TESTING (Continued)

212 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
- Electrical inputs/outputs, vehicle wiring looms, PCM, shift valves, transmission range sensor (TR-Sensor), brake on/off switch (BOO), torque converter clutch solenoid valve (TCC), vehicle speed sensor (VSS), throttle position sensor (TP), turbine shaft speed sensor (TSS), electronic pressure control solenoid (EPC), 3-2 shift/coast clutch solenoid (CCS).	- Check for damage and repair as necessary.

SHIFT CONCERNS: TIMING - ERRATIC/HUNTING

312 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Automatic transmission fluid	- Adjust fluid to correct level.
- Not filled to correct level	- Adjust fluid to correct level.
- Condition	- Inspect; refer to Transmission Fluid Condition Check.
Speedometer drive pinion	
- Speedometer worm gear damaged	- Check for damage and repair as necessary.
- Speedometer drive pinion damaged	- Check for damage and repair as necessary.
Main Control	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
Damaged gaskets	- Check for damage. Renew as necessary.
- 3-2 timing valve, 2nd gear regulator valve, 2-4 accumulator, servo release shuttle valve, 3-2 control valve stuck, damaged, incorrectly installed	- Check for damage and repair as necessary.
- Solenoid screen blocked	-Clean or renew screen.
Separator plates damaged, blocked	- Check for damage and repair as necessary.
- Pressure plate/gasket damaged	- Check for damage and repair as necessary.
Diagnosis of specific shift quality concerns in accordance with adjacent diagnostic procedures	
- Shift Concern: No 1-2 Shift	- Routine 220/320
- Shift Concern: No 2-3 Shift	- Routine 221/321
- Shift Concern: No 3-4 Shift	- Routine 222/322
- Shift Concern: Soft/Slip 1-2 Shift	- Routine 226/326
- Shift Concern: Soft/Slip 2-3 Shift	- Routine 227/327
- Shift Concern: Soft/Slip 3-4 Shift	- Routine 228/328
- Shift Concern: Soft/Slip 4-3 Shift	- Routine 229/329
- Shift Concern: Soft/Slip 3-2 Shift	- Routine 230/330
- Shift Concern: Soft/Slip 2-1 Shift	- Routine 231/331
- Shift Concern: Harsh 1-2 Shift	- Routine 232/332
- Shift Concern: Harsh 2-3 Shift	- Routine 233/333
- Shift Concern: Harsh 3-4 Shift	- Routine 234/334
- Shift Concern: Harsh 4-3 Shift	- Routine 235/335
- Shift Concern: Harsh 3-2 Shift	- Routine 236/336

Feel - Soft/Slipping

213 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	

DIAGNOSIS AND TESTING (Continued)

213 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
- Electrical inputs/outputs, vehicle wiring harnesses, PCM, electronic pressure control solenoid (EPC), transmission fluid temperature (TFT) sensor, throttle position sensor (TPS), MAF sensor.	- Perform Shift Point Road Test; refer to Road Testing Vehicle.
	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

Feel - Soft/Slipping

313 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Automatic transmission fluid	
- Not filled to correct level	- Adjust fluid to correct level.
- Condition	- Inspect; refer to Transmission Fluid Condition Check.
External Shift Linkage	
- Damaged, out of adjustment	- Check and repair as necessary. Ensure correct adjustment of the gear shift; refer to the adjustment procedure. After completing the repair, make sure that the transmission range sensor (TR sensor) is correctly adjusted; refer to Automatic Transmission, Assembly.
Incorrect pressures	
- Low line pressure	- Measure the operating pressures using a pressure connection at the mainline pressure blanking plug. Test the operating pressure; for data refer to reference table no. 401, transmission fluid pressures. If the operating pressures are low or if all shifts are soft or slipping, check the following components: valve body, transmission fluid pump, transmission fluid filter/seal. If the pressures are OK and only one particular shift is soft/slipping, refer to the appropriate routine(s) for additional diagnosis.
	- Shift 1-2, Routine 226/326
	- Shift 2-3, Routine 227/327
	- Shift 3-4, Routine 228/328
	- Shift 4-3, Routine 229/329
	- Shift 3-2, Routine 230/330
	- Shift 2-1, Routine 231/331
Internal Shift Controls	
- Damaged, out of adjustment or incorrectly assembled	- Check and repair as necessary. Ensure correct adjustment of the gear shift; refer to the adjustment procedure. After completing the repair, make sure that the transmission range sensor (TR sensor) is correctly adjusted; refer to Automatic Transmission, Assembly.
Main Controls	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
Damaged gaskets	- Inspect gaskets and renew as required.

DIAGNOSIS AND TESTING (Continued)

313 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
- Main regulator valve, system pressure modulator valve stuck, damage or incorrectly installed or springs missing, tangled or damaged	- Check for damage and repair as necessary.
- EPC solenoid stuck or damaged	- Check for damage or contamination. Operate the solenoid valve using the transmission testing equipment, repair as necessary.
Separator plates damaged, blocked	- Check for damage and repair as necessary.
- Pressure plate/gasket damaged or missing	- Check for damage and repair as necessary.
Pump Assembly	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
Damaged gaskets	- Check for damage and repair as necessary.
- Porosity/cross-leaks	- Check for damage and repair as necessary.
Fluid Filter/Seal Assembly	
- Filter/seal damaged, blocked or missing	- Renew filter and seal assembly.
- Recirculation seal damaged or out of position	- Renew recirculation seal.

GEARSHIFT: ABRUPT

214 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs, vehicle wiring looms, PCM, electronic pressure control solenoid (EPC), transmission fluid temperature sensor (TFT), torque converter speed sensor (TSS), throttle position sensor (TP), vehicle speed sensor (VSS), mass air flow sensor (MAF), torque converter lock-up clutch solenoid (TCC), transmission range sensor (TR-Sensor), 3-2 shift/coast clutch solenoid (CCS)	- Perform torque converter lock-up clutch operation test; refer to Road Test Vehicle.
	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

GEARSHIFT: ABRUPT

314 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Automatic transmission fluid	
- Not filled to correct level	- Adjust fluid to correct level.
- Condition	- Inspect; refer to Check Fluid Level and Condition.
CV Joint/Front axle driveshaft and Joints	
- Damaged, loose, splines damaged	- Check for damage and repair as necessary.
Powertrain bearing	
- Damaged, loose, missing	- Check for damage and repair as necessary.
Incorrect pressures	

DIAGNOSIS AND TESTING (Continued)

314 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
- High line pressure	- Measure the operating pressure using a pressure connection at the mainline pressure blanking plug. Test the operating pressure and perform a stall speed test; for data refer to reference table no. 401, transmission fluid pressures. If the operating pressures are high or if all the shifts are harsh, continue with the test of the valve body.
	- If pressures are OK and only a specific shift is harsh, refer to the appropriate shift routine for additional diagnosis.
	- Shift 1-2, Routine 232/332
	- Shift 2-3, Routine 233/333
	- Shift 3-4, Routine 234/334
	- Shift 4-3, Routine 235/335
	- Shift 3-2, Routine 236/336
	- Shift 2-1, Routine 237/337
Main Controls	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
Damaged gaskets	- Check for damage and repair as necessary.
- Main regulator valve, bypass valve or the line modulator valve is sticking, damaged or incorrectly assembled. springs caught, missing, damaged	- Check for damage and repair as necessary.
- EPC solenoid stuck or damaged	- Check for damage or contamination. Operate the solenoid valve using the transmission testing equipment, repair as necessary.
- Hydraulic passages damaged	- Check for damage and repair as necessary.
- Separator plate damaged, blocked	- Check for damage and repair as necessary.
Torque Converter Assembly	NOTE: If the TCC is engaged during shifts:
- Piston damaged	- Check for damage and repair as necessary.
- Pump hub seal No. 1 (CBY circuit) leaking, missing or damaged	- Check for damage and repair as necessary.
- Case leaking	- Check for damage and repair as necessary.
- Converter assembly damaged	- If heat stained, renew converter.

SHIFT CONCERNS: NO 1ST GEAR, ENGAGES IN HIGHER GEAR

215 Electrical System	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs, vehicle wiring looms, PCM, shift valve, transmission range sensor (TR sensor)	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

SHIFT CONCERNS: NO 1ST GEAR, ENGAGES IN HIGHER GEAR

315 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
External Shift Linkages	

DIAGNOSIS AND TESTING (Continued)

315 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
- Damaged, out of adjustment or incorrectly assembled	- Check for correct adjustment and repair as necessary. Ensure correct adjustment of the gear shift; refer to the adjustment procedure. After completing the repair, make sure that the transmission range sensor (TR sensor) is correctly adjusted; refer to Transmission, Assembly.
Main Controls	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
Damaged gaskets	- Check for damage and repair as necessary.
- 2nd gear regulator valve, solenoid regulator valve, shift valves stuck, damaged, incorrectly installed	- Check for damage and repair as necessary.
- Solenoid filter seal damaged or fitted incorrectly	- Check for damage and repair as necessary.
- Hydraulic passages damaged	- Check for damage and repair as necessary.
- SS1, SS2 solenoid not functioning	Operate the solenoid valve using the transmission testing equipment, repair as necessary.
Use the transmission testing equipment for diagnosing a specific gear	
	- Refer to the following routines:
	- Shift 1-2, Routine 220/320
	- Shift 2-3, Routine 221/321
	- Shift 3-4, Routine 222/322
Mechanical	
- Seals, clutches damaged, worn	- Refer to the dismantling routine, repair as necessary.
- Direct clutch, 2/4 band, 2/4 servo damaged, stuck on	- Refer to the dismantling routine, repair as necessary.

SHIFT CONCERNS: NO MANUAL 1ST GEAR

216 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs, vehicle wiring looms, PCM, shift valve, transmission range sensor (TR sensor)	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

SHIFT CONCERNS: NO MANUAL 1ST GEAR

316 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Internal and External Shift Linkages	
- Damaged, out of adjustment or incorrectly assembled	- Check and repair as necessary. Ensure correct adjustment of the gear shift; refer to the adjustment procedure. After completing the repair, make sure that the transmission range sensor (TR sensor) is correctly adjusted; refer to Automatic Transmission, Assembly.
Main Controls	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
Damaged gaskets	- Inspect for damage, Renew as required.

DIAGNOSIS AND TESTING (Continued)

316 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
- 2nd gear pull-in valve stuck, damaged	- Inspect for damage, Renew as required.
- SS2 stuck "on"	Operate the solenoid valve using the transmission testing equipment, repair as necessary.
- Hydraulic passages damaged	- Check for damage and repair as necessary.
Separator plates damaged, blocked	- Check for damage and repair as necessary.

SHIFT CONCERNS: NO 1-2 SHIFT (AUTOMATIC)

220 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs, vehicle wiring looms, PCM, shift valve, transmission range sensor (TR sensor)	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

SHIFT CONCERNS: NO 1-2 SHIFT (AUTOMATIC)

320 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Incorrect pressures	
- Line pressure	- Measure the operating pressure using a pressure connection at the mainline pressure blanking plug. Test the operating pressure and perform a stall speed test; for data refer to reference table no. 401, transmission fluid pressures. If not OK, check the following component: Valve body
Main Control	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
Damaged gaskets	- Check for damage. Renew as necessary.
- 1-2 shift valve, 2-4 accumulator, main regulator valve stuck, damaged, or incorrectly installed	- Check for damage. Renew as necessary.
- SS1 not functioning correctly	- Check for damage. Operate the solenoid valve using the transmission testing equipment.
- Pressure plate/gasket damaged	- Check for damage. Renew as necessary.
- Separator plates damaged	- Check for damage. Renew as necessary.
- Hydraulic passages damaged	- Check for damage. Renew as necessary.
INT/OD Band and Servo Assembly	NOTE: Also no 4th gear.
- Seals damaged, missing	- Check for damage. Renew as necessary.
- Piston damaged	- Check for damage. Renew as necessary.
- Band damaged	- Check for damage. Renew as necessary.
- Springs damaged	- Check for damage. Renew as necessary.
- Servo rod or rod bore damaged	- Check for damage. Renew as necessary.
Clutch - Low One-Way	
- Assembly	- Check for damage. Renew as necessary.
OD/Reverse Sun Gear and Shell	
- Damaged, weld broken	- Check for damage. Renew as necessary.
- Lugs damaged	- Check for damage. Renew as necessary.
Case	

SHIFT CONCERNS: NO 2-3 SHIFT (AUTOMATIC)

DIAGNOSIS AND TESTING

221 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs, vehicle wiring looms, PCM, shift valve, transmission range sensor (TR sensor)	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

SHIFT CONCERNS: NO 2-3 SHIFT (AUTOMATIC)

321 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Incorrect pressures	
- Line pressure	- Measure the operating pressure using a pressure connection at the mainline pressure blanking plug. Test the operating pressure; for data refer to reference table no. 401, transmission fluid pressures. If not OK, check the following components: Valve body
Main Control	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Gasket leaks	- Check for damage and repair as necessary.
- 2-3 shift valve (also no 4th), main regulator valve stuck, damaged, incorrectly installed	- Check for damage and repair as necessary.
- SS2 not functioning correctly (also no 4th)	- Check for damage. Operate the solenoid valve using the transmission testing equipment.
- Separator plates damaged	- Check for damage and repair as necessary.
- Pressure plate/gasket leaks	- Check for damage and repair as necessary.
- Hydraulic passages damaged	- Check for damage and repair as necessary.
Pump Assembly	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
Damaged gaskets	- Check for damage and repair as necessary.
- Porosity/cross-leaks	- Check for damage and repair as necessary.
- Pump hub seal rings nos. 4 or 5 damaged	- Check for damage and repair as necessary.
Direct Clutch Assembly	
- Seals or piston damaged	- Perform Air Pressure Tests.
- Piston bore damaged	- Check for damage and repair as necessary.
- Friction plates severely damaged, worn	- Check for damage and repair as necessary.
- Ball check not seating correctly	- Check for damage and repair as necessary.
Compression spring	- Check for damage and repair as necessary.
- Cylinder bore/splines damaged	- Check for damage and repair as necessary.
- Shell/hub damaged	- Check for damage and repair as necessary.
INT/OD Servo	
- Piston or piston bore damaged	- Check for damage and repair as necessary.
- Rod bore or rod damaged, leaking	- Check for damage and repair as necessary.
Case	
- Leak in the servo apply, servo release or direct clutch circuits.	Check the casing for damage. Perform an air pressure test. Repair or renew as necessary.

SHIFT CONCERNS: NO 3-4 SHIFT (AUTOMATIC)

222 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	

DIAGNOSIS AND TESTING (Continued)

222 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
- Electrical inputs/outputs, vehicle wiring looms, PCM, shift valve, transmission range sensor (TR sensor),TCS	- perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

SHIFT CONCERNS: NO 3-4 SHIFT (AUTOMATIC)

322 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Incorrect pressures	
- Line pressure	- Measure the operating pressure using a pressure connection at the mainline pressure blanking plug. Test the operating pressure; for exact data refer to reference table no. 401, transmission fluid pressures. If outside the specified values, check the valve body.
Main Control	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Gasket leaks	- Check for damage and repair as necessary.
- 3-4 shift valve, main regulator valve stuck, damaged or incorrectly installed	- Check for damage and repair as necessary.
- SS1 not functioning correctly (also no 1st)	Operate the solenoid valve using the transmission testing equipment, repair as necessary.
- Separator plates damaged or orifice blocked	- Check for damage and repair as necessary.
INT/OD band and Servo Assembly	NOTE: Also no 2nd gear.
- INT/OD band damaged, worn	- Check for damage and repair as necessary.
- Servo rod or rod bore damaged	- Check for damage and repair as necessary.
- Servo piston or cover damaged or leaking	- Check for damage and repair as necessary.
- Springs damaged	- Check for damage and repair as necessary.
Coast Clutch Assembly	
- Seals damaged, missing	- Check for damage and repair as necessary.
- Piston damaged	- Check for damage and repair as necessary.
- Friction plates severely damaged, worn	- Check for damage and repair as necessary.
- Check ball severely damaged	- Check for damage and repair as necessary.
Forward One-Way Clutch	
- Damaged	- Check for damage and repair as necessary.
Case	NOTE: Also no 2nd gear.
- Band anchor damaged	- Check for damage. Perform Air Pressure Tests.
- Leak in the servo apply and servo release circuits	- Check for damage and repair as necessary.

SHIFT CONCERNS: SOFT/SLIP 1-2 SHIFT ONLY (AUTOMATIC)

226 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs, vehicle wiring harnesses, PCM, electronic pressure control (EPC) solenoid, transmission fluid temperature (TFT) sensor	- Perform diagnosis using the Diagnostic Tool. Perform the stall speed test, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

SHIFT CONCERNS: SOFT/SLIP 1-2 SHIFT ONLY (AUTOMATIC)

DIAGNOSIS AND TESTING

326 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Main Control	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
Damaged gaskets	- Check for damage and repair as necessary.
- 2-4 accumulator piston plug and seal (also soft 3-4 shift), main regulator valve, line modulator valve (also soft 3-4 shift) stuck, damaged or incorrectly installed	- Check for damage and repair as necessary.
- Hydraulic passages damaged	- Check for damage and repair as necessary.
- Pressure plate/gasket damaged	- Check for damage and repair as necessary.
- Separator plates damaged	- Check for damage and repair as necessary.
INT/OD Band and Servo Assembly	
- Piston not tightened to correct torque	- Check for damage and repair as necessary.
- Servo rod or rod bore damaged	- Check for damage and repair as necessary.
- 2/4 brake band and/or reverse clutch drum assembly worn, damaged or incorrectly assembled	- Check for damage and repair as necessary.
- Springs damaged	- Check for damage and repair as necessary.
- Servo cover and seal damaged	- Check for damage and repair as necessary.
Forward OWC Assembly (slips in 1st)	
- Not holding or damaged	- Check for damage and repair as necessary.
Forward Clutch Assembly (slips in 1st)	- Perform Air Pressure Test.
Damaged gaskets	- Check for damage and repair as necessary.
- Return spring damaged	- Check for damage and repair as necessary.
- Friction plates damaged	- Check for damage and repair as necessary.
- Pump hub seals nos. 3 or 4 damaged	- Check for damage and repair as necessary.
Low OWC Assembly	
- Not overrunning, damaged	- Check for damage and repair as necessary.
Low Reverse Clutch Assembly	
- Friction plates severely damaged	- Check for damage and repair as necessary.
Case	
- Band anchor damaged	
- Porosity/leaks in the servo apply and servo release circuits	

SHIFT CONCERNS: SOFT/SLIP 2-3 SHIFT ONLY (AUTOMATIC)

227 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs, vehicle wiring harnesses, PCM, electronic pressure control (EPC) solenoid, transmission fluid temperature (TFT) sensor	- perform diagnosis using the Diagnostic Tool. Perform the stall speed test, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

SHIFT CONCERNS: SOFT/SLIP 2-3 SHIFT ONLY (AUTOMATIC)

327 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Pump Assembly	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
Damaged gaskets	- Check for damage. Renew as necessary.
- Pump hub seal rings No. 4 or No. 5 damaged	- Check for damage. Renew as necessary.
Main Control Valve Body Assembly	

DIAGNOSIS AND TESTING (Continued)

327 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Gasket leaks	- Check for damage. Renew as necessary.
- System pressure modulator valve (also soft 1-2 and 3-4 shifts), servo release shuttle valve stuck, damaged or incorrectly installed	- Check for damage. Renew as necessary.
- Hydraulic passages damaged	- Check for damage. Renew as necessary.
- Separator plates damaged	- Check for damage. Renew as necessary.
- Pressure plate/gasket leaks	- Check for damage. Renew as necessary.
Direct Clutch	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Seals or pistons damaged	- Check for damage. Renew as necessary.
- Friction plates damaged, worn or excessive end clearance	- Check for damage. - Check the end float and repair as necessary.
- Check ball not seating correctly	- Check for damage. Renew as necessary.
- Return spring damaged	- Check for damage. Renew as necessary.
INT/OD Servo	
- Piston or piston bore damaged	- Check for damage. Renew as necessary.
- Servo rod or rod bore damaged	- Check for damage. Renew as necessary.
Case	
- Leak in the servo apply, servo release or direct clutch circuits	Check the casing for damage. - Perform Air Pressure Test.
Forward One-Way Clutch	
- Not holding, damaged	- Check for damage. Renew as necessary.

SHIFT CONCERNS: SOFT/SLIP 3-4 SHIFT ONLY (AUTOMATIC)

228 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs, vehicle wiring harnesses, PCM, electronic pressure control (EPC) solenoids, transmission fluid temperature (TFT) sensor	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

SHIFT CONCERNS: SOFT/SLIP 3-4 SHIFT ONLY (AUTOMATIC)

328 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Main Control	
- Bolts not tightened to correct torque	- Tighten bolts to specifications.
- Gasket leaks	- Check for damage. Renew as necessary.
- System pressure modulator valve, 2-4 accumulator valve plug and seal (also soft 1-2 shift), stuck, damaged or incorrectly installed	- Check for damage. Renew as necessary.
- Pressure plate/gasket leaks	- Check for damage. Renew as necessary.
- Hydraulic passages damaged	- Check for damage. Renew as necessary.
- Separator plates damaged or orifice blocked	- Check for damage. Renew as necessary.
INT/OD Band and Servo Assembly	- Check for damage. Renew as necessary.
- 2/4 brake band and/or reverse clutch drum assembly worn, damaged or incorrectly assembled	- Check for damage. Renew as necessary.
- Piston, seals or piston bore damaged, missing	- Check for damage. Renew as necessary.

DIAGNOSIS AND TESTING (Continued)

328 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
- Servo cover or seal damaged	Perform an, air pressure test. Check for damage and repair as necessary.
- Servo rod or rod bore damaged	- Check for damage. Renew as necessary.
- Springs damaged	- Check for damage. Renew as necessary.
Clutch - Direct	NOTE: Slipping may occur in 3rd gear. - Perform Air Pressure Test.
- Seals damaged, missing	- Check for damage. Renew as necessary.
- Piston damaged	- Check for damage. Renew as necessary.
- Check ball damaged, missing or leaking	- Check for damage. Renew as necessary.
- Return spring damaged	- Check for damage. Renew as necessary.
- Friction plates damaged	- Check for damage. Renew as necessary.
Case	
- Band anchor damaged	- Check for damage. Renew as necessary.
- Leak in the servo apply and servo release circuits	- Check for damage. Perform an air pressure test, renew as necessary.

SHIFT CONCERNS: SOFT/SLIP 4-3 SHIFT ONLY (AUTOMATIC)

229 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs, vehicle wiring harnesses, PCM, electronic pressure control (EPC) solenoid, vehicle speed sensor, MAF sensor, throttle position sensor (TPS).	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

SHIFT CONCERNS: SOFT/SLIP 4-3 SHIFT ONLY (AUTOMATIC)

329 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Main Control	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Gasket leaks	- Check for damage and repair as necessary.
- Servo release shuttle valve, main regulator valve stuck, damaged or incorrectly installed	- Check for damage and repair as necessary.
- Hydraulic passages damaged	- Check for damage and repair as necessary.
- Pressure plate/gasket leaks, or damaged	- Check for damage and repair as necessary.
Separator plates damaged, blocked	- Check for damage and repair as necessary.
INT/OD Band and Servo Assembly	
- 2/4 brake band and reverse clutch drum assembly worn, damaged, or incorrectly assembled	- Check for damage and repair as necessary.
- Servo return spring broken	- Check for damage and repair as necessary.
- Servo rod damaged	- Check for damage and repair as necessary.
- Piston seal damaged	- Check for damage and repair as necessary.
Direct Clutch Assembly	
- Seals damaged, missing	- Perform Air Pressure Test.
	- Check for damage and repair as necessary.
- Piston damaged	- Check for damage and repair as necessary.
- Check ball damaged, missing or leaking	- Check for damage and repair as necessary.
- Return spring damaged	- Check for damage and repair as necessary.
- Friction plates damaged	- Check for damage and repair as necessary.

DIAGNOSIS AND TESTING (Continued)

329 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Forward/Coast Clutch Assembly	
- Seals damaged, missing	- Perform Air Pressure Test.
	- Check for damage and repair as necessary.
- Piston damaged	- Check for damage and repair as necessary.
- Friction plates worn, damaged	- Check for damage and repair as necessary.
- Check ball not functioning	- Check for damage and repair as necessary.
- Forward clutch piston and return spring damaged	- Check for damage and repair as necessary.
Case	
- Porosity/leaks in the servo apply, servo release and direct clutch circuits	- Check for damage. Perform an air pressure compressed air test.

SHIFT CONCERNS: SOFT/SLIP 3-2 SHIFT ONLY (AUTOMATIC)

230 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs, vehicle wiring harnesses, PCM, electronic pressure control (EPC) solenoid, throttle position sensor (TPS), vehicle speed sensor (VSS), MAF sensor, 3-2 timing coast clutch solenoid (CCS)	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

SHIFT CONCERNS: SOFT/SLIP 3-2 SHIFT ONLY (AUTOMATIC)

330 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Main Control	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Gasket damaged	- Check for damage. Renew as necessary.
- 3-2 timing valve, solenoid regulator valve, 3-2 control valve stuck, damaged or incorrectly installed	- Check for damage and repair as necessary.
- 3-2T/CCS solenoid not functioning correctly	Operate the solenoid valve using the transmission testing equipment, repair as necessary.
- Pressure plate/gasket leaks, or damaged	- Check for damage and repair as necessary.
Separator plates damaged, blocked	- Check for damage and repair as necessary.
Direct clutch	
- Return spring damaged, broken	- Perform Air Pressure Test.
	- Check for damage and repair as necessary.
- Friction plates damaged, worn	- Check for damage and repair as necessary.
- Ball check not releasing	- Check for damage and repair as necessary.
- Piston or seal damaged	- Check for damage and repair as necessary.
INT/OD Band and Servo Assembly	
- 2/4 band and/or reverse clutch drum assembly worn, damaged or incorrectly assembled	- Check for damage and repair as necessary.
- Servo piston damaged	- Check for damage and repair as necessary.
- Servo return and cushion springs damaged, incorrectly assembled	- Check for damage and repair as necessary.
- Springs damaged, incorrectly assembled	- Check for damage and repair as necessary.
- Servo rod bent, damaged	- Check for damage and repair as necessary.
Pump Assembly	
- Bolts not tightened to correct torque	- Tighten bolts to specification.

DIAGNOSIS AND TESTING (Continued)

330 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Damaged gaskets	- Check for damage. Renew as necessary.
- Porosity/cross-leaks	- Check for porosity and leaks. Renew the pump if necessary.
- Pump hub seal rings nos. 4, 5, 6 damaged or incorrectly installed	- Check for damage and repair as necessary.
- Leak in the forward gear line to the direct gear line	- Check for damage and repair as necessary.
Case	
- Band anchor damaged	- Check for damage and repair as necessary.
- Leaks in the servo apply and servo release circuits	- Check for damage. Perform an air pressure test. Repair as necessary.
- Case bore damaged (servo rod)	- Check for damage and repair as necessary.

SHIFT CONCERNS: SOFT/SLIP 2-1 SHIFT ONLY (AUTOMATIC OR KICKDOWN)

231 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs, vehicle wiring harnesses, PCM, electronic pressure control (EPC) solenoid, transmission fluid temperature (TFT) sensor, throttle position sensor (TPS), MAF sensor.	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

SHIFT CONCERNS: SOFT/SLIP 2-1 SHIFT ONLY (AUTOMATIC OR KICKDOWN)

331 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Pump Assembly	
Damaged gaskets	- Check for damage. Renew as necessary.
- Porosity/cross-leaks	- check for leaks/porosity. Renew as necessary.
- Pump hub seals nos. 3 or 4 leaking, incorrectly installed, damaged	- Check for damage and repair as necessary.
Intermediate OD Servo and Band Assembly	
- Servo piston damaged	- Check for damage and repair as necessary.
- Servo piston return spring damaged	- Check for damage and repair as necessary.
Forward Clutch Assembly	- Perform Air Pressure Test.
- Piston or seals damaged	- Perform Air Pressure Test.
	- Check for damage and repair as necessary.
- Friction plates damaged	- Check for damage and repair as necessary.
Low OWC	
- Damaged, not holding	- Check for damage and repair as necessary.

SHIFT CONCERNS: HARSH 1-2 SHIFT ONLY (AUTOMATIC)

232 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	

DIAGNOSIS AND TESTING (Continued)

232 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
- Electrical inputs/outputs, vehicle wiring looms, PCM, electronic pressure control solenoid (EPC), transmission fluid temperature sensor (TFT), vehicle speed sensor (VSS), turbine shaft speed sensor (TSS), throttle position sensor (TPS), mass air flow sensor (MAF), torque converter clutch solenoid (TCC), transmission range sensor (TR-Sensor)	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool. Perform the stall speed test.

SHIFT CONCERNS: HARSH 1-2 SHIFT ONLY (AUTOMATIC)

332 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Main Control	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Gasket leaks	- Check for damage. Renew as necessary.
- 2-4 accumulator valve, 3-2 control valve (also harsh 3-4 shift) stuck, damaged or incorrectly installed	- Check for damage and repair as necessary.
- Separator plates damaged	- Check for damage and repair as necessary.
- Hydraulic passages damaged	- Check for damage and repair as necessary.
Pump Assembly	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Gasket damaged	- Check for damage. Renew as necessary.
- Pump hub seal rings, nos. 3 or 4, damaged	- Check for damage and repair as necessary.
- Porosity/cross-leaks	- Check for damage and repair as necessary.
INT/OD Band and Servo Assembly	
- Cushion return springs damaged	- Check for damage and repair as necessary.
- INT/OD band damaged, worn	- Check for damage and repair as necessary.
- 2/4 brake band and/or reverse clutch drum assembly worn, damaged or incorrectly assembled	- Check for damage and repair as necessary.
Forward Clutch Assembly	
Damaged gaskets	- Perform Air Pressure Test.
	- Check for damage and repair as necessary.
- Return spring damaged	- Check for damage and repair as necessary.
- Friction plates damaged	- Check for damage and repair as necessary.
Case	
- Band anchor area damaged	- Check for damage. If damaged, renew the housing.

SHIFT CONCERNS: HARSH 2-3 SHIFT ONLY (AUTOMATIC)

233 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- electrical inputs/outputs, vehicle wiring looms, PCM, electronic pressure control solenoid (EPC), transmission range sensor (TR sensor), vehicle speed sensor (VSS), transmission fluid temperature sensor (TFT), mass air flow sensor (MAF), torque converter clutch solenoid (TCC), turbine shaft speed sensor (TSS).	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

DIAGNOSIS AND TESTING

SHIFT CONCERNS: HARSH 2-3 SHIFT ONLY (AUTOMATIC)

333 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Main Control	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Gasket leaks	- Check for damage. Renew as necessary.
- System pressure modulator valve (also 1-2 and 3-4 harsh shift), servo release shuttle valve stuck, damaged or incorrectly installed	- Check for damage and repair as necessary.
- Separator plates damaged	- Check for damage and repair as necessary.
- Hydraulic passages damaged	- Check for damage and repair as necessary.
Pump Assembly	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Gasket damaged	- Check for damage. Renew as necessary.
- Porosity/cross-leaks	- Check for damage and repair as necessary.
- Pump hub seal rings nos. 4 or 5 damaged	- Check for damage and repair as necessary.
Direct clutch	
- Piston or piston bore damaged	- Perform Air Pressure Test.
	- Check for damage and repair as necessary.
- Friction plates damaged, worn	- Check for damage and repair as necessary.
- Ball check not seating correctly	- Check for damage and repair as necessary.
- Return spring damaged	- Check for damage and repair as necessary.
- Clutch cylinder splines damaged	- Check for damage and repair as necessary.
INT/OD Servo	
- Servo piston or piston bore damaged	- Check for damage and repair as necessary.
- Servo rod damaged	- Check for damage and repair as necessary.
Case	
- Leaks in the servo apply, servo release or direct clutch circuits	Check the casing for damage. Perform an air pressure test. Repair or renew the housing as necessary.
- Servo rod bore damaged	- Check for damage and repair as necessary.

SHIFT CONCERNS: HARSH 3-4 SHIFT ONLY (AUTOMATIC)

234 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs, vehicle wiring looms, PCM, electronic pressure control solenoid (EPC), vehicle speed sensor (VSS),3-2 shift/coast clutch solenoid (CCS), transmission range sensor (TR-Sensor), transmission fluid temperature sensor (TFT), turbine shaft speed sensor (TSS), throttle position sensor (TPS), mass air flow sensor (MAF), torque converter clutch solenoid (TCC)	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

SHIFT CONCERNS: HARSH 3-4 SHIFT ONLY (AUTOMATIC)

334 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Main Control	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Gasket leaks	- Check for damage. Renew as necessary.

DIAGNOSIS AND TESTING (Continued)

334 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
- System pressure modulator valve (also 1-2 and 2-3 harsh shift), 3-2 control valve, 2-4 accumulator valve, coast clutch valve, stuck, damaged or incorrectly installed	- Check for damage and repair as necessary.
- Hydraulic passages damaged	- Check for damage and repair as necessary.
Separator plates damaged, blocked	- Check for damage and repair as necessary.
Pump Assembly	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
Damaged gaskets	- Check for damage. Renew as necessary.
- Porosity/cross-leaks	- Check for damage and repair as necessary.
- Coast clutch Teflon seals damaged	- Check for damage. Renew as necessary.
INT/OD Band and Servo Assembly	
- 2/4 band and reverse clutch drum assembly, damaged, worn, incorrectly assembled	- Check for damage and repair as necessary.
- Servo piston or cover damaged or leaking	- Check for damage and repair as necessary.
- Springs damaged	- Check for damage and repair as necessary.
Coast Clutch Assembly	
- Piston or seals damaged, missing	- Check for damage and repair as necessary.
- Friction plates damaged, worn	- Check for damage and repair as necessary.
- Check ball not functioning	- Check for damage and repair as necessary.
Direct Clutch Assembly	
- Piston or seals damaged, missing	- Perform Air Pressure Test.
	- Check for damage and repair as necessary.
- Check ball damaged, missing or leaking	- Check for damage and repair as necessary.
- Return spring damaged	- Check for damage and repair as necessary.
- Friction plates damaged	- Check for damage and repair as necessary.
- Clutch cylinder splines damaged	- Check for damage and repair as necessary.
Case	
- Band anchor damaged	- Check for damage and repair as necessary.

SHIFT CONCERNS: HARSH 4-3 SHIFT ONLY (AUTOMATIC)

235 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs, vehicle wiring looms, PCM, electronic pressure control solenoid (EPC), transmission range sensor (TR-Sensor), vehicle speed sensor (VSS),3-2 shift/coast clutch solenoid (CCS), transmission fluid temperature sensor (TFT), turbine shaft speed sensor (TSS), throttle position sensor (TPS), mass air flow sensor (MAF), torque converter clutch solenoid (TCC)	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

SHIFT CONCERNS: HARSH 4-3 SHIFT ONLY (AUTOMATIC)

335 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Main Control	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Gasket leaks	- Check for damage. Renew as necessary.

DIAGNOSIS AND TESTING (Continued)

335 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
- Servo release shuttle valve, 3-2 timing/coast valve stuck, damaged or incorrectly installed	- Check for damage and repair as necessary.
- Hydraulic passages damaged	- Check for damage and repair as necessary.
Separator plates damaged, blocked	- Check for damage and repair as necessary.
Pump Assembly	
- Bolts not tightened to correct torque	-Tighten bolts to specification.
- Porosity/cross-leaks, seal rings damaged, missing or leaking ball plug	- Check for damage. Renew the pump if necessary.
- Gasket damaged	- Check for damage. Renew as necessary.
- Seal rings nos. 2, 3, 4 or 5 (coast and direct clutch circuits)	- Check for damage and repair as necessary.
- Pump hub damaged	- Check for damage and repair as necessary.
INT/OD Band and Servo Assembly	
- Servo rod bent, damaged	- Check for damage and repair as necessary.
- Servo return spring broken	- Check for damage and repair as necessary.
Coast Clutch Assembly	
- Seals damaged, missing	- Check for damage. Repair where necessary.
- Piston damaged	- Check for damage. Repair where necessary.
- Friction plates worn, damaged	- Check for damage. Repair where necessary.
- Check ball not functioning	- Check for damage. Repair where necessary.
- Forward clutch piston and return spring damaged	- Check for damage. Repair where necessary.
Case	
- Porosity/leaks in the servo apply, servo release and direct clutch circuits.	- Check for damage. Perform an air pressure test. Repair as necessary.

SHIFT CONCERNS: HARSH 3-2 SHIFT ONLY (AUTOMATIC)

236 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs, vehicle wiring looms, PCM, electronic pressure control solenoid (EPC), transmission range sensor (TR-Sensor), vehicle speed sensor (VSS),3-2 shift/coast clutch solenoid (CCS), transmission fluid temperature sensor (TFT), turbine shaft speed sensor (TSS), throttle position sensor (TPS), mass air flow sensor (MAF), torque converter clutch solenoid (TCC)	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

SHIFT CONCERNS: HARSH 3-2 SHIFT ONLY (AUTOMATIC)

336 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Main Control	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Gasket damaged	- Check for damage. Renew as necessary.
- 3-2 timing valve, solenoid regulator valve, 3-2 control valve stuck, damaged, incorrectly installed	- Check for damage and repair as necessary.
- Hydraulic passages damaged	- Check for damage and repair as necessary.
- Separator plates damaged or blocked	- Check for damage and repair as necessary.

DIAGNOSIS AND TESTING (Continued)

336 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
- 3-2T/CCS solenoid not functioning correctly	Operate the solenoid valve using the transmission testing equipment. If the coast clutch operation is OK, continue diagnosis on the direct clutch.
Direct Clutch Assembly	
- Return spring damaged, broken	- Perform Air Pressure Test.
	- Check for damage and repair as necessary.
- Friction plates damaged, worn	- Check for damage and repair as necessary.
- Check ball not opening	- Check for damage and repair as necessary.
INT/OD Band and Servo Assembly	
- INT/OD band and/or reverse clutch drum assembly damaged, worn or incorrectly assembled	- Check for damage and repair as necessary.
- Servo piston damaged	- Check for damage and repair as necessary.
- Servo return and cushion springs damaged, incorrectly assembled	- Check for damage and repair as necessary.
- Springs damaged, incorrectly assembled	- Check for damage and repair as necessary.
- Servo rod bent or damaged	- Check for damage and repair as necessary.
Pump Assembly	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
Damaged gaskets	- Check for damage. Renew as necessary.
- Porosity/cross-leaks	- Check for porosity and leaks. Renew as necessary.
- Pump hub seal rings damaged or incorrectly installed	- Check for damage and repair as necessary.
Case	
- Band anchor damaged	- Check for damage and repair as necessary.
- Servo rod bore damaged	- Check for damage and repair as necessary.

TORQUE CONVERTER OPERATION CONCERNS: NO APPLY

240 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs, vehicle wiring harnesses, PCM, transmission fluid temperature (TFT) sensor, torque converter clutch (TCC) solenoid, brake on/off (BOO) switch, turbine shaft speed (TSS) sensor.	- Perform torque converter clutch operation test; refer to Road Test Vehicle. - Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

TORQUE CONVERTER OPERATION CONCERNS: NO APPLY

340 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Main Control	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Gasket damaged	- Check for damage. Renew as necessary.
- Solenoid pressure regulator valve, bypass clutch control valve and plunger, converter regulator valve stuck, damaged, incorrectly installed	- Check for damage and repair as necessary.
- TCC solenoid not functioning correctly	Operate the solenoid valve using the transmission testing equipment, repair as necessary.
- Hydraulic passages damaged	- Check for damage. Renew as necessary.
- Separator plates damaged or blocked	- Check for damage and repair as necessary.

DIAGNOSIS AND TESTING (Continued)

340 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Torque Converter	
- Leakage, internal damage	- Check for damage and leaks. - Perform torque converter clutch operation test; refer to Road Test Vehicle. Renew as necessary.

TORQUE CONVERTER OPERATION CONCERN: ALWAYS APPLIED/STALLS VEHICLE

241 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs, vehicle wiring harnesses, powertrain control module (PCM), transmission fluid temperature (TFT) sensor, TCC solenoid	- Perform torque converter clutch operation test; refer to Road Test Vehicle. - Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

TORQUE CONVERTER OPERATION CONCERN: ALWAYS APPLIED/STALLS VEHICLE

341 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Main Control	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Gasket damaged	- Check for damage. Renew as necessary.
- Bypass clutch control valve and plunger (always applied), converter regulator valve stuck, damaged, incorrectly installed	- Check for damage and repair as necessary.
Separator plates damaged, blocked	- Check for damage and repair as necessary.
- TCC solenoid not functioning correctly. NOTE: Converter clutch not applied in 1st gear or reverse gear	Operate the solenoid valve using the transmission testing equipment, repair as necessary.
- Pressure plate/gasket damaged	- Check for damage and repair as necessary.
- Hydraulic passages damaged	- Check for damage and repair as necessary.
Pump Assembly	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
Damaged gaskets	- Check for damage. Renew as necessary.
- Pump hub No. 1 seal ring damaged, missing, incorrectly installed	- Check for damage and repair as necessary.
Torque Converter Assembly	
- Internal seals damaged	- Check for damage and repair as necessary.
- Piston plate damaged/stuck to cover	- If cover is heat stained, renew torque converter.
Case	
- Porosity/cross-leaks from the clutch bypass circuit	- Check for leaks/porosity, repair or renew as necessary.

OTHER CONCERNS: SHIFT LEVER EFFORT IS HIGH

351 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Brake Shift Interlock	- Refer to diagnostic procedure.
Internal and External Shift Linkages	

DIAGNOSIS AND TESTING (Continued)

351 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
- Damaged, out of adjustment or incorrectly assembled	- Check and repair as necessary. Ensure correct adjustment of the gear shift; refer to the adjustment procedure. After completing the repair, make sure that the transmission range sensor (TR sensor) is correctly adjusted; refer to the procedure during adjustment.
- Manual selector lever damaged, park inhibitor mechanism damaged, shaft bent, detent lever shaft bore (in case) damaged, detent spring bent/damaged, nut loose	- Check for damage and repair as necessary.
Main Control	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Manual valve stuck, damaged	- Check for damage and repair as necessary.

OTHER CONCERNS: EXTERNAL LEAKS

352 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Fluid	
- Not filled to correct level	- Adjust fluid to correct level.
Seals/Gaskets	
- Differential seals, speedometer drive pinion, retainer seal, pump assembly, main control cover, servo cover, split flange gasket, converter impeller hub, selector lever shaft seal, fluid level indicator tube	- Locate the leak, repair as necessary. If the leak is at the differential seal or impeller hub, check the return holes in the housing/converter housing, check the surface of the linkshaft or front axle driveshaft and joint for roughness. Surface roughness can lead to seal failure, repair as necessary.
Other	
- Fluid tube bracket, mainline pressure plug, pressure port plugs, drain plug, cooler tubes, case porosity, cracked case	- Locate the leak, repair as necessary.
	Check vent for damage or blockage, repair as required.
	- Check for leaks and repair as necessary.
Sensors/Connectors	
- Transmission multiplug, transmission range sensor (TR sensor). Turbine shaft speed sensor (TSS) or seal	- Locate the leak, repair as necessary.

OTHER CONCERNS: POOR VEHICLE PERFORMANCE

253 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Base engine concerns	- Refer to diagnostic procedure in the Workshop Manual.
- Electrical inputs/outputs, vehicle wiring looms, PCM, transmission fluid temperature (TFT), torque converter clutch (TCC) solenoid, transmission range sensor (TR-Sensor), throttle position sensor (TPS)	- Perform torque converter clutch operation test; refer to Road Test Vehicle. - perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

OTHER CONCERNS: POOR VEHICLE PERFORMANCE

DIAGNOSIS AND TESTING

353 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Internal or external shift components or transmission range (TR sensor)	
- Damaged, out of adjustment or misassembly	- Check and repair as necessary. Ensure correct adjustment of the gear shift; refer to the adjustment procedure. After completing the repair, make sure that the transmission range sensor (TR sensor) is correctly adjusted; refer to the procedure during adjustment.
- Verify Proper Shift Timing and Engagements	
- Go to the appropriate diagnostic routines in the index	
Torque Converter Clutch Always Applied	- Go to Routine 341.
Torque Converter One-Way Clutch	
- Damaged	- Check the torque converter, repair or renew as necessary.

OTHER CONCERNS: NOISE/VIBRATION - FORWARD/REVERSE

354 - HYDRAULIC/MECHANICAL ROUTINES	
Possible Component	**Reference/Action**
For Noises/Vibrations That Change With Engine Speed:	
- Torque converter components	- Locate the source, repair as necessary.
- Fluid level (low) pump cavitation	
Pump Assembly	
- Engine drive accessories	
- Cooler tubes touching	
- Flywheel	
- Inspection cover	
For Noises/Vibrations that Change with Vehicle Speed:	
- Powertrain mounts loose, damaged	- Locate the source, repair as necessary. For specific shifts or torque converter concerns, refer to the routines in the index.
- Tires	
- Driveline concerns: front axle driveshaft and joint or linkshaft, differential: chain drive, suspension, non-standard modifications	
- Planetary gear sets	
- Chain touching the chain cover	- Inspect the chain cover for signs of damage or incorrect installation, repair as necessary.
Forward One-Way Clutch	
Torque Converter	
- LH and RH front axle driveshaft and joint splines worn, damaged	- Check for damage and repair as necessary.
- Front axle driveshafts or speedometer gears	
Other Noises/Vibrations:	
- Shift cable and bracket vibration, touching	- Locate the source, repair as necessary.
- Cooler lines touching bodywork	

OTHER CONCERNS: ENGINE WILL NOT CRANK

DIAGNOSIS AND TESTING

255 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Base engine concerns	- Refer to diagnostic procedure in the Workshop Manual.
- Electrical inputs/outputs, vehicle wiring looms, PCM, shift valves, transmission range sensor (TR sensor) damaged, incorrectly adjusted.	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

OTHER CONCERNS: ENGINE WILL NOT CRANK

355 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Starter/Flywheel	
- Damaged or incorrectly installed	- Check for damage, incorrect installation, repair as necessary.
Internal or external shift components or transmission range (TR sensor)	
- Damaged, out of adjustment or misassembly	Ensure correct adjustment of the gear shift; refer to the adjustment procedure. After completing the repair, make sure that the transmission range sensor (TR sensor) is correctly adjusted; refer to the procedure during adjustment.

OTHER CONCERNS: NO PARK RANGE

356 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Internal or External Shift Linkages	
- Damaged, out of adjustment or misassembly	- Check and repair as necessary. Ensure correct adjustment of the gear shift; refer to the adjustment procedure. After completing the repair, make sure that the transmission range sensor (TR sensor) is correctly adjusted. Refer to the procedure during adjustment.
Park Mechanism	- Check for damage and repair as necessary.
- Parking lock gear on the driven sprocket, parking pawl return spring, engagement springs	- Check for damage and repair as necessary.
- Parking pawl, parking pawl shaft, selector lever, cam plate drive dog, selector lever linkage spring, transmission range sensor (TR-Sensor), parking pawl drive plate, selector lever shaft nut damaged, missing or incorrectly fitted	- Check for damage and repair as necessary.

OTHER CONCERNS: TRANSAXLE OVERHEATING

257 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs, vehicle wiring harnesses, PCM, torque converter clutch (TCC) solenoid, transmission fluid temperature (TFT) sensor, turbine shaft speed (TSS) sensor	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool.

OTHER CONCERNS: TRANSAXLE OVERHEATING

DIAGNOSIS AND TESTING

357 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Vehicle Concerns Causing Engine Overheating	- Refer to diagnostic procedure.
Fluid	
- Not filled to correct level	- Adjust to correct level.
- Condition	- Inspect; refer to Check Fluid Level and Condition. If the fluid is foaming, check the thermovalve and filter seals and repair as necessary.
Cooler Tubes	
- Damaged, blocked, reversed	- Check for damage and repair as necessary.
Intake Cooler	
- Damaged, blocked, restricted or leaking	- Check for damage and repair as necessary.
Auxiliary Cooler (if equipped)	
- Damaged, blocked, restricted or leaking	- Check for damage or incorrect installation, repair as necessary.
Main Control	
- Bolts not tightened to correct torque	- Tighten bolts to specification.
- Main regulator valve, bypass clutch control valve, converter regulator valve stuck, damaged, incorrectly installed	- Check for damage and repair as necessary.
- Hydraulic passages damaged	- Check for damage and repair as necessary.
- Separator plates/gaskets damaged	- Check for damage and repair as necessary.
- TCC solenoid not functioning correctly (off)	Operate the solenoid valve using the transmission testing equipment, repair as necessary.
Torque Converter Clutch - No Apply	- Go to Routine 240/340
Pump Assembly	
- Gasket damaged	- Check for damage and repair as necessary.
- Rear lube passage blocked	- Check for damage and repair as necessary.
Chain Pan	
- Missing	- Check whether present. If missing, install.
Thermostatic Fluid Level Control Valve	
- Stuck open or damaged	- Check for damage and repair as necessary.
- Gasket damaged or missing	- Check for damage. Renew as necessary.
- Bolt or bracket damaged, missing, or incorrectly installed	- Check for damage and repair as necessary.
Case/Converter Housing/Stator Support	
- Front lube passage blocked or restricted	- Check passages, refer to Air Pressure Tests and Air Pressure Test Port Locations for identification of passages, repair as necessary.
- Torque converter lock-up clutch, timing passages blocked or restricted	

OTHER CONCERNS: NO ENGINE BRAKING IN MANUAL 1ST POSITION

258 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs, vehicle wiring harnesses, powertrain control module, 3-2 timing/coast clutch solenoid	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool. Perform the stall speed test.

OTHER CONCERNS: NO ENGINE BRAKING IN MANUAL 1ST POSITION

DIAGNOSIS AND TESTING

358 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Main Controls	
- Bolts out of specification	- Tighten bolts to specification.
Damaged gaskets	- Check for damage. Renew as necessary.
- Low/reverse modulator valve, coast clutch valve stuck, damaged or incorrectly installed	- Check for damage and repair as necessary.
- 3-2 timing/coast clutch solenoid stuck or damaged	- Check for damage or contamination. Operate the solenoid valve using the transmission testing equipment, repair as necessary.
- Hydraulic passages damaged	- Check for damage and repair as necessary.
- Pressure plate/gasket damaged	- Check for damage and repair as necessary.
- Separator plate/gasket damaged	- Check for damage and repair as necessary.
Coast Clutch	
- Incorrectly assembled, damaged	- Check for damage and repair as necessary.
- Forward clutch hub seal damaged	- Check for damage and repair as necessary.
- Piston or seals damaged	- Check for damage and repair as necessary.
- Ball check damaged, missing	- Check for damage and repair as necessary.
Low/reverse clutch	
- Incorrectly assembled, damaged	- Perform Air Pressure Test.
	- Check for damage and repair as necessary.
- Piston or seals damaged	- Check for damage and repair as necessary.
Pump Assembly	
- Pump hub seals number 2 or 3 for coast clutch circuit damaged, missing	- Check for damage and repair as necessary.

OTHER GEARSHIFT DIFFICULTIES: NO ENGINE BRAKING IN DRIVE (O/D SWITCH ON) OR SELECTOR LEVER POSITION "2".

259 - ELECTRICAL ROUTINE	
Possible Component	**Reference/Action**
Powertrain Control System	
- Electrical inputs/outputs, vehicle wiring harnesses, powertrain control module, 3-2 timing/coast clutch solenoid	- Perform diagnosis using the Diagnostic Tool, repair as necessary. Clear trouble codes, road test and check again using the Diagnostic Tool. Perform the stall speed test.

OTHER GEARSHIFT DIFFICULTIES: NO ENGINE BRAKING IN DRIVE (O/D SWITCH ON) OR SELECTOR LEVER POSITION "2".

359 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Internal or External Shift Linkages	
- Damaged, out of adjustment or incorrectly assembled	- Check and repair as necessary. Ensure correct adjustment of the gear shift; refer to the adjustment procedure. After completing the repair, make sure that the transmission range sensor (TR sensor) is correctly adjusted; refer to the procedure during adjustment.
Main Controls	
- 3-4 shift valve, 1-2 shift valve, 2nd gear control valve, coast clutch solenoid sticking or damaged	- Check for damage and repair as necessary.

DIAGNOSIS AND TESTING (Continued)

359 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
- 3-2 timing/coast clutch solenoid stuck or damaged	- Check for damage or contamination. Operate the solenoid valve using the transmission testing equipment, repair as necessary.
Forward One-Way Clutch	
- Damaged, incorrectly assembled	- Check for damage and repair as necessary.
Coast clutch	
- Incorrectly assembled	- Check for damage and repair as necessary.
- Forward clutch hub seal assembled	- Check for damage and repair as necessary.
- Piston or seals damaged	- Check for damage and repair as necessary.
- Ball check damaged, missing	- Check for damage and repair as necessary.
Pump Assembly	
- Pump hub seals number 2 and 3 for the coast clutch circuit damaged, missing	- Check for damage and repair as necessary.

OTHER CONCERNS: VEHICLE MOVEMENT WITH GEAR SELECTOR IN THE "N" POSITION

362 - HYDRAULIC/MECHANICAL ROUTINE	
Possible Component	**Reference/Action**
Internal or External Shift Linkages	
- Damaged, out of adjustment or incorrectly assembled	- Check and repair as necessary. Ensure correct adjustment of the gear shift; refer to the adjustment procedure. After completing the repair, make sure that the transmission range sensor (TR sensor) is correctly adjusted; refer to the procedure during adjustment.
Pump Assembly	
- Gaskets severely damaged	- Check for damage. Renew as necessary.
- Pump hub seal number 2, leak in the forward clutch circuit	- Check for damage and repair as necessary.
Forward/Coast Clutch Assembly	
- Friction plates severely damaged	- Check for damage and repair as necessary.
- Return spring damaged	- Check for damage and repair as necessary.
- Check ball damaged, missing	- Check for damage and repair as necessary.

CAUTION: The transmission testing equipment must be removed from the transmission and the vehicle wiring harness re-connected to determine these pressures

Reference: Pressure Chart

Shift lever position	Idle (bar)	Stall (bar)
PARK, NEUTRAL	4,4 - 5,2	-
REVERSE	4,4 - 5,2	18 - 20
DRIVE	3,1 - 4,3	11,6 - 12,7
SECOND	3,1 - 4,3	11,6 - 12,7
FIRST	3,1 - 4,3	11,6 - 12,7

Reference Table: Clutch/Band Application

DIAGNOSIS AND TESTING

Gear	2/4 Intermediate Overdrive Band	Forward Clutch	Direct Clutch	Coast Clutch	Low/Rev Clutch	Reverse Clutch	Forward One-Way Clutch		Clutch - Low One-Way	
Gear							Drive	Coast	Drive	Coast
R					X	X				
D-1		X					X	OR	X	OR
D-2	X	X					X	OR	OR	OR
D-3		X	X				X	OR	OR	OR
D-4	X	X	X				OR	OR	OR	OR
M-2	X	X		X			X		OR	OR
M-1		X		X	X		X		X	

X - Transmits torque. OR - Overrunning

SOLENOID OPERATION CHART - CD4E

Transaxle Range Selector Lever Position	PCM Commanded Gear	SSA	SSB	3-2T/CCS	TCC
P	PARK	OFF	ON	ON	OFF
R	REVERSE	OFF	ON/OFF	ON	*
N	NEUTRAL	OFF	ON	ON	OFF
OD					
D	1	ON	ON	ON	*
D	2	OFF	ON	ON	**
D	3	OFF	OFF	ON	**
D	4	ON	OFF	ON	**
OD OFF					
D	1	ON	ON	ON	*
D	2	OFF	ON	OFF	**
D	3	OFF	OFF	OFF	**
2	2	OFF	ON	OFF	**
2***	3	OFF	OFF	OFF	**
1	1	ON	ON	OFF	*
1***	2	OFF	ON	OFF	**
1***	3	OFF	OFF	OFF	**

*Not allowed by hydraulics.**Powertrain control module (PCM) commanded.***When a manual pull - in occurs above a calibrated speed, the transaxle will not downshift from the higher gear until the vehicle speed drops below this calibrated speed.

GENERAL PROCEDURES

Transmission Fluid Cooler - Backflushing and Cleaning

1. **CAUTION: Do not use automatic transmission fluid of any other specification as this may severly damage the automatic transmission.**

NOTE: Install new gaskets, oil seals and self-locking nuts.

Remove the fluid cooler tubes. For additional information, refer to Section 307-02A / 307-02B.

2. **CAUTION: If the automatic transmission fluid is very dirty or it contains metallic particles, then install new fluid cooler tubes and a new fluid cooler.**

Using compressed air, evacuate the fluid cooler tubes.

3. **Remove the fluid cooler. For additional information, refer to Section 307-02A / 307-02B.**
4. **CAUTION: If the automatic transmission fluid is very dirty or it contains metallic particles, then install new fluid cooler tubes and a new fluid cooler.**

Using compressed air, evacuate the fluid cooler.

5. **Install the fluid cooler. For additional information, refer to Section 307-02A / 307-02B.**

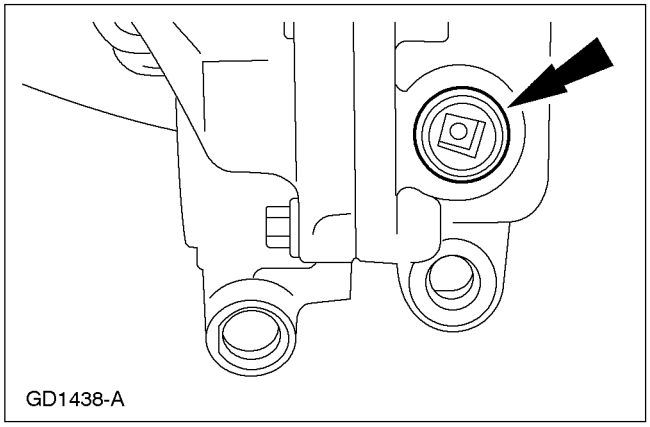
GENERAL PROCEDURES

Transmission Fluid Drain and Refill

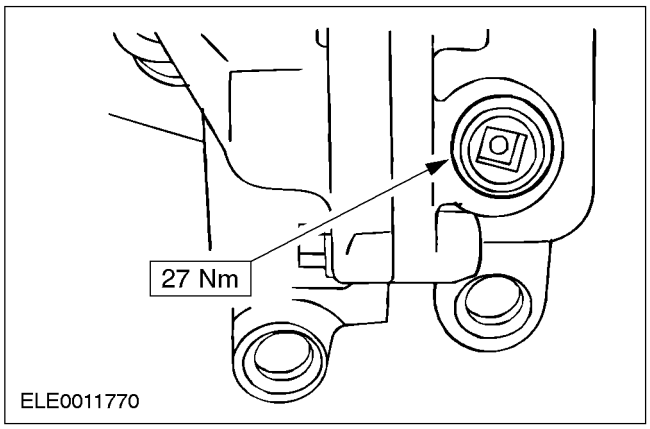
Name	Specification
Pipe Sealant with Teflon	WSK-M2G350-A2, ESR-M18PZ-A
Automatic transmission fluid	ESP-M2C166-H

1. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
2. **Place a suitable container under the transaxle drain plug.**
3. **NOTE:** If an integral problem is suspected, drain the fluid through a paper filter. A small amount of metal or friction particles may be found from normal wear. However, if excessive metal and friction particles are present, internal service will be required.

   Remove the transaxle drain plug and drain transmission fluid.



4. **Install the transaxle drain plug.**
   - After the fluid has been drained, clean the drain plug threads and apply a small amount of Pipe Sealant with Teflon .



5. **Lower the vehicle**
6. **Add automatic transmission fluid into the filler neck. For additional information, refer to Specifications in this section.**
7. **Check the transmission fluid level. For additional information, refer to Preliminary Inspection in this section.**
8. **Add automatic transmission fluid if necessary.**

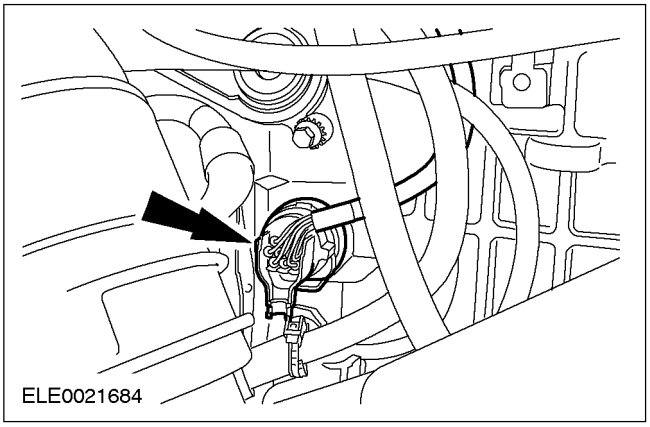
IN-VEHICLE REPAIR

Fluid Pan, Gasket and Filter

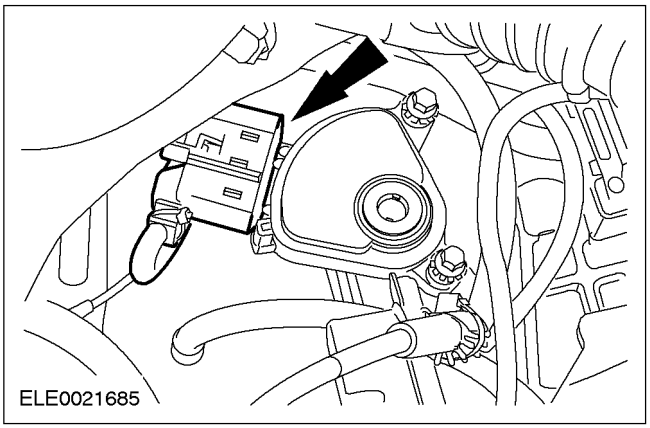
Name	Specification
Automatic transmission fluid	ESP-M2C166-H

Removal

1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Remove the battery tray. For additional information, refer to Section 414-01.**
3. **Disconnect the solenoid body electrical connector.**



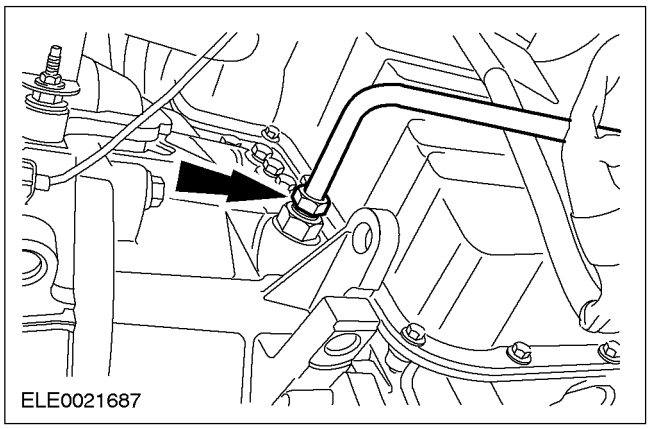
4. **Disconnect the transmission range (TR) sensor electrical connector.**



5. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
6. **CAUTION: Using and open-end spanner, prevent the fluid pipe adapter from turning, do not remove the adapter from the transaxle housing.**

   Disconnect the transaxle cooler inlet pipe.

   - Allow the oil to drain into a suitable container.

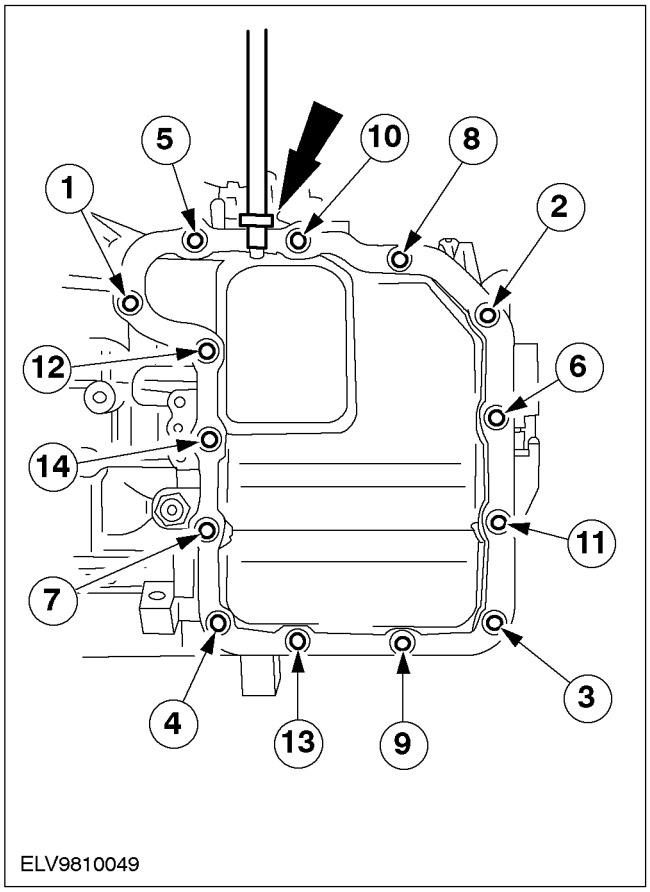


IN-VEHICLE REPAIR (Continued)

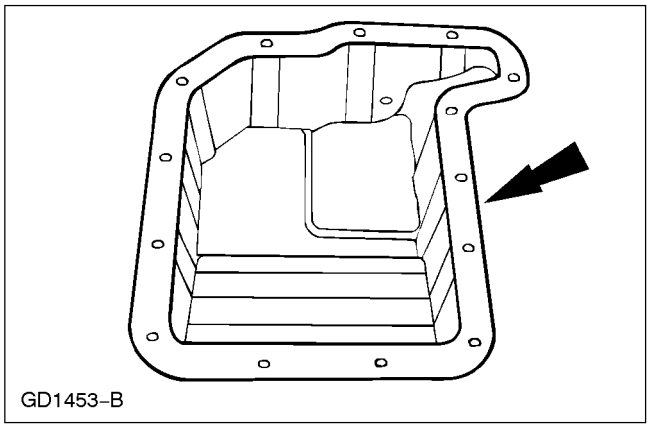
7. NOTE: Remove the bolts in the sequence shown.

Remove the fluid pan.

- Disconnect the fluid pan vent tube.

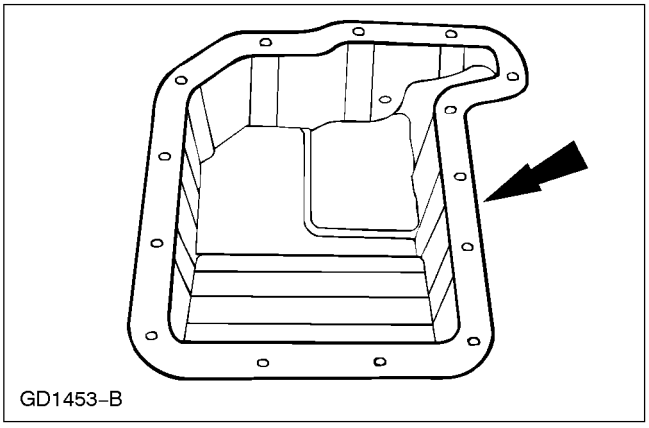


8. Remove the fluid pan cover gasket.



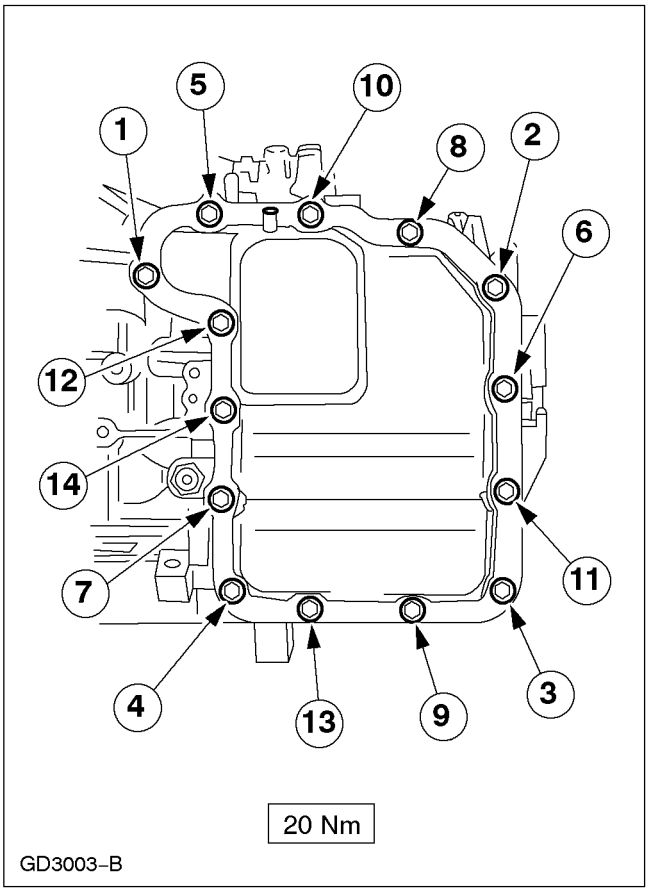
Installation

1. Install a new fluid pan cover gasket..



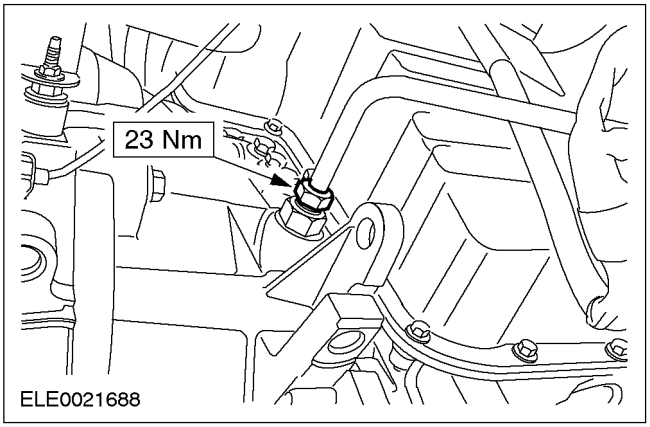
2. Install the fluid pan.

1. Connect the fluid pan vent tube.
2. Tighten the bolts in the sequence shown.

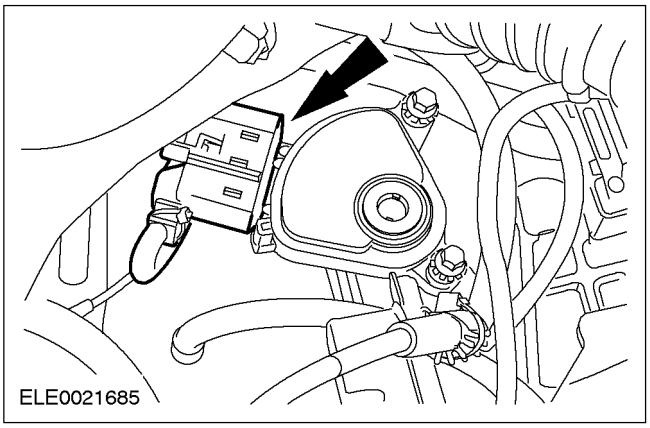


IN-VEHICLE REPAIR (Continued)

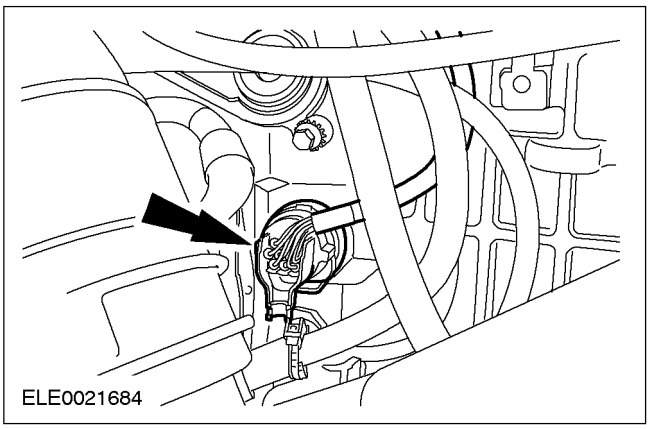
3. Connect the transaxle cooler inlet line.



4. Lower the vehicle.
5. Connect the TR sensor electrical connector.



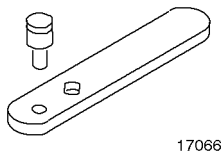
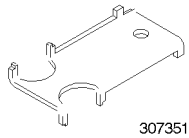
6. Connect the solenoid body electrical connector.



7. Install the battery tray. For additional information, refer to Section 414-01.
8. Connect the battery ground cable. For additional information, refer to Section 414-01.
9. Check the transmission fluid level. For additional information, refer to Preliminary Inspection in this section.
10. Initialize the door window motors. For additional information, refer to Section 501-11.

IN-VEHICLE REPAIR

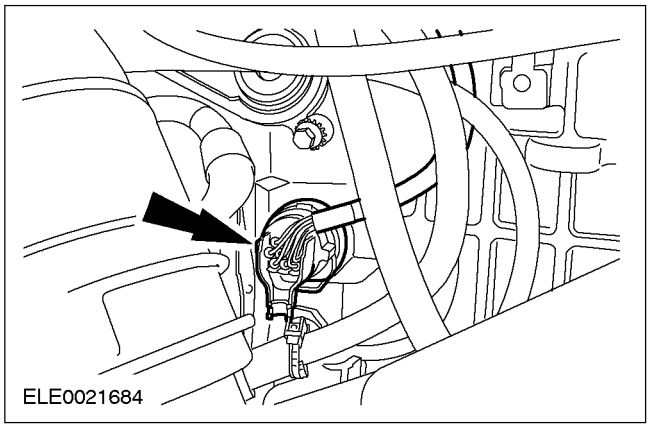
Main Controls

Special Tool(s)	
 17066	Aligner, Selector Shaft 307-S290 (17-066)
 307351	Alignment Gauge, TR Sensor 307-351

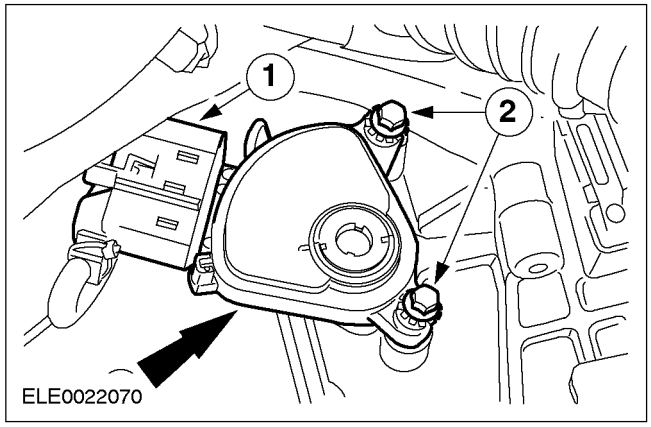
Name	Specification
Automatic transmission fluid	ESP-M2C166-H

Removal

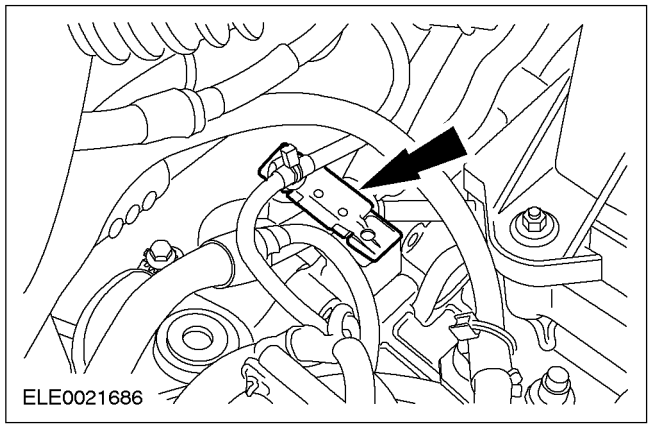
1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Remove the battery tray. For additional information, refer to Section 414-01.**
3. **Disconnect the solenoid body electrical connecter.**



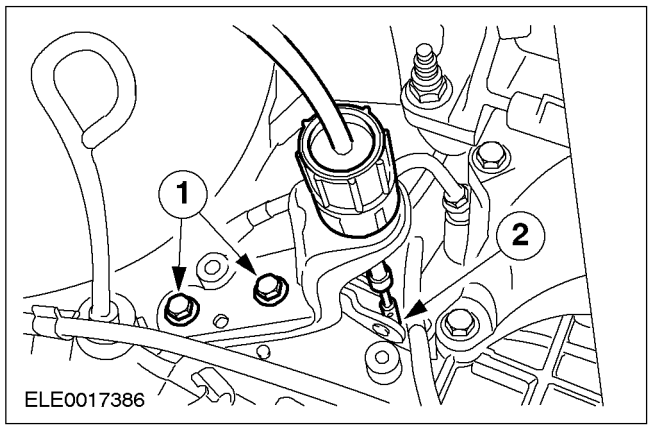
4. **Remove the transmission range (TR) sensor.**
   1. Disconnect the TR sensor electrical connector.
   2. Remove the bolts.



5. **Remove the wiring harness retaining clip.**



6. **Disconnect the selector lever cable and bracket.**
   1. Remove the bracket retaining bolts.
   2. Detach the selector lever cable from the bracket.



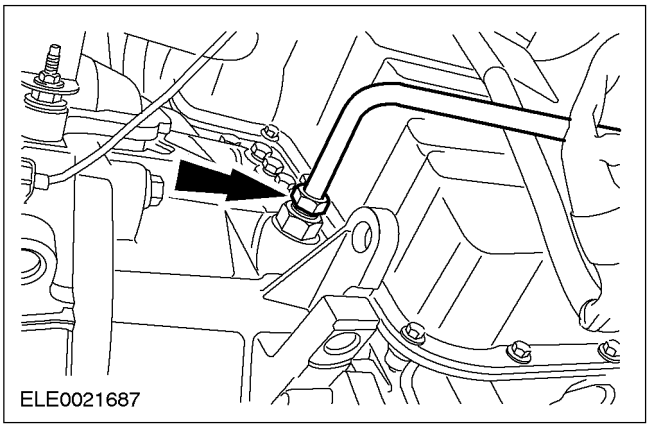
IN-VEHICLE REPAIR (Continued)

7. **Raise and support the vehicle. For additional information, refer to Section 100-02.**

8. **CAUTION: Prevent the fluid pipe from turning, use an open-end spanner, do not remove it from the transaxle housing.**

   Disconnect the transaxle cooler inlet pipe.

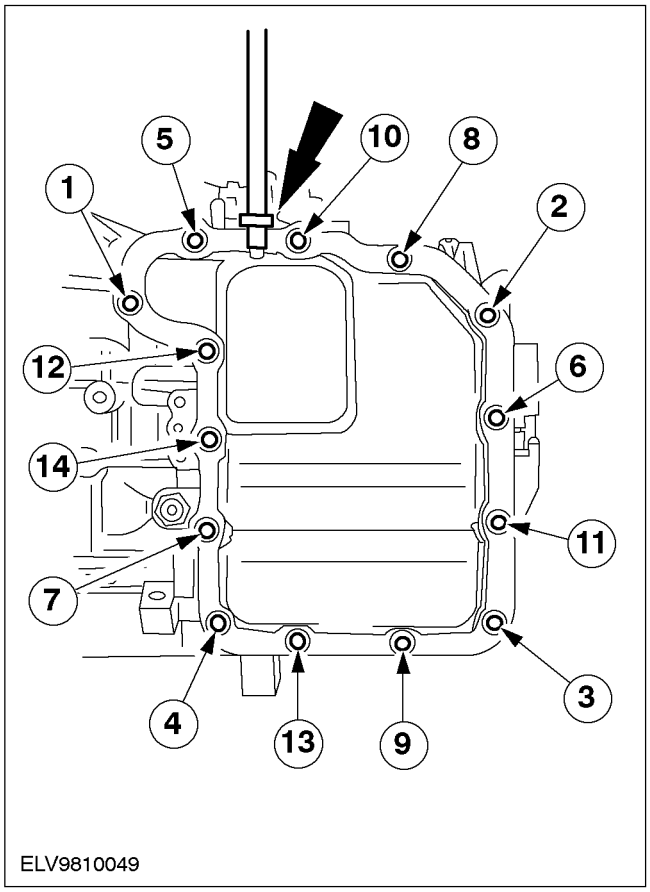
   - Allow the oil to drain into a suitable container.



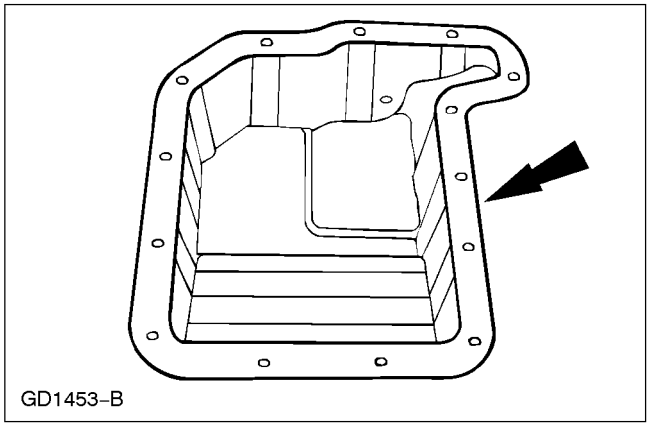
9. **NOTE:** Remove the bolts in the sequence shown.

   Remove the main control valve cover.

   - Disconnect the main control valve cover vent tube.

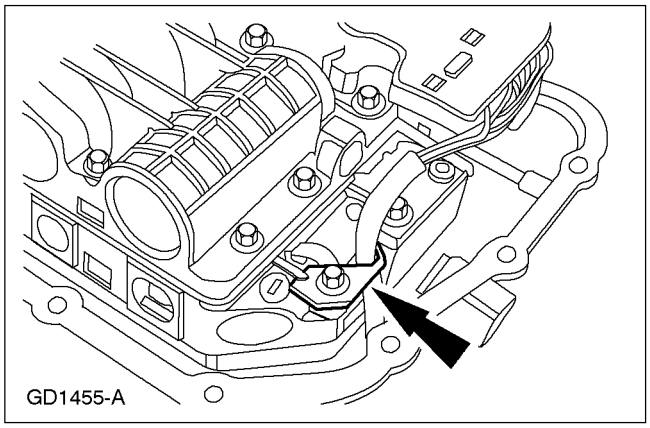


10. **Remove the main control valve cover gasket.**

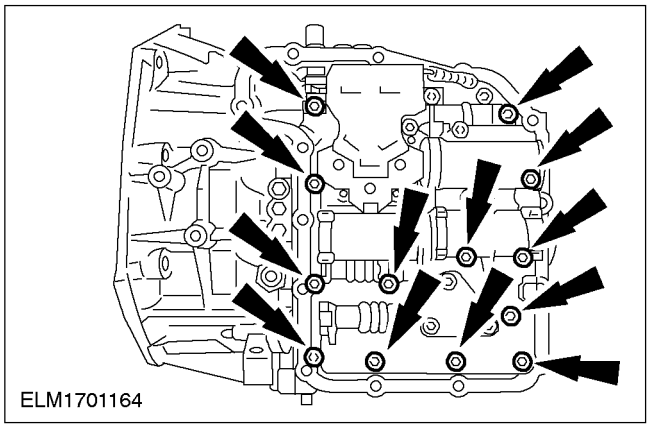


IN-VEHICLE REPAIR (Continued)

11. Remove the solenoid body wiring harness clip from the main control valve body.

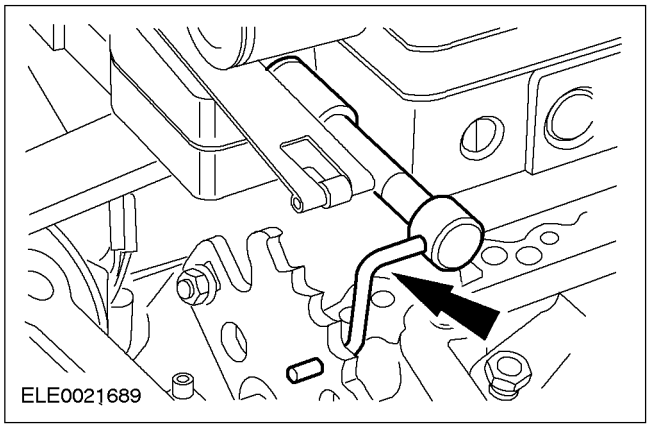


12. Remove the main control valve body retaining bolts.



13. ⚠ CAUTION: Do not allow loose manual valve to become damaged.

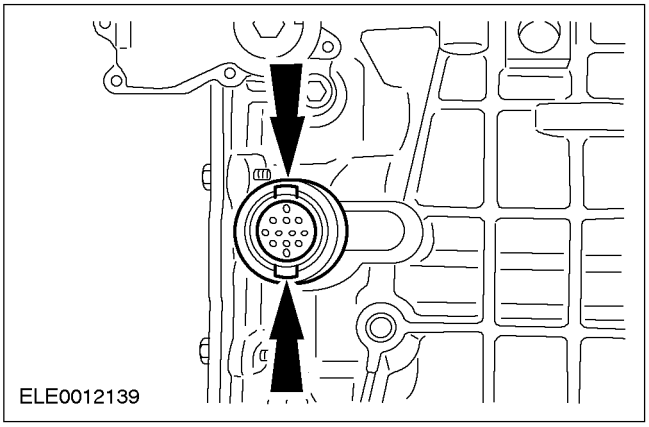
Disconnect the manual valve link from the manual control valve when removing the main control valve body from the case.



14. ⚠ CAUTION: Do not pull solenoid body electrical connector wires.

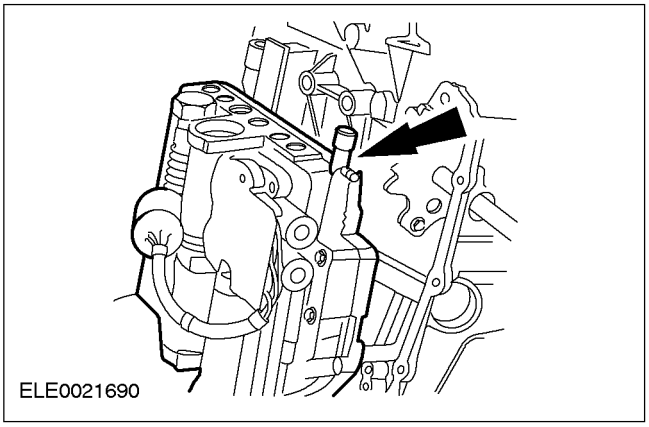
Remove the solenoid body electrical connector.

- Depress the retaining tabs and push the connector through the transaxle case.



15. ⚠ CAUTION: Make sure the manual valve control lever does not fall out.

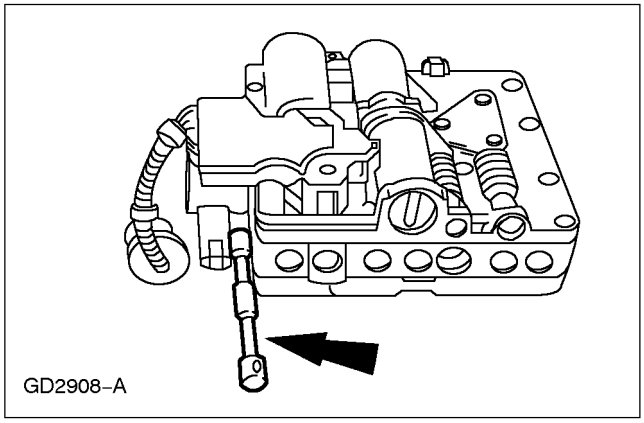
Remove the manual valve control body.



IN-VEHICLE REPAIR (Continued)

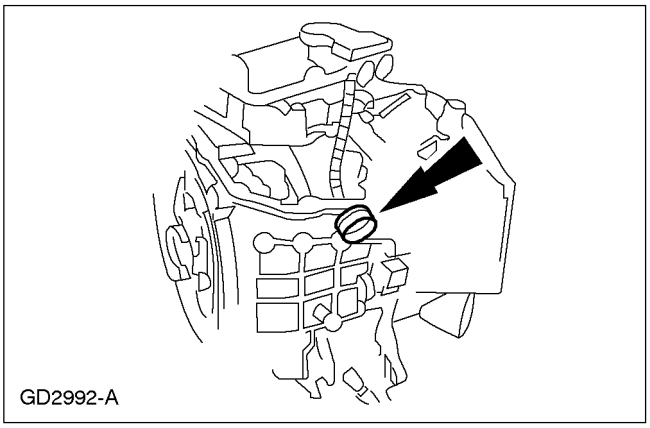
Installation

1. Install the manual valve control body.

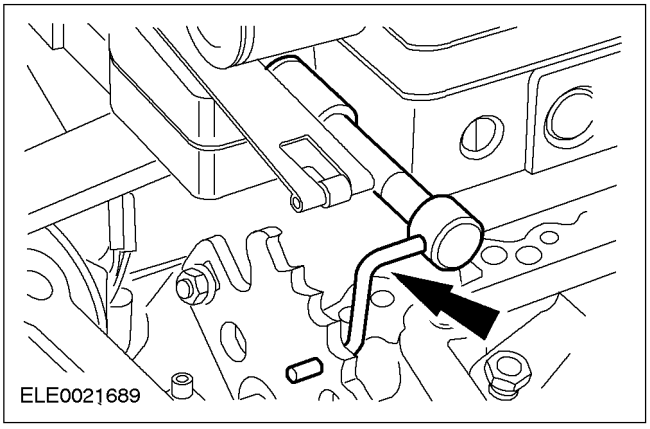


2. NOTE: Inspect the solenoid valve body harness connector O-ring seal and install a new as necessary, before installing solenoid valve body harness connector in transaxle case.

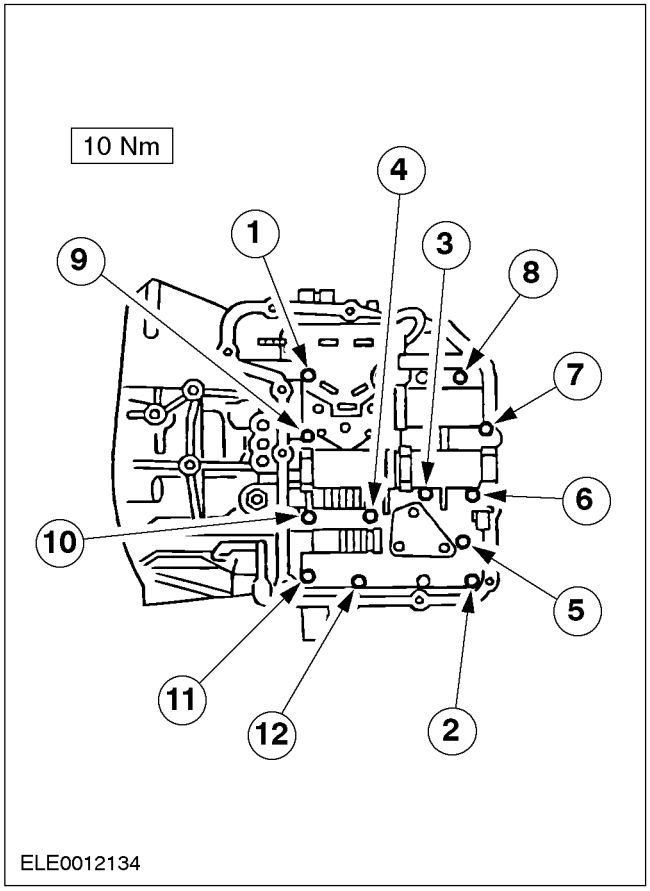
Push the solenoid valve body harness connector into the transaxle case.



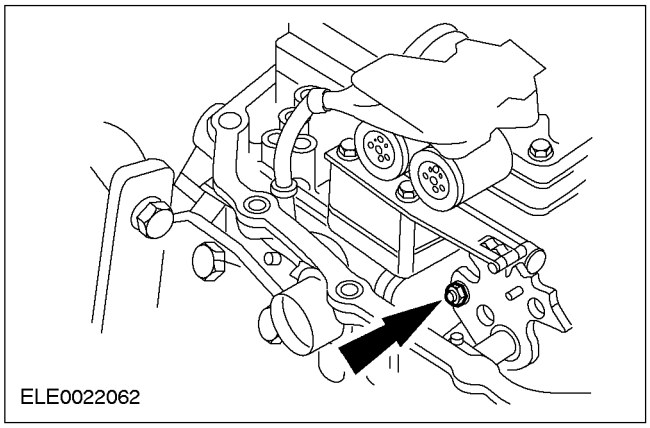
3. Connect the manual valve link to the manual valve.



4. Position the main control valve body and install the retaining bolts in the sequence shown.

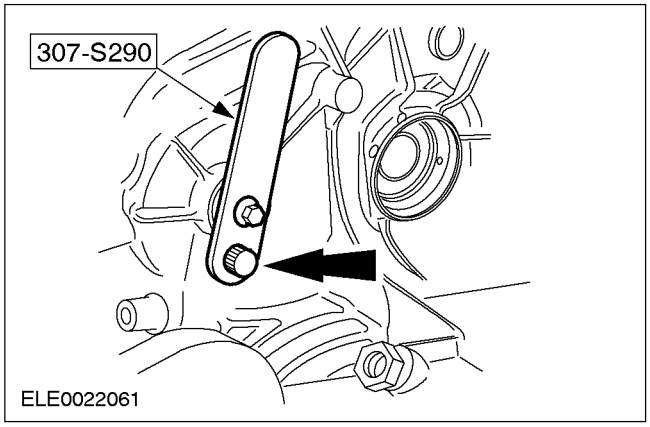


5. Loosen the manual valve detent lever to actuating rod assembly retaining nut.

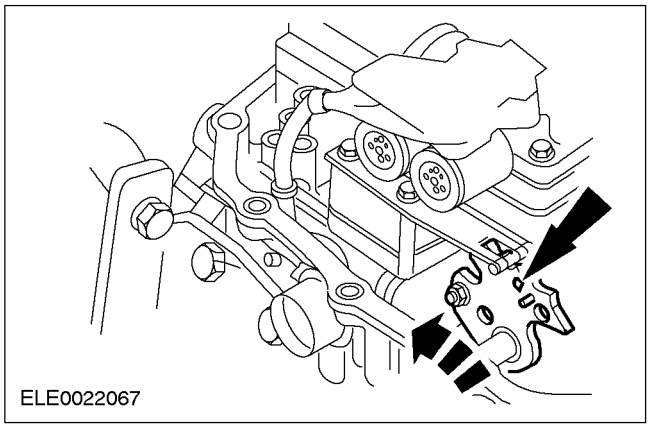


IN-VEHICLE REPAIR (Continued)

6. Using the special tool and pin, align the shifter shaft.



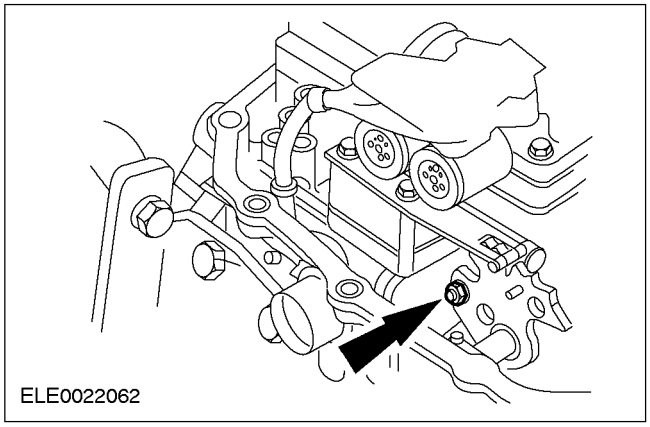
7. Move the manual valve detent lever assembly to the "D" position.



8. NOTE: Do not fully tighten the nut at this stage.

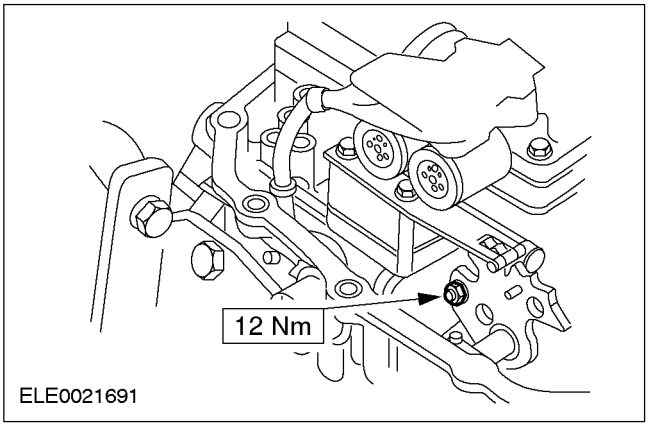
Tighten the nut on the ball.

- Remove the special tool.

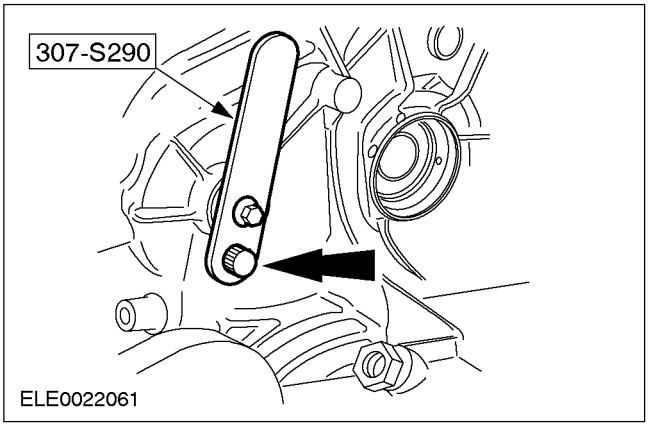


9. Tighten the lever to manual valve detent actuating rod assembly retaining nut.

- Rotate back to the "D" position and check the adjustment.

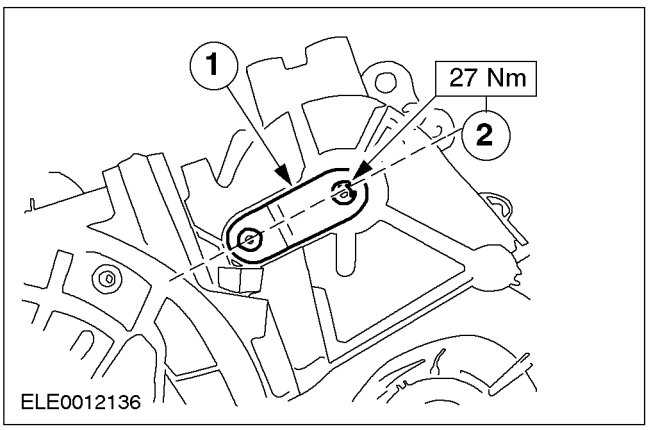


10. Using the special tool, check the manual control lever assembly settings.



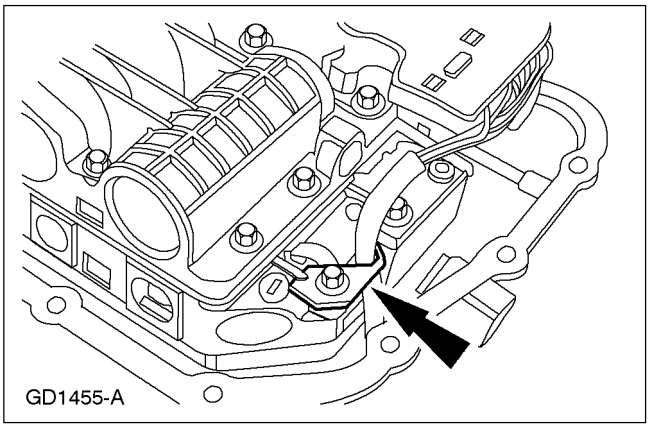
11. Install the manual control lever.

1. Align the manual control lever.
2. Tighten the retaining bolt.

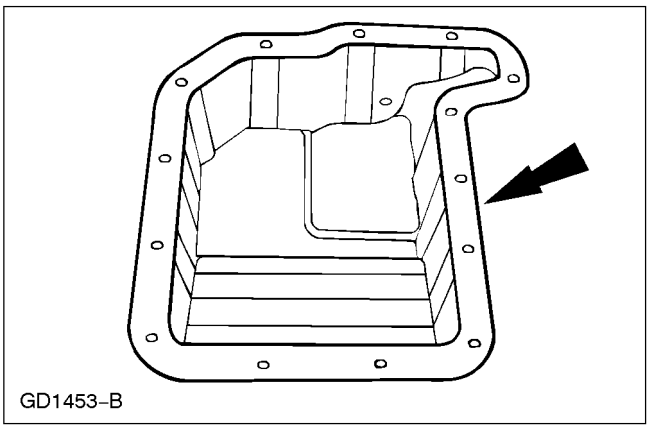


IN-VEHICLE REPAIR (Continued)

12. Install solenoid body wiring harness clip to main control valve body.

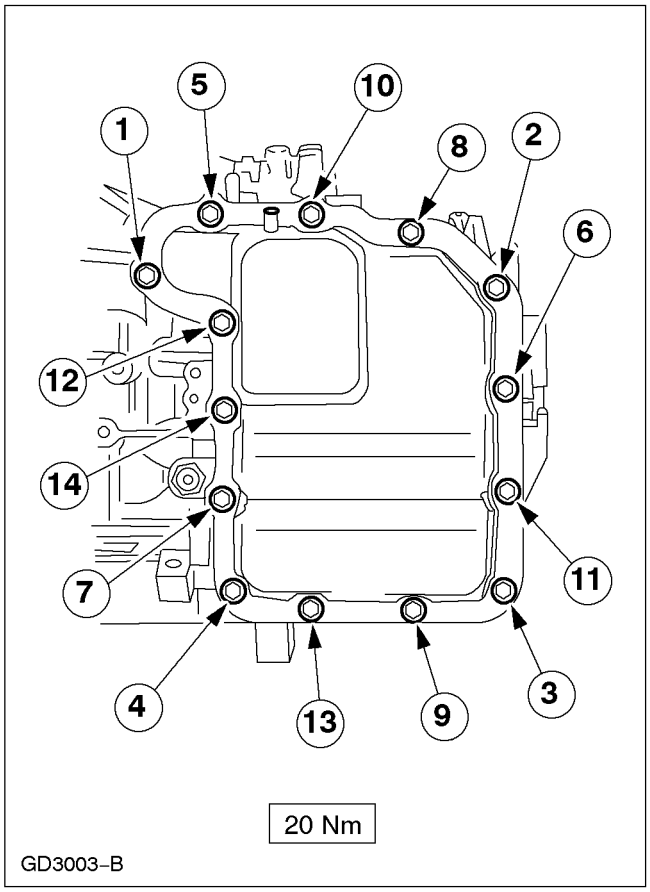


13. Install a new main control valve cover gasket.

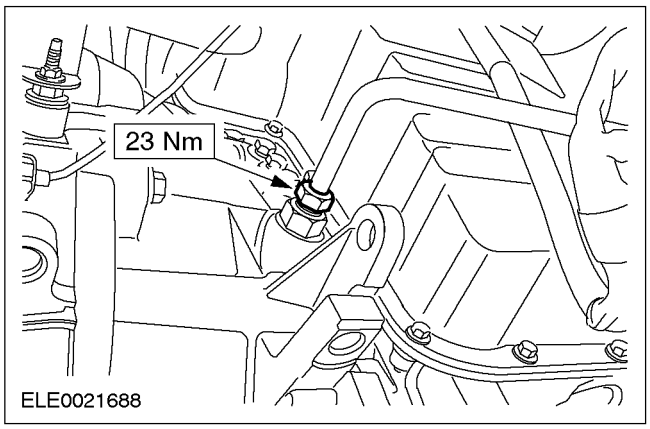


14. Install the main control valve cover.

- Connect the main control valve cover vent tube.
- Position main control valve cover and tighten the bolts in the sequence shown.



15. Connect the transaxle cooler inlet line.

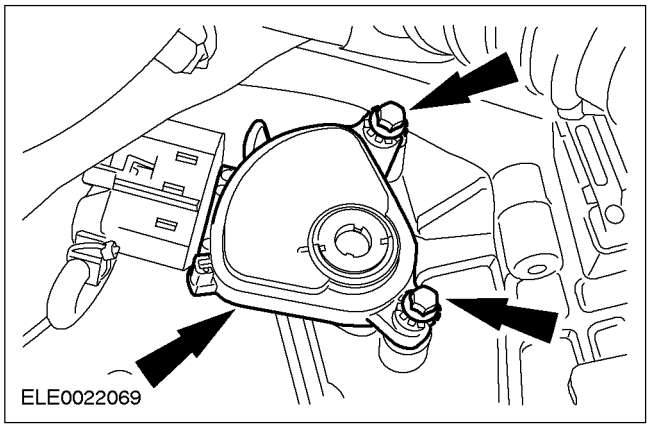


16. Lower the vehicle.

IN-VEHICLE REPAIR (Continued)

17. **NOTE:** Do not tighten the TR sensor bolts at this stage.

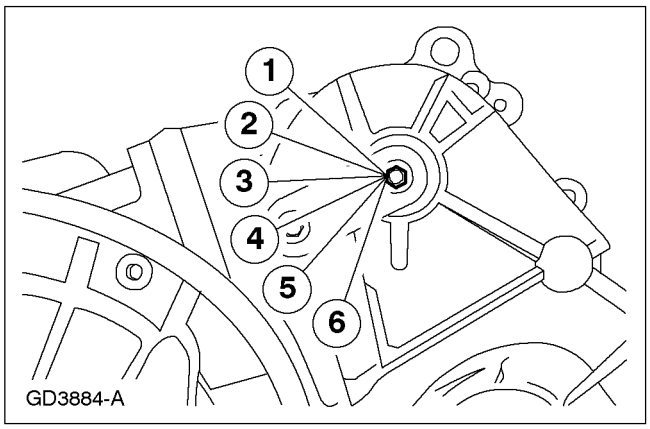
    Install the TR sensor.



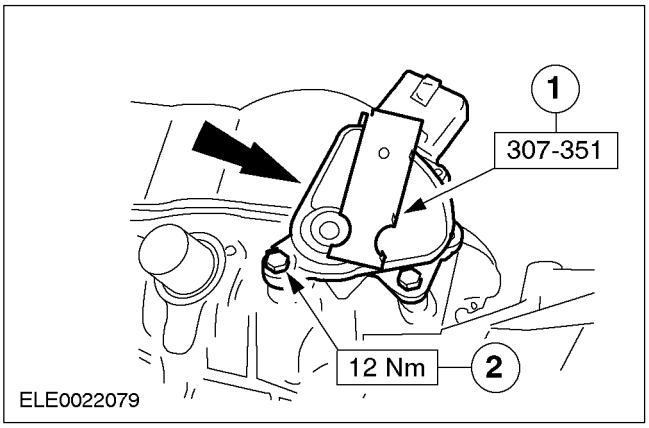
18. **NOTE:** Make sure the manual control lever is in "N" position for TR sensor adjustment.

    Rotate the manual valve detent lever assembly to the Neutral position.

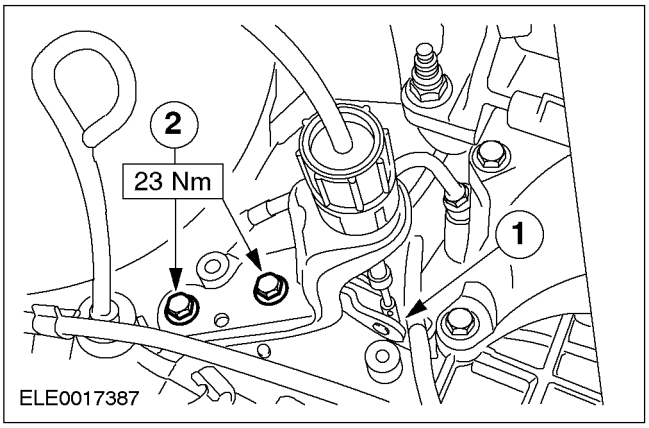
    1. Low 1
    2. Low 2
    3. Drive
    4. Neutral
    5. Reverse
    6. Park



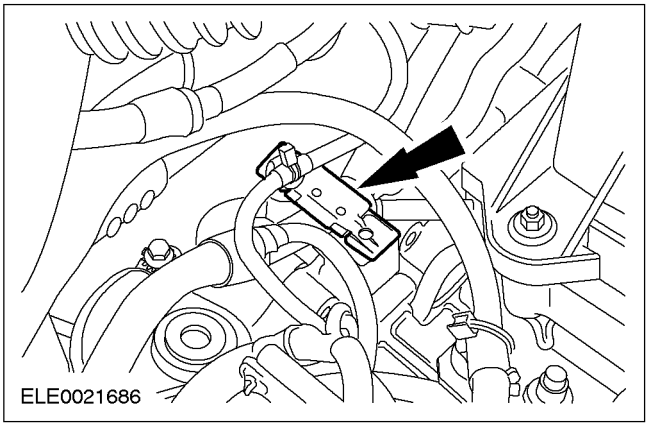
19. **Adjust the TR sensor.** **For additional information, refer to Transmission Range (TR) Sensor in this section.**
    1. Install the special tool and align TR sensor to the slots.
    2. Tighten the retaining bolts.



20. **Connect the selector lever cable to the control lever.**
    1. Attach the selector lever cable.
    2. Install the retaining bolts.

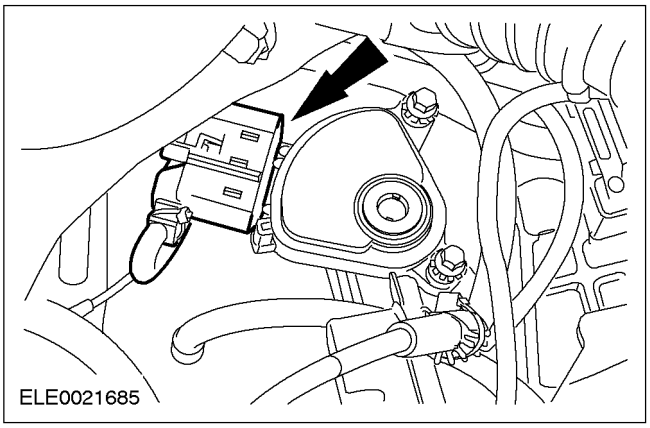


21. **Install the wiring harness retaining clip.**

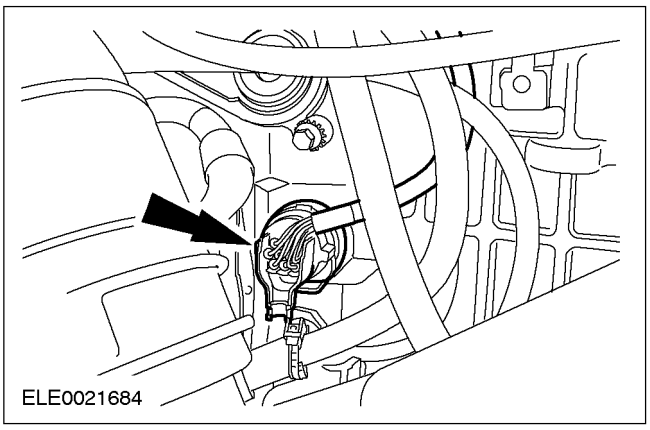


IN-VEHICLE REPAIR (Continued)

22. Connect the TR sensor electrical connector.



23. Connect the solenoid body electrical connector.



24. Install the battery tray. For additional information, refer to Section 414-01.
25. Connect the battery ground cable. For additional information, refer to Section 414-01.
26. Check the transmission fluid level. For additional information, refer to Preliminary Inspection in this section.

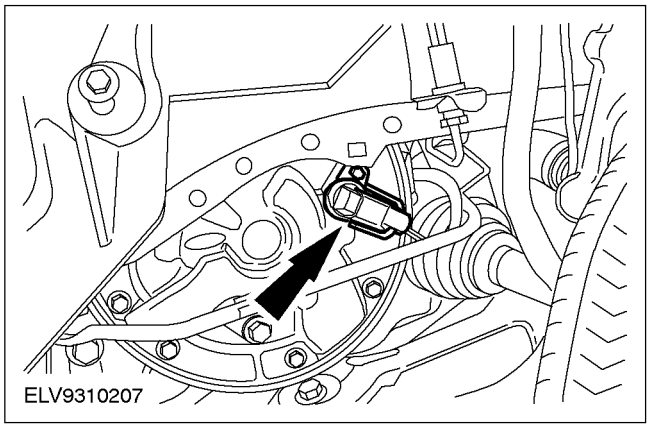
IN-VEHICLE REPAIR

Turbine Shaft Speed (TSS) Sensor

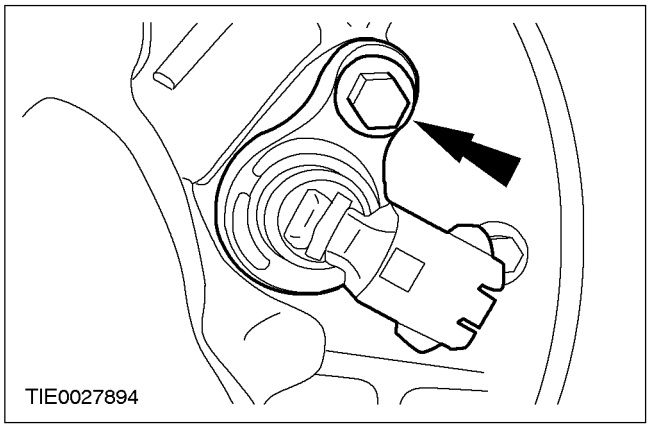
Name	Specification
Automatic transmission fluid	ESP-M2C166-H
Petroleum jelly	SM-1C115-A

Removal

1. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
2. **Disconnect the turbine shaft speed (TSS) sensor electrical connector (colored white).**



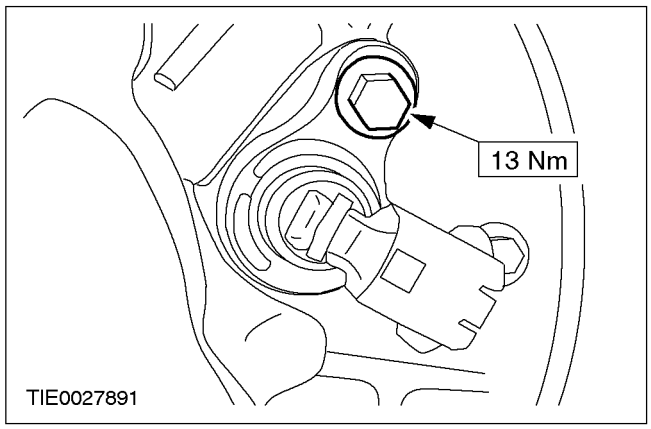
3. **Remove the TSS sensor.**
   - Allow the oil to drain into a suitable container.
   - Discard the O-ring seal.



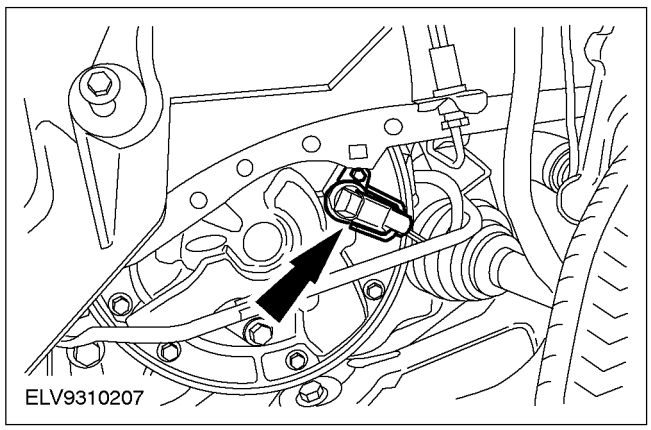
Installation

1. **NOTE:** Install a new TSS sensor O-ring seal.

   Install the TSS sensor.
   - Lubricate the O-ring seal with petroleum jelly.



2. **Connect the TSS sensor electrical connector (colored white).**



3. **Lower vehicle.**
4. **Start the engine and move the selector lever through all of the ranges, allowing sufficient time for each position to engage.**
   - Engage the selector lever in the "P" (park) position.
5. **Check the transmission fluid level. For additional information, refer to Preliminary Inspection in this section.**
6. **Add automatic transmission fluid, if necessary.**

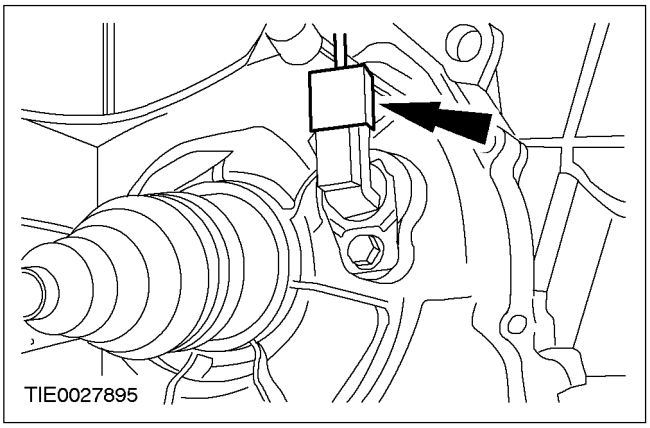
IN-VEHICLE REPAIR

Output Shaft Speed (OSS) Sensor

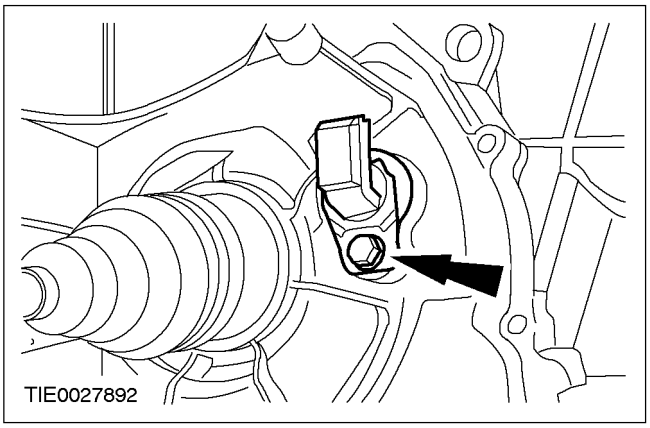
Name	Specification
Automatic transmission fluid	ESP-M2C166-H
Petroleum jelly	SM-1C115-A

Removal

1. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
2. **Disconnect the output shaft speed (OSS) sensor electrical connector (colored black).**



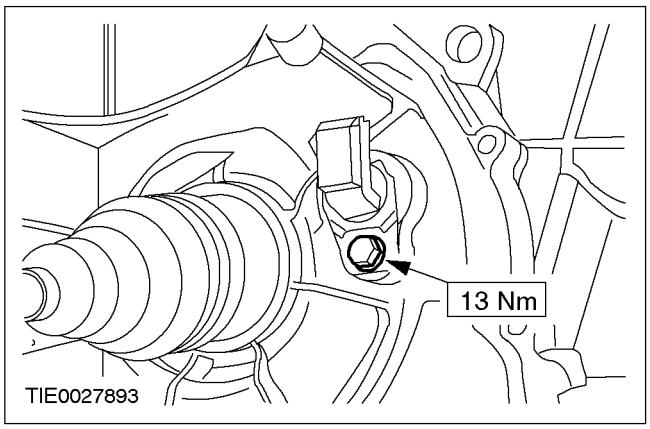
3. **Remove the OSS sensor.**
   - Allow the oil to drain into a suitable container.
   - Discard the O-ring seal.



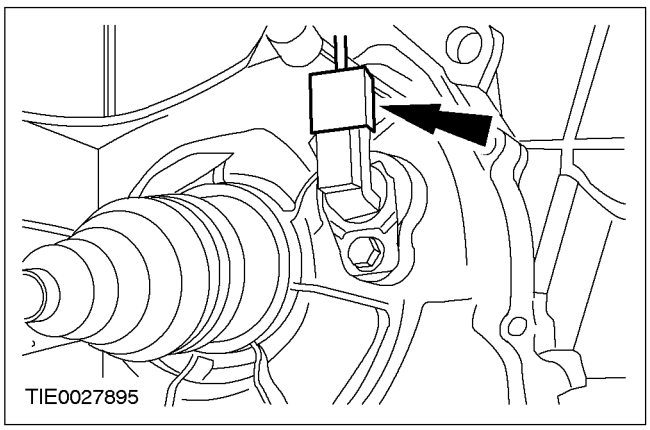
Installation

1. **NOTE:** Install a new OSS sensor O-ring seal.

   Install the OSS sensor.
   - Lubricate the O-ring seal with petroleum jelly.



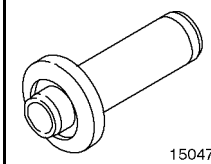
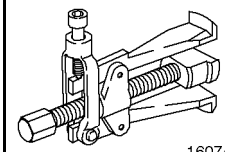
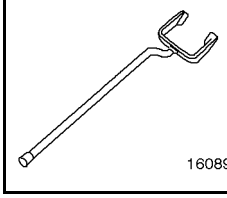
2. **Connect the OSS sensor electrical connector (colored black).**



3. **Lower vehicle.**
4. **Start the engine and move the selector lever through all of the ranges, allowing sufficient time for each position to engage.**
   - Engage the selector lever in the "P" (park) position.
5. **Check the transmission fluid level. For additional information, refer to Preliminary Inspection in this section.**
6. **Add automatic transmission fluid, if necessary.**

IN-VEHICLE REPAIR

Halfshaft Seal LH (14 303 0)

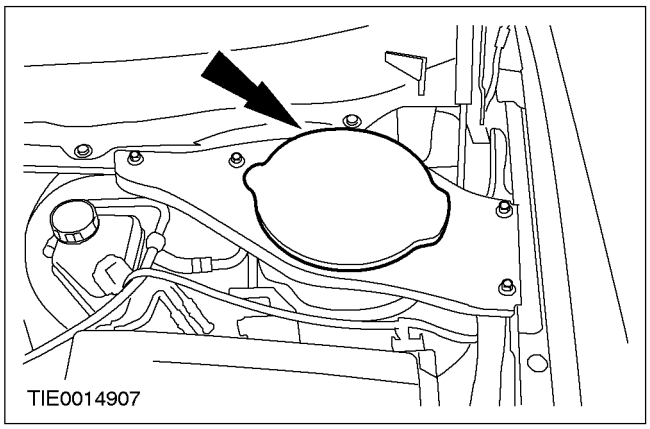
Special Tool(s)	
 15047A	Installer, Drive Pinion Oil Seal 205-077 (15-047 A)
 16074	Remover, Halfshaft Oil Seal 308-208 (16-074)
 16089	Remover, Halfshaft 308-256 (16-089)

General Equipment
Transmission jack

Name	Specification
Cable ties	
Automatic transmission fluid	ESP-M2C-116-H

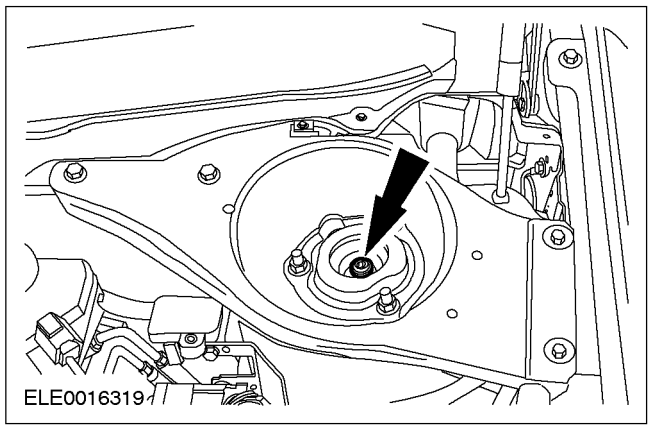
Removal

1. **Remove the suspension strut and spring assembly top mount brace cover.**

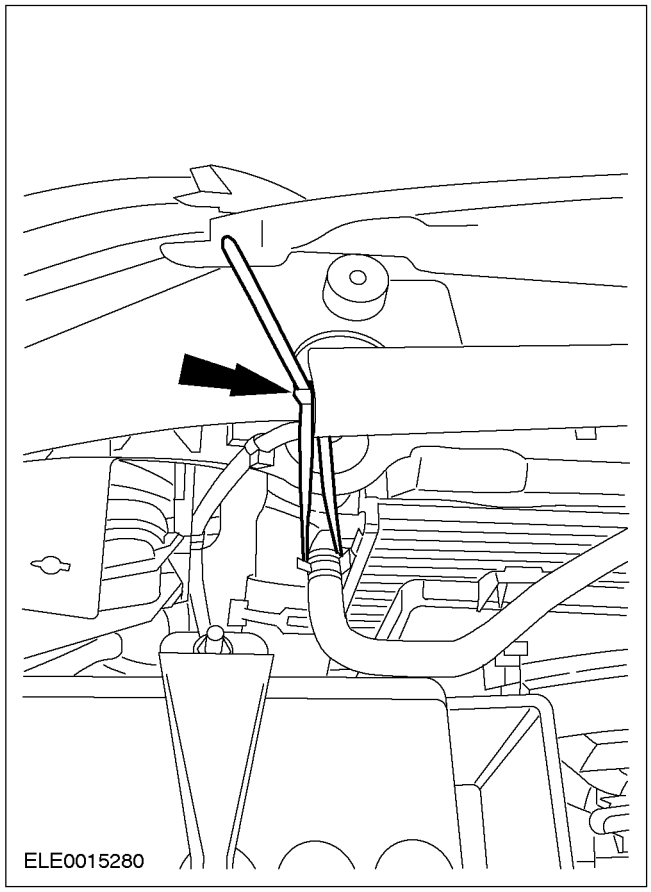

TIE0014907

2. **CAUTION: Use an Allen key to prevent the piston rod from turning.**

   Loosen the suspension top mount nut by five turns.


ELE0016319

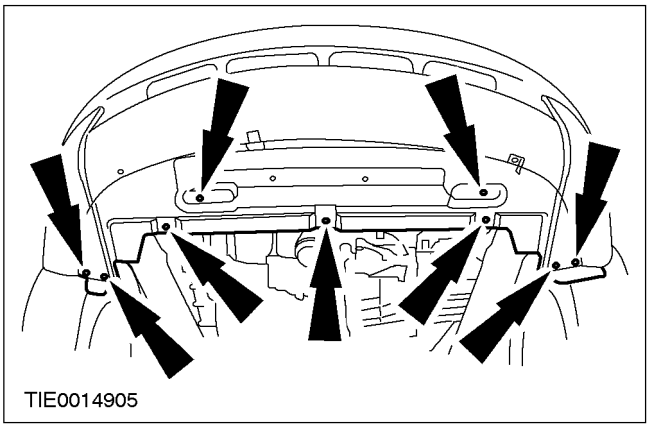
3. **Using cable ties, support the radiator on both sides.**


ELE0015280

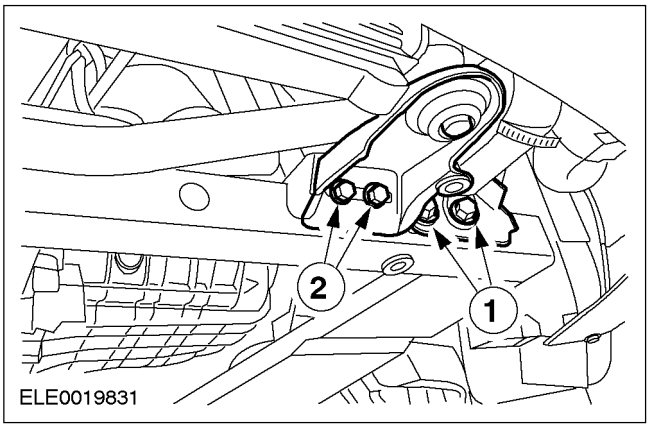
4. **Raise and support the vehicle. For additional information, refer to Section 100-02.**

IN-VEHICLE REPAIR (Continued)

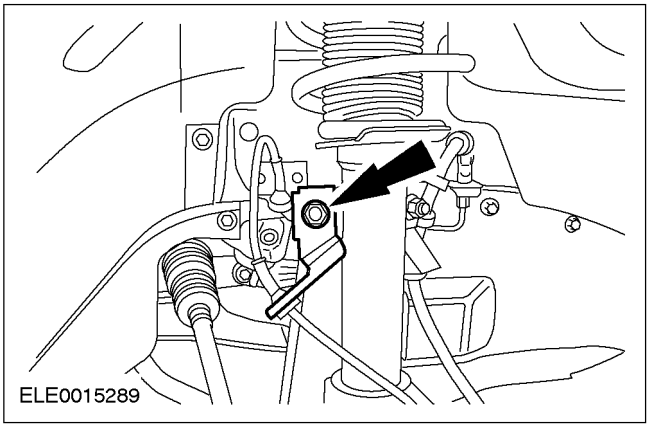
5. **Remove the front wheel and tire. For additional information, refer to Section 204-04.**
6. **Remove the splash shield.**



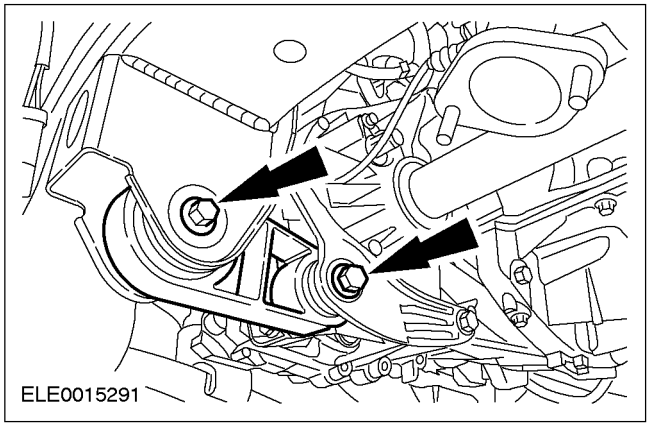
7. **Remove the radiator support brackets.**
   1. Remove the hose bracket.
   2. Remove both radiator support brackets.



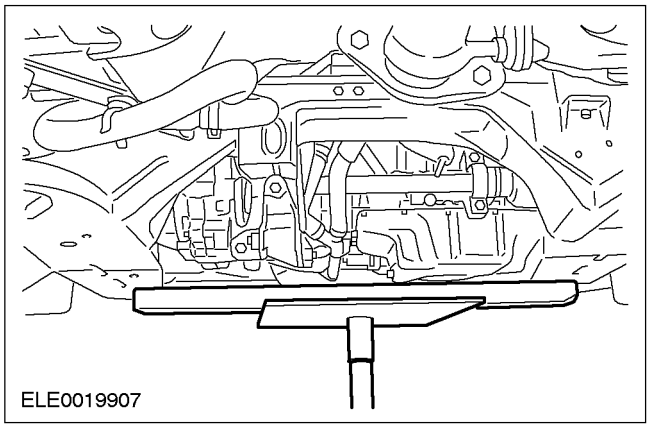
8. **Detach the stabilizer connecting link from the suspension strut on both sides.**



9. **Remove the exhaust flexible pipe. For additional information, refer to Section 309-00.**
10. **Remove the engine rear support insulator.**



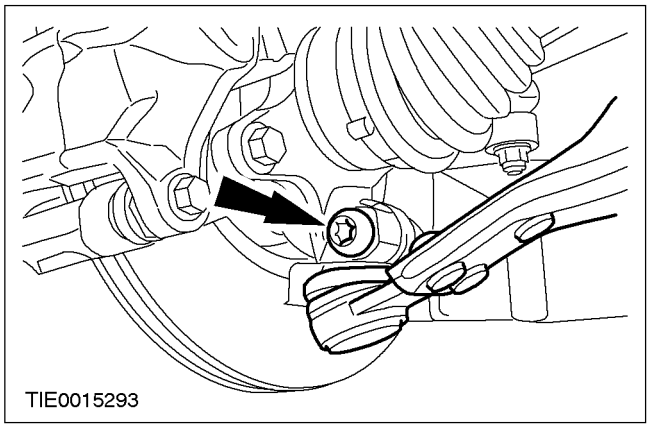
11. **Using two suitable wooden blocks and suitable transmission jack, support the subframe.**



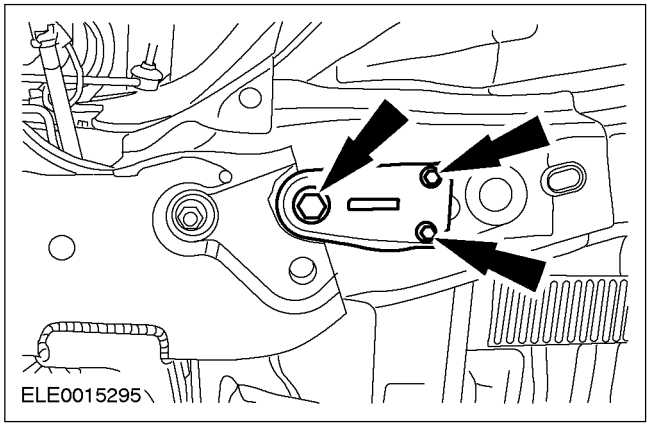
IN-VEHICLE REPAIR (Continued)

12. **CAUTION: Do not pull down the lower arm, to prevent the lower arm hydro-bushing from damage.**

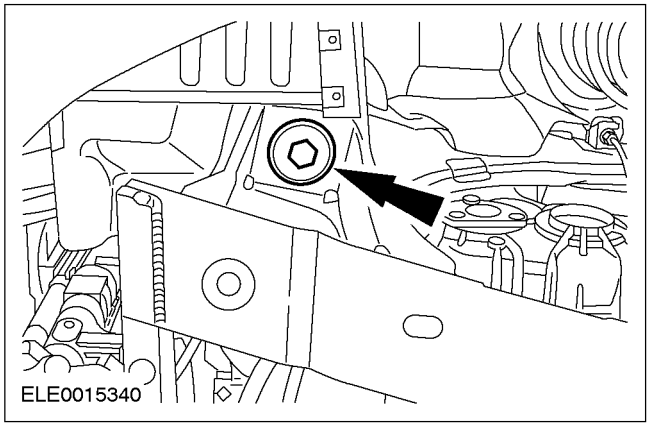
    Remove the lower arm ball joint retaining nut and bolt.



13. **Remove the subframe rear retaining bolts and the subframe bracket retaining bolts on both sides.**

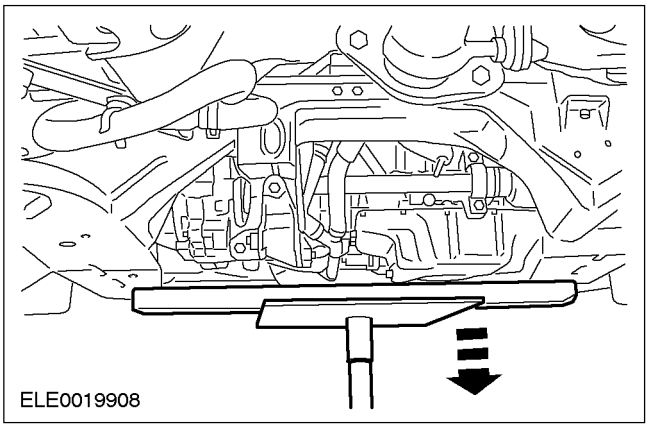


14. **Remove the subframe front retaining bolts on both sides.**



15. **CAUTION: Lower the subframe uniformly, to prevent the lower arm hydro-bushing from damage.**

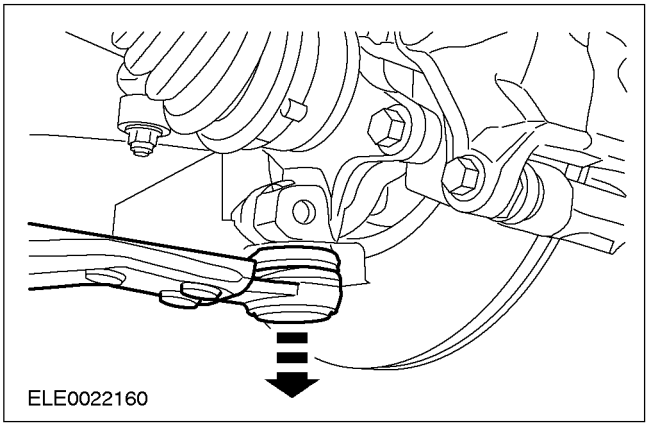
    Using the transmission jack, lower the subframe approximately 150 mm.



16. **CAUTION: Protect the ball joint seal using a soft cloth to prevent damage.**

    Detach the lower arm ball joint from the wheel knuckle.

    - Remove the heat shield.

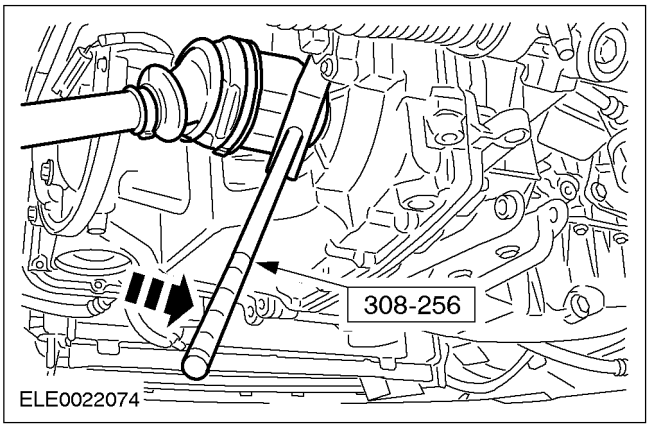


IN-VEHICLE REPAIR (Continued)

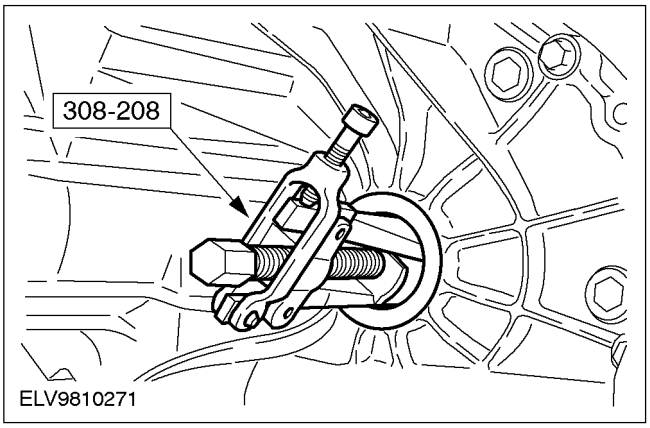
17. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

    Using the special tool, detach the halfshaft from the transaxle and secure it to one side.

    - Allow the oil to drain into a suitable container.
    - Remove and discard the snap ring from the stub shaft.

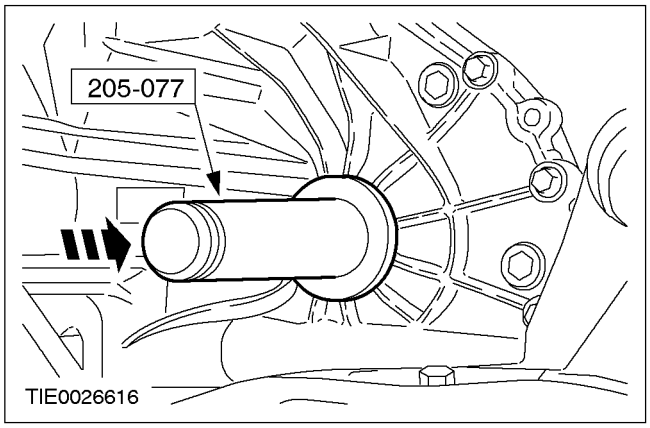


18. **Using the special tool, remove the halfshaft oil seal.**



Installation

1. **Using the special tool, install the halfshaft oil seal.**



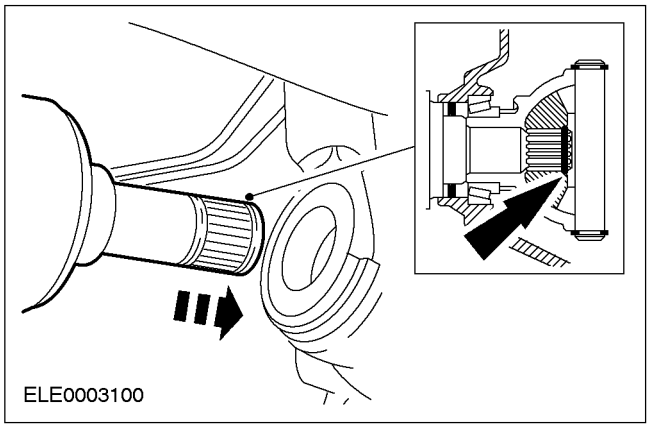
2. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

CAUTION: Do not damage the halfshaft oil seal.

CAUTION: Make sure the snap ring is correctly seated.

NOTE: Install a new snap ring.

Attach the halfshaft to the transaxle.

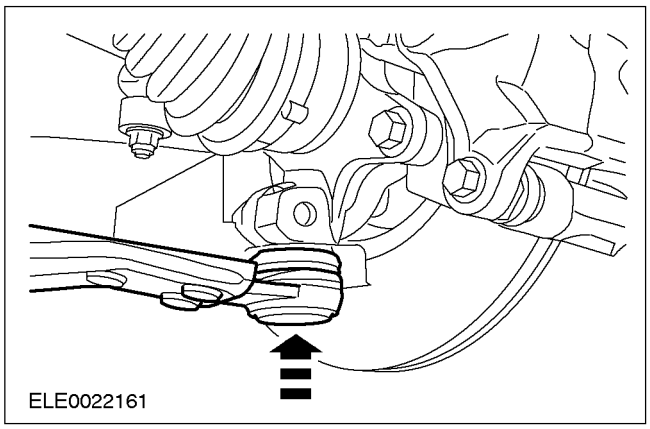


IN-VEHICLE REPAIR (Continued)

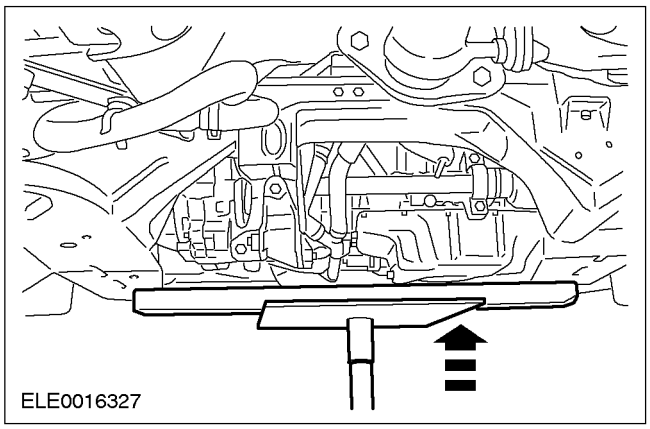
3. **CAUTION: Make sure the heat shield is installed to prevent damage to the ball joint.**

   Attach the lower arm to the wheel knuckle on both sides.

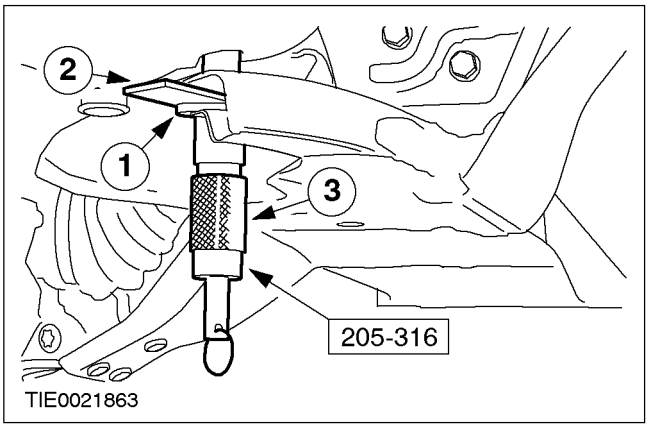
   - Install the heat shield.



4. **Using the transmission jack, position the subframe.**

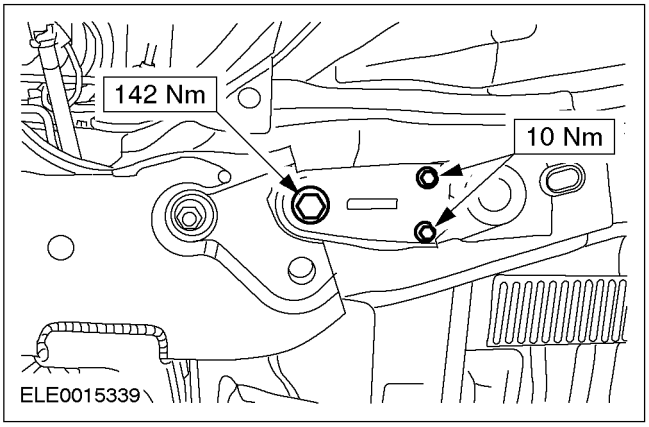


5. **Using the special tools and a suitable washer, align the subframe.**
   1. Insert the washer, with inside diameter 22 mm, outside diameter 44 mm and height 5 mm, into the subframe above the lower alignment hole.
   2. Insert the alignment pin through the subframe alignment holes and the washer.
   3. Slide the locking plates on top of the washer and into the groove of the tool and tighten the alignment pin sleeve.



6. **CAUTION: While tightening the subframe retaining bolts, make sure the subframe does not move.**

   Install the subframe rear retaining bolts and the subframe bracket retaining bolts on both sides.

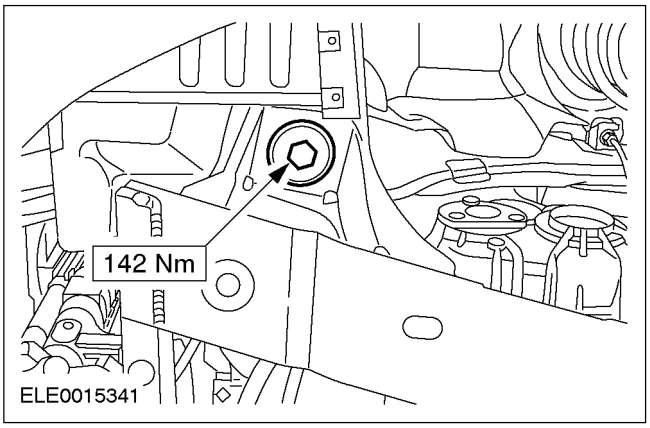


IN-VEHICLE REPAIR (Continued)

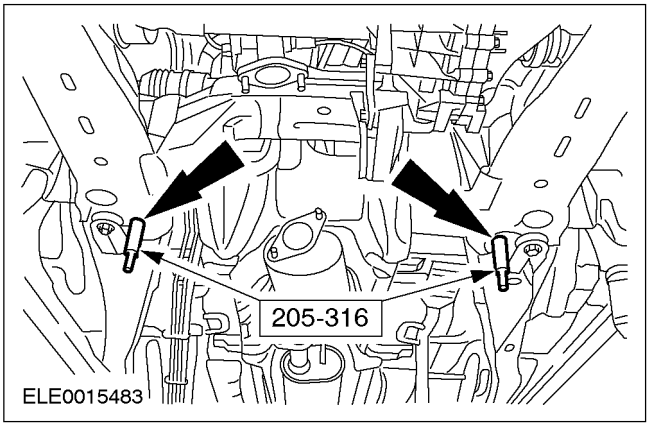
7. **CAUTION: While tightening the subframe retaining bolts, make sure the subframe does not move.**

   Install the subframe front retaining bolts.

   - Lower and remove the transmission jack.

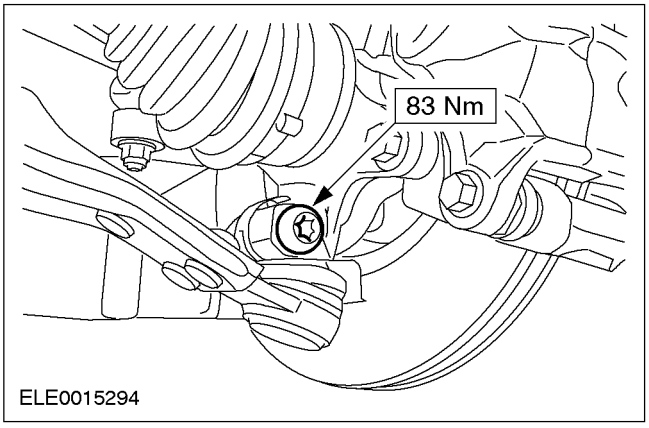


8. **Remove the special tools.**

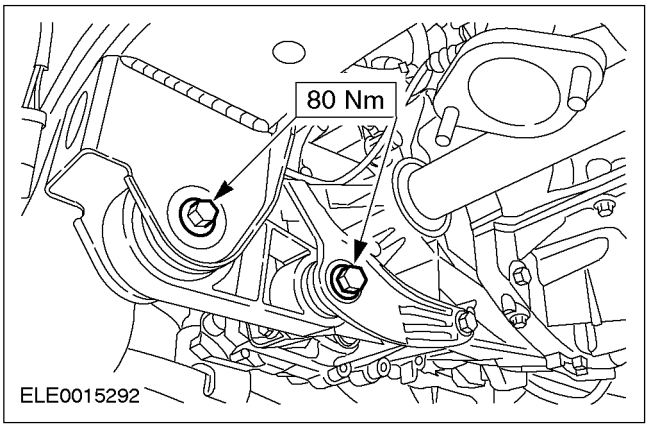


9. **WARNING: Install a new self-locking nut.**

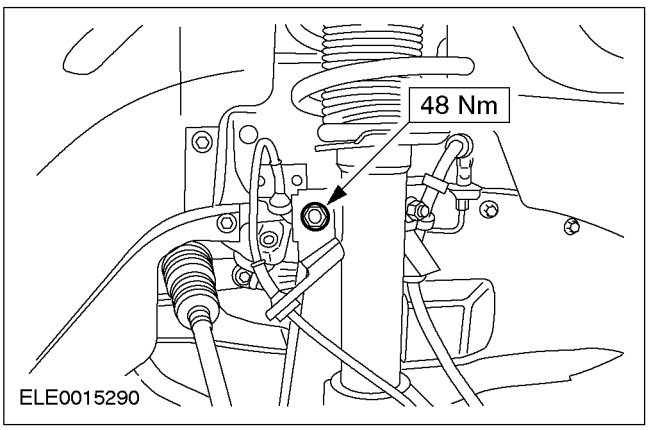
   Install the lower arm ball joint pinch bolt from the rear, the retaining nut from the front.



10. **Install the engine rear support insulator.**



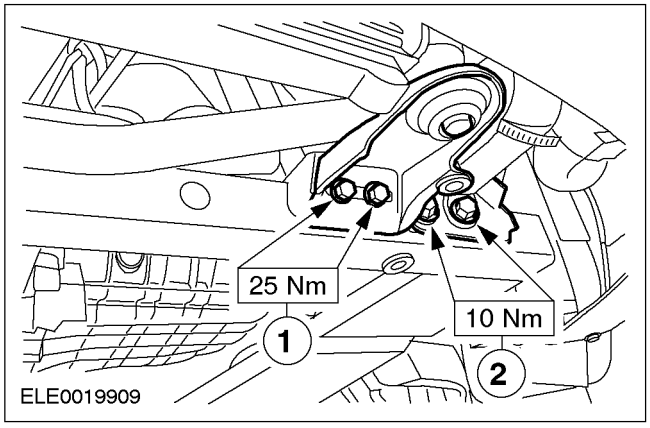
11. **Install the exhaust flexible pipe. For additional information, refer to Section 309-00.**
12. **Install the stabilizer connecting link to the suspension strut on both sides.**



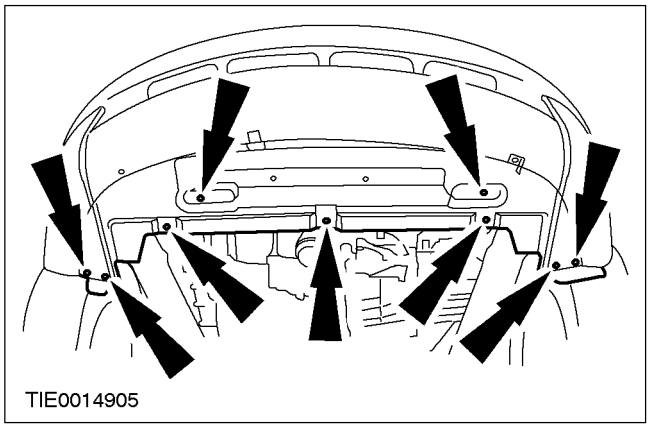
IN-VEHICLE REPAIR (Continued)

13. Install the radiator support brackets.

1. Install both radiator support brackets.
2. Install the hose bracket.



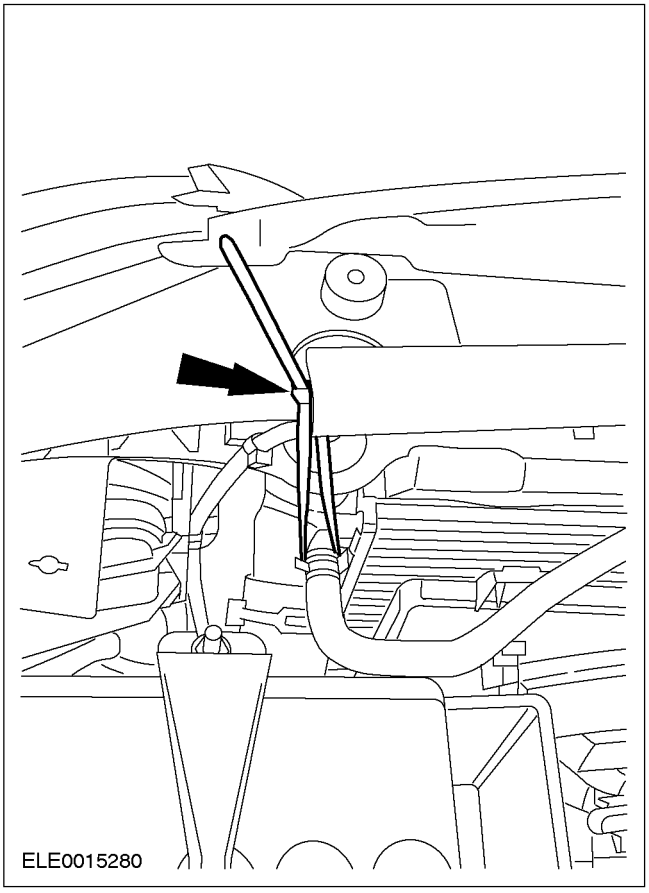
14. Install the splash shield.



15. Install the wheel and tire. For additional information, refer to Section 204-04.

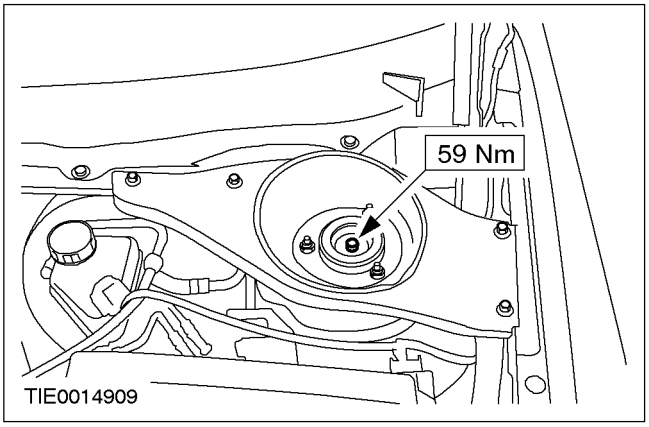
16. Lower the vehicle.

17. Remove the cable ties.



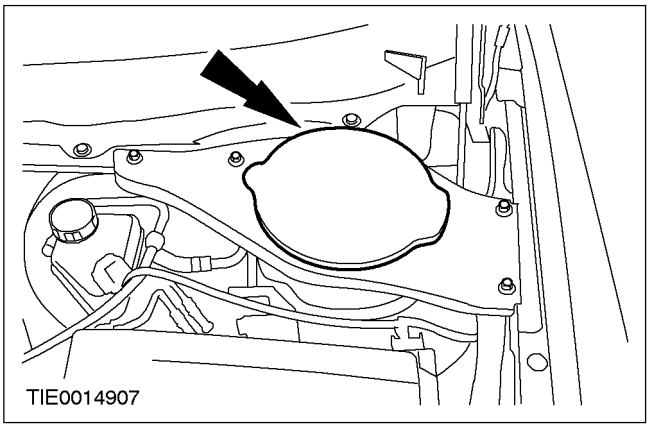
18. CAUTION: Use an Allen key to prevent the piston rod from turning.

Tighten the suspension top mount nut.



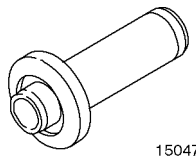
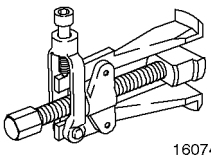
IN-VEHICLE REPAIR (Continued)

19. Install the suspension strut and spring assembly top mount brace cover.



IN-VEHICLE REPAIR

Halfshaft Seal RH (14 304 0)

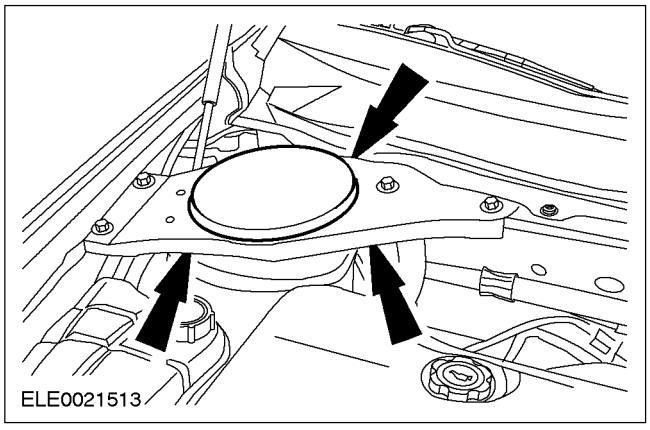
Special Tool(s)	
 15047A	Installer, Drive Pinion Oil Seal 205-077 (15-047 A)
 16074	Remover, Halfshaft Oil Seal 308-208 (16-074)

General Equipment
Transmission jack

Name	Specification
Cable ties	
Automatic transmission fluid	ESP-M2C-116-H

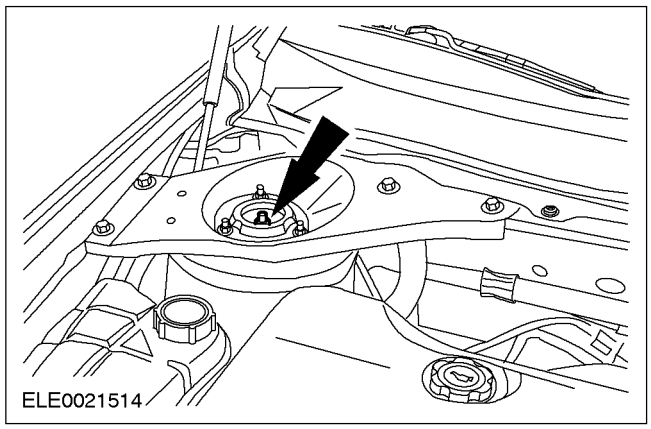
Removal

1. **Remove the suspension strut and spring assembly top mount brace cover.**

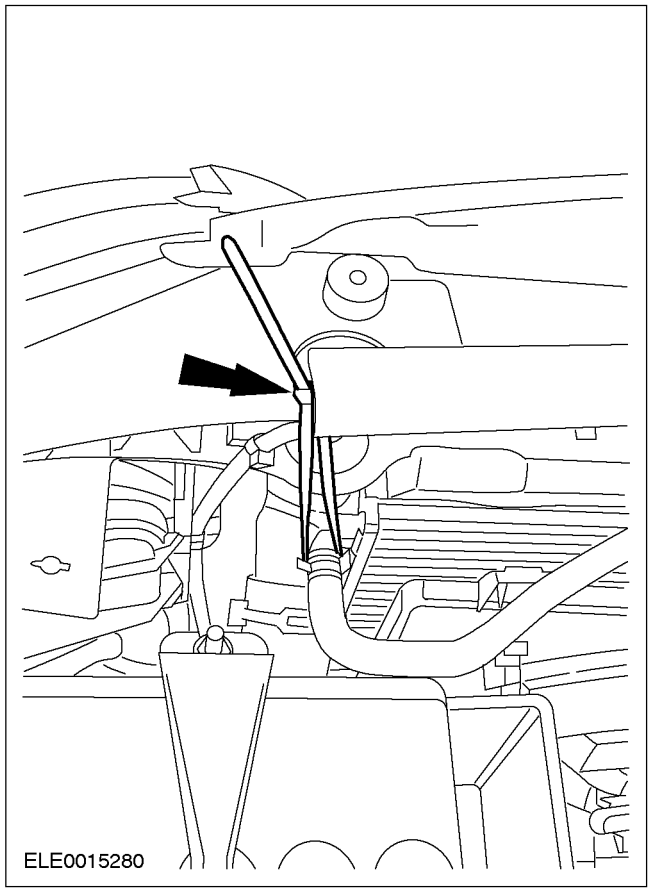


2. **CAUTION: Use an Allen key to prevent the piston rod from turning.**

   Loosen the suspension top mount nut by five turns.



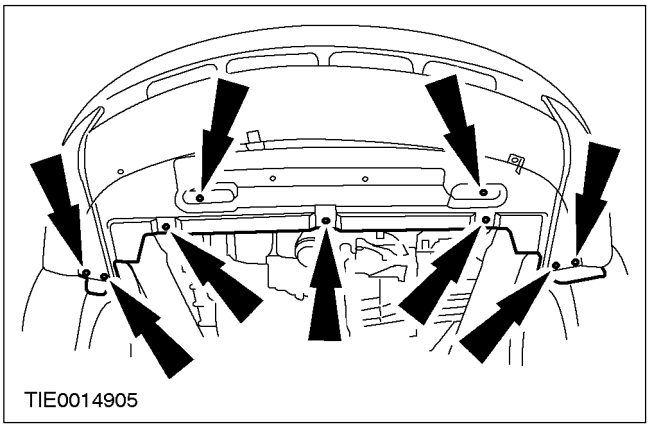
3. **Using cable ties, support the radiator on both sides.**



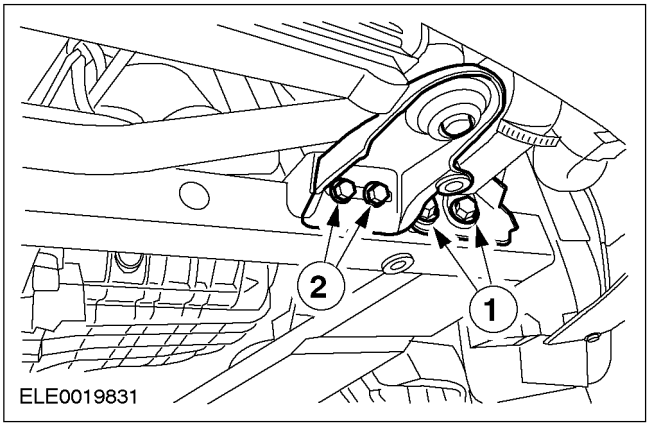
4. **Raise and support the vehicle. For additional information, refer to Section 100-02.**

IN-VEHICLE REPAIR (Continued)

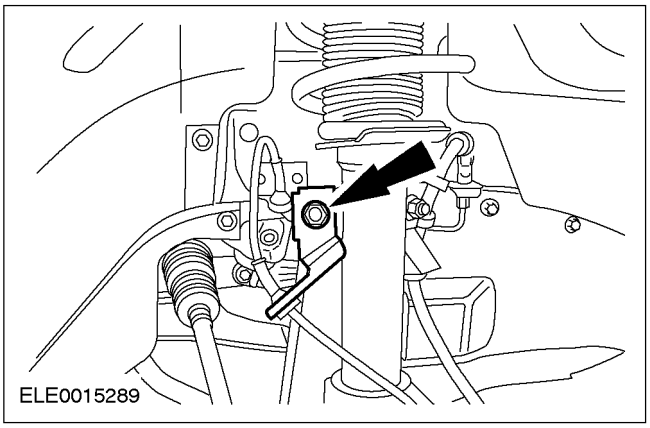
5. **Remove the front wheel and tire. For additional information, refer to Section 204-04.**
6. **Remove the splash shield.**



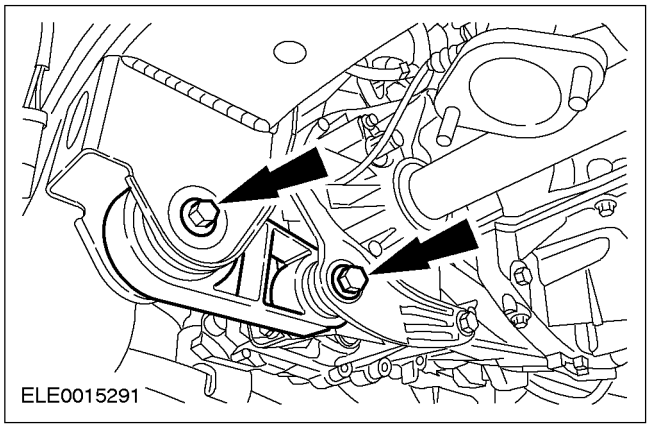
7. **Remove the radiator support brackets.**
   1. Remove the hose bracket.
   2. Remove both radiator support brackets.



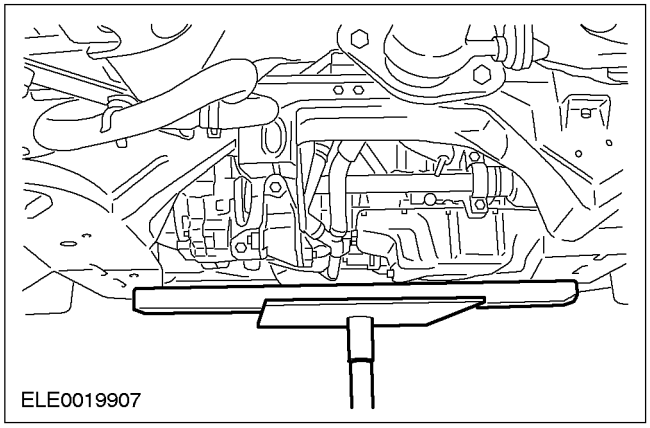
8. **Detach the stabilizer connecting link from the suspension strut on both sides.**



9. **Remove the exhaust flexible pipe. For additional information, refer to Section 309-00.**
10. **Remove the engine rear support insulator.**



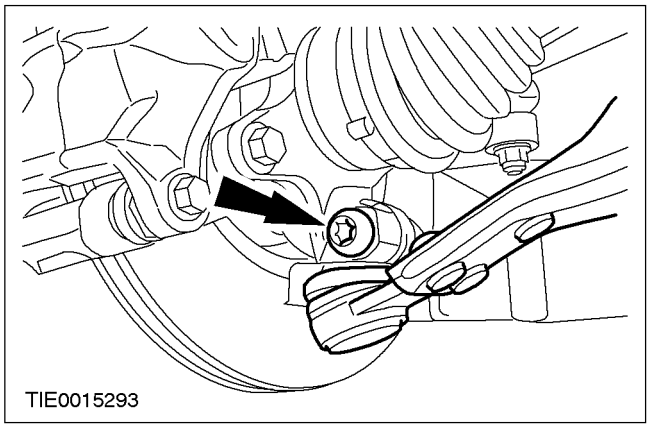
11. **Using two suitable wooden blocks and suitable transmission jack, support the subframe.**



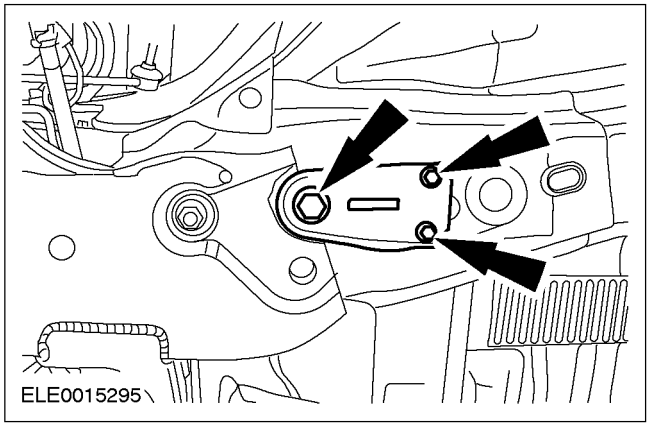
IN-VEHICLE REPAIR (Continued)

12. **CAUTION: Do not pull down the lower arm, to prevent the lower arm hydro-bushing from damage.**

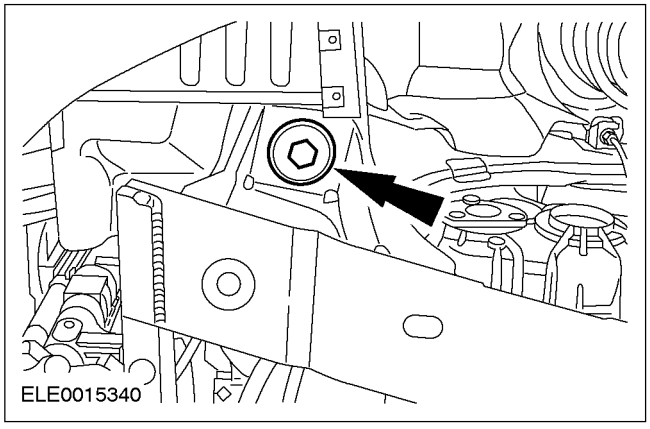
    Remove the lower arm ball joint retaining nut and bolt.



13. **Remove the subframe rear retaining bolts and the subframe bracket retaining bolts on both sides.**

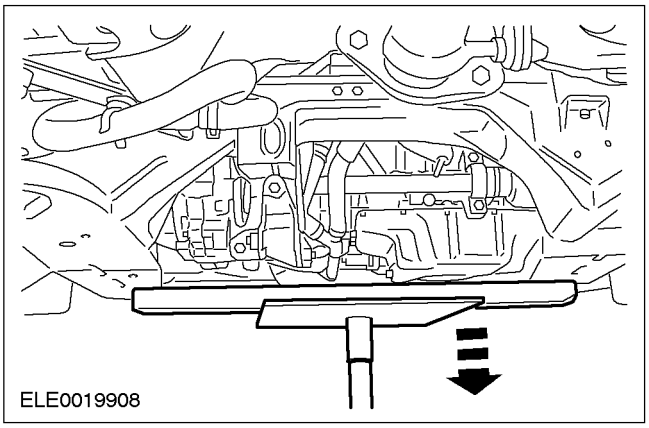


14. **Remove the subframe front retaining bolts on both sides.**



15. **CAUTION: Lower the subframe uniformly, to prevent the lower arm hydro-bushing from damage.**

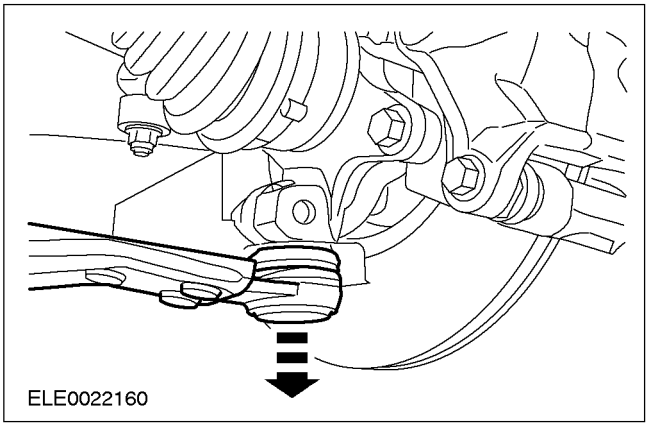
    Using the transmission jack, lower the subframe approximately 150 mm.



16. **CAUTION: Protect the ball joint seal using a soft cloth to prevent damage.**

    Detach the lower arm ball joint from the wheel knuckle.

    - Remove the heat shield.

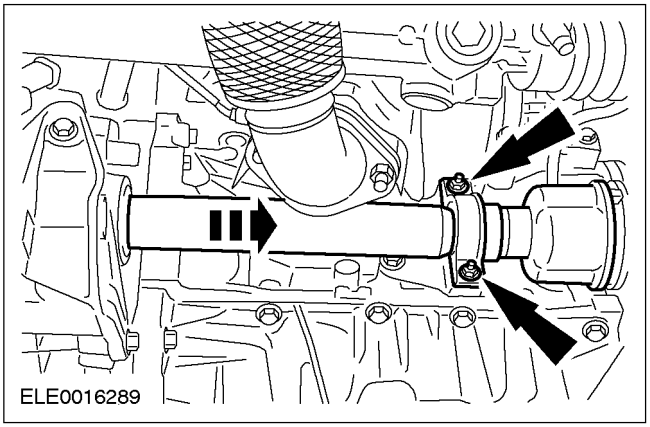


IN-VEHICLE REPAIR (Continued)

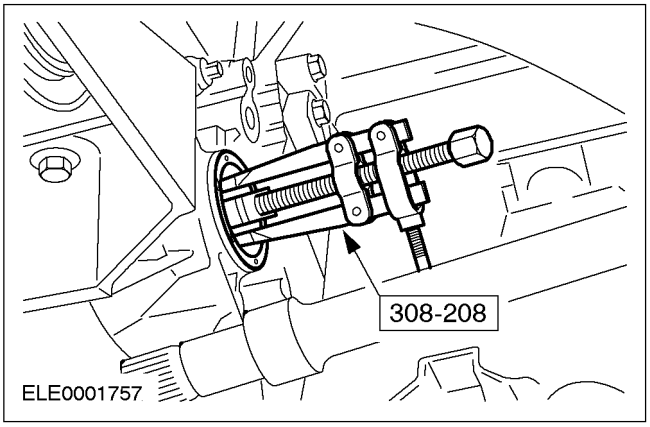
17. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

    Detach the halfshaft from the transaxle and secure it to one side.

    - Remove and discard the center bearing cap and locknuts.
    - Allow the oil to drain into a suitable container.

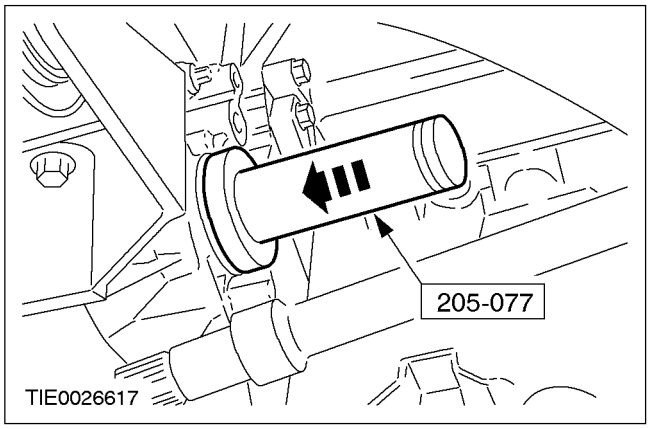


18. **Using the special tool, remove the halfshaft oil seal.**



Installation

1. **Using the special tool, install the halfshaft oil seal.**



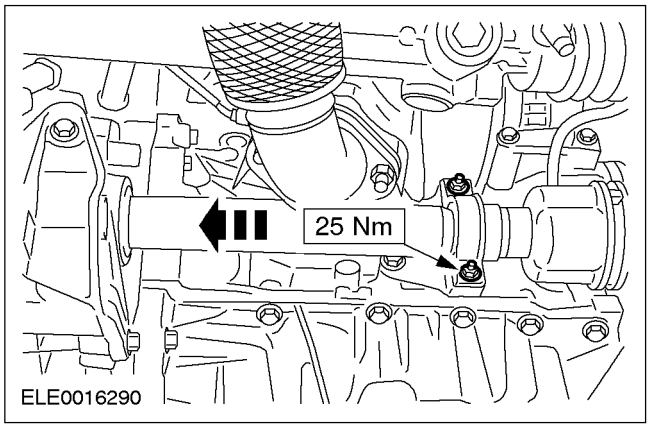
2. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

CAUTION: Do not damage the halfshaft oil seal.

NOTE: Install a new center bearing cap and locknuts.

Attach the halfshaft to the transaxle.

- Install the center bearing cap.

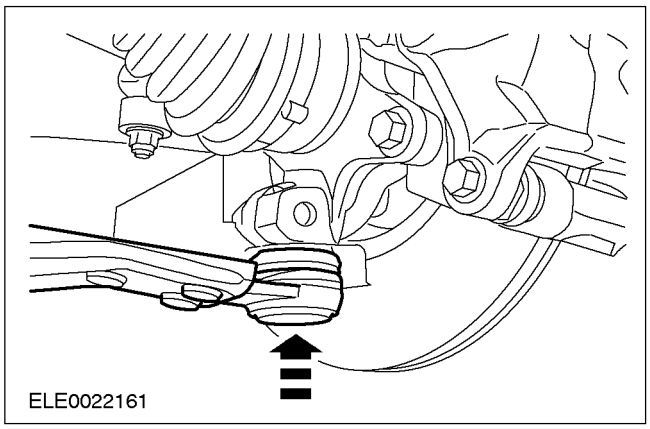


IN-VEHICLE REPAIR (Continued)

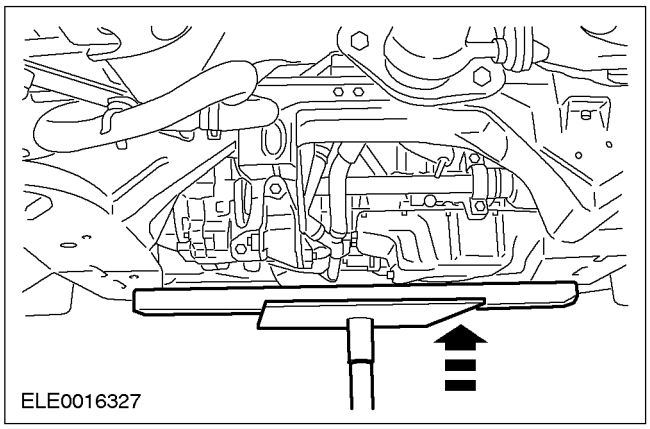
3. **CAUTION: Make sure the heat shield is installed to prevent damage to the ball joint.**

   Attach the lower arm to the wheel knuckle on both sides.

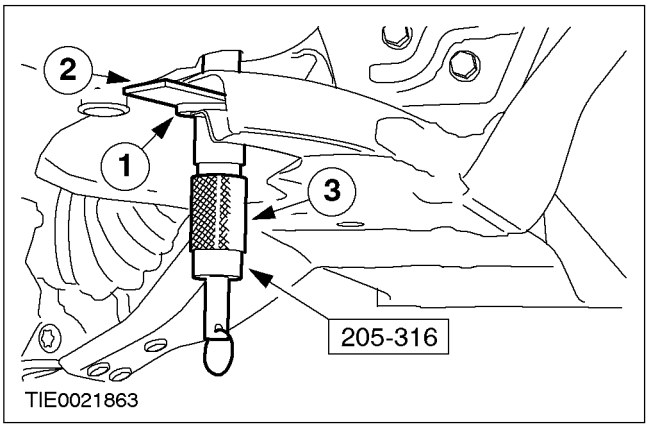
   - Install the heat shield.



4. **Using the transmission jack, position the subframe.**

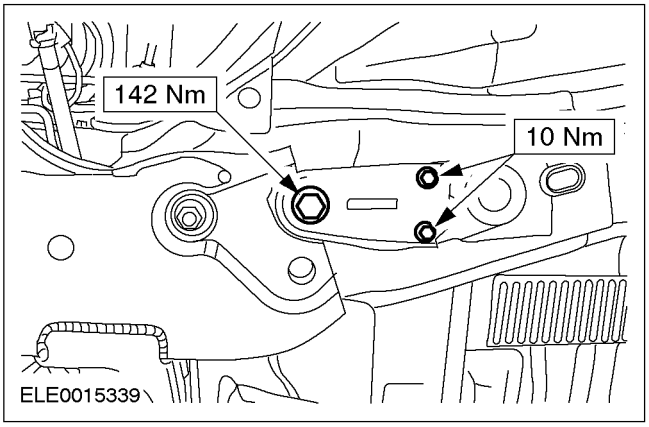


5. **Using the special tools and a suitable washer, align the subframe.**
   1. Insert the washer, with inside diameter 22 mm, outside diameter 44 mm and height 5 mm, into the subframe above the lower alignment hole.
   2. Insert the alignment pin through the subframe alignment holes and the washer.
   3. Slide the locking plates on top of the washer and into the groove of the tool and tighten the alignment pin sleeve.



6. **CAUTION: While tightening the subframe retaining bolts, make sure the subframe does not move.**

   Install the subframe rear retaining bolts and the subframe bracket retaining bolts on both sides.

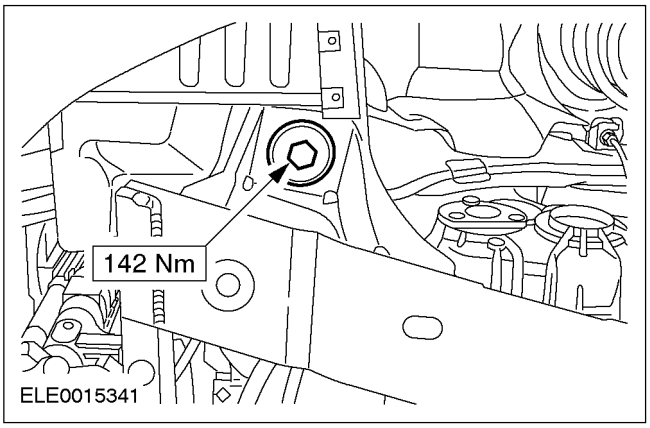


IN-VEHICLE REPAIR (Continued)

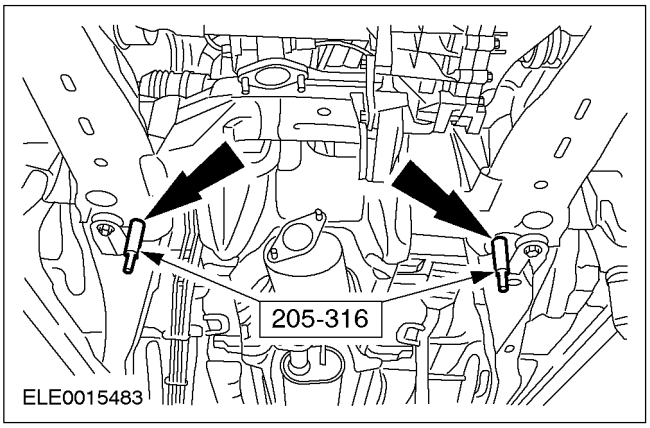
7. **CAUTION: While tightening the subframe retaining bolts, make sure the subframe does not move.**

   Install the subframe front retaining bolts.

   - Lower and remove the transmission jack.

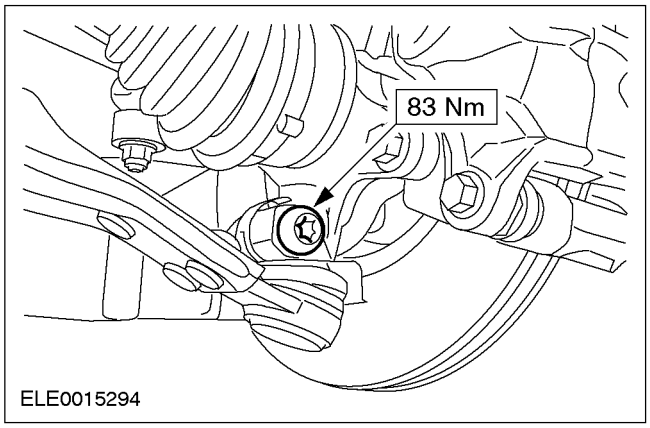


8. **Remove the special tools.**

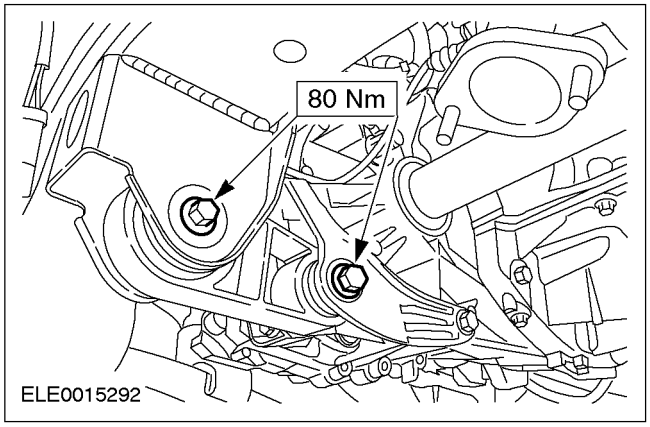


9. **WARNING: Install a new self-locking nut.**

   Install the lower arm ball joint pinch bolt from the rear, the retaining nut from the front.



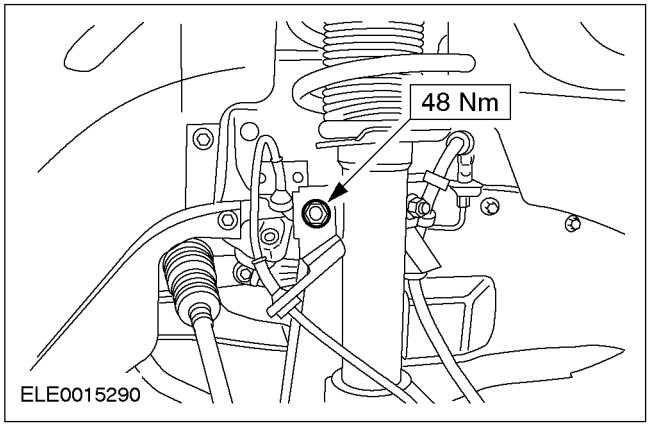
10. **Install the engine rear support insulator.**



11. **Install the exhaust flexible pipe. For additional information, refer to Section 309-00.**

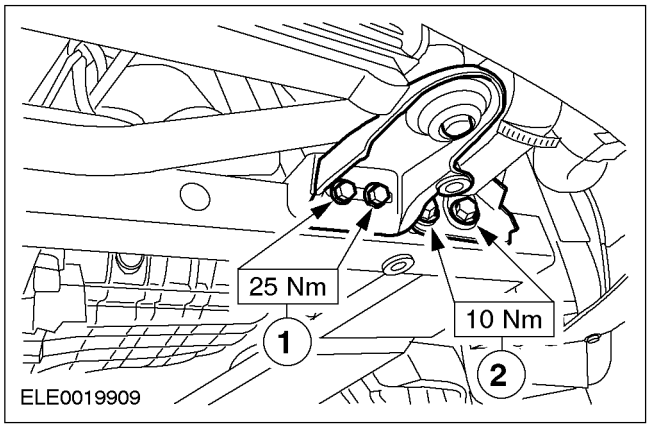
IN-VEHICLE REPAIR (Continued)

12. Install the stabilizer connecting link to the suspension strut on both sides.

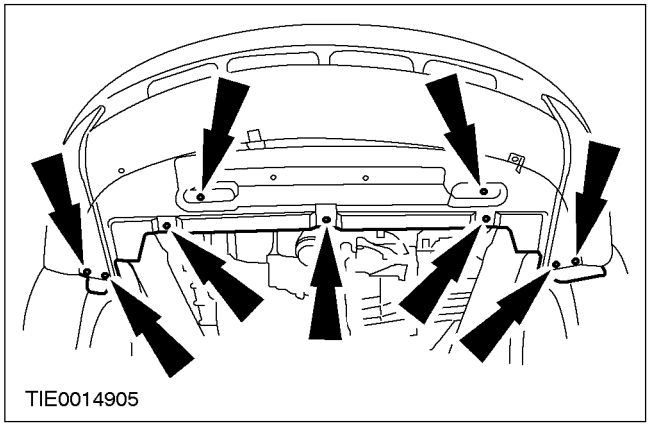


13. Install the radiator support brackets.

1. Install both radiator support brackets.
2. Install the hose bracket.



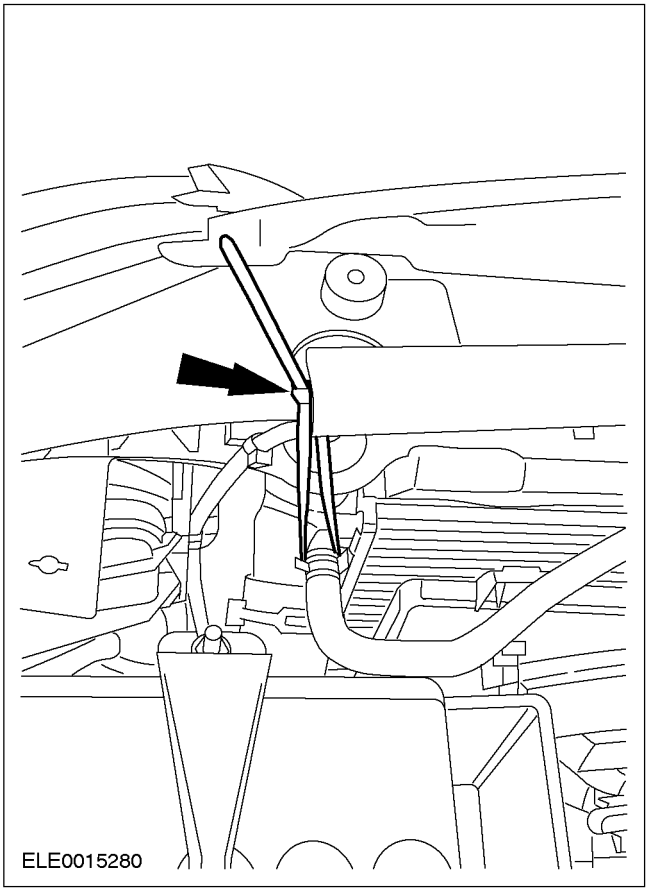
14. Install the splash shield.



15. Install the wheel and tire. For additional information, refer to Section 204-04.

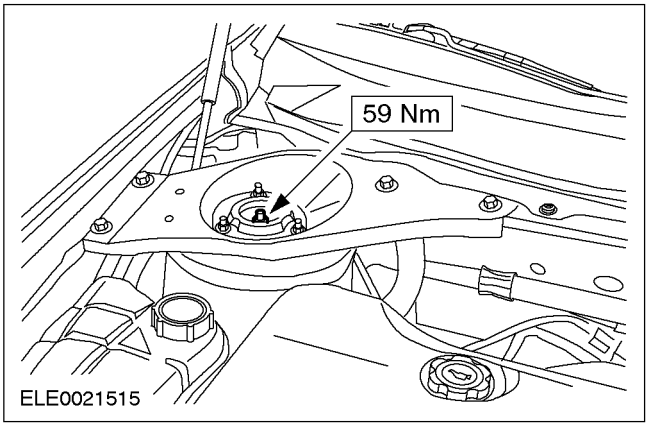
16. Lower the vehicle.

17. Remove the cable ties.



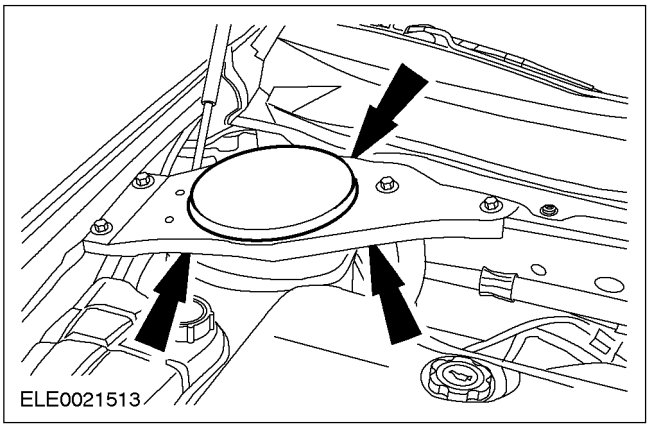
18. ⚠ CAUTION: Use an Allen key to prevent the piston rod from turning.

Tighten the suspension top mount nut.



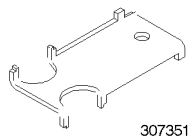
IN-VEHICLE REPAIR (Continued)

19. Install the suspension strut and spring assembly top mount brace cover.



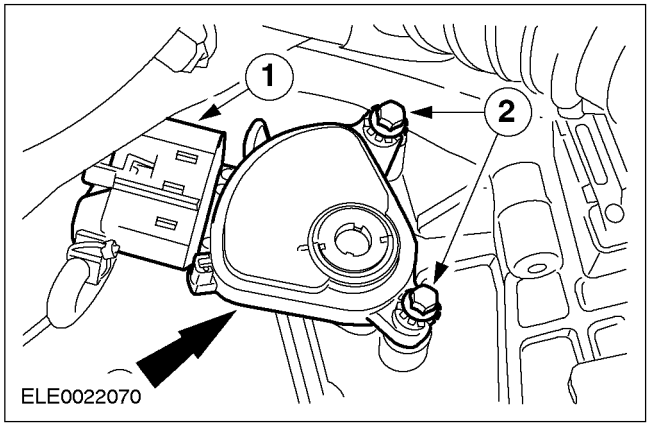
IN-VEHICLE REPAIR

Transmission Range (TR) Sensor (17 705 0)

Special Tool(s)	
 307351	Gauge TR Sensor Alignment 307-351 (17–090)

Removal

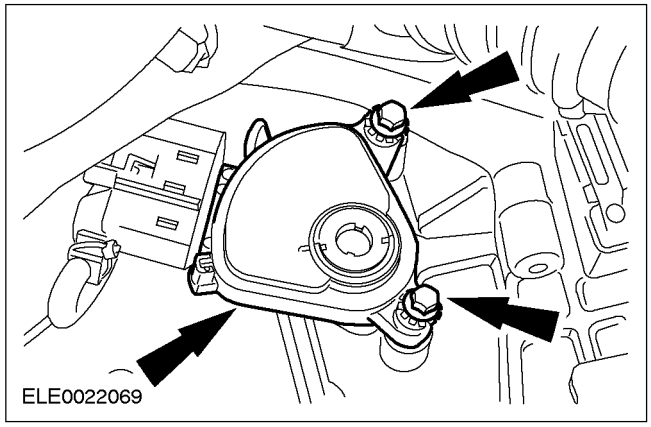
1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Move the selector lever to neutral "N".**
3. **Remove the battery tray. For additional information, refer to Section 414-01.**
4. **Remove the transmission range (TR) sensor.**
   1. Disconnect the TR electrical connector.
   2. Remove the retaining bolts.



Installation

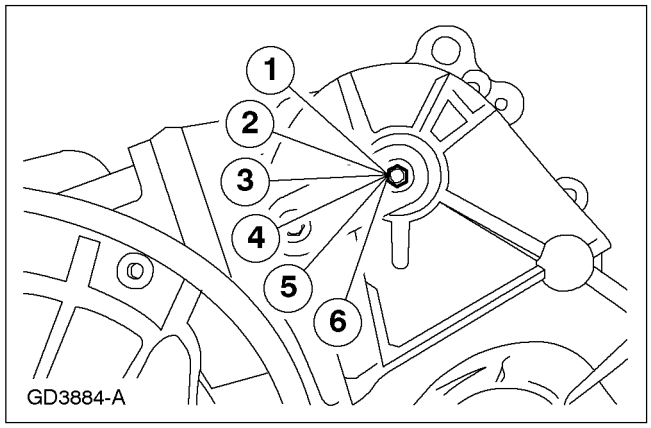
1. **NOTE:** Make sure the transaxle is in the NEUTRAL position.

   Position the transmission range (TR) sensor and loosely install the bolts.



2. **NOTE:** As necessary, move the manual control lever to ""N" position for TR sensor adjustment.

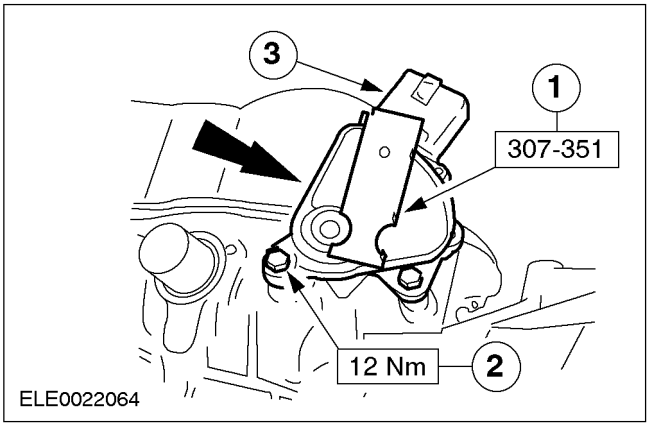
   Rotate the manual valve detent lever assembly to the neutral position.
   1. Low 1
   2. Low 2
   3. Drive
   4. Neutral
   5. Reverse
   6. Park



IN-VEHICLE REPAIR (Continued)

3. Install the TR sensor.

1. Using the special tool, align the TR sensor.
2. Tighten the retaining bolts and remove the special tool.
3. Connect the electrical connector.



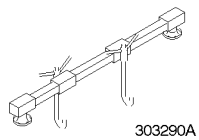
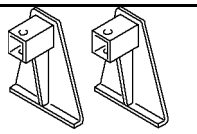
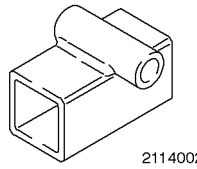
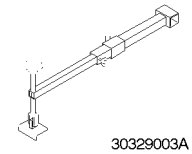
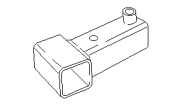
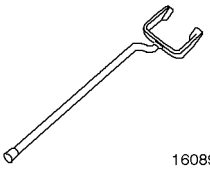
4. Install the battery tray. For additional information, refer to Section 414-01.

5. Connect the battery ground cable.

6. Check the correct operation. With parking brake applied the engine should start only in park "P" or neutral "N". Reversing lamps should illuminate only when Reverse "R" is selected.

REMOVAL

Transaxle (17 214 0)

Special Tool(s)	
 303290A	Support Bar, Engine 303-290A (21-140A)
 2114001	Adapter for 303-290A 303–290–01 (21–140–01)
 2114002	Adapter for 303-290A 303-290-02 (21-140-02)
 30329003A	Adapter for 303-290A 303-290-03A (21-140-03A)
 30329005A	Adapter for 303-290A 303-290-05A (21-140-05A)
 16089	Remover, Halfshaft 308-256 (16-089)

General Equipment
Securing straps
Transmission jack
Tire lever

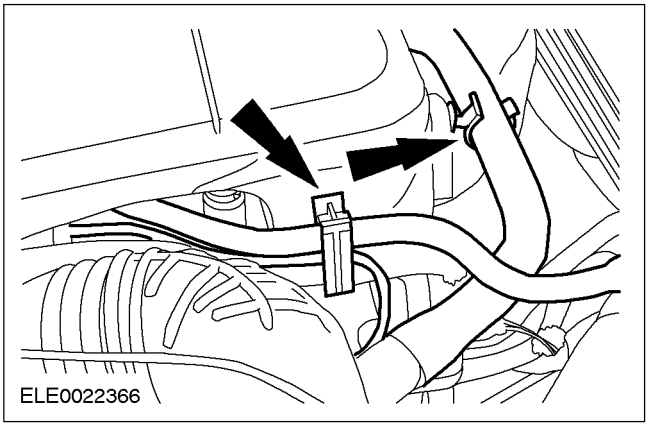
Removal

All Vehicles

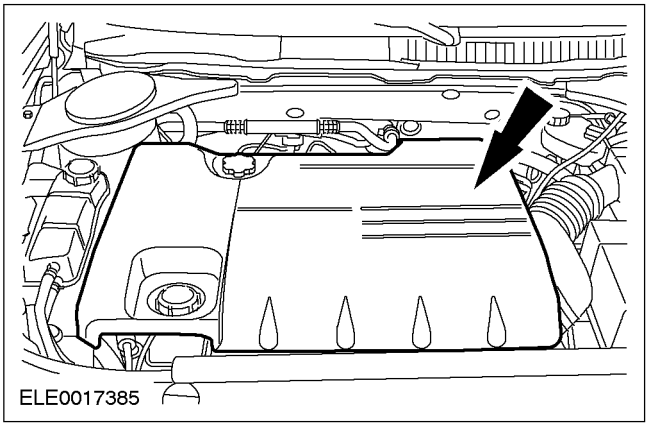
1. **NOTE:** The locations of engine and transaxle mountings and engine support insulators are described looking from the transaxle to the engine.

   Disconnect the battery ground cable. For additional information, refer to Section 414-01.

2. **Detach the pipes and hoses from the engine upper cover.**

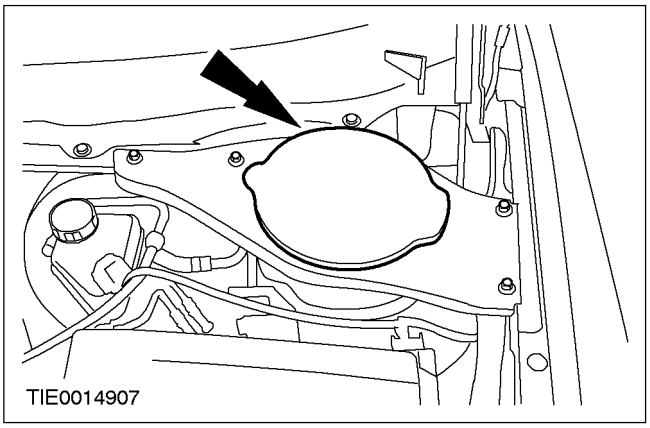

ELE0022366

3. **Remove the engine upper cover.**


ELE0017385

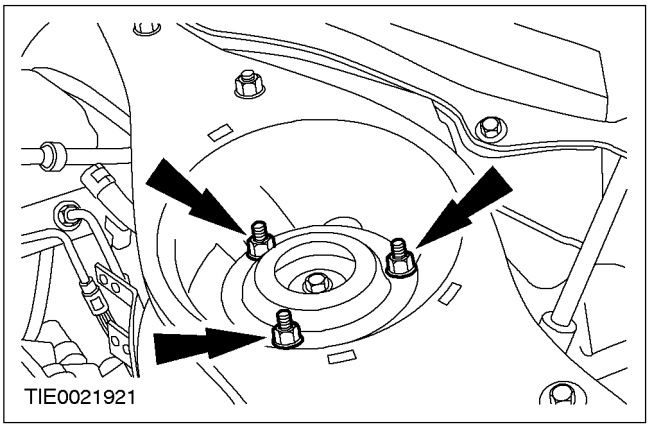
REMOVAL (Continued)

4. **Remove the strut and spring assembly top mount brace cover.**



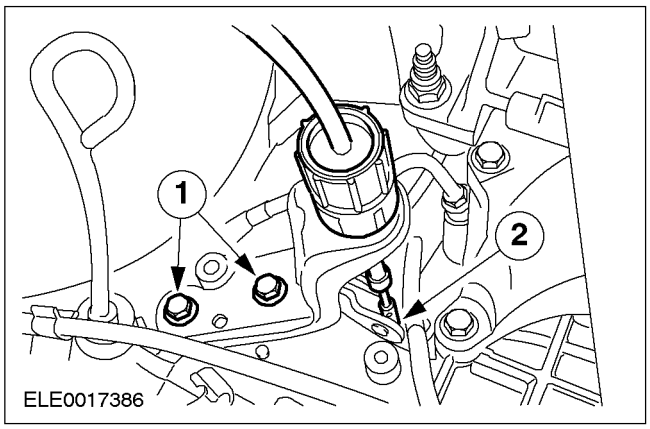
5. **CAUTION: Use an Allen key to prevent the piston rod from rotating.**

   Loosen the strut and spring assembly top mount nut by five turns.

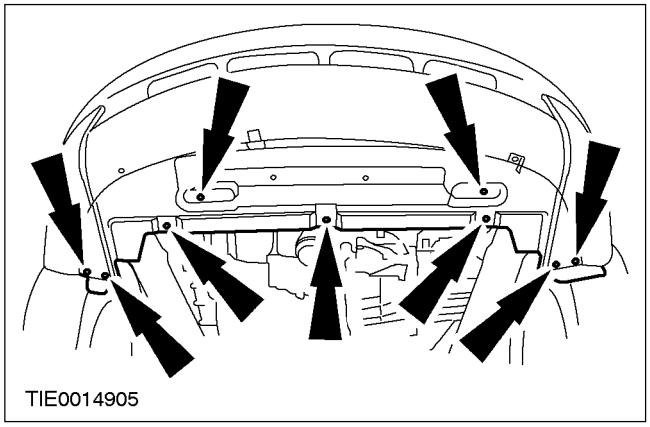


6. **Remove the air cleaner. For additional information, refer to Section 303-01A / 303-01B / 303-01C / 303-01D.**

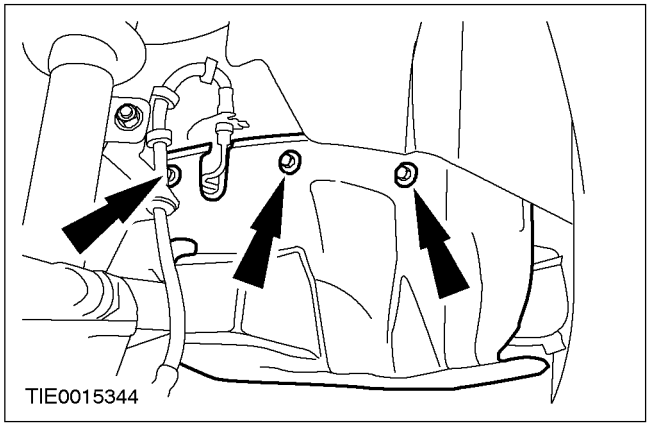
7. **Detach the selector lever cable from the transaxle.**
   1. Remove the selector lever cable bracket.
   2. Detach the selector lever cable.



8. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
9. **Remove the radiator splash shield.**



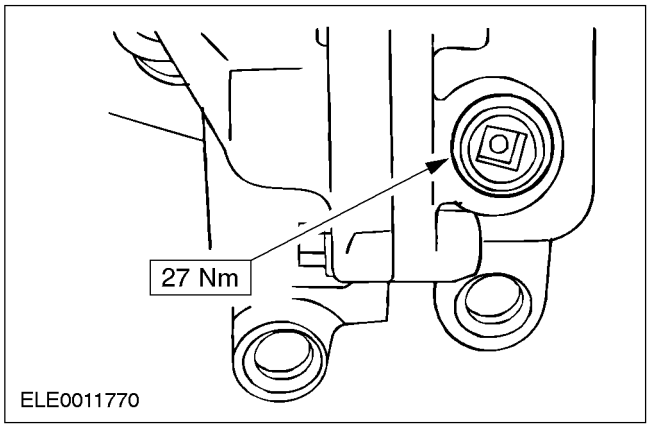
10. **Remove the subframe. For additional information, refer to Section 502-00.**
11. **Remove the accessory drive belt cover.**



REMOVAL (Continued)

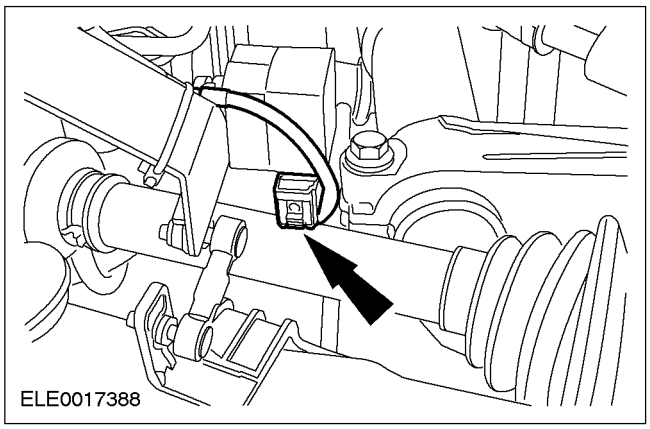
12. Remove the transaxle drain plug and drain the transmission fluid.

- Discard the gasket.
- Allow the oil to drain into a suitable container.



Vehicles with Xenon headlamps

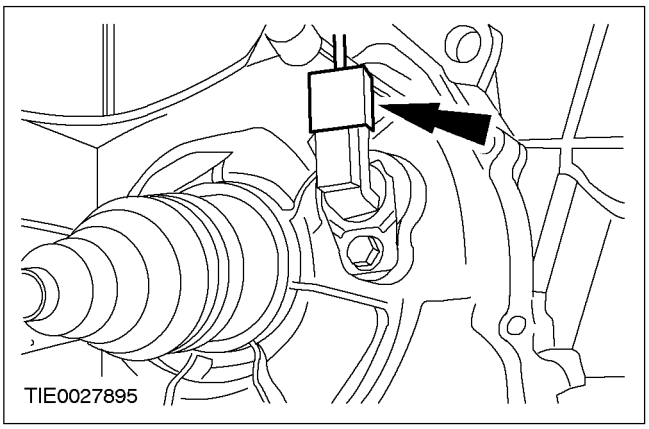
13. Disconnect the headlamp levelling sensor electrical connector.



All vehicles

14. NOTE: The electrical connector color is black.

Disconnect the output shaft speed (OSS) sensor electrical connector.

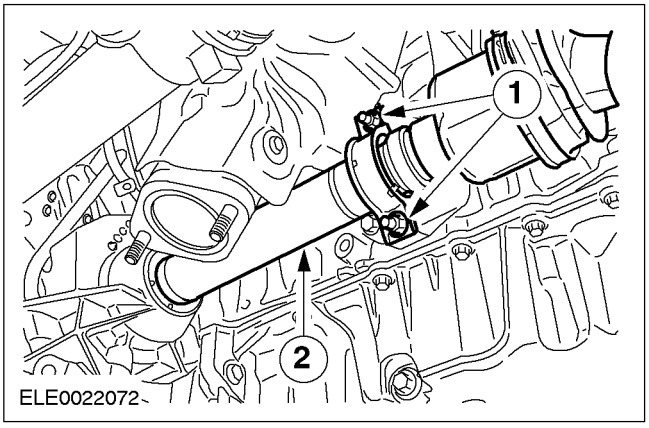


15. CAUTION: The inner joint must not be bent more than 18 degrees, the outer joint must not be bent more than 45 degrees.

Detach the right-hand front drive halfshaft and intermediate shaft.

1. Remove the centre bearing cap.
2. Remove the intermediate shaft from the transaxle.

- Using cable ties, secure the right-hand front drive halfshaft.
- Using a suitable plug, close off the transaxle opening.

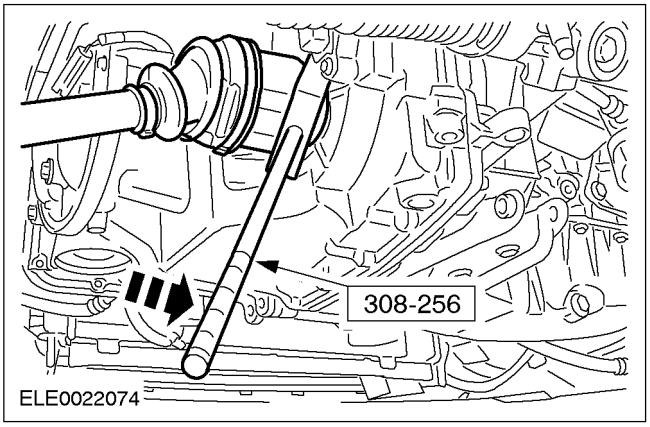


REMOVAL (Continued)

16. **CAUTION: The inner joint must not be bent more than 18 degrees, the outer joint must not be bent more than 45 degrees.**

    Detach the left-hand front drive halfshaft.

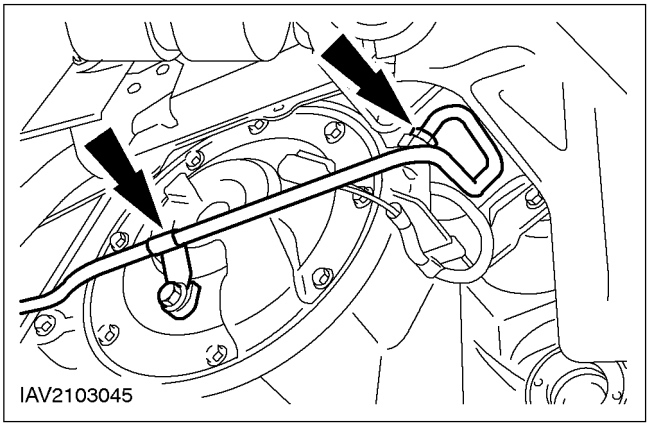
    - Using the special tool, detach the halfshaft from the transaxle.
    - Using cable ties, secure the left-hand front drive halfshaft.
    - Using a suitable plug, close off the transaxle opening.



17. **CAUTION: Prevent the fluid pipe adapter from turning using an open-end spanner, do not remove it from the transaxle housing.**

    Detach the fluid cooler pipe from the transaxle.

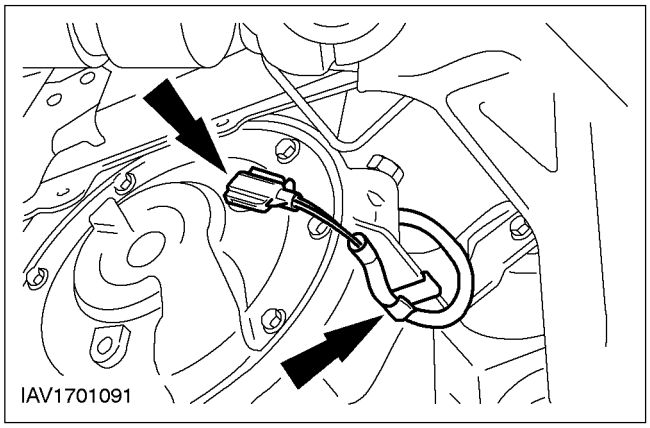
    - Detach the fluid pipe bracket from the transaxle.
    - Close off the openings using suitable plugs.



18. **NOTE:** The electrical connector color is white.

    Disconnect the turbine shaft speed (TSS) sensor electrical connector.

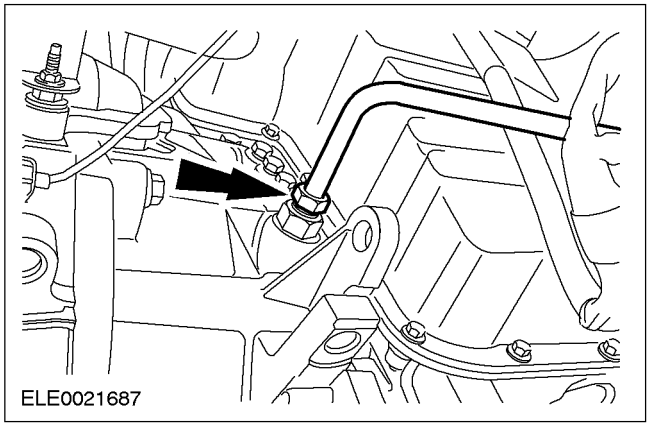
    - Remove the cable retaining clip.



19. **CAUTION: Prevent the fluid pipe adapter from turning using an open-end spanner, do not remove it from the transaxle housing.**

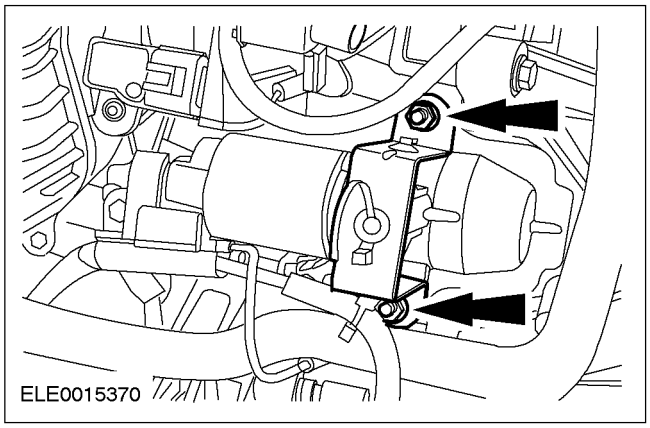
    Detach the fluid cooler pipe from the transaxle.

    - Close off the openings using suitable plugs.

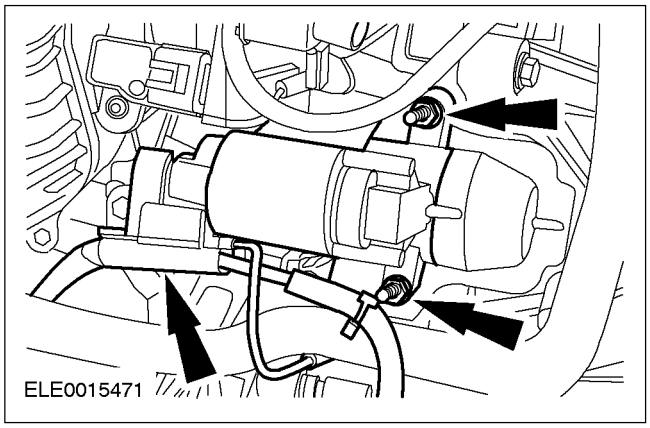


REMOVAL (Continued)

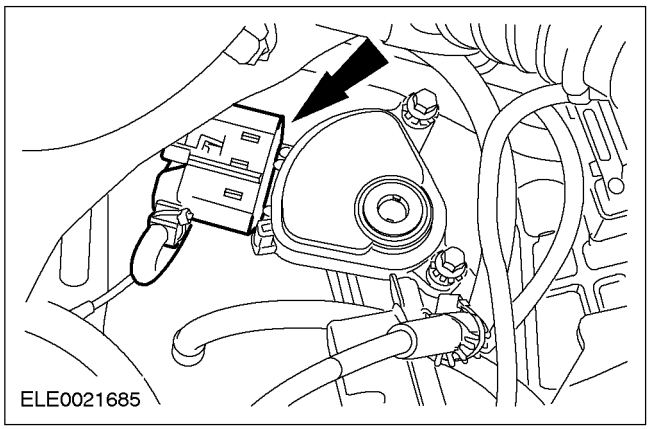
20. **Remove the wiring harness and fluid cooler pipe bracket.**
    - Detach the fluid cooler pipe.
    - Detach the wiring harness.



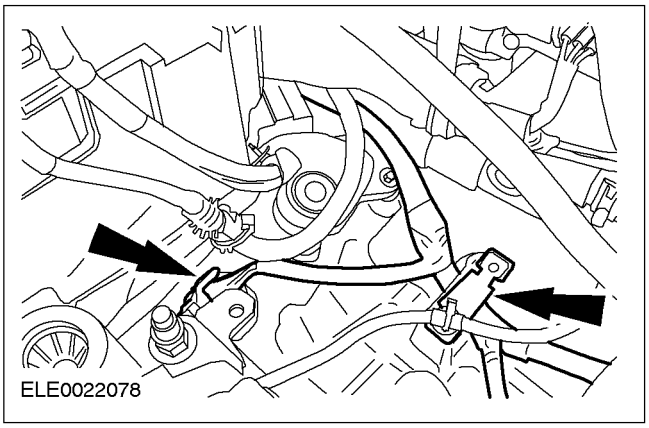
21. **Remove the starter motor.**



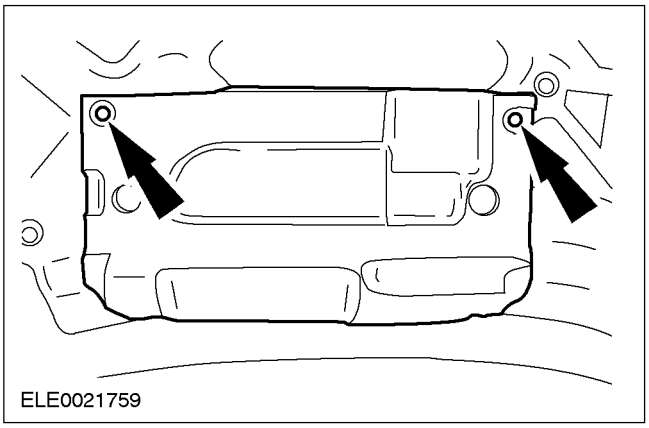
22. **Lower the vehicle.**
23. **Disconnect the transmission range (TR) sensor electrical connector.**



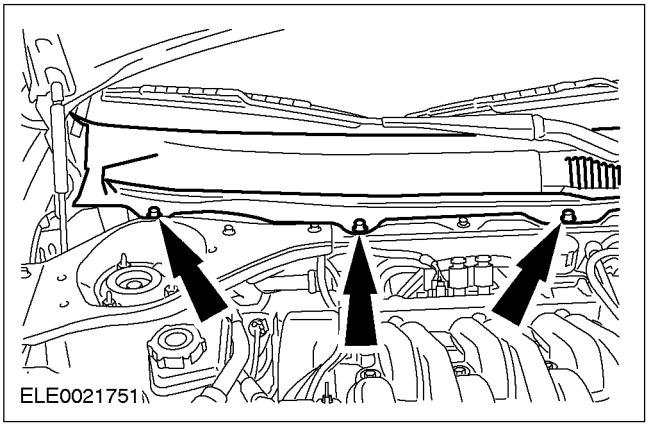
24. **Disconnect the automatic transmission control electrical connector.**
    - Remove the wiring harness retaining clip.
    - Remove the cable ties.



25. **Remove the plastic cover from the hood.**



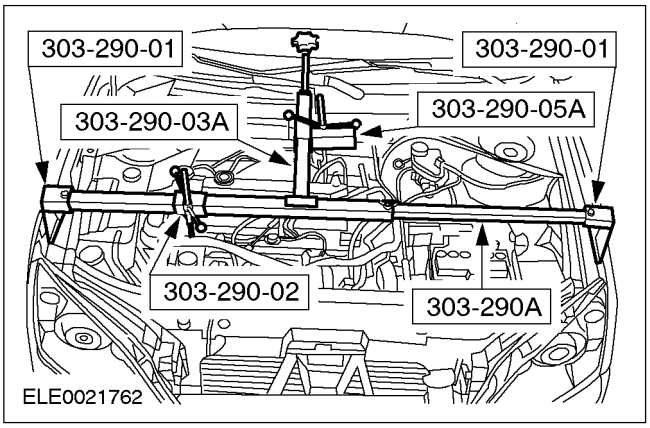
26. **Remove the bulkhead cover.**



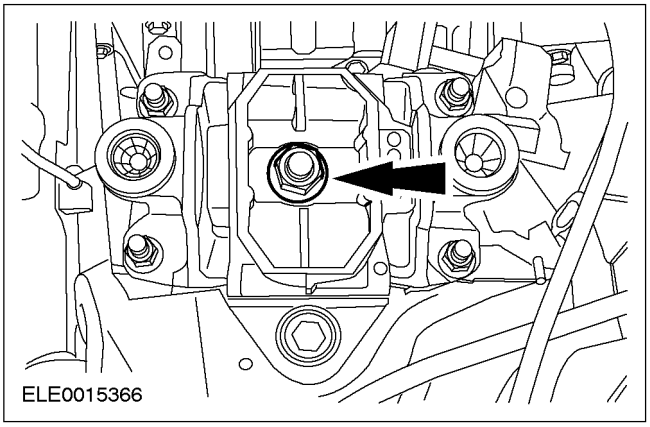
REMOVAL (Continued)

27. ⚠ **CAUTION: Do not damage coating of the fender.**

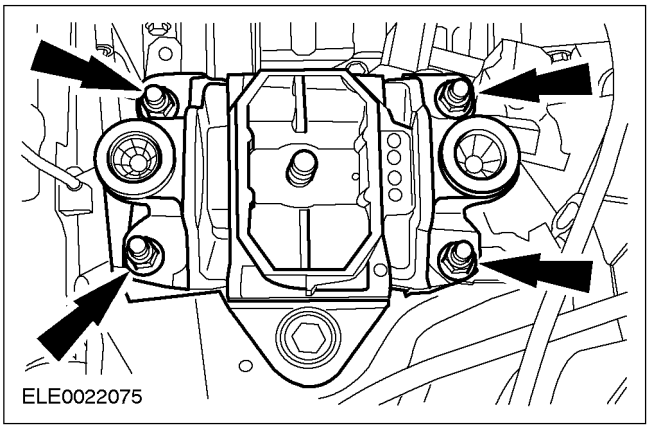
    Install the special tools.
    - Secure the engine.



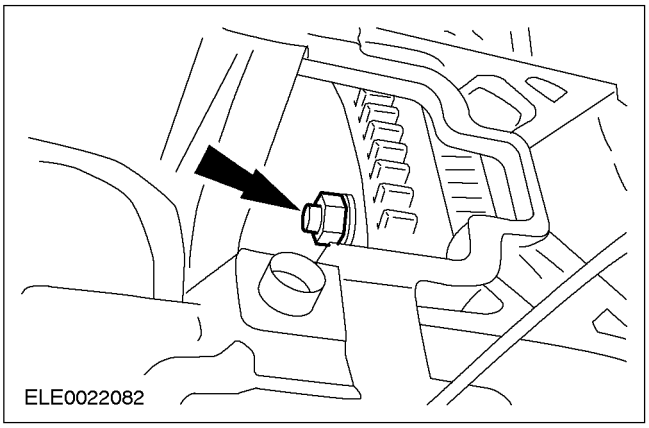
28. **Detach the rear engine and transaxle mounting.**



29. **Remove the rear engine and transaxle mounting bracket.**

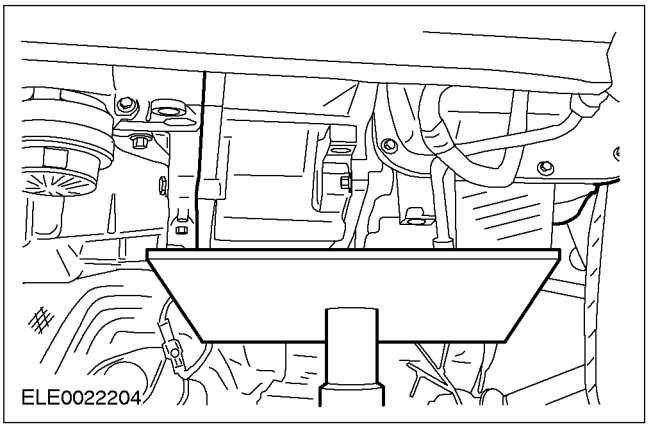


30. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
31. **Remove the rubber cover and the four torque converter to engine drive plate nuts.**
    - Rotate the torque converter to gain access to remaining nuts.
    - Discard the nuts



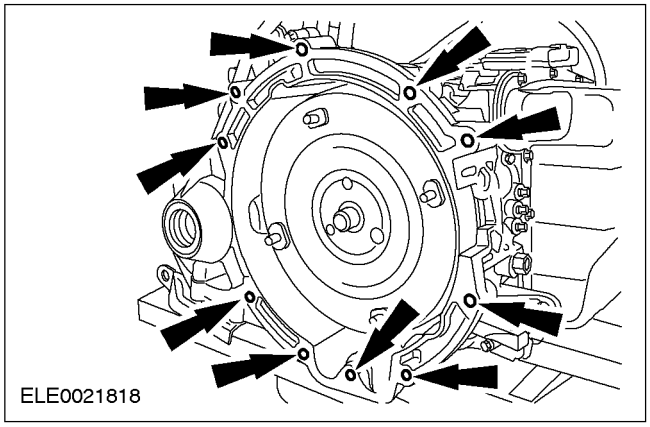
32. **NOTE:** Use a suitable wooden block and securing straps.

    Using a transmission jack and wooden block support the transaxle.
    - Secure the transaxle with securing straps.



REMOVAL (Continued)

33. **Remove the transaxle retaining bolts (transaxle removed for clarity).**

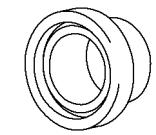
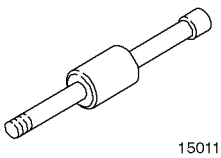
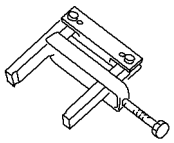
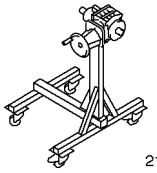
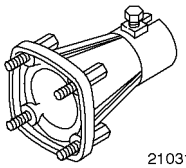
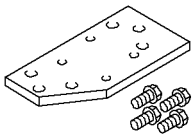


34. **CAUTION: Make sure that the torque converter remains in the transaxle.**

    Using a transmission jack lower the transaxle.

DISASSEMBLY

Transaxle (17 214 8)

Special Tool(s)	
 14043	Remover/Installer, Lower Arm Bushing 204-168 (14-043)
 15011	Slide Hammer 205-047 (15-011)
 17061	Remover, Torque Converter Oil Seal 307-272 (17-061)
 21187	Mouting Stand 303-435 (21-187)
 21031B	Mounting Bracket for 303-435 303-435-06 (21-031B)
 21170A	Mounting Plate for 303-435-06 303-435-13 (21-170A)

General Equipment
Inside puller

Disassembly

1. **CAUTION: In the case of abraded particles of metal, install a new valve body, fluid pipes, fluid cooler and torque converter.**

NOTE: Clean the transaxle assembly to prevent the entry of dirt when reassembling.

NOTE: Do not clean brake band and friction plates with cleaning agents.

NOTE: If, during repair work, abraded particles are found in the transmission fluid (particles from the clutch or metal chips or debris), the transaxle must be disassembled completely and cleaned. Also, clean fluid pipes, fluid cooler and torque converter carefully; in case of extreme soiling the fluid pipes, fluid cooler and torque converter should be newly installed.

NOTE: In case of clutch abrasion, rinse the torque converter with clean automatic transmission fluid.

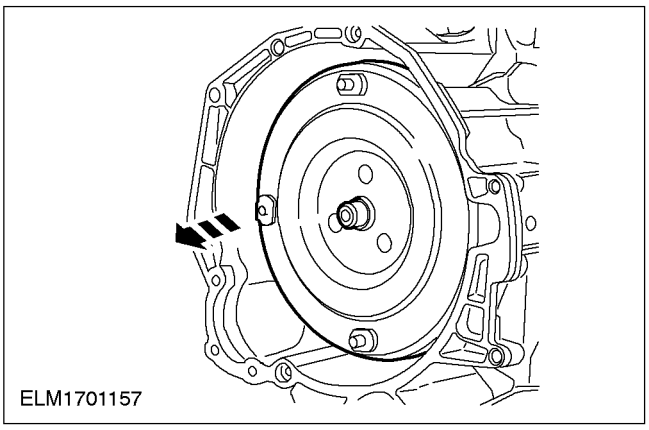
NOTE: Before taking measurements, compress all the clutches where axial play is detected to squeeze the oil out from between the plates.

Inspect transaxle during disassembly.

2. **CAUTION: Do not tilt the torque converter when removing it to avoid damaging the torque converter hub.**

NOTE: The torque converter is filled with fluid. Position it on a table so that fluid will drain out of the torque converter into a drain pan.

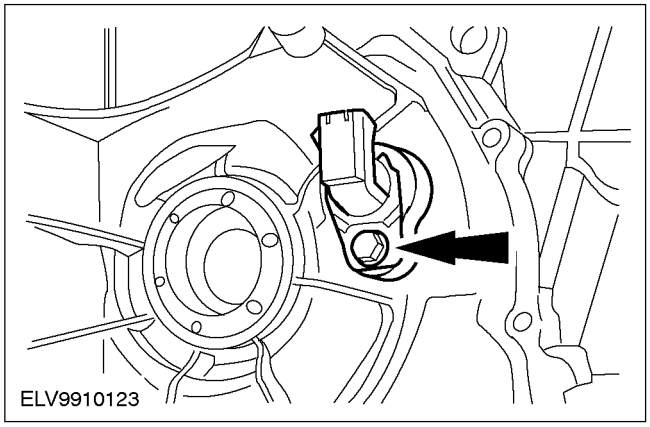
Remove the torque converter.



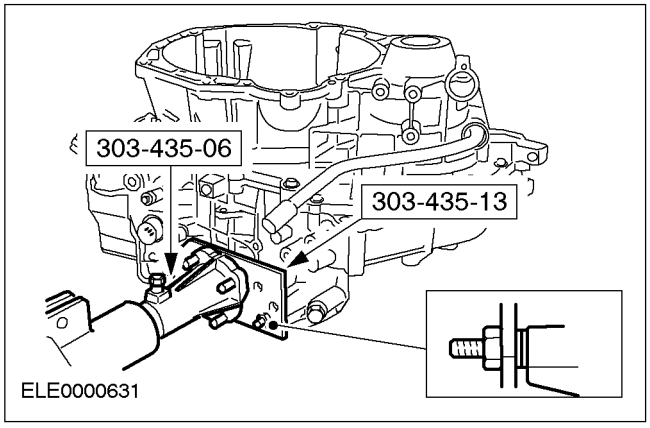
DISASSEMBLY (Continued)

3. Remove the output shaft speed (OSS) sensor.

- Remove and discard the OSS sensor O-ring seal.

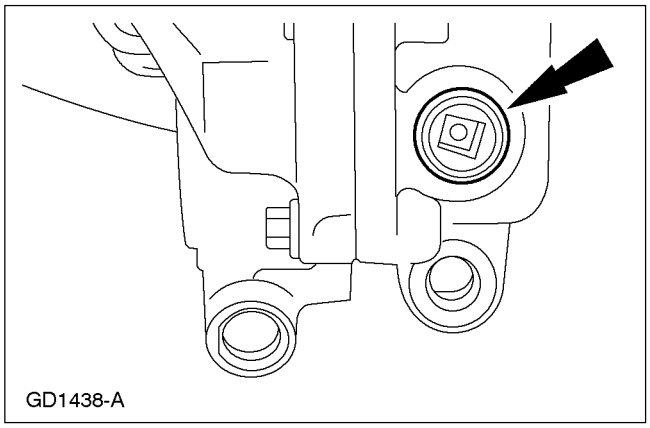


4. Using the special tool, secure the transaxle.

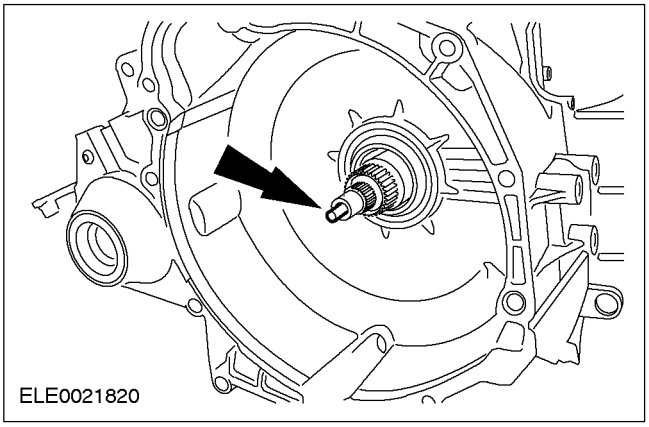


5. Position the drain pan under the transaxle, remove the drain plug, and drain the transmission fluid.

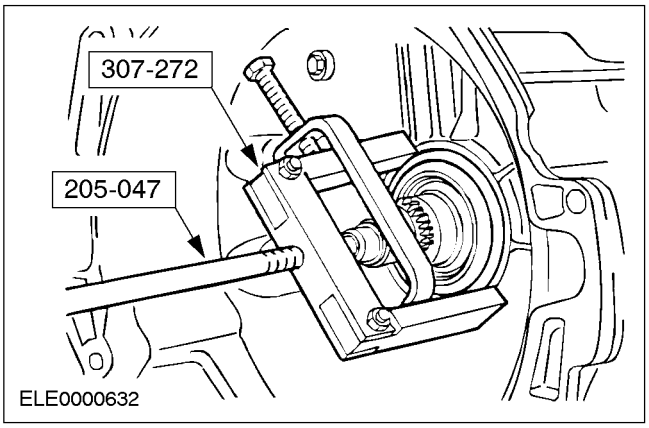
- Discard the gasket.



6. Remove the pump assembly driveshaft.

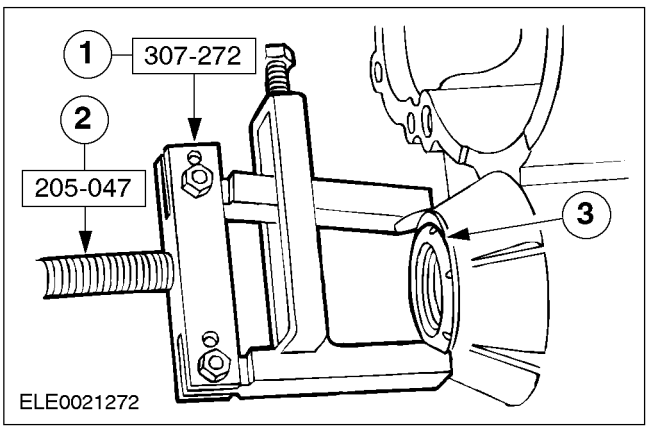


7. Using the special tools, remove and discard the torque converter impeller hub seal.



8. Using the special tools, remove the left-hand and right-hand differential seals.

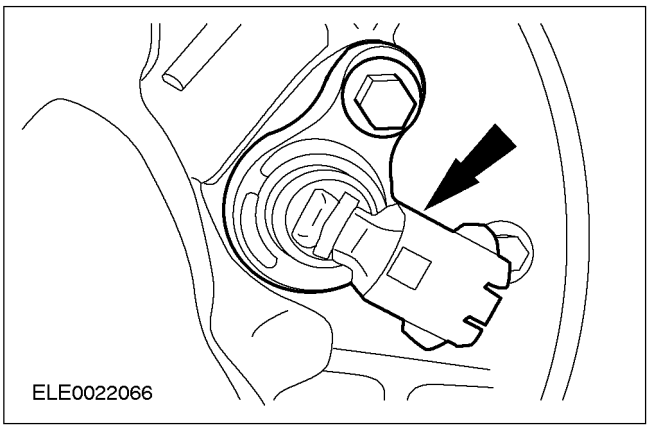
1. Install the special tool.
2. Install the special tool.
3. Remove and discard the differential seals.



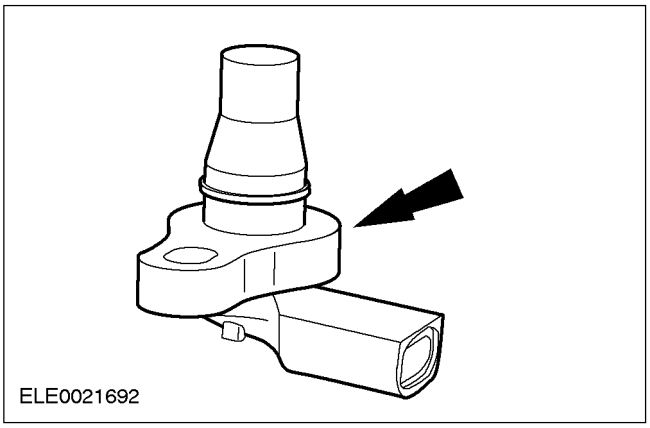
DISASSEMBLY (Continued)

9. Remove the turbine shaft speed (TSS) sensor.

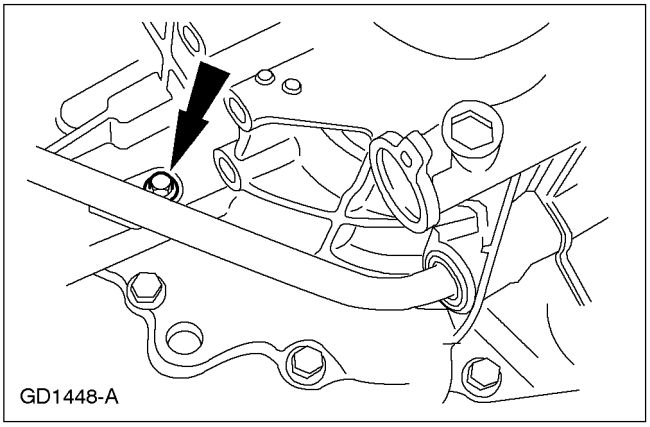
1. Remove the bolt.
2. Remove the TSS sensor.



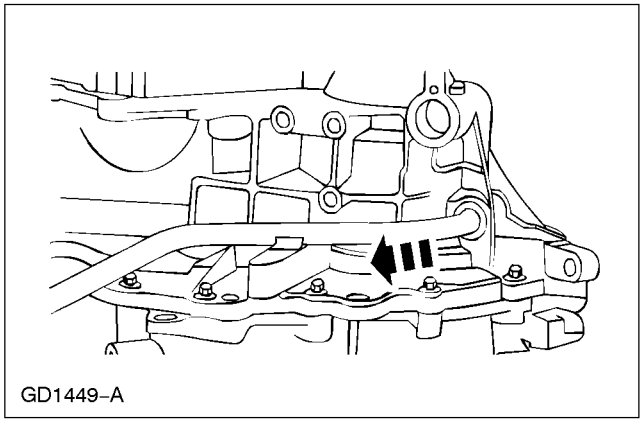
10. Remove and discard the TSS sensor O-ring seal.



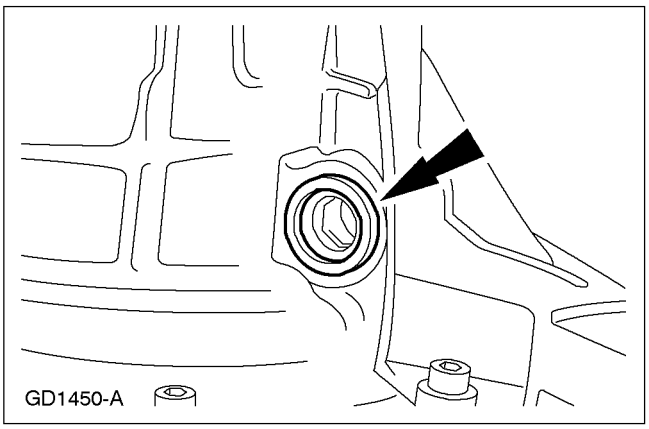
11. Remove the transaxle fluid filler tube bolt.



12. Remove the transaxle fluid filler tube.

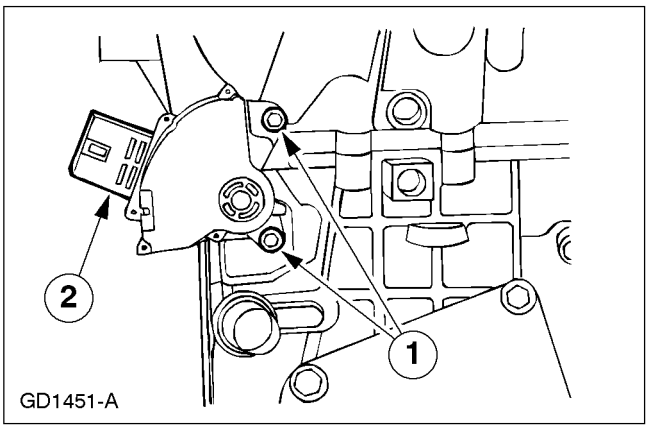


13. Remove and discard the transaxle filler tube grommet.



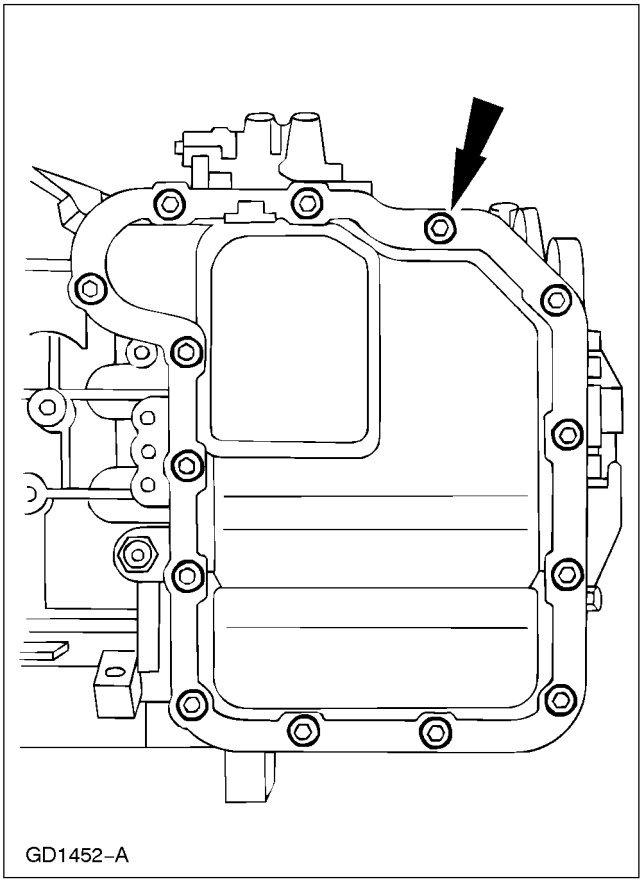
14. Remove the transmission range (TR) sensor.

1. Remove the bolts.
2. Remove the TR sensor from the manual valve detent lever shaft.

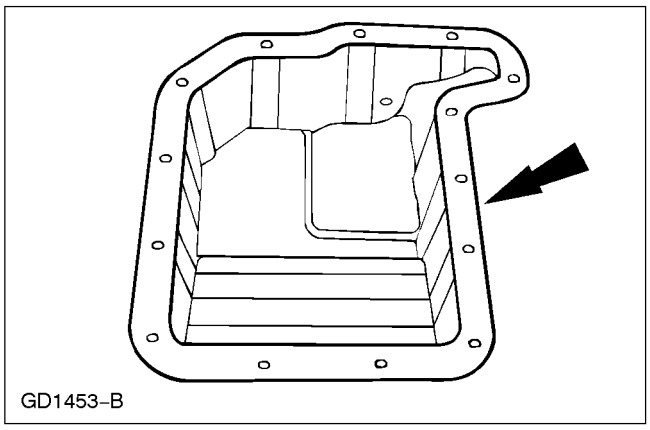


DISASSEMBLY (Continued)

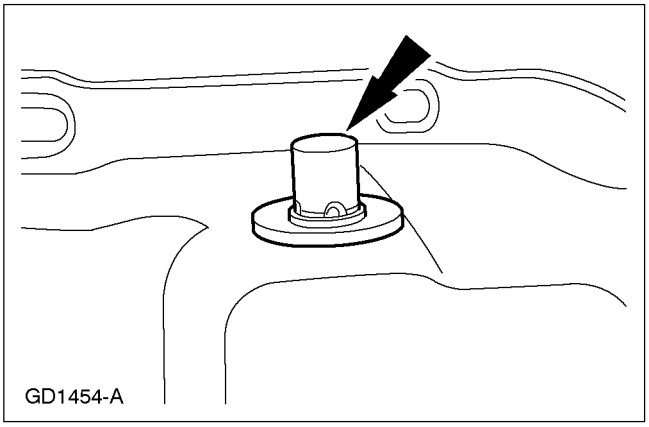
15. Remove the main control cover bolts, and cover.



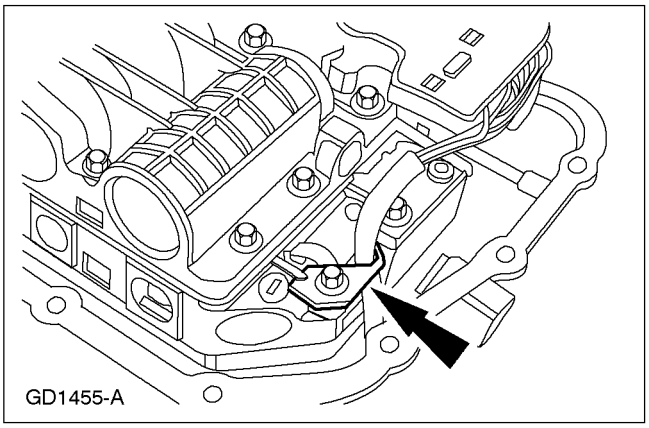
16. Remove and discard the gasket.



17. Inspect the fitting of the main control cover vent tube for blockage (if available).

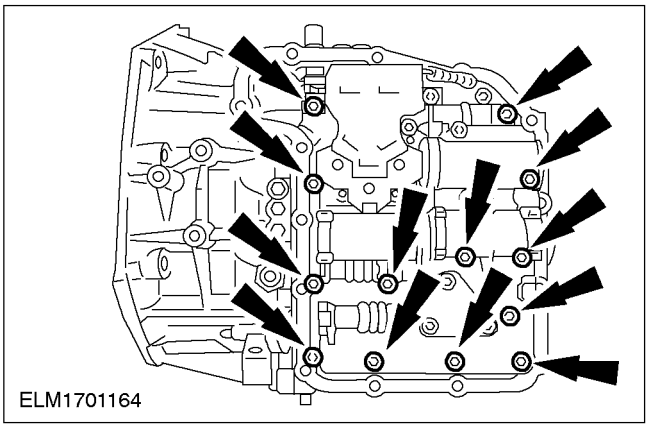


18. Remove the solenoid body assembly wiring harness retaining clip.



19. ⚠ CAUTION: Only remove the indicated bolts.

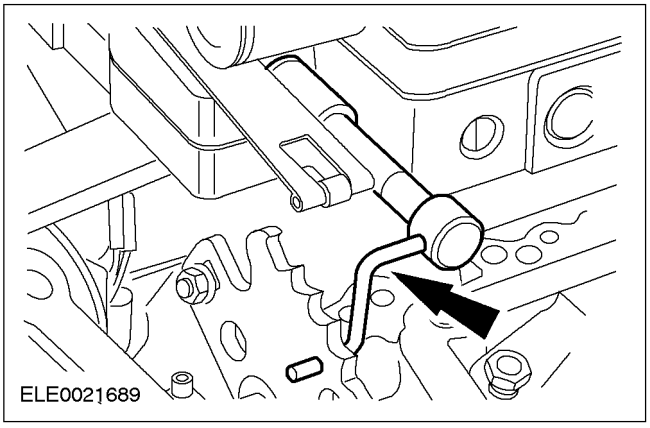
    Remove the main control valve body bolts.



DISASSEMBLY (Continued)

20. **CAUTION: Do not allow loose manual valve to become damaged.**

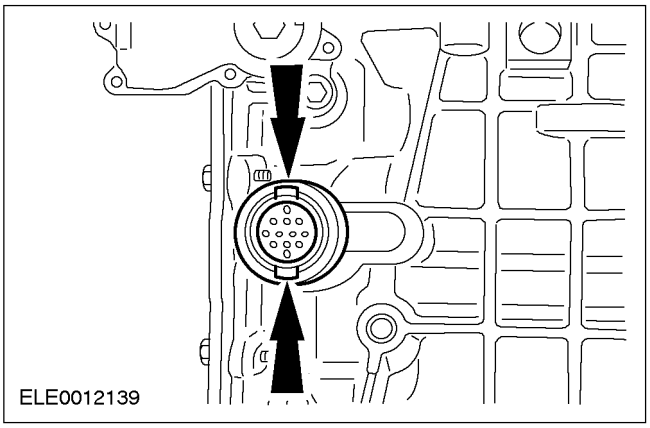
    Disconnect the manual valve link from the manual valve when lifting the main control valve body from the case.



21. **CAUTION: Do not pull solenoid body electrical connector wires, or don't use a hammer on the electrical connector.**

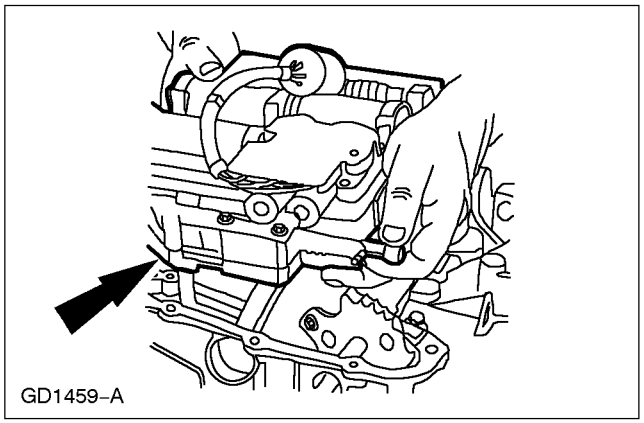
    Remove the solenoid body electrical connector.

    - Release the retaining tabs and push the connector through the transaxle case.

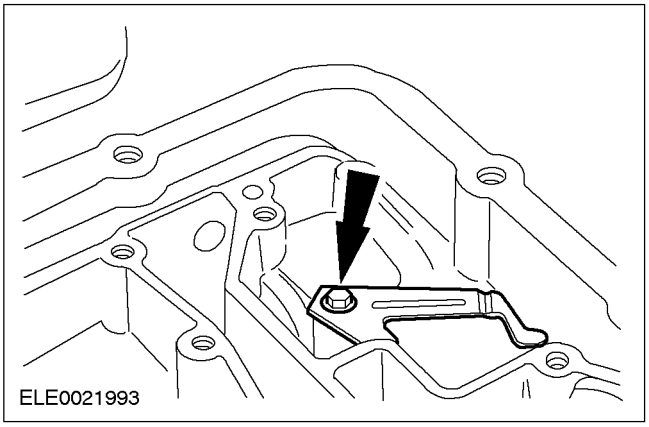


22. **Support the manual valve and remove the main control.**

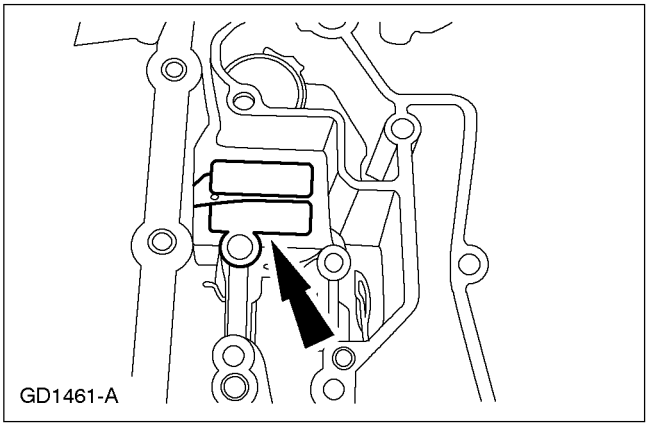
    - Store the main control in a clean, dry location.



23. **Remove the thermostatic fluid level control valve bracket.**



24. **Remove the thermostatic fluid level control valve.**



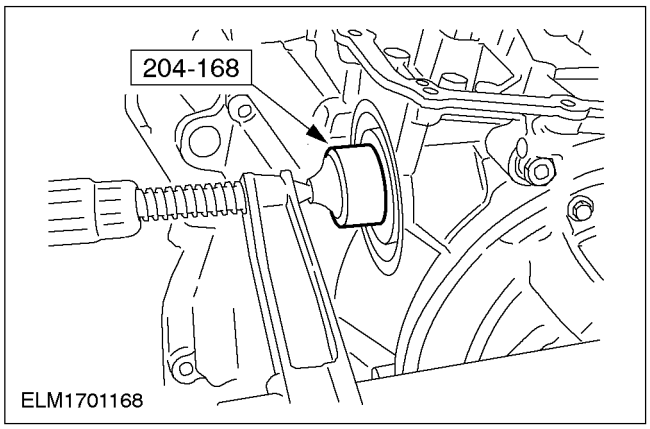
DISASSEMBLY (Continued)

25. **WARNING: The servo is under pressure.**

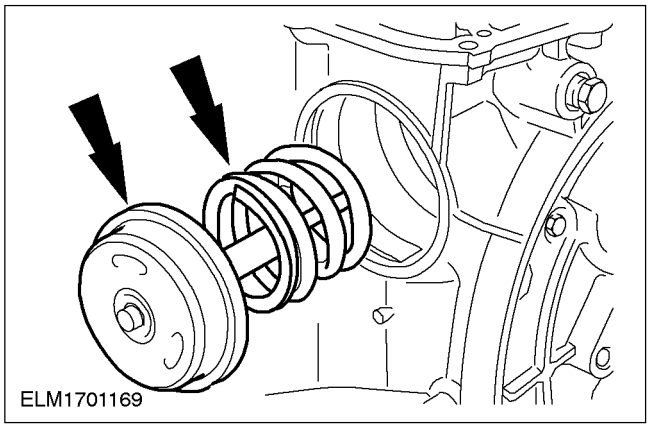
WARNING: Servo and servo cover are under high spring force. Use caution when removing servo cover. Failure to follow these instructions will result in personal injury.

NOTE: To aid in the removal of the servo cover, install a nut with an integral washer N621943-S2 (using permanent thread sealer) onto the forcing bolt of the servo cover.

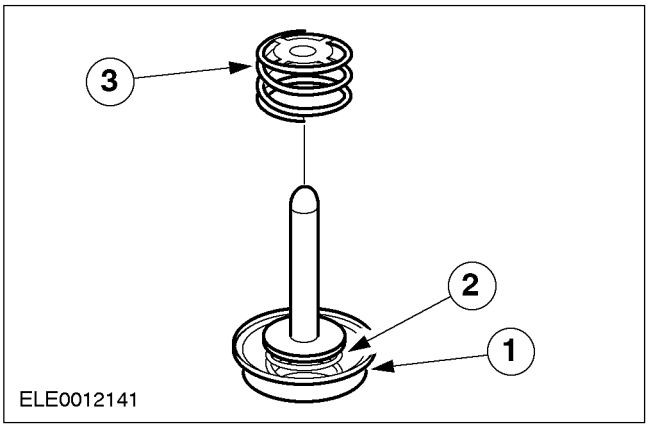
Compress the servo cover and remove the snap ring.



26. **Remove the servo piston assembly.**

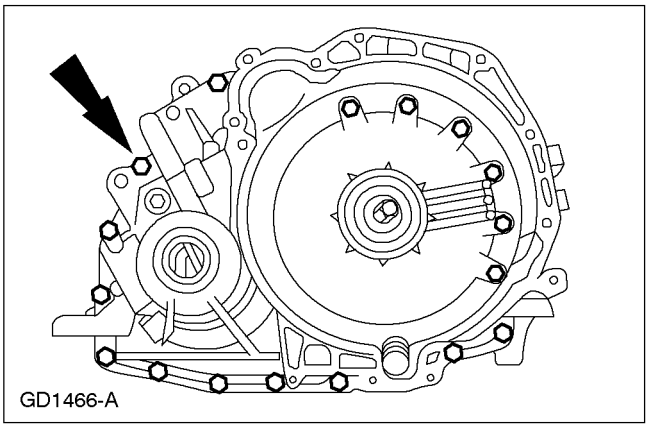


27. **Inspect the intermediate and overdrive servo assembly and bore for damage or wear.**
    1. Inspect the servo cover and bonded seal.
    2. Inspect the cushion spring and servo apply rod.
    3. Inspect the servo return spring.
    - Inspect the case servo bore.



28. **NOTE:** Position the transaxle with the torque converter housing facing upward.

Remove the 20 bolts.

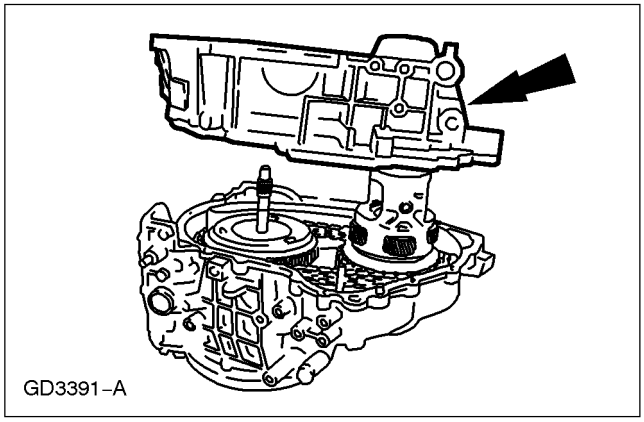


DISASSEMBLY (Continued)

29. NOTE: Place the torque converter housing on the engine flange side after removal to prevent damage to the lube tube.

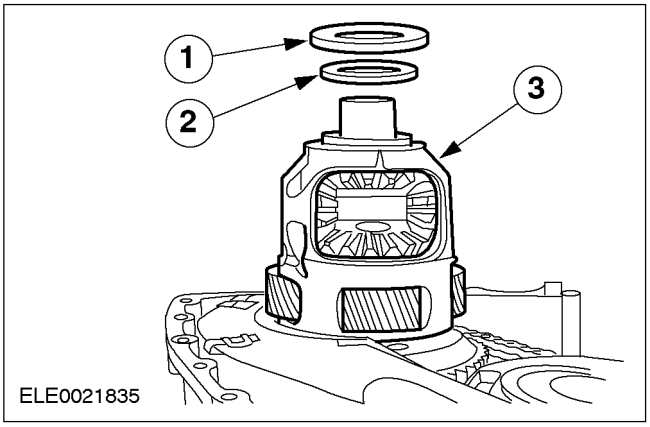
Separate the torque converter housing from the transaxle case.

- Remove and discard the transaxle split flange gasket.

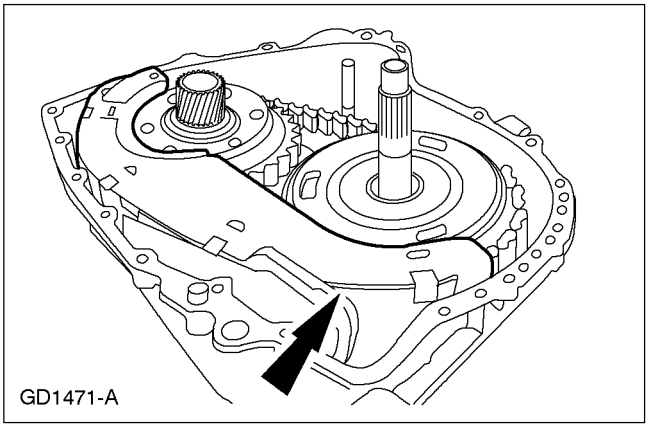


30. Remove the final drive carrier and differential assembly.

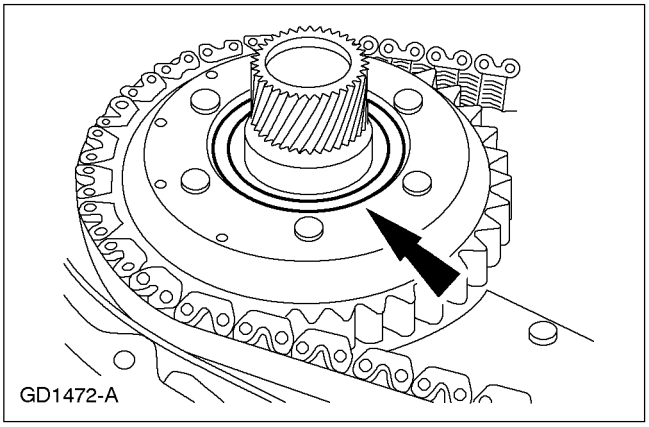
1. Remove the No. 15 differential bearing.
2. Remove the No. 14 differential bearing shim.
3. Remove the final drive carrier and differential assembly.



31. Unsnap and remove the chain pan cover.

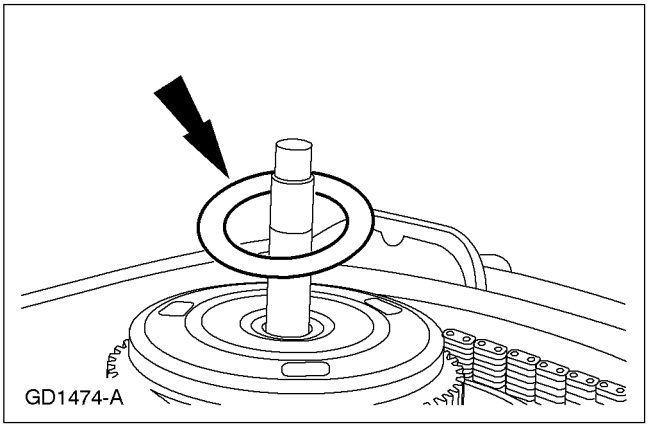


32. Remove the No. 13 driven sprocket thrust bearing.



33. NOTE: The driven sprocket thrust washer may adhere to the converter housing.

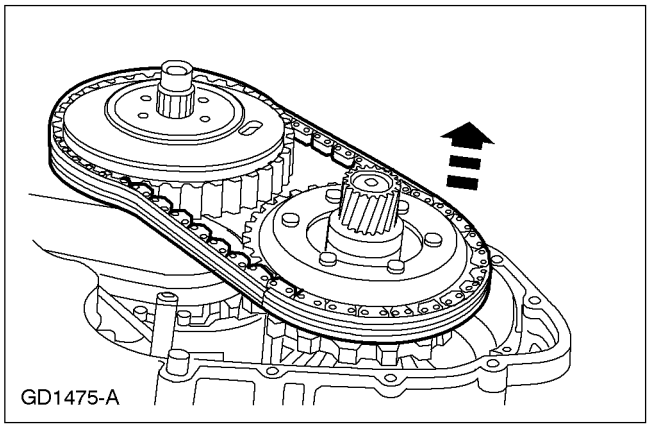
Remove the No. 10 driven sprocket thrust washer from the reverse/overdrive ring gear assembly.



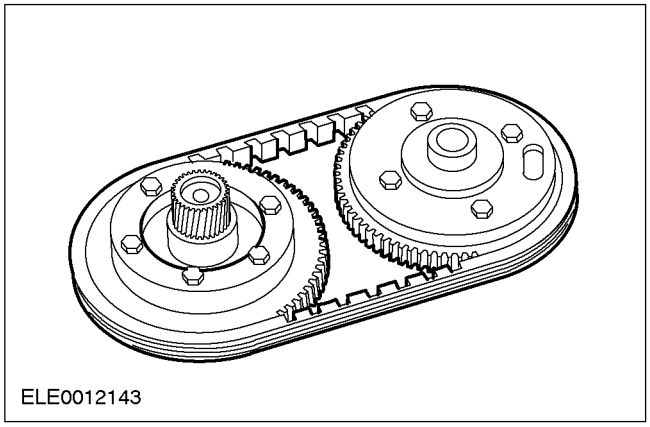
DISASSEMBLY (Continued)

34. **WARNING: Wear gloves as protection from sharp chain and sprocket teeth. Failure to follow these instructions will result in personal injury.**

    Remove the chain drive, reverse/overdrive ring gear, and driven sprocket assembly.

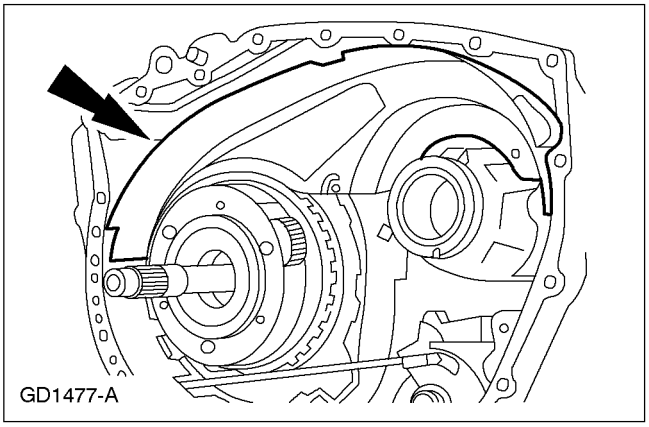


35. **Separate the drive chain assembly from the driven sprocket assembly and reverse/overdrive ring gear assembly.**

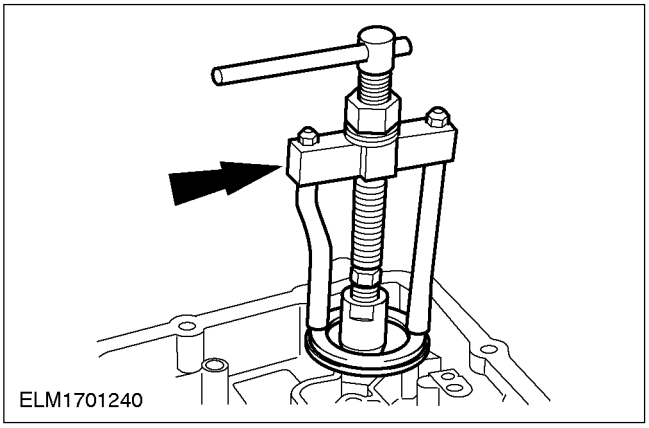


36. **NOTE:** Inspect the magnet located on the chain pan for excessive metal particles.

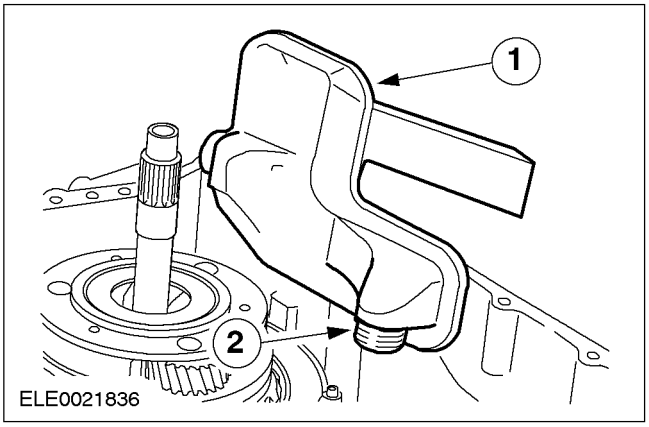
    Remove the chain pan (with the magnet attached) from the transaxle case.



37. **Remove the filter recirculation exhaust pipe using an inside puller.**
    - Discard the exhaust pipe.

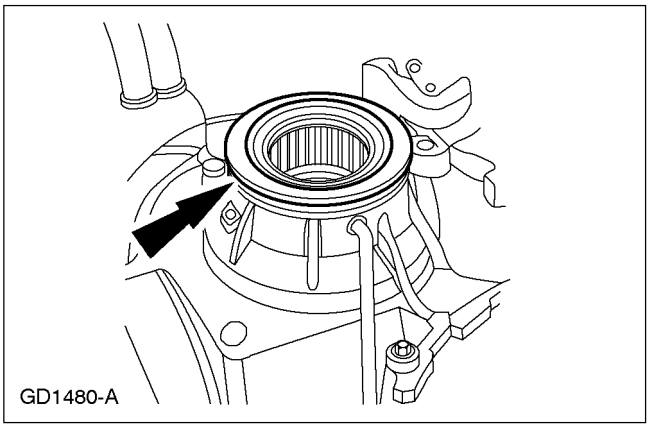


38. **Remove the fluid filter and seal assembly.**
    1. Discard the fluid filter.
    2. Discard the fluid filter seal.

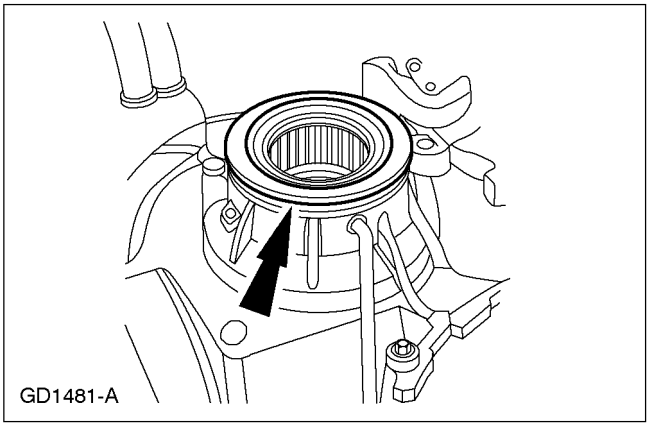


DISASSEMBLY (Continued)

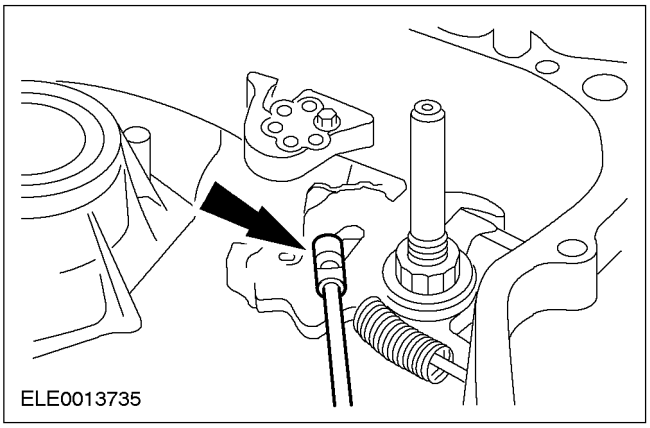
39. **Remove the No. 12 driven sprocket bearing.**



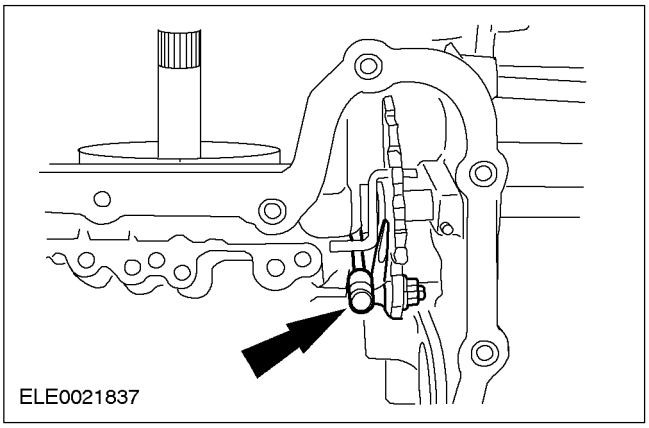
40. **Remove the No. 11 driven sprocket shim (selective fit).**



41. **Disconnect the parking lever actuating rod from the parking cam actuator lever assembly.**

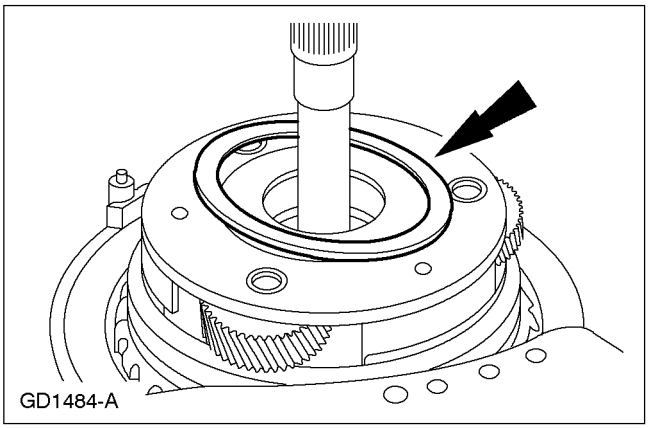


42. **Disconnect the parking lever actuation rod from the manual valve detent lever, and remove the parking lever actuation rod.**



43. **NOTE:** The thrust bearing may adhere to the reverse/overdrive sprocket.

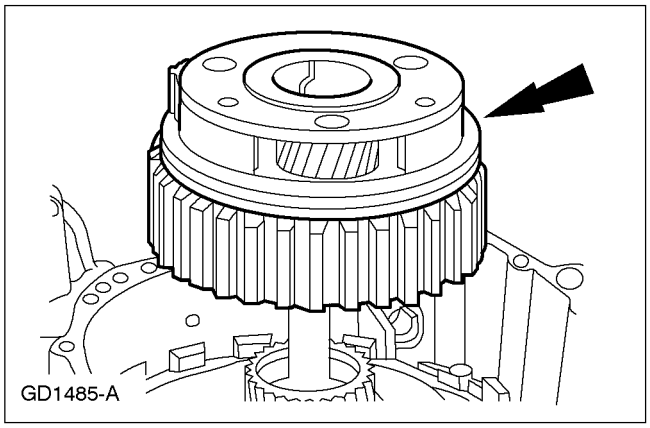
Remove the No. 9 reverse/overdrive ring gear thrust bearing.



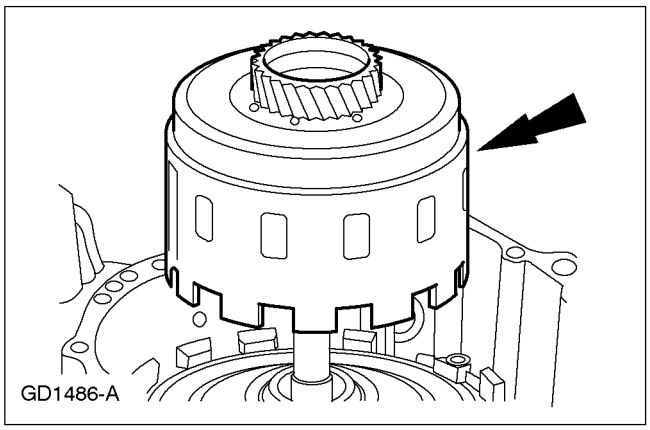
DISASSEMBLY (Continued)

44. NOTE: The thrust bearing is part of the reverse/overdrive carrier assembly.

Remove the reverse/overdrive carrier assembly with captured No. 8 thrust bearing.

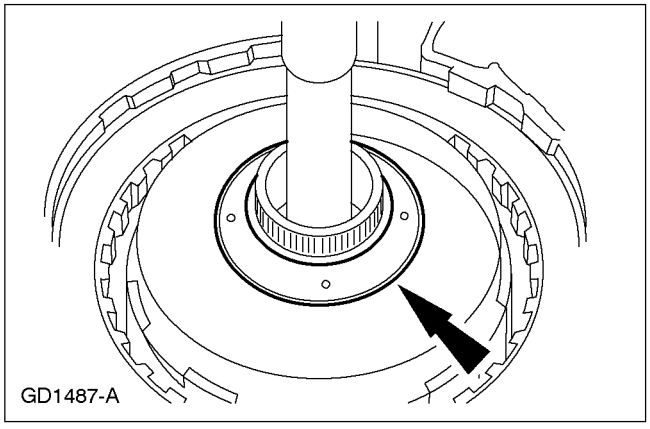


45. Remove the reverse/overdrive sun gear and shell assembly.

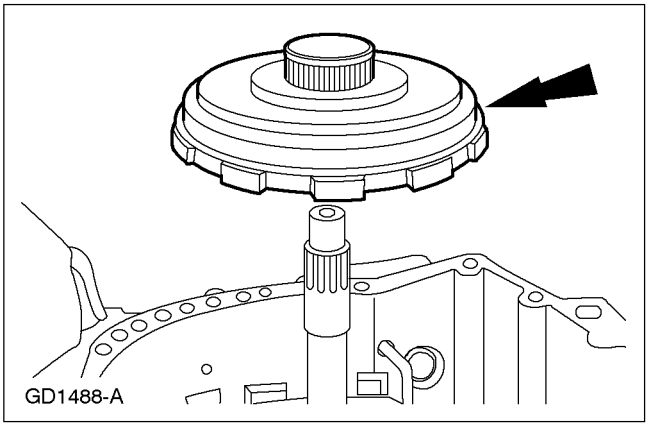


46. NOTE: The thrust bearing may adhere to the reverse/overdrive sun gear and shell.

Remove the reverse/overdrive sun gear and No. 7 shell thrust bearing.

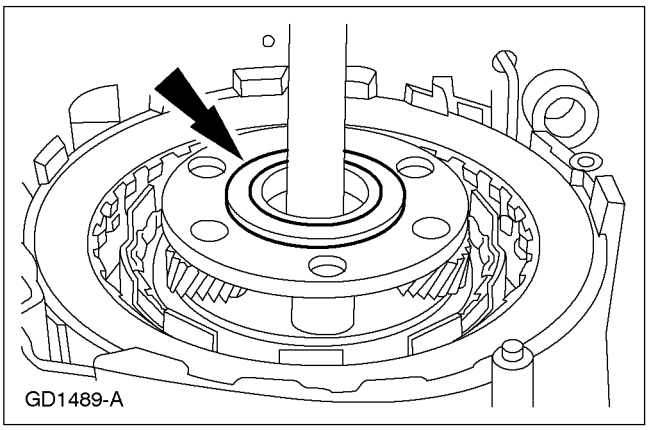


47. Remove the low-intermediate ring gear assembly.

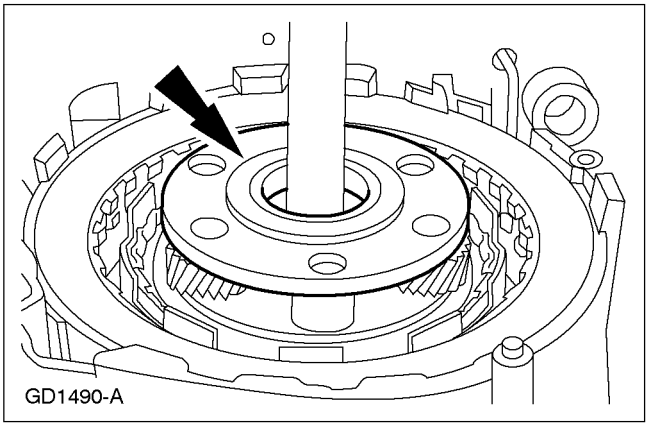


48. NOTE: The low-intermediate carrier thrust bearing may adhere to the low-intermediate ring gear.

Remove the No. 6 low-intermediate carrier thrust bearing.

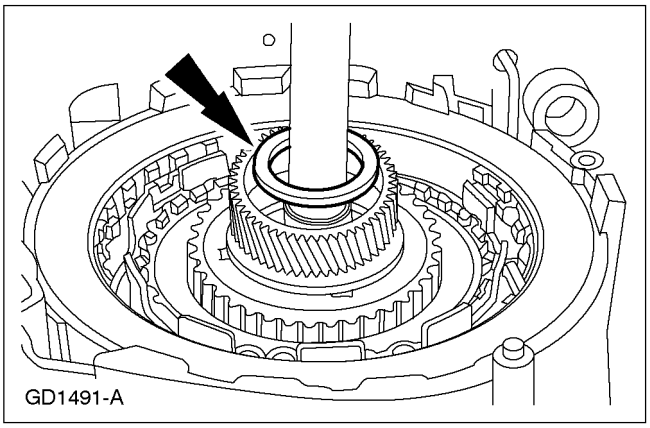


49. Remove the low-intermediate carrier assembly.

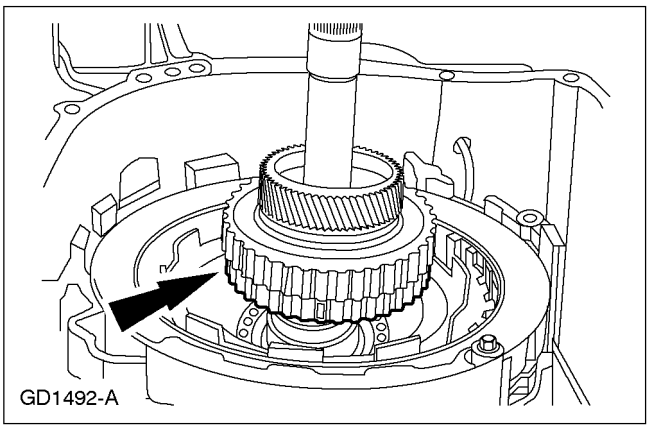


DISASSEMBLY (Continued)

50. Remove the No. 5 low-intermediate sun gear thrust bearing.

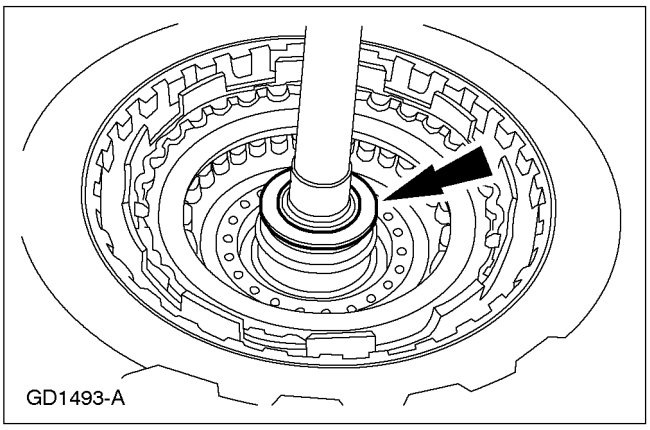


51. Remove the forward one-way clutch and low/intermediate sun gear.

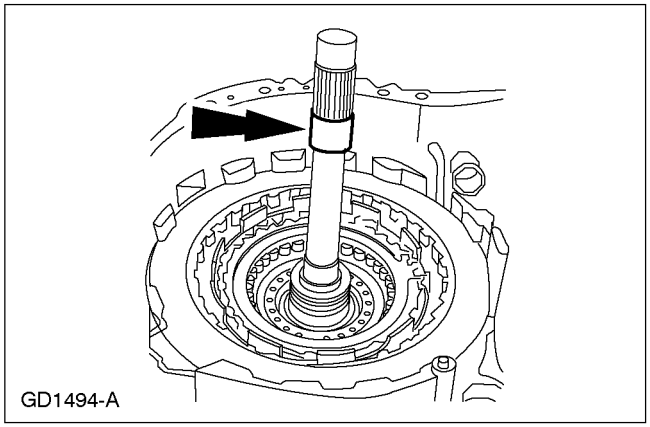


52. NOTE: The turbine shaft thrust bearing may adhere to the forward one-way clutch and low/intermediate sun gear.

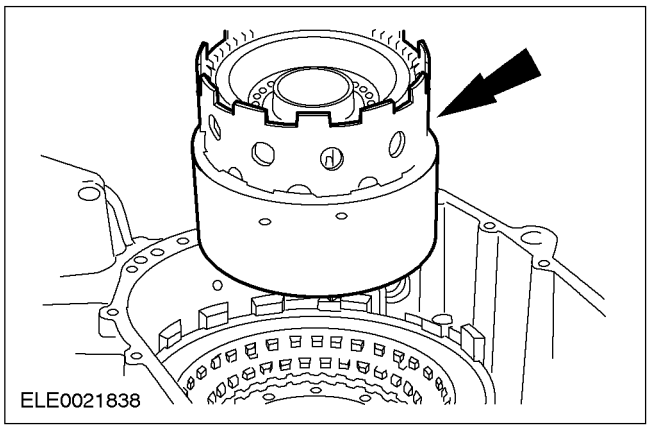
Remove the No. 4 turbine shaft thrust bearing.



53. Remove the turbine shaft assembly.

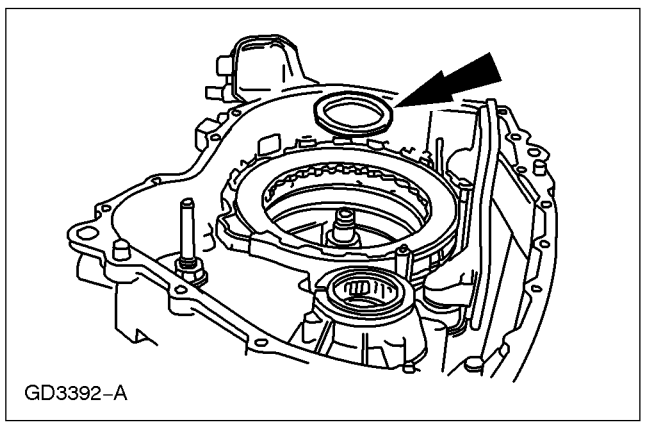


54. Remove the forward/coast/direct clutch cylinder assembly and reverse clutch drum assembly from the transaxle.



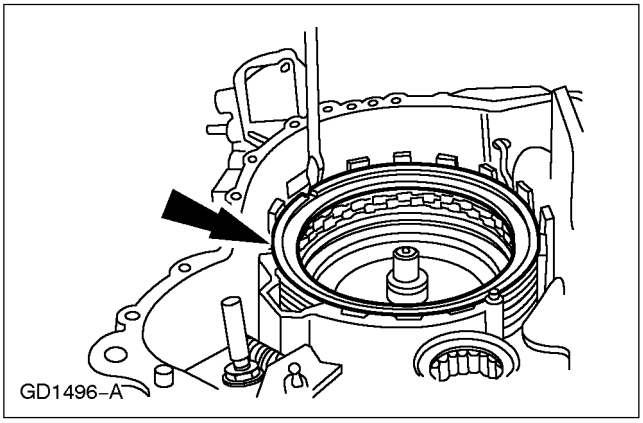
55. NOTE: The pump support thrust bearing assembly may adhere to the reverse clutch drum assembly.

Remove the No. 1 pump support thrust bearing.

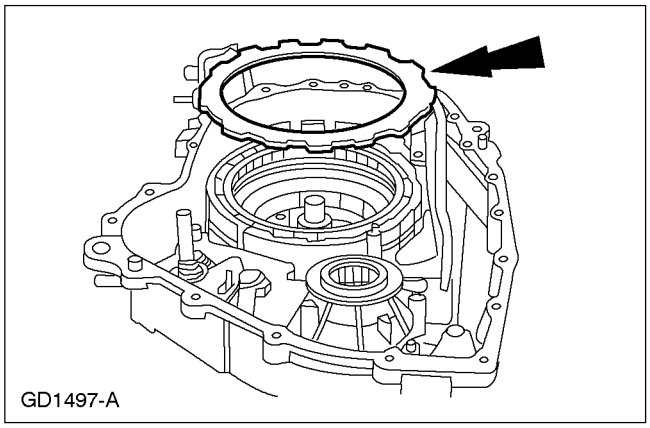


DISASSEMBLY (Continued)

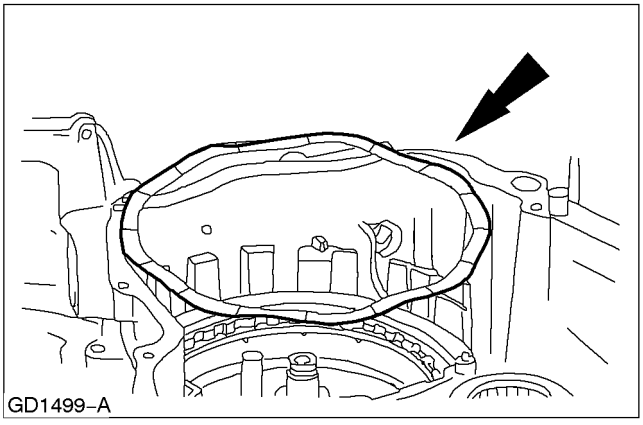
56. Remove the low one-way clutch retaining ring.



57. Remove the low one-way clutch thrust plate.

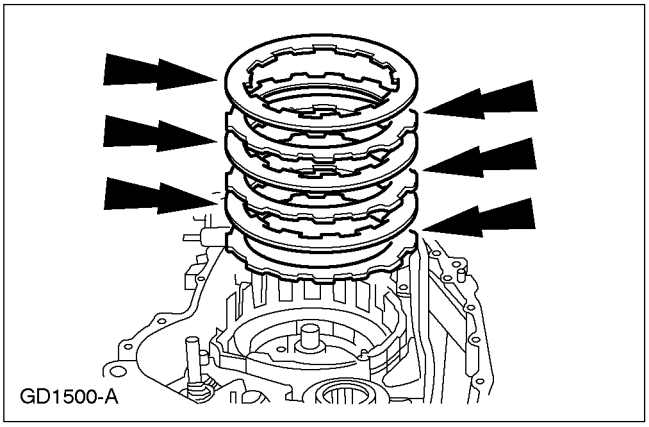


58. Remove the thin, eight wave low/reverse clutch wave spring.

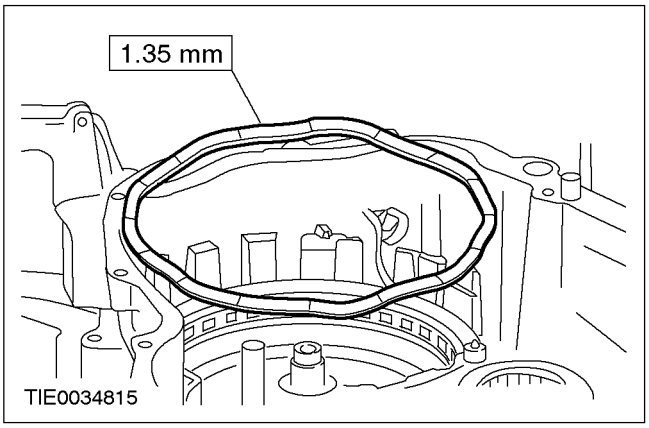


59. Remove the low/reverse clutch plates.

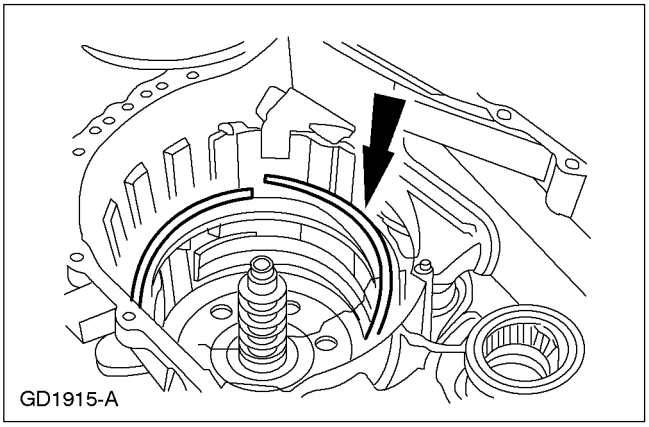
- Inspect the friction plates for partially stripped, stripped, broken or bent spline teeth, burnt, worn or flaked off friction material, and warped or bent friction discs.
- Inspect the steel plates for heat discoloration or distortion.



60. Remove the thick, ten-wave low/reverse clutch wave spring.

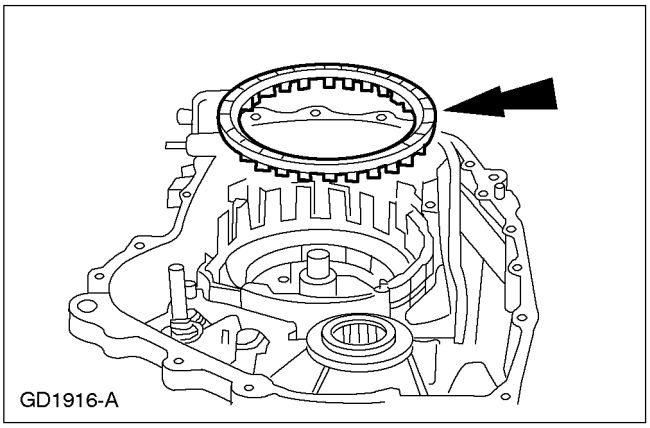


61. Remove the low/reverse clutch return spring retaining ring.



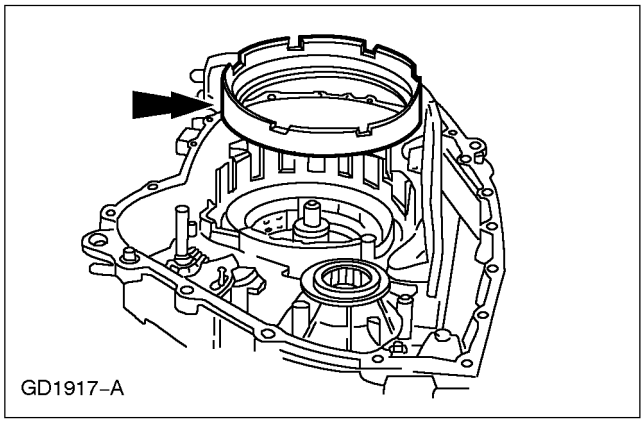
DISASSEMBLY (Continued)

62. Remove the low/reverse clutch return spring assembly.



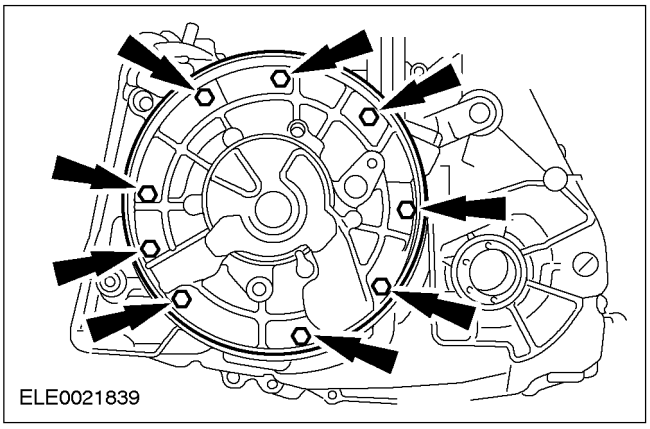
63. NOTE: Rotate the low/reverse clutch piston while pulling upward.

Remove the low/reverse clutch piston.



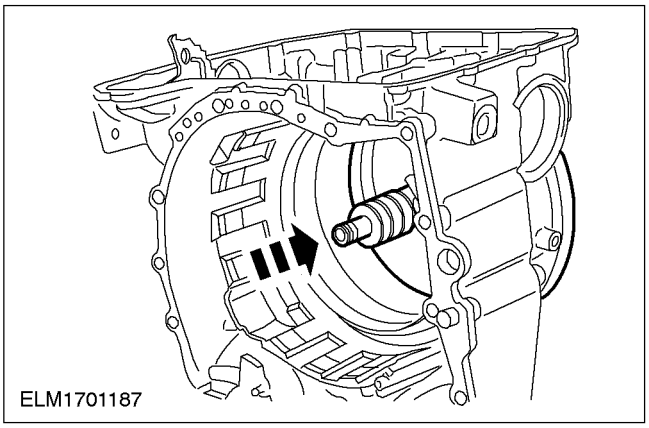
64. NOTE: Position the transaxle that the pump assembly is facing upward.

Remove the pump assembly bolts.



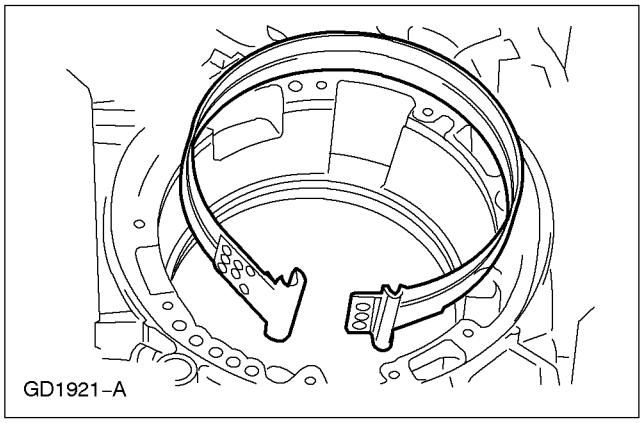
65. Remove the pump assembly.

- Using a hammer handle, remove the pump assembly.



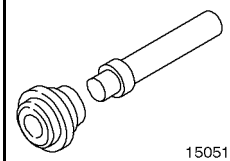
66. Remove the intermediate and overdrive band assembly from the case.

- Inspect the intermediate and overdrive band assembly for damage and wear.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

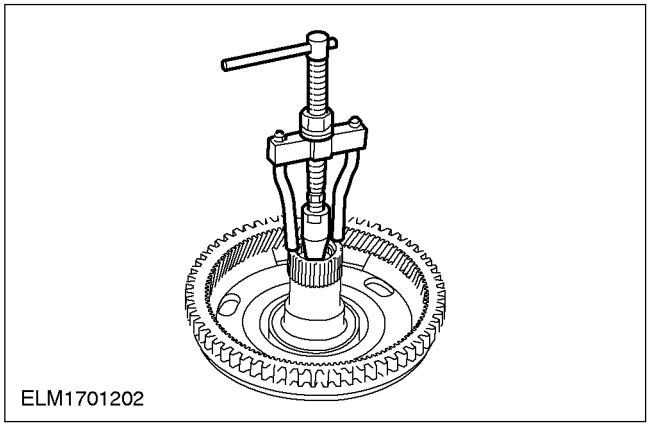
Chain Sprockets

Special Tool(s)	
 15051	Installer, Wheel Hub Bearing Cone/Oil Seal 205-101 (15-051)
 17053	Installer, Needle Bearing 307-294 (17-053)

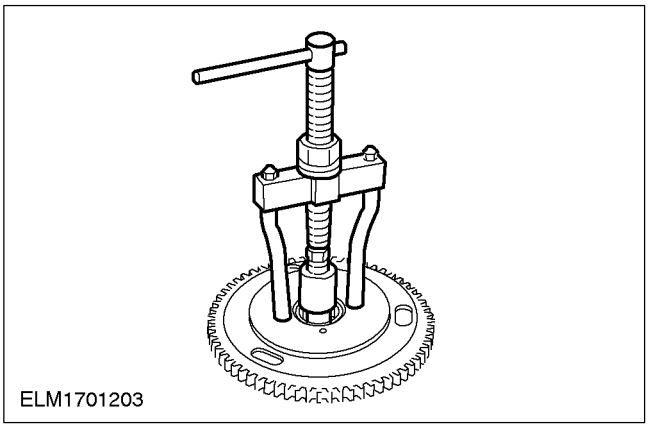
General Equipment
Internal puller

Disassembly

1. Using an internal puller, remove the reverse and overdrive ring gear bearing.



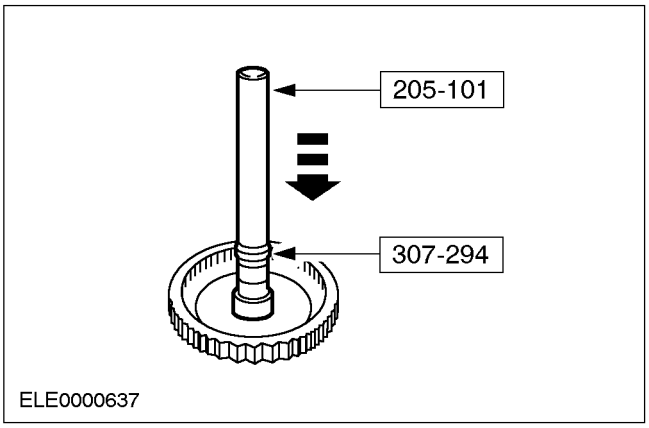
2. Using an internal puller, remove the stator support bearing.



Assembly

1. NOTE: The stamped part number on the reverse and overdrive ring gear bearing must face the special tool.

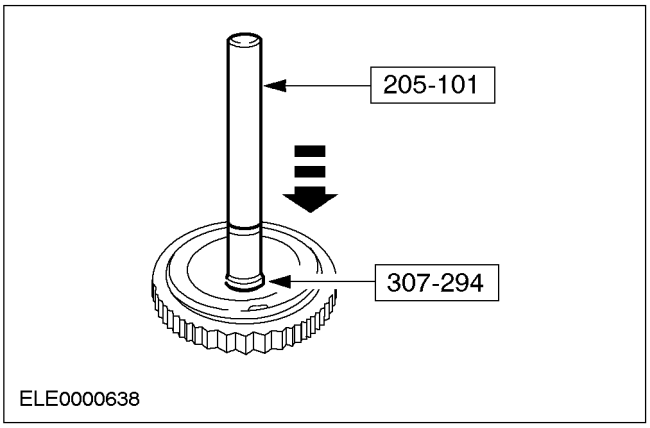
Using the special tool, install the reverse and overdrive ring gear bearing.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

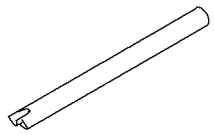
2. NOTE: The stamped part number on the stator support bearing must face the special tool.

Using the special tools, install the stator support bearing into the stator support sprocket.



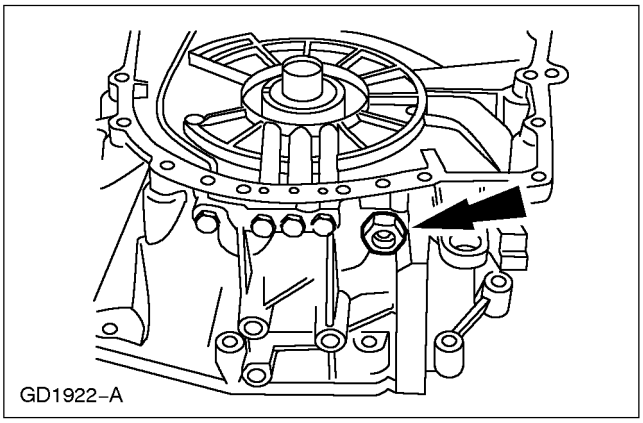
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

Torque Converter Housing

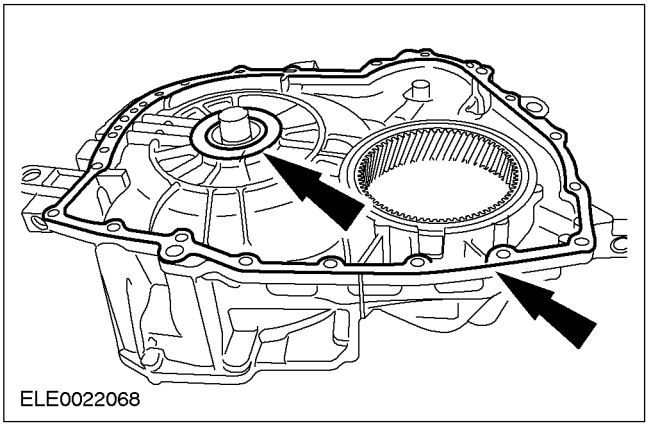
Special Tool(s)	
 17065	Installer, Oil Fill Pipe 307-307 (17-065)

Disassembly

1. Remove and discard the transmission fluid cooler tube adaptor.

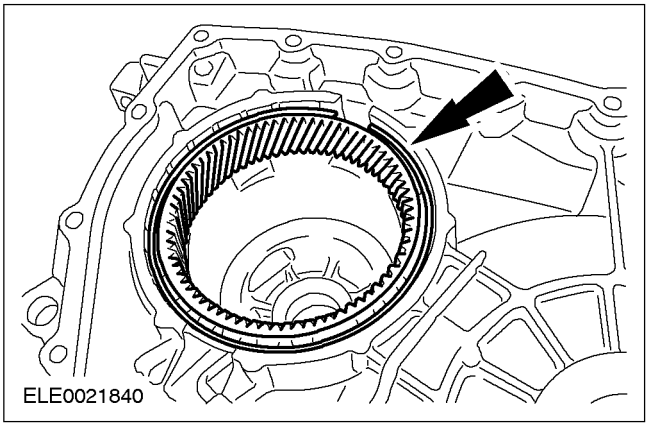

GD1922–A

2. Remove and discard the sealing and the plastic washer.

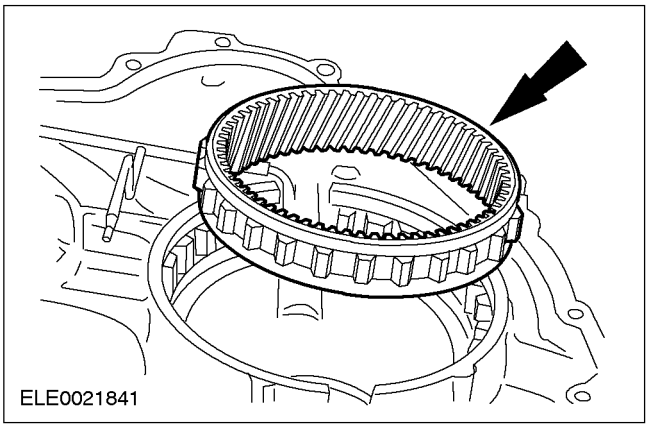

ELE0022068

3. Remove the final drive ring gear.

- Remove the retaining ring.

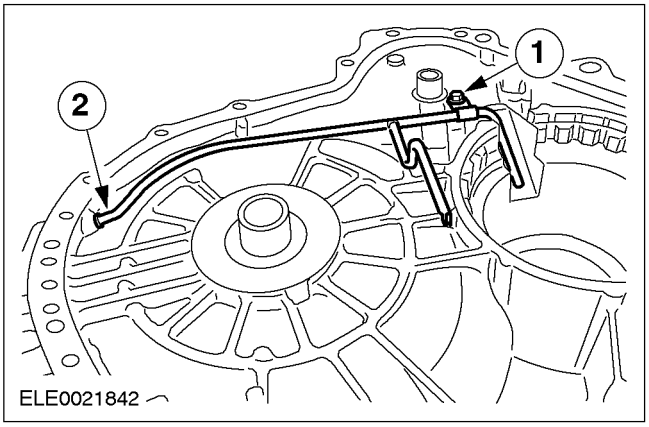

ELE0021840

4. Inspect the final drive ring gear and housing lug teeth for damage or wear.


ELE0021841

5. Remove the differential lube tube.

1. Remove the retaining bolt.
2. Remove the differential lube tube from the housing.



ELE0021842

DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

6. ⚠ WARNING: In order to avoid injury, eye protection should be worn when cleaning components with compressed air. Failure to follow these instructions will result in personal injury.

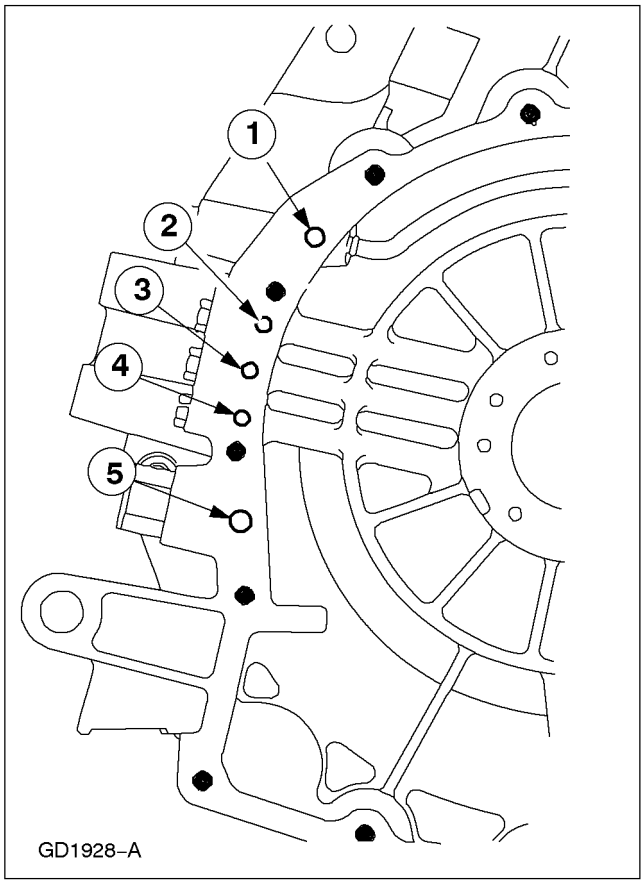
NOTE: Clean all components with a suitable solvent and use moisture-free compressed air to dry all parts and clean fluid passages.

Inspect the converter housing.

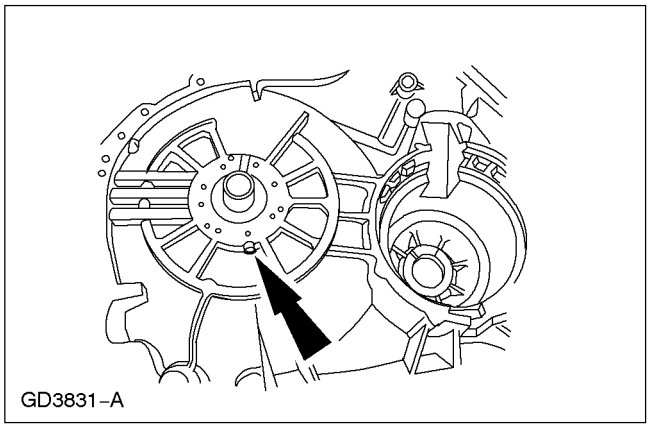
- Inspect the stator support area for wear.
- Inspect the differential bushing for wear.
- Inspect the case mating surfaces for nicks or deformation.

7. Check the converter housing hydraulic passages for blockage.

1. Check the differential lubrication passage.
2. Check the front lubrication passage.
3. Check the converter turbine passage.
4. Check the converter impeller passage.
5. Check the transmission fluid cooler passage.

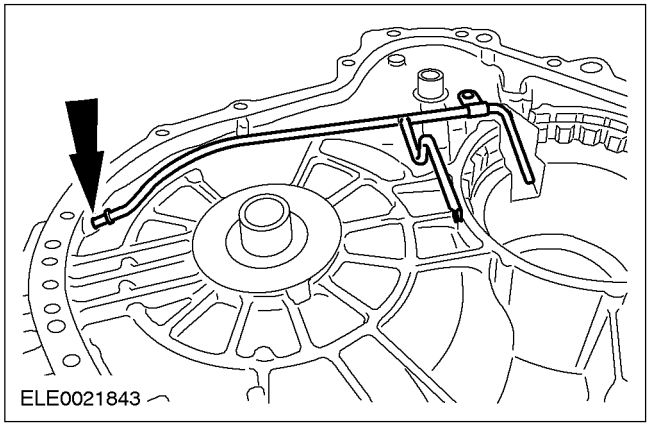


8. Check for blockage at the torque converter seal return hole.

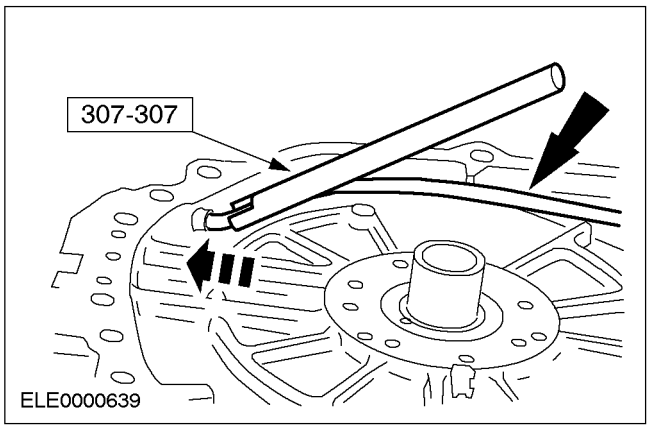


Assembly

1. Locate a new differential lube tube in the torque converter housing.

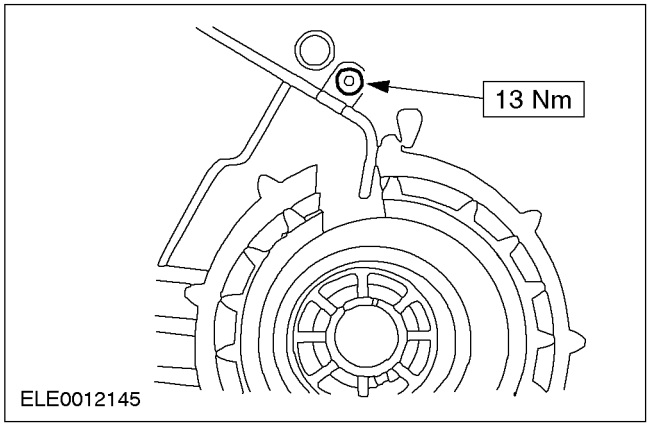


2. Using the special tool, install the differential lube tube.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

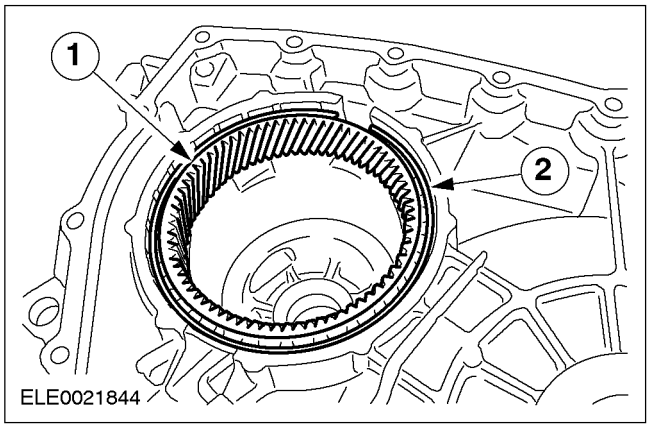
3. Install the differential lube tube retaining bolt.



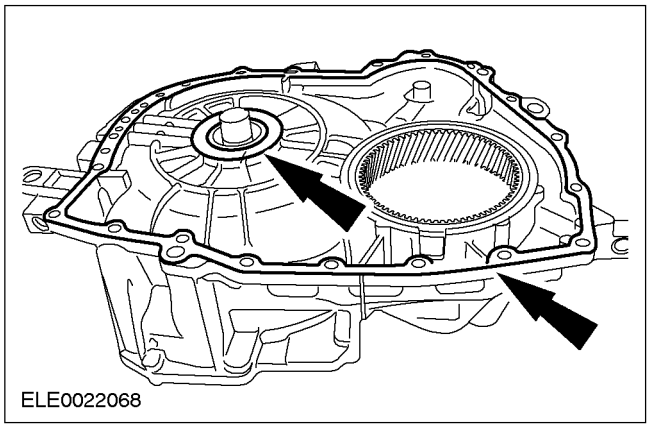
4. NOTE: The final drive ring gear is installed with the lug end up.

Install the final drive ring gear.

- Install the retaining ring.

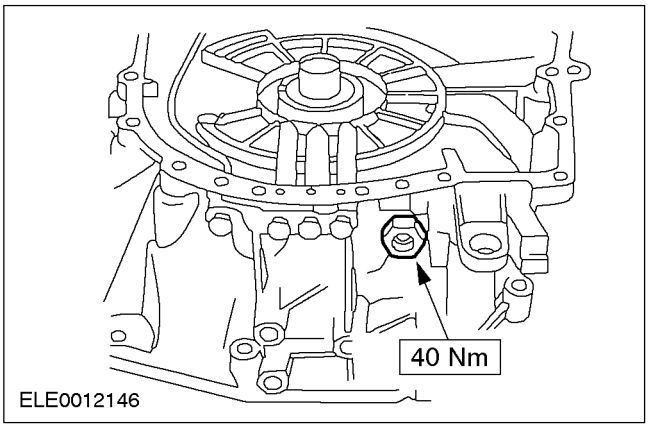


5. Install a new sealing and plastic washer.



6. NOTE: Install a new transmission fluid cooler tube adaptor.

Install the transmission fluid cooler tube adaptor.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

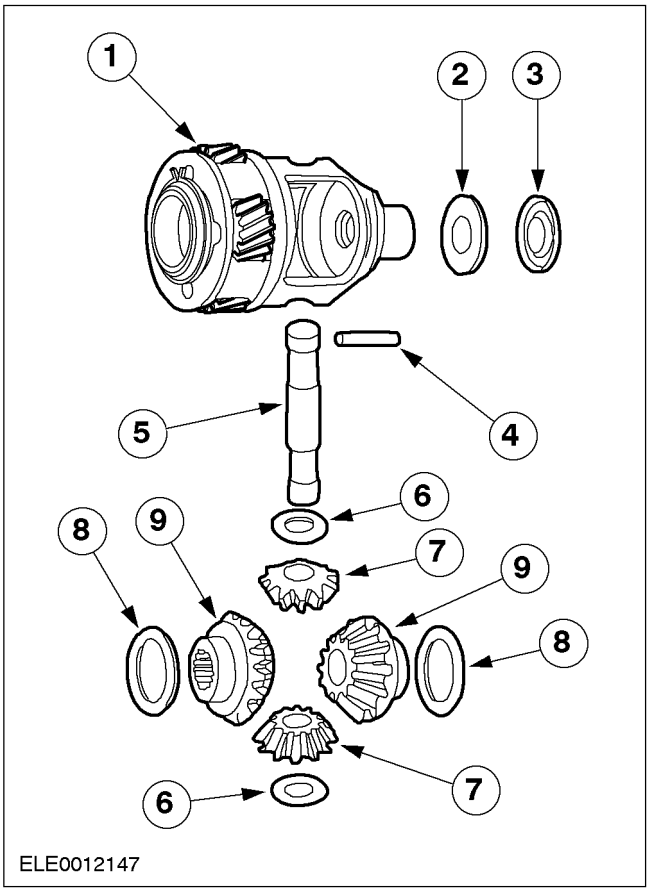
Final Drive Carrier and Differential Assembly

General Equipment
Feeler gauge

Disassembly

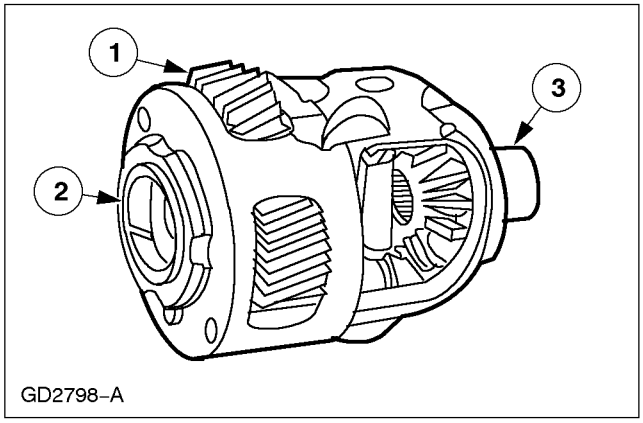
1. **NOTE:** If damage is detected during the checking procedure, the differential should be replaced.

   Inspect the differential for damage.
   1. Inspect the differential housing.
   2. Inspect the differential bearing shim.
   3. Inspect the differential housing bearing.
   4. Inspect the pinion shaft roll pin.
   5. Inspect the pinion shaft.
   6. Inspect the pinion thrust washer.
   7. Inspect the pinion gear.
   8. Inspect the side gear thrust washer.
   9. Inspect the differential side gear.



ELE0012147

2. **Inspect the final drive planet and carrier for damage.**
   1. Inspect the pinion gear teeth.
   2. Inspect the thrust bearing surfaces.
   3. Inspect the bushing surfaces.

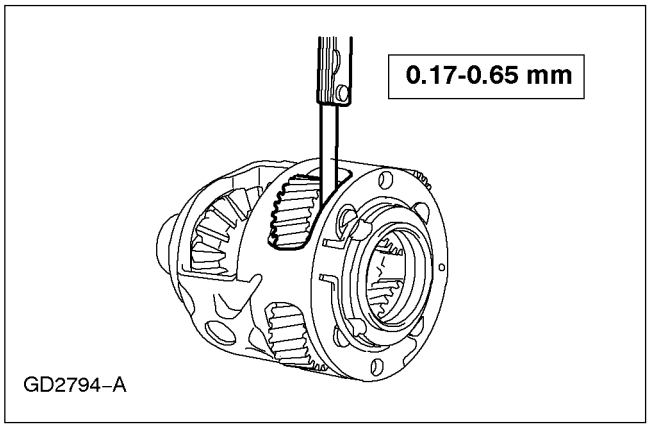


GD2798–A

3. **CAUTION: Do not disassemble the planet carrier.**

NOTE: If the measurement exceeds specification, install a new final drive carrier.

Using a feeler gauge, measure the final drive planet gear end play.



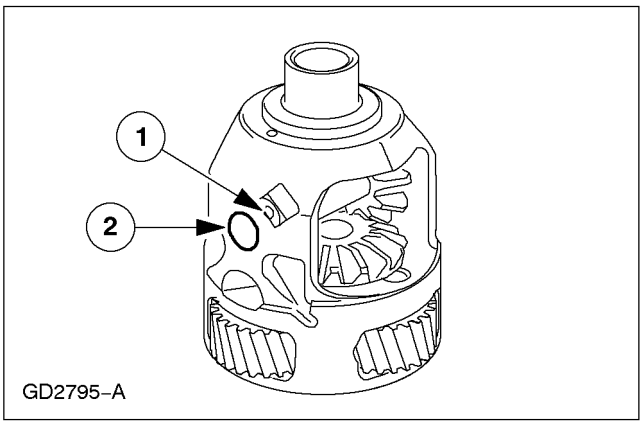
GD2794–A

DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

4. NOTE: Do not remove the final drive pinion shaft retaining ring.

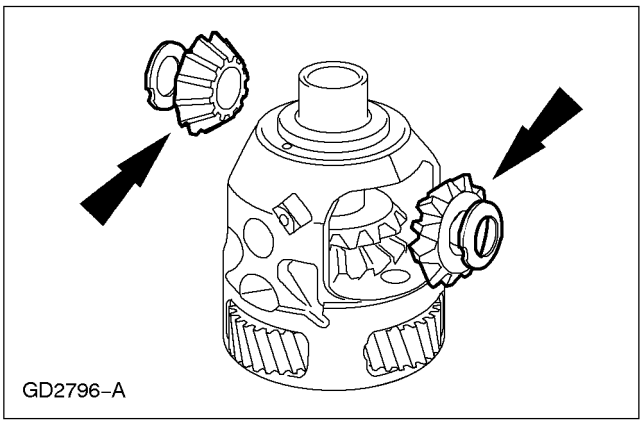
Remove the differential pinion shaft.

1. Remove the pinion shaft roll pin.
2. Remove the differential pinion shaft.

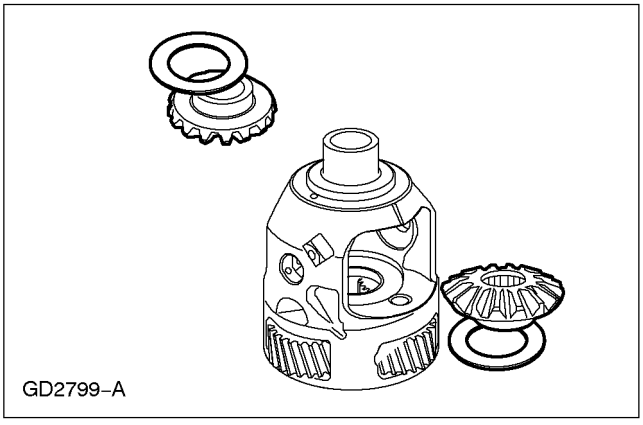


5. Remove the pinion gears and thrust washers.

- Turn the differential pinion gears through 90 degrees and remove.



6. Remove the differential side gears and differential side gear thrust washers.



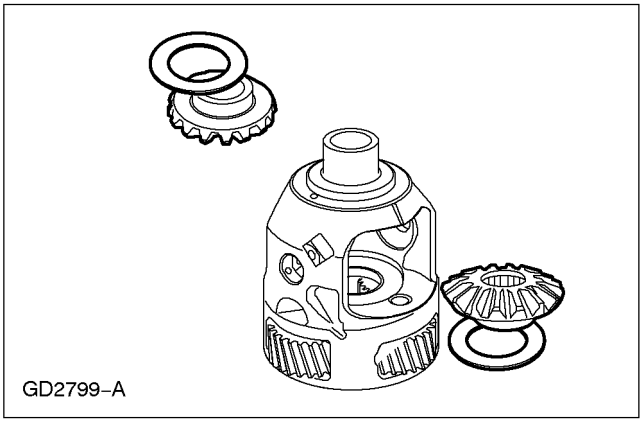
7. Clean all parts thoroughly in clean solvent and blow dry with moisture-free regulated compressed air.

8. Inspect the differential components for damage and wear.

- Inspect the gear teeth.
- Inspect the thrust washer surface.
- Inspect the thrust bearing surface.
- Inspect the pinion shaft.

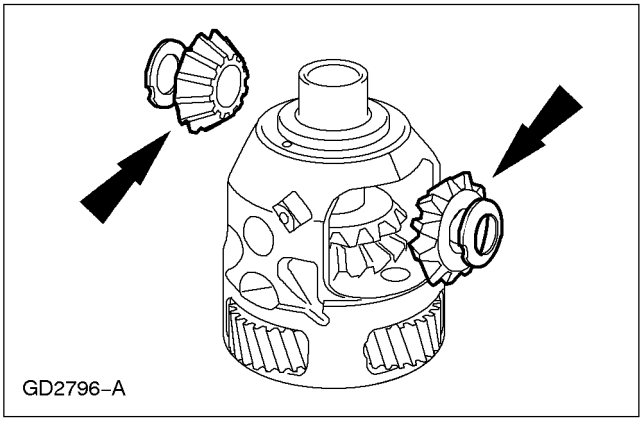
Assembly

1. Install the differential side gears and thrust washers.



2. Install the differential pinion gears and thrust washers.

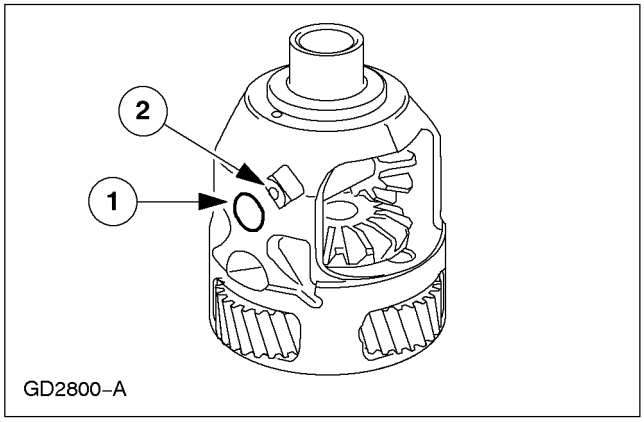
- Rotate the differential pinion gears through 90 degrees to align with pinion shaft.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

3. Install the differential pinion shaft.

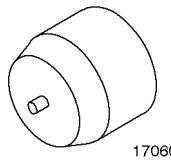
1. Install the pinion shaft.
2. Install the roll pin.

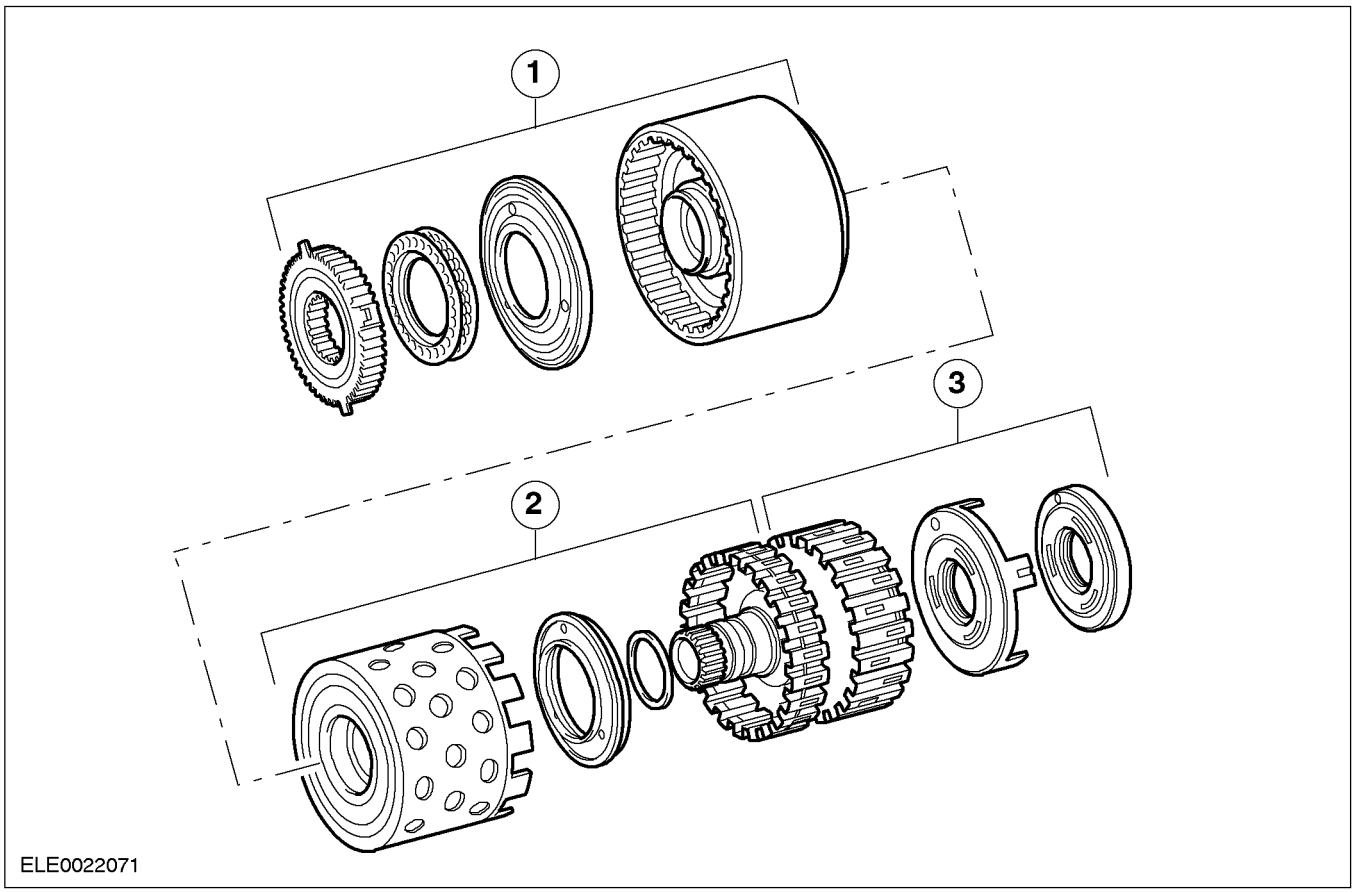


DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

Forward/Coast/Direct Clutch Cylinder and Reverse Clutch Drum - Assembly

Disassembly

Special Tool(s)	
 1706004	Protector Piston Seal 307-278 (17-060-04)

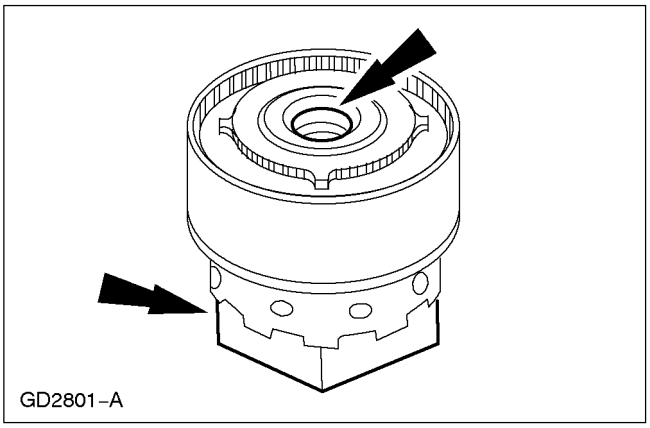


Item	Part Number	Description
1	-	Reverse clutch
2	-	Direct clutch
3	-	Forward/coast clutch

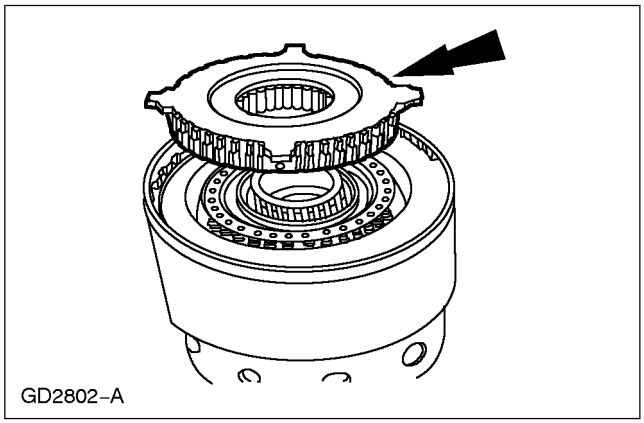
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

1. **NOTE:** Use a suitable wooden block to support the forward, coast and direct clutch cylinder assembly.

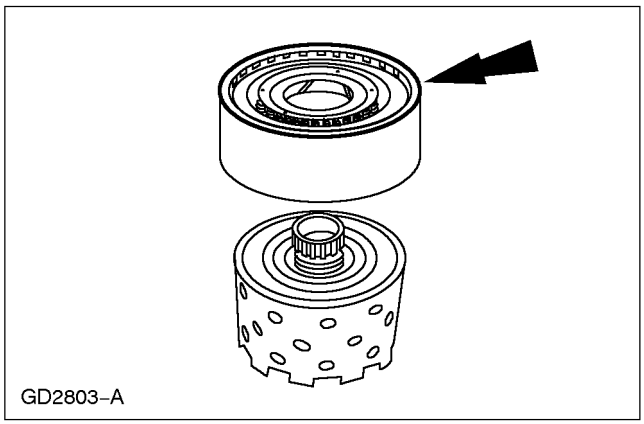
   Remove the reverse clutch hub retaining ring.



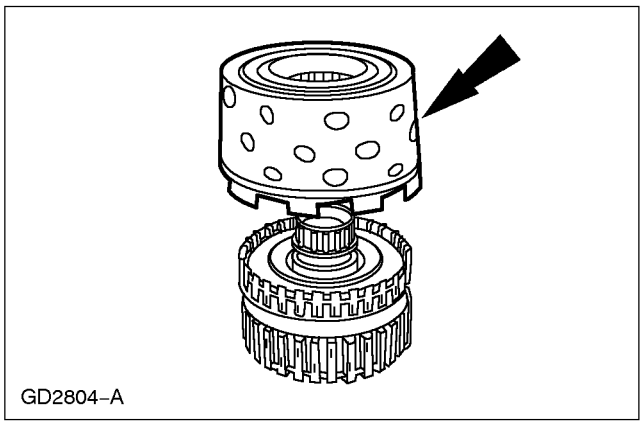
2. **Remove the reverse clutch hub.**



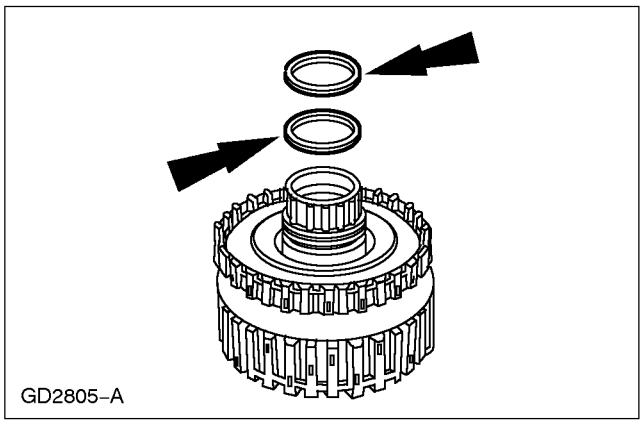
3. **Remove the reverse clutch drum assembly.**



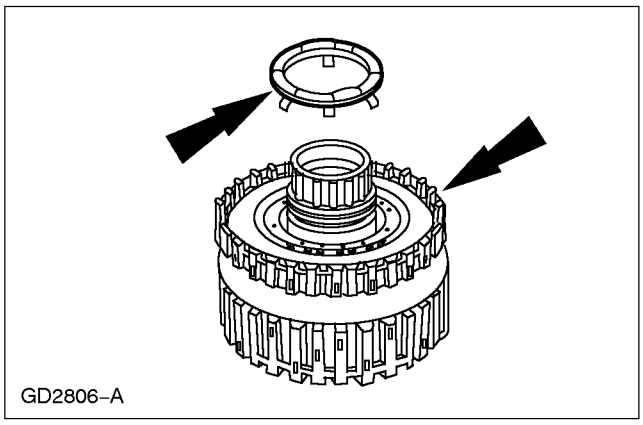
4. **Remove the direct clutch hub and shell from the forward, coast and direct clutch cylinder.**



5. **Remove and discard the two reverse clutch cylinder seals from the forward, coast and direct clutch cylinder assembly.**

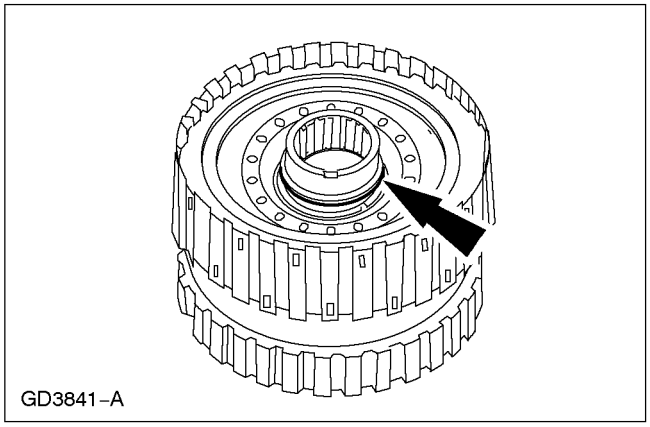


6. **Remove the No. 2 direct clutch thrust washer from the forward, coast and direct clutch cylinder.**



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

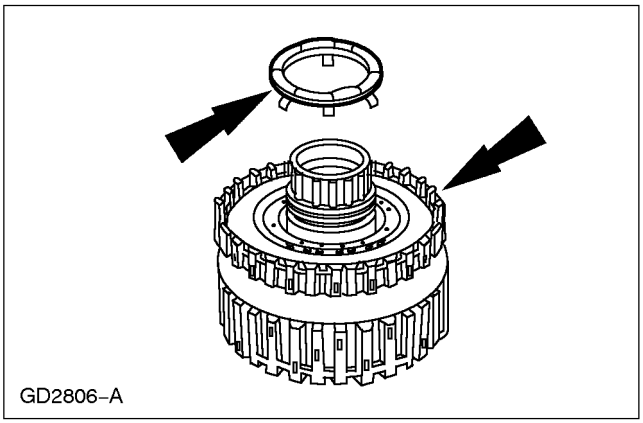
7. Remove and discard the forward, coast and direct clutch cylinder hub seal.



Assembly

1. CAUTION: The tabs on the No. 2 direct clutch thrust washer must be seated in the direct clutch support and spring.

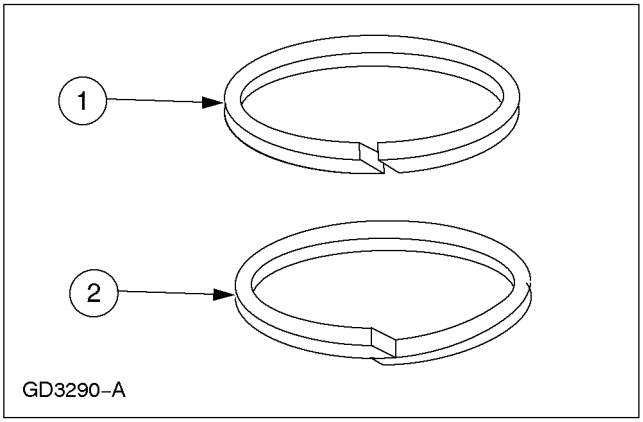
Install the No. 2 direct clutch thrust washer on the forward, coast and direct clutch cylinder with the tabs facing downward.



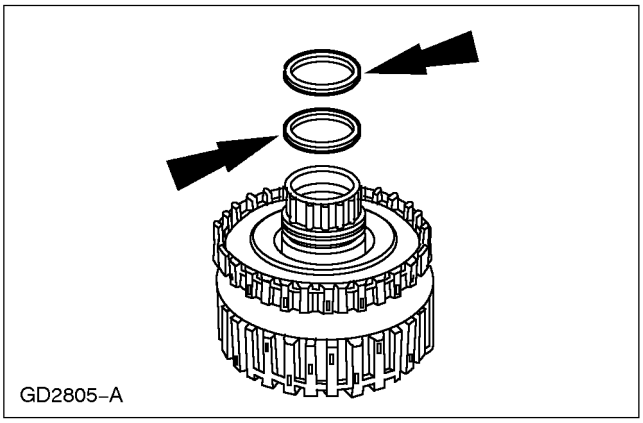
2. NOTE: Make sure that the reverse clutch cylinder seals are overlapped correctly.

Position the reverse clutch cylinder seals.

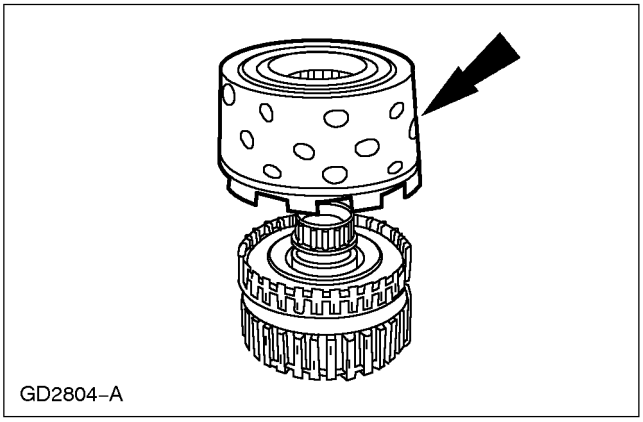
1. Correct installation
2. Incorrect installation



3. Install the two reverse clutch cylinder seals.

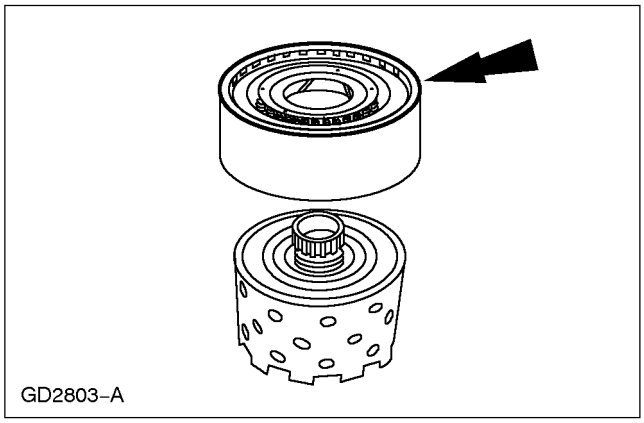


4. Using a suitable wooden block to assist in installation, install the direct clutch hub and shell on the forward, coast and direct clutch cylinder.

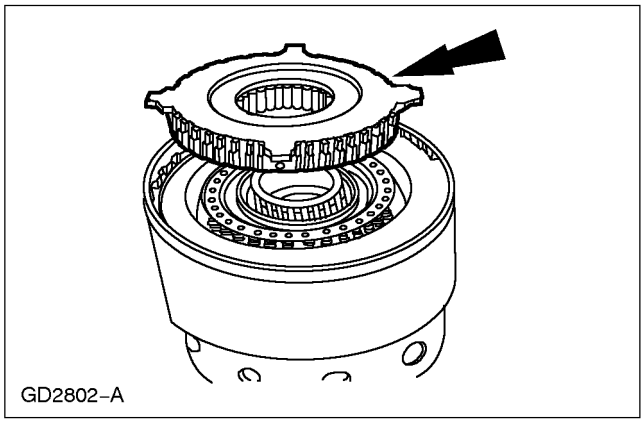


DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

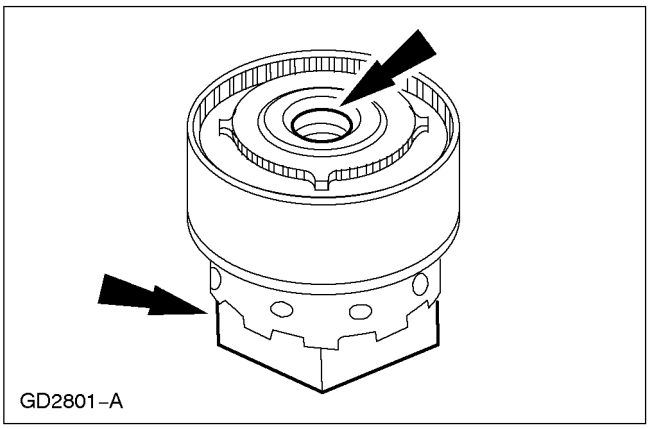
5. Install the reverse clutch drum assembly.



6. Install the reverse clutch hub.

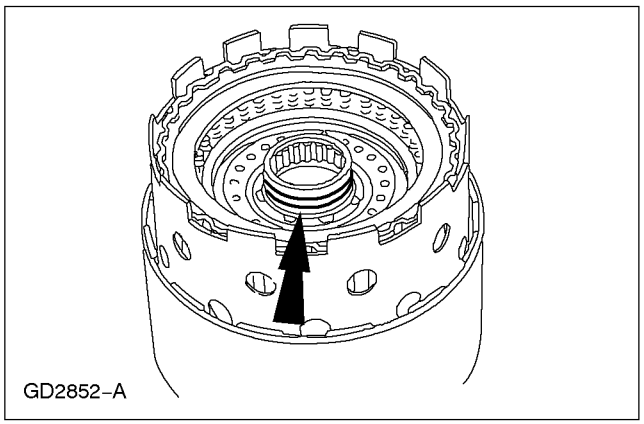


7. Installing the reverse clutch hub retaining ring.

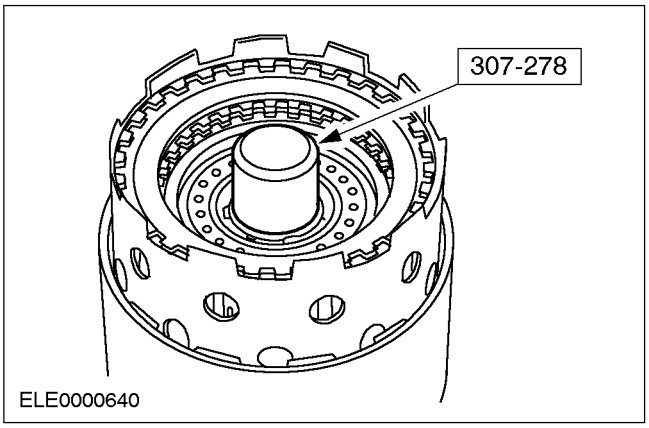


8. NOTE: Turn the forward, coast and direct clutch cylinder over.

Install the forward, coast and direct clutch cylinder hub seal.

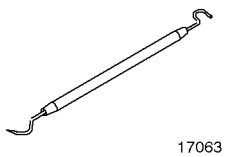
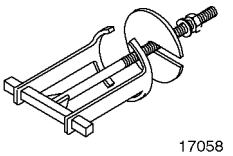


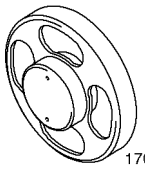
9. Using the special tool, size the seal. Leave special tool attached until the forward/coast/direct clutch cylinder is installed into the transaxle housing.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

Forward/Coast/Direct Clutches

Special Tool(s)	
 17063	Remover, O-Ring 100-010 (17-063)
 17058	Compressor, Clutch Spring 307-015 (17-058)

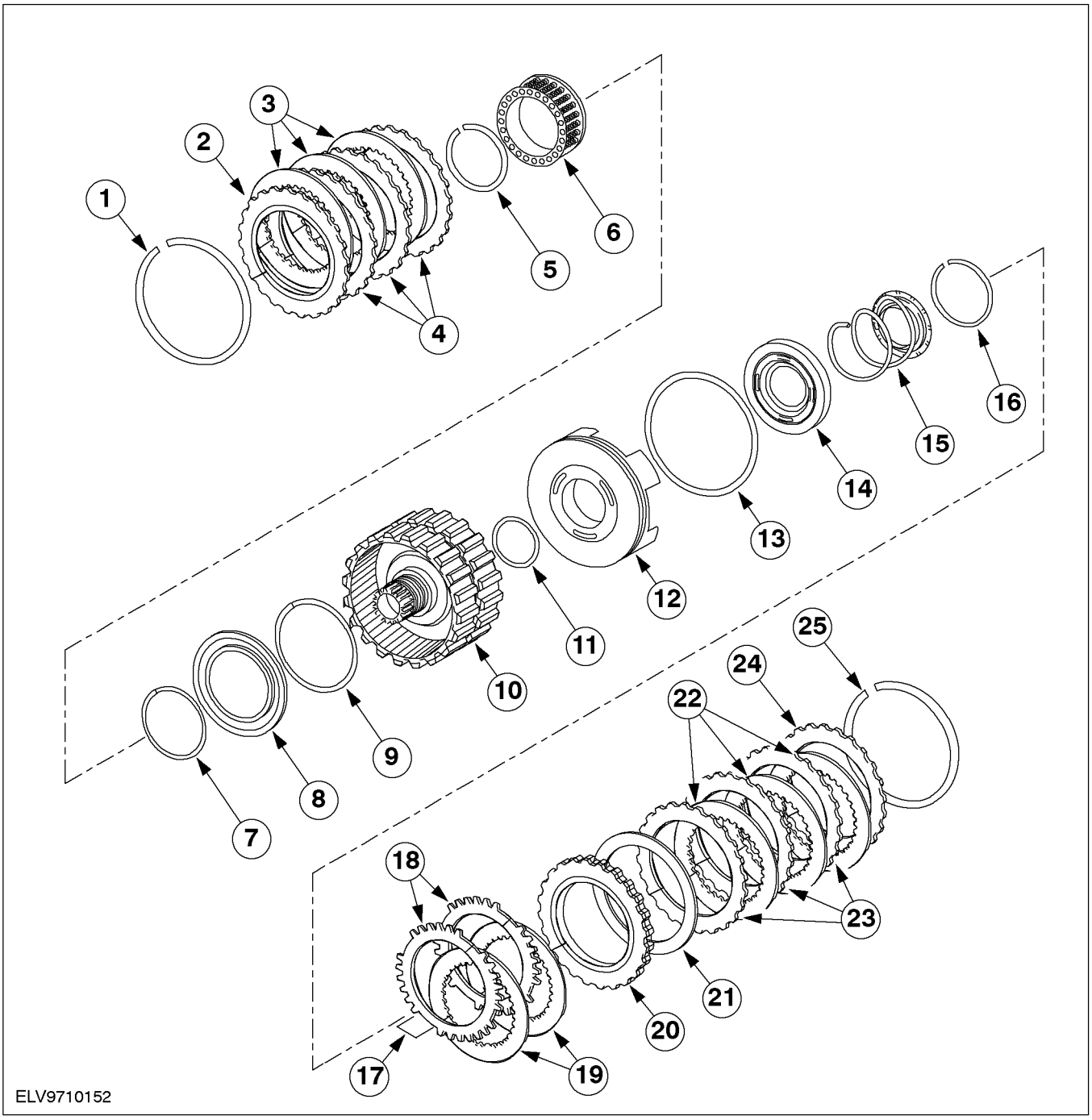
Special Tool(s)	
 1706003	Protector, Piston Seal 307-277 (17-060-03)

General Equipment
Holding fixture, dial indicator gauge

Name	Specification
Automatic transmission fluid	ESP-M2C166-H

Disassembly

DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES



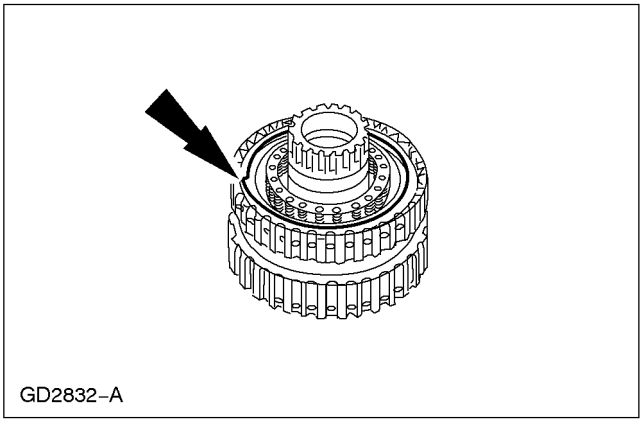
Item	Part Number	Description
1	7D483	Direct clutch pressure plate retaining ring
2	7B477	Direct clutch pressure plate
3	7B164	Direct clutch internal spline clutch plates (friction)

Item	Part Number	Description
4	7B442	Direct clutch external spline clutch plates (steel)
5	7C122	Direct clutch spring retaining ring
6	7F235	Direct clutch return spring
7	7F225	Direct clutch piston inner lip seal

DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

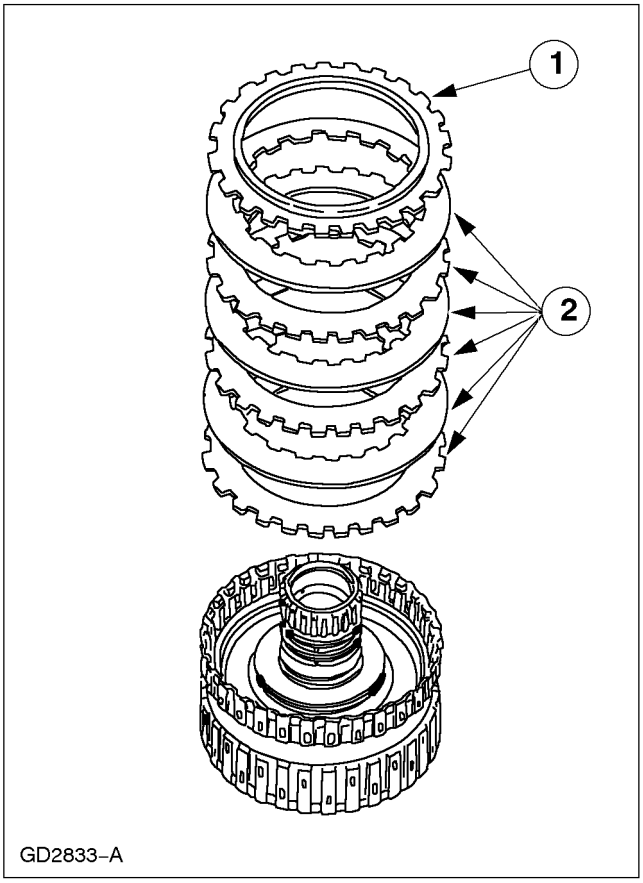
Item	Part Number	Description
8	7A262	Direct clutch piston assembly
9	7A548	Direct clutch piston outer lip seal
10	7G120	Forward, coast and direct clutch cylinder assembly
11	7A548	Forward clutch piston inner lip seal
12	7A262	Forward clutch piston assembly
13	7A548	Forward clutch piston outer lip seal
14	7A262	Coast clutch piston and seal assembly
15	7G299	Forward, coast clutch return spring
16	7N169	Forward clutch spring retaining ring
17	--	Clearance for fingers on the forward clutch piston
18	7B442	Coast clutch external spline clutch plates (steel)
19	7B164	Coast clutch internal spline clutch plates (friction)
20	7B066	Coast clutch pressure plate
21	74159	Forward clutch wave spring
22	7B164	Forward clutch internal spline clutch plates (friction)
23	7B442	Forward clutch external spline clutch plates (steel)
24	7B066	Forward clutch pressure plate
25	7D483	Forward clutch pressure plate retaining ring

1. Remove the direct clutch pressure plate retaining ring.



2. Disassemble the direct clutch pack.

1. Remove the direct clutch pressure plate.
2. Remove the direct clutch plates.



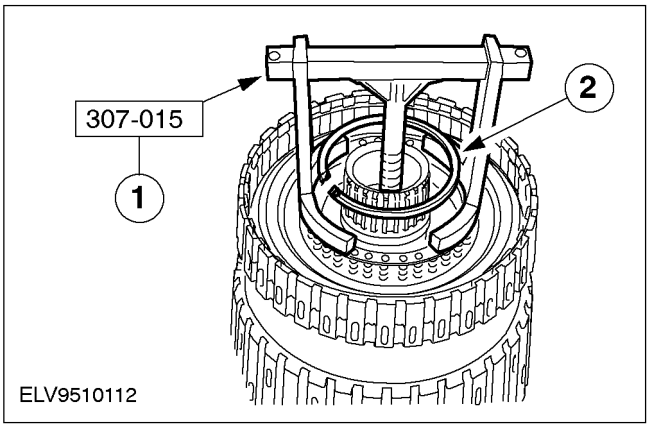
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

3. **WARNING: Use caution when releasing tool pressure on the clutch piston springs. Failure to follow these instructions may result in personal injury.**

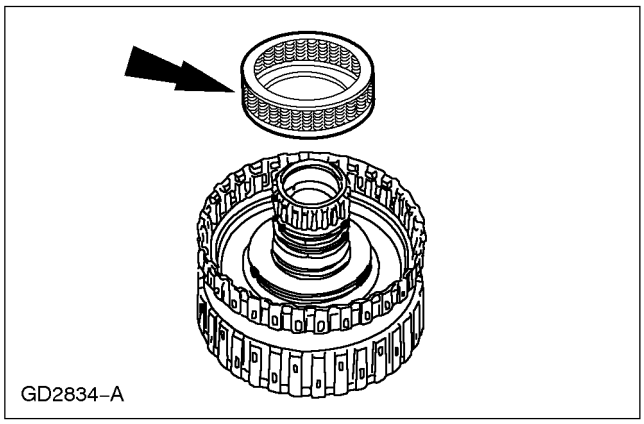
CAUTION: Do not compress the direct clutch return springs completely.

Remove the direct clutch spring retaining ring.

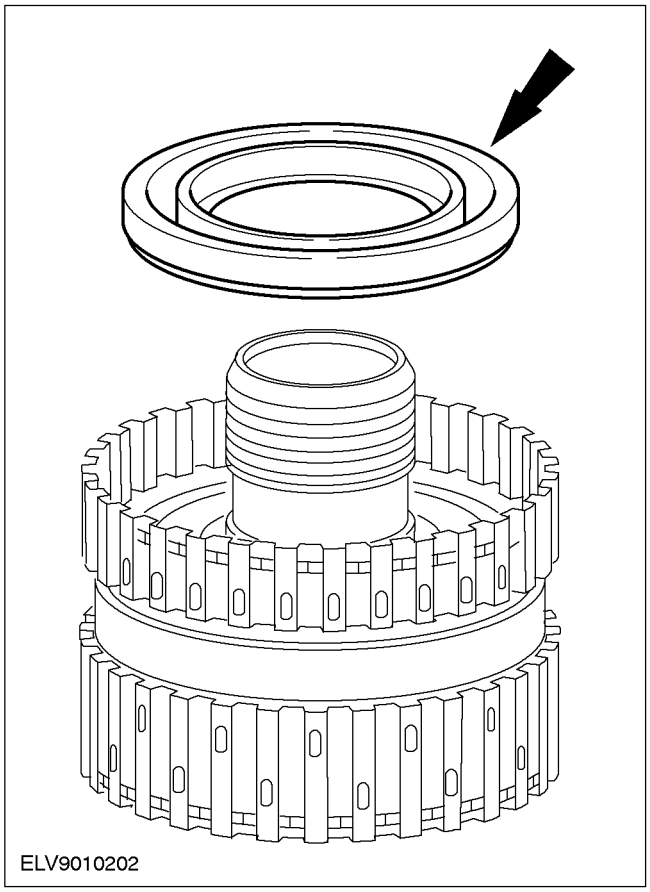
1. Using the special tool, compress the direct clutch return springs.
2. Remove the direct clutch return spring retaining ring.



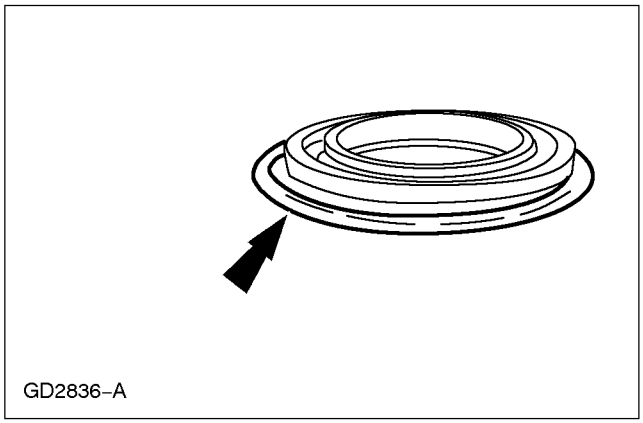
4. **Remove the direct clutch return spring assembly.**



5. **Remove the direct clutch piston assembly.**

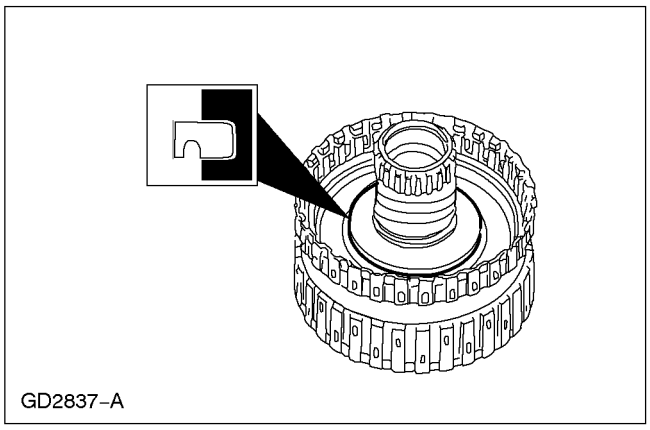


6. **Remove and discard the direct clutch piston outer lip seal.**

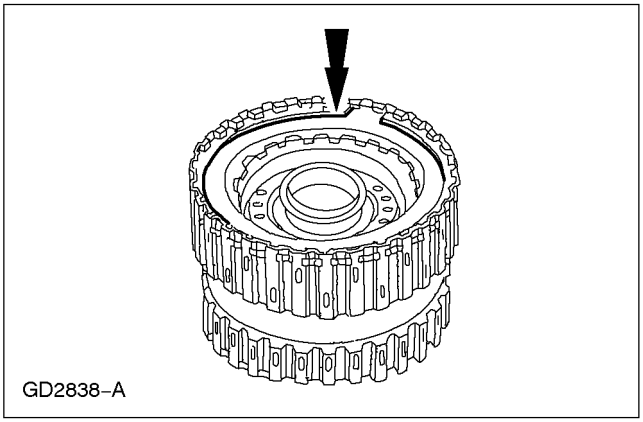


DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

7. Remove and discard the direct clutch piston inner lip seal from the forward, coast and direct clutch cylinder assembly.

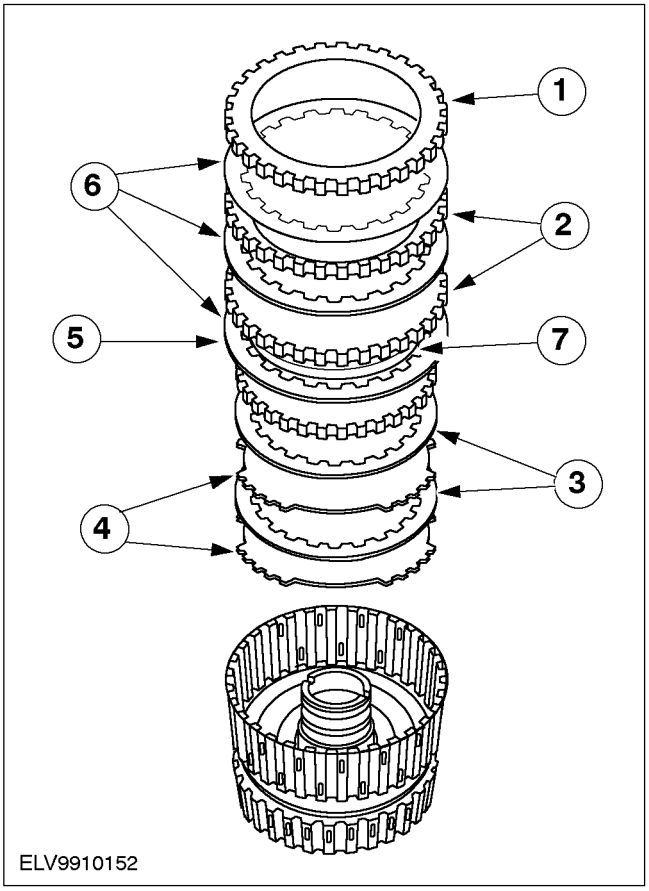


8. Remove the forward clutch pressure plate retaining ring from the forward, coast and direct clutch cylinder assembly.



9. Remove the forward and coast clutch plates.

1. Remove the forward clutch pressure plate.
2. Remove the forward clutch external spline clutch plates (steel).
3. Remove the coast clutch internal spline clutch plates (friction).
4. Remove the coast clutch external spline clutch plates (steel).
5. Remove the coast clutch pressure plate.
6. Remove the forward clutch internal spline clutch plates (friction).
7. Remove the forward clutch wave spring.



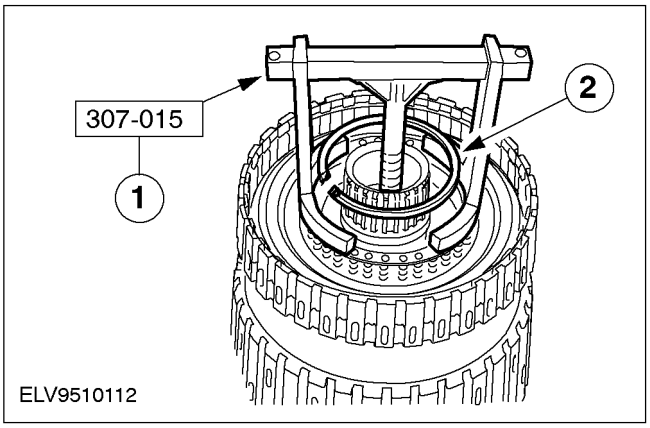
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

10. WARNING: Use caution when releasing tool pressure on the clutch piston springs. Failure to follow these instructions may result in personal injury.

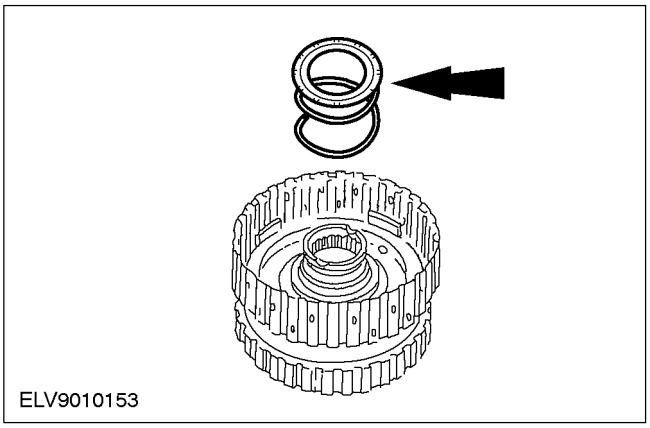
CAUTION: Do not fully compress the return springs.

Remove the forward and coast clutch return spring retaining ring.

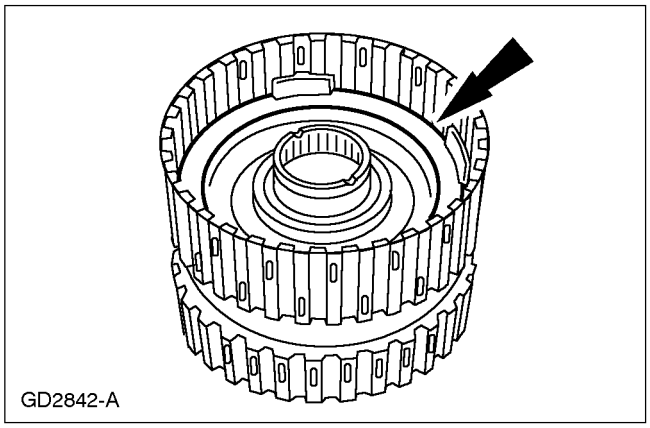
1. Using the special tool, compress the return spring.
2. Remove the retaining ring.



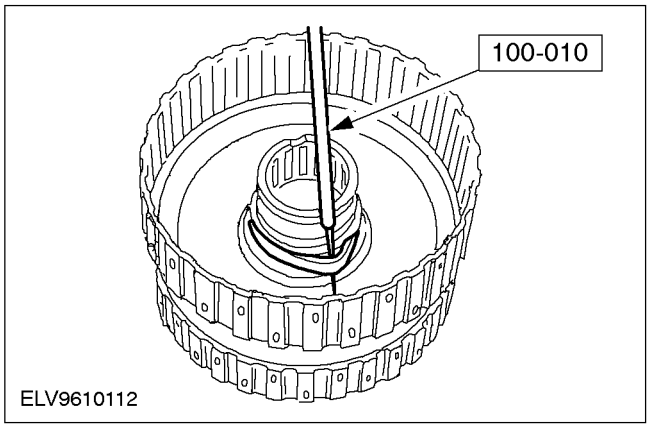
11. Remove the forward and coast clutch return spring assembly.



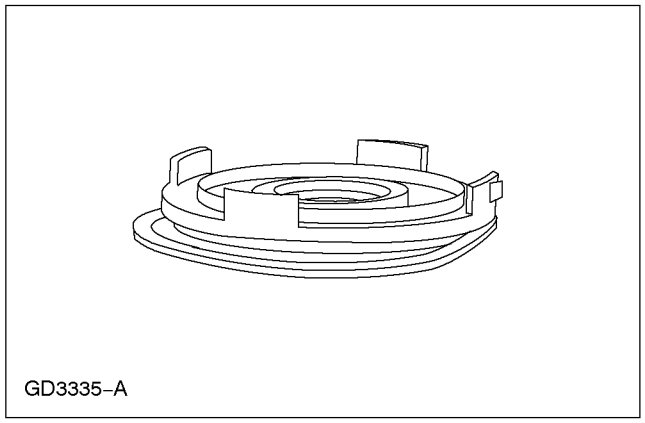
12. Remove the forward and coast clutch pistons.



13. Using the special tool, remove and discard the forward clutch piston inner seal from the forward, coast and direct clutch cylinder assembly.

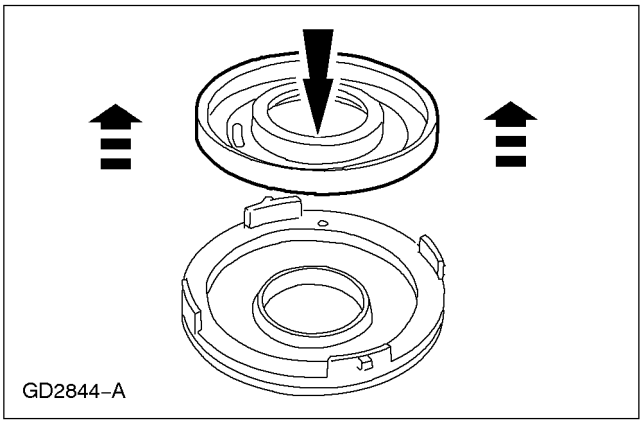


14. Remove and discard the forward clutch piston outer lip seal.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

15. Separate the coast clutch piston assembly from the forward clutch piston assembly.



16. NOTE: Do not clean the clutch plates in a vapor degreaser or in any other type of detergent solution.

Clean all parts thoroughly in a clean solvent and blow dry with moisture-free regulated compressed air.

- Clean the clutch plates with a lint-free cloth.

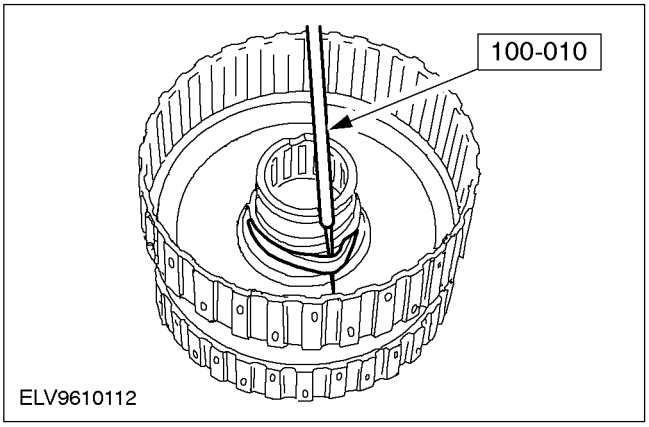
17. Inspect the parts for damage or wear.

- Inspect the spline teeth.
- Inspect the clutch plates.
- Inspect the seals.
- Inspect the bushing.
- Inspect the check balls in pistons.
- Inspect the piston bore.
- Inspect the forward, coast and direct clutch cylinder lubrication passages.

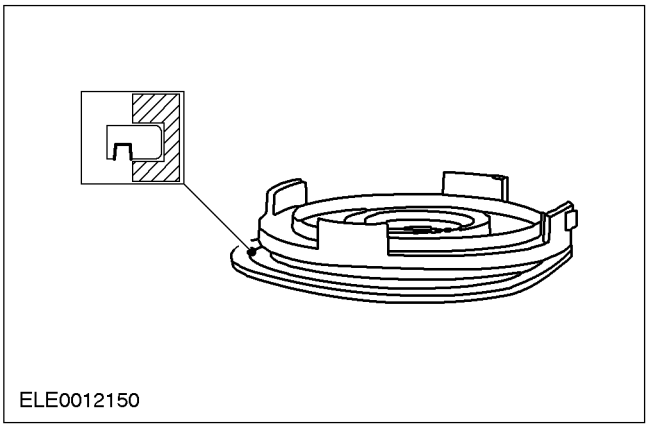
Assembly

1. Soak the internal spline clutch plates in clean automatic transmission fluid for 15 minutes before assembly.

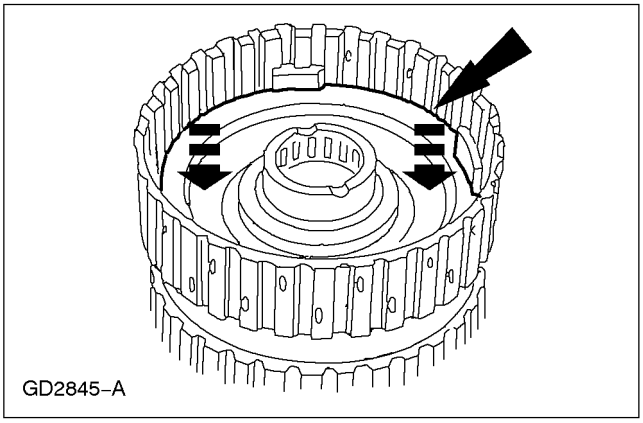
2. Install the forward clutch piston inner seal on the forward, coast and direct clutch cylinder assembly.



3. Install the forward clutch piston outer lip seal on the forward clutch piston assembly.



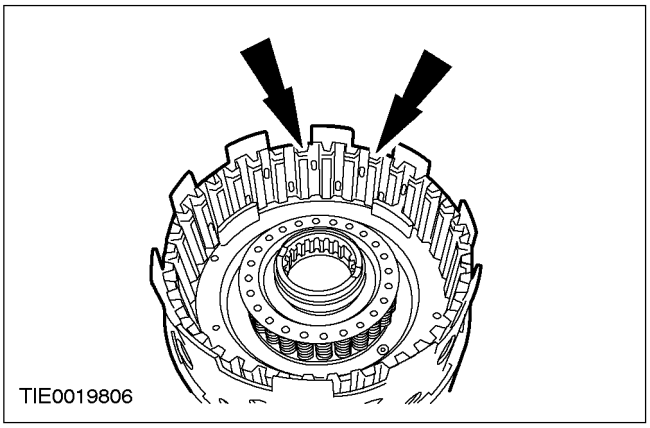
4. Install the forward clutch piston assembly in the forward, coast and direct clutch cylinder assembly.



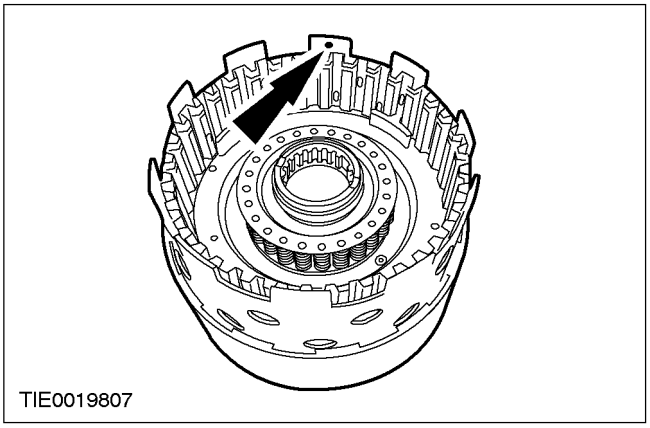
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

5. NOTE: The select fit retaining ring must be centered between two adjacent legs.

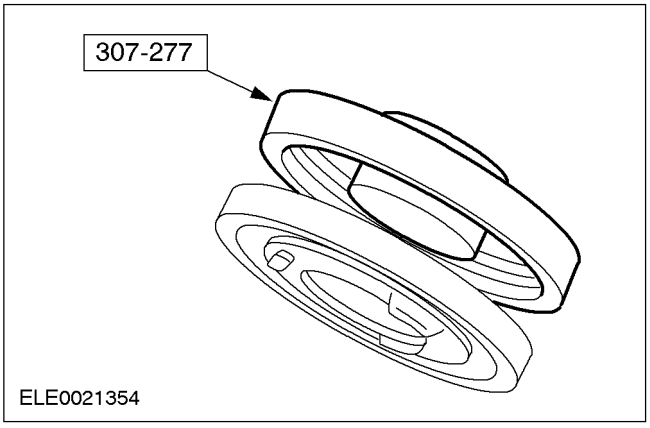
Using a felt tip marker (do not use a paint pen) mark the center of two adjacent legs on the top of the cylinder.



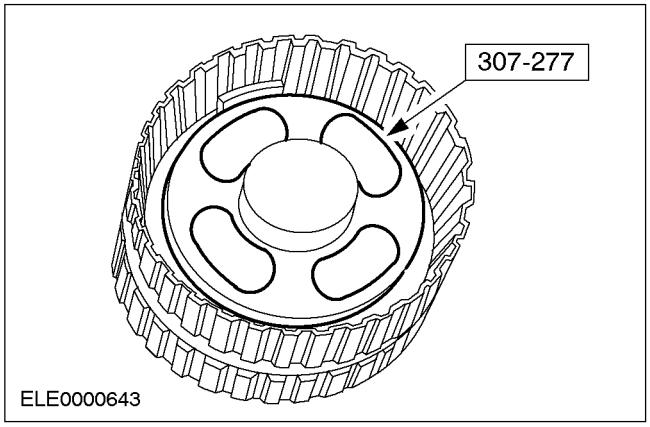
6. Using a felt tip marker (do not use a paint pen) mark the cylinder at the center point between the marks on the two adjacent legs.



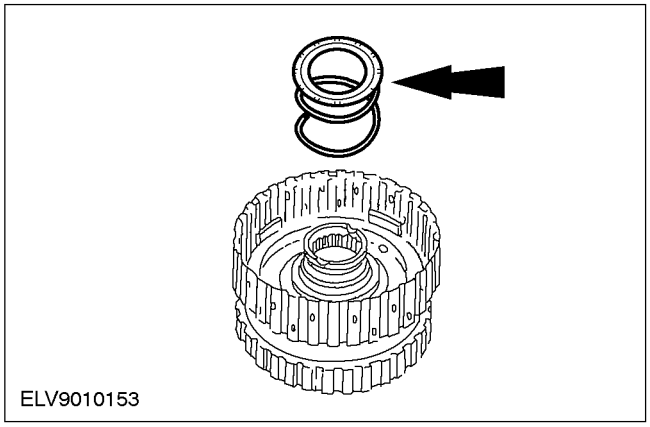
7. Install the coast clutch piston assembly onto the special tool.



8. Using the special tool, install the coast clutch piston into the forward clutch piston assembly.



9. Install the forward and coast clutch return spring assembly.



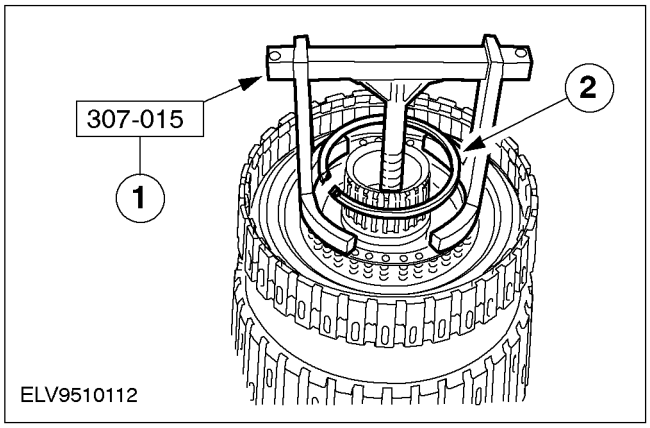
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

10. ⚠ WARNING: Use caution when releasing tool pressure on the clutch piston springs. Failure to follow these instructions may result in personal injury.

⚠ CAUTION: Do not compress the return springs completely.

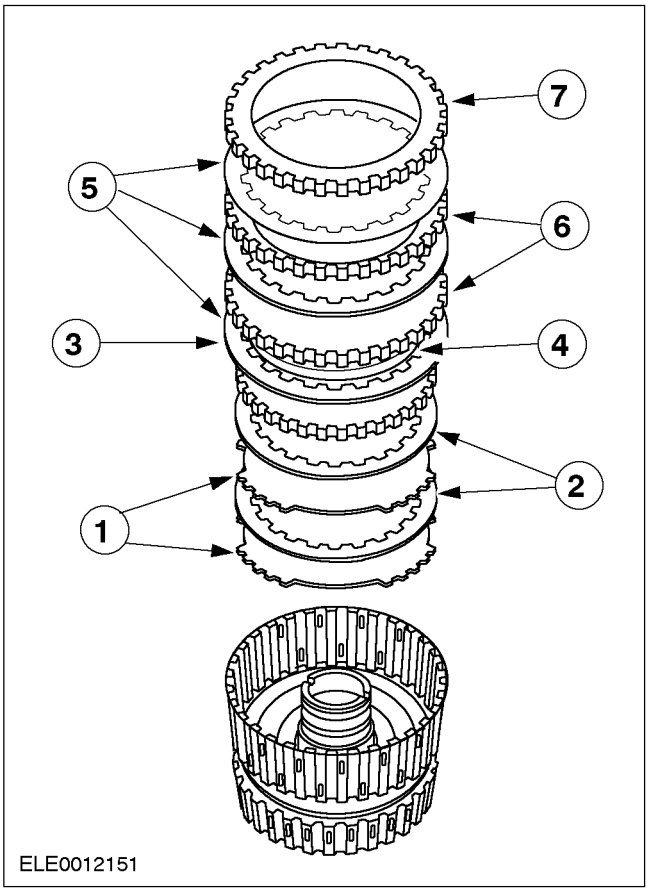
Using the special tool, remove the forward/coast clutch return spring retaining ring.

1. Compress the return spring.
2. Remove the retaining ring.
   - Align the gap between the piston legs.



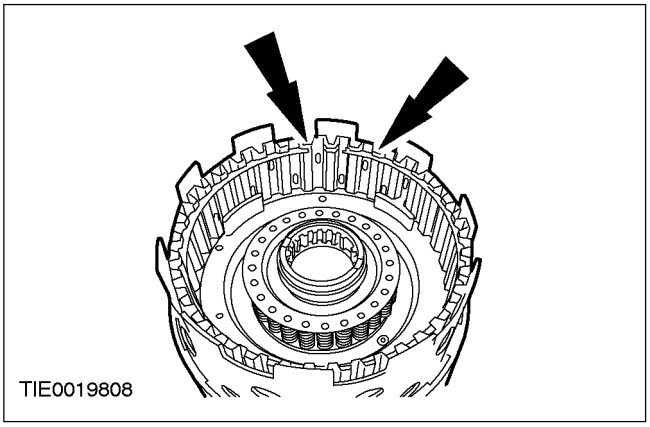
11. Install the forward and coast clutch plates in the sequence shown.

1. Install the coast clutch external spline clutch plates (steel).
2. Install the coast clutch internal spline clutch plates (friction).
3. Install the coast clutch pressure plate.
4. Install the forward clutch wave spring.
5. Install the forward clutch internal spline clutch plates (friction).
6. Install the forward clutch internal spline clutch plates (steel).
7. Install the forward clutch pressure plate.



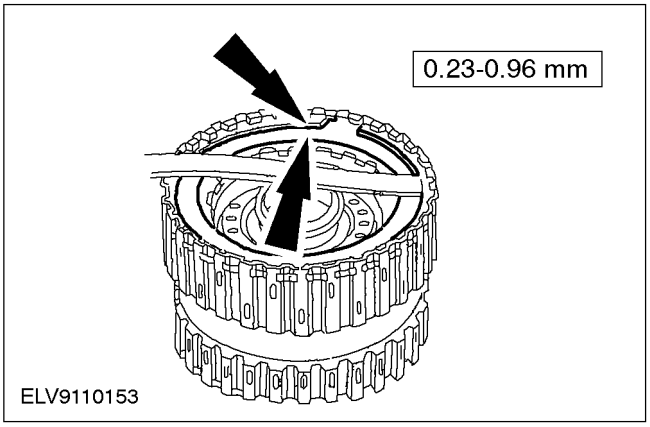
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

12. Position the select fit retaining ring on the center mark between the two adjacent legs.

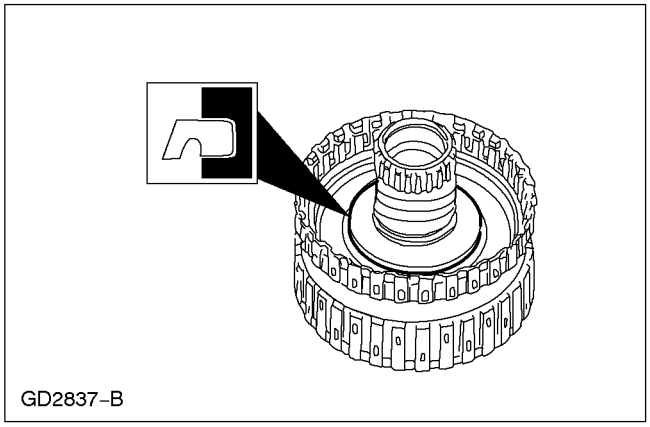


13. Measure the clearance between the forward clutch pressure plate and the forward clutch pressure plate retaining ring with a feeler gauge.

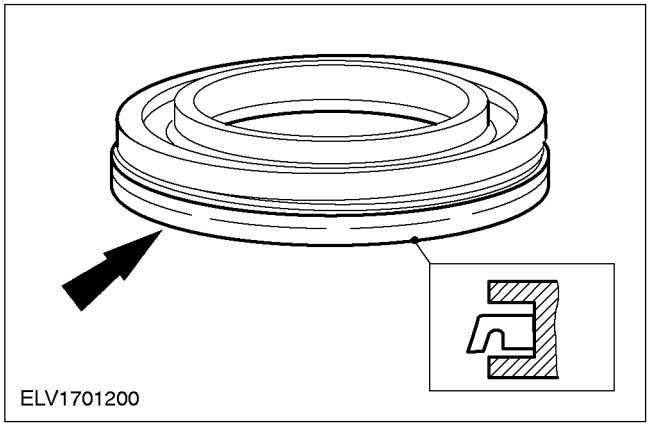
- Repeat the measurement on the opposite side.
- Average the two measurements to get the clearance.
- If the clearance is not within specification, select and install the proper thickness retaining ring to obtain the standard clearance.
- Retaining ring sizes:
- 1.43 - 1.53 mm
- 1.59 - 1.69 mm
- 1.75 - 1.85 mm
- 1.92 - 2.02 mm



14. Install the direct clutch piston inner lip seal on the direct clutch cylinder assembly.



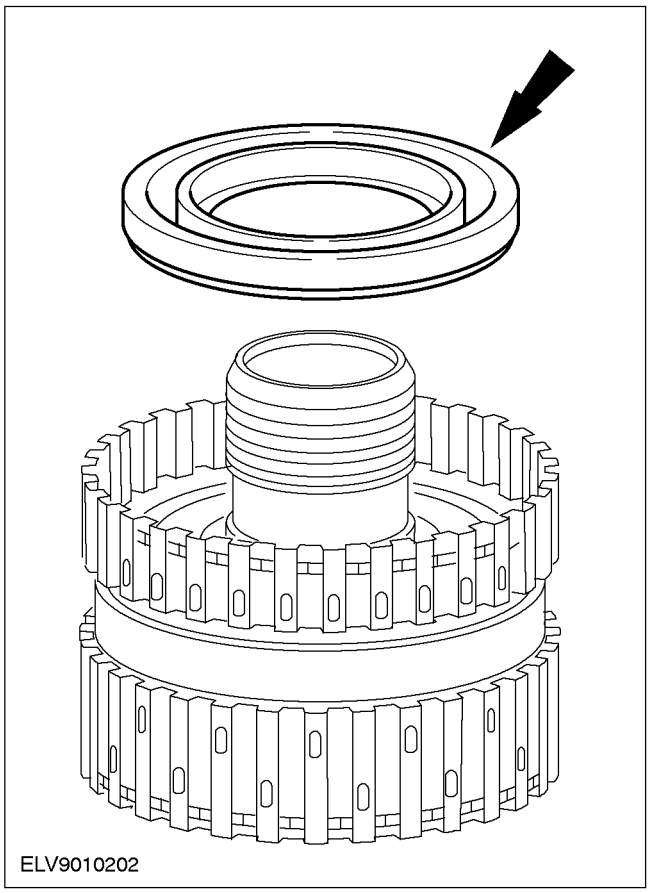
15. Install the direct clutch piston outer seal on the direct clutch piston assembly.



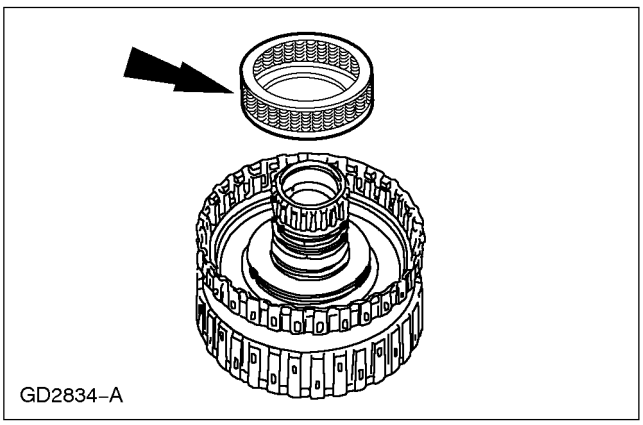
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

16. **NOTE:** Position the lip seal facing down.

    Install the direct clutch piston assembly in the forward, coast and direct clutch cylinder assembly.



17. **Install the direct clutch return spring assembly.**

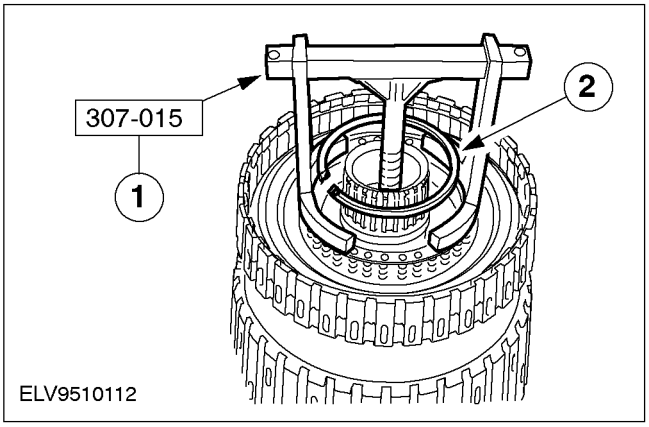


18. **WARNING: Use caution when releasing tool pressure on the clutch piston springs. Failure to follow these instructions may result in personal injury.**

CAUTION: Do not fully compress the direct clutch return springs.

Using the special tool, install the direct clutch return spring retaining ring.

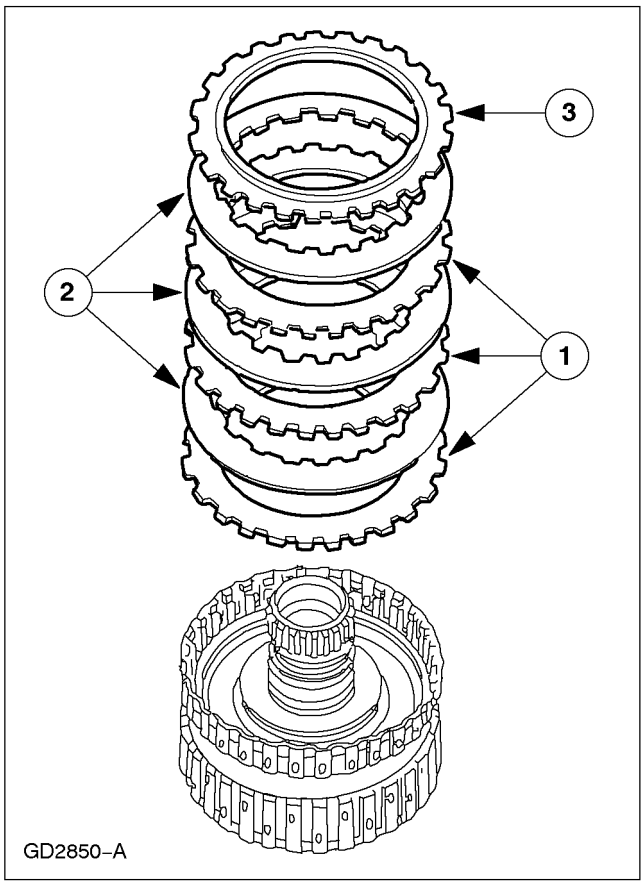
1. Compress the direct clutch return springs.
2. Install the direct clutch return spring retaining ring.



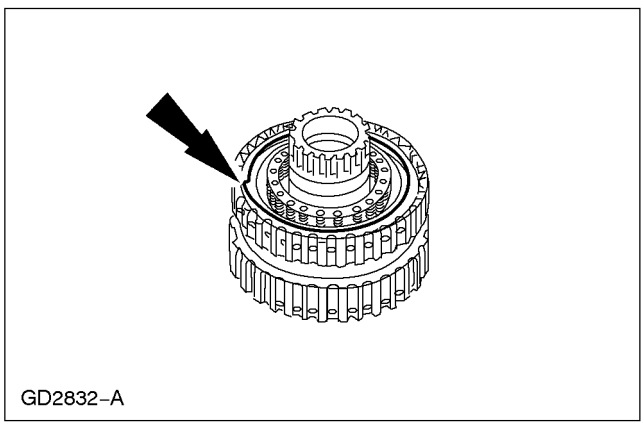
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

19. Install the direct clutch plates.

1. Install the direct clutch external spline (steel) clutch plates.
2. Install the direct clutch internal spline (friction) clutch plates.
3. Install the direct clutch pressure plate.

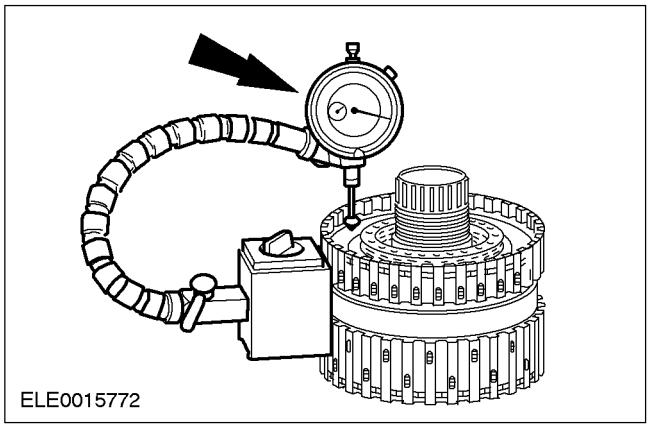


20. Install the direct clutch pressure plate retaining ring.



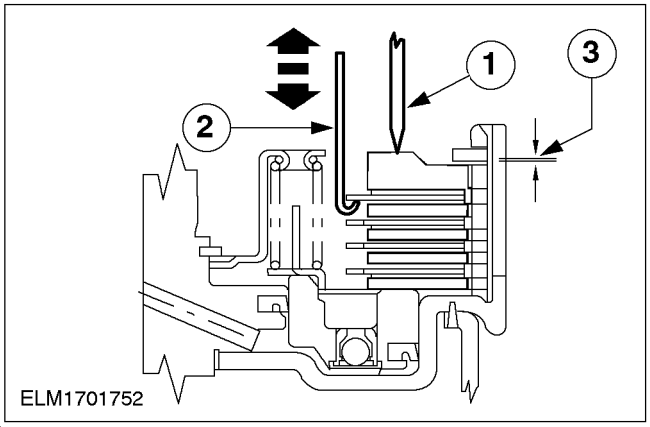
21. Measure and adjust the clearance of the direct clutch.

- Attach a dial gauge to the direct clutch.



22. Measure and adjust the direct clutch play.

1. Mount a dial gauge onto the thrust washer.
   - Press the pack of clutch plates together and zero the dial gauge on the thrust washer.
2. Lift the pressure plate as far as possible using two scribers on opposite sides.
3. Note the axial clearance displayed on the dial gauge.
   - Rotate through 180 degrees and repeat the measurement.
   - Calculate the average of the two values.
   - Permissible axial clearance:
   - With three friction plates: 0,52 - 1,12 mm
   - With four friction plates: 0,73 - 1,42 mm
   - The snap-ring for the clutch plate assembly is used to correct the axial clearance and is available in different thicknesses:
   - 1,28 mm - 1,38 mm
   - 1,39 mm - 1,49 mm
   - 1,52 mm - 1,62 mm
   - 1,65 mm - 1,75 mm

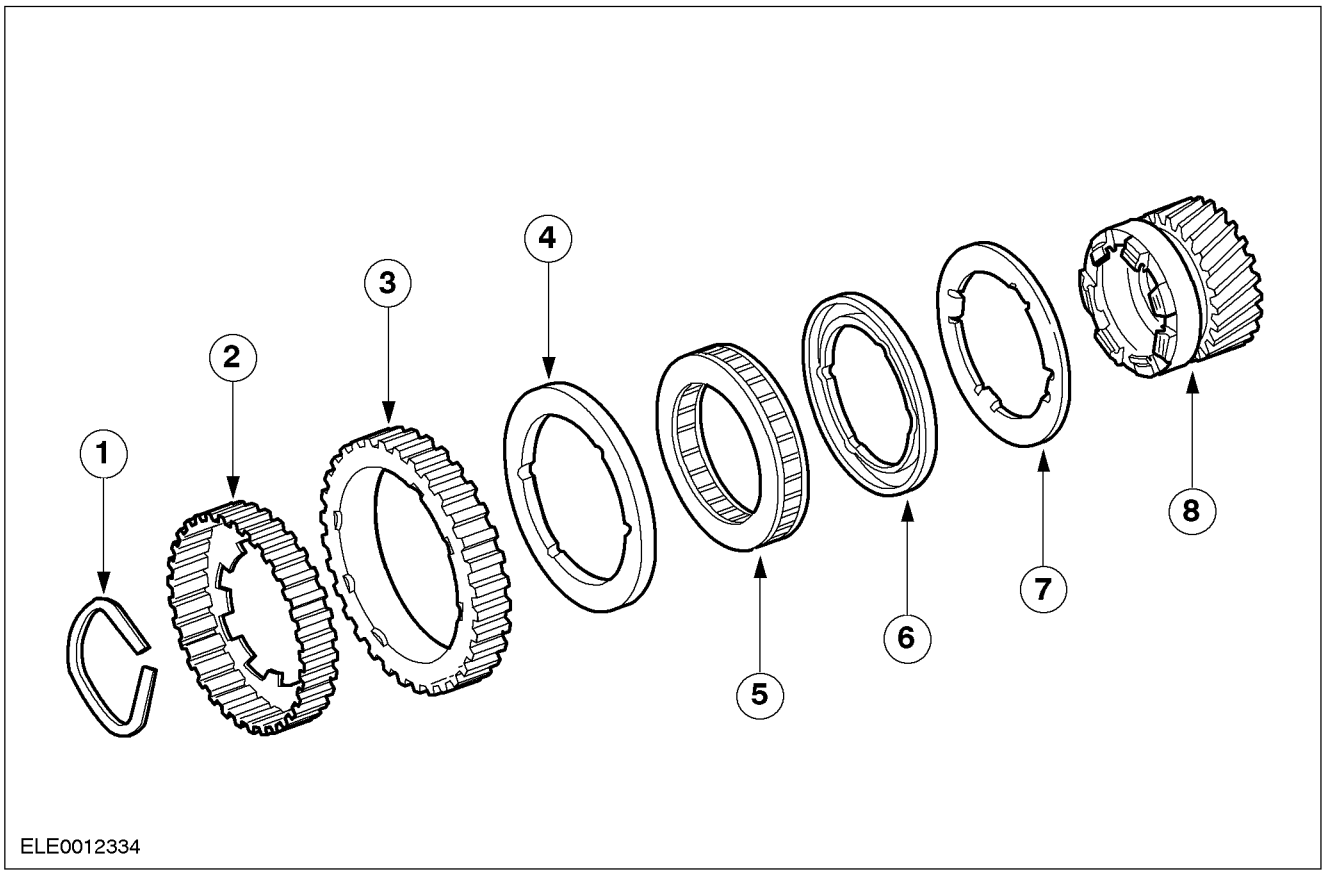


DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

Forward One-Way Clutch

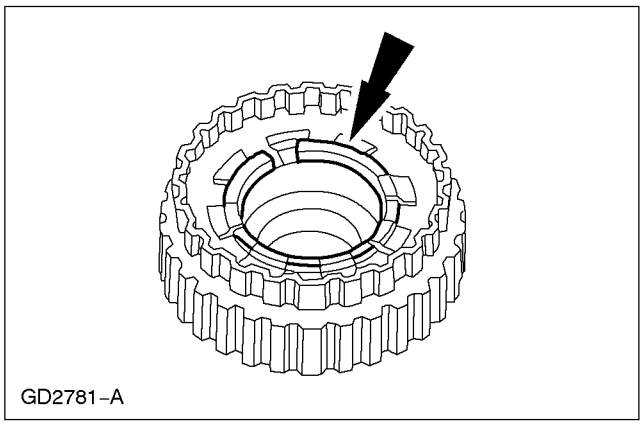
Disassembly



Forward one-way clutch

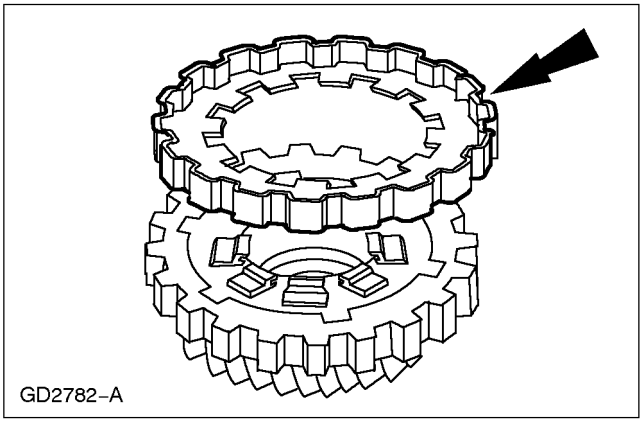
Item	Part Number	Description
1	–	Coast clutch hub retaining ring
2	–	Coast clutch hub
3	–	Forward one-way clutch outer ring
4	–	Forward one-way clutch end cap
5	-	Forward one-way clutch
6	-	Forward one-way clutch end cap
7	–	Forward one-way retainer
8	–	Low intermediate sun gear, race and bushing assembly

1. Remove the coast clutch hub retaining ring.

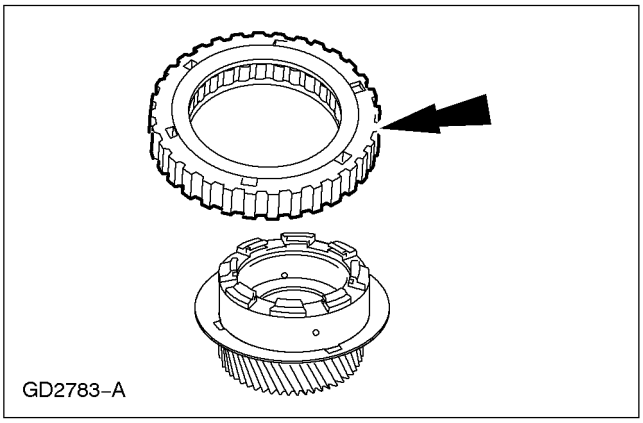


DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

2. Remove the coast clutch hub.



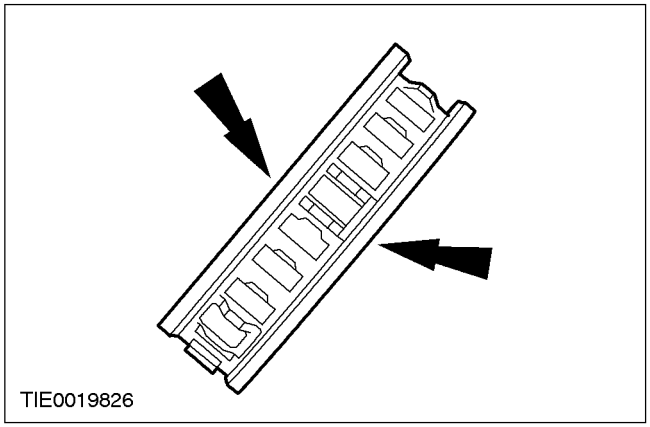
3. Remove the forward one-way clutch outer ring and forward one-way clutch with the end caps.



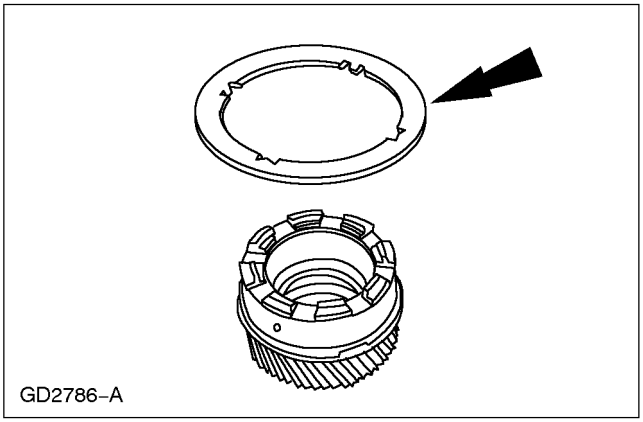
4. NOTE: Orientation of the end caps forward one-way clutch. New design end caps are of the same thickness and interchangeable (but not reversible).

NOTE: Not all transaxles contain the forward one-way clutch style shown.

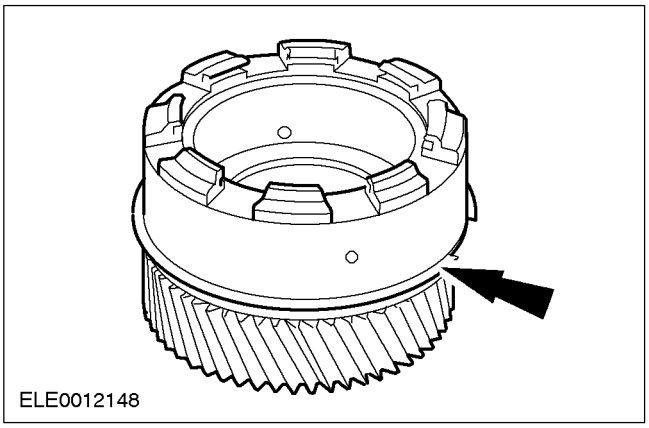
Remove the forward one-way clutch end caps from the forward one-way clutch.



5. Remove the forward one-way clutch retainer.



6. Remove the retaining ring downward over the gear.



7. WARNING: Wear protective goggles when using compressed air to clean components.

Thoroughly clean all components and blow them dry with moisture-free regulated compressed air.

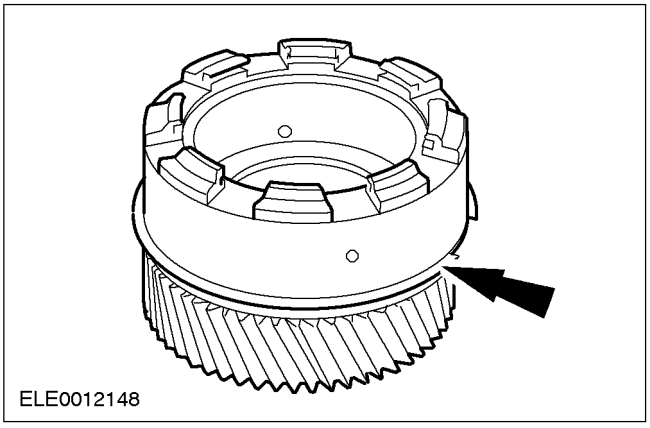
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

8. Inspect the forward one-way clutch components for damage and wear.

- Inspect the forward one-way clutch.
- Inspect the forward one-way clutch and end caps.
- Inspect the inner race and low-intermediate sun gear assembly.
- Inspect the lube holes.
- Inspect the coast clutch hub.

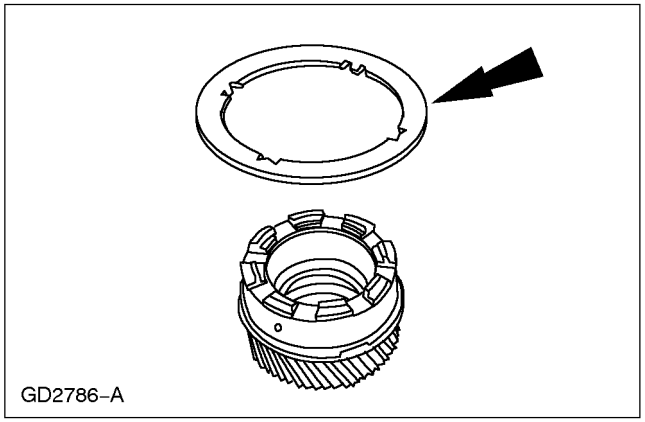
Assembly

1. Install the retaining ring.



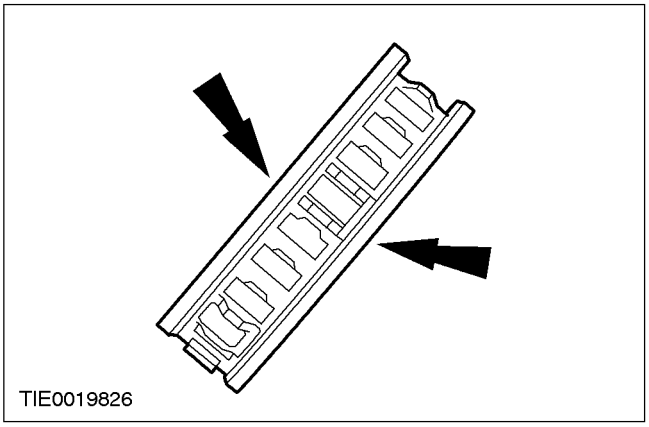
2. NOTE: The tabs on the forward one-way clutch retainer face downward.

Install the forward one-way clutch retainer.

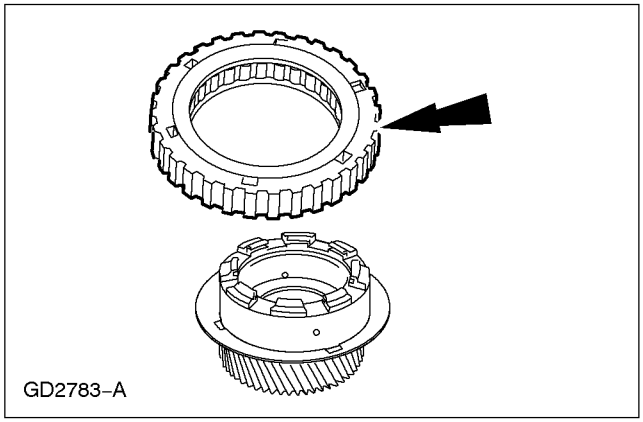


3. NOTE: Orientation of the forward one-way clutch end caps. New design end caps are of the same thickness and interchangeable (but not reversible).

Install the forward one-way clutch end caps onto the forward one-way clutch.



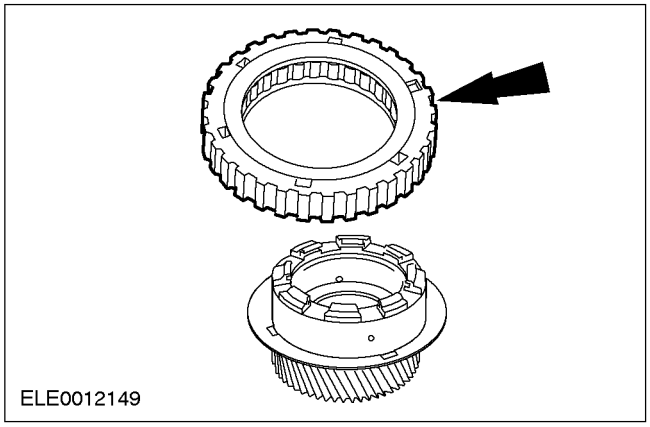
4. Install the forward one-way clutch and end caps in the forward one-way clutch outer ring.



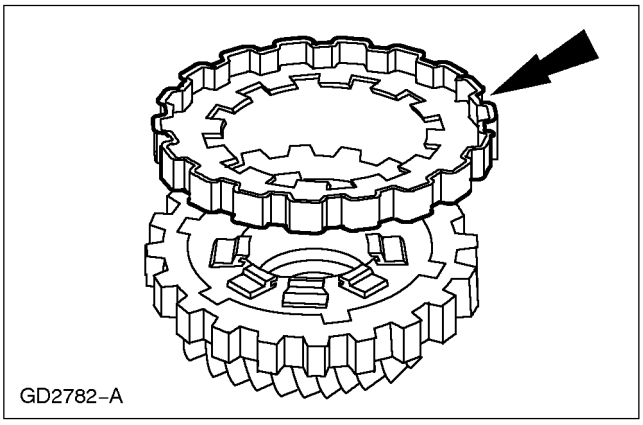
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

5. NOTE: Lube grooves face upward (away from the sun gear) forward one-way clutch.

Install the forward one-way clutch outer ring and one-way clutch on the forward one-way clutch inner race by rotating them.



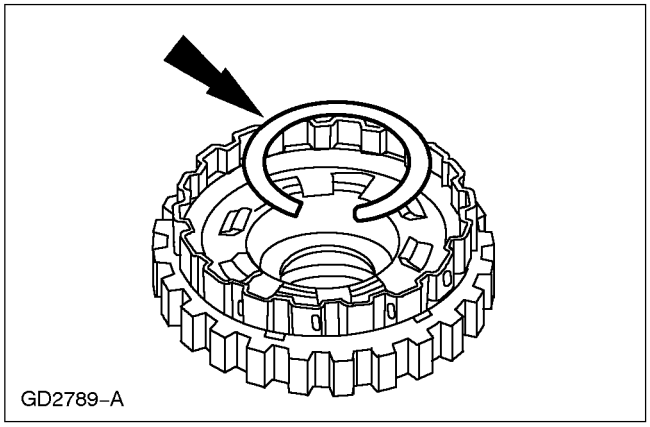
6. Install the coast clutch hub.



7. NOTE: The ends of the retaining ring should point toward the coast clutch hub.

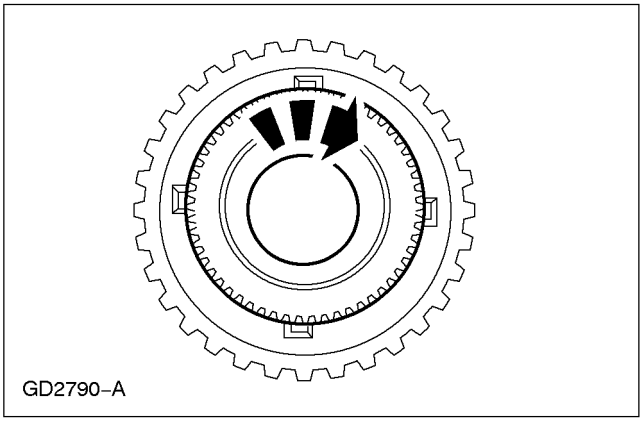
NOTE: Make sure the retaining ring is fully seated upon installation.

Install the coast clutch hub retaining ring.



8. Check the operation of the forward one-way clutch with the low-intermediate sun gear facing upward.

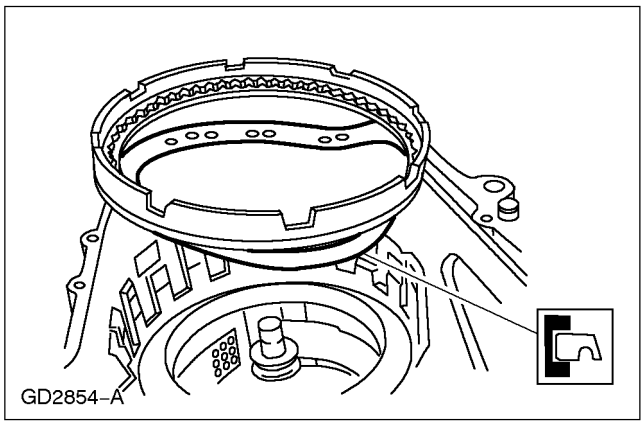
- Hold the outer race firmly.
- Rotate the low-intermediate sun gear clockwise.
- The low-intermediate sun gear should rotate with a slight drag without attempting to rotate the outer race.
- Rotate the low-intermediate sun gear counterclockwise; the low-intermediate sun gear should rotate the outer race.



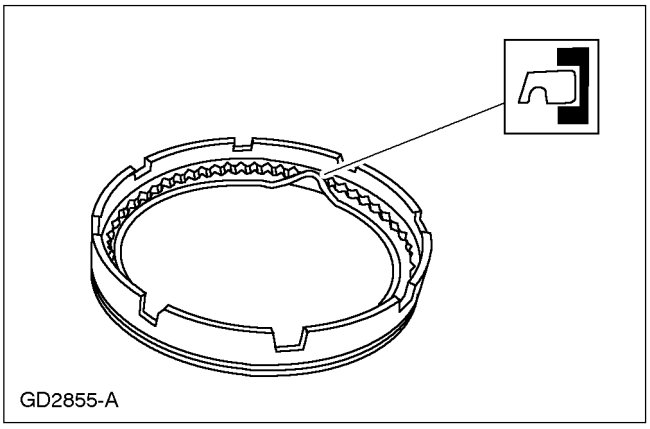
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

Low/Reverse Piston

1. **Install a new outer seal for the 1st and reverse gear servo piston.**



2. **Install a new inner seal for the 1st and reverse gear servo piston.**



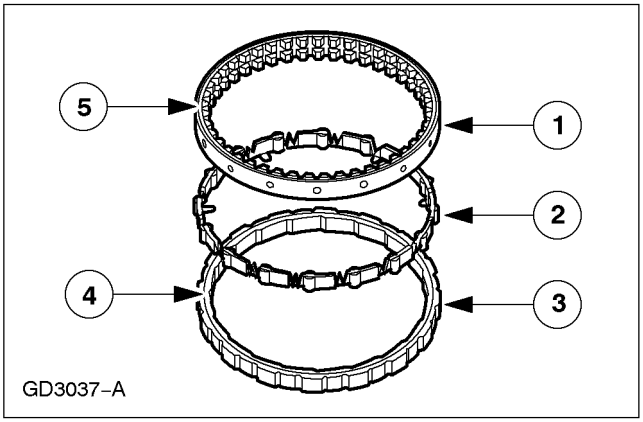
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

Low One-Way Clutch Assembly

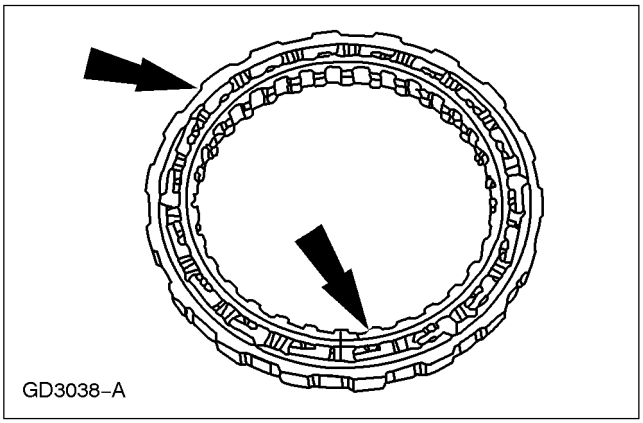
Disassembly

1. Inspect the low one-way clutch components:

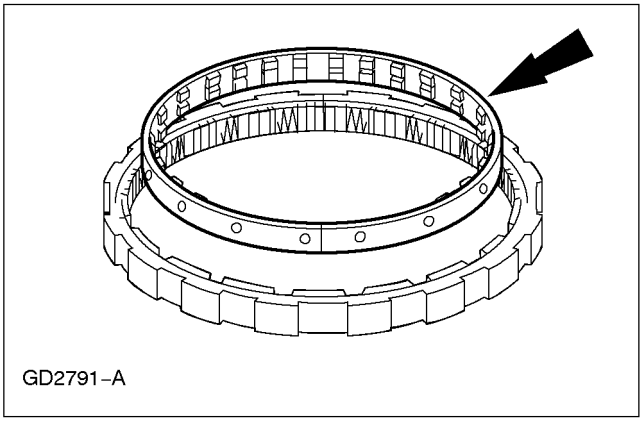
1. Inspect the inner race.
2. Inspect the roller assembly.
3. Inspect the outer race.
4. Identification groove
5. Identification groove



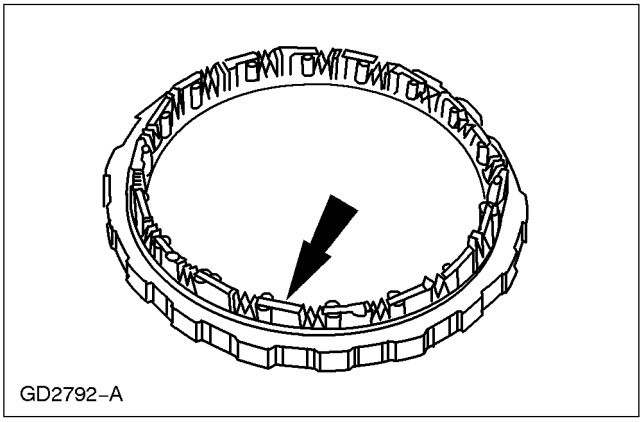
2. Position the low one-way clutch so that the inner and outer race grooves are facing upward.



3. Remove the inner race.



4. Remove the roller assembly.



5. Clean all parts thoroughly in clean solvent and blow dry with moisture-free regulated compressed air.

DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

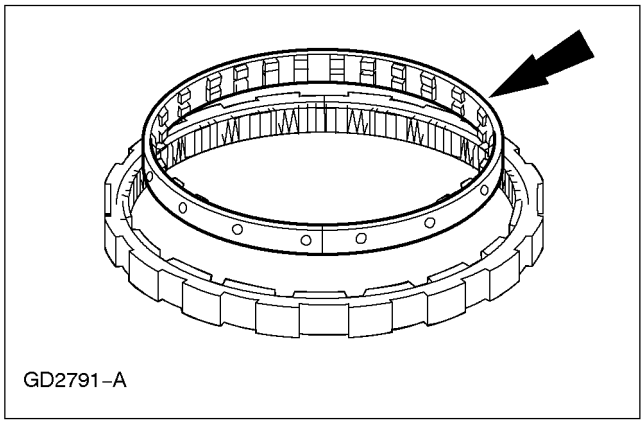
6. Inspect the low one-way clutch parts for damage and wear.

- Inspect the outer race.
- Inspect the roller assembly.
- Inspect the inner race.
- Inspect the lubrication holes.

Assembly

1. NOTE: Outer tabs of the roller assembly must face up.

Install the roller assembly into the outer race.

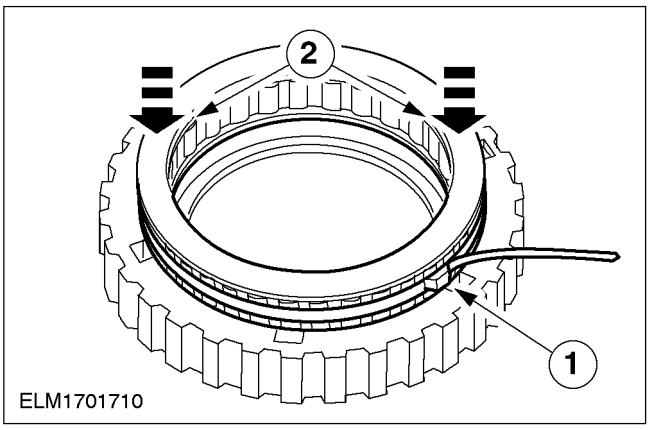


2. CAUTION: The inner race groove must be facing upwards.

NOTE: To aid the inner race installation, rotate the inner race clockwise during installation.

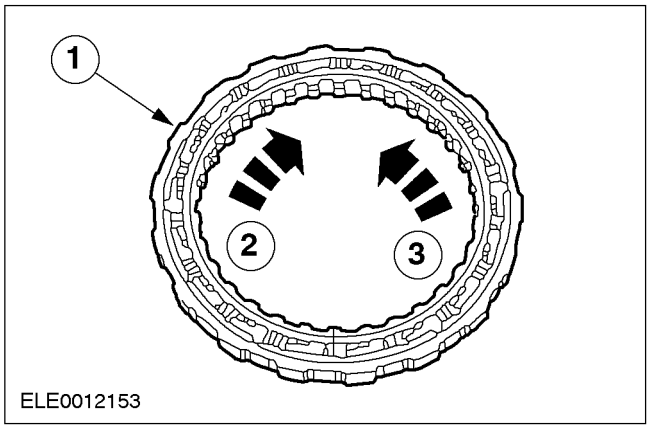
Install the inner race into the roller assembly.

1. Align tabs with the locating groove.



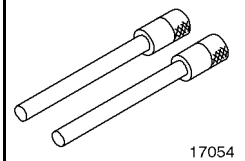
3. Check the operation of the one-way clutch as follows:

1. Hold the outer race in place.
2. Turn the inner race clockwise. It must be possible to turn the inner race slowly against the outer race.
3. Turn the inner race anti-clockwise. The inner race should force the outer race to turn in the same direction.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

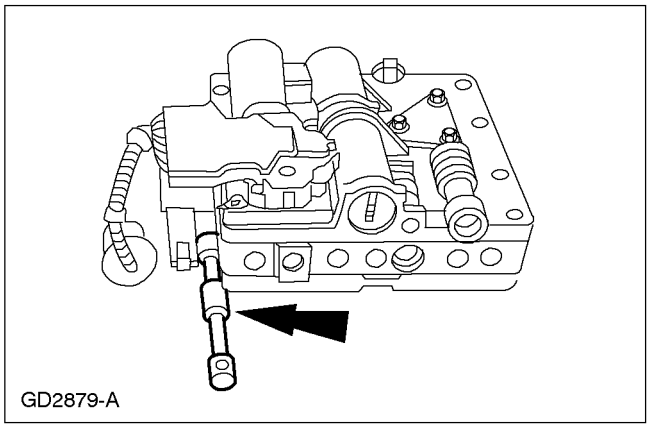
Main Control Valve Body

Special Tool(s)	
 17054	Alignment Pins, Valve Body 307-299 (17-054)

Name	Specification
Automatic transmission fluid	ESP-M2C166-H

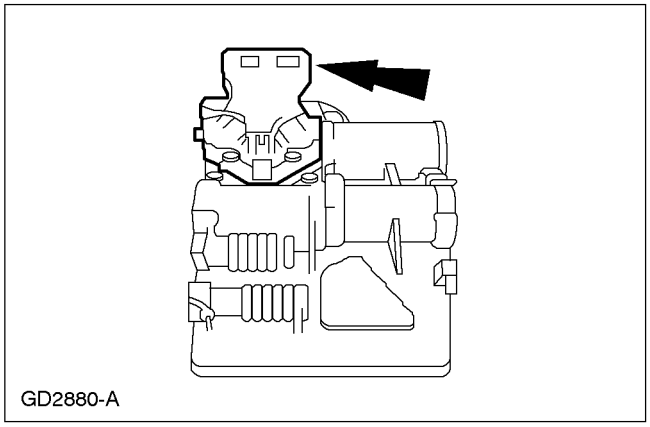
Disassembly

1. Remove the manual valve.

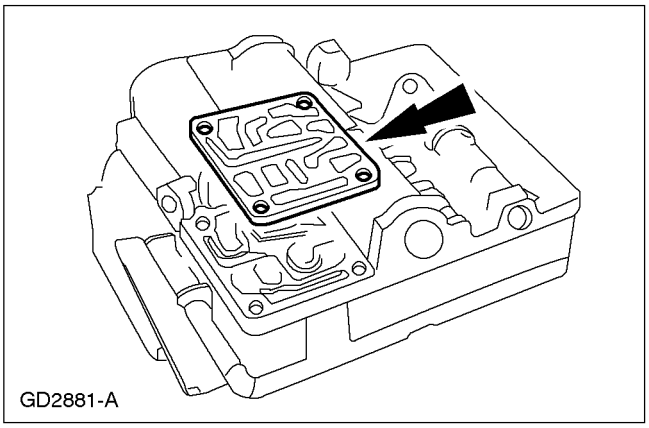

GD2879-A

2. ⚠ CAUTION: Do not attempt to remove the solenoid valve body wiring cover.

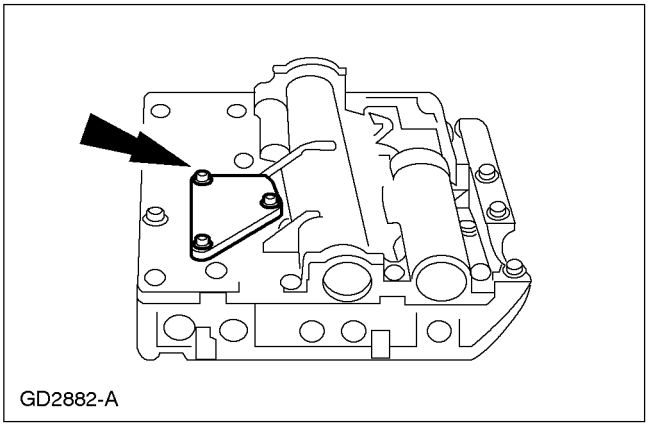
Remove the two solenoid valve body retaining bolts and remove the solenoid valve body.


GD2880-A

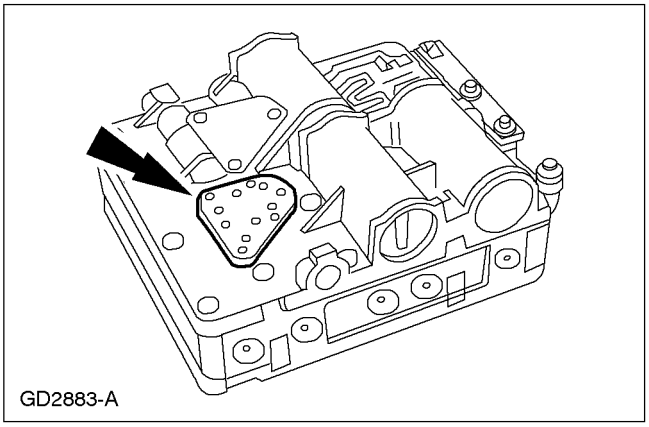
3. Remove and discard the solenoid valve body gasket.


GD2881-A

4. Remove the three pressure tap plate retaining bolts and the pressure tap plate.

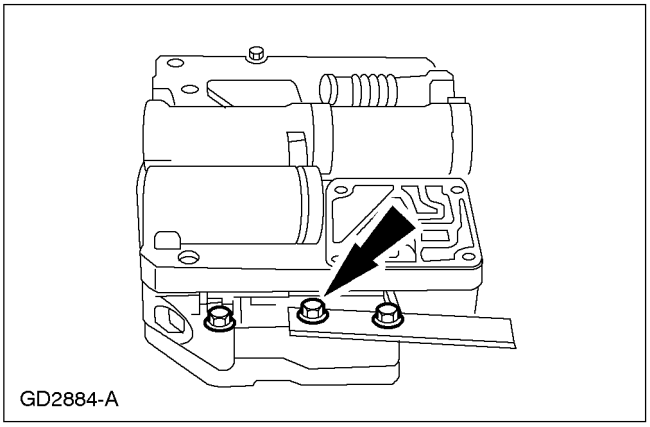

GD2882-A

5. Remove and discard the pressure plate tap gasket.

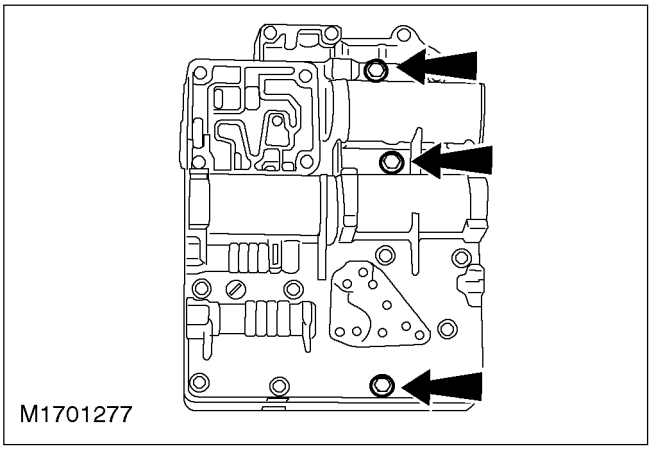

GD2883-A

DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

6. Remove the control valve body-to-transfer plate retaining bolts, and remove the manual valve detent spring assembly.

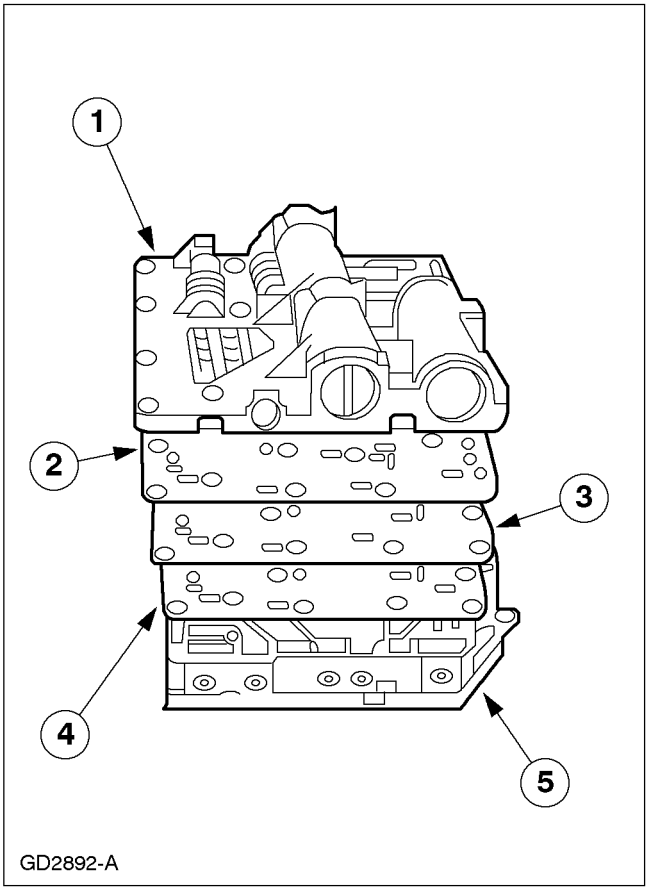


7. Remove the accumulator body-to-transfer plate retaining bolts.



8. Separate the accumulator body from the main control valve body.

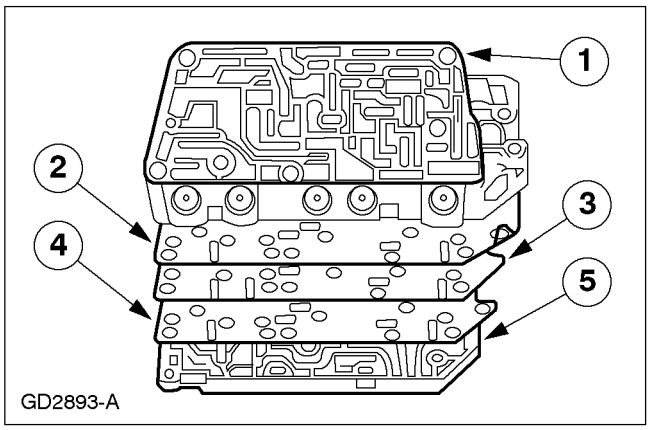
1. Remove the accumulator body assembly.
2. Remove and discard the accumulator body separator gasket.
3. Remove the accumulator body separator plate.
4. Remove and discard the accumulator body separator gasket.
5. Remove the main control valve body.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

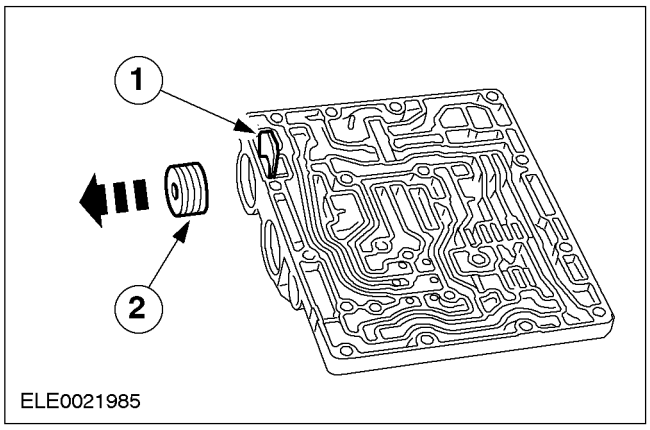
9. Separate the transfer plate from the main control valve body.

1. Remove the main control valve body.
2. Remove and discard the valve body separator plate gasket.
3. Remove the valve body separator plate.
4. Remove and discard the valve body separator plate gasket.
5. Remove the transfer plate.

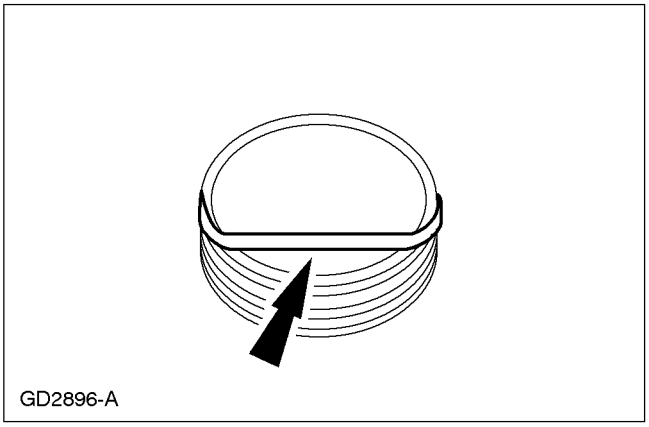


10. Remove the intermediate and overdrive accumulator valve plug.

1. Remove the accumulator valve plug retaining plate.
2. Remove the accumulator valve plug.



11. Remove and discard the intermediate and overdrive accumulator plug seal.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

12. CAUTION: Remove, note location and clean one valve at a time to avoid incorrect installation.

As necessary, disassemble the parts of the accumulator body and main control valve body assemblies.

- Coat the components as quickly as possible with automatic transmission fluid and reassemble them to prevent damage or incorrect installation.

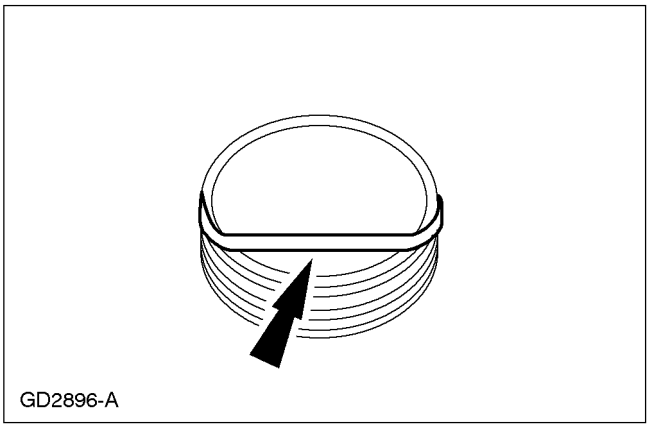
Assembly

1. WARNING: Wear protective safety goggles when cleaning components with compressed air.

CAUTION: If the valve sticks in its bore and cannot be freed, install a new main control valve body.

NOTE: Clean the main control valve body and accumulator body assembly of the main control in cleaning solvent. Blow dry with moisture-free regulated compressed air. The solenoid valve body should not be cleaned in cleaning solvent. It may be blown clean with compressed air or wiped clean with a lint-free cloth.

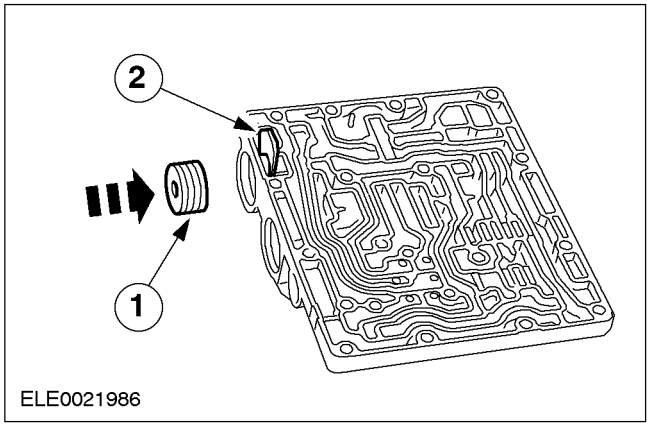
Install a new intermediate and overdrive accumulator plug seal and coat with petroleum jelly.



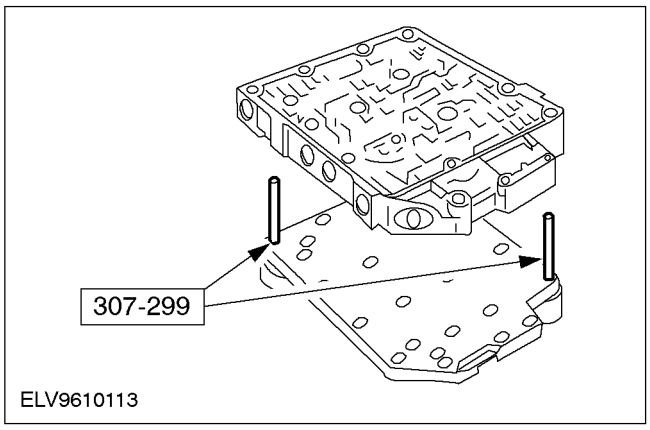
2. CAUTION: Do not install the intermediate and overdrive accumulator valve plug and seal too far into the bore and damage the seal. Only push the intermediate and overdrive accumulator valve plug until it is flush with the accumulator body assembly.

Install the intermediate and overdrive accumulator plug assembly.

1. Install the accumulator valve plug.
2. Install the accumulator valve plug retaining plate.



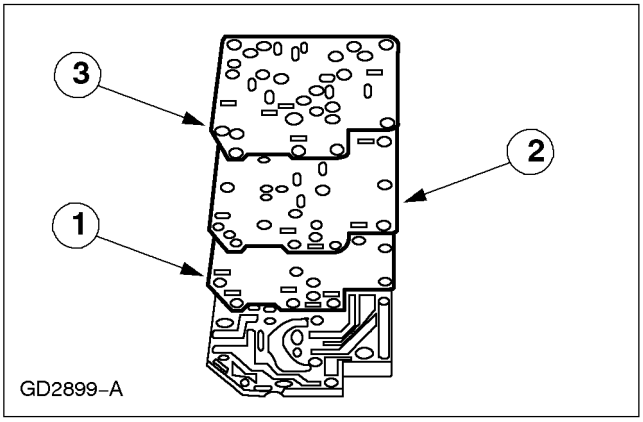
3. Install the special tool.



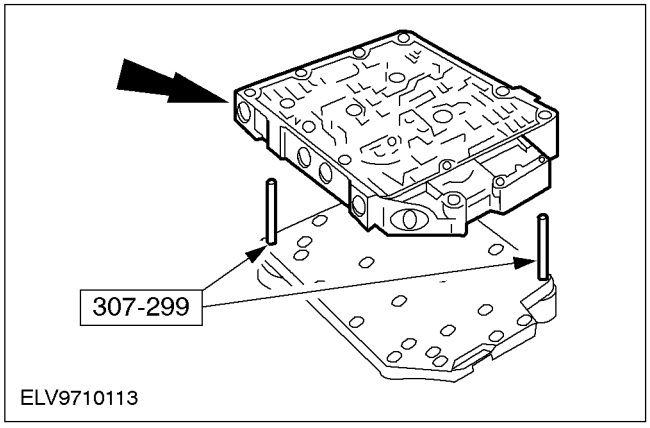
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

4. Using the special tool, install the valve body separator plate gaskets and valve body separator plate.

1. Install a new valve body separator plate gasket.
2. Install the valve body separator plate.
3. Install a new valve body separator plate gasket.

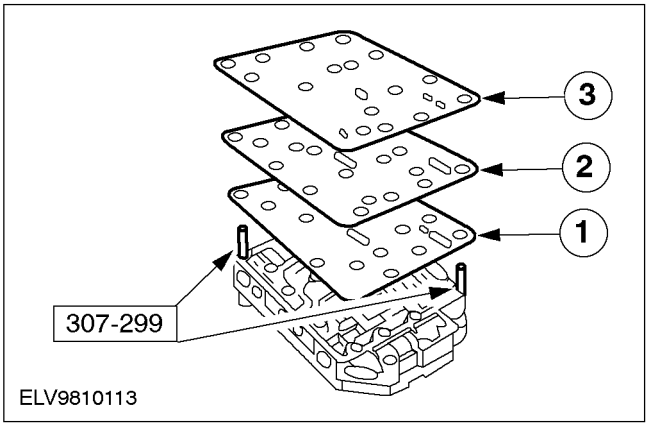


5. Using the special tool, install the main control valve body.

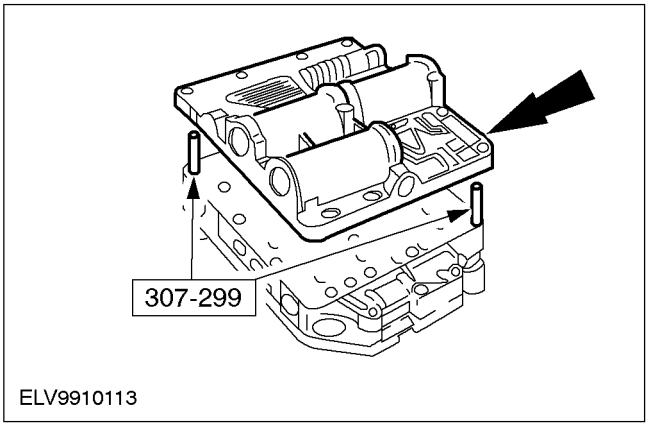


6. Using the special tool, install the accumulator body separator plate and gaskets.

1. Install a new accumulator body separator plate gasket.
2. Install the accumulator body separator plate.
3. Install a new accumulator body separator plate gasket.



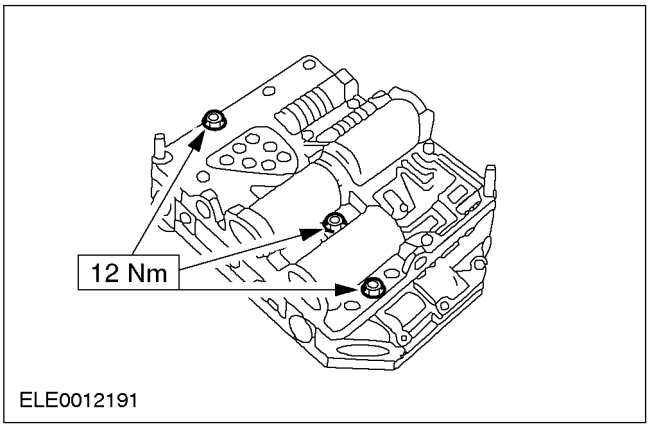
7. Using the special tool, install the accumulator body assembly.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

8. Install the accumulator body transfer plate retaining bolts.

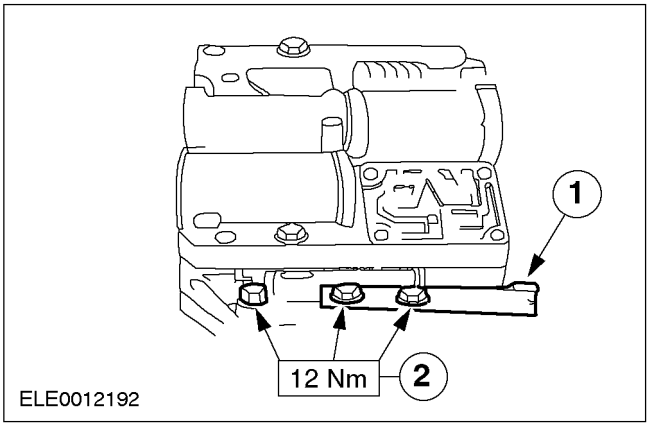
- Tighten the centre bolt first.



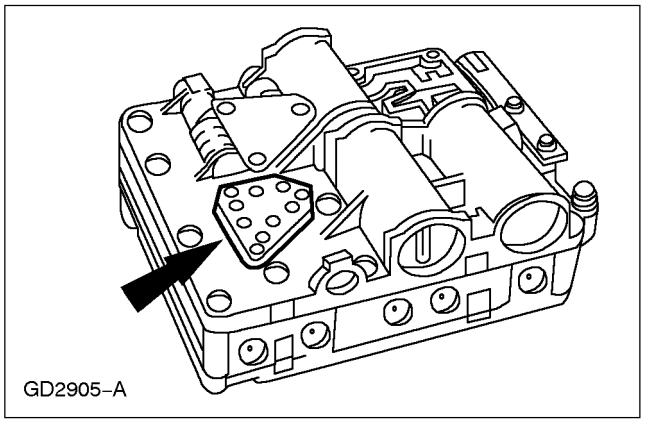
9. Install the main control valve body to transfer plate retaining bolts.

1. Install the manual valve detent spring.
2. Install the control valve body to transfer plate bolts.

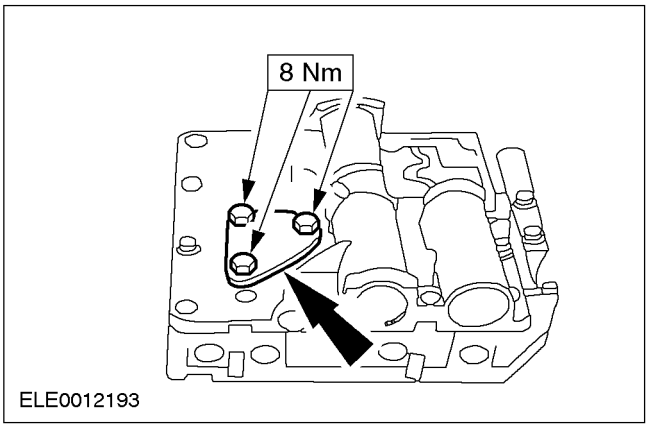
- Tighten with the centre bolt first.



10. Install a new pressure tap plate gasket.



11. Install the pressure tap plate and retaining bolts.

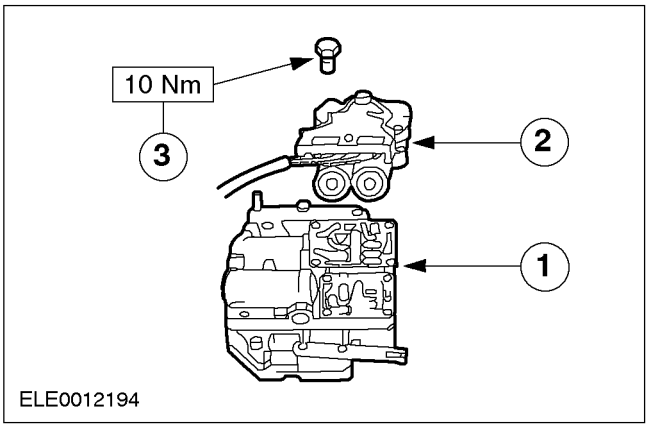


12. NOTE: Match the solenoid valve body gasket to passages.

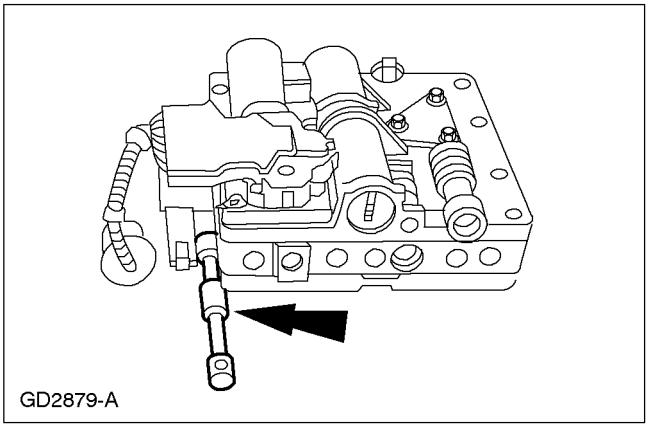
Install the solenoid valve body.

1. Install the solenoid valve body gasket.
2. Install the solenoid valve body.
3. Install the two solenoid valve body retaining bolts.

- Remove the special tool.



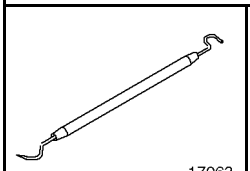
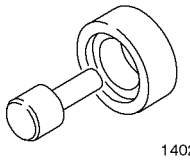
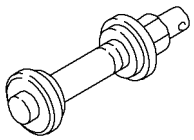
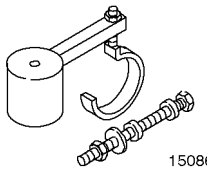
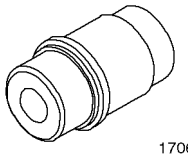
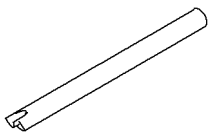
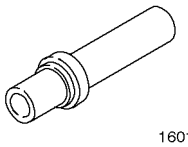
13. Install the manual valve.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

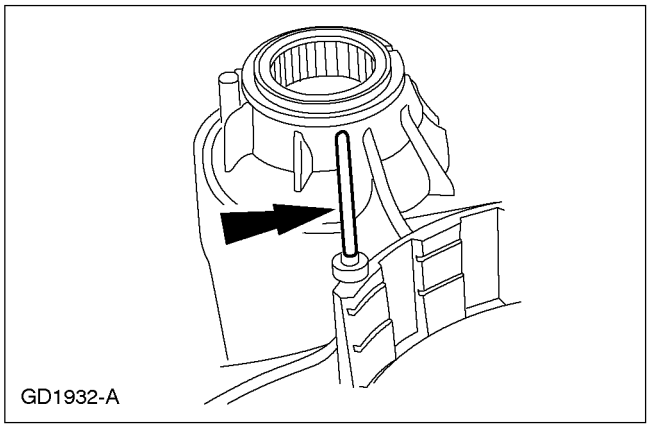
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

Transaxle Case

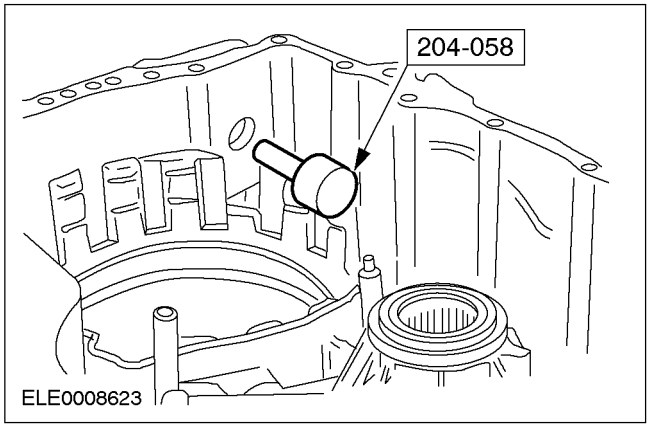
Special Tool(s)	
 17063	Remover, O-Ring 100-010 (17-063)
 14027	Remover/Installer, Bushing, Lower Arm 204-058 (14-027)
 15035	Installer, Bearing Cup, Pinion 205-074 (15-035)
 15086	Remover/Installer Pivot Bushing 205-297 (15-086)
 17064	Remover/Installer, Needle Bearing 307-286 (17-064)
 17065	Installer, Oil Fill Pipe 307-307 (17-065)
 16015	Installer, Bushing/Oil Seal, Transmission Extension 308-045 (16-015)

Disassembly

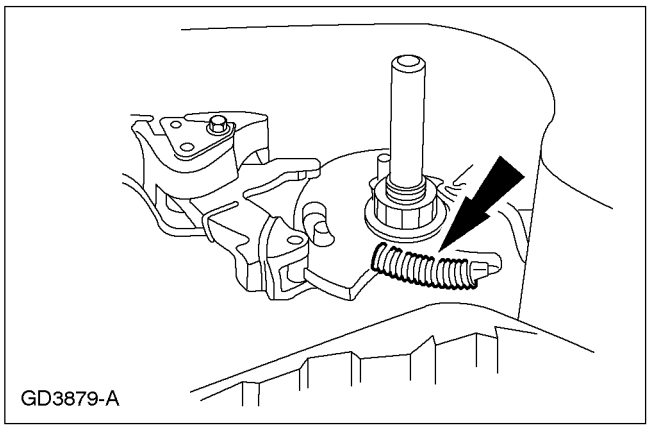
1. **Remove and discard the final drive lubrication tube.**



2. **Using the special tool, remove and discard the final drive lubrication tube seal.**

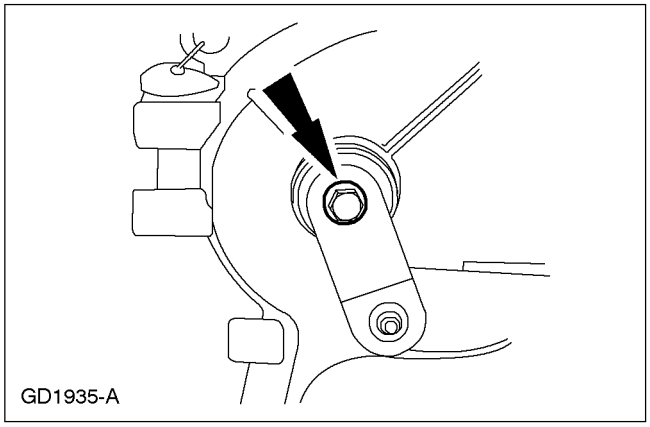


3. **Remove the parking pawl ratcheting spring.**



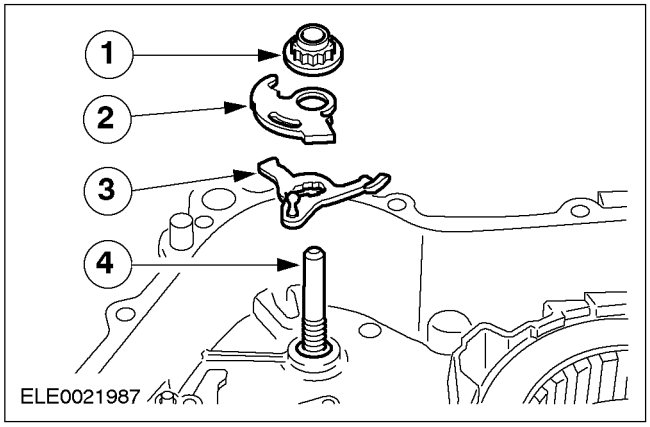
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

4. Remove the manual control lever assembly.

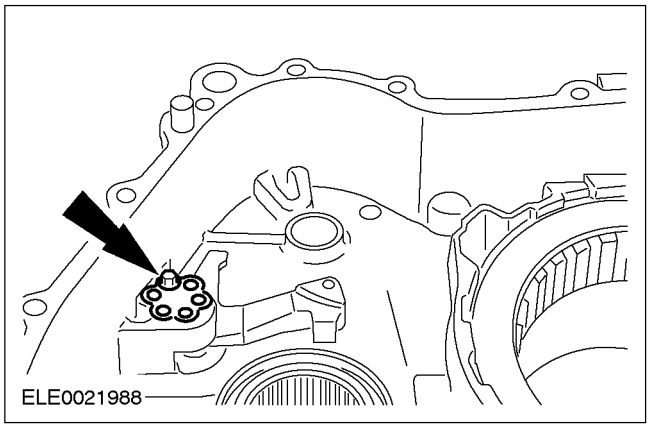


5. Remove the selector lever assembly.

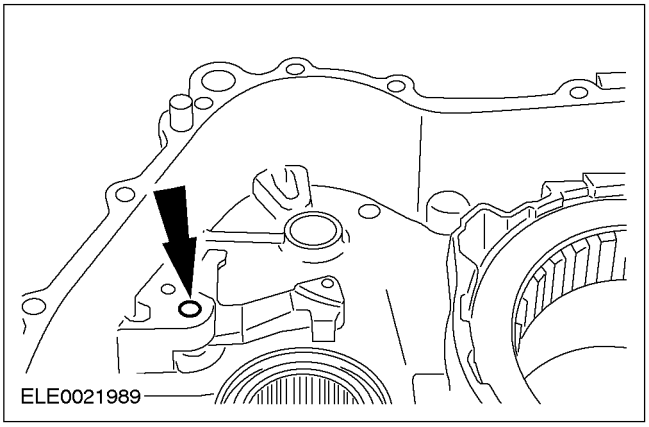
1. Remove the nut.
2. Remove the cam plate.
3. Remove the drive plate.
4. Remove the selector lever shaft.



6. Remove selector lever shaft retaining bolt and bracket.

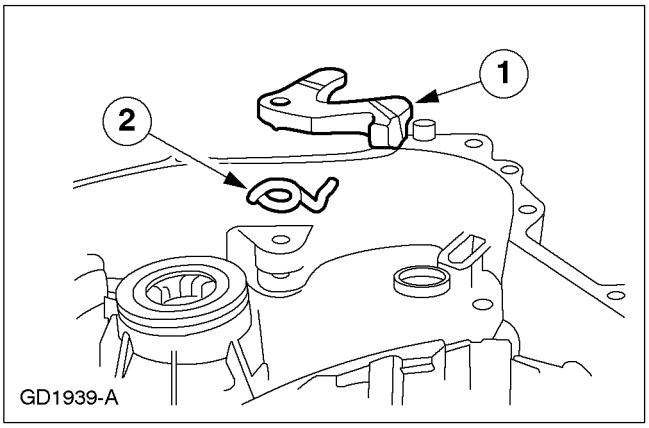


7. Remove the parking pawl shaft.



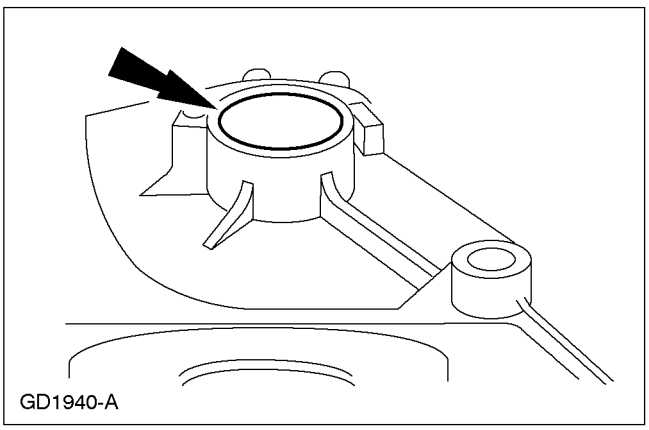
8. Remove the parking pawl assembly.

1. Remove the parking pawl.
2. Remove the parking pawl return spring.



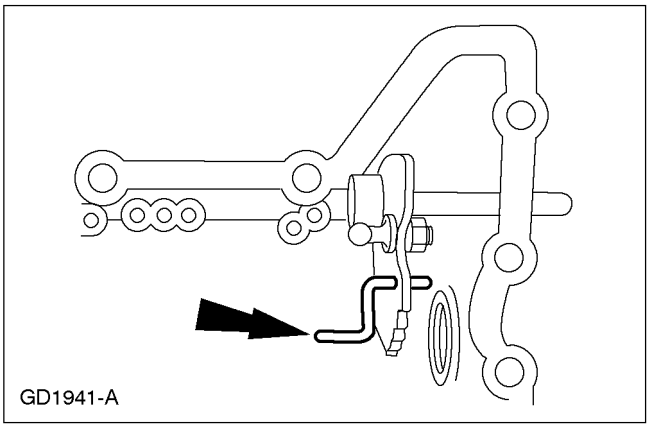
9. ⚠ CAUTION: Do not damage the transaxle case bore during seal removal.

Remove and discard the manual control lever seal.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

10. Remove the manual valve actuator rod (Z-link).

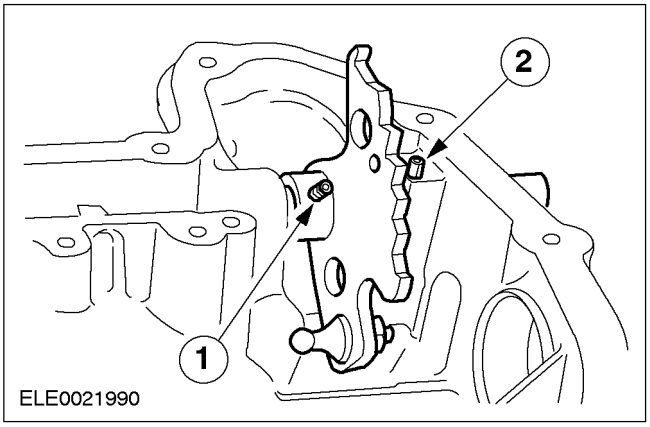


11. CAUTION: Do not damage the transaxle case sealing surface.

NOTE: There are two retaining pins, one on either side of the manual valve detent lever.

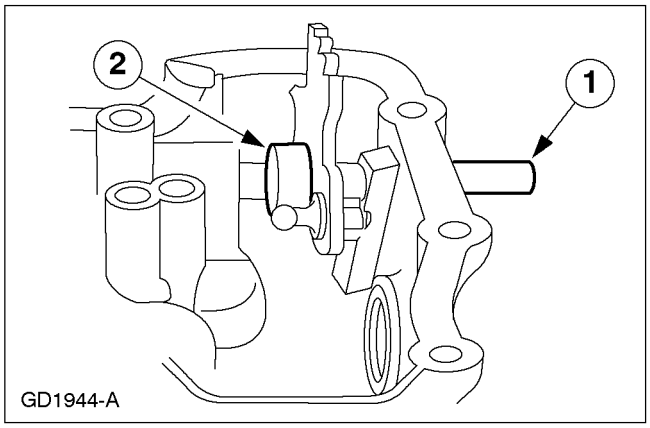
Remove and discard the manual valve detent lever assembly retaining pins.

1. Remove the detent lever retaining pin.
2. Remove the detent lever shaft retaining pin.



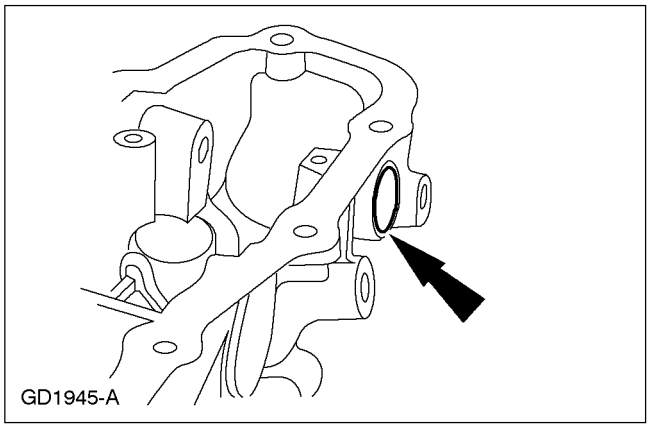
12. Remove the manual valve detent lever and shaft assembly.

1. Remove the manual valve detent lever and manual valve detent lever shaft from the transaxle case.
2. Remove the manual valve detent lever from the transaxle case.



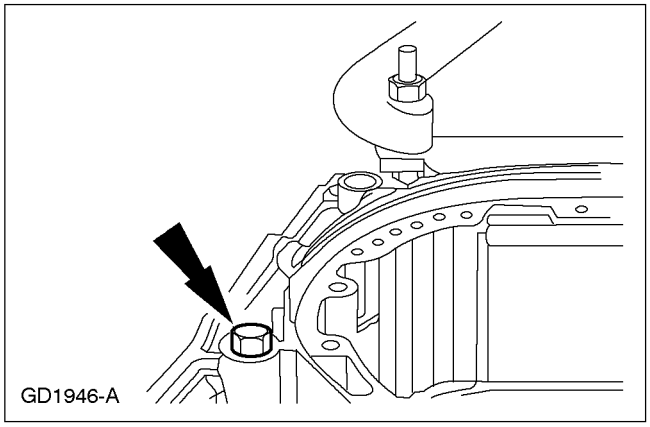
13. CAUTION: Do not damage seal bore in the transaxle case during seal removal.

Remove and discard the manual control seal.

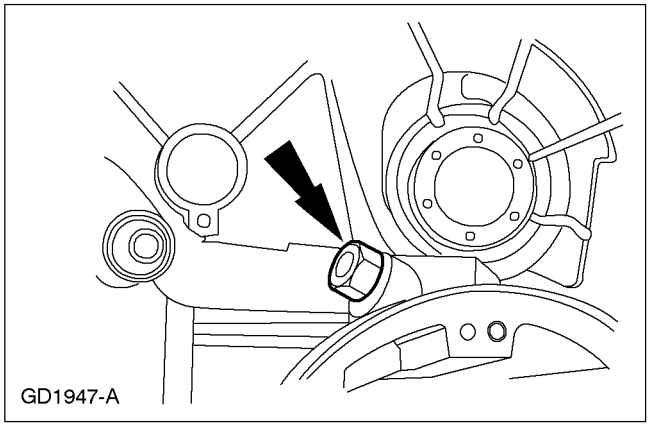


DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

14. Remove the line pressure port plug.



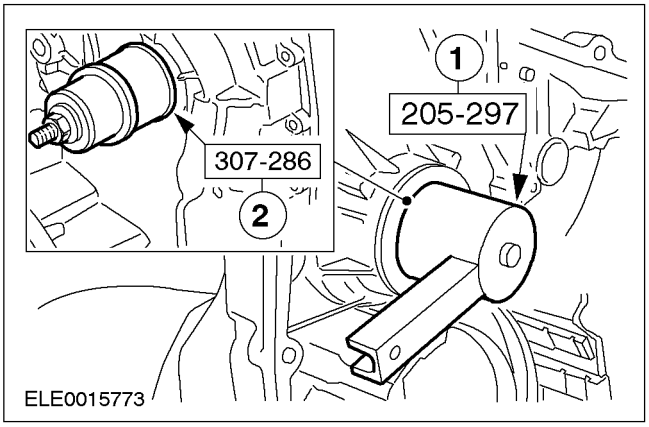
15. Remove and discard the cooler tube adaptor.



16. NOTE: The driven sprocket bearing No. 18 can only be replaced once. Should the bearing have been replaced previously a new transaxle case must be used.

As necessary, remove the No. 18 driven sprocket bearing assembly from transaxle case.

1. Install the special tool at the inner side of the transaxle case.
2. Install the special tool at the outer side of the transaxle case.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

17. WARNING: Eye protection should be worn when cleaning components with compressed air. Failure to follow these instructions may result in personal injury.

Clean all components with a suitable solvent and use moisture-free compressed air to dry all parts and clean fluid passages. Check the following before assembling:

- Final drive lubrication tube for damage
- Manual control linkage for damage or wear
- Case mating surfaces for nicks or deformation
- Bearing wear
- Support area wear

Assembly

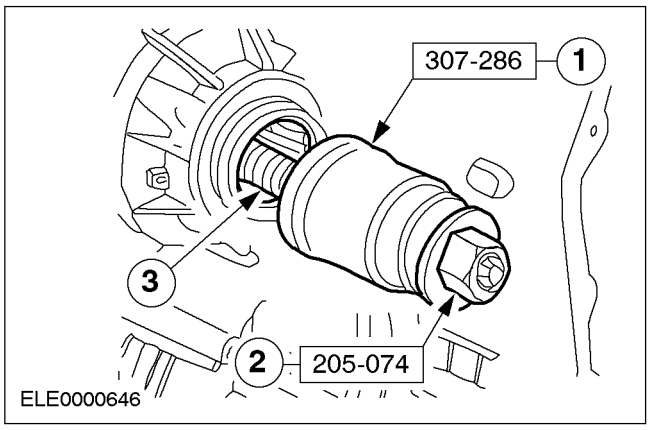
1. CAUTION: Do not lubricate the outer surface of the No. 18 driven sprocket bearing assembly.

NOTE: A new driven sprocket bearing No. 18 can be installed once before an installation of the transaxle case becomes necessary. If the No. 18 driven sprocket bearing has been installed previously and requires a second installation a new transaxle case must be installed.

NOTE: The No. 18 driven sprocket bearing must be installed with the lettering on the needle bearing surface facing towards the Needle Bearing Replacer.

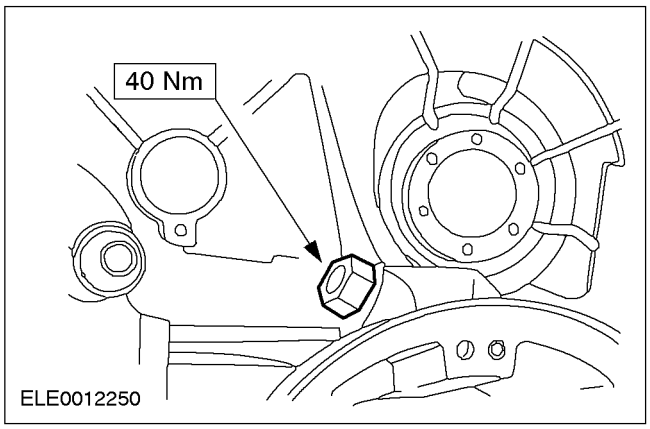
Using the special tools, install the No.18 driven sprocket bearing assembly by pressing it into the transaxle case.

1. Position the special tool.
2. Position the special tool.
3. Install the No. 18 driven sprocket bearing.

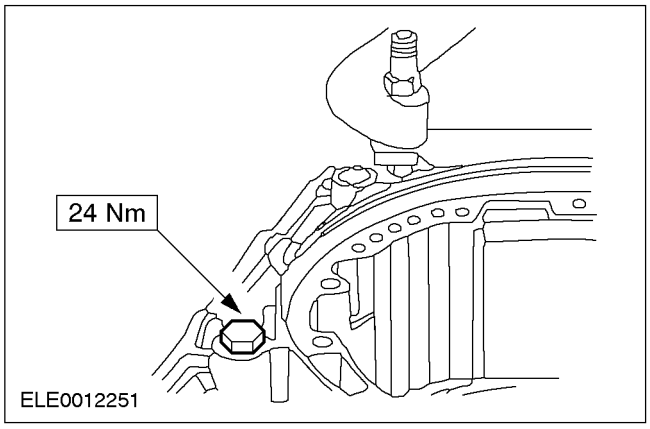


2. Install the fluid tube adaptor.

- Install a new seal if necessary.

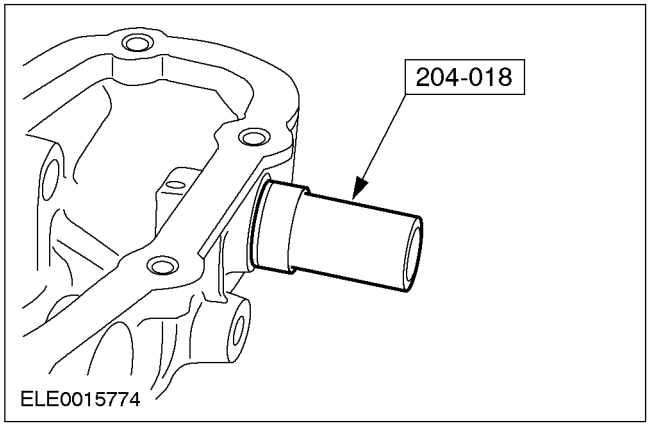


3. Install the line pressure port plug.



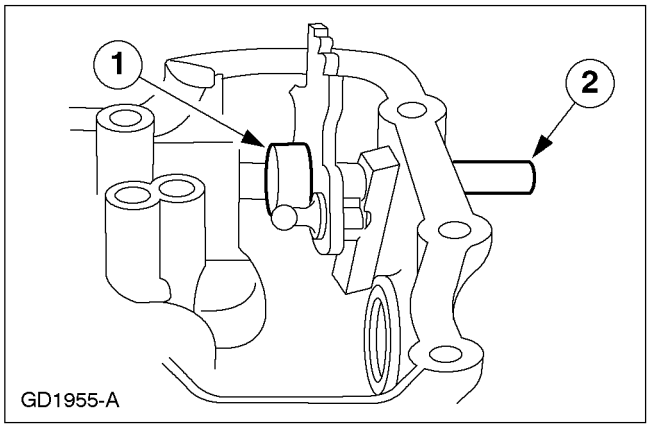
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

4. Using the special tool, install a new manual valve seal.



5. Install the manual valve detent lever assembly, and the manual valve detent lever shaft assembly.

1. Install the manual valve detent lever into the transaxle case.
2. Install the manual valve detent lever shaft into the transaxle case and lever.

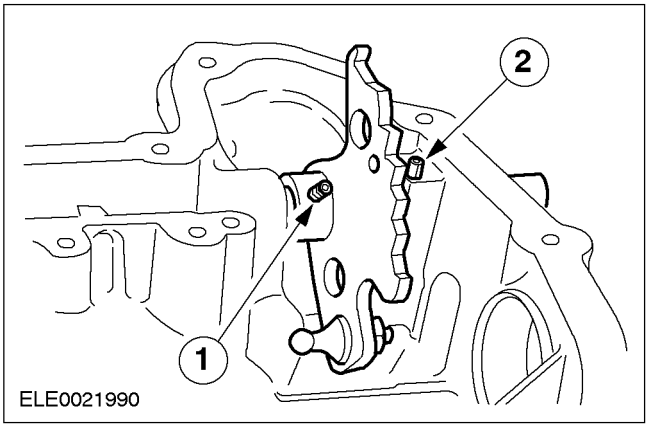


6. CAUTION: Do not allow the manual shaft retaining pin to contact the transaxle case.

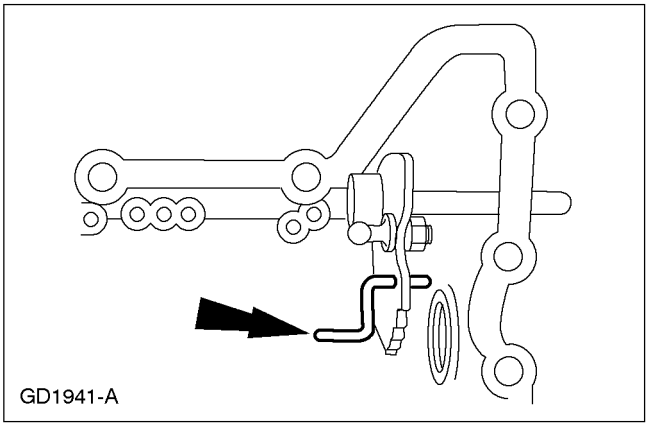
Install new retaining pins for the manual valve detent lever assembly.

1. Install the detent lever shaft retaining pin.
2. Install the detent lever retaining pin.

- Verify the manual valve detent lever shaft rotates without binding.



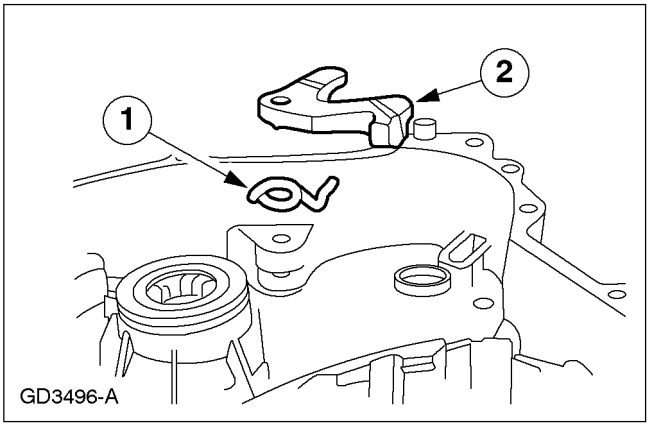
7. Install the manual valve actuator rod (Z-link).



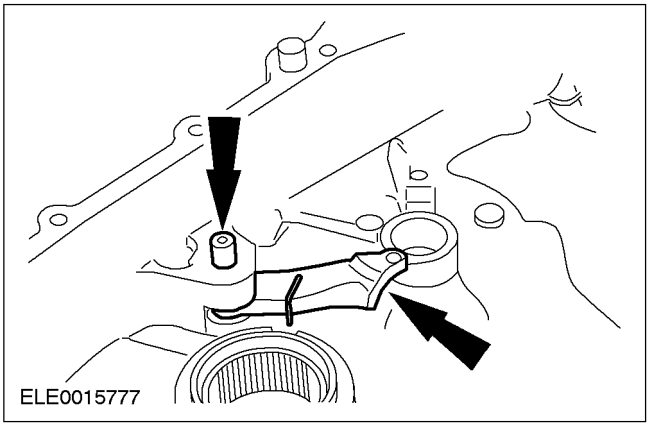
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

8. Install the parking pawl assembly.

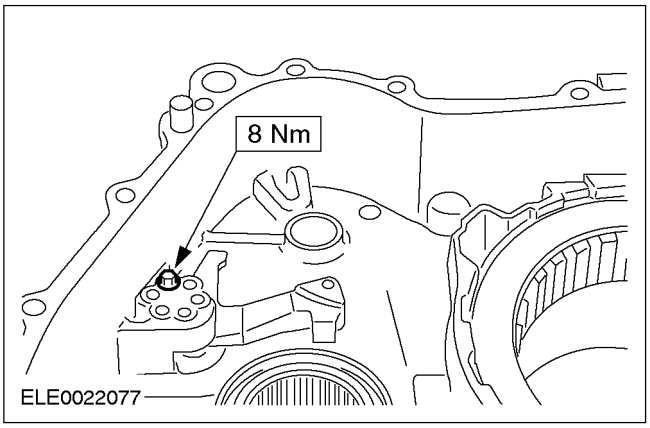
1. Install the parking pawl return spring.
2. Install the parking pawl.



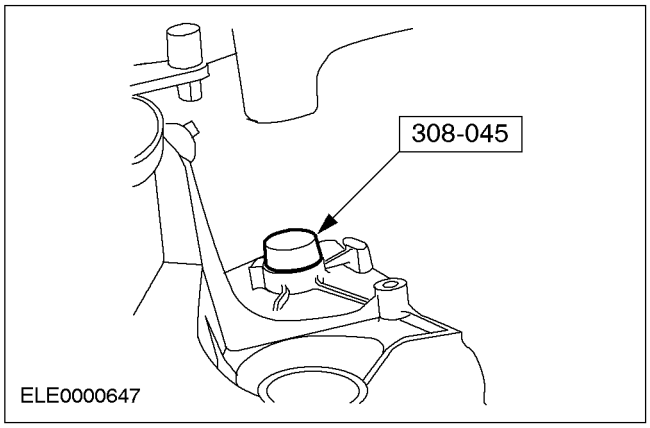
9. Install the parking pawl shaft.



10. Install the parking pawl shaft retainer and bolt.



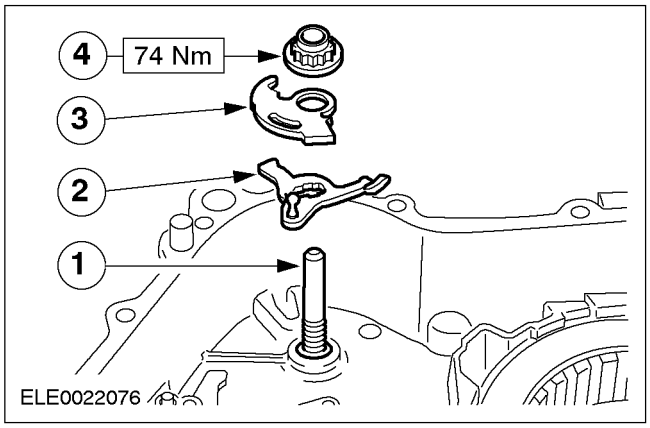
11. Using the special tool, install a new manual control lever seal.



12. NOTE: Lubricate the manual control lever inner shaft prior to installation.

Install the manual control lever shaft assembly.

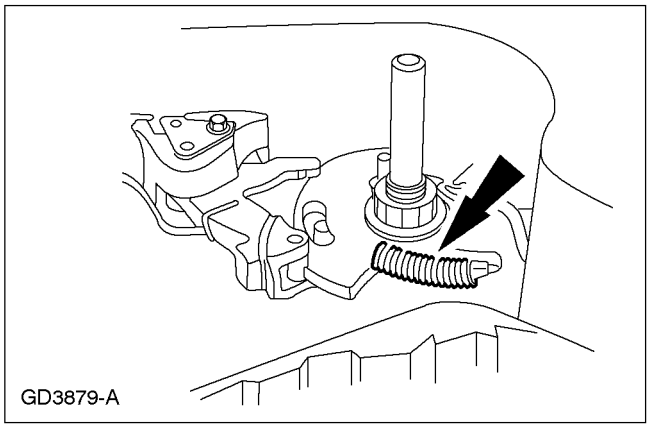
1. Install the selector lever shaft upwards.
2. Install the drive plate.
3. Install the cam plate.
4. Install the nut.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

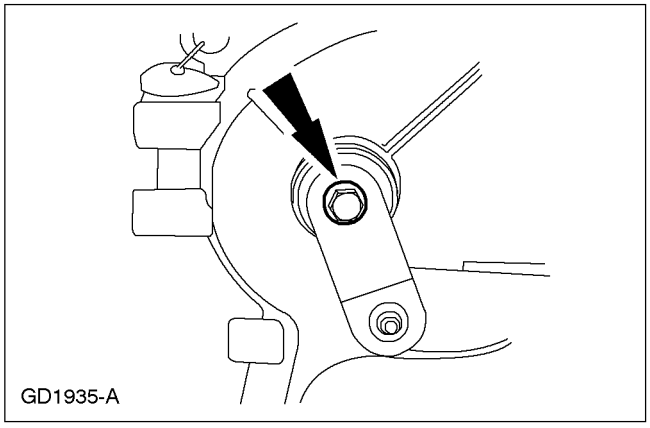
13. NOTE: Verify that the actuating cam rotates freely.

Install the parking pawl ratcheting spring.

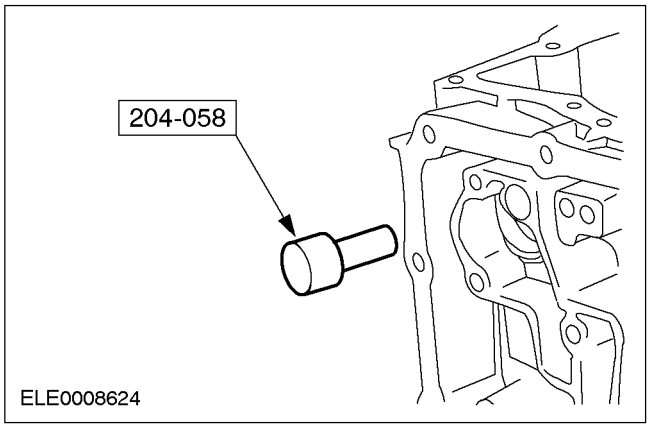


14. NOTE: Do not tighten the manual control at this stage.

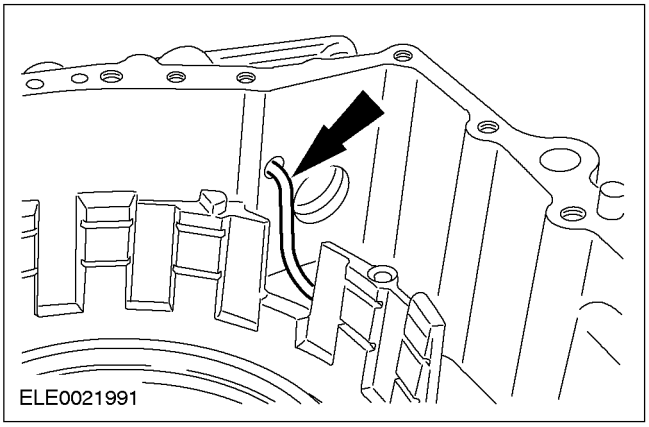
Install the manual control lever assembly and bolt.



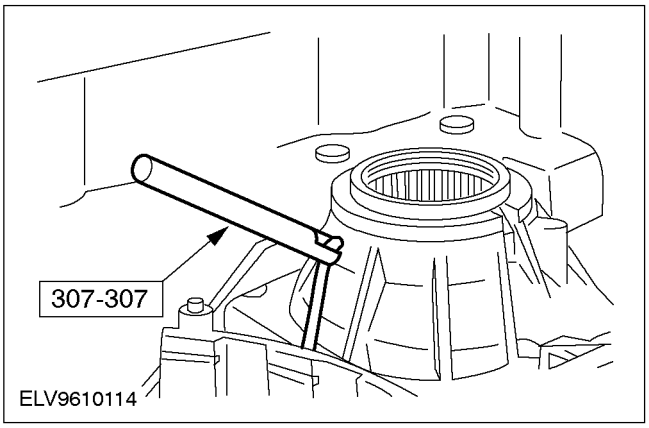
15. Using the special tool, install a new final drive lubrication tube seal.



16. Install the final drive lubrication tube into the seal.

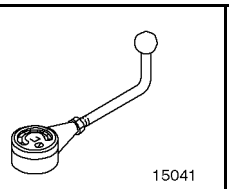
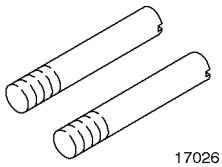


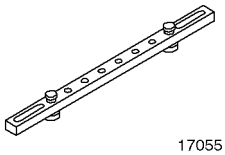
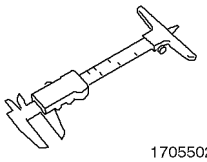
17. Using the special tool, install the final drive lubrication tube into the transaxle case.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

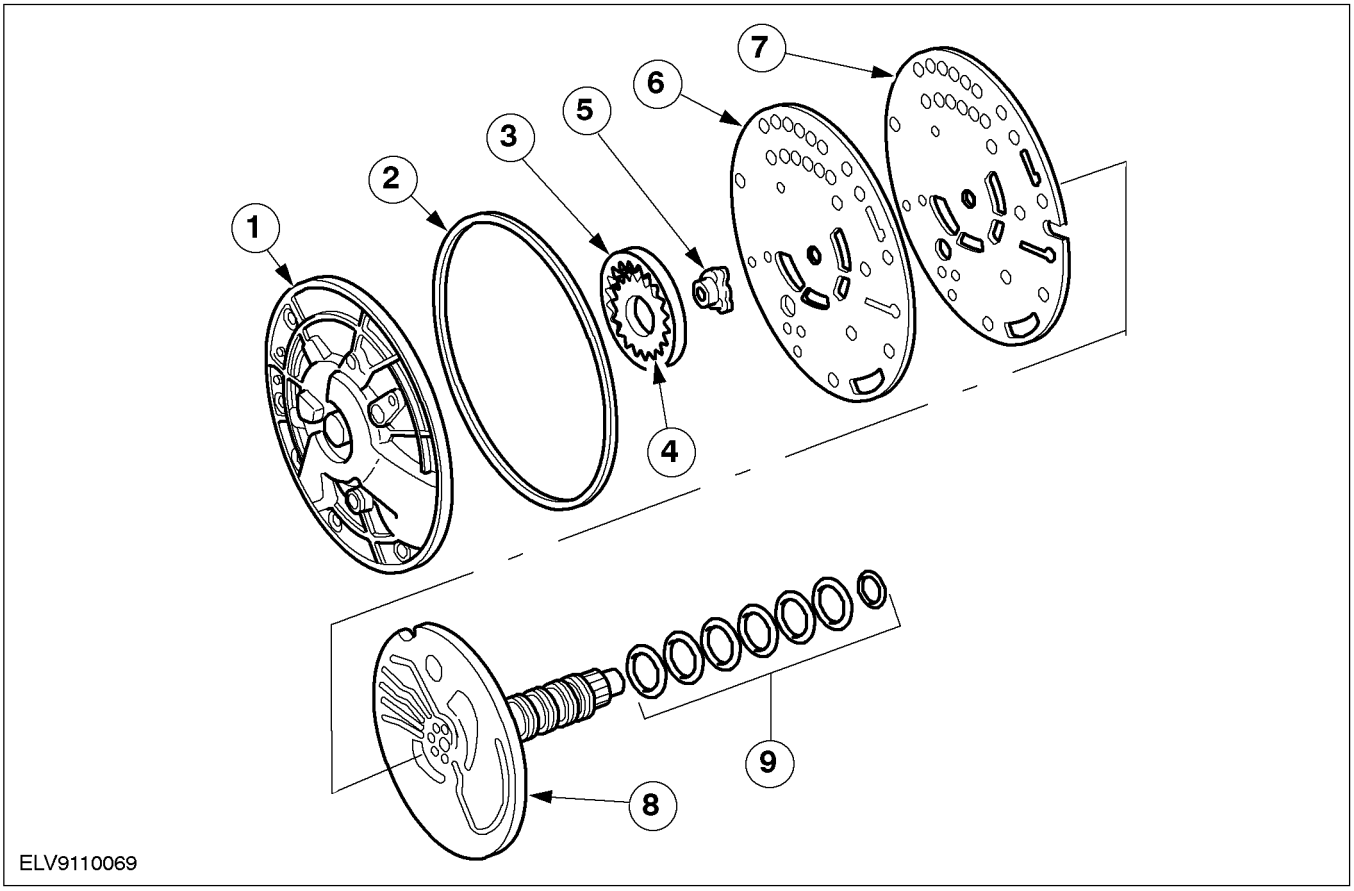
Pump Assembly

Special Tool(s)	
 15041	Preload Gauge 205-067 (15-041)
 17026	Guide Studs 307-127 (17-026)

Special Tool(s)	
 17055	Gauge Bar, Shim Selection 307-300 (17-055)
 1705502	Depth Gauge, Shim Selection 307-300-02 (17-055-02)

Name	Specification
Automatic transmission fluid	ESP-M2C166-H

Disassembly



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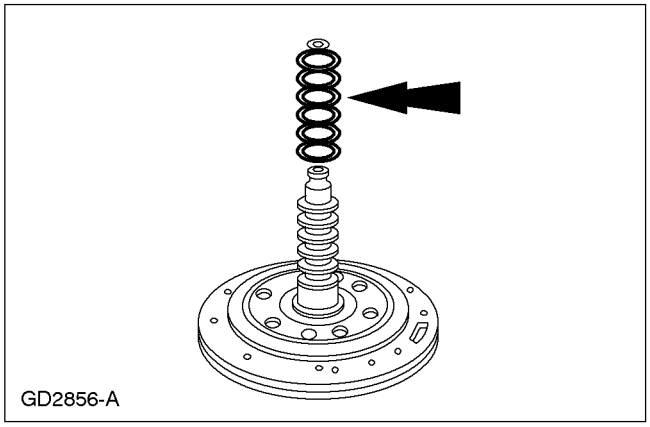
Item	Part Number	Description
1	–	Front pump body

Item	Part Number	Description
2	–	Pump seal O-ring

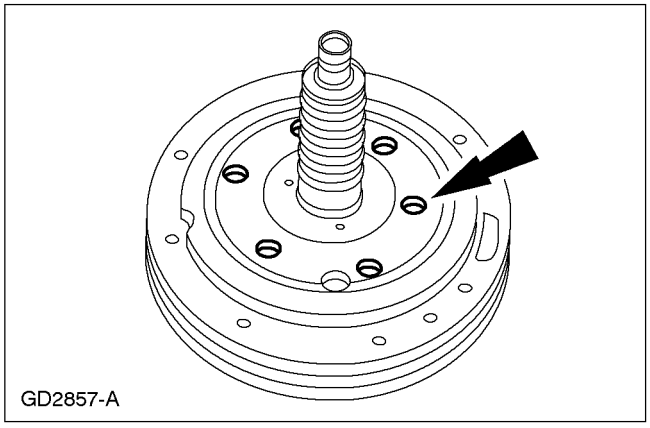
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

Item	Part Number	Description
3	–	Pump driven gear
4	–	Pump drive gear
5	–	Pump drive gear insert
6	–	Pump body separator plate
7	–	Pump body separator plate gasket
8	–	Front pump support
9	–	Front pump seals

1. Remove and discard the seven pump support seal rings from the pump support.

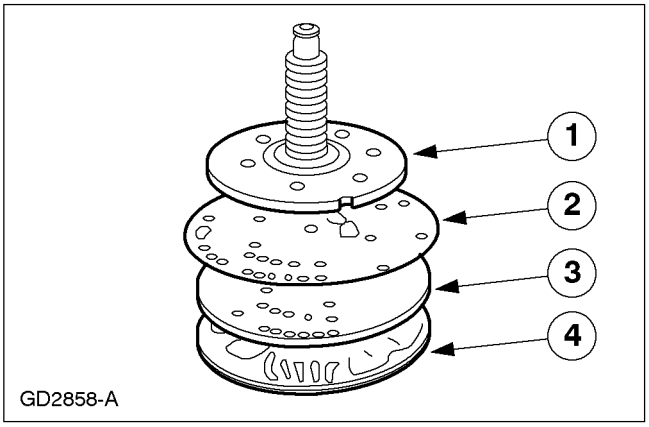


2. Remove the six pump support bolts.

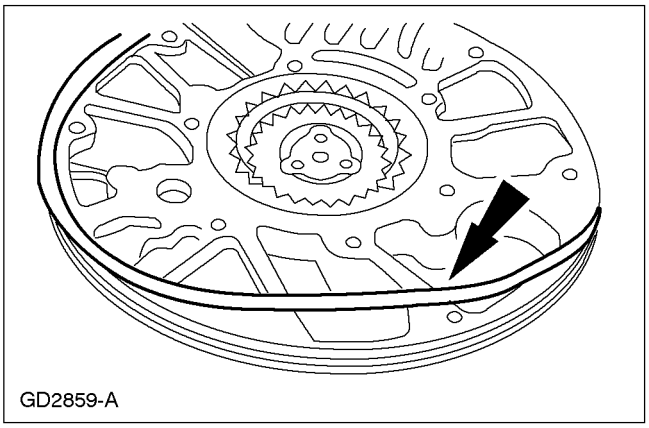


3. Separate the pump support and body assembly.

1. Remove the pump support.
2. Remove the pump body separator plate gasket.
3. Remove the pump body separator plate.
4. Remove the pump body.

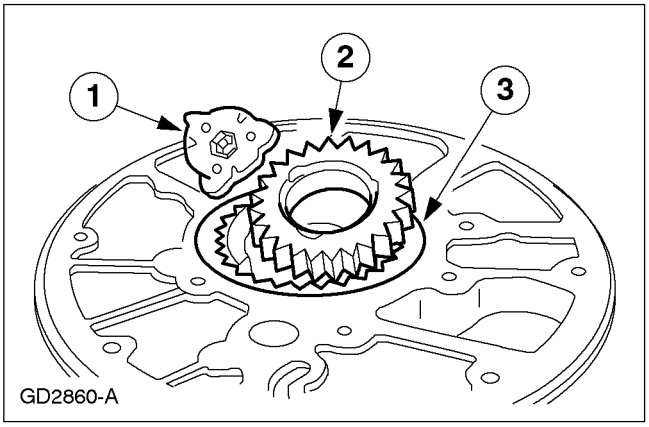


4. Remove and discard the pump seal.



5. Remove the pump drive gear assembly.

1. Remove the pump drive gear insert.
2. Remove the pump drive gear.
3. Remove the pump driven gear.



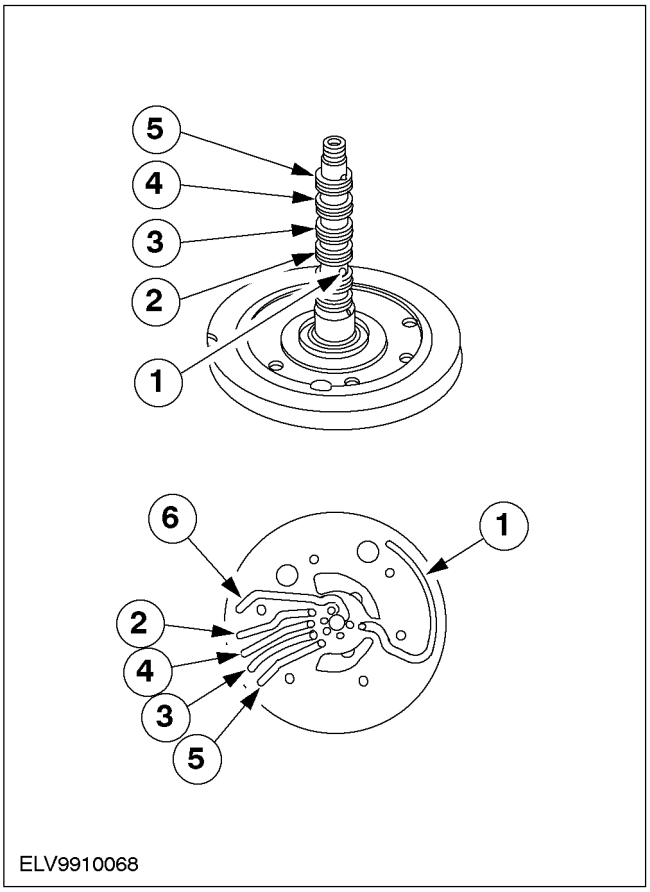
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

6. **WARNING: Wear protective safety goggles when cleaning components with compressed air.**

   Thoroughly clean all components and blow them dry with completely dry, regulated compressed air.

7. **Inspect the pump body and gears for damage and wear.**
   - Inspect the driven gear teeth.
   - Inspect the drive gear teeth.
   - Inspect the gear bore.
   - Inspect the crescent.
   - Inspect the lubrication passages.

8. **Inspect the pump support apply circuit passages and lubrication passages.**
   1. Inspect the rear lubrication circuit.
   2. Inspect the reverse clutch circuit.
   3. Inspect the direct clutch circuit.
   4. Inspect the forward clutch circuit.
   5. Inspect the coast clutch circuit.
   6. Inspect the converter clutch bypass circuit.

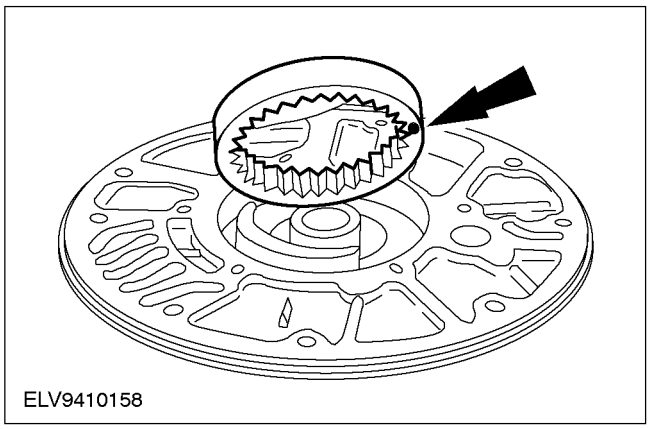


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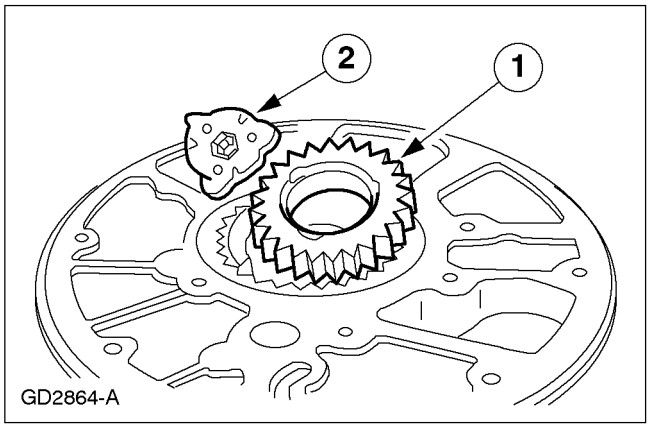
Assembly

1. **NOTE:** The identification mark on the pump driven gear must be facing downward.

   Install the pump driven gear.


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2. **Install the pump drive gear assembly.**
   1. Install the pump drive gear.
   2. Install the pump drive gear insert.

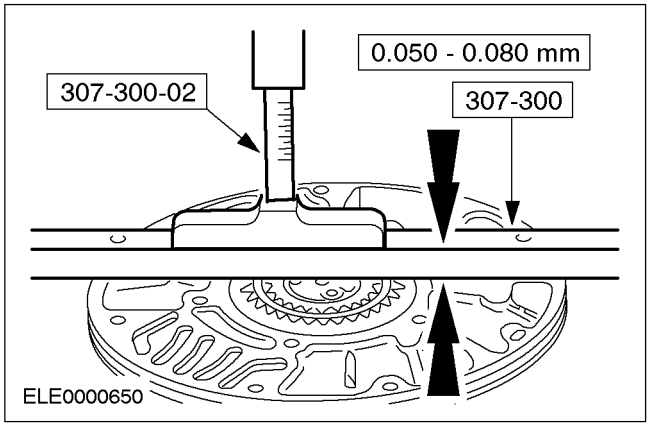


GD2864-A

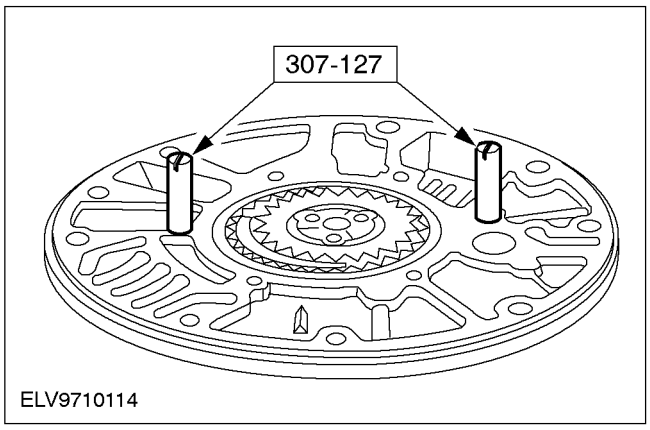
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

3. Using the special tool, measure the clearance between each gear and the pump body face.

- If the clearance exceeds specification, install a new pump assembly.



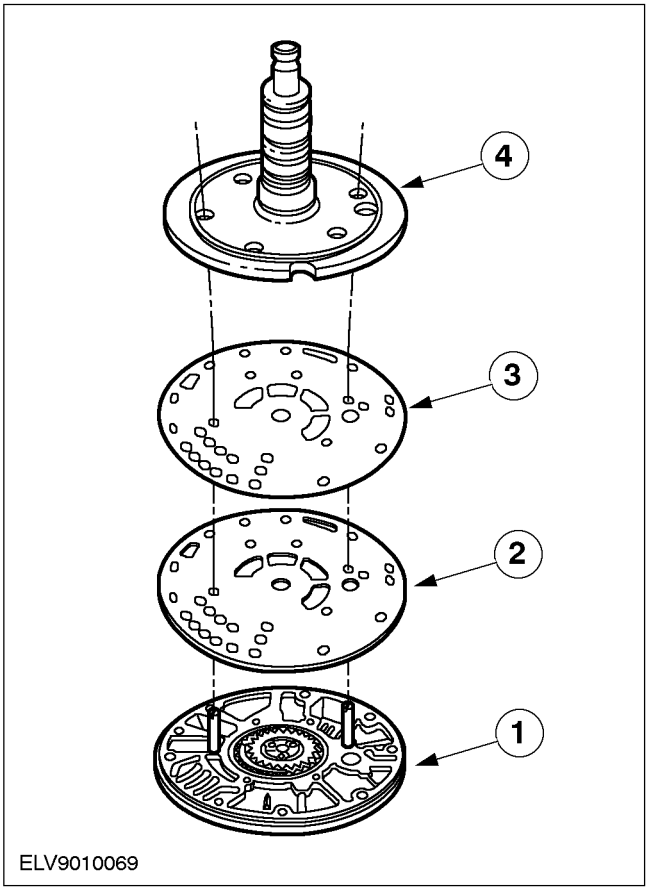
4. Install the special tool.



5. Align the pump support assembly.

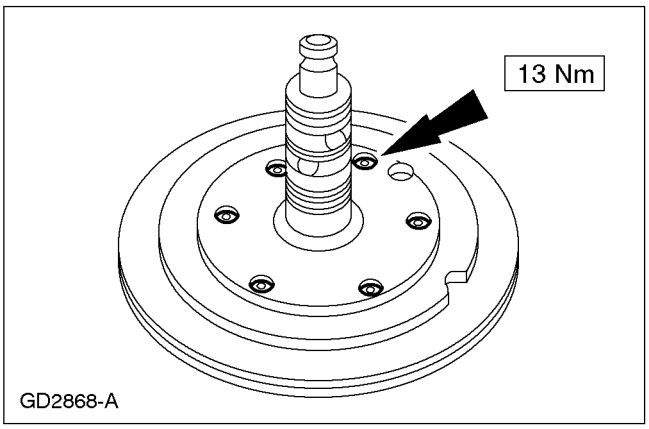
- Fill the pump gear cavity with automatic transmission fluid to the top of the gears.
- Align the pump guide screws.

1. Install the pump body.
2. Install the pump body separator plate.
3. Install the pump body separator plate gasket onto the pump body.
4. Install the pump support.



6. NOTE: Install the four pump support bolts in the pump support holes, and remove the guide studs. Then install the last two bolts.

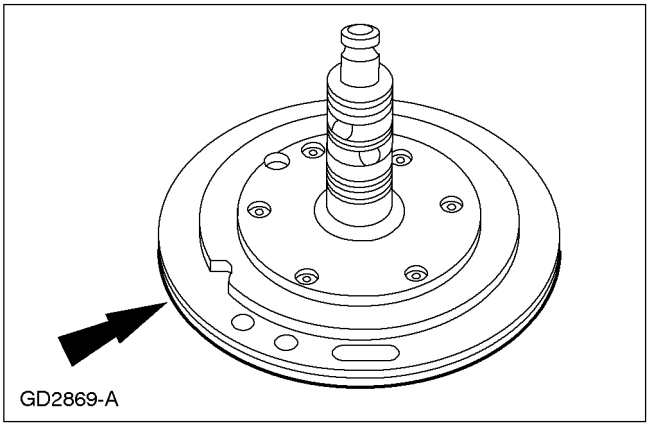
Install the six pump support bolts.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

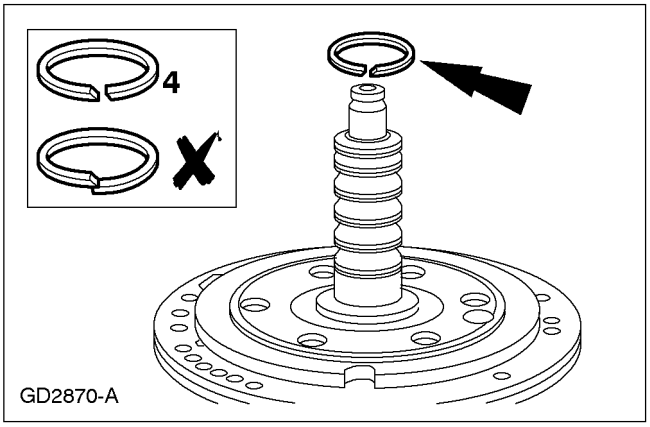
7. NOTE: Make sure that the white stripe on the pump seal is visible around the pump body circumference.

Install the pump seal on the pump body.



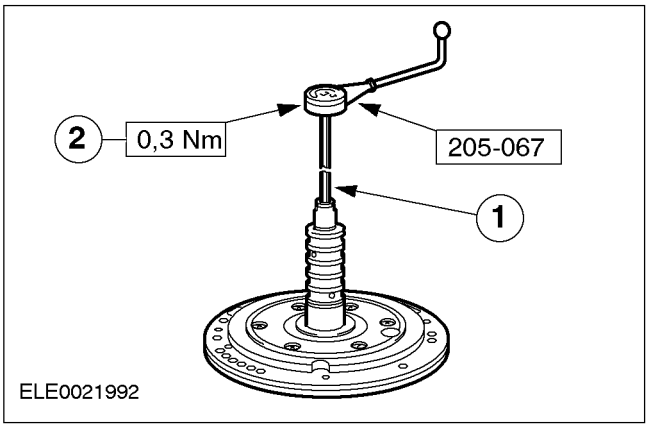
8. NOTE: Make sure the pump support seal rings are overlapped correctly.

Install the seven pump support seal rings.



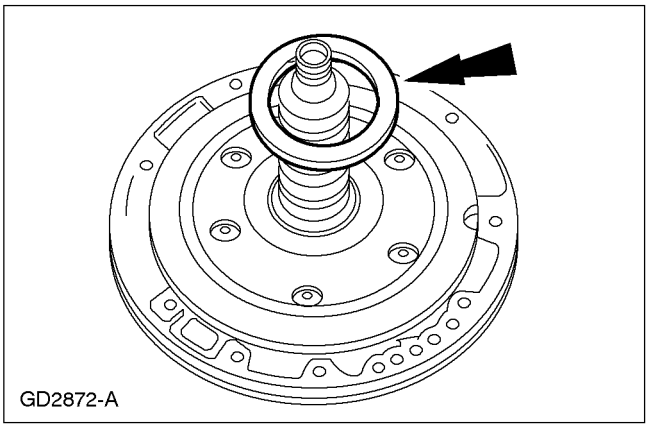
9. Measure the pump rotational torque.

1. Install the pump drive shaft.
2. Measure the pump rotational torque.
   - Remove the pump drive shaft.
   - If rotational torque exceeds the specification, disassemble and inspect the pump assembly for contamination or incorrect end clearance.



10. Install the No.1 pump support thrust bearing.

- Lubricate the seal rings with automatic transmission fluid.



11. Install the forward, coast and direct clutch cylinder and reverse clutch drum on the pump support.

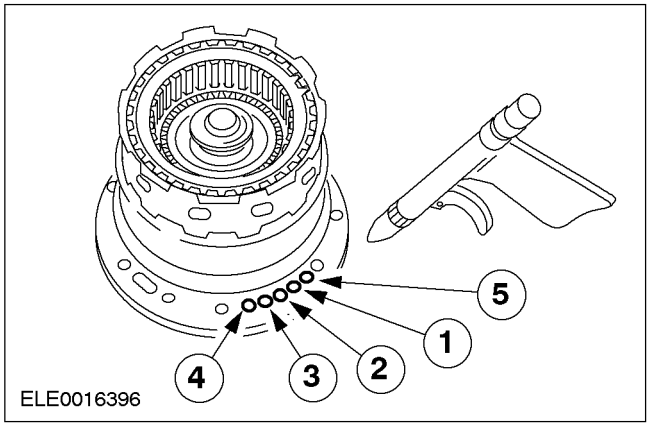
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

12. **WARNING: Wear protective safety goggles when cleaning components with compressed air.**

NOTE: With each application of air, you should hear the operation of the clutch pack. A hissing or high pitched squeal indicates that a seal is damaged or torn. Inspect to find the source and repair as necessary.

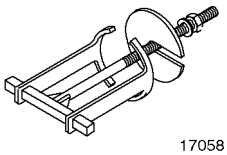
Check the following passages of the forward, coast and direct clutch cylinder and reverse clutch drum with moisture - free compressed air, regulated to 276 kPa (40 psi).

1. Check the reverse clutch passage.
2. Check the forward clutch passage.
3. Check the direct clutch passage.
4. Check the coast clutch passage.
5. Check the fluid line from the torque converter lock-up clutch bypass.



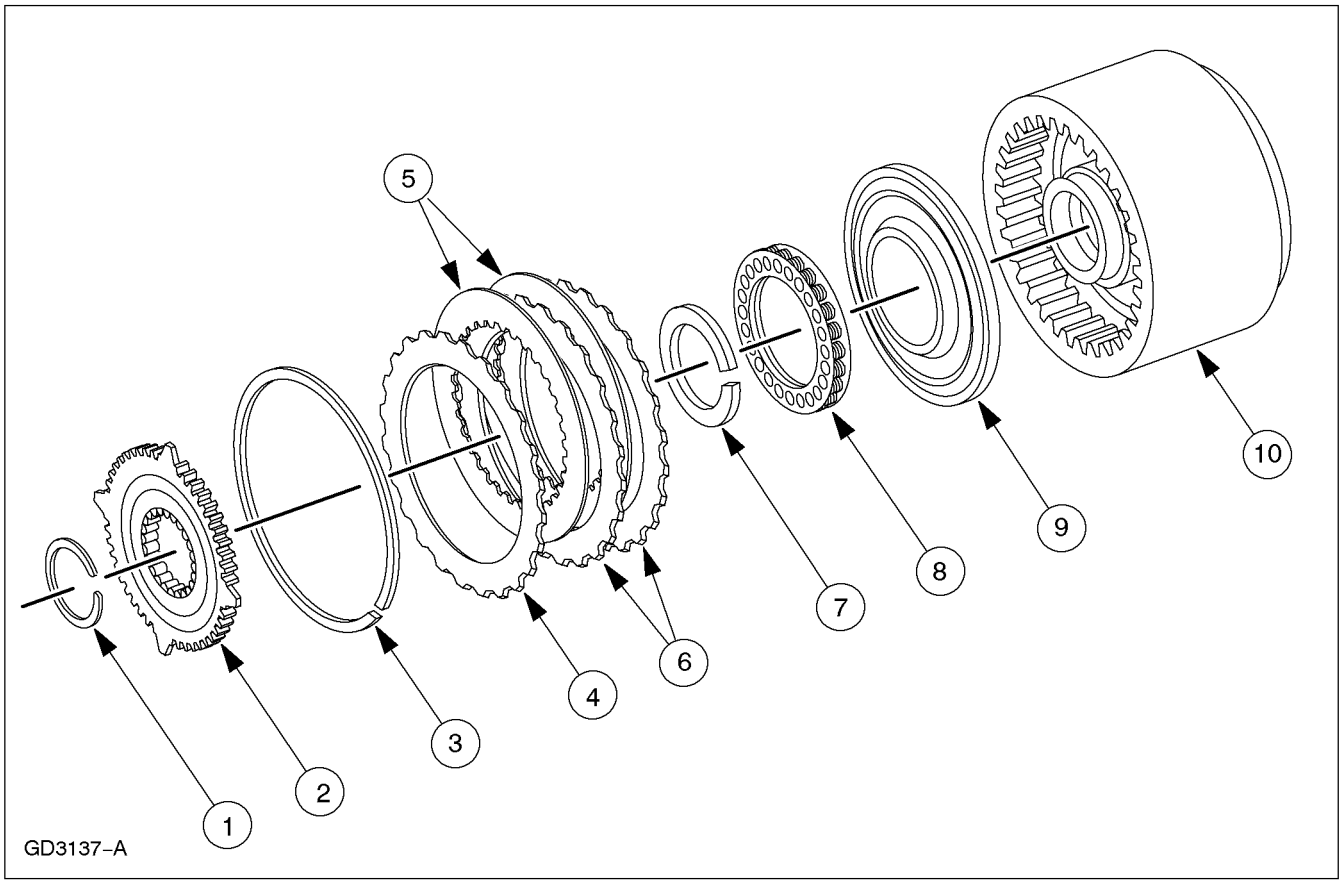
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

Reverse Clutch

Special Tool(s)	
 17058	Compressor, Clutch Spring 307-015 (17-058)

Special Tool(s)	
 1706002	Protector, Piston Seal 307-276 (17-060-02)

Name	Specification
Automatic Transmission Fluid	GSPM-2C166-H



Item	Part Number	Description
1		Reverse clutch hub retaining ring
2		Reverse clutch hub
3		Reverse clutch pressure plate retaining ring
4		Reverse clutch pressure plate

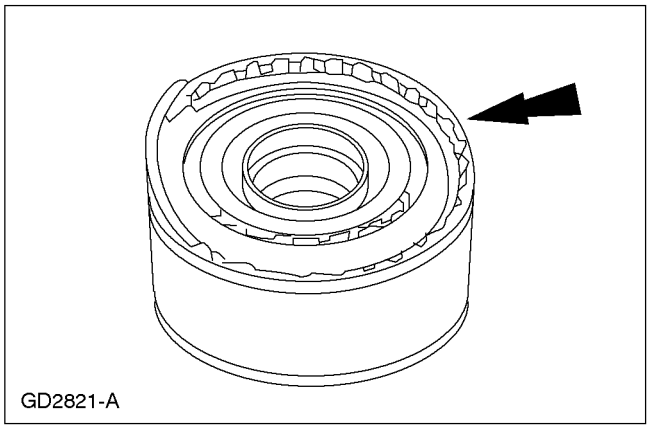
Item	Part Number	Description
5		Reverse clutch internal spline clutch plates (friction)
6		Reverse clutch external spline clutch plates (steel)
7		Retaining ring
8		Reverse clutch return spring assembly
9		Reverse clutch piston assembly

DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

Item	Part Number	Description
10		Reverse clutch drum assembly

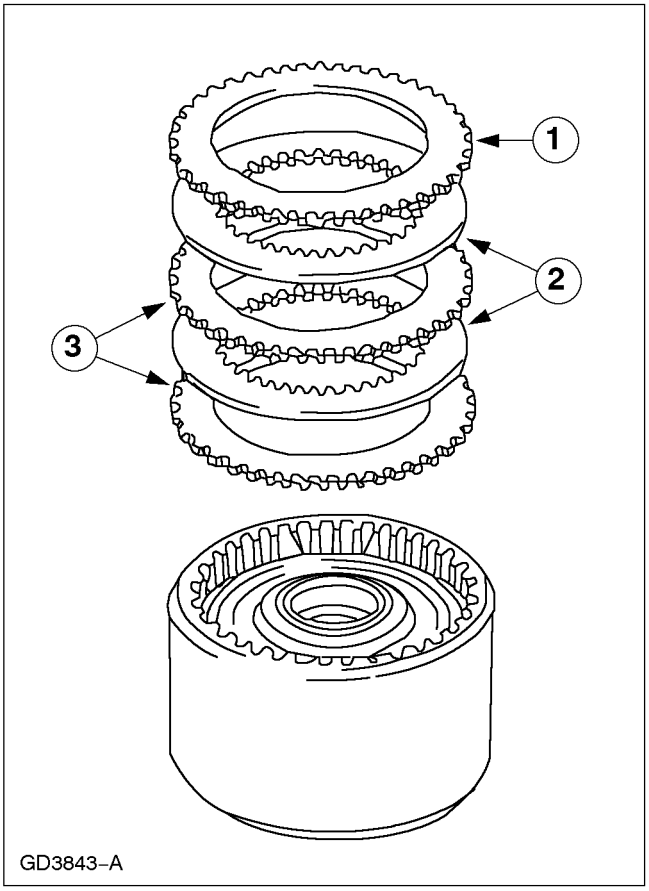
Disassembly

1. Remove the reverse clutch pressure plate retaining ring.



2. Remove the reverse clutch plates.

1. Remove the pressure plate.
2. Remove the friction plates.
3. Remove the steel plates.
   - Inspect for damage or wear.

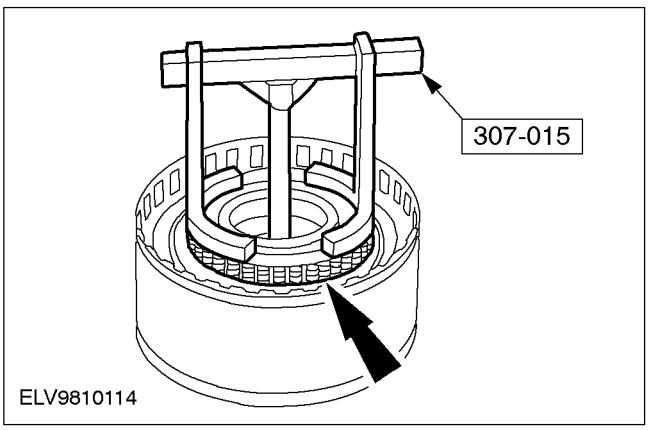


3. WARNING: Careless handling of the special tool can cause personal injury.

CAUTION: Do not fully compress the reverse clutch return springs.

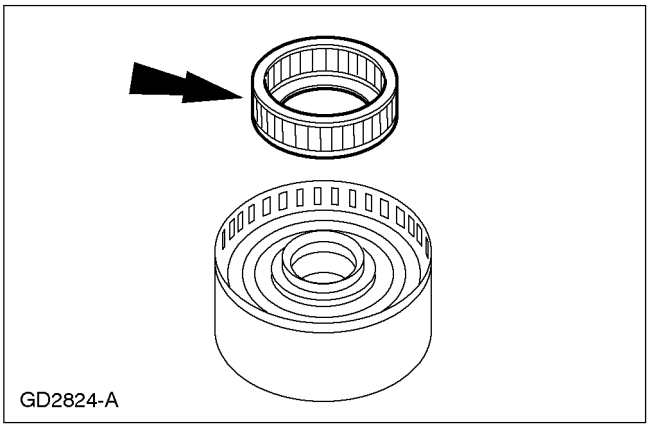
Remove the retaining ring.

- Using the special tool, compress the reverse clutch return springs.

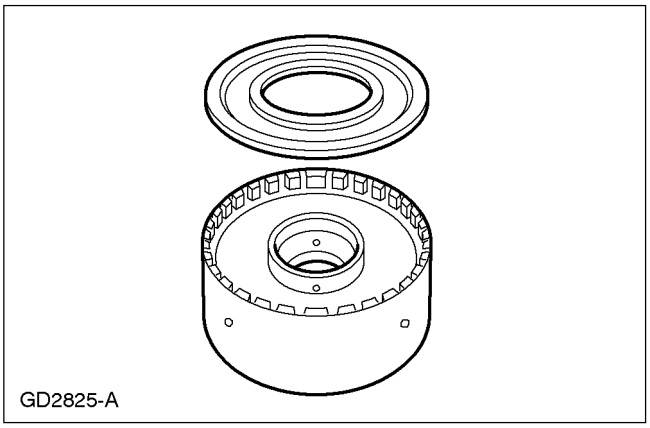


DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

4. Remove the reverse clutch return spring assembly.



5. Remove and discard the reverse clutch piston assembly with its integral seals.



6. WARNING: Wear protective safety goggles when cleaning components with compressed air.

NOTE: Do not clean the clutch plates in a vapor degreaser or with any other type of detergent solution. Clean all parts thoroughly in a clean solvent and blow dry with moisture-free regulated compressed air.

Clean the friction plates with a lint-free cloth.

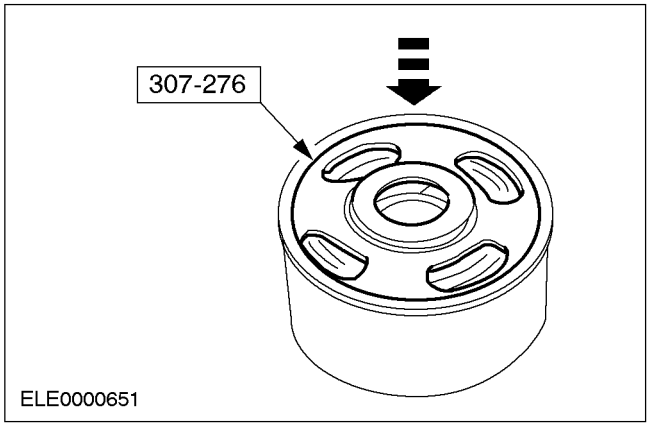
7. Inspect the parts for damage and wear:

- Inspect the clutch plates.
- Inspect the piston and seals.
- Inspect the bushings.
- Inspect the check ball in drum.
- Inspect the drum outer surface band contact area.
- Inspect the piston bore.

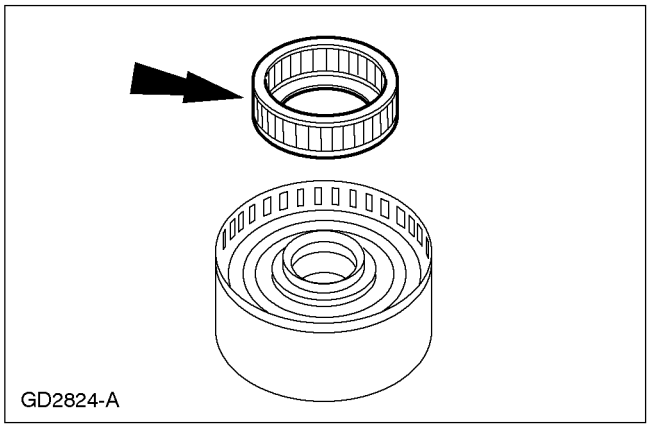
Assembly

1. Soak the internal spline clutch plates in clean transmission fluid for 15 minutes before assembly.

2. Using the special tool, install the new reverse clutch piston assembly with integral seals.



3. Install the reverse clutch return spring assembly.

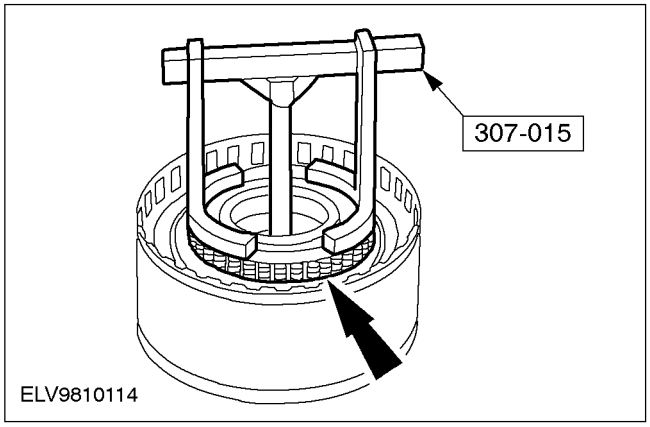


DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

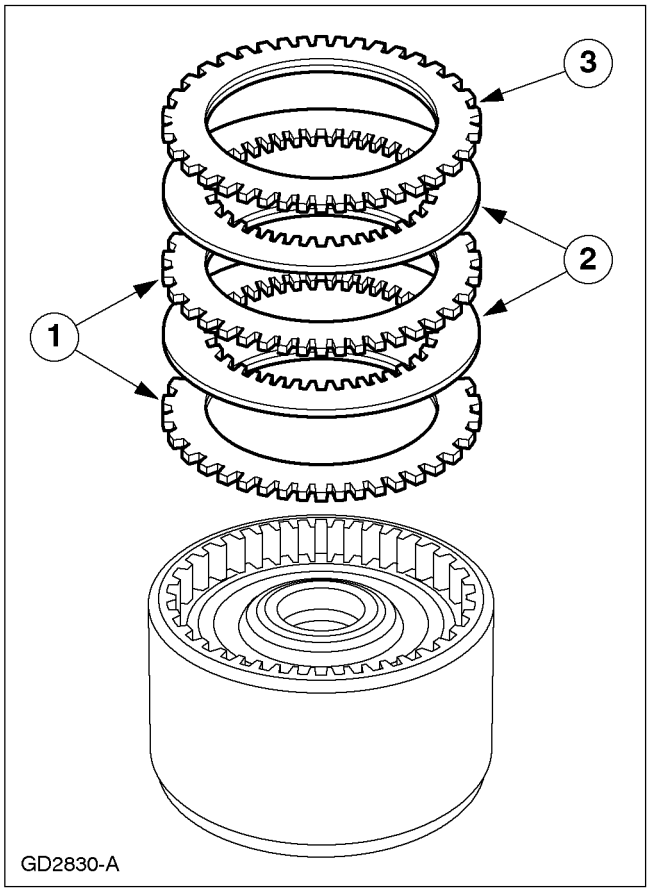
4. **CAUTION: Do not fully compress the reverse clutch return springs.**

   Install the reverse clutch retaining ring.

   - Using the special tool, compress the reverse clutch return springs.

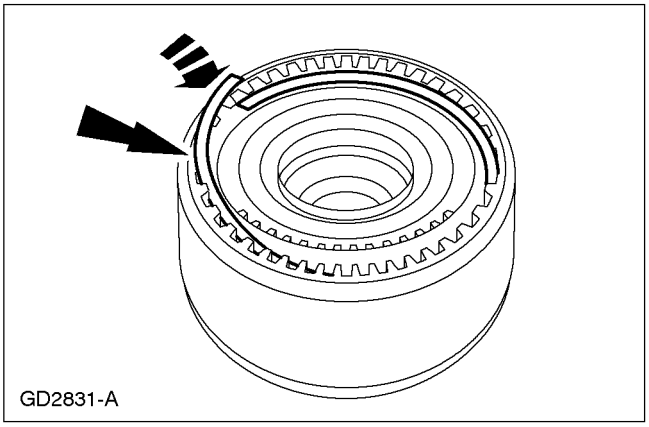


5. **Install the reverse clutches.**
   1. Install the steel plates.
   2. Install the friction plates.
   3. Install the pressure plate.

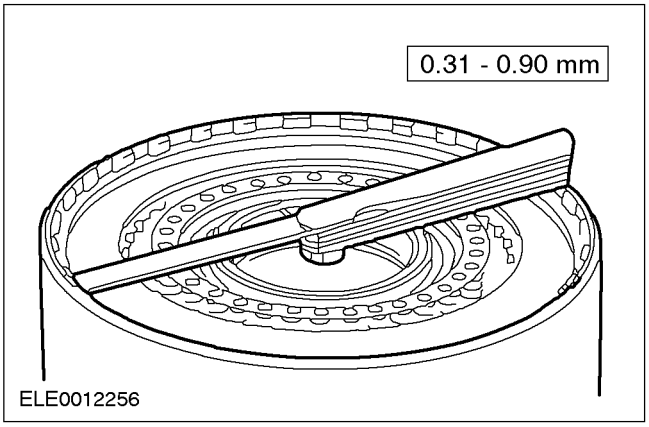


6. **NOTE:** The retaining rings are available in various thicknesses.

   Install the reverse clutch pressure plate retaining ring (selective fit).



7. **Measure the clearance between the reverse clutch pressure plate and the reverse clutch pressure plate retaining ring with a feeler gauge.**
   - Repeat the measurement on the opposite side.
   - Average the two measurements to calculate the clearance.
   - If the clearance is not within the specifications, select and install the correct thickness retaining ring to obtain the specified clearance.
   - Retaining ring sizes:
   - 1.39-1.49 mm
   - 1.53-1.63 mm
   - 1.68-1.78 mm

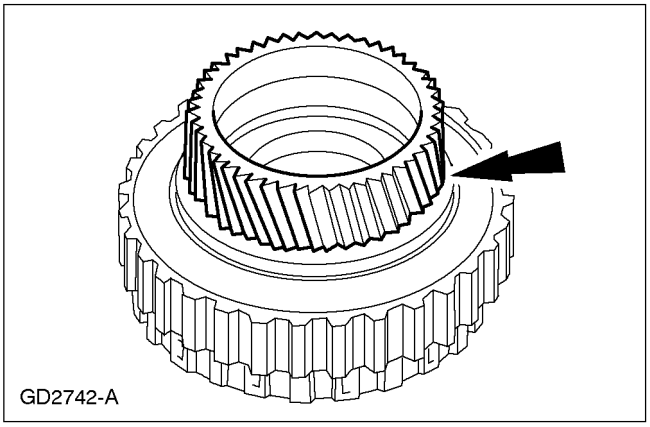


DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

Planetary Gearsets and Chain Drive Parts

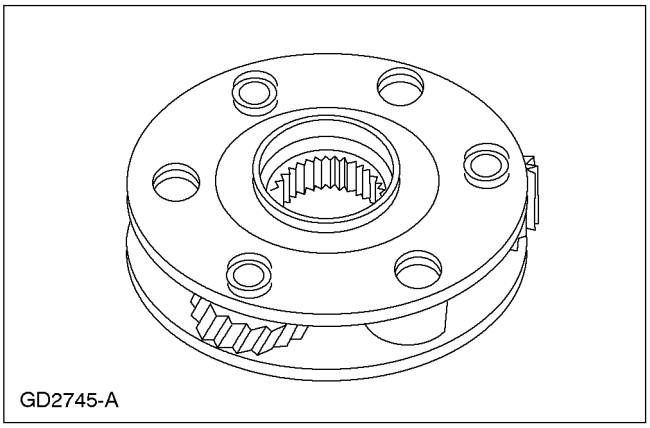
1. Inspect the low and intermediate sun gear assembly for damage.

- Inspect the gear teeth.
- Inspect the thrust bearing surfaces.
- Inspect the journal surface.



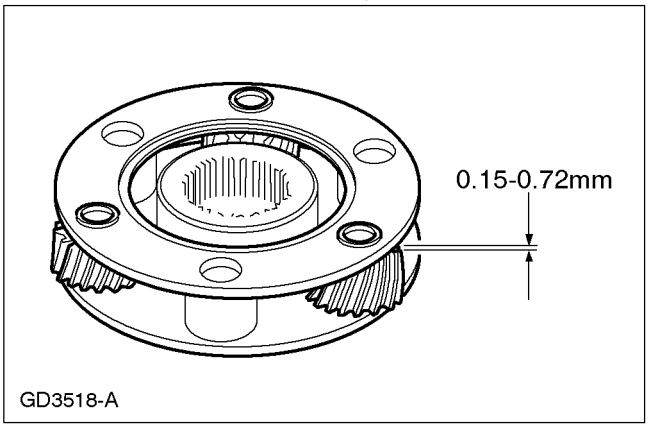
2. Inspect the low and intermediate carrier assembly.

- Inspect the pinion gear teeth.
- Inspect the spline teeth.
- Inspect the pinion gear surfaces.
- Inspect the bushing surfaces.
- Inspect the pinion gear bearings.



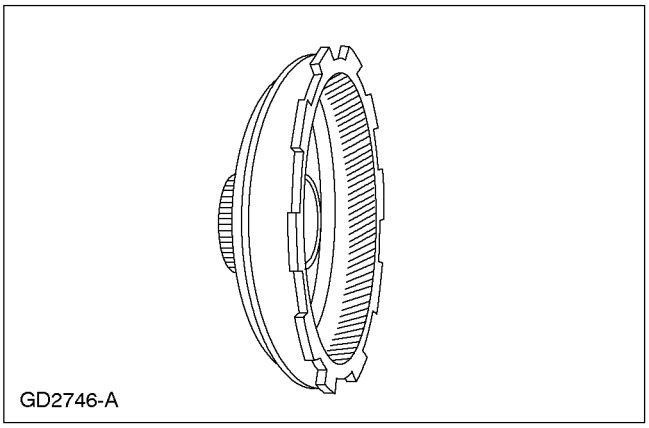
3. Inspect the low and intermediate carrier assembly end play.

- Use a feeler gauge to measure the end play.
- If the end play is out of specification install a new assembly.



4. Inspect the low and intermediate ring gear.

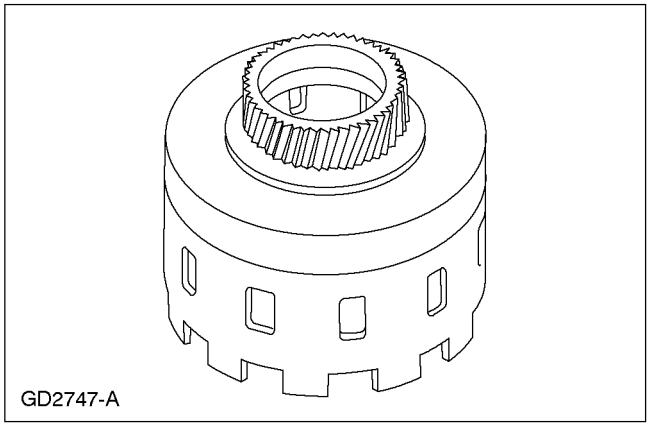
- Inspect the gear teeth.
- Inspect the spline teeth.
- Inspect the thrust bearing surfaces.
- Inspect the journal surface.
- Inspect the lug teeth.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

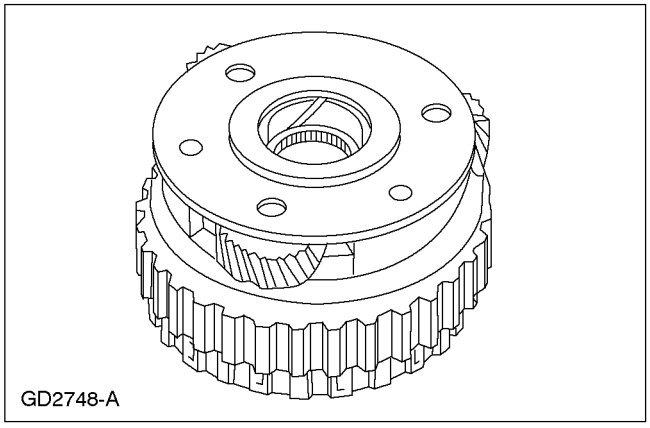
5. Inspect the reverse/overdrive sun gear and shell assembly for damage or wear.

- Inspect the gear teeth.
- Inspect the lug teeth.
- Inspect the thrust bearing surfaces.
- Inspect the bushing surface.



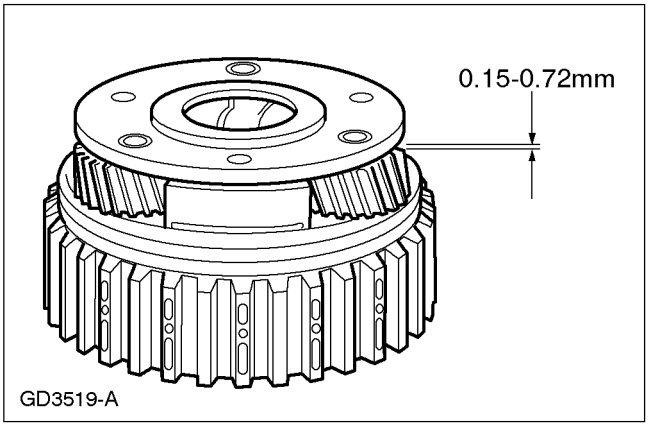
6. Inspect the reverse/overdrive carrier assembly.

- Inspect the pinion gear teeth.
- Inspect the clutch plate spline teeth.
- Inspect the pinion gear bearings.
- Inspect the thrust bearing surfaces.
- Inspect the bushing surfaces.
- Inspect the No. 8 thrust bearing captured between the pinions and carrier.



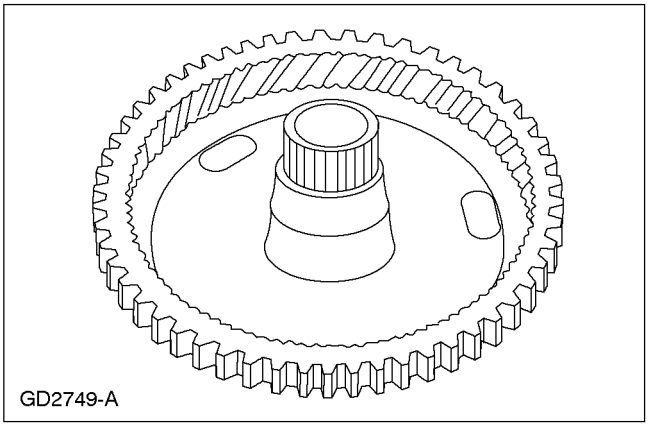
7. Inspect the reverse/overdrive carrier assembly end play.

- Use feeler gauge to measure the end play.
- If the end play is out of specification install a new assembly.



8. Inspect the reverse/overdrive ring gear.

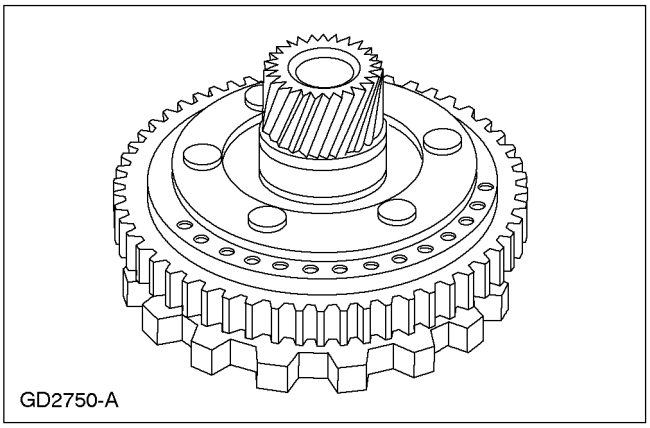
- Inspect the gear teeth.
- Inspect the spline teeth.
- Inspect the drive sprocket teeth.
- Inspect the thrust bearing surfaces.
- Inspect the journal surface.
- Inspect the bearings.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES (Continued)

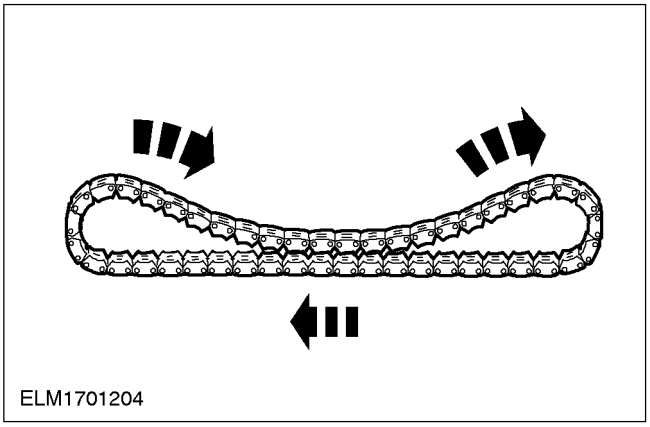
9. Inspect the driven sprocket assembly.

- Inspect the gear teeth.
- Inspect the parking gear lug teeth.
- Inspect the driven sprocket teeth.
- Inspect the thrust bearing surfaces.
- Inspect the bearing surfaces.
- Inspect the rivets.
- Inspect the bushing surfaces.
- Inspect the lubrication holes.

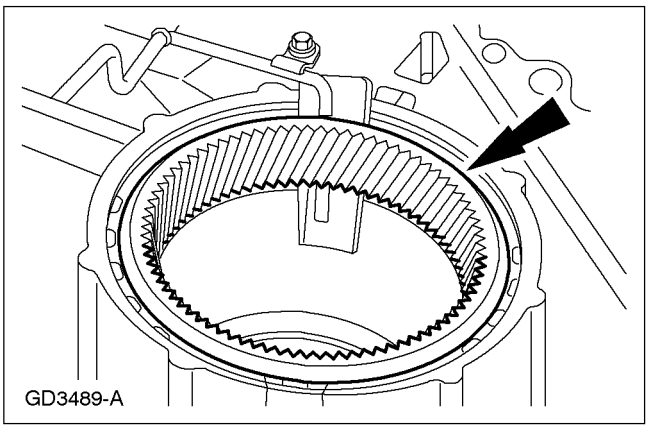


10. Inspect the drive chain.

- Check the drive chain for wear, stretching, and tightness of the chain links.
- The chain must move freely.

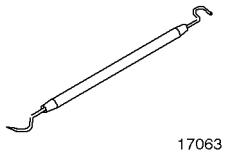


11. Inspect the final drive ring gear teeth.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

Torque Converter One-Way Clutch Check

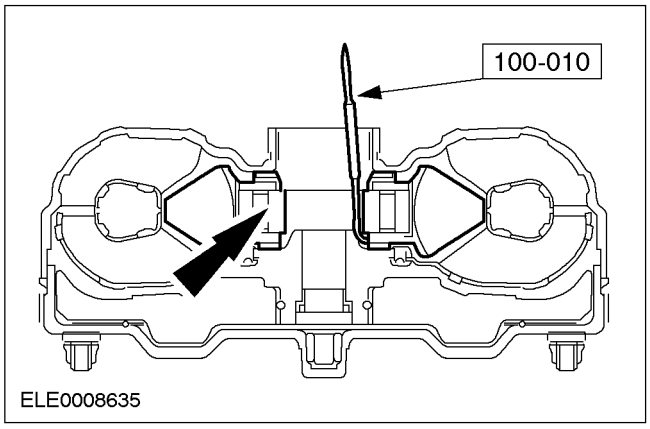
Special Tool(s)	
 17063	Remover, O-ring 100-010 (17-063)

1. NOTE: If leakage or failures are detected during the test, install a new torque converter.

NOTE: The one-way clutch should only turn anti-clockwise.

Using the special tool lock the stator.

- Try to rotate the one-way clutch. If the one-way clutch rotates in a clockwise direction, discard the torque converter.

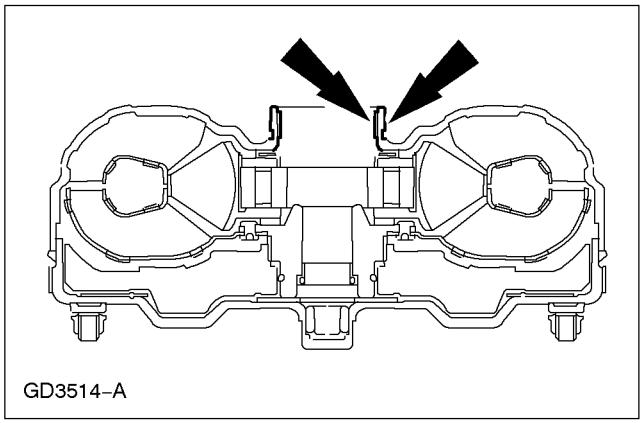


DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

Torque Converter Cleaning and Inspection

1. **When a new torque converter is installed the following actions must be carried out.**
   - All cooler lines must be thoroughly cleaned by back and forward flushing. For additional information, refer to Transmission Fluid Cooler - Backflushing and Cleaning in this section.
   - All coolers (in-tank and auxiliary) must be thoroughly cleaned by back and forward flushing. For additional information, refer to Transmission Fluid Cooler in this section.
   - If the transmission cooling system fails the flow test, new coolers or lines must be installed. If new cooler lines are to be installed refer to Transmission Cooling. For additional information, refer to Transmission Fluid Cooler Tubes in this section. If new coolers are to be installed, use only factory approved service parts and refer to Engine Cooling. For additional information, refer to Section 303-03.
2. **If a new torque converter is not being installed, the following must be carried out.:**
   - Thoroughly clean the torque converter. For additional information, refer to Torque Converter Flushing in this section.
   - All cooler lines must be thoroughly cleaned by back and forward flushing. For additional information, refer to Transmission Fluid Cooler - Backflushing and Cleaning in this section.
   - All coolers (in-tank and auxiliary) must be thoroughly cleaned by back and forward flushing. For additional information, refer to Transmission Fluid Cooler - Backflushing and Cleaning in this section.
   - Carry out transmission cooler flow test as outlined in this section. If the transmission cooling system fails the flow test, new coolers or lines must be installed. If new cooler lines are to be installed, refer to Transmission Cooling. For additional information, refer to Section 307-02A / 307-02B. If new coolers are to be installed, use only factory approved service parts and refer to Engine Cooling. For additional information, refer to Section 303-03.
3. **Carry out all torque converter checks listed in this section.**
4. **NOTE:** If leaks or damage is detected during inspection, a new torque converter should be installed.

   Check seal contact surface on the impeller hub of torque converter for excessive wear or scoring.


GD3514–A

5. **Inspect the torque converter studs for damage.**

DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

Torque Converter Flushing

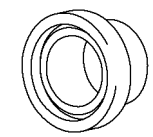
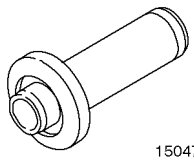
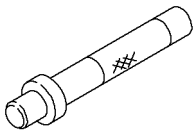
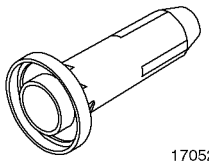
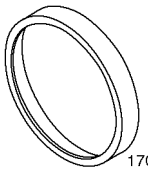
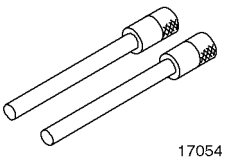
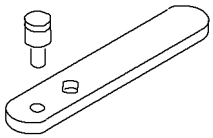
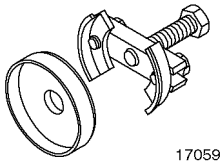
Name	Specification
Automatic transmission fluid	ESP-M2C166-H

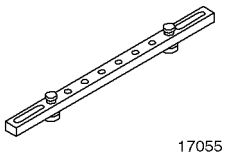
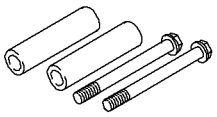
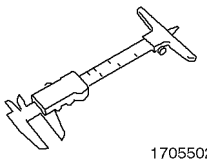
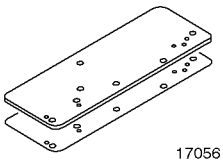
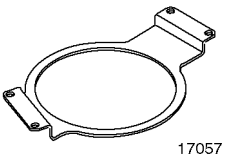
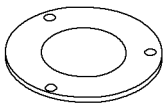
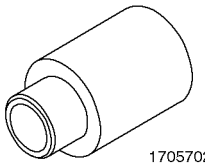
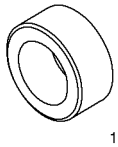
1. **CAUTION: Mineral spirits used to clean the torque converter must be fresh, non-chlorinated and non-halogenated. Do not use water based solvents or damage to the transaxle or torque converter may occur. If local ordinances state that water based solvent must be used, then for this procedure use clean automatic transmission fluid recommend for this transaxle.**

   Partially fill the torque converter using automatic transmission fluid.
2. **Hand agitate the torque converter then thoroughly drain the fluid.**
3. **Repeat this procedure until the torque converter is clean.**
4. **After flushing drain the remainder of the solvent.**
5. **Add 1.9 litre of clean automatic transmission fluid and agitate by hand.**
6. **Thoroughly drain the torque converter.**
7. **Refill the torque converter automatic transmission fluid.**
8. **Iinstall the torque converter.**

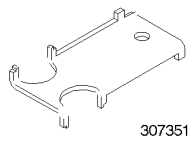
ASSEMBLY

Transaxle (17 214 8)

Special Tool(s)	
 14043	Remover and Installer, Lower Arm Bushing 204-168 (14-043)
 15047A	Installer, Drive Pinion Oil Seal 205-077 (15-047A)
 17008	Installer, Shift Shaft Oil Seal 307-050 (17-008)
 17052	Installer, Torque Converter Oil Seal 307-273 (17-052)
 1706001	Protector, Piston Seal 307-275 (17-060-01)
 17054	Alignment Pins, Valve Body 307-299 (17054)
 17066	Aligner, Selector Shaft 307-S290 (17066)
 17059	Rod Selector, Servo Piston 307-S296 (17-059)

Special Tool(s)	
 17055	Gauge Bar, Shim Selection 307-300 (17-055)
 1705501	Adapter for 307-300 307-300-01 (17-055-01)
 1705502	Depth Gauge, Shim Selection 307-300-02 (17-055-02)
 17056	Plate, Transmission Air Test 307–301 (17–056)
 17057	Preload Plate, Shim Selection 307-304 (17-057)
 ST1963–A	Adapter for 307-304 307-304-01 (17-057-01)
 1705702	Adapter for 307-304 307-304-02 (17-057-02)
 1705703	Adapter for 307-304 307-304-03 (17-057-03)

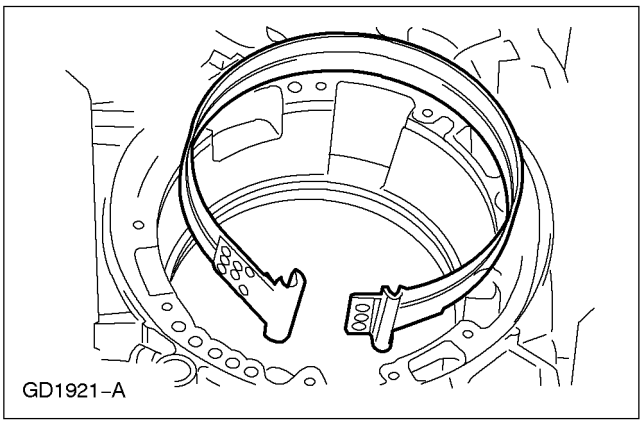
ASSEMBLY (Continued)

Special Tool(s)	
 307351	Alignment Gauge, TRS 307-351 (17-090)

Name	Specification
Automatic transmission fluid	ESP-M2C166-H
Permanent thread sealer	
Petroleum jelly	

Assembly

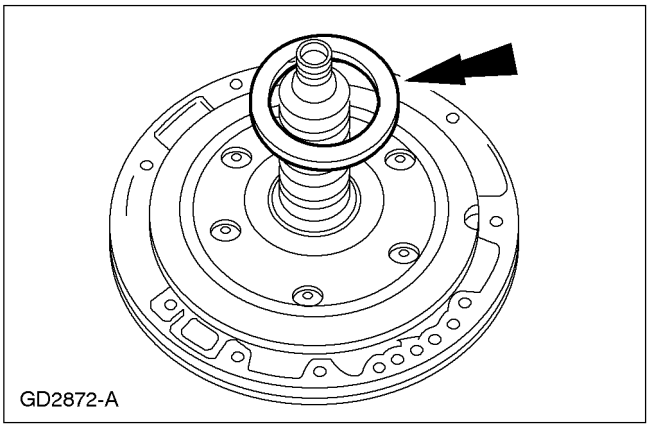
1. **Prepare the transaxle for assembly by proceeding the following steps:**
   - Clean all parts (except the friction plates, seals, and intermediate and overdrive band) in solvent.
   - Dry all parts with moisture-free regulated compressed air (do not use shop towels).
   - Lubricate all internal parts (including friction plates) with automatic transmission fluid.
   - Order the required repair parts.
   - Make sure the complete assortment of selective thickness parts are available for adjustments during assembly:
   - Drive sprocket thrust washers
   - Driven sprocket thrust bearing shims
   - Differential case thrust bearing shims
   - Low and reverse clutch pressure plates
   - During assembly, use petroleum jelly to hold the parts in position (do not use grease).
   - When tightening retaining bolts or nuts, use an accurate torque wrench.
   - Lightly coat bolt and nut threads with automatic transmission fluid before installation.
2. **Install intermediate and overdrive band assembly into the transaxle case.**



ASSEMBLY (Continued)

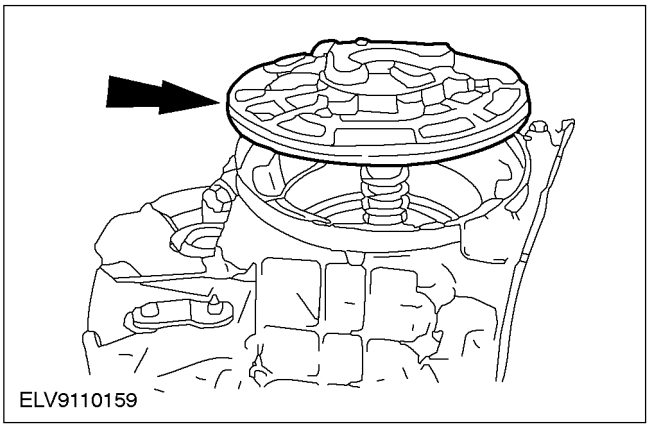
3. **NOTE:** Lubricate the seal rings with clean automatic transmission fluid.

   Install the No. 1 pump support thrust bearing.



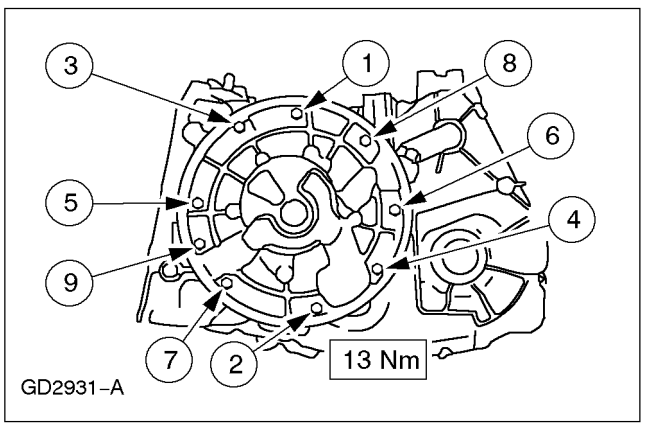
4. **NOTE:** Apply a thin coat of petroleum jelly to the pump support seals and to the pump bore in the transaxle.

   Install pump assembly into the transaxle case.



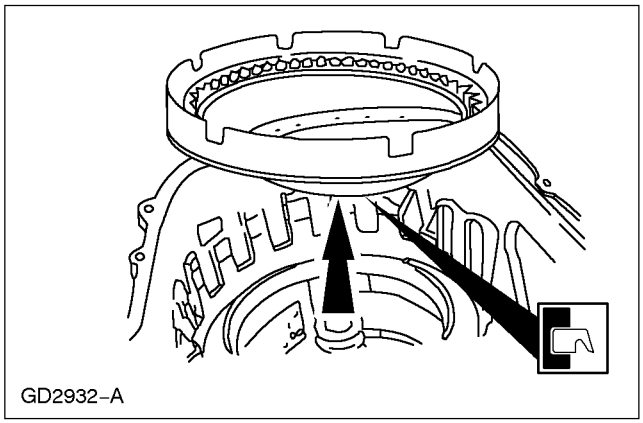
5. **NOTE:** Tighten the retaining bolts in the sequence shown.

   Install the pump assembly bolts.



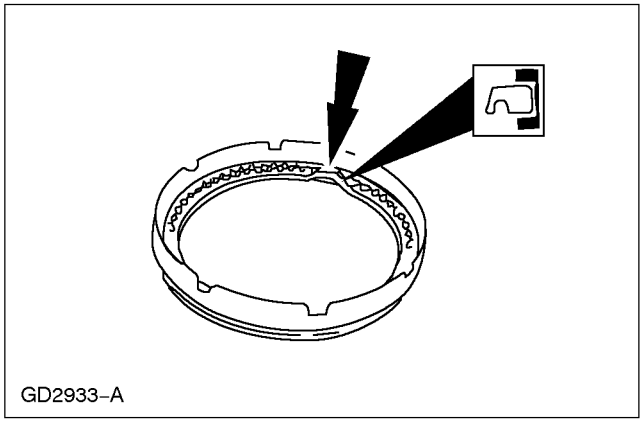
6. **NOTE:** Coat the low and reverse clutch piston oil seals and the piston bore with clean automatic transmission fluid.

   Install a new low and reverse clutch piston outer seal.



7. **NOTE:** Coat the low and reverse clutch piston oil seals and the piston bore with clean automatic transmission fluid.

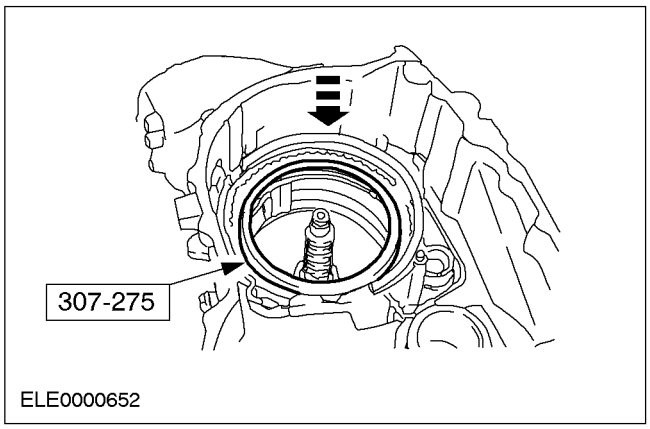
   Install a new low and reverse clutch piston inner seal.



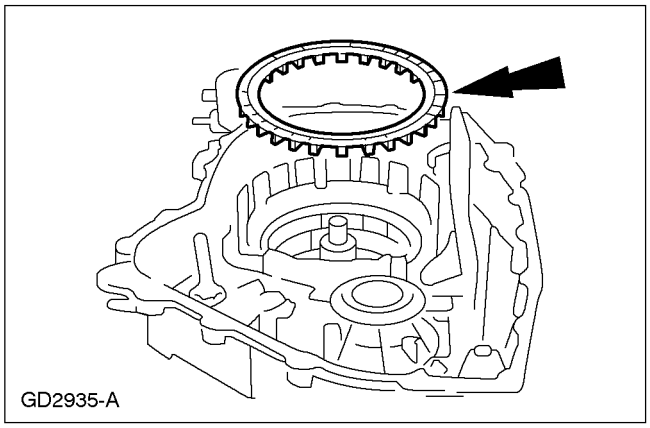
ASSEMBLY (Continued)

8. Using the special tool, install the low and reverse clutch piston.

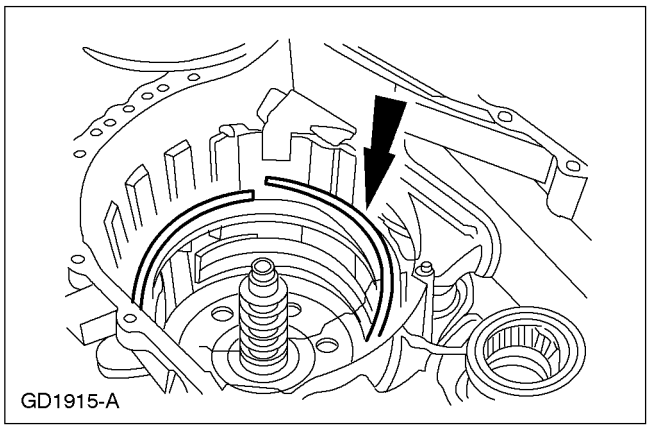
- Lubricate seals and piston bore with clean automatic transmission fluid.



9. Install the low and reverse clutch return spring assembly.

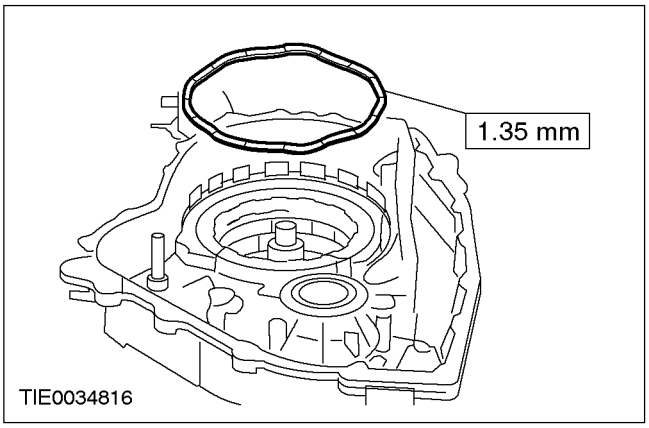


10. Install the low and reverse clutch return spring retaining ring.



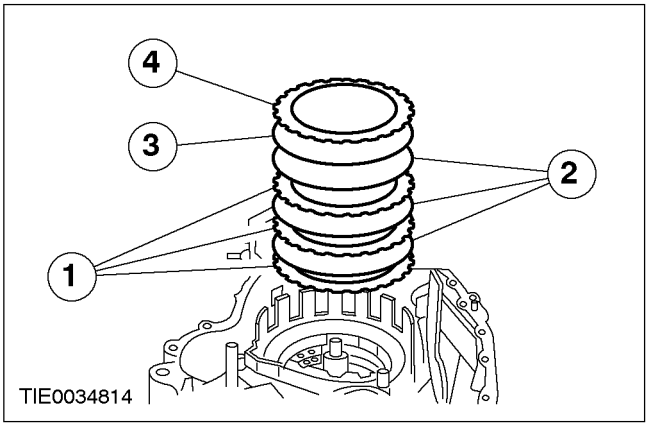
11. CAUTION: The low and reverse clutch wave spring is installed at this stage for measurement purposes only.

Install the low and reverse clutch wave spring.



12. Install the low/reverse clutch plates.

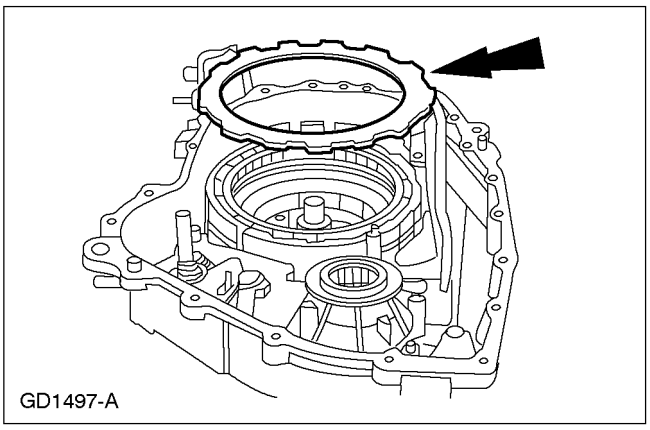
1. The low/reverse clutch external splined (steel) clutch plates.
2. The low/reverse clutch internal splined (friction) clutch plates.
3. The thin, eight wave low/reverse clutch cushion spring.
4. The low/reverse clutch plate.



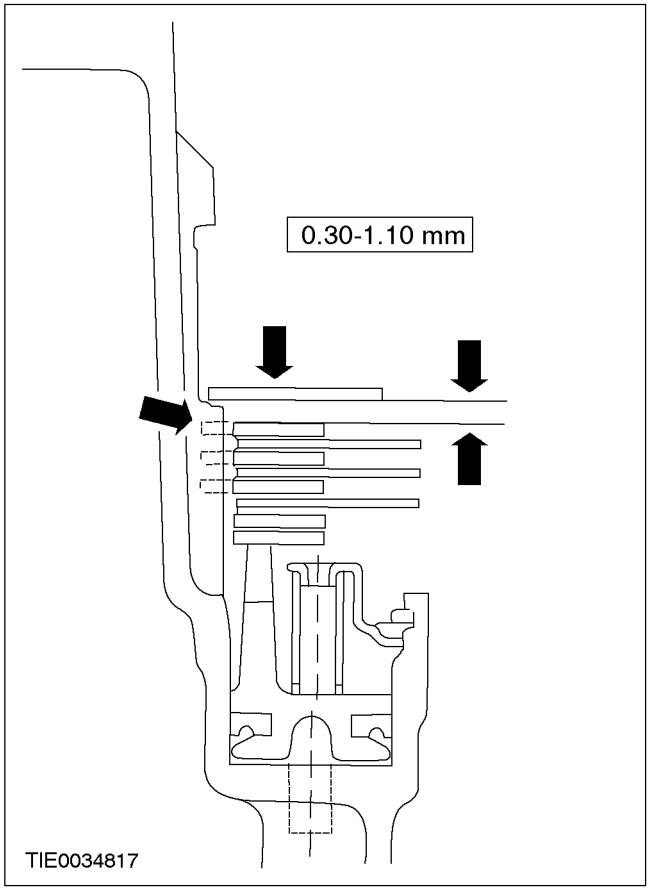
ASSEMBLY (Continued)

13. **CAUTION: The low one-way clutch thrust plate is installed at this stage for measurement purposes only.**

    Install the low one-way clutch thrust plate.

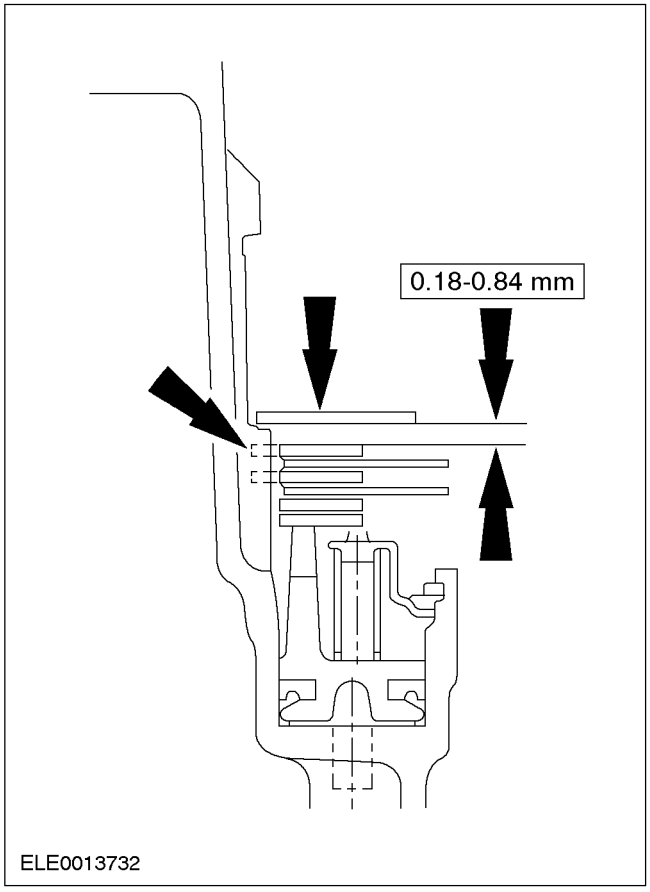


14. **Measure the play between the low and reverse clutch pressure plate and the thrust washer of the low one-way clutch (three-plate clutch).**
    - Repeat the measurement on the opposite side.
    - Average the two measurements to calculate the clearance.
    - If the clearance is not within specification, select and fit the correct thickness pressure plate to obtain the specified clearance.
    - Pressure plate thicknesses:
    - 2.57-2.46 mm
    - 2.36-2.26 mm
    - 2.16-2.06 mm



ASSEMBLY (Continued)

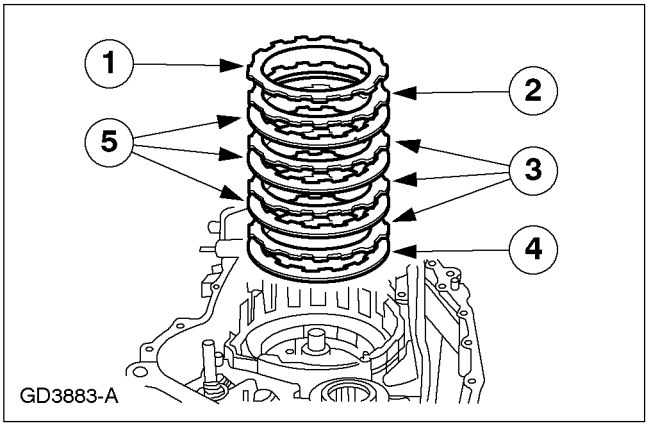
15. **Measure the play between the low and reverse clutch pressure plate and the thrust washer of the low one-way clutch (two-plate clutch).**
    - Repeat the measurement on the opposite side.
    - Average the two measurements to calculate the clearance.
    - If the clearance is not within specification, select and fit the correct thickness pressure plate to obtain the specified clearance.
    - Pressure plate thicknesses:
    - 2.57-2.46 mm
    - 2.36-2.26 mm
    - 2.16-2.06 mm



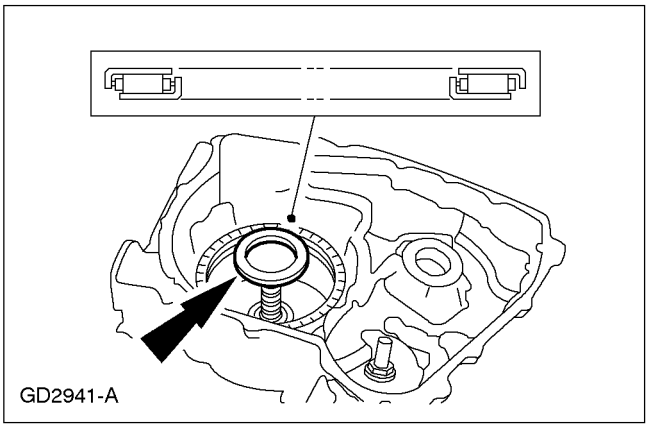
16. **NOTE:** One tooth of the low and reverse clutch pressure plate is notched for identification.

    Remove the low one-way and low and reverse clutch plates.

    1. The low one-way clutch thrust plate.
    2. The low/reverse clutch external splined (steel) clutch plates.
    3. The low/reverse clutch internal splined (friction) clutch plates.
    4. The thin, eight wave low/reverse clutch cushion spring.
    5. The low/reverse clutch plate.



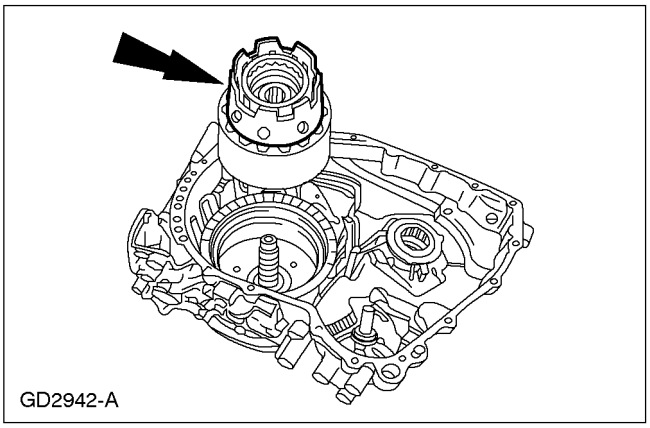
17. **Install the No. 1 pump support thrust bearing assembly.**



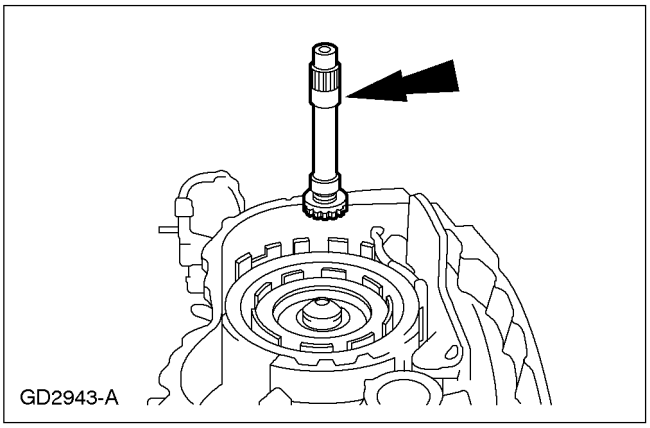
ASSEMBLY (Continued)

18. **NOTE:** Remove Seal Sizer from forward, coast and direct clutch cylinder.

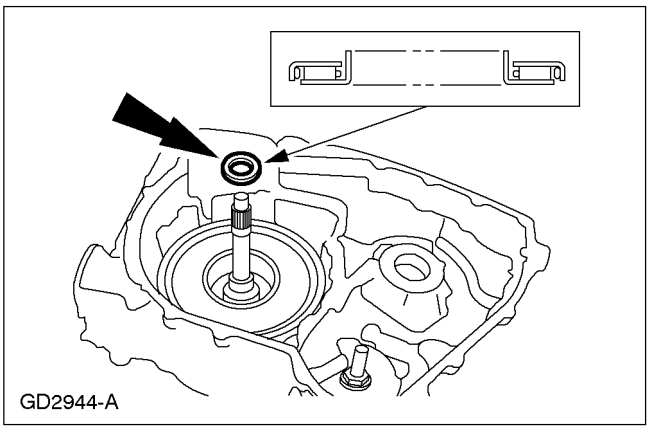
    Install the forward, coast and direct clutch cylinder assembly and reverse clutch drum assembly.



19. **Install the turbine shaft.**



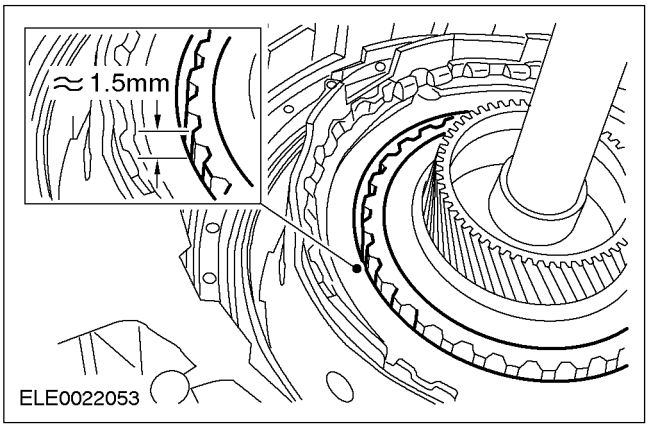
20. **Install the No. 4 turbine shaft thrust bearing.**



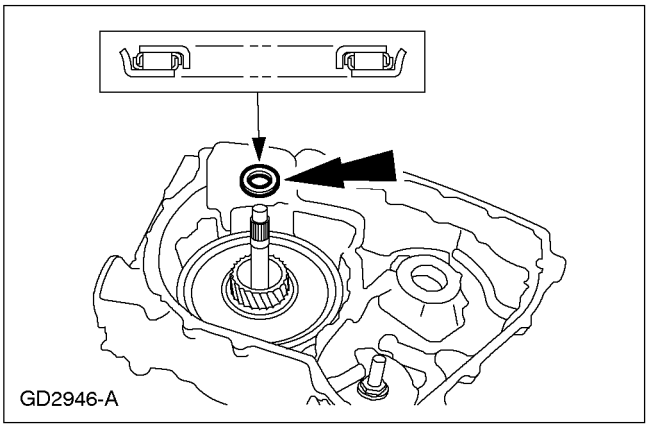
21. **NOTE:** It is essential that the installation depth of the sun gear is maintained.

    Install the forward one-way clutch and low-intermediate sun gear assembly.

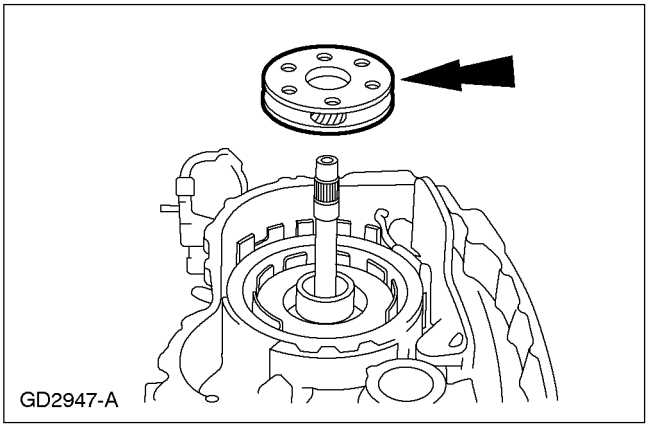
    • Measure the sun gear clearance.



22. **Install the No. 5 low-intermediate sun gear thrust bearing.**

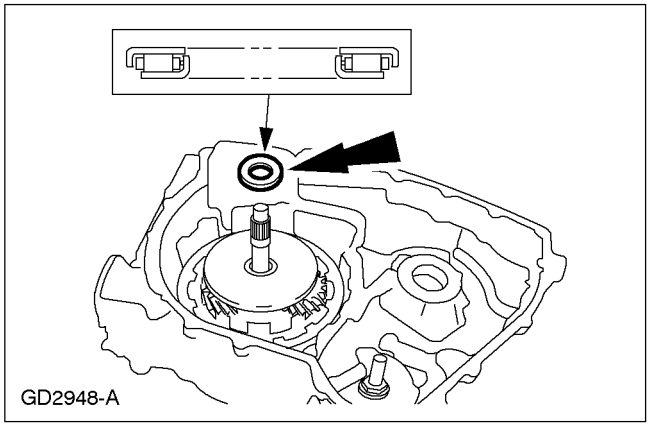


23. **Install the low-intermediate carrier assembly.**

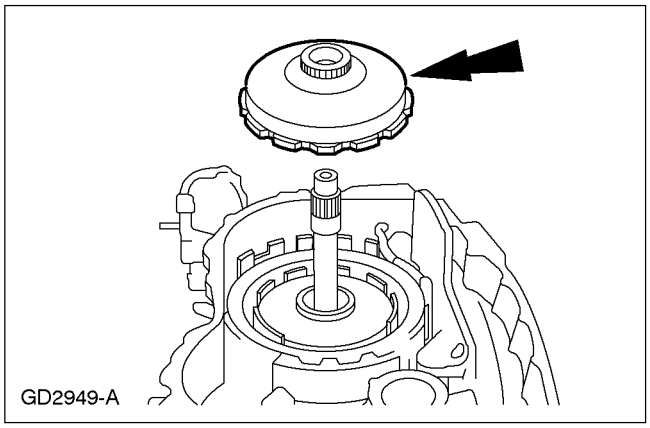


ASSEMBLY (Continued)

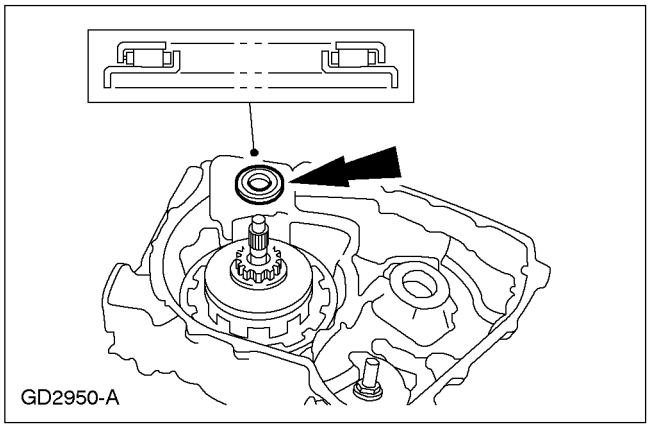
24. Install the No. 6 low-intermediate carrier thrust bearing.



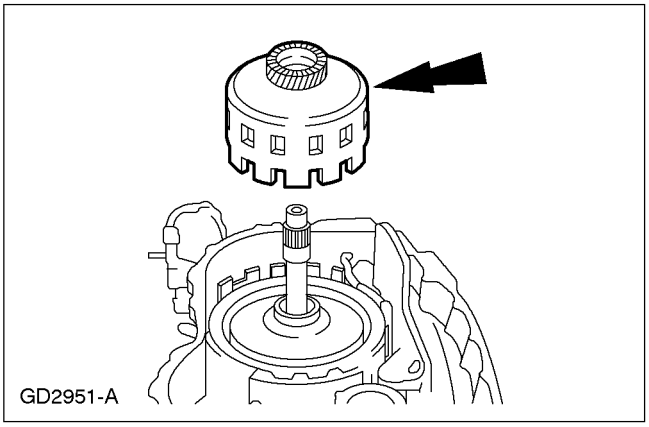
25. Install the low-intermediate ring gear assembly.



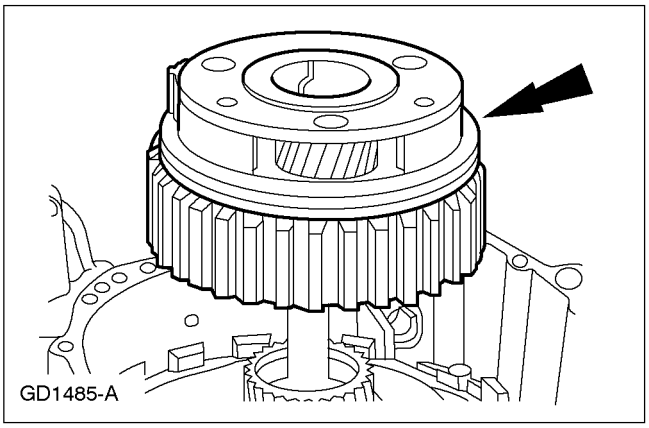
26. Install the No. 7 reverse and overdrive sun gear thrust bearing.



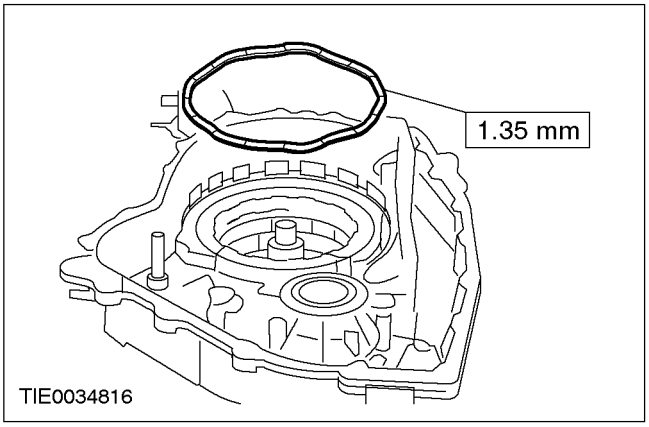
27. Install the reverse and overdrive sun gear and shell assembly.



28. Install the reverse and overdrive carrier assembly with the captured No. 8 thrust bearing.



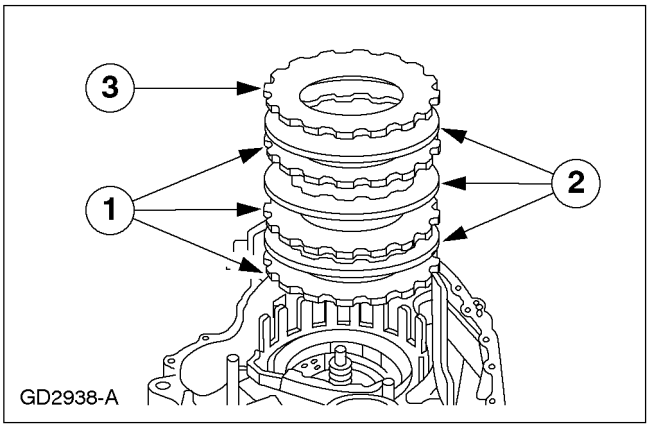
29. Install the thick, ten-wave low/reverse clutch wave spring.



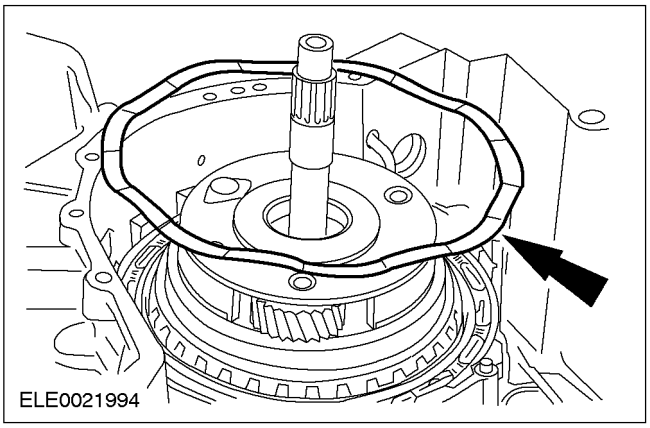
ASSEMBLY (Continued)

30. Install the low and reverse clutch plates.

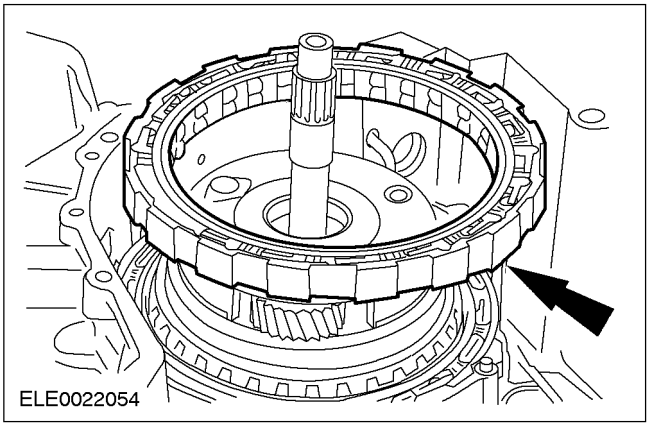
1. Install the external spline (steel) clutch plates.
2. Install the clutch internal spline (friction) clutch plates.
3. Install the clutch pressure plate previously selected.



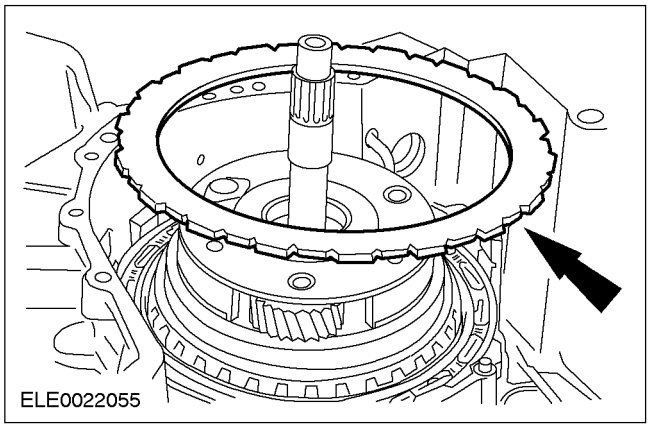
31. Install the thin, eight wave low and reverse clutch wave spring.



32. Install the low one-way clutch assembly with the identification ring on the inner ring facing upward.

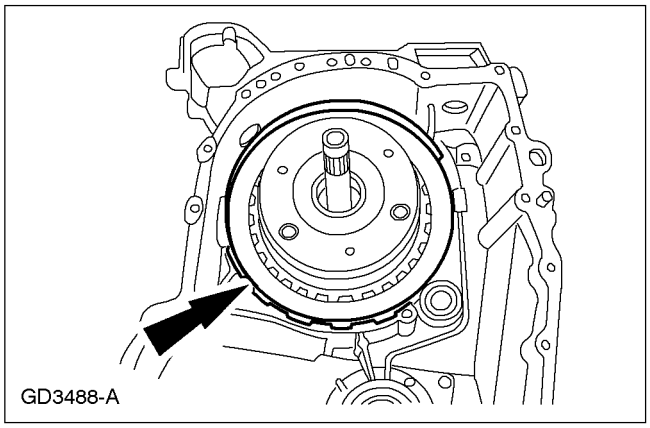


33. Install the low one-way clutch thrust plate.



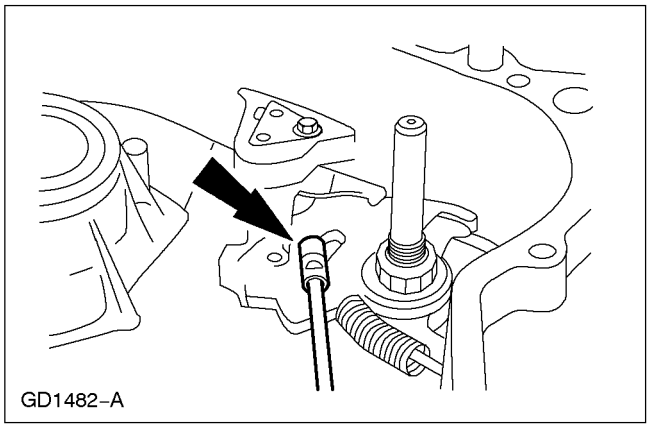
34. NOTE: Make sure to position the low one-way clutch retaining ring as shown.

Install the low one-way clutch retaining ring.



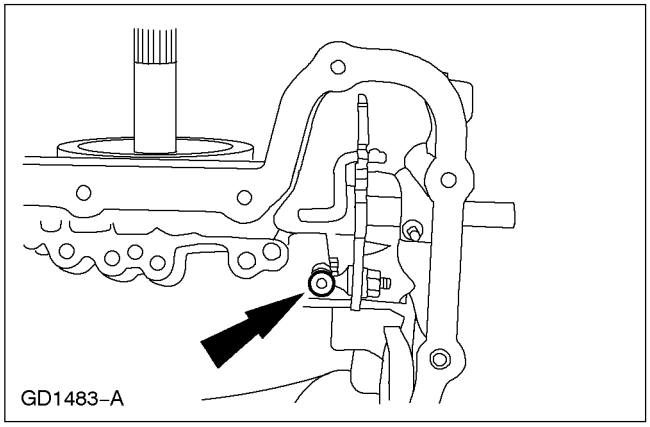
35. Install the manual valve detent lever actuating rod assembly.

- Install the parking cam actuator lever.

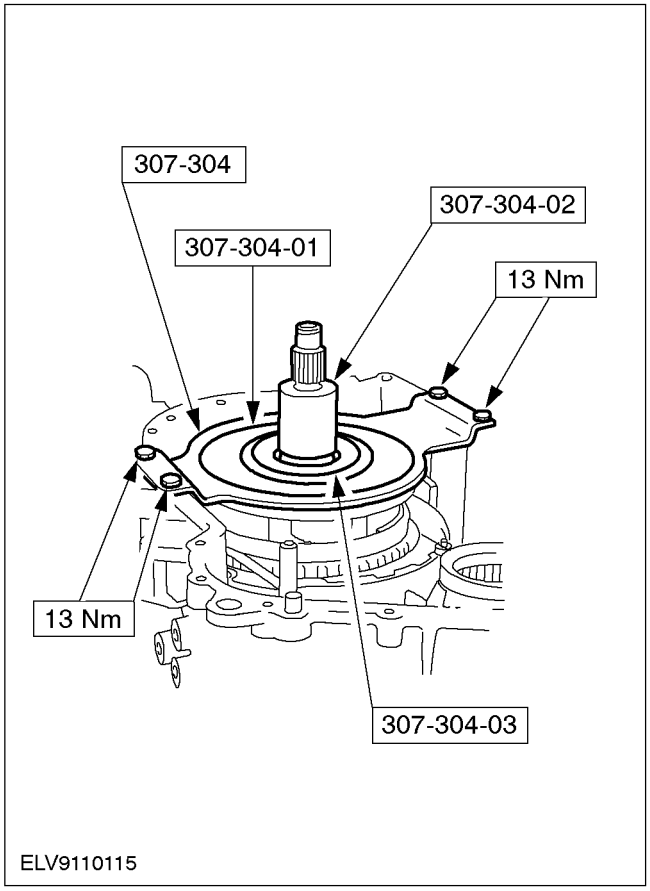


ASSEMBLY (Continued)

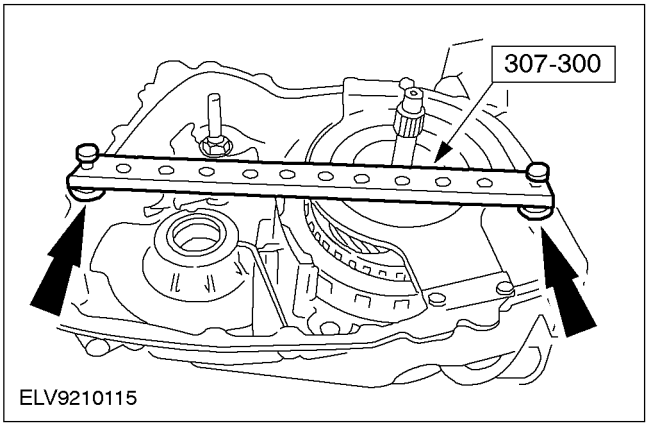
36. Install the manual valve detent lever.



37. Install the special tools.

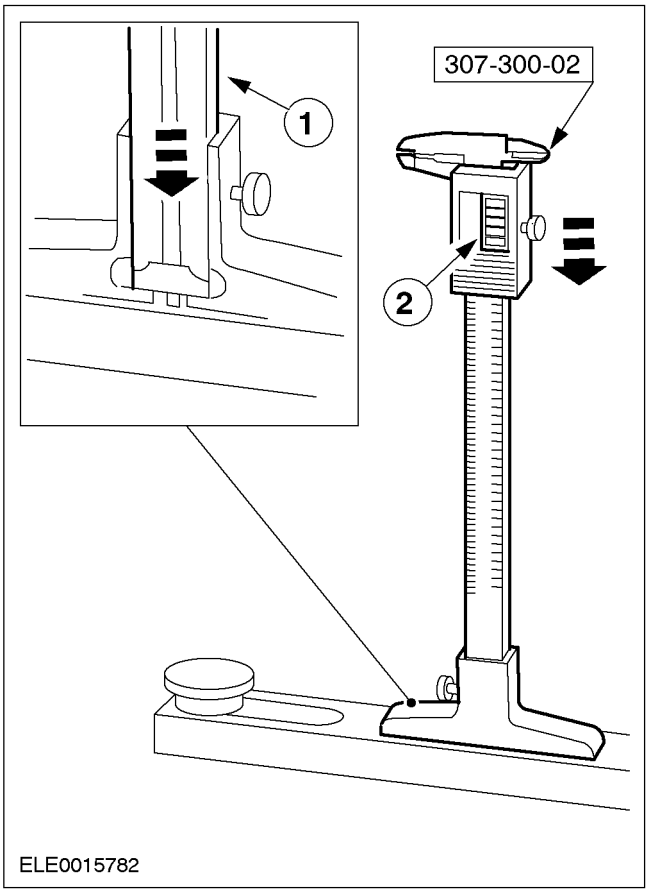


38. Install the special tool with short spacers.



39. Zero the Vernier calipers.

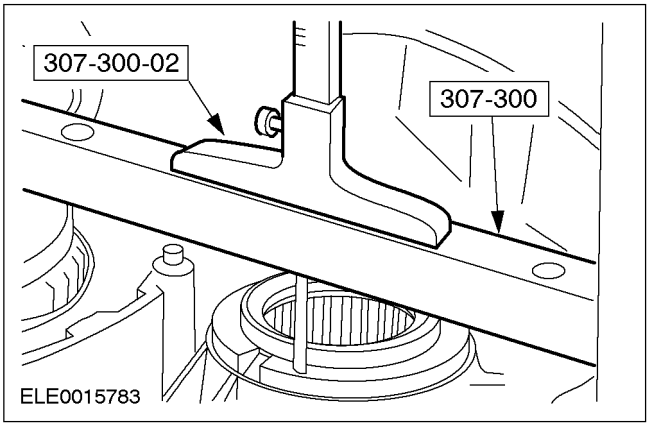
1. Position the measuring calipers on the measuring bar (or measuring plate) and slide down the depth gauge as far as possible.
2. Zero the depth gauge.



ASSEMBLY (Continued)

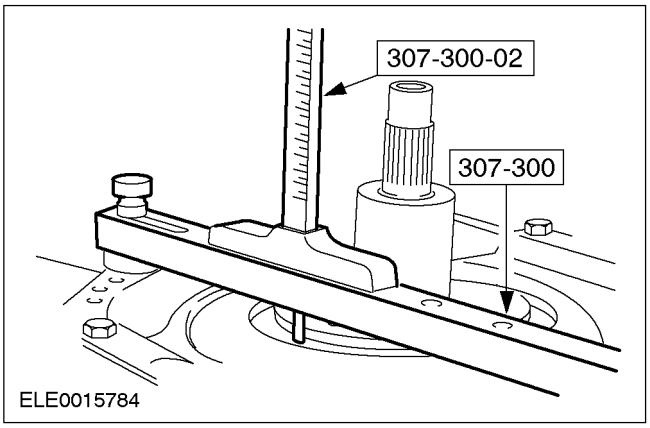
40. Using the special tools, measure the depth of the bearing thrust surface from the measuring bar.

- Lay the measuring bar with the spacer shims on the housing.
- Measure and note the distance between the measuring bar and the bearing thrust surface, measurement ""A".



41. Using the special tools, measure the depth of the reverse and the 4th gear planet carrier

- Repeat the measurement at the opposite side and calculate the average value, measurement "B".
- Remove the special tools.

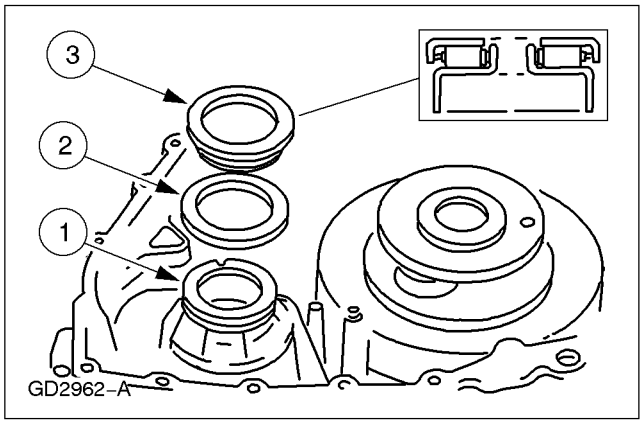


42. Determine the thickness of the driven sprocket adjustment shim (No. 11).

- "A" - "B" = "C"
- Dimension "A" = measured distance
- Dimension "B" = measured distance
- Dimension "C" = thickness of adjustment shim.
- The adjustment shim is available in different thicknesses:
- Measured axial clearance shim that should be fitted
- 14.34mm - 14.17mm – 2.20mm - 2.10mm
- 14.16mm - 14.00mm – 2.02mm - 1.92mm
- 13.99mm - 13.83mm – 1.8mm - 1.75mm
- 13.82mm - 13.66mm – 1.67mm - 1.57mm
- 13.65mm - 13.49mm – 1.50mm - 1.40mm
- 13.48mm - 13.32mm – 1.32mm - 1.22mm

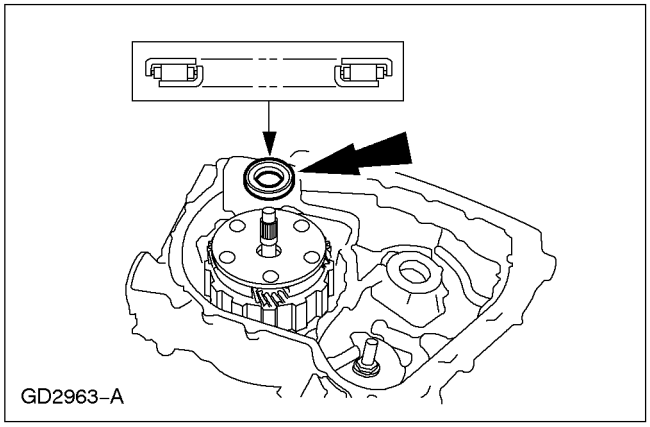
43. Install and lubricate with automatic transmission fluid the following:

1. The needles and seals in the No. 18 driven sprocket bearing.
2. Install the selected No. 11 driven sprocket shim.
3. Install the No. 12 driven sprocket bearing.



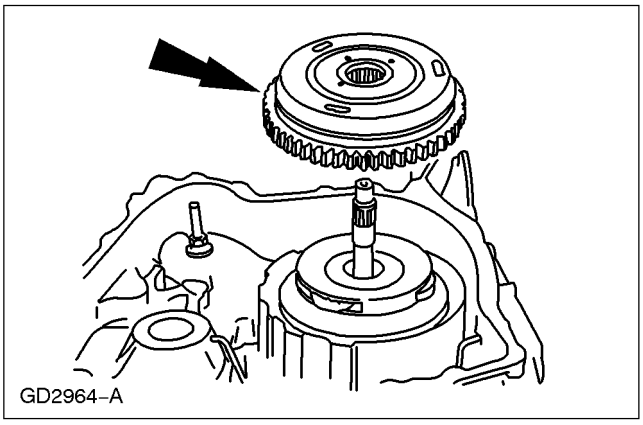
ASSEMBLY (Continued)

44. Install the No. 9 reverse and overdrive ring gear thrust bearing.

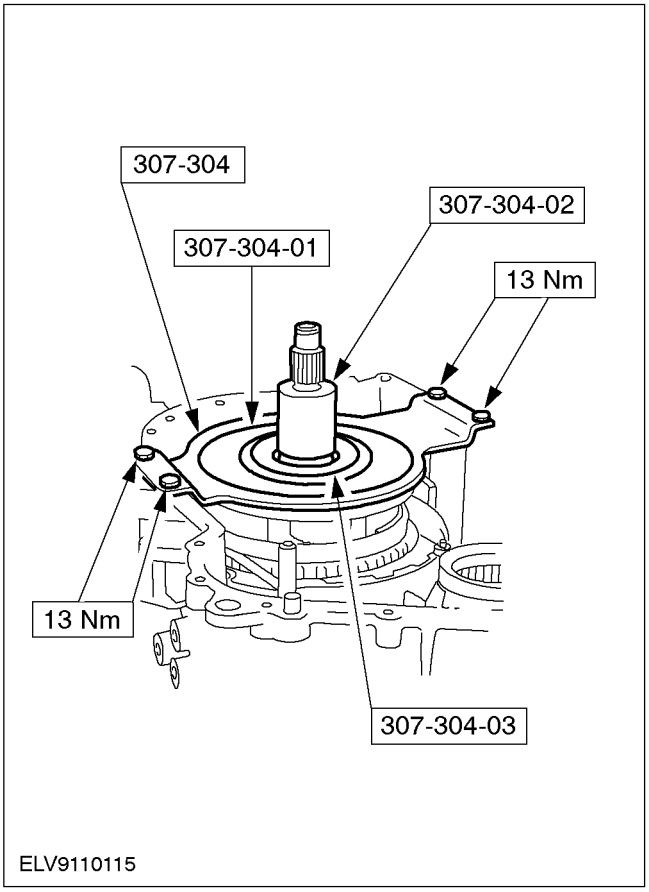


45. NOTE: Installation of the reverse and overdrive ring gear assembly at this stage is for measurement purposes only.

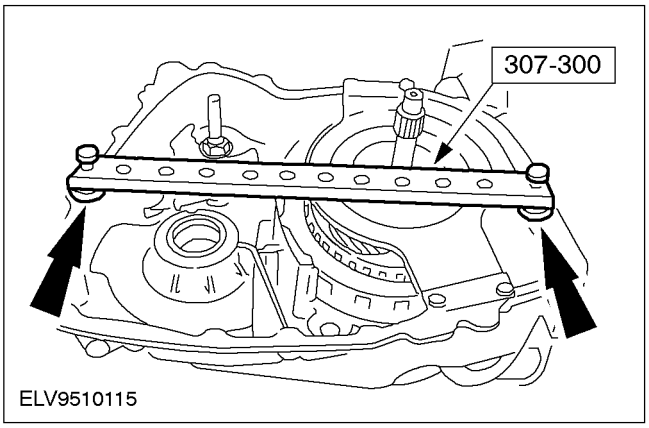
Install the reverse and overdrive ring gear assembly.



46. Install the special tools.



47. Install the special tool with short spacers.



ASSEMBLY (Continued)

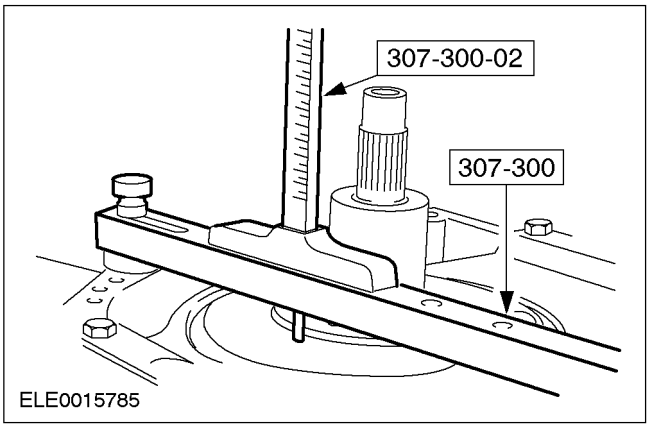
48. Calculate the thrust washer for the drive gear.

- Add the thickness of the measuring bar and the height of the short spacer sleeves, measurement ""A”.

49. NOTE: Zero the measuring tip on the measuring bar.

Using the special tools, measure the depth of drive gear thrust washer from the measuring bar, and note the reading.

- Repeat the measurement at the opposite side and calculate the average value, measurement "B”.
- Remove the special tools and the drive gear.

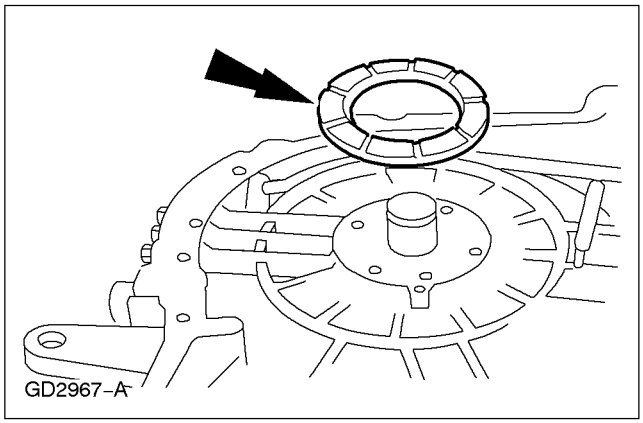


50. Determine the thickness of the drive gear thrust washer.

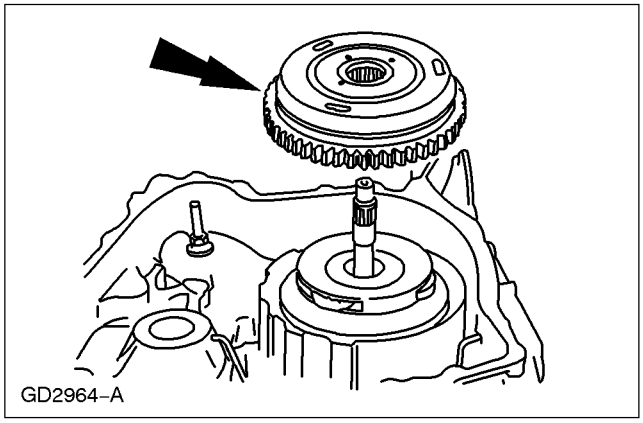
- "A" - "B" = "C"
- Dimension "A" = (thickness of measuring bar)+ (height of spacer sleeves)
- Dimension "B" = measured distance
- Dimension "C" = thickness of thrust washer
- The thrust washer is available in different thicknesses: (measured in mm):
- Measured size washer that should be fitted (color code)
- 1.12mm - 0.86mm – 1.51mm -1.41mm (blue)
- 0.85mm - 0.60mm – 1.67mm (black)
- 0.59mm - 0.34mm – 2.03mm - 1.93mm (grey)
- 0.33mm - 0.08mm – 2.29mm - 2.19mm (green)

51. Install the selected No. 10 drive sprocket thrust washer on the torque converter housing.

- Coat the No.10 drive sprocket thrust washer with petroleum jelly.

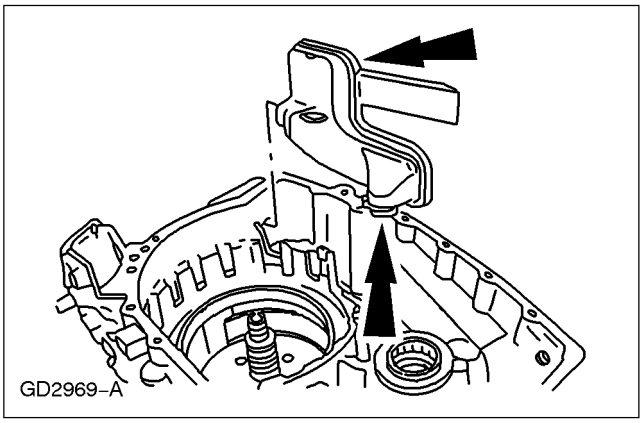


52. Install the reverse and overdrive ring gear assembly.



ASSEMBLY (Continued)

53. Install the filter and seal assembly.

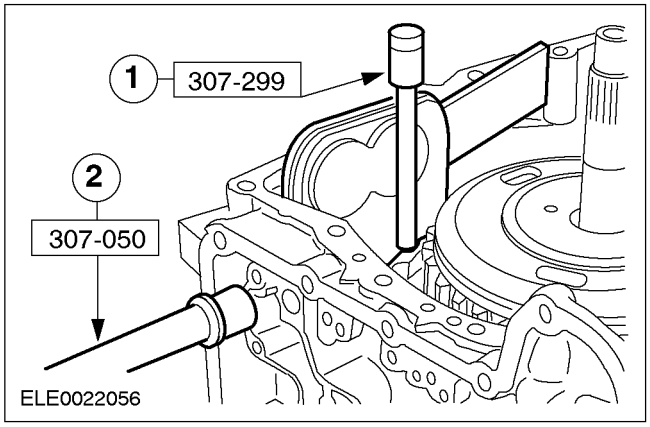


54. NOTE: Lubricate the filter recirculating regulator return pipe with automatic transmission fluid prior to installation.

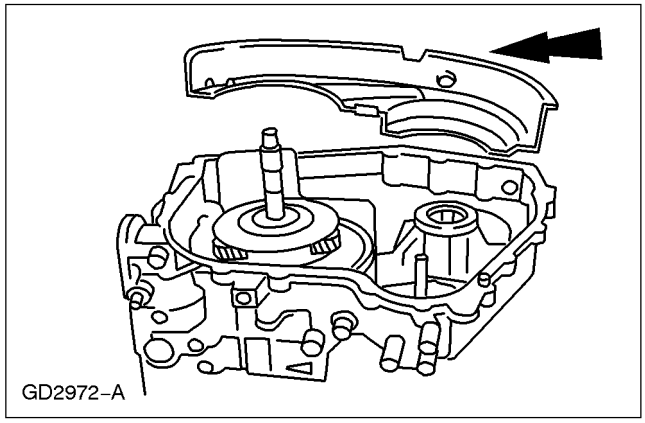
Using the special tools, install a new filter recirculation regulator return pipe.

1. Install the special tool in the filter eyelet and transaxle hole.
2. Using the special tool, install the return pipe seal.

- Remove the special tool.



55. Install the chain pan in the transaxle case.

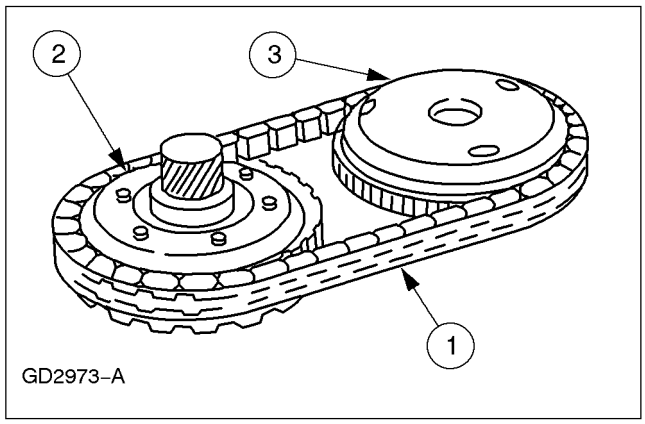


56. ⚠ WARNING: Wear gloves as protection from sharp chain and sprocket teeth. Failure to follow this instruction may result in personal injury.

Assemble and install the drive chain assembly.

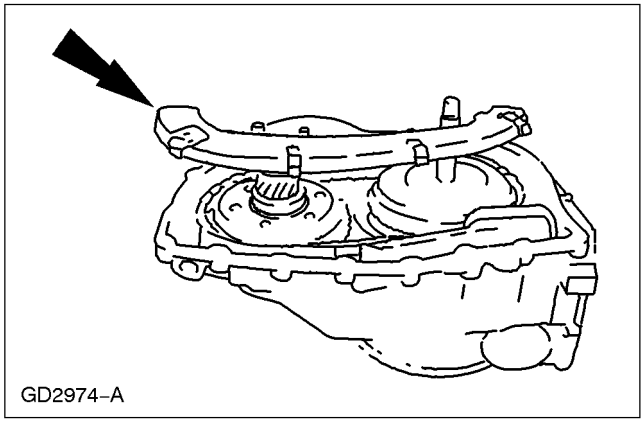
1. Drive chain (copper colored link facing upward).
2. Driven sprocket assembly.
3. Reverse and overdrive ring gear assembly.

- Verify that the driven sprocket assembly and reverse and overdrive ring gear assembly are fully installed.

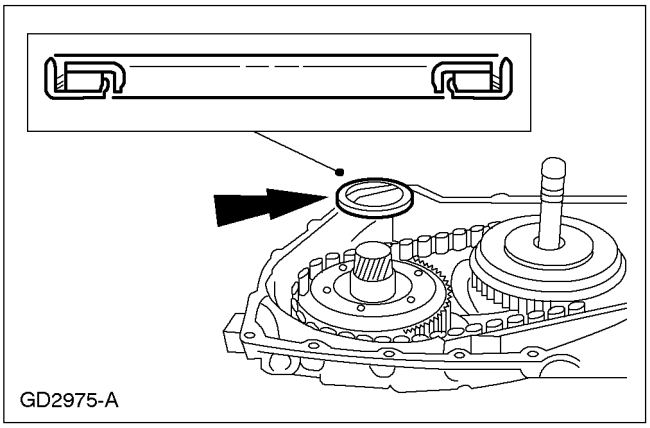


ASSEMBLY (Continued)

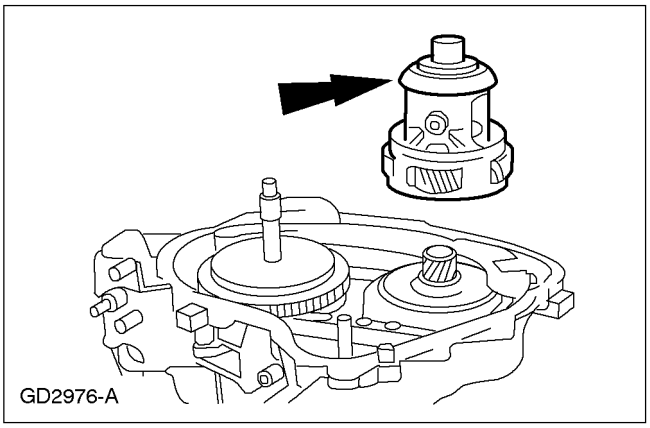
57. Install the chain pan cover.



58. Install the No. 13 driven sprocket thrust bearing.



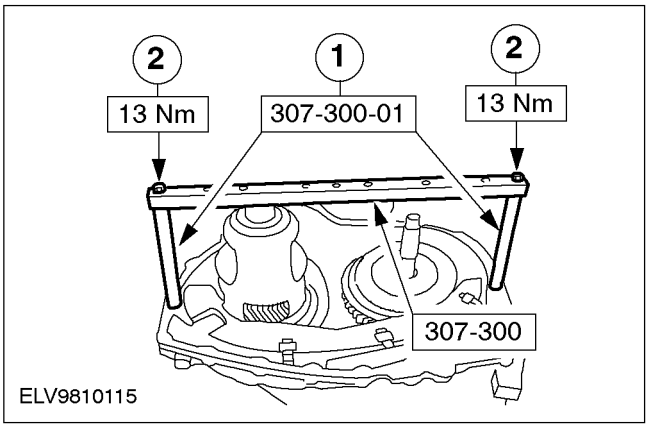
59. Install the final drive carrier and differential assembly.



60. ⚠ CAUTION: Use plastic washers between bolt heads and special tool.

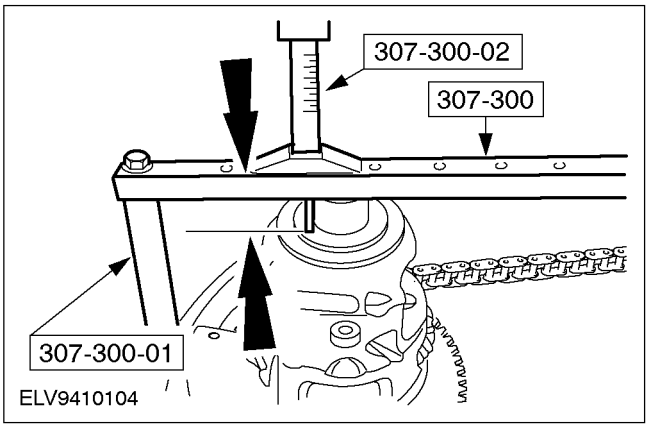
Install the special tools.

1. Install the special tool.
2. Install the special tool and bolts.



61. Using the special tools, measure the distance between the measuring bar and the bearing thrust surface.

- Repeat the measurement at the opposite side and calculate the average value, measurement "B".
- Remove the special tools.



ASSEMBLY (Continued)

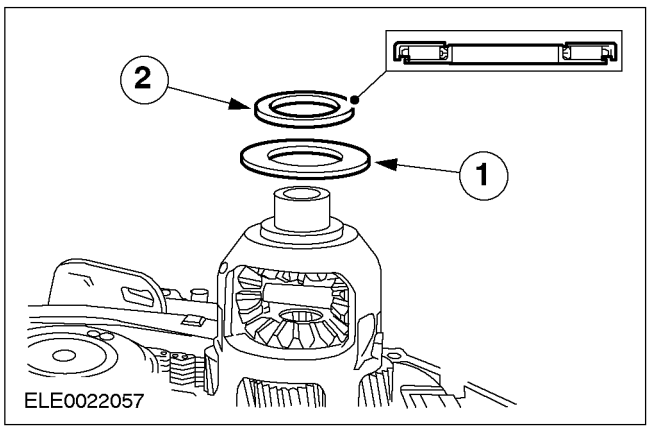
62. NOTE: "A" is a predefined dimension of 177.8 mm.

Calculate the shim thickness (measuring bar and spacer sleeve).

- "A" - "B" = "C"
- Dimension "A" = 177.8 mm
- Dimension "B" = measured distance
- Dimension "C" = thickness of shim
- The adjustment shim is available in different thicknesses (measured in mm):
- Measured axial clearance -> shim that should be fitted
- 130.76mm - 130.46mm – 1.08mm - 0.98mm
- 130.45mm - 130.16mm – 1.38mm - 1.28mm
- 130.15mm - 129.87mm – 1.67mm - 1.57mm
- 129.86mm - 129.57mm – 1.97mm - 1.87mm
- 129.56mm - 129.27mm – 2.27mm - 2.17mm

63. Install the differential shim and differential bearing assembly.

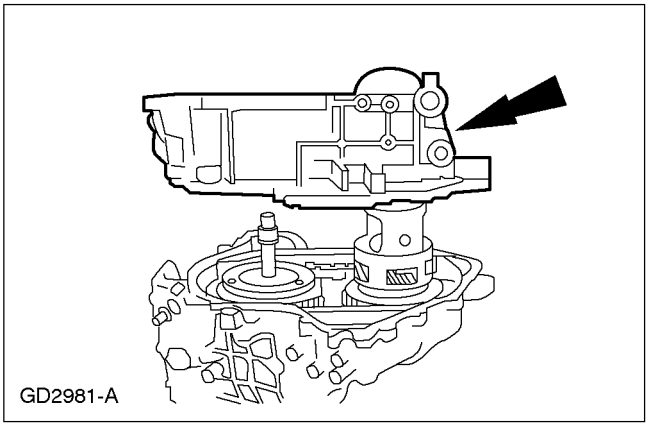
1. Install the No. 14 differential bearing shim (selective fit).
2. Install the No. 15 differential bearing.



64. NOTE: Check for correct alignment of the lube tube on the converter housing.

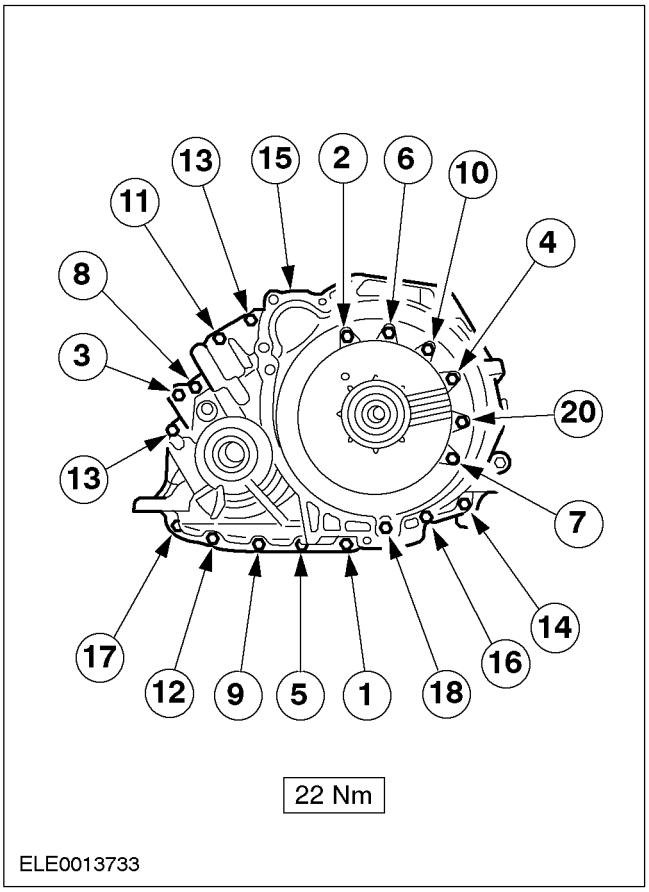
Install the torque converter housing onto the transaxle case.

- Install a new split flange gasket.



65. NOTE: Tighten the torque converter housing retaining bolts in the sequence shown.

Install the torque converter housing to transaxle case bolts.

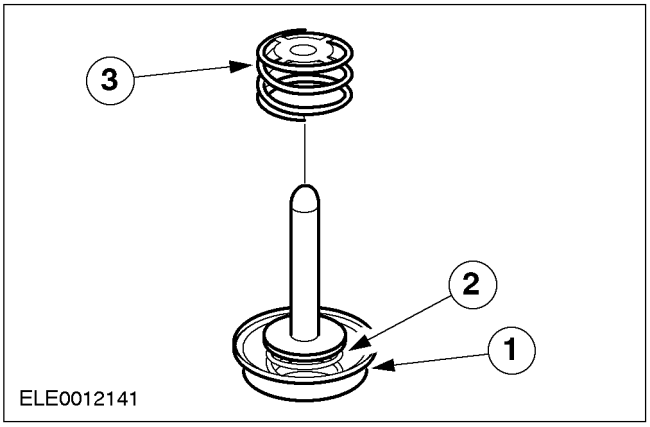


ASSEMBLY (Continued)

66. NOTE: Note the number of grooves on the intermediate and overdrive servo apply rod.

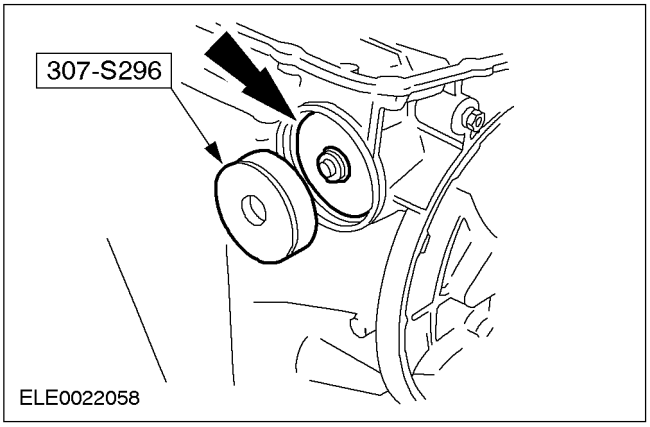
Lubricate the assembly with transmission fluid before installation.

1. Install the servo cover with integral seal.
2. Install the damping spring.
3. Install the servo return spring.



67. Install the intermediate and overdrive servo piston assembly into the transaxle case.

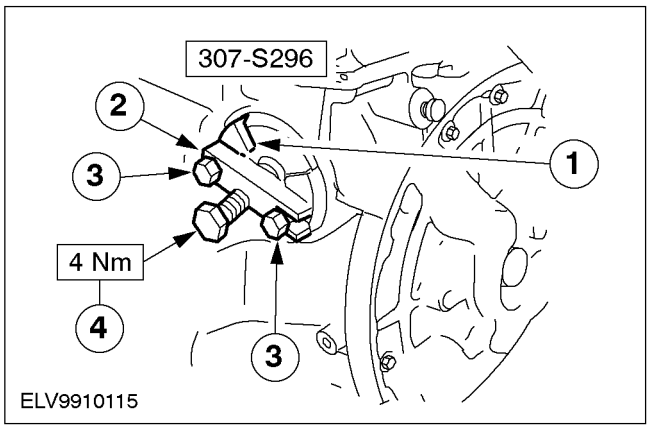
- Install the special tool.



68. NOTE: Struts on the special tool fit into the servo cover retaining ring groove.

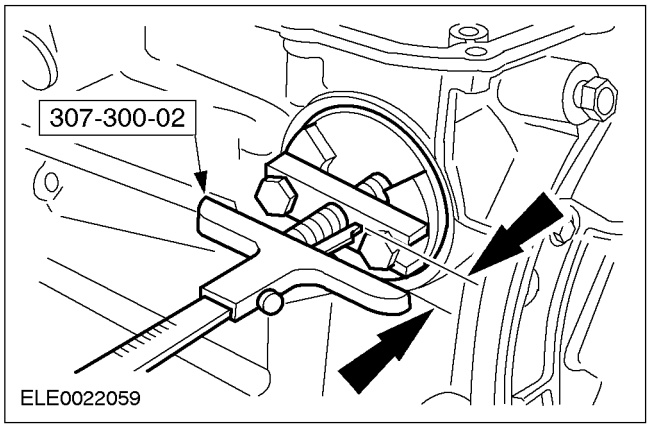
Assemble the special tool.

1. Install struts.
2. Install bar.
3. Install the bolts.
4. Install the center bolt.



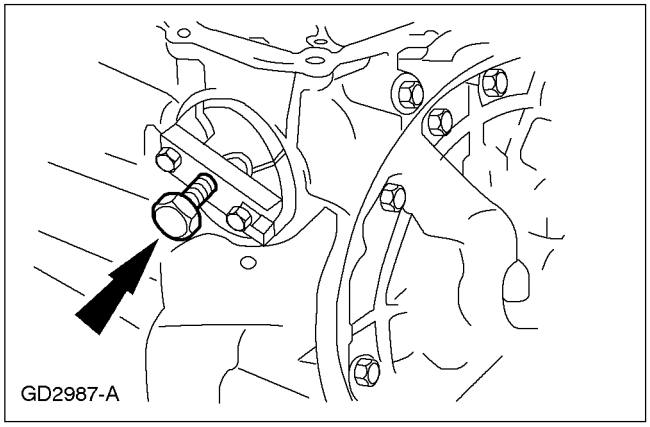
69. Using the special tool, measure the distance between the center bolt and the special tool securing bar gap.

- Record the measurement.



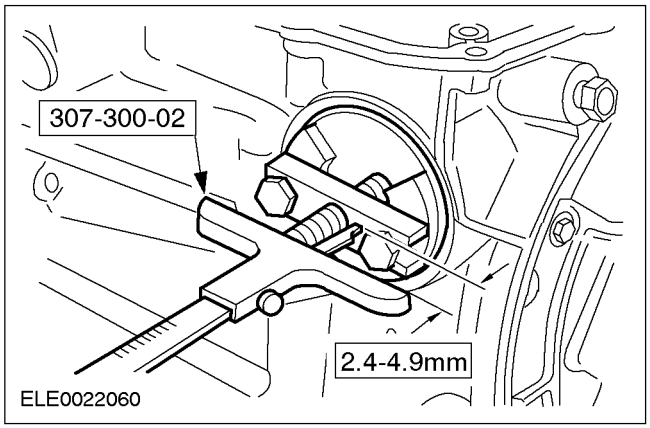
ASSEMBLY (Continued)

70. Tighten the center bolt on the special tool until the servo piston no longer moves.



71. Using the special tool, measure the distance between the center bolt and the special tool securing bar.

- Subtract the previously noted measurement from this measurement to calculate the travel.
- If the piston travel is not within the specification, select a new actuating rod for the intermediate and overdrive gear servo piston assembly.
- Repeat the measurement steps if a new actuating rod is installed.
- Remove the special tool.



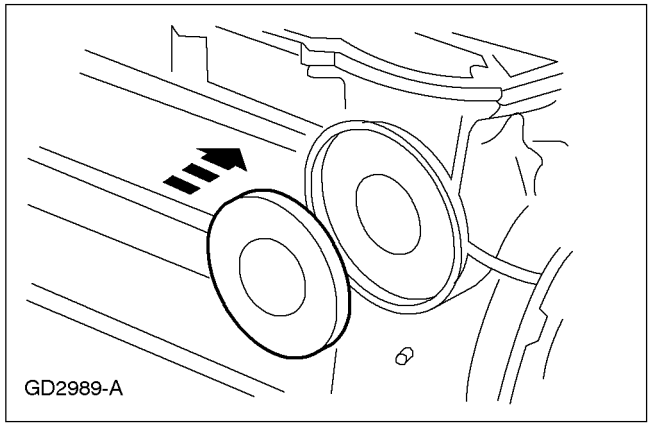
72. NOTE: The piston rod and servo piston are supplied as an assembly.

Calculate the required rod length form parts available.

- 105,7 mm (two marking rings)
- 107,1 mm (one marking ring)
- 108,1 mm (no marking ring)

73. Install the required servo piston assembly.

74. Align the servo cover.

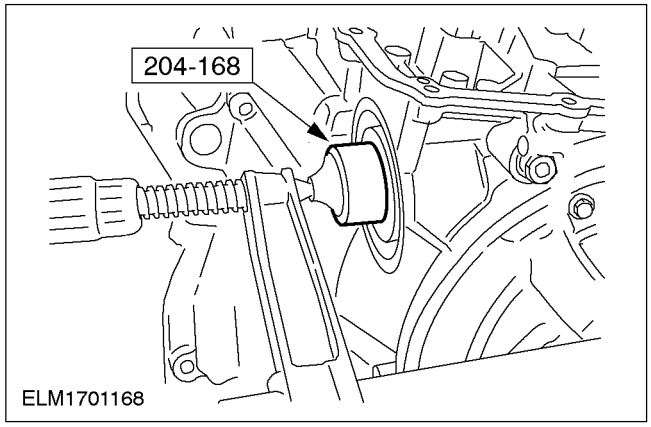


75. ⚠ WARNING: Servo return spring force is very high.

⚠ CAUTION: Only compress the servo piston until the retainer groove becomes visible.

Using the special tools, install the servo cover.

- Install the retaining ring.



ASSEMBLY (Continued)

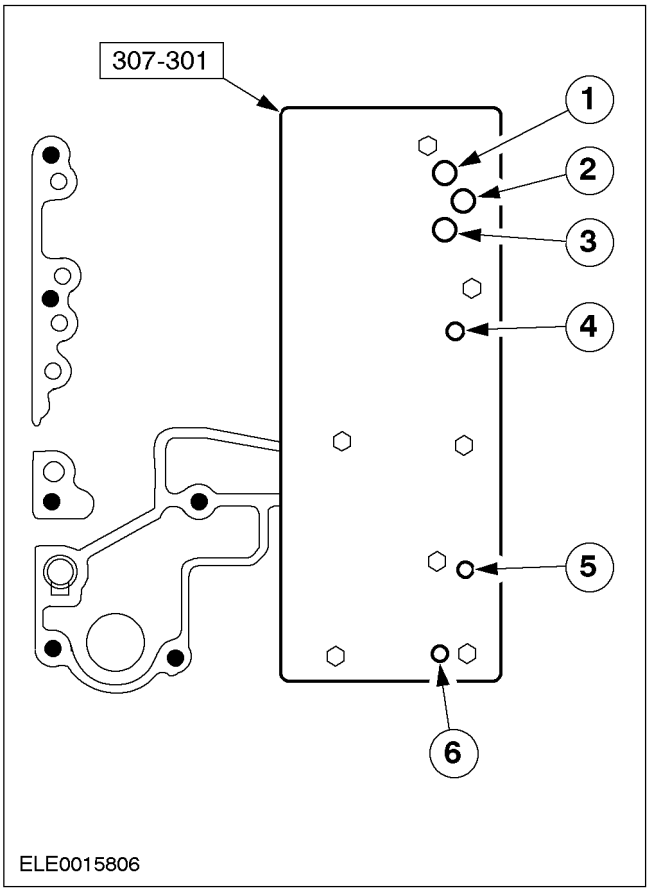
76. **CAUTION: Do not check the coast clutch, as this would cause the coast clutch piston to be pushed out of the forward clutch piston.**

CAUTION: Carry out the air pressure test only with dry compressed air at a maximum pressure of 2,75 bar.

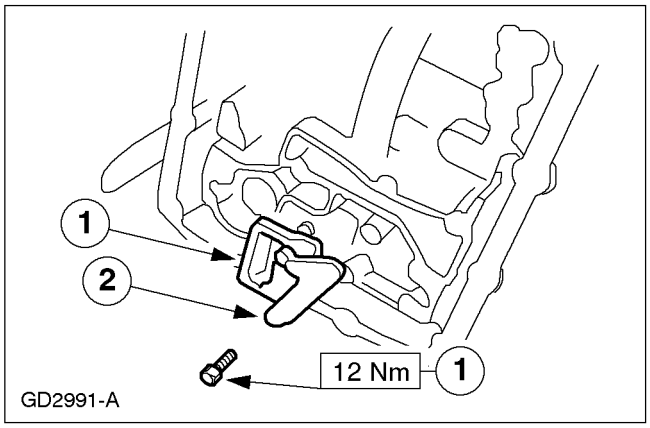
NOTE: In the event of leaks first check that the special tool is correctly attached.

Perform Compressed Air Test.

1. Test the reverse clutch.
2. Test the forward clutch.
3. Test the direct clutch.
4. Test the low and reverse clutch.
5. Test the loosened position of 2nd and 4th brake band.
6. Test the tightened position of 2nd and 4th brake band.

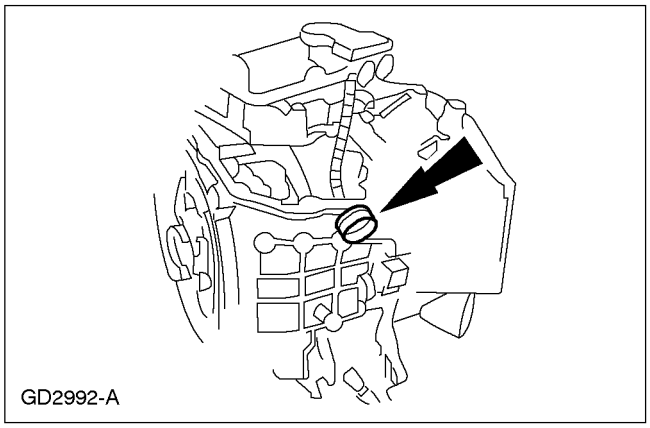


77. **Install the thermostatic fluid level control valve.**
    1. Install the thermostatic fluid level control valve.
    2. Install the bracket.
    3. Install the thermostatic fluid level control valve bracket retaining bolt.



78. **CAUTION: Do not pull wires or damage the solenoid body electrical connector, damage to the connector and terminals may result.**

Install the solenoid body electrical connector O-ring seal and install the electrical connector into its bore in the transaxle case.



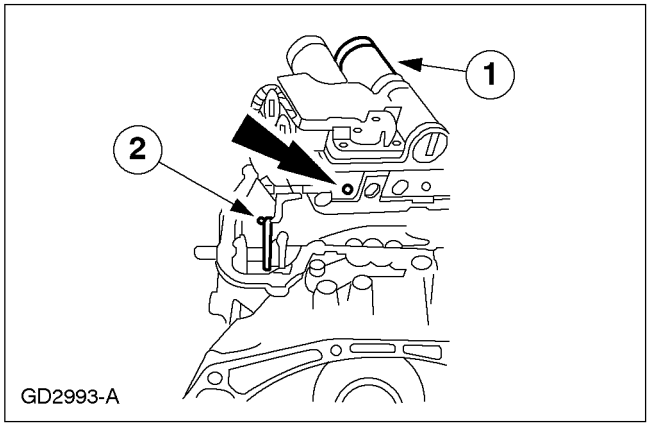
ASSEMBLY (Continued)

79. **CAUTION: Handle the main control valve body with care to prevent manual valve damage.**

Connect the manual valve.

1. Lift the main control away from the case.
2. Connect the Z-link to the manual valve.

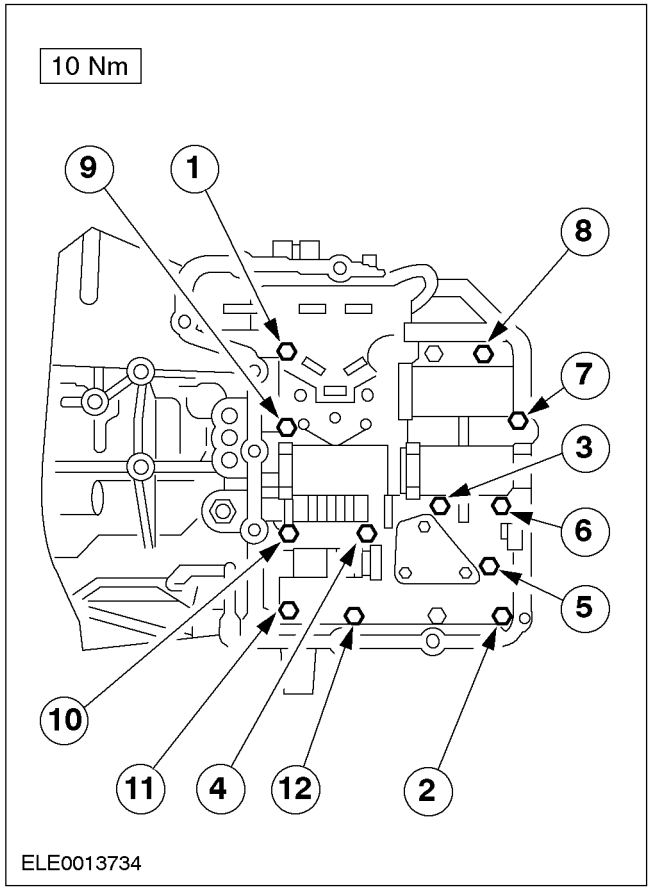
- Install the solenoid body retaining clip.



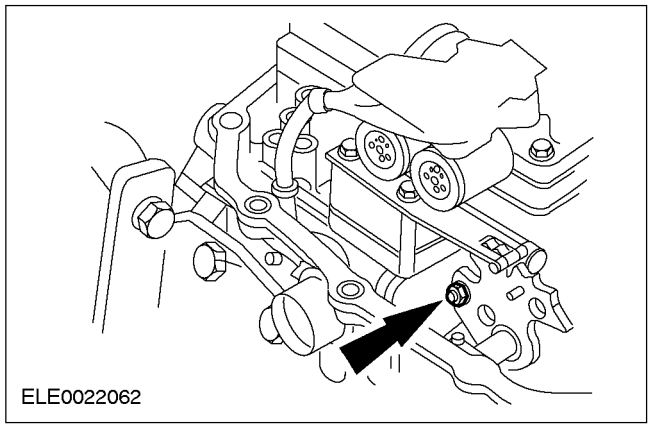
80. **NOTE:** Tighten the main control valve body retaining bolts in the sequence shown.

NOTE: Bolts 1, 7 and 9 are longer than the others.

Install the main control valve body bolts.



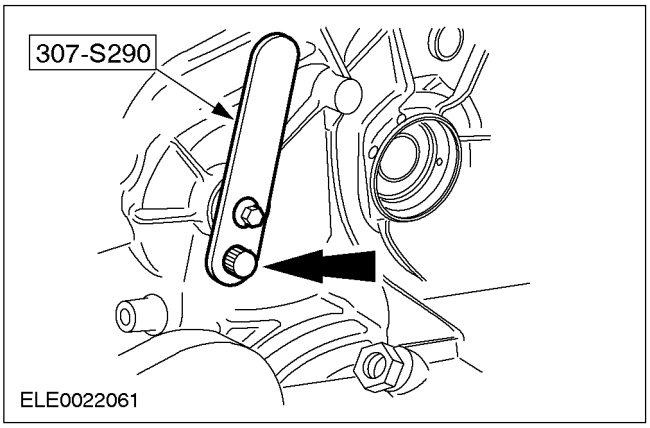
81. **Loosen the nut on the ball stud for the manual valve detent lever actuating rod assembly.**



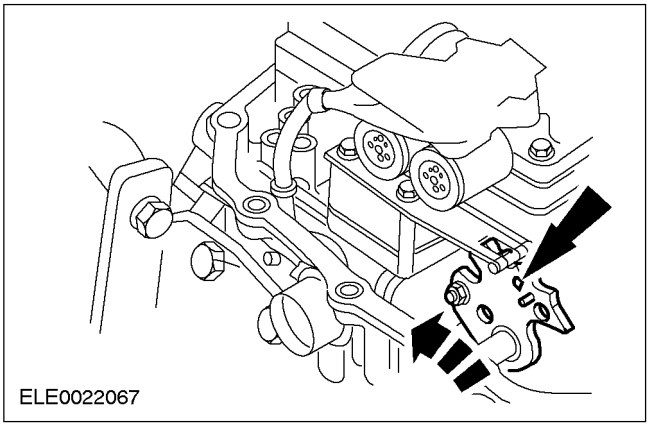
ASSEMBLY (Continued)

82. Move the manual control lever shaft to the "D" position.

- Install a pin to hold special tool in place.

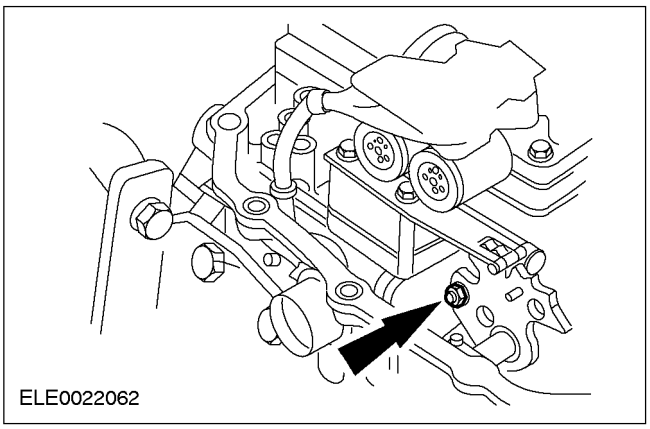


83. Move the manual valve detent lever assembly to the "D" position.



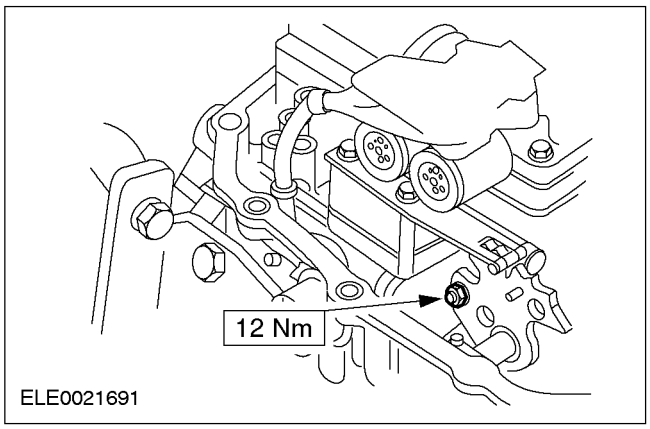
84. Tighten the nut on the ball stud finger tight.

- Remove the shifter pin from the special tool.

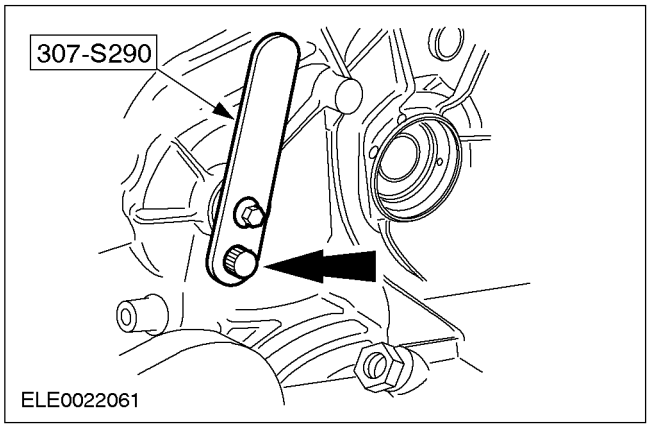


85. Adjust the shift linkage.

- Tighten the nut on the ball stud.
- Move back to the "D" position to recheck the adjustment.

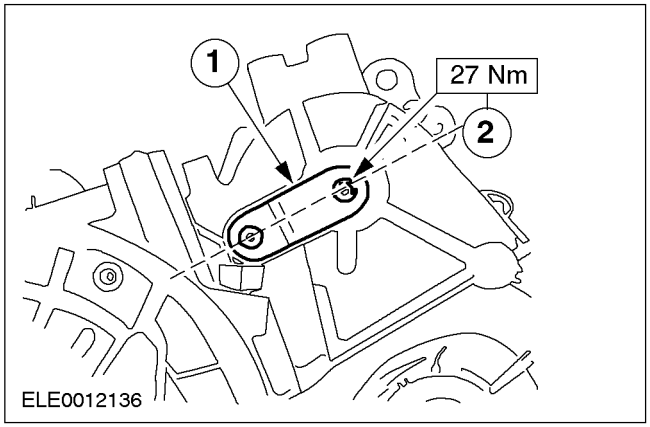


86. Using the special tool, recheck the manual control lever assembly setting.



87. Install the manual control lever.

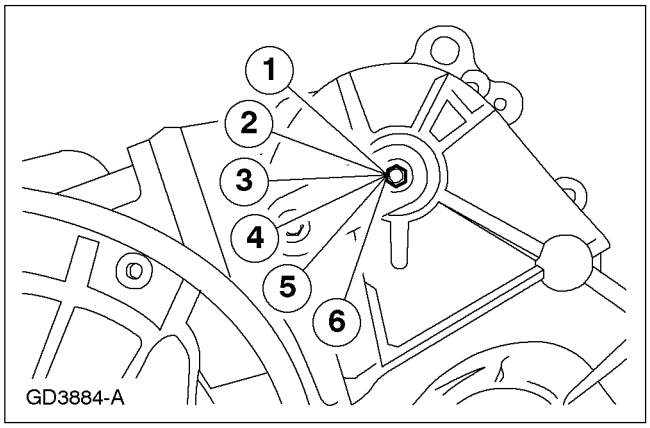
1. Install the manual control lever.
2. Tighten the manual control lever retaining bolt.



ASSEMBLY (Continued)

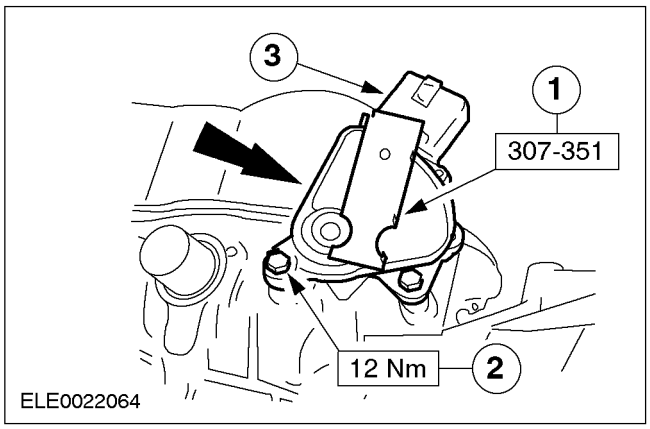
88. Rotate the manual valve detent lever assembly to the Neutral position.

1. Low 1
2. Low 2
3. Drive
4. Neutral
5. Reverse
6. Park



89. Using the special tool, install the transmission range (TR) sensor.

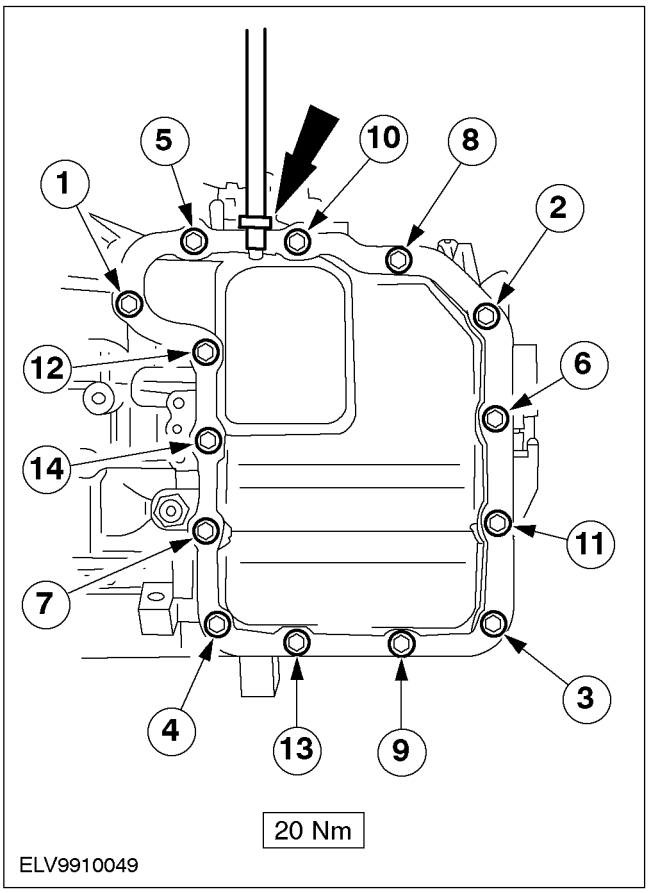
1. Install the special tool.
2. Tighten the sensor bolts.
3. Check the connector for damage.
   - Remove the special tool.



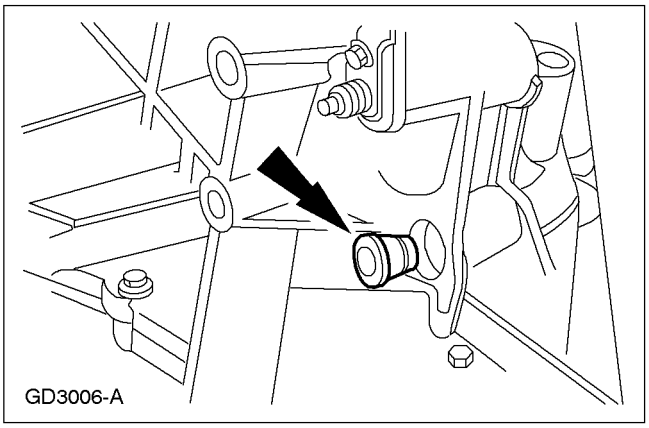
90. NOTE: Tighten the main valve control cover bolts in the sequence shown.

Install the main valve control cover.

- Install a new gasket.
- Install the main valve control cover bolts.



91. Install a new transmission filler tube grommet.

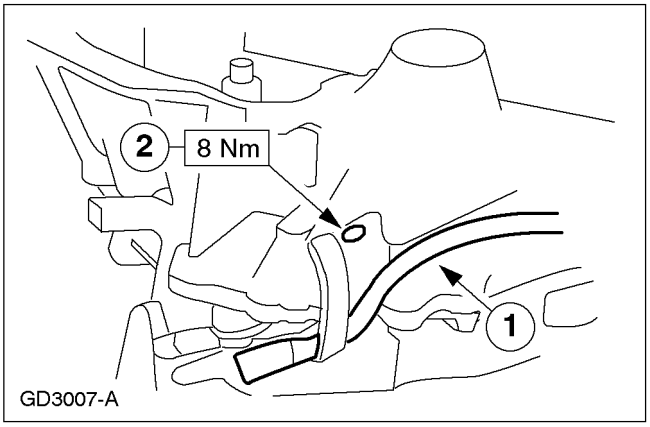


ASSEMBLY (Continued)

92. Install the transmission filler tube assembly.

1. Install the tube.
2. Install the transmission filler tube retaining bolt.

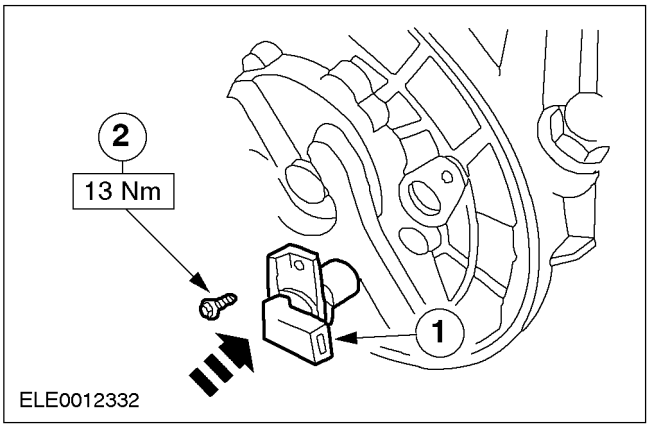
- Install the fluid level indicator.



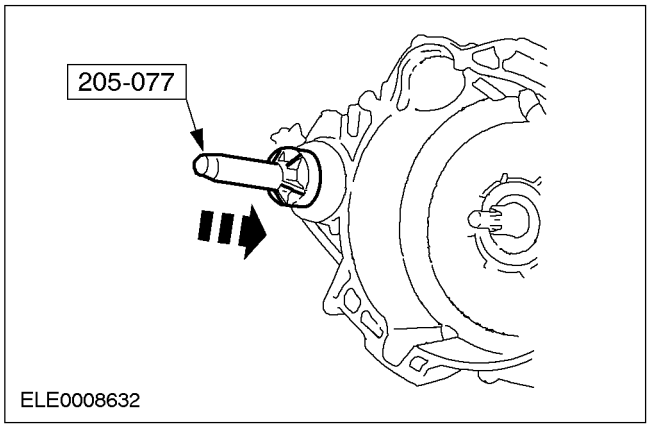
93. Install the turbine shaft speed (TSS) sensor.

- Install a new O-ring seal.

1. Lubricate the O-ring seal with petroleum jelly.
2. Install the TSS sensor retaining bolt.



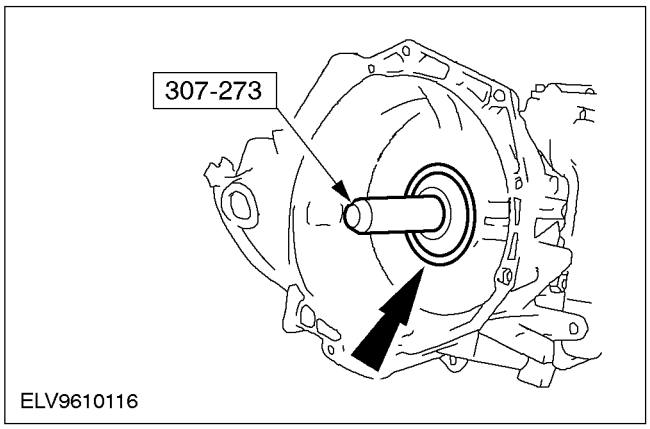
94. Using the special tool, install new half-shaft oil seals.



95. NOTE: Make sure the torque converter fluid seal garter spring does not become dislodged during installation. If the garter spring does become dislodged, install a new torque converter fluid seal.

Using the special tool, install a new torque converter fluid seal.

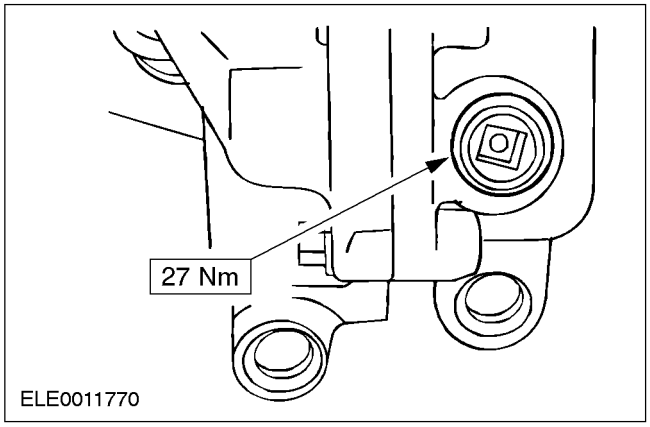
- Coat the torque converter fluid seal garter spring with petroleum jelly.



ASSEMBLY (Continued)

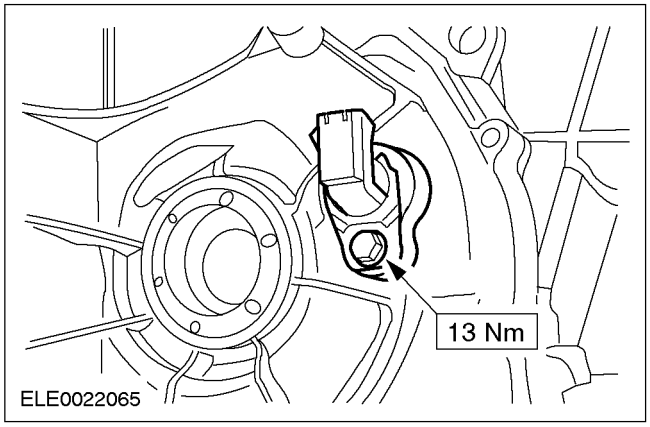
96. Install the drain plug.

- Use a new drain plug gasket.



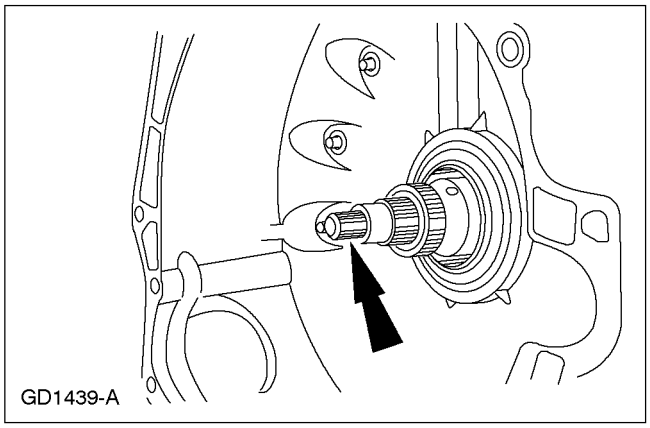
97. Install the output shaft speed (OSS) sensor with a new O-ring seal.

- Lubricate the O-ring seal with petroleum jelly.



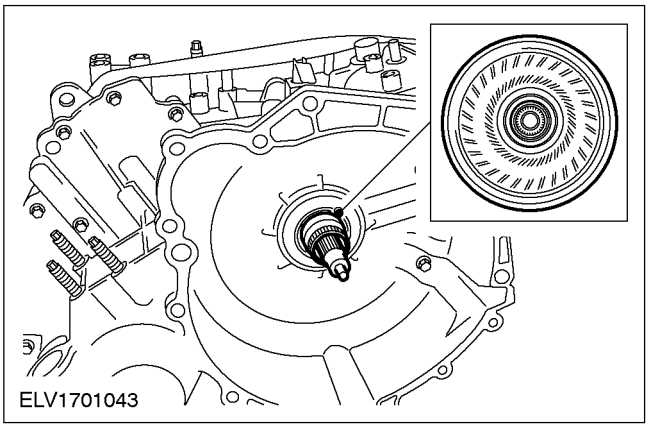
98. NOTE: Check correct rotation of the pump drive shaft.

Install the pump drive shaft.



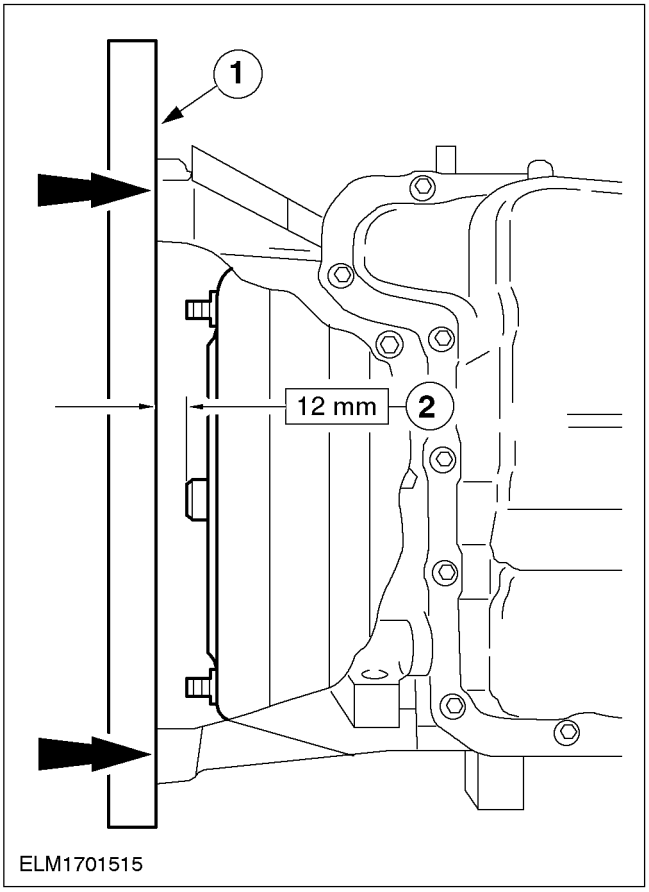
99. NOTE: The torque converter hub must engage fully with the oil pump drive gear.

Install the torque converter.



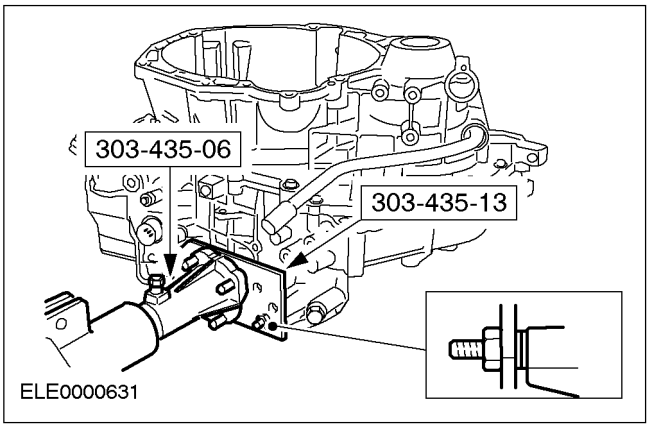
100. Check the torque converter installation depth.

1. Place a steel rule on the transaxle flange.
2. Check the distance between the transaxle flange and the torque converter centering pin.



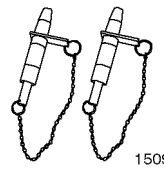
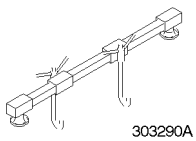
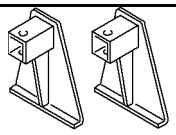
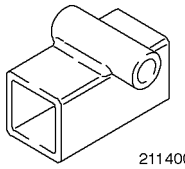
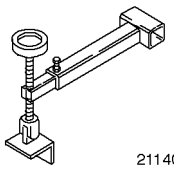
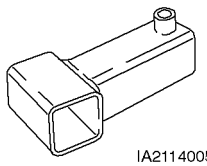
ASSEMBLY (Continued)

101. Remove the transaxle from the special tool.



INSTALLATION

Transaxle (17 214 0)

Special Tool(s)	
 15097A	Alignment Pins, Subframe 205-316 (15-097-A)
 303290A	Support Bar, Engine 303-290A (21-140A)
 2114001	Adapter for 303-290A 303-290-01 (21-140-03)
 2114002	Adapter for 303-290A 303-290-02 (21-140-02)
 2114003	Adapter for 303-290A 303-290-03A (21-140-03A)
 IA2114005	Adapter for 303-290A 303-290-05A (21-140-05A)

General Equipment
Securing straps
Transmission jack
Tire lever
Steel straightedge
Auxiliary plugs

Name	Specification
Washer	E830819S71
High-temperature grease	ESD-M1C220-A
Automatic transmission fluid	ESP-M2C166-H

INSTALLATION (Continued)

Installation

All Vehicles

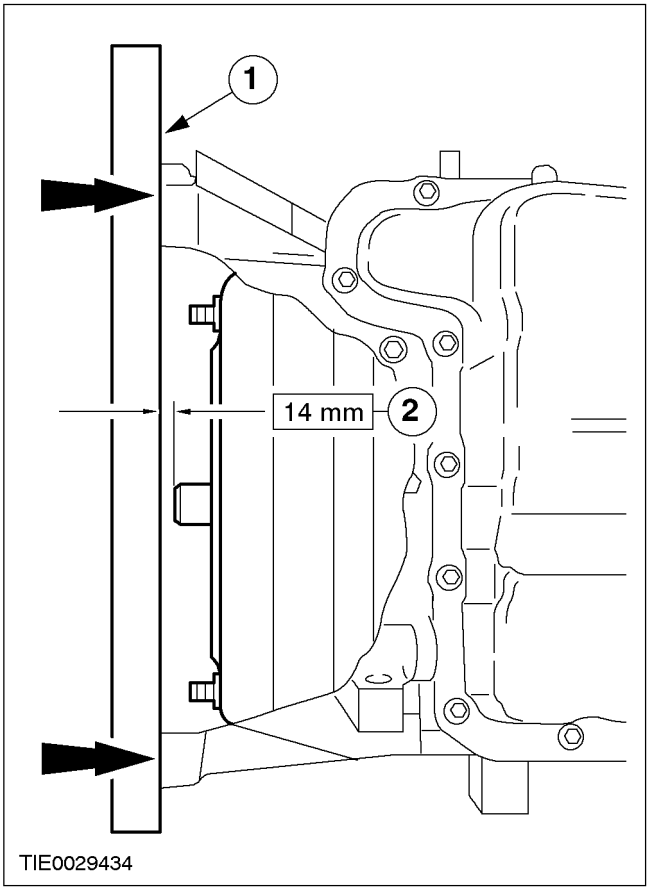
1. **CAUTION: The torque converter hub must be engaged fully in the oil pump drive gear.**

NOTE: The locations of engine and transaxle mountings and engine support insulators are described looking from the transaxle to the engine.

Check the installation depth of the torque converter.

1. Lay a steel straightedge across the automatic transaxle flange.
2. Check the installation depth between the transaxle flange and the torque converter centering spigot for the correct clearance.

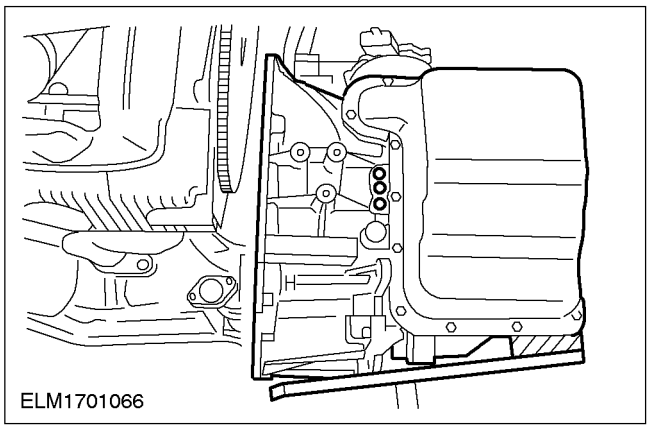
- Apply a thin layer of high-temperature grease to the centering spigot bore on the torque converter.



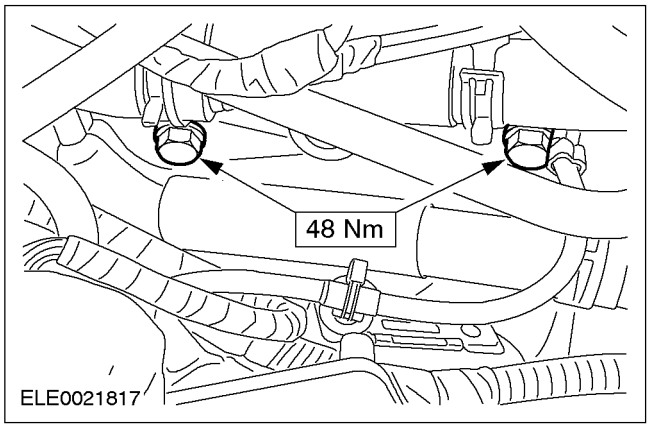
2. **CAUTION: The torque converter must remain at the correct installation depth throughout the entire installation procedure. Check that the adapter plate is in the correct position.**

Using the transmission jack install the transaxle.

- Make sure the studs on the torque converter are entered into the engine drive plate and loosely install in the transaxle retaining flange bolts.
- Remove the securing straps.

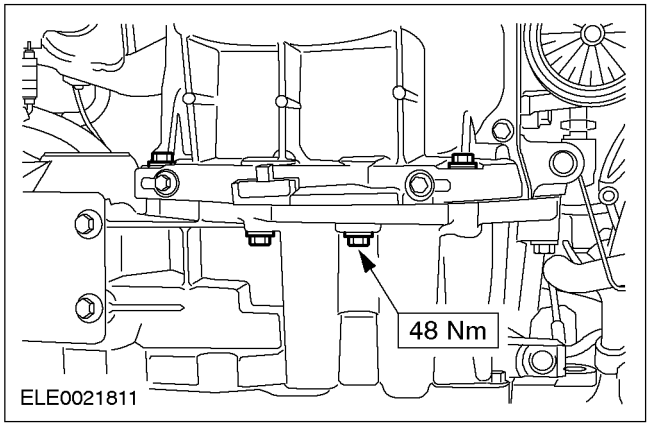


3. Install the upper transaxle retaining bolts.

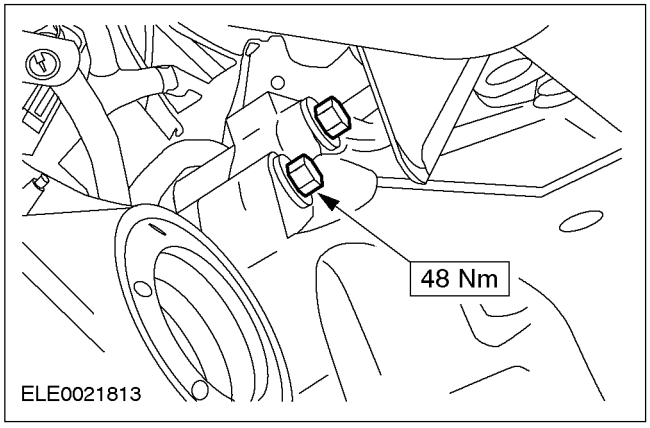


INSTALLATION (Continued)

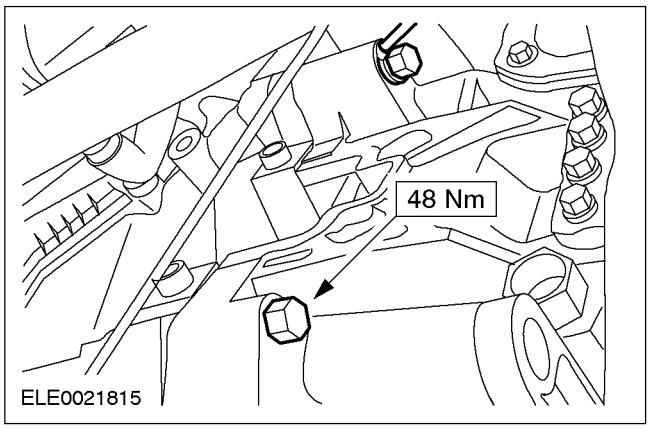
4. Install the lower transaxle retaining bolts.



5. Install the right-hand side transaxle retaining bolts.

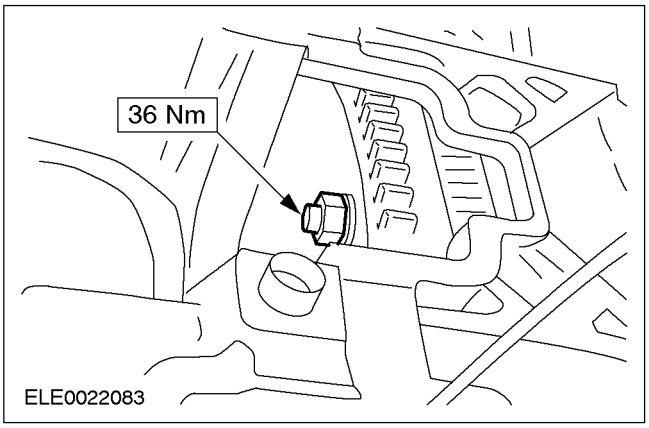


6. Install the left-hand side transaxle retaining bolts.



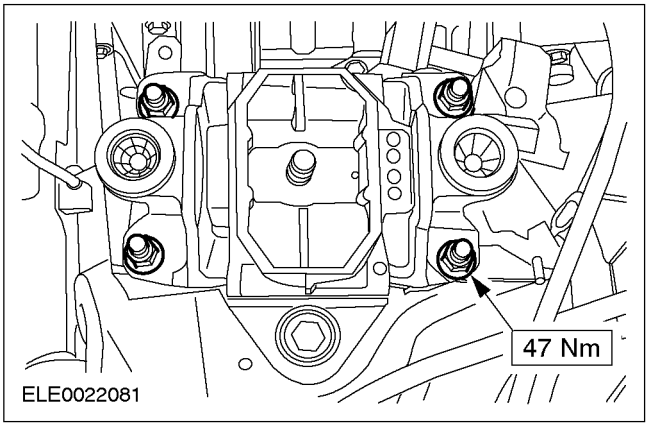
7. Attach the torque converter to the flywheel with new retaining nuts (four nuts).

- Install the rubber cover.

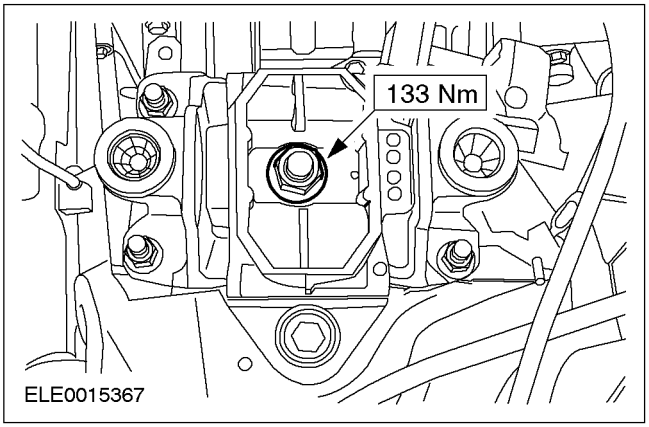


8. Lower the vehicle.

9. Install the rear engine and transaxle mounting bracket.

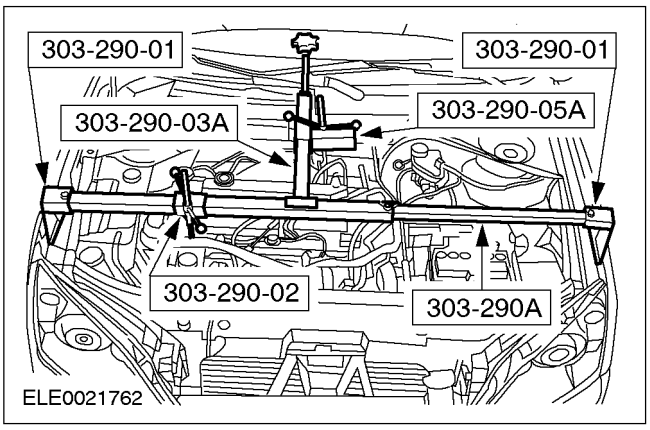


10. Install the rear engine mounting.

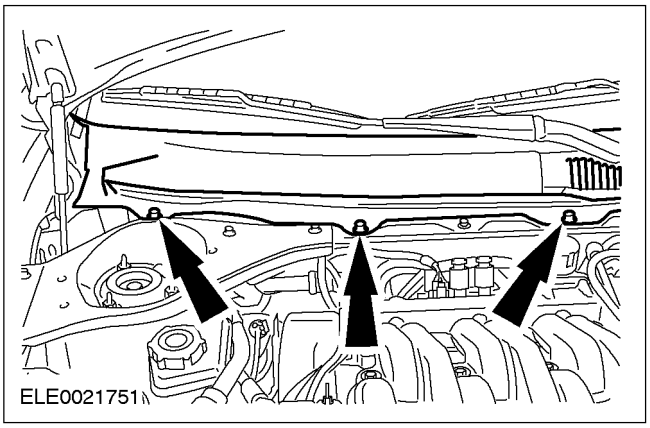


INSTALLATION (Continued)

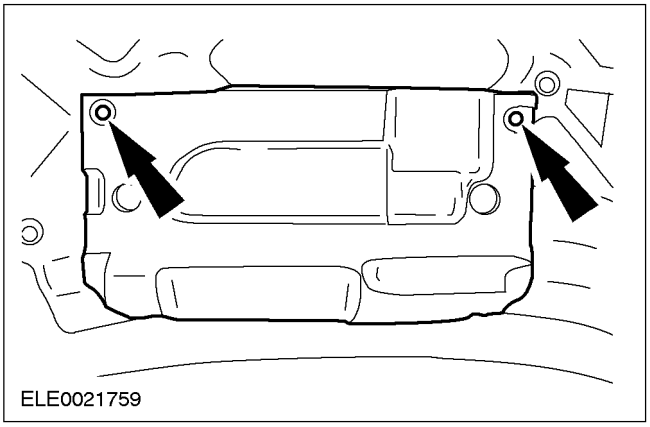
11. Remove the special tools.



12. Install the bulkhead cover.

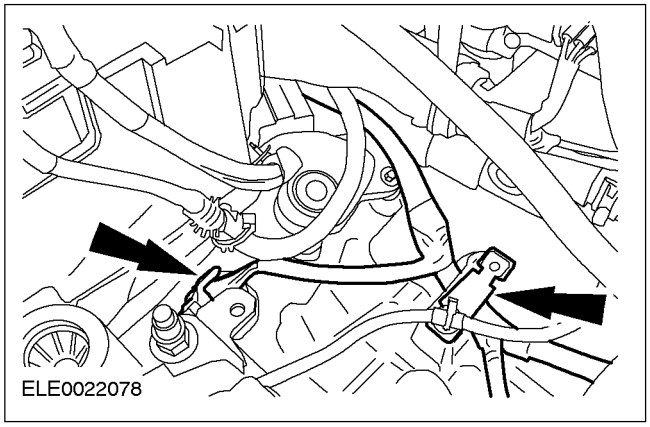


13. Install the plastic cover to the hood.

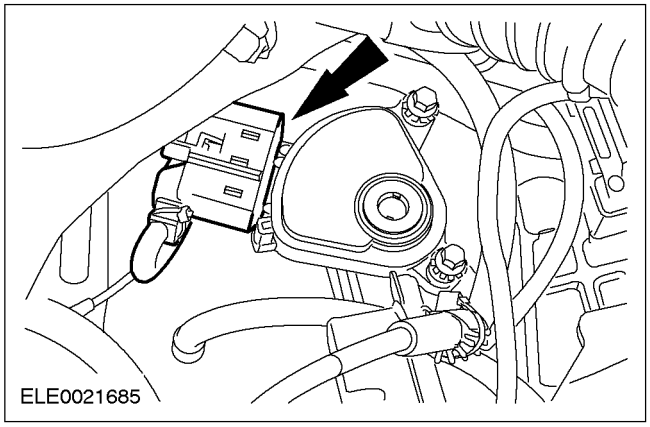


14. Connect the automatic transmission control electrical connector.

- Install the cable ties.
- Attach the wiring harness retaining clip.

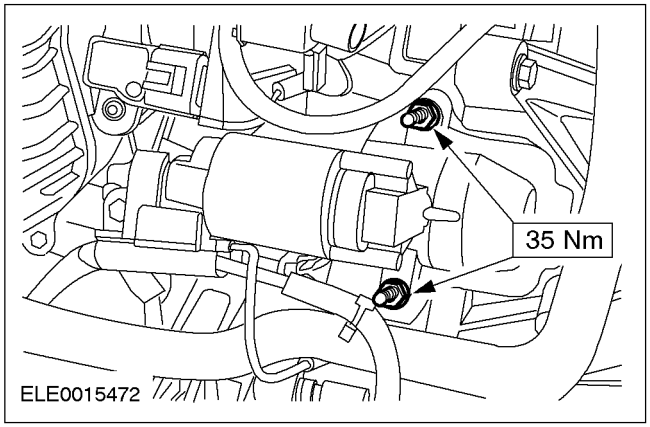


15. Connect the transmission range (TR) sensor electrical connector.



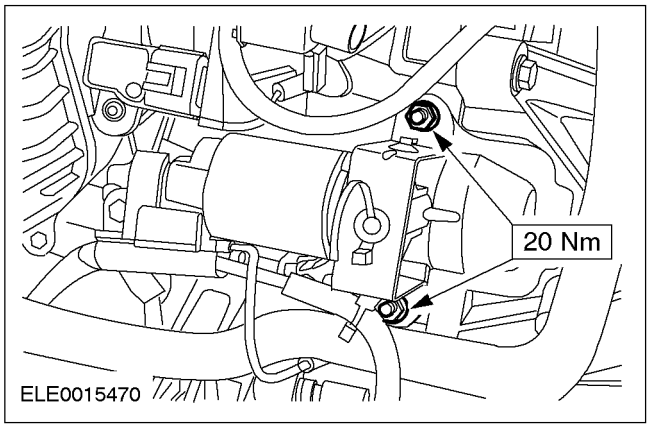
16. Raise and support the vehicle. For additional information, refer to Section 100-02.

17. Install the starter motor.



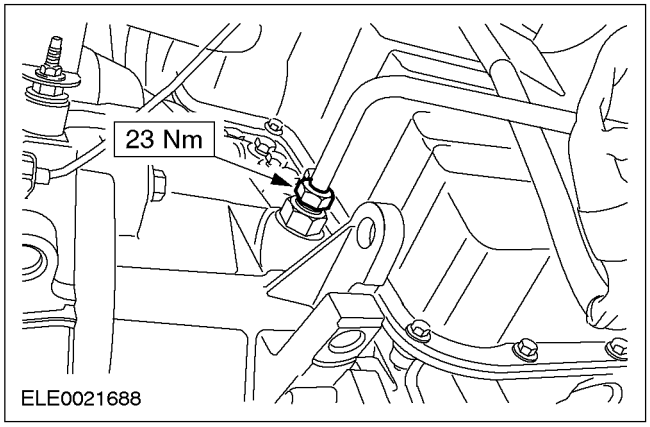
INSTALLATION (Continued)

18. **Install the wiring harness and fluid cooler pipe bracket.**
    - Attach the fluid cooler pipe.
    - Attach the wiring harness.

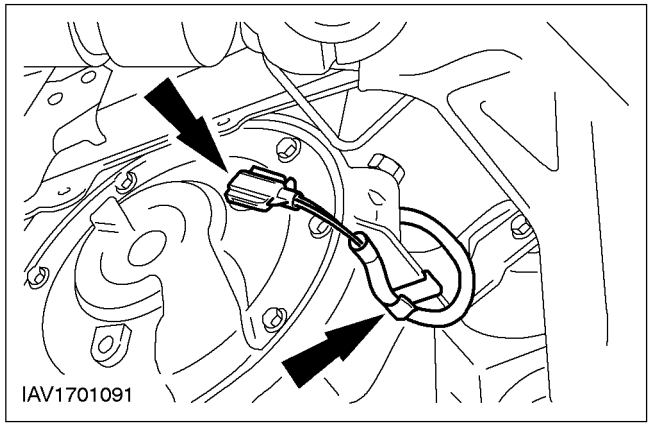


19. **CAUTION: Use an open ended spanner on the fluid line adaptor to prevent it from turning.**

    Attach the fluid cooler pipe to the transaxle.

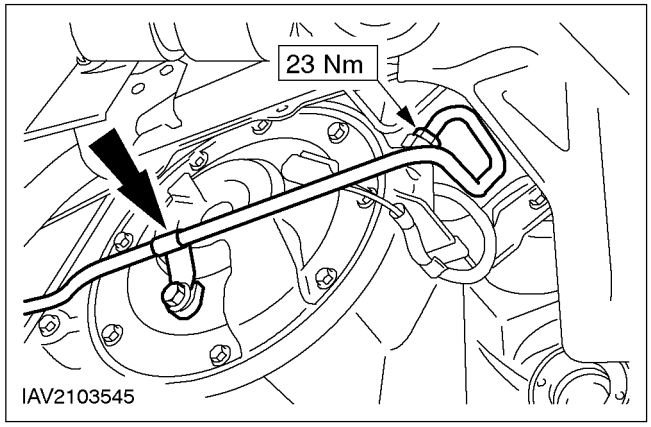


20. **Connect the turbine shaft speed (TSS) sensor electrical connector (colored white).**
    - Install the wiring retaining clip.



21. **CAUTION: Use an open ended spanner on the fluid line adaptor to prevent it from turning.**

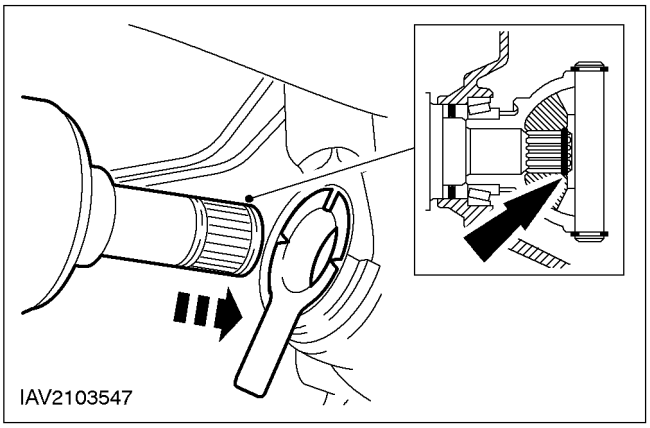
    Attach the fluid cooler pipe to the transaxle.
    - Attach the fluid pipe bracket to the transaxle.



INSTALLATION (Continued)

22. **CAUTION: The inner joint must not be bent more than 18 degrees, the outer joint must not be bent more than 45 degrees.**

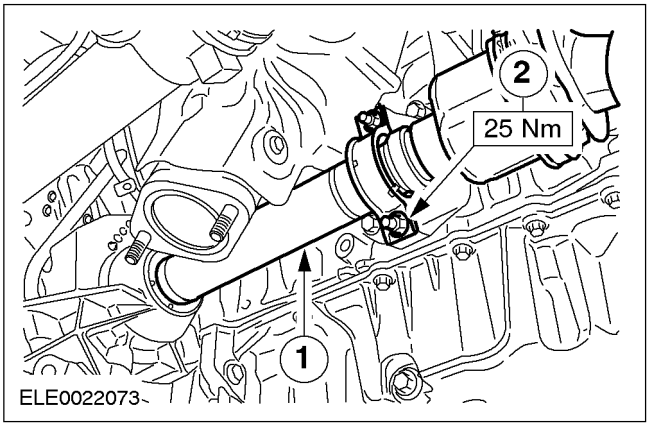
    Attach the left-hand front drive halfshaft.



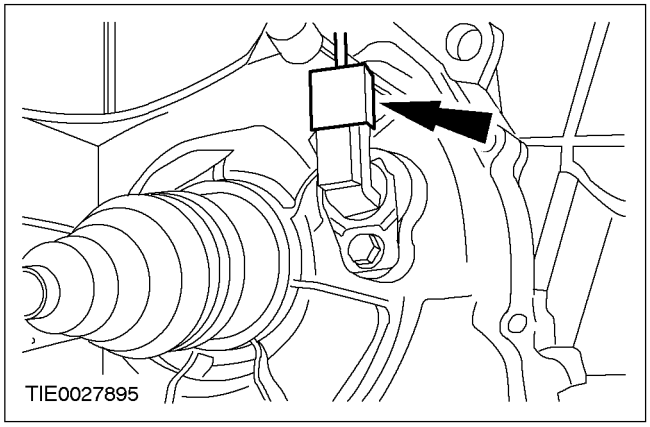
23. **CAUTION: The inner joint must not be bent more than 18 degrees, the outer joint must not be bent more than 45 degrees.**

    Attach the right-hand front drive halfshaft and intermediate shaft.

    1. Push the intermediate shaft into the output flange.
    2. Install a new centre bearing cap and retaining nuts.

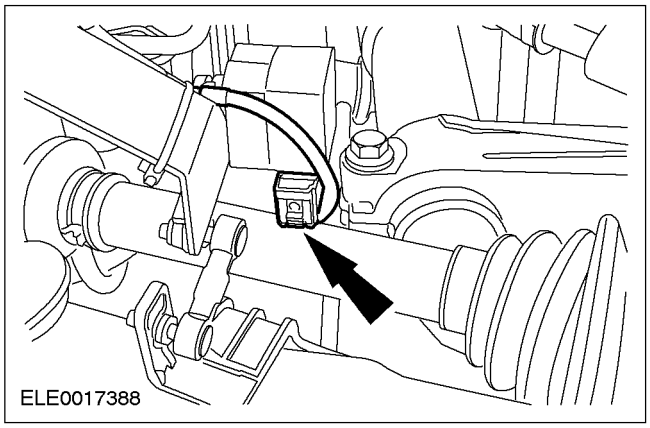


24. **Connect the output shaft speed (OSS) sensor electrical connector (colored black).**



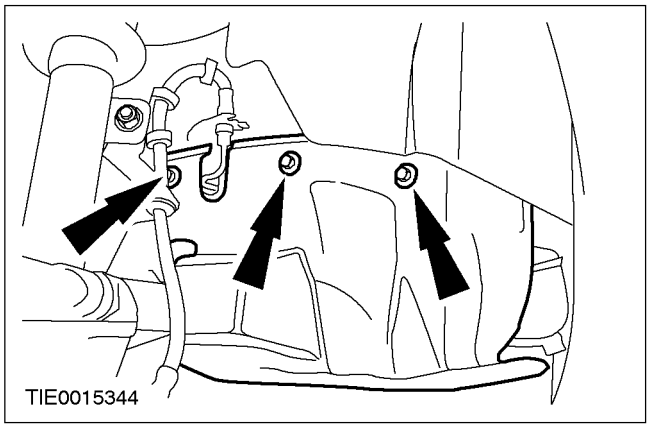
Vehicles with Xenon headlamps

25. **Connect the headlamp levelling sensor electrical connector.**



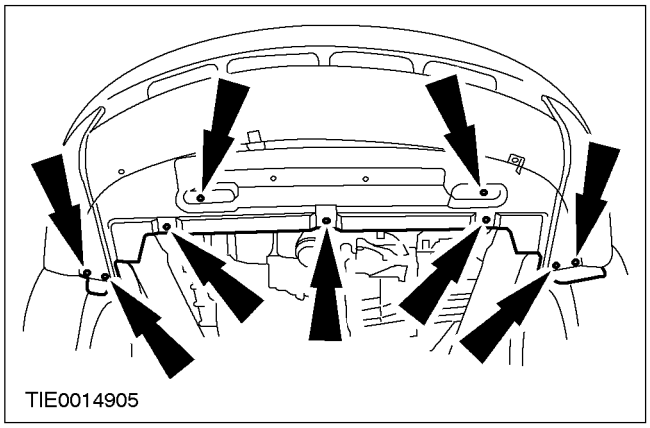
All vehicles

26. **Install the accessory drive belt cover.**

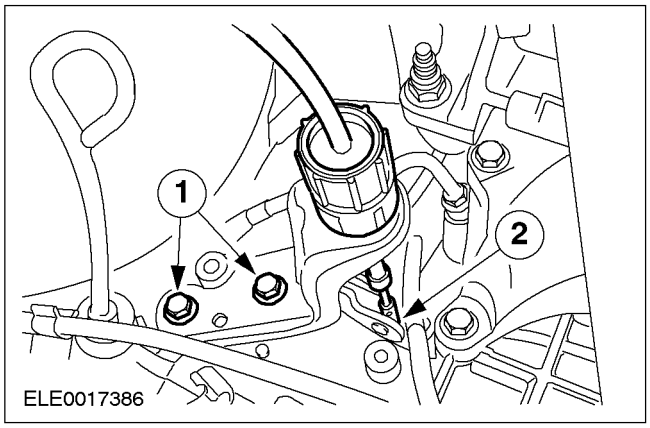


INSTALLATION (Continued)

27. **Install the subframe. For additional information, refer to Section 502-00.**
28. **Install the radiator splash shield.**

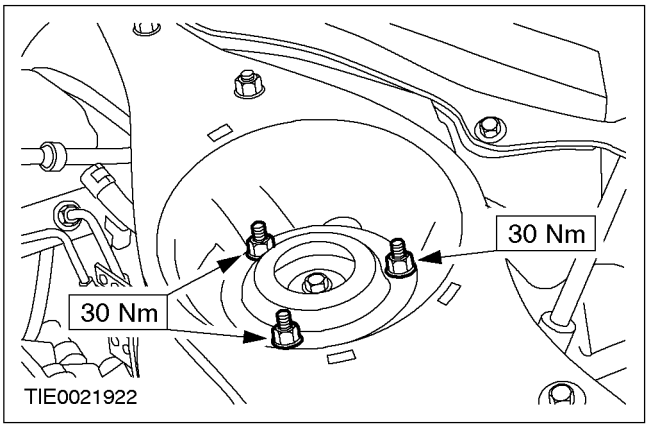


29. **Lower the vehicle.**
30. **Attach the selector lever cable to the transaxle.**
    1. Install the selector lever cable bracket.
    2. Attach the selector lever cable.

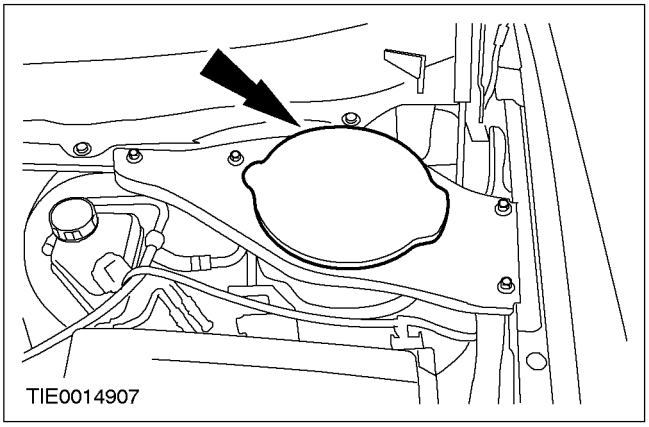


31. **Install the air cleaner. For additional information, refer to Section 303-01A / 303-01B / 303-01C / 303-01D.**
32. **Refill the transaxle. For additional information, refer to Transmission Fluid Drain and Refill in this section.**
33. **CAUTION: Use an Allen key to prevent the piston rod from rotating.**

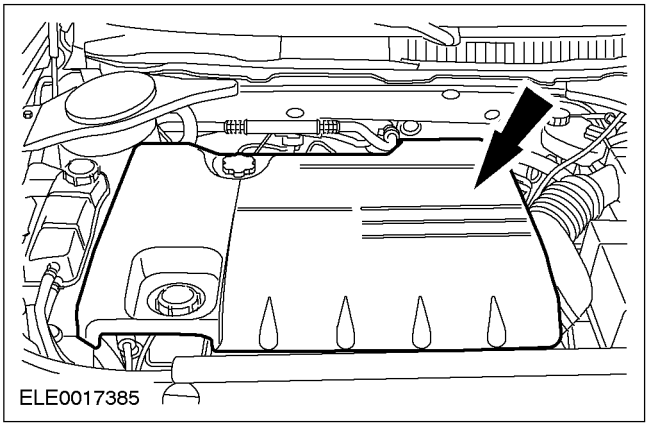
    Tighten the suspension top mount nut.



34. **Install the strut and spring assembly top mount brace cover.**

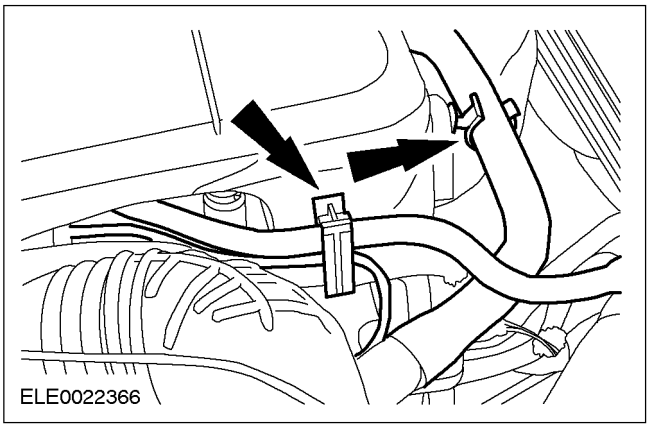


35. **Install the engine upper cover.**



INSTALLATION (Continued)

36. Install the pipes, attach the pipes and hoses to the engine upper cover.



37. Connect the battery ground cable. For additional information, refer to Section 414-01.

SECTION 307-01B Automatic Transmission/Transaxle

VEHICLE APPLICATION: 2003.0 Mondeo

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Transaxle — 2.5L ..... (17 214 0) 307-01-111

SPECIFICATIONS

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Automatic transmission fluid	WSS-M2C922-A1
Sealer	WSS-M4G320-A3
Grease	WSD-M1C230-A

Capacities

	Litres
Automatic transmission fluid (2.0L diesel engine)	7.9
Automatic transmission fluid (2.5L V6 engine)	8.8

Gear Ratios

Description	Gear Ratio
Fifth gear	3.801
Second gear	2.131
Third gear	1.364
Fourth gear	0.935
Fifth gear	0.685
Reverse gear	2.970
Final drive (2.0L diesel engine)	3.491
Final drive (2.5L V6 engine)	3.712

Torque Specifications

Item	Nm	lb-ft	lb-in
Transmission range (TR) sensor retaining bolt	6	-	53
Transaxle housing to engine retaining bolts	48	35	-
Torque converter retaining nuts	36	27	-
Engine rear mount bracket retaining bolts	80	59	-
Engine rear mount retaining bolts M12	133	98	-
Engine rear mount retaining bolts M10	48	35	-
Ground cable to the transaxle retaining bolt	20	15	-
Cable bracket bolts	10	-	89
Intermediate shaft center bearing cap locknuts	25	18	-
Charge air cooler intake hose retaining bolts	20	15	-
Selector lever cable cover retaining bolts	22	16	-
Strut and spring assembly top mount retaining nuts	30	22	-
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DESCRIPTION AND OPERATION

Transaxle Description

General

The 5F31J automatic transmission has been developed by the Japanese automatic transmission manufacturer Jatco TransTechnology.

5F31J stands for:

- **5**- 5 forward drive gears
- **F**- front-wheel drive
- **31**- maximum input torque of 310 Nm
- **J**- Jatco TransTechnology

The transmission is fully-automatic and electronically controlled.

It is available in the Mondeo in conjunction with the following engines:

- 2.5L Duratec
- 2.0L Duratorq TDCi

The transmission ratios are achieved with three planetary gearsets on two shafts. The individual components are driven or held by means of four clutches, three brakes and two roller-type one-way clutches.

A torque converter lock-up clutch (TCC) ensures that fuel consumption is optimised. It is engaged by the transmission control unit depending on the vehicle speed and the engine load.

If the vehicle is stopped while a gear is engaged, then the transmission control system ensures that the transmission is shifted into neutral (currently only available on vehicles with a diesel engine). This results in improved NVH characteristics, reduced fuel consumption and reduced emissions.

The transmission control unit calculates the gearshift timing according to the personal driving style of the driver. The current driving resistance, such resistance due to towing a trailer or driving uphill/downhill in mountains or steep hills, is also taken into account when calculating the gearshift timing.

Gears can be selected either automatically (selector lever position "D") or by the driver (Select-Shift-Mode). The transmission range or selected gear (Select-Shift-Mode) is indicated to the driver in the instrument panel.

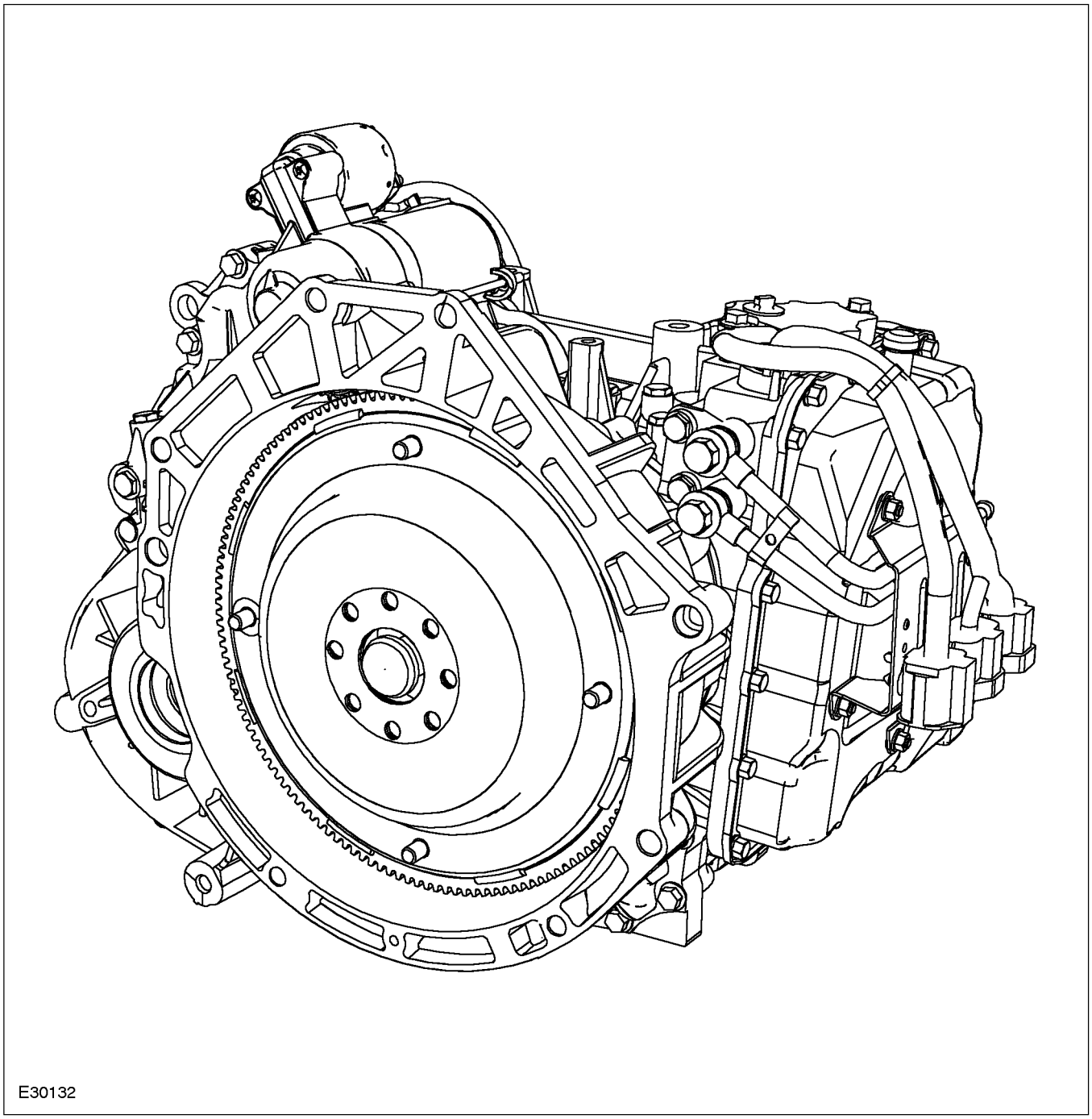
In the event of failure of key electronic components a hydraulic emergency running programme provides restricted operation of the transmission.

For one year initially no repairs are planned on the transmission, apart from the replacement of various oil seals, the main control body, individual solenoid valves, the torque converter and the transmission range (TR) sensor.

Under normal operating conditions the transmission fluid is filled for service life of the transmission and does not need to be changed.

At a glance

DESCRIPTION AND OPERATION



Transmission layout

DESCRIPTION AND OPERATION (Continued)

- 5-speed automatic transmission for FWD
- Three simple planetary gearsets on two shafts
- Transmission ratios achieved by means of four multi-plate clutches, two multi-plate brakes, one brake band and two one-way clutches
- The final drive is integrated into the transmission housing.
- Electronically controlled, hydraulically activatedTCC
- Gearshift timing is calculated by the transmission control unit according to the individual driving style of the driver and the current driving resistance.
- Automatic gear selection by the transmission control unit or manual gear selection by the driver in Select-Shift-Mode
- Automatic engagement of neutral when the vehicle is stationary to stabilise idling and reduce fuel consumption and emissions (only on vehicles with a diesel engine)

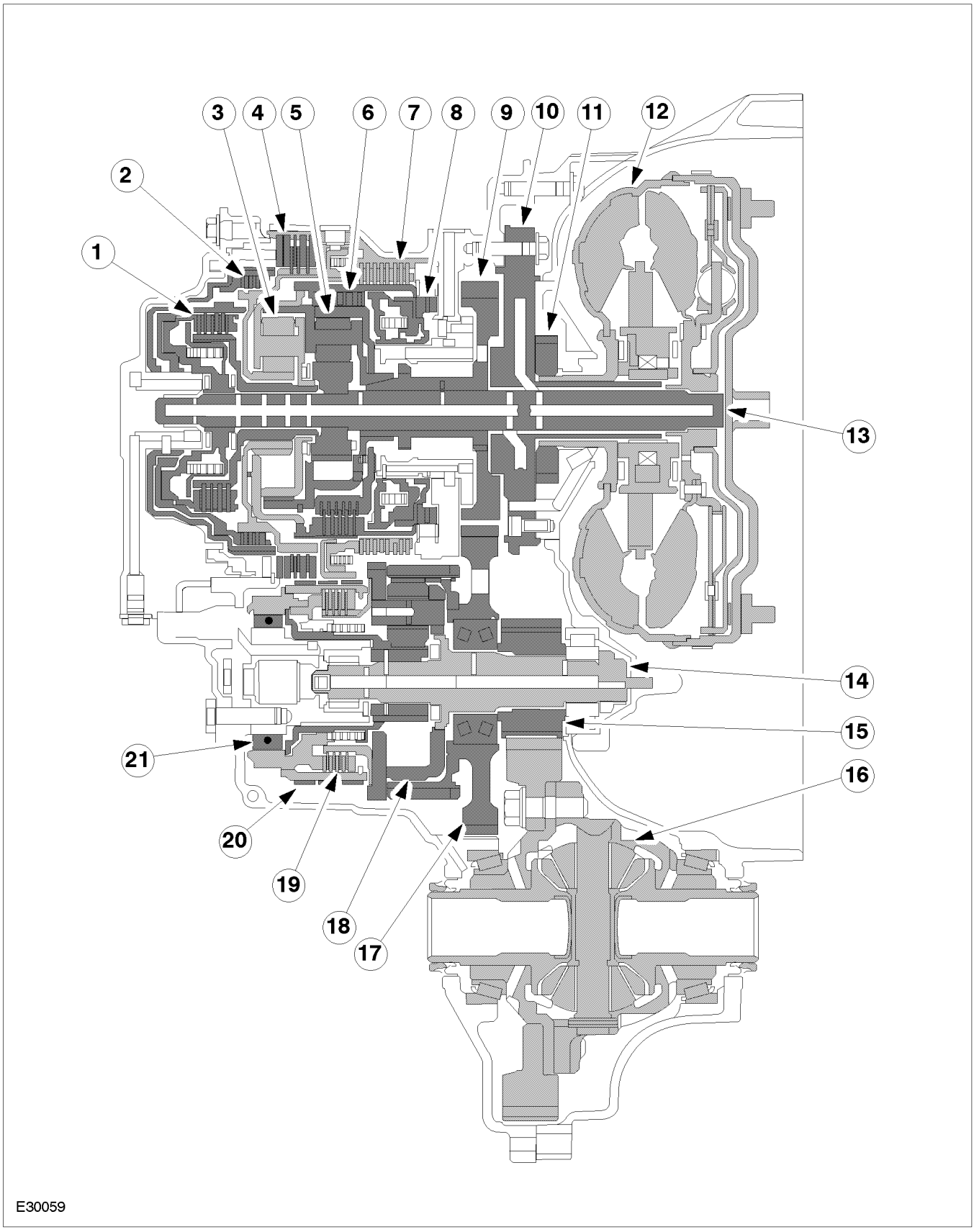
Transmission ratios in the individual gears:

Gear	Transmission ratio
1st gear	3.801
2nd gear	2.131
3rd gear	1.364
4th gear	0.935
5th gear	0.685
Reverse gear	2.970

Transmission control

DESCRIPTION AND OPERATION (Continued)

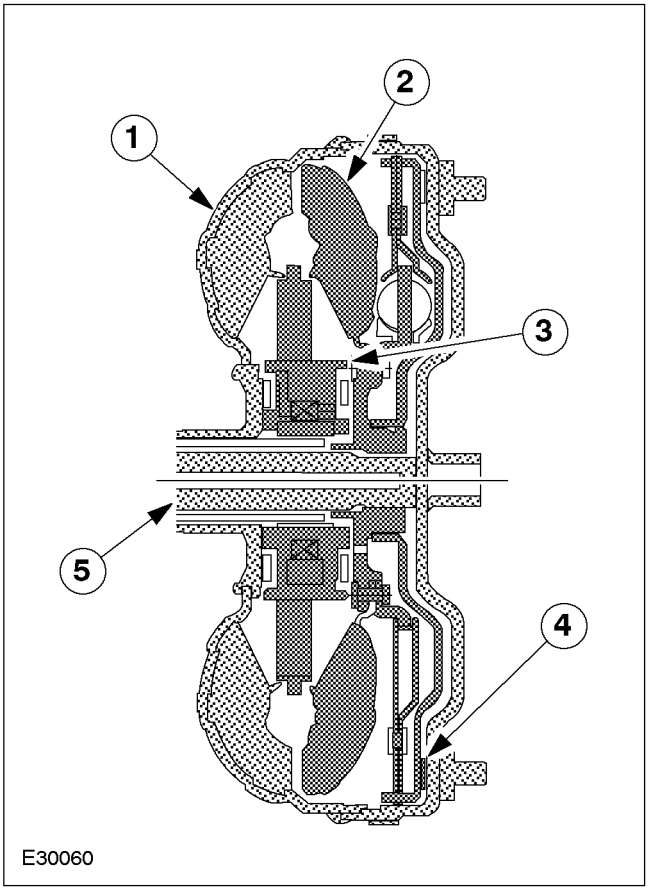
Transmission cross-section



DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1	-	3rd-5th gear clutch
2	-	Reverse clutch
3	-	1st planetary gearset
4	-	2nd/4th/5th gear brake
5	-	2nd planetary gearset
6	-	1st-3rd gear clutch
7	-	Reverse gear brake
8	-	1st gear one-way clutch
9	-	Driven gear of 1st and 2nd planetary gearset
10	-	Stator shaft
11	-	Oil pump
12	-	Torque converter
13	-	Transmission input shaft
14	-	Intermediate shaft
15	-	Driven gear of reduction planetary gearset
16	-	Differential assembly
17	-	Drive gear for reduction planetary gearset
18	-	Reduction planetary gearset
19	-	5th gear clutch
20	-	Reduction brake band
21	-	Reduction one-way clutch

Torque converter with TCC



Item	Part Number	Description
1	-	Torque converter housing and impeller
2	-	Turbine
3	-	Stator with roller-type one-way clutch
4	-	TCC
5	-	Transmission input shaft

NOTE: Three different torque converters are used, depending on the engine variant.

The torque converter hydraulically transmits the output torque from the engine to the input shaft of the transmission.

The stator increases the torque up to the clutch point (approx. 90% speed difference between the impeller and the turbine).

In order to increase the efficiency of the automatic transmission, the torque converter is also equipped with a hydraulically activated TCC

DESCRIPTION AND OPERATION (Continued)

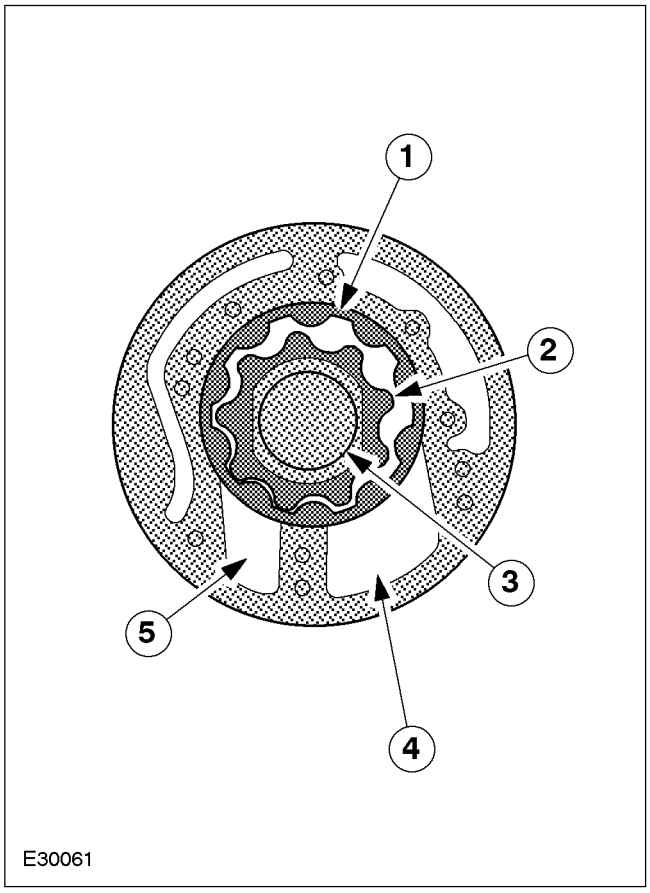
The torque converter lock-up clutch (is applied with controlled slip to ensure soft engagement.)

When the TCC is engaged, the torque is transmitted directly from the crankshaft via the torque converter housing to the transmission input shaft.

Under normal operating conditions, the TCC can be activated in selector lever position "D" in 3rd, 4th and 5th gear, as well as in 2nd gear if the temperature of the transmission fluid is too high.

When Select-Shift-Mode is activated the TCC can be activated in all forward drive gears.

Oil pump



Item	Part Number	Description
1	-	Outer ring
2	-	Inner ring
3	-	Drive (input)
4	-	Suction side
5	-	High-pressure side

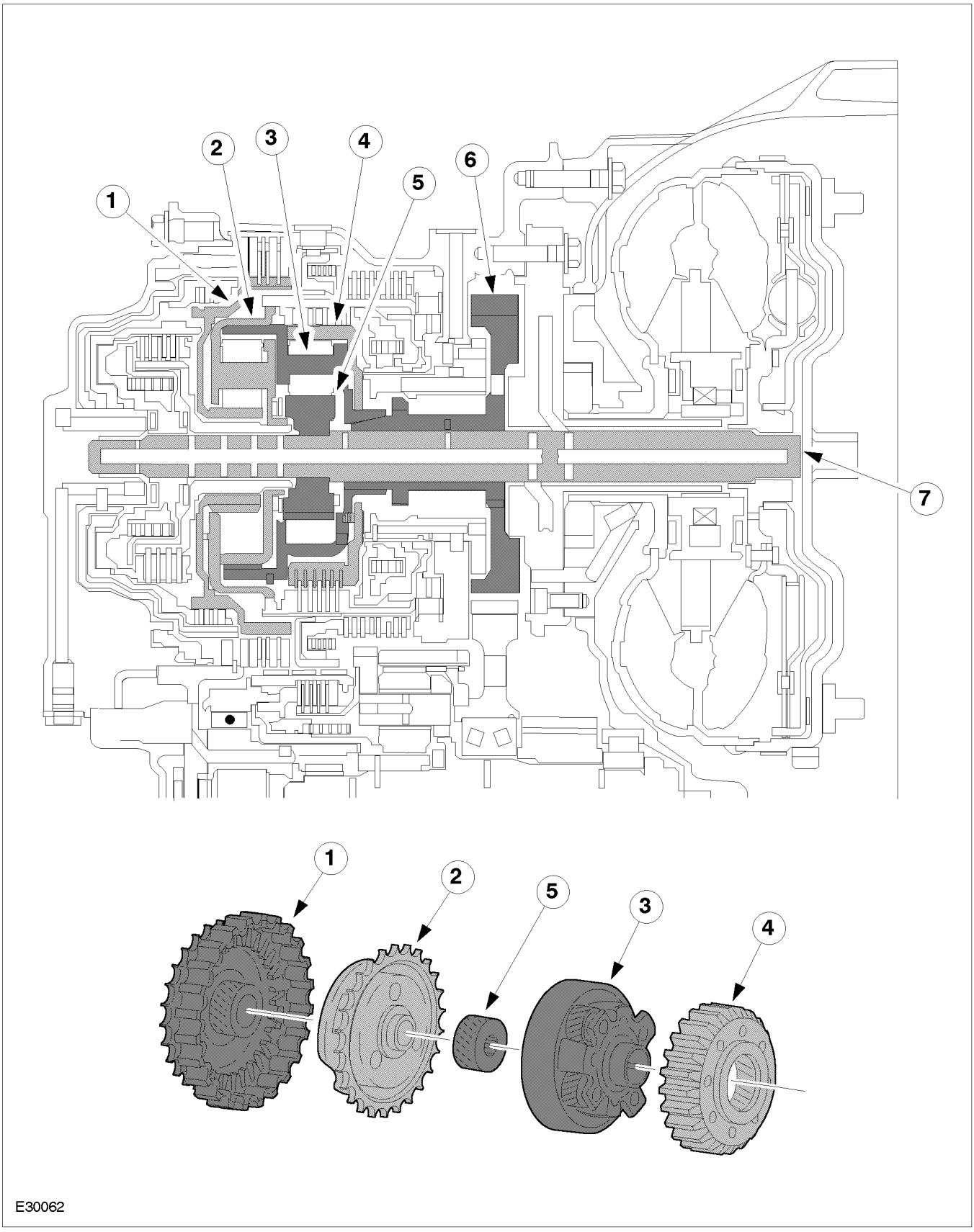
The oil pump is a G-rotor oil pump.

It sucks up transmission fluid from the sump, builds up the oil pressure and then supplies it under high pressure to the main control body.

The oil pump is driven by the crankshaft via the torque converter housing.

DESCRIPTION AND OPERATION

1. and 2nd planetary gearset



DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1	-	Sun gear (1st set)
2	-	Planetary gear carrier (1st set)
3	-	Ring gear (1st set) and planetary gear carrier (2nd set)
4	-	Ring gear (2nd set)
5	-	Sun gear (2nd set)
6	-	Driven gear
7	-	Transmission input shaft

The 1st and 2nd planetary gearsets are located on the level of the transmission input shaft.

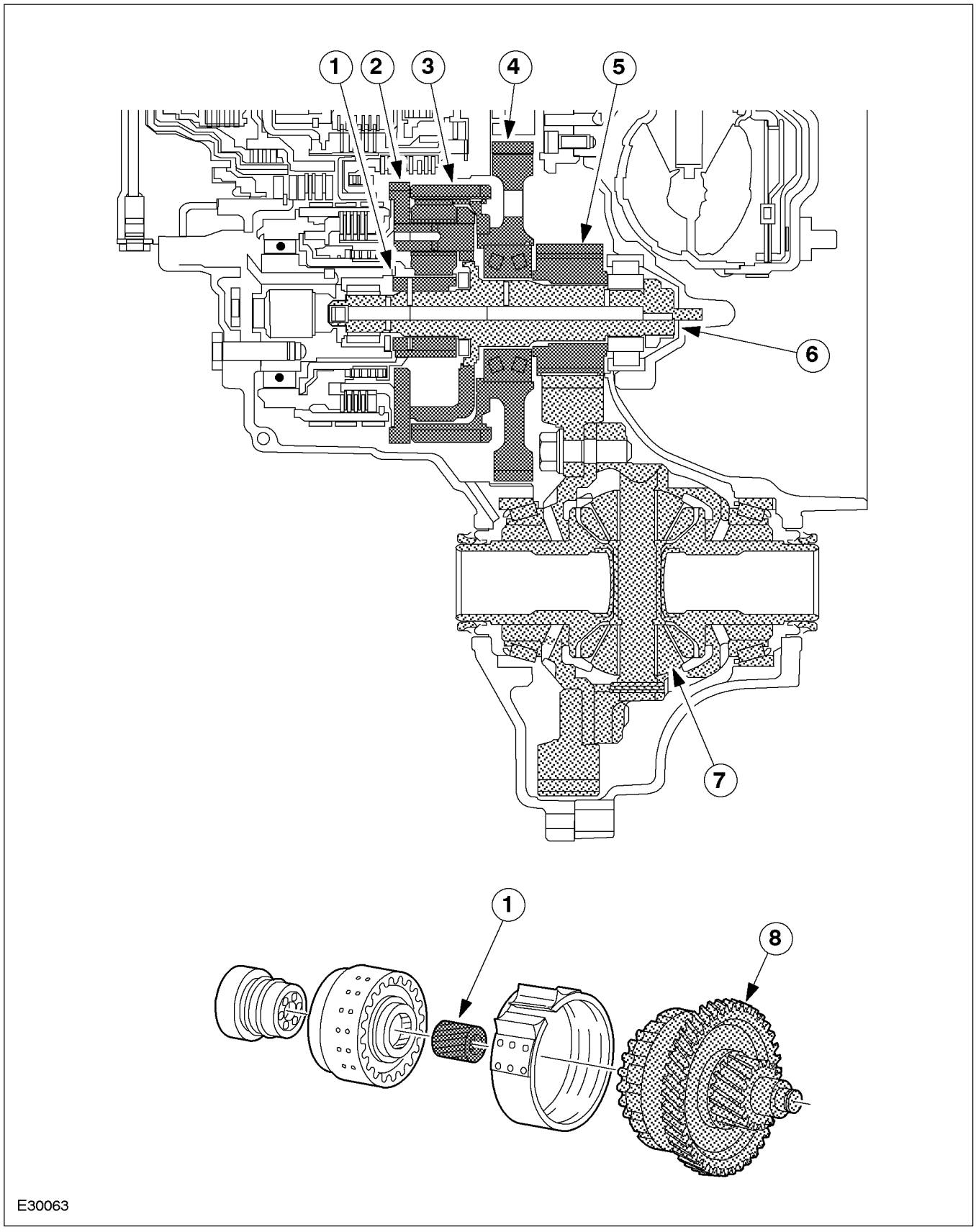
They are two simple planetary gearsets, whereby the ring gear (1st set) and the planetary gear carrier (2nd set) form a single component.

Through actuation of various clutches and brakes, certain components of the planetary gearsets are driven while others are held still. The different combinations of driven/held components result in different transmission ratios.

Drive is output via the ring gear (1st set) and the planetary gear carrier (2nd set) to the driven gear.

DESCRIPTION AND OPERATION (Continued)

Reduction planetary gearset



DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1	-	Sun gear
2	-	Planetary gear carrier
3	-	Ring gear
4	-	Drive gear for reduction planetary gearset
5	-	Driven gear of reduction planetary gearset
6	-	Intermediate shaft
7	-	Differential assembly
8	-	Reduction gearing

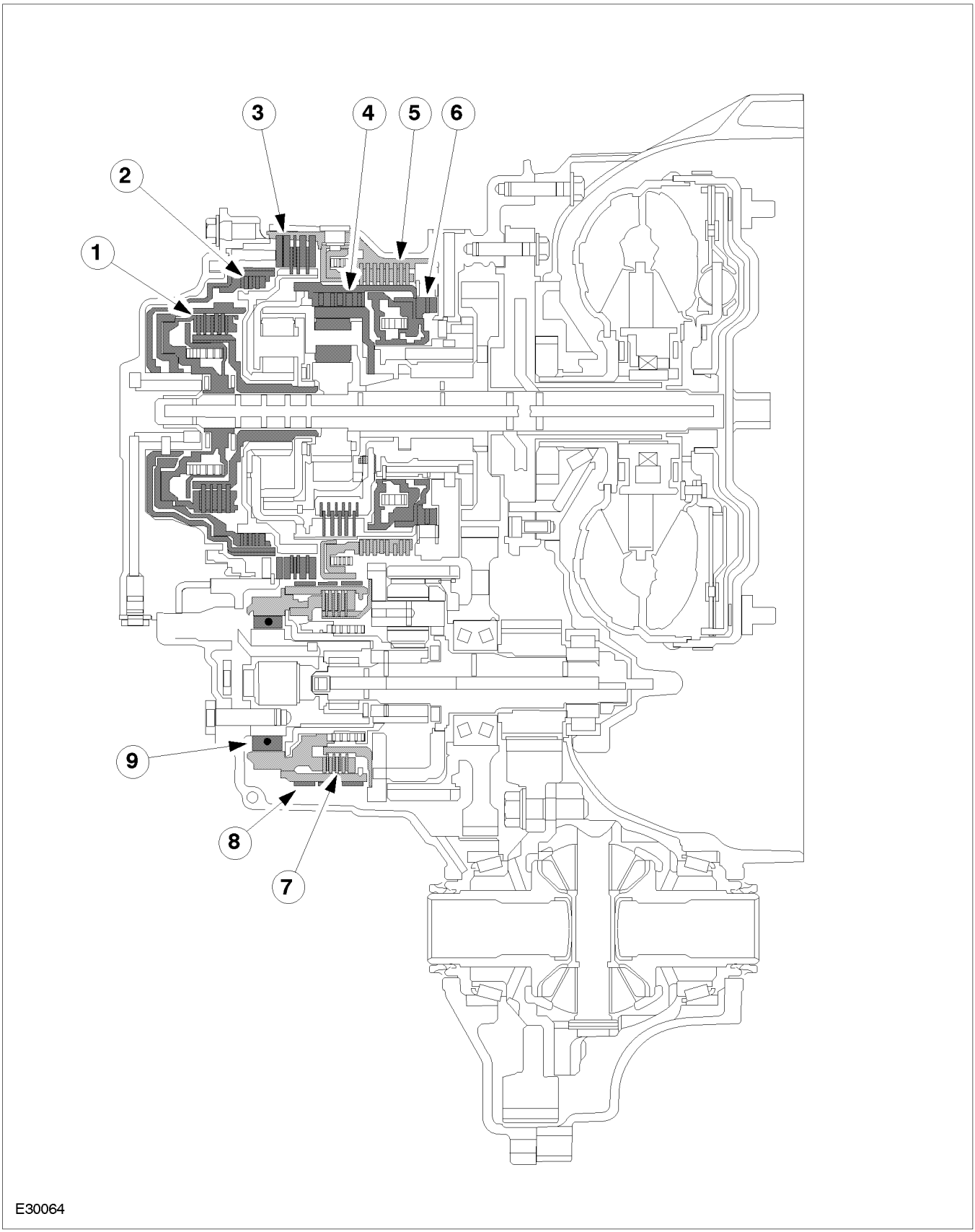
The reduction planetary gearset is a simple planetary gearset.

The ring gear of the reduction planetary gearset is driven by the driven gear of the 1st and 2nd planetary gearset via the drive gear of the reduction planetary gearset.

Drive is always output via the planetary gear carrier to the driven gear of the reduction planetary gearset, and thereby to the differential.

DESCRIPTION AND OPERATION (Continued)

Clutches and brakes



DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1	-	3rd - 5th gear clutch
2	-	Reverse clutch
3	-	2nd/4th/5th gear brake
4	-	1st - 3rd gear clutch
5	-	Reverse gear brake
6	-	1st gear one-way clutch
7	-	5th gear clutch
8	-	Reduction brake band
9	-	Reduction one-way clutch

The transmission is equipped with four clutches and five brakes.

The clutches are laid out as multi-plate clutches.

The brakes are made up of two multi-plate brakes (2nd/4th/5th gear brake and reverse gear brake), two one-way clutches (1st gear one-way clutch and reduction one-way clutch) and one brake band (reduction brake band).

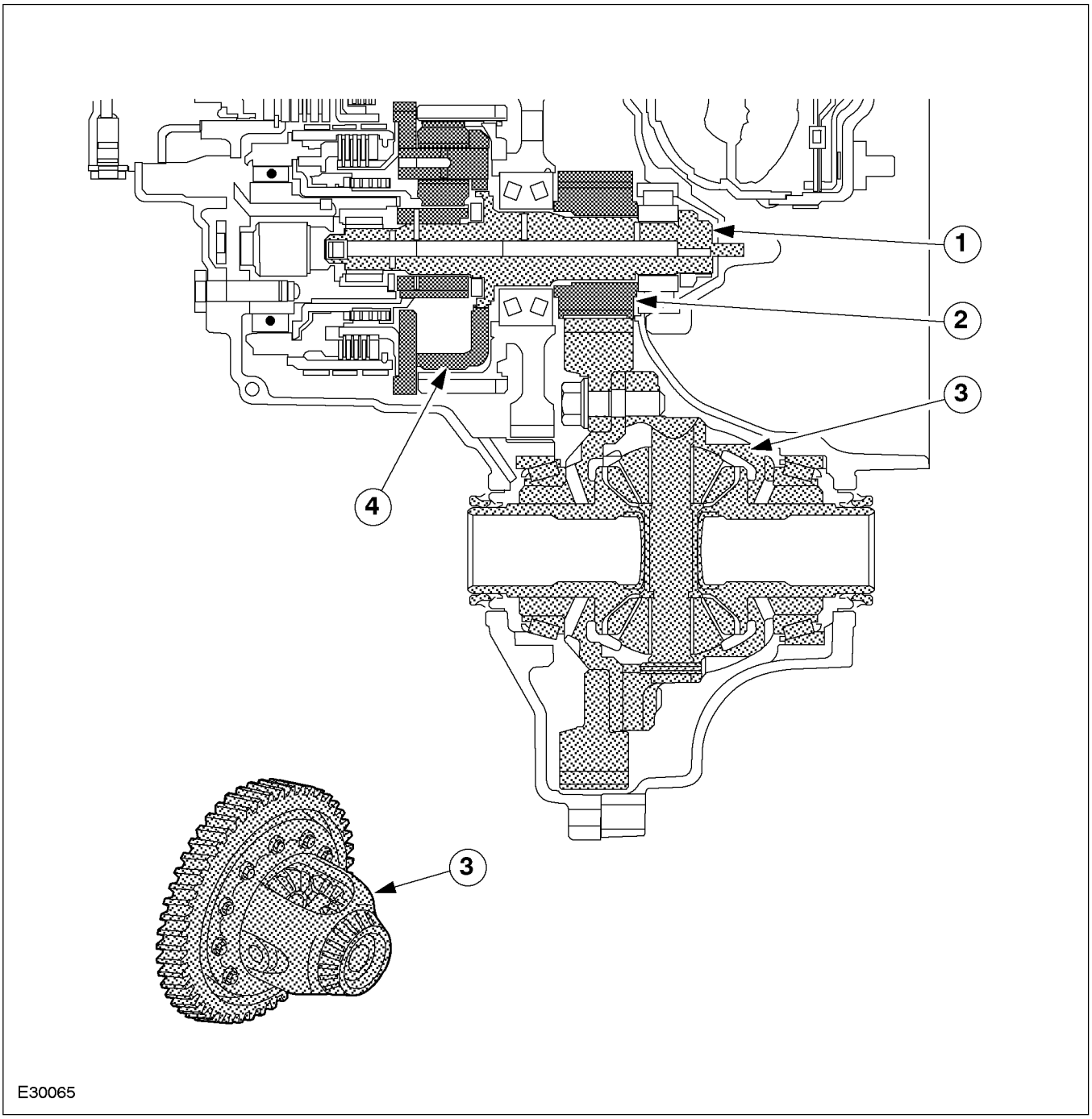
The torque is transmitted via the clutches to certain components in the planetary gearsets.

Other components in the planetary gearsets are held with the brakes.

These combinations result in the different transmission ratios for the individual gears.

DESCRIPTION AND OPERATION (Continued)

Differential assembly



Item	Part Number	Description
1	-	Intermediate shaft
2	-	Driven gear of reduction planetary gearset
3	-	Differential assembly
4	-	Planetary gear carrier for reduction planetary gearset

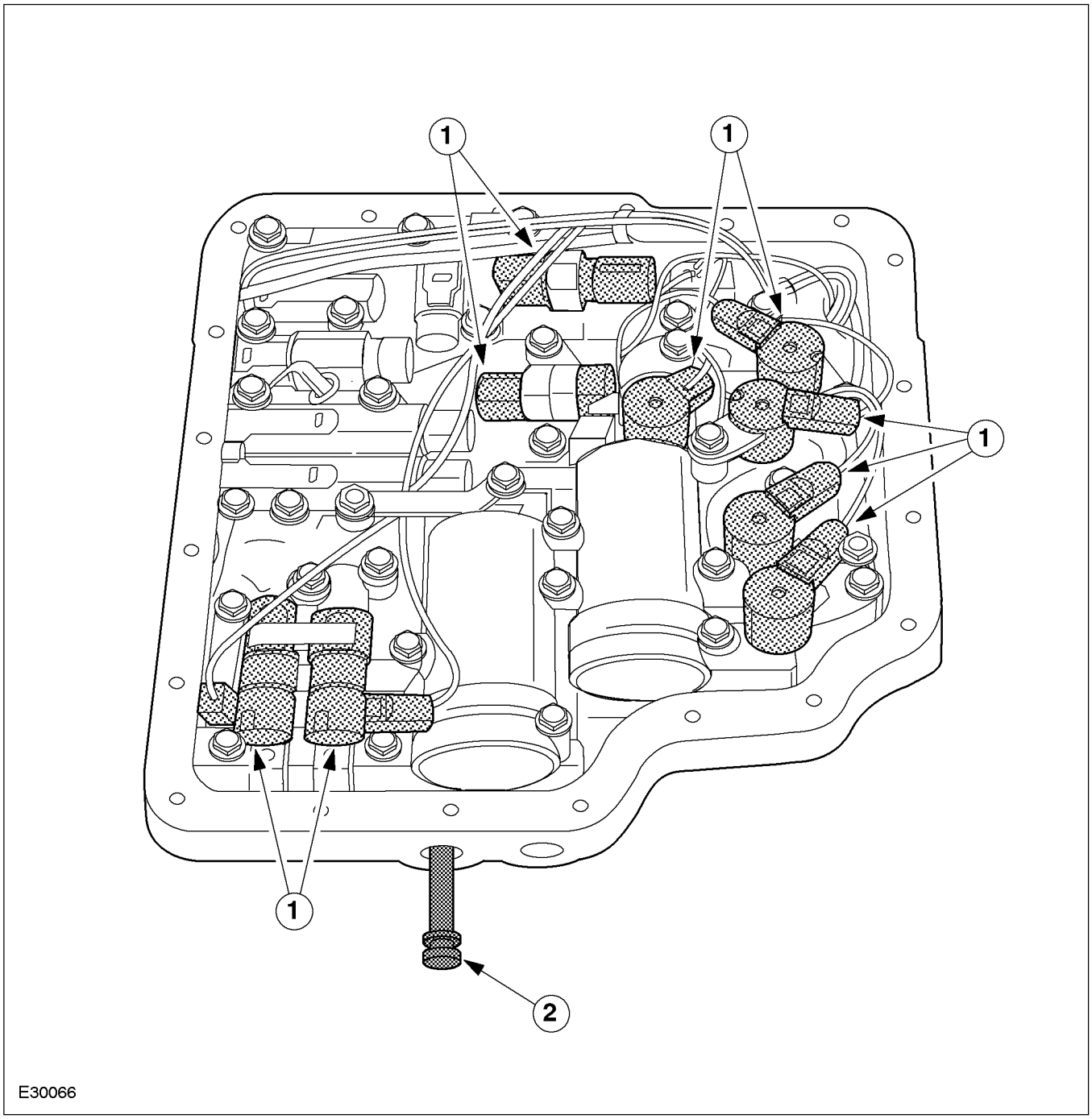
The planetary gear carrier for the reduction planetary gearset is rigidly linked via the intermediate shaft to the driven gear of the reduction planetary gearset and drives the differential.

The differential assembly transmits the torque via the drive halfshafts to the front wheels.

Any differences in rotational speed between the two drive halfshafts are compensated by the differential.

DESCRIPTION AND OPERATION (Continued)

Control housing



Item	Part Number	Description
1	-	Solenoid valves
2	-	Manual selector lever

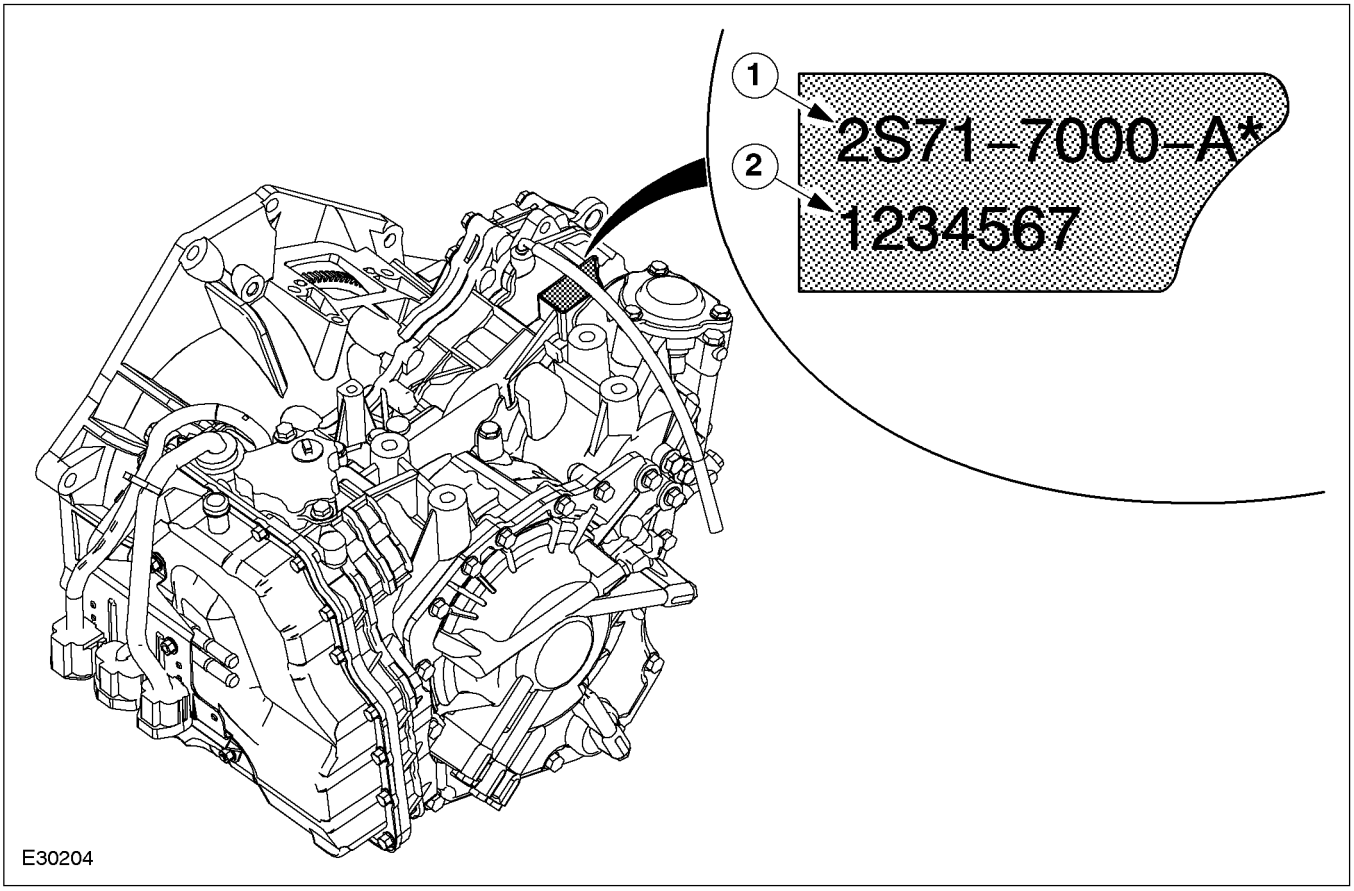
The hydraulic pressure is distributed to the individual clutches and brakes in the main control body.

The hydraulic lines and pressures are electronically regulated by four pulse-width modulated (PWM) solenoid valves and five shift solenoid valves.

In addition, the manual selector lever in the main control body provides a hydraulic emergency running programme, which allows the vehicle to drive in 4th gear with the selector lever in position "D" and in reverse gear with the selector lever in position "R".

DESCRIPTION AND OPERATION

Identification Tags



Item	Part Number	Description
1	-	Transmission designation
2	-	Manufacturer number

DESCRIPTION AND OPERATION

Transmission Ranges and Power Flow

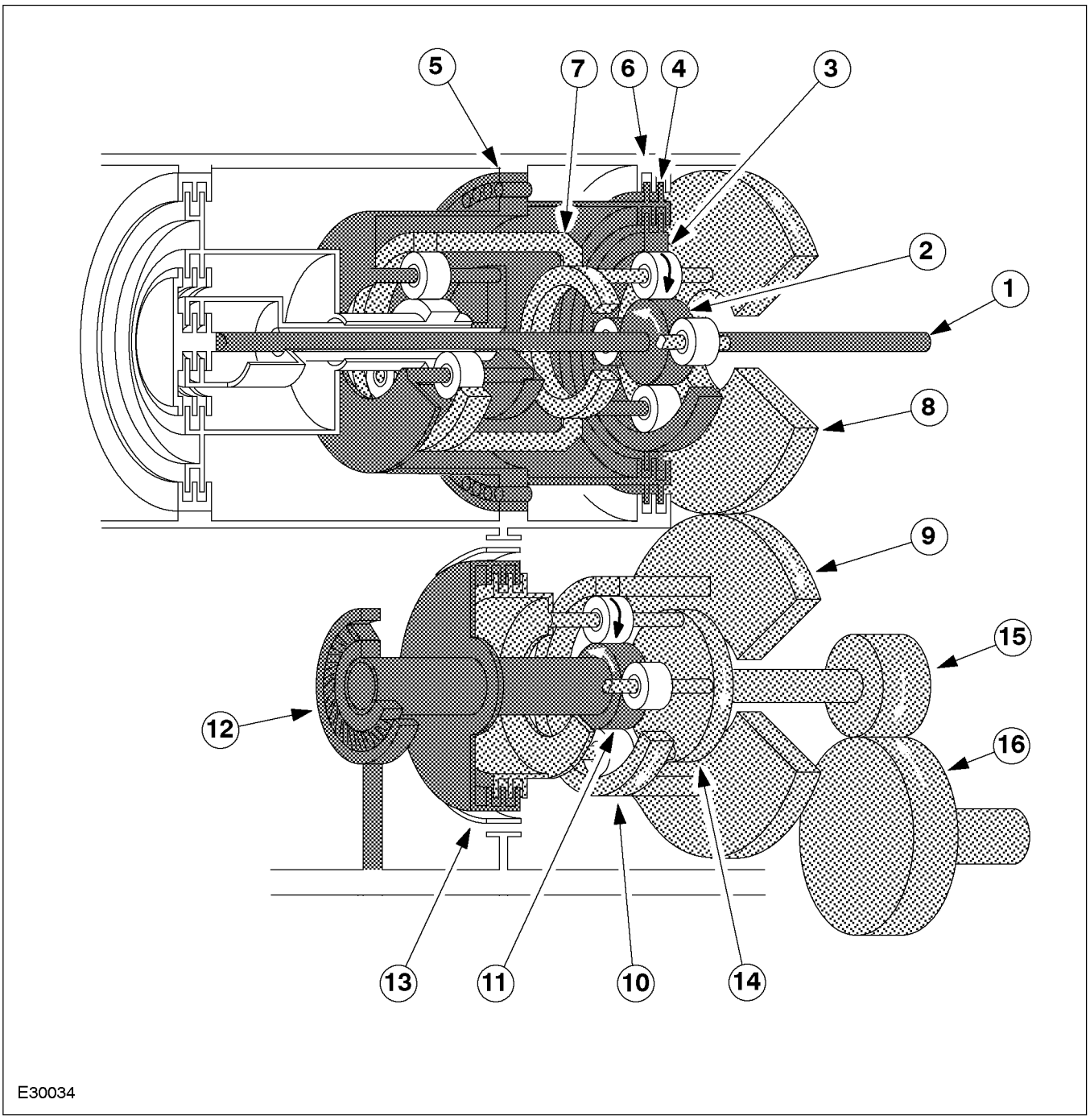
Overview of operation

Component	Connects	P	R	N	1	2	3	4	5
1st - 3rd gear clutch	Planetary gear carrier (1st set) and ring gear (2nd set)				X	X	X		
3rd - 5th gear clutch	Transmission input shaft and planetary gear carrier (1st set)						X	X	X
5th gear clutch	Planetary gear carrier and sun gear (reduction gearset)								X
Reverse clutch	Transmission input shaft and sun gear (1st set)		X						
Reverse gear brake	Transmission housing and planetary gear carrier (1st set)		X		X*				
2nd/4th/5th gear brake	Transmission housing and sun gear (1st set)					X		X	X
Reduction brake band	Transmission housing and sun gear (reduction gearset)	X	X	X	X*	X*	X	X	
1st gear one-way clutch	Transmission housing and planetary gear carrier (1st set)				X				
Reduction one-way clutch	Transmission housing and sun gear (reduction gearset)				X	X	X	X	

* Only in Select-Shift-Mode

DESCRIPTION AND OPERATION

Transmission in 1st gear



Item	Part Number	Description
1	-	Transmission input shaft
2	-	Sun gear (2nd set)
3	-	Ring gear (2nd set)
4	-	1st - 3rd gear clutch

Item	Part Number	Description
5	-	1st gear one-way clutch
6	-	Reverse gear brake
7	-	Planetary gear carrier (2nd set) and ring gear (1st set).

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
8	-	Driven gear of 1st and 2nd planetary gearset
9	-	Drive gear for reduction gearset
10	-	Ring gear (reduction gearset)
11	-	Sun gear (reduction gearset)
12	-	Reduction one-way clutch
13	-	Reduction brake band
14	-	Planetary gear carrier (reduction gearset)
15	-	Driven gear of reduction gearset
16	-	Differential assembly

1st and 2nd planetary gearset:

The drive is transmitted from the transmission input shaft (1) to the sun gear (2nd set) (2).

The ring gear (2nd set) (3) is held by the 1st - 3rd gear clutch (4) and the 1st gear one-way clutch (5).

NOTE: In Select-Shift-Mode the ring gear (2nd set) is also held by the reverse gear brake (6) via the 1st - 3rd gear clutch (engine braking).

The planetary gears roll on the ring gear (2nd set) which is being held, thereby driving the planetary gear carrier (2nd set) and the ring gear (1st set) (7).

The planetary gear carrier (2nd set) is rigidly linked to the driven gear of the 1st and 2nd planetary gearset (8).

The 1st planetary gearset has no influence on the transmission.

Reduction planetary gearset:

The driven gear of the 1st and 2nd planetary gearset drives the drive gear for the reduction gearset (9), which is rigidly linked to the ring gear (10).

The sun gear (11) is held by the one-way clutch (12).

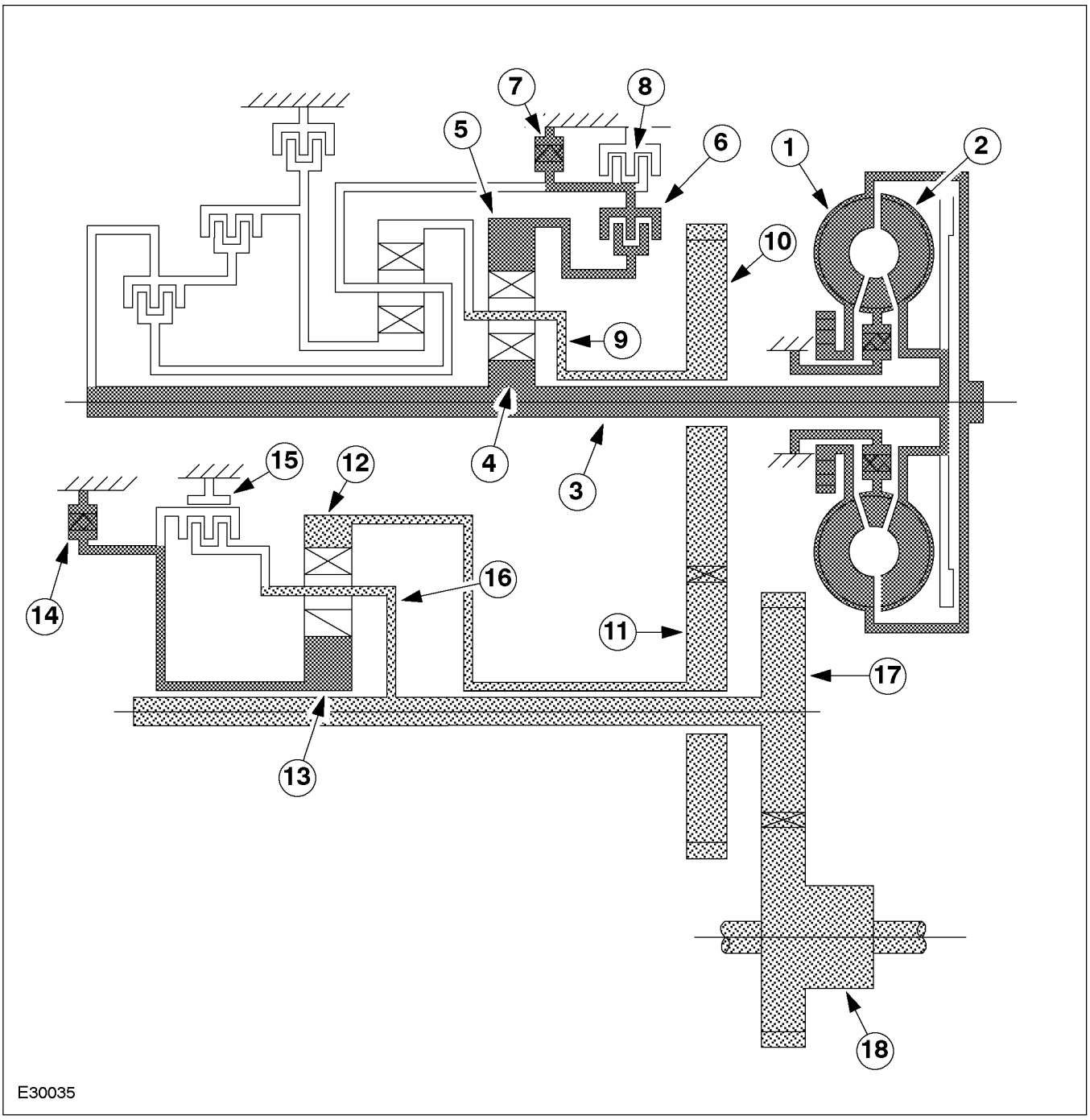
NOTE: In Select-Shift-Mode the sun gear is held by the reduction brake band (13) (engine braking).

The planetary gears roll on the sun gear, which is being held, and drive the planetary gear carrier (14), which is rigidly linked to the driven gear of the reduction gearset (15).

The driven gear of the reduction gearset drives the differential (16).

DESCRIPTION AND OPERATION

Power transmission route in first gear



Item	Part Number	Description
1	-	Impeller
2	-	Turbine
3	-	Transmission input shaft
4	-	Sun gear (2nd set)

Item	Part Number	Description
5	-	Ring gear (2nd set)
6	-	1st - 3rd gear clutch
7	-	1st gear one-way clutch
8	-	Reverse gear brake

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
9	-	Planetary gear carrier (2nd set) and ring gear (1st set).
10	-	Driven gear of 1st and 2nd planetary gearset
11	-	Drive gear for reduction gearset
12	-	Ring gear (reduction gearset)
13	-	Sun gear (reduction gearset)
14	-	Reduction one-way clutch
15	-	Reduction brake band
16	-	Planetary gear carrier (reduction gearset)
17	-	Driven gear of reduction gearset
18	-	Differential assembly

1st and 2nd planetary gearset:

Drive (input)

- Impeller (1)
  - Turbine (2)
  - Transmission input shaft (3)
  - Sun gear (2nd set) (4)

Held

- Ring gear (2nd set) (5) by the 1st gear one-way clutch (7) (no engine braking) via the 1st - 3rd gear clutch (6)

NOTE: In Select-Shift-Mode the ring gear (2nd set) is held by the reverse gear brake (8) via the 1st - 3rd gear clutch (engine braking).

Drive (output)

- Planetary gear carrier (2nd set) and ring gear (1st set) (9)
  - Driven gear of 1st and 2nd planetary gearset (10)

Reduction planetary gearset:

Drive (input)

- Drive gear for reduction gearset (11)
  - Ring gear (12)

Held

- Sun gear (13) via the reduction one-way clutch (14) (no engine braking)

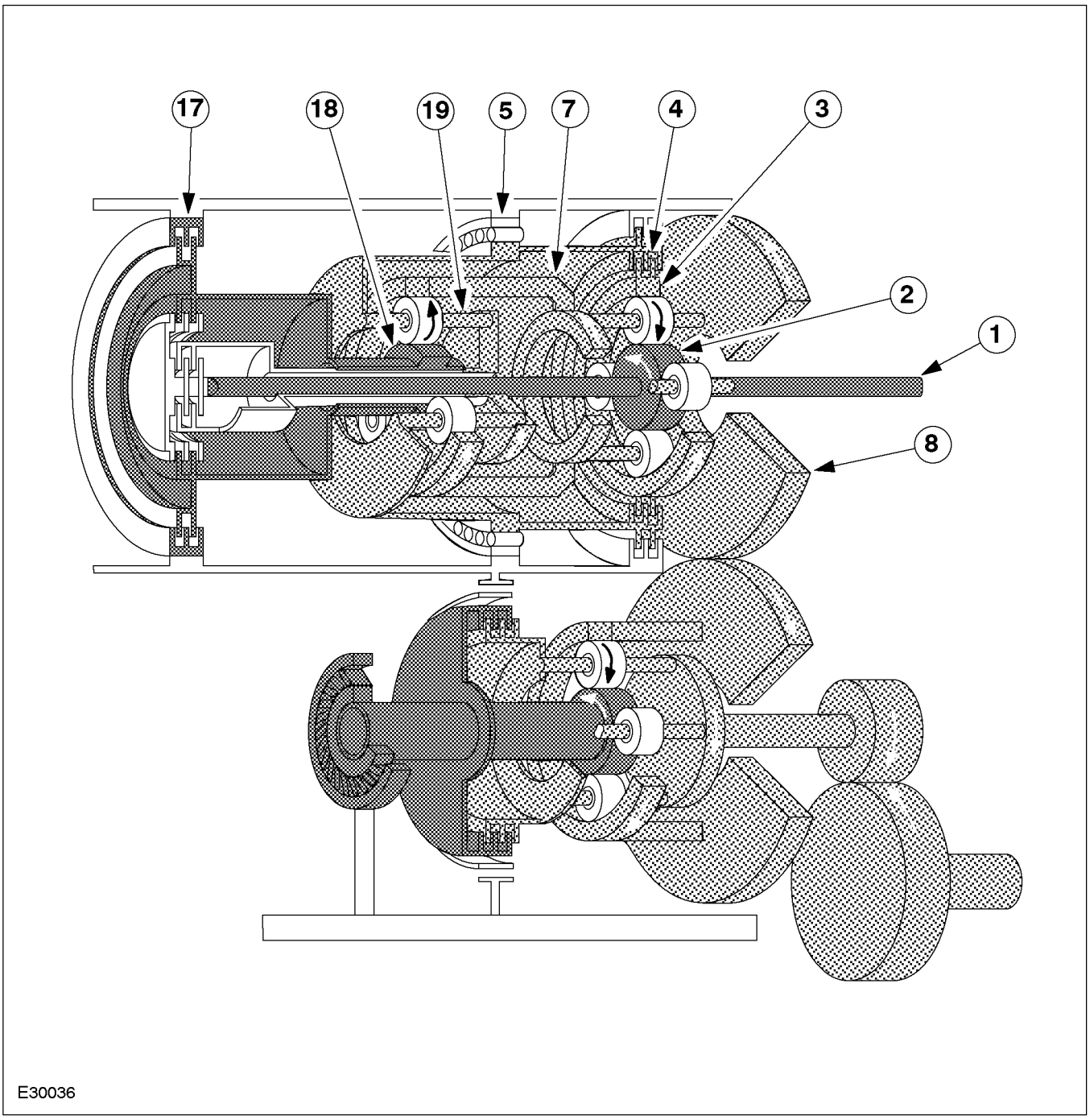
NOTE: In Select-Shift-Mode the sun gear is held by the reduction brake band (15) (engine braking).

Drive (output)

- Planetary gear carrier (16)
  - Driven gear of reduction gearset (17)
  - Differential (18)

DESCRIPTION AND OPERATION

Transmission in 2nd gear



Item	Part Number	Description
1	-	Transmission input shaft
2	-	Sun gear (2nd set)
3	-	Ring gear (2nd set)
4	-	1st - 3rd gear clutch

Item	Part Number	Description
5	-	1st gear one-way clutch
7	-	Planetary gear carrier (2nd set) and ring gear (1st set).
8	-	Driven gear of 1st and 2nd planetary gearset

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
17	-	2nd/4th/5th gear brake
18	-	Sun gear (1st set)
19	-	Planetary gear carrier (1st set)

1st and 2nd planetary gearset:

The drive is transmitted from the transmission input shaft (1) to the sun gear (2nd set) (2).

The ring gear (2nd set) (3) is initially held by the 1st - 3rd gear clutch (4) and the 1st gear one-way clutch (5).

As a result, the planetary gears roll on the ring gear (2nd set) which is being held, thereby driving the planetary gear carrier (2nd set) and the ring gear (1st set) (7).

The planetary gears (1st set) roll on the sun gear (1st set) (18) which is being held by the 2nd/4th/5th gear brake (17).

As a result, they drive the planetary gear carrier (1st set) (19), and therefore also the ring gear (2nd set) via the 1st - 3rd gear clutch.

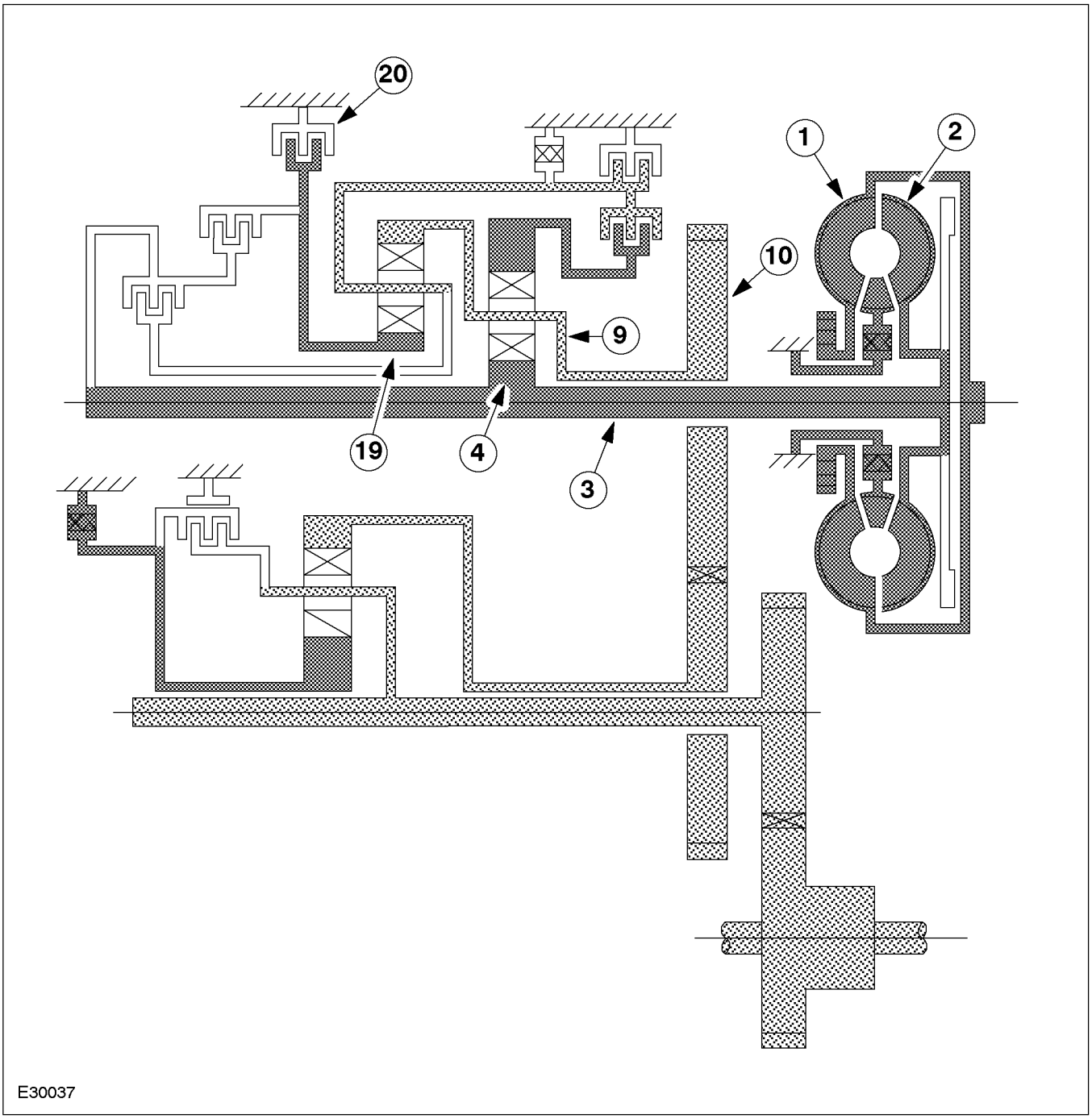
The resulting relative movement is transmitted via the planetary gear carrier (2nd set) to the driven gear of the 1st and 2nd planetary gearset (8).

Reduction planetary gearset:

See 1st gear.

DESCRIPTION AND OPERATION (Continued)

Power transmission route in second gear



Item	Part Number	Description
1	-	Impeller
2	-	Turbine
3	-	Transmission input shaft
4	-	Sun gear (2nd set)

Item	Part Number	Description
9	-	Planetary gear carrier (2nd set) and ring gear (1st set).
10	-	Driven gear of 1st and 2nd planetary gearset
19	-	Sun gear (1st set)
20	-	2nd/4th/5th gear brake

DESCRIPTION AND OPERATION (Continued)

1st and 2nd planetary gearset:

Drive (input)

- Impeller (1)
  - Turbine (2)
  - Transmission input shaft (3)
  - Sun gear (2nd set) (4)

Held

- Sun gear (1st set) (19) by the 2nd/4th/5th gear brake (20)

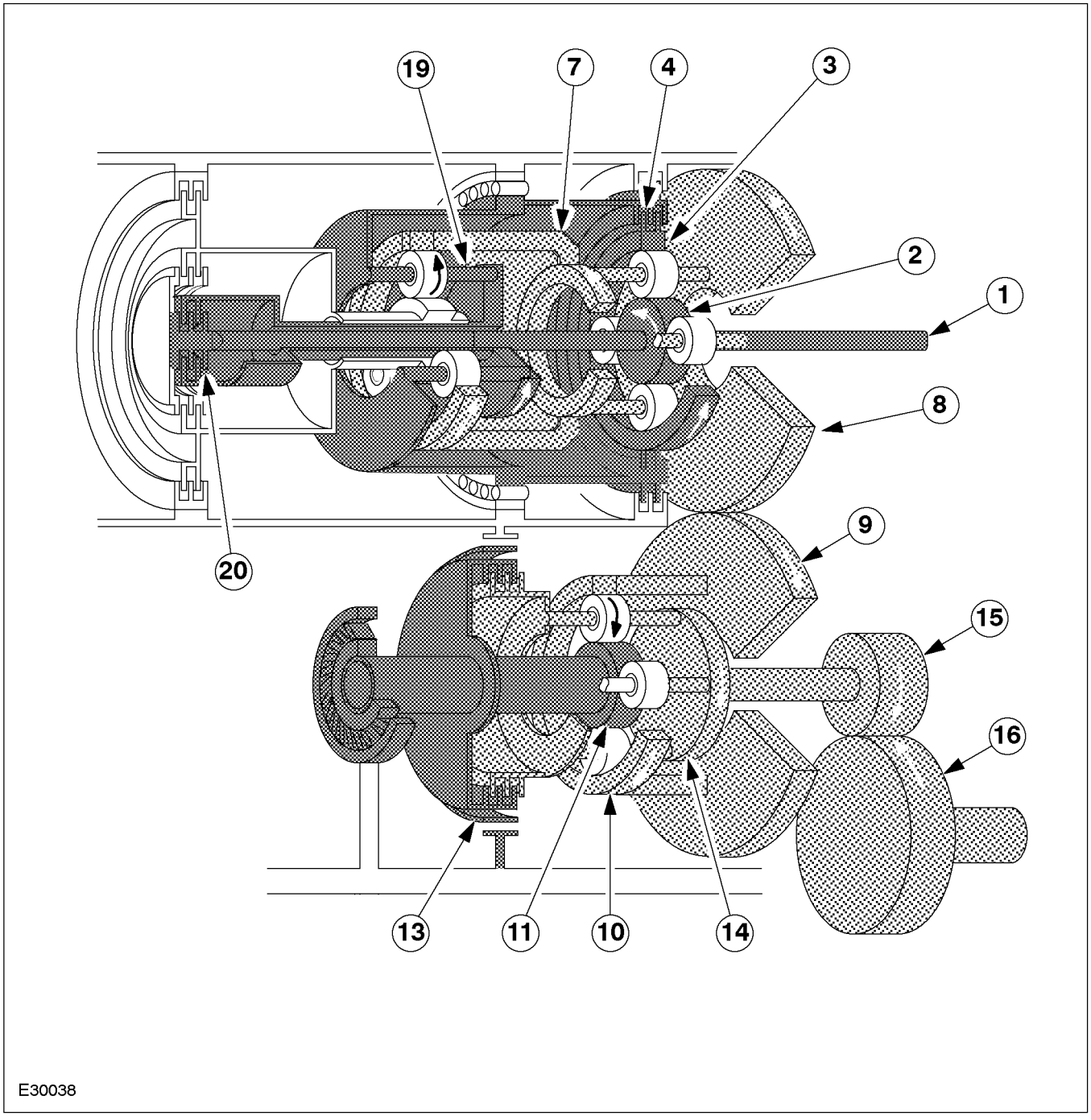
Drive (output)

- Planetary gear carrier (2nd set) and ring gear (1st set) (9)
  - Driven gear of 1st and 2nd planetary gearset (10)

Reduction planetary gearset:

See 1st gear.

Transmission in 3rd gear



DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1	-	Transmission input shaft
2	-	Sun gear (2nd set)
3	-	Ring gear (2nd set)
4	-	1st - 3rd gear clutch
7	-	Planetary gear carrier (2nd set) and ring gear (1st set).
8	-	Driven gear of 1st and 2nd planetary gearset
9	-	Drive gear for reduction gearset
10	-	Ring gear (reduction gearset)
11	-	Sun gear (reduction gearset)
13	-	Reduction brake band
14	-	Planetary gear carrier (reduction gearset)
15	-	Driven gear of reduction gearset
16	-	Differential assembly
19	-	Planetary gear carrier (1st set)
20	-	3rd - 5th gear clutch

1st and 2nd planetary gearset:

Drive is transmitted from the transmission input shaft (1) to the sun gear (2nd set) (2) and via the 3rd - 5th gear clutch (20) to the planetary gear carrier (1st set) (19). The planetary gear carrier (1st set) drives the ring gear (2nd set) (3) via the 1st - 3rd gear clutch (4).

As two components are being driven simultaneously in the 2nd planetary gearset, there is no resulting relative movement. The planetary gearsets rotate as complete units.

The planetary gear carrier (2nd set) and the ring gear (1st set) (7) are rigidly linked to the driven gear of the 1st and 2nd planetary gearset (8).

Reduction planetary gearset:

The driven gear of the 1st and 2nd planetary gearset drives the drive gear for the reduction gearset (9), which is rigidly linked to the ring gear (10).

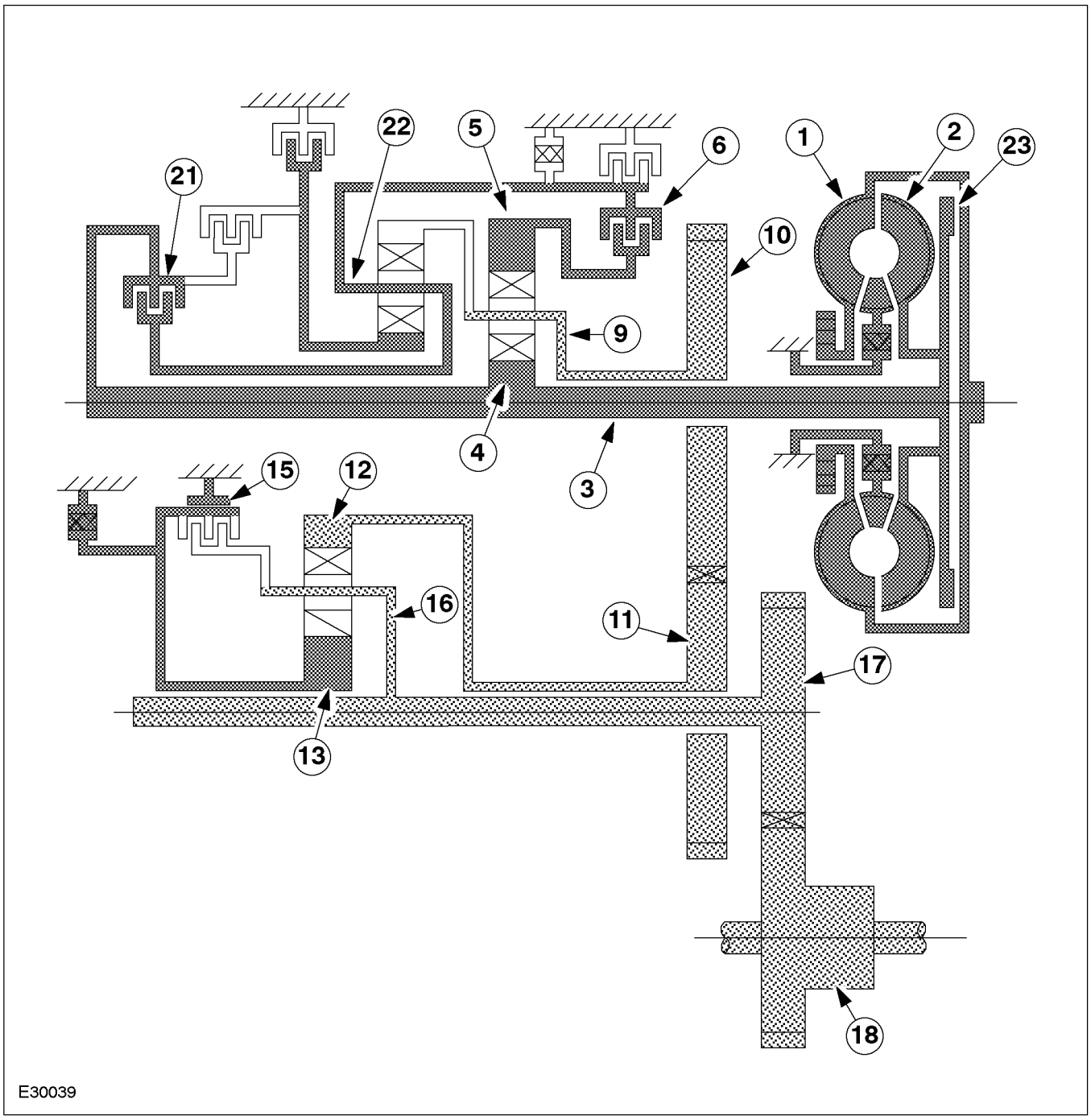
The sun gear (11) is held by the reduction brake band (13) (engine braking).

The planetary gears roll on the sun gear, which is being held, and drive the planetary gear carrier (14), which is rigidly linked to the driven gear of the reduction gearset (15).

The driven gear of the reduction gearset drives the differential (16).

DESCRIPTION AND OPERATION

Power transmission route in third gear



Item	Part Number	Description
1	-	Impeller
2	-	Turbine
3	-	Transmission input shaft
4	-	Sun gear (2nd set)

Item	Part Number	Description
5	-	Ring gear (2nd set)
6	-	1st - 3rd gear clutch
9	-	Planetary gear carrier (2nd set) and ring gear (1st set).

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
10	-	Driven gear of 1st and 2nd planetary gearset
11	-	Drive gear for reduction gearset
12	-	Ring gear (reduction gearset)
13	-	Sun gear (reduction gearset)
15	-	Reduction brake band
16	-	Planetary gear carrier (reduction gearset)
17	-	Driven gear of reduction gearset
18	-	Differential assembly
21	-	3rd - 5th gear clutch
22	-	Planetary gear carrier (1st set)
23	-	Torque converter lock-up clutch (TCC)

1st and 2nd planetary gearset:

Drive (input)

- Impeller (1)
  - Turbine (2)
  - Transmission input shaft (3)
  - Sun gear (2nd set) (4)
- Impeller (1)
  - Turbine (2)
  - Transmission input shaft (3)
  - 3rd - 5th gear clutch (21)
  - Planetary gear carrier (1st set) (22)
  - 1st - 3rd gear clutch (6)
  - Ring gear (2nd set) (5)

NOTE: When the TCC(23) is engaged the drive is transmitted directly from the torque converter housing to the transmission input shaft.

Held

- No components

Drive (output)

- Planetary gear carrier (2nd set) and ring gear (1st set) (9)
  - Driven gear of 1st and 2nd planetary gearset (10)

Reduction planetary gearset:

Drive (input)

- Drive gear for reduction gearset (11)
  - Ring gear (12)

Held

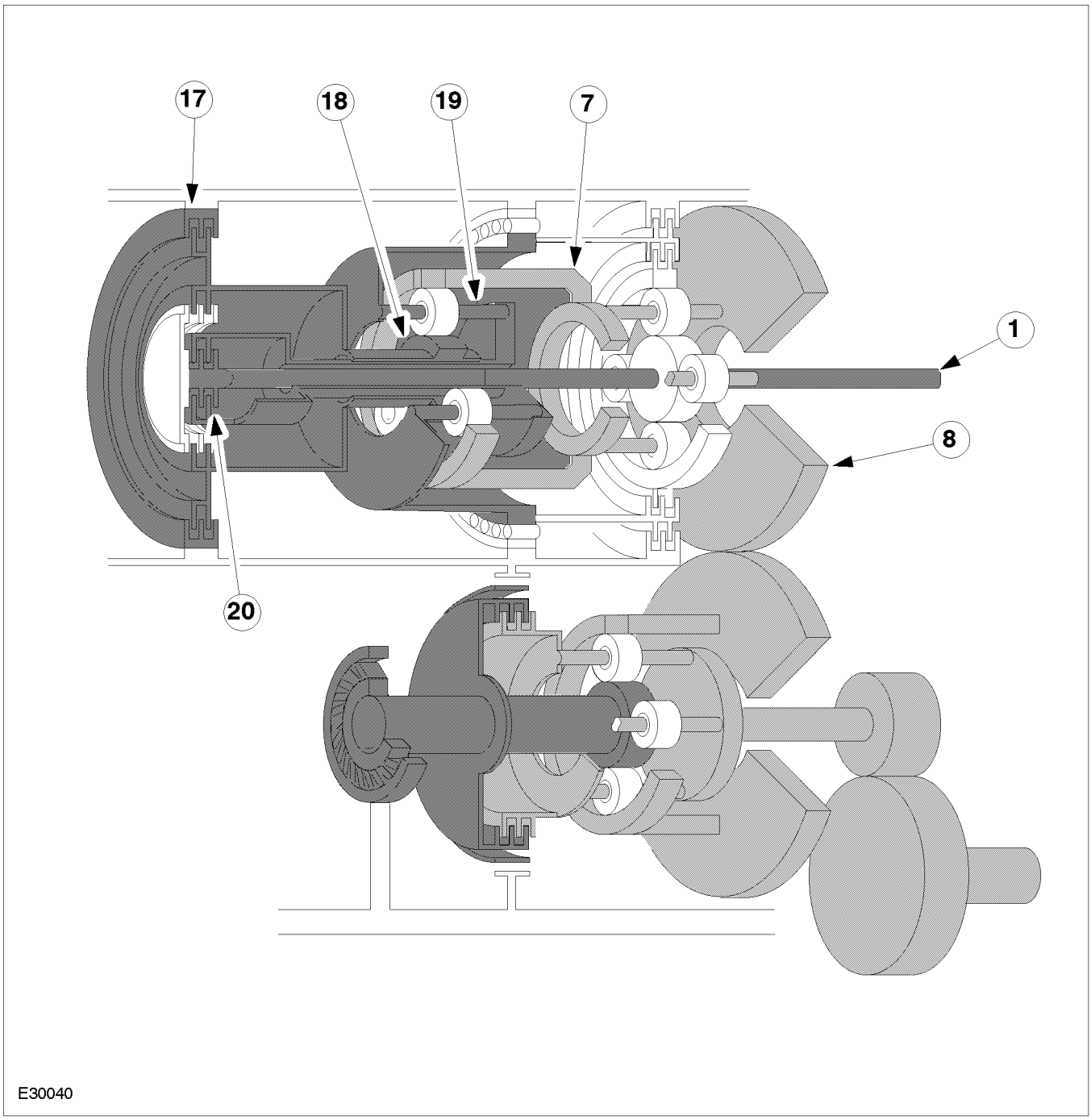
- Sun gear (13) via the reduction one-way clutch (15) (no engine braking)

Drive (output)

- Planetary gear carrier (16)
  - Driven gear of reduction gearset (17)
  - Differential (18)

DESCRIPTION AND OPERATION

Transmission in 4th gear



Item	Part Number	Description
1	-	Transmission input shaft
7	-	Planetary gear carrier (2nd set) and ring gear (1st set).
8	-	Driven gear of 1st and 2nd planetary gearset

Item	Part Number	Description
17	-	2nd/4th/5th gear brake
18	-	Sun gear (1st set)
19	-	Planetary gear carrier (1st set)
20	-	3rd - 5th gear clutch

DESCRIPTION AND OPERATION (Continued)

1st and 2nd planetary gearset:

Drive is transmitted from the transmission input shaft (1) via the 3rd - 5th gear clutch (20) to the planetary gear carrier (1st set) (19).

The planetary gears (1st set) roll on the sun gear (1st set) (18) which is being held by the 2nd/4th/5th gear brake (17).

As a result, the planetary gear carrier (2nd set) and the ring gear (1st set) (7) are driven.

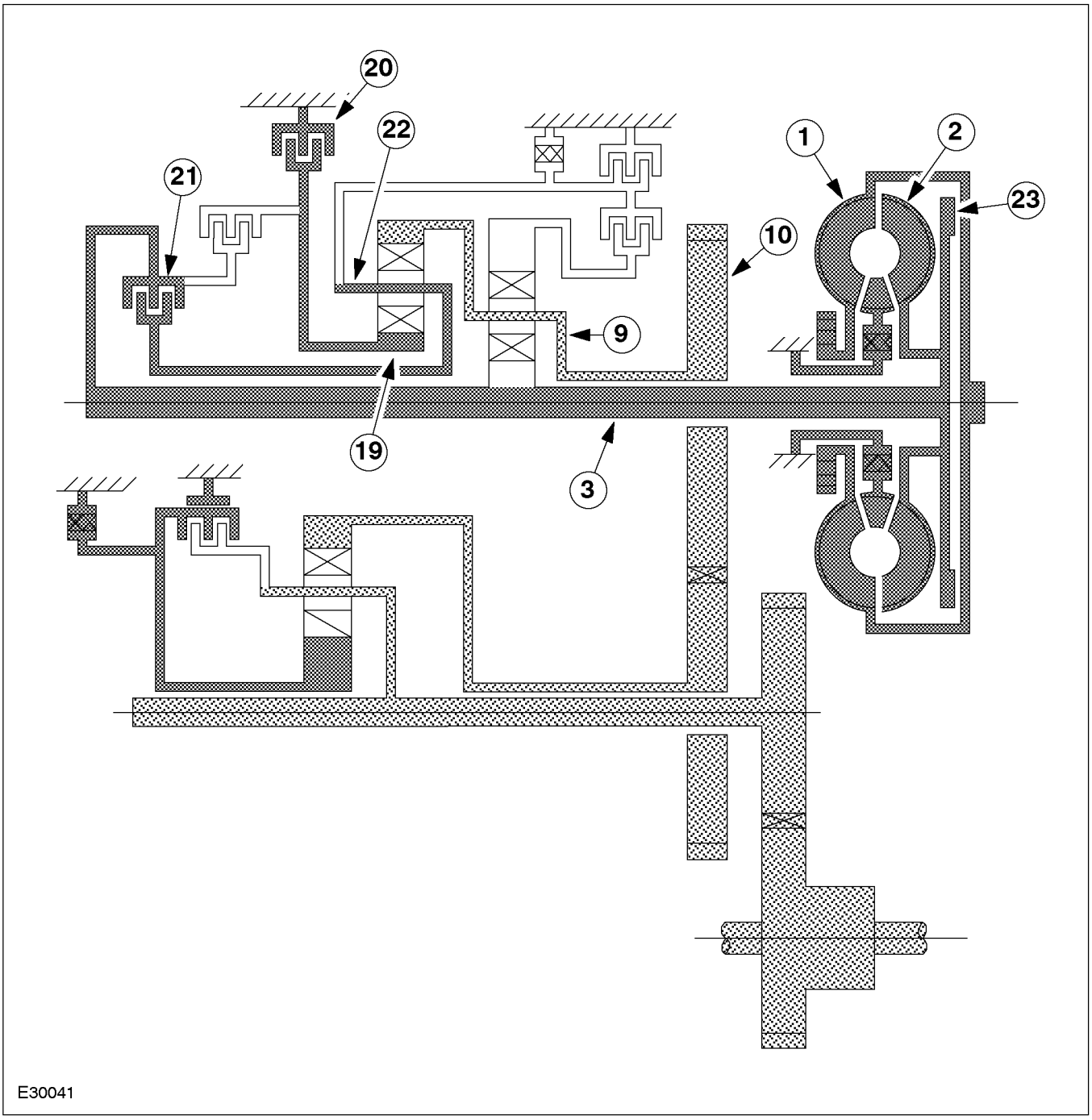
This is rigidly linked to the driven gear of the 1st and 2nd planetary gearset (8).

The 2nd planetary gearset has no influence on the transmission.

Reduction planetary gearset:

See 3rd gear.

Power transmission route in fourth gear



DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1	-	Impeller
2	-	Turbine
3	-	Transmission input shaft
9	-	Planetary gear carrier (2nd set) and ring gear (1st set).
10	-	Driven gear of 1st and 2nd planetary gearset
19	-	Sun gear (1st set)
20	-	2nd/4th/5th gear clutch
21	-	3rd - 5th gear clutch
22	-	Planetary gear carrier (1st set)
23	-	TCC

1st and 2nd planetary gearset:

Drive (input)

- Impeller (1)
  - Turbine (2)
  - Transmission input shaft (3)
  - 3rd - 5th gear clutch (21)
  - Planetary gear carrier (1st set) (22)

NOTE: When the TCC(23) is engaged the drive is transmitted directly from the torque converter housing to the transmission input shaft.

Held

- Sun gear (1st set) (19) by the 2nd/4th/5th gear brake (20)

Drive (output)

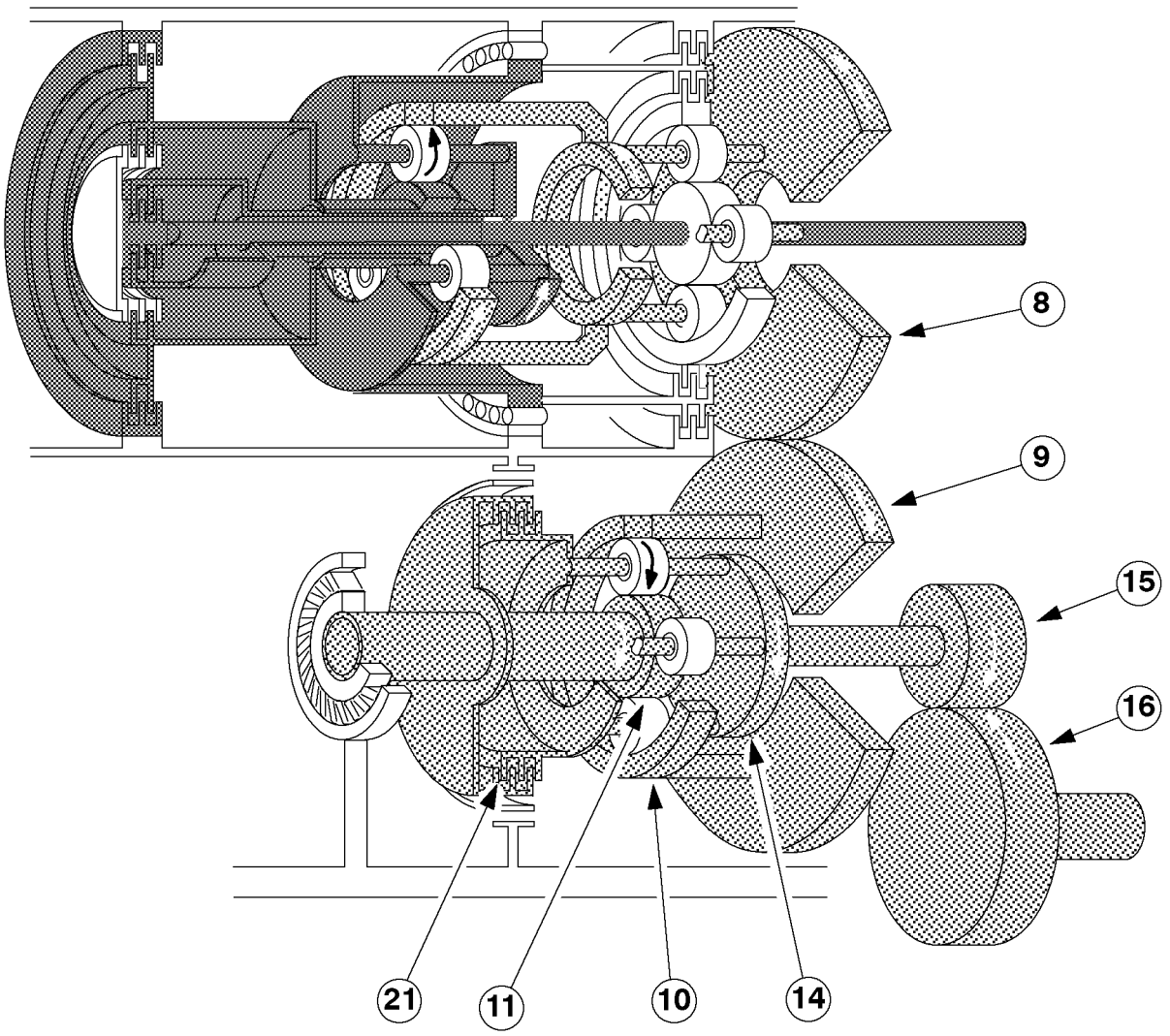
- Planetary gear carrier (2nd set) and ring gear (1st set) (9)
  - Driven gear of 1st and 2nd planetary gearset (10)

Reduction planetary gearset:

See 3rd gear.

DESCRIPTION AND OPERATION (Continued)

Transmission in 5th gear



E30042

Item	Part Number	Description
8	-	Driven gear of 1st and 2nd planetary gearset
9	-	Drive gear for reduction gearset
10	-	Ring gear (reduction gearset)

Item	Part Number	Description
11	-	Sun gear (reduction gearset)
14	-	Planetary gear carrier (reduction gearset)
15	-	Driven gear of reduction gearset
16	-	Differential assembly

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
21	-	5th gear clutch

1st and 2nd planetary gearset:

See 4th gear.

Reduction planetary gearset:

The driven gear of the 1st and 2nd planetary gearset (8) drives the drive gear for the reduction gearset (9), which is rigidly linked to the ring gear (10).

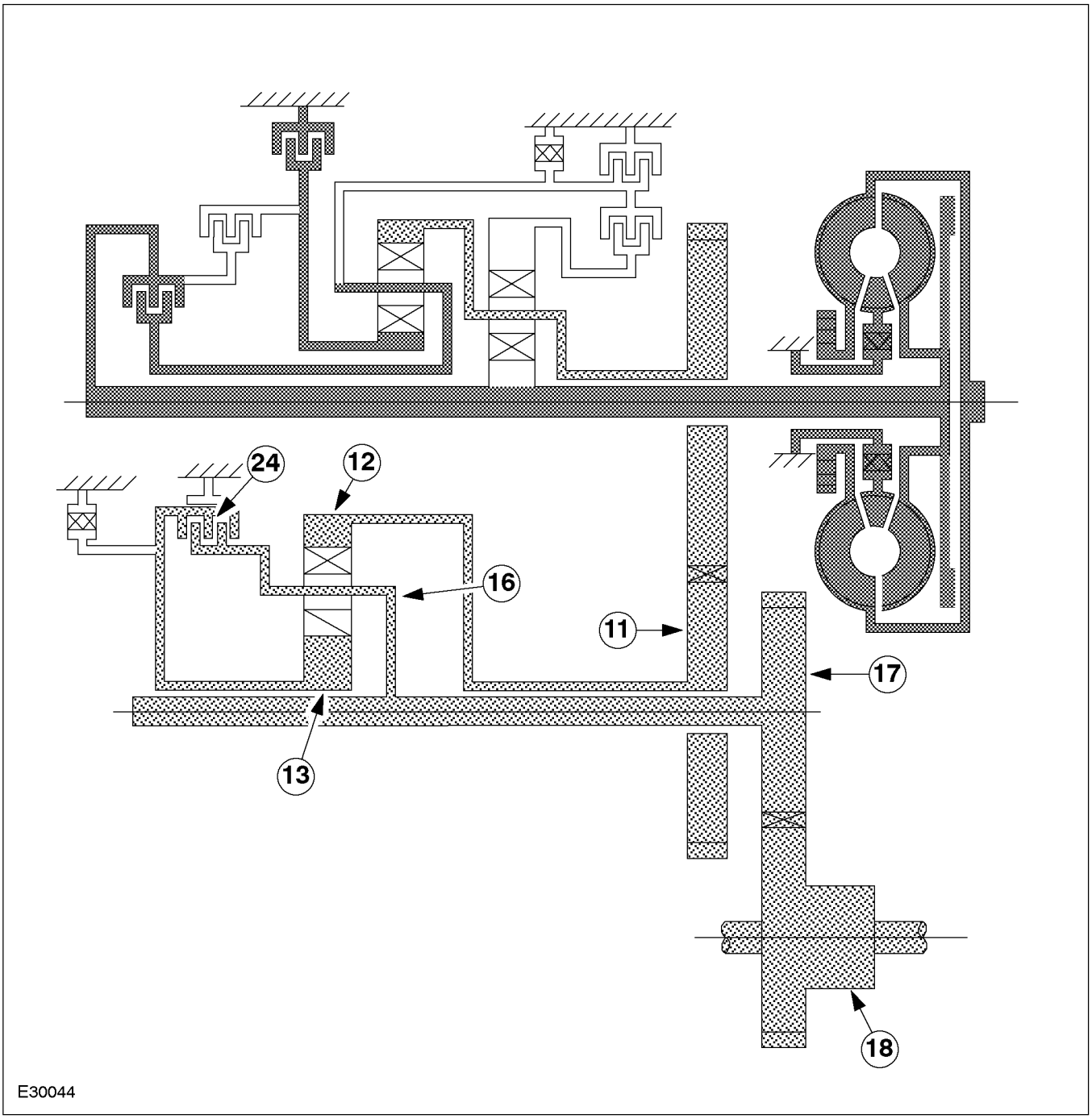
The 5th gear clutch (21) connects the planetary gear carrier (14) with the sun gear (11). As a result there are no relative movements between these components. The planetary gearset rotates as a complete unit.

The planetary gear carrier is rigidly linked to the driven gear of the reduction gearset (15).

The driven gear of the reduction gearset drives the differential (16).

DESCRIPTION AND OPERATION (Continued)

Power transmission route in fifth gear



Item	Part Number	Description
11	-	Drive gear for reduction gearset
12	-	Ring gear (reduction gearset)
13	-	Sun gear (reduction gearset)

Item	Part Number	Description
16	-	Planetary gear carrier (reduction gearset)
17	-	Driven gear of reduction gearset
18	-	Differential assembly
24	-	5th gear clutch

DESCRIPTION AND OPERATION (Continued)

1st and 2nd planetary gearset:

See 4th gear.

Reduction planetary gearset:

Drive (input)

- Drive gear for reduction gearset (11)
  - Ring gear (12)

Held

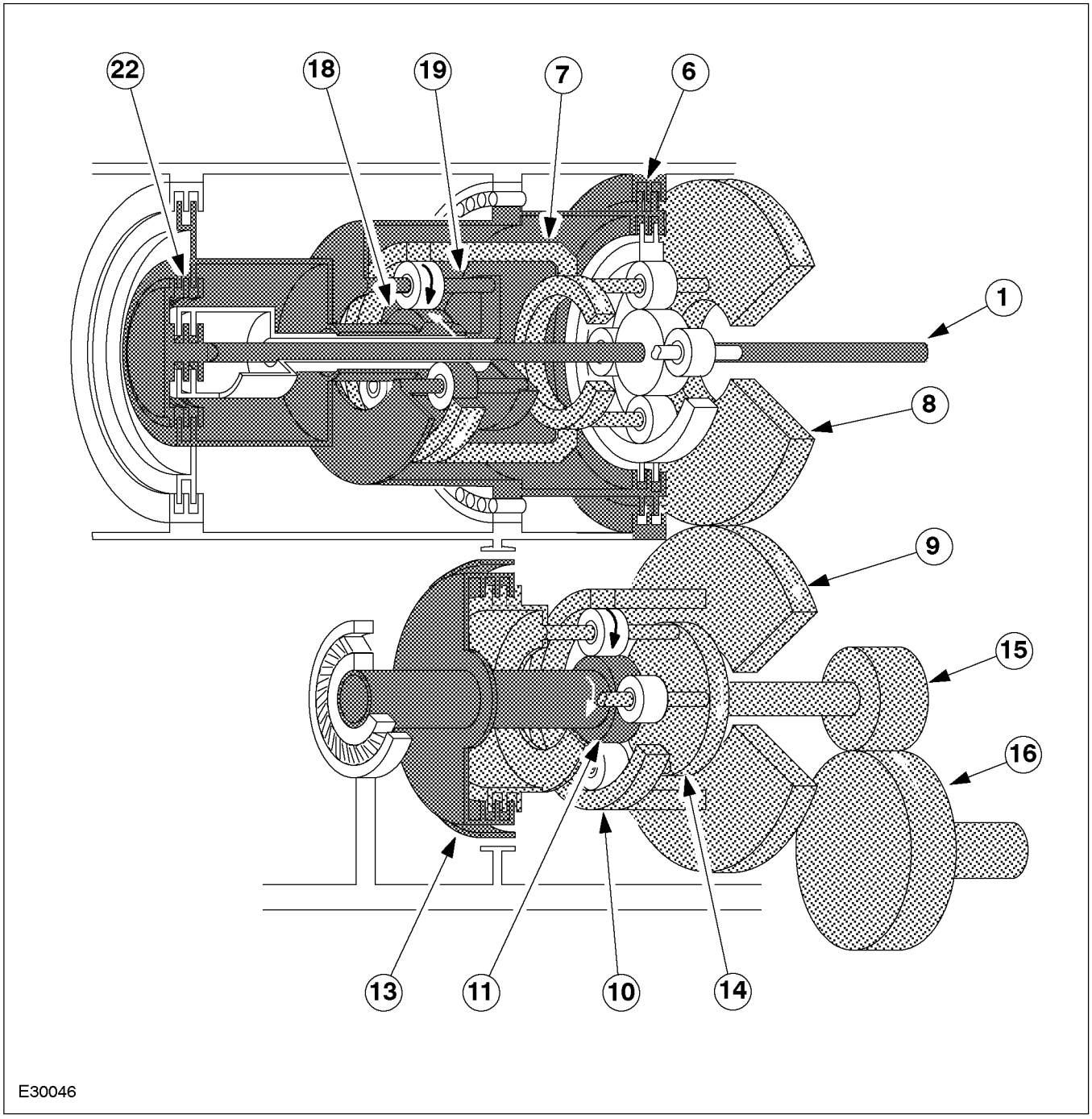
- No components

NOTE: The planetary gear carrier (16) and the sun gear (13) are coupled via the 5th gear clutch (24). The planetary gearset rotates as a complete unit.

Drive (output)

- Planetary gear carrier (16)
  - Driven gear of reduction gearset (17)
  - Differential (18)

Transmission in reverse gear



DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1	-	Transmission input shaft
6	-	Reverse gear brake
7	-	Planetary gear carrier (2nd set) and ring gear (1st set).
8	-	Driven gear of 1st and 2nd planetary gearset
9	-	Drive gear for reduction gearset
10	-	Ring gear (reduction gearset)
11	-	Sun gear (reduction gearset)
13	-	Reduction brake band
14	-	Planetary gear carrier (reduction gearset)
15	-	Driven gear of reduction gearset
16	-	Differential assembly
18	-	Sun gear (1st set)
19	-	Planetary gear carrier (1st set)
22	-	Reverse clutch

1st and 2nd planetary gearset:

Drive is transmitted from the transmission input shaft (1) via the reverse clutch (22) to the sun gear (1st set) (18).

The planetary gear carrier (1st set) (19) is held by the reverse gear brake (6).

The planetary gears (1st set) drive the planetary gear carrier (2nd set) and the ring gear (1st set) (7).

The planetary gear carrier (2nd set) is rigidly linked to the driven gear of the 1st and 2nd planetary gearset (8).

The 2nd planetary gearset has no influence on the transmission.

Reduction planetary gearset:

The driven gear of the 1st and 2nd planetary gearset drives the drive gear for the reduction gearset (9), which is rigidly linked to the ring gear (10).

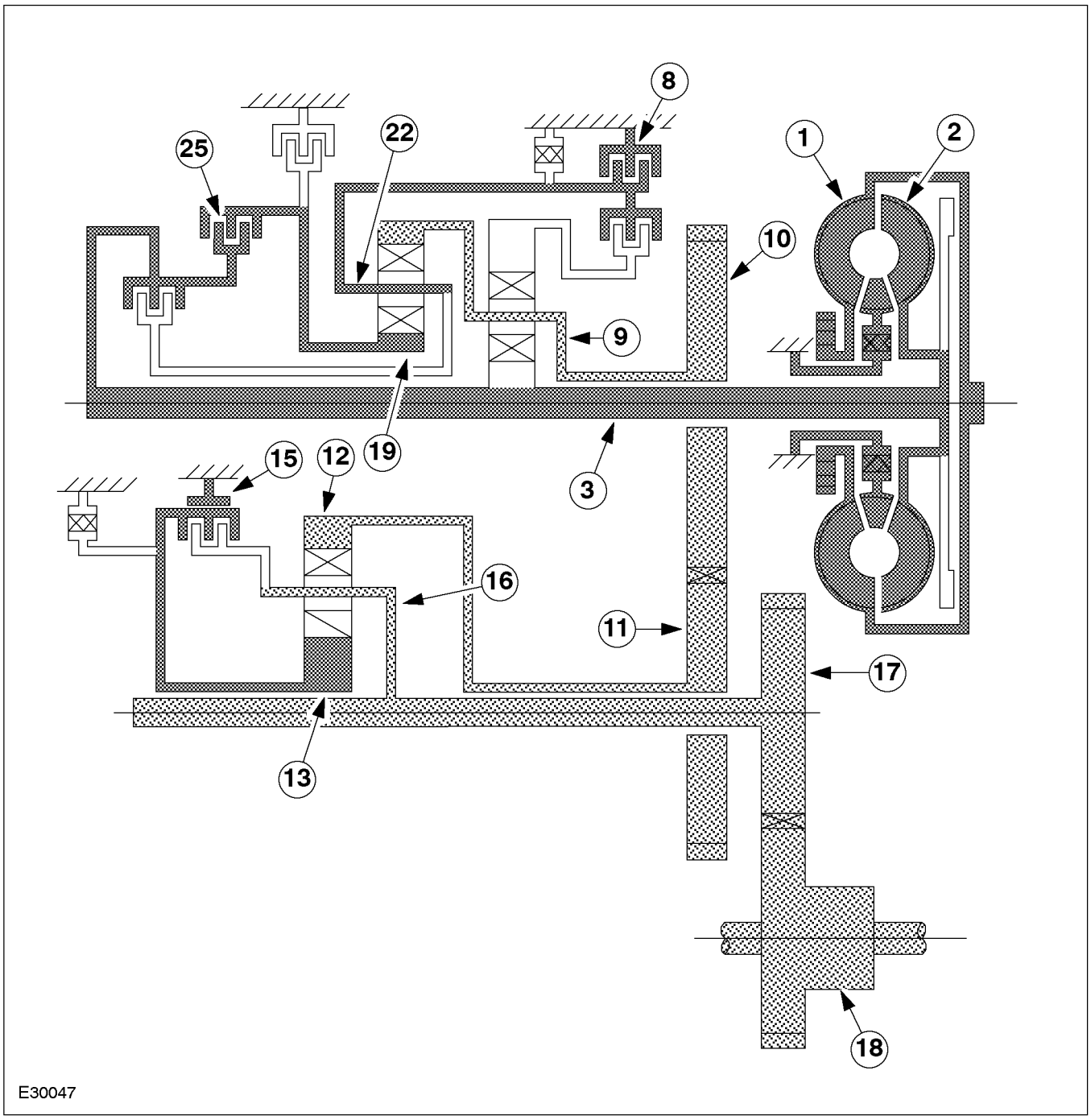
The sun gear (11) is held by the reduction brake band (13).

The planetary gears roll on the sun gear, which is being held, and drive the planetary gear carrier (14), which is rigidly linked to the driven gear of the reduction gearset (15).

The driven gear of the reduction gearset drives the differential (16).

DESCRIPTION AND OPERATION

Power transmission route in reverse gear



Item	Part Number	Description
1	-	Impeller
2	-	Turbine
3	-	Transmission input shaft
8	-	Reverse gear brake

Item	Part Number	Description
9	-	Planetary gear carrier (2nd set) and ring gear (1st set).
10	-	Driven gear of 1st and 2nd planetary gearset
11	-	Drive gear for reduction gearset

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
12	-	Ring gear (reduction gearset)
13	-	Sun gear (reduction gearset)
15	-	Reduction brake band
16	-	Planetary gear carrier (reduction gearset)
17	-	Driven gear of reduction gearset
18	-	Differential assembly
19	-	Sun gear (1st set)
22	-	Planetary gear carrier (1st set)
25	-	Reverse clutch

1st and 2nd planetary gearset:

Drive (input)

- Impeller (1)
  - Turbine (2)
  - Transmission input shaft (3)
  - Reverse clutch (25)
  - Sun gear (1st set) (19)

Held

- Planetary gear carrier (1st set) (22) by the reverse gear brake (8)

Drive (output)

- Planetary gear carrier (2nd set) and ring gear (1st set) (9)
  - Driven gear of 1st and 2nd planetary gearset (10)

Reduction planetary gearset:

Drive (input)

- Drive gear for reduction gearset (11)
  - Ring gear (12)

Held

- Sun gear (13) via the reduction brake band (15)

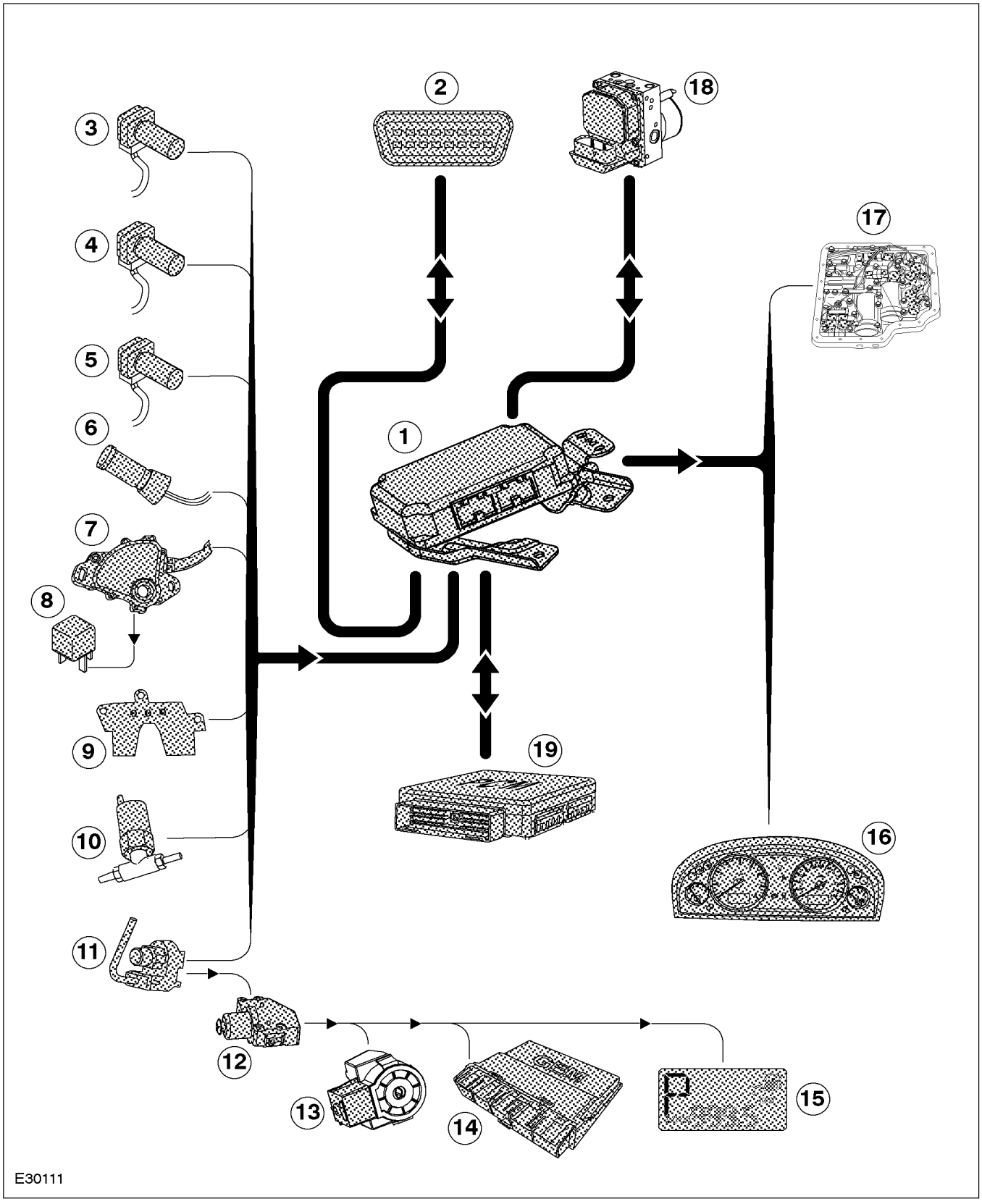
Drive (output)

- Planetary gear carrier (16)
  - Driven gear of reduction gearset (17)
  - Differential (18)

DESCRIPTION AND OPERATION

Transaxle Electronic Control System

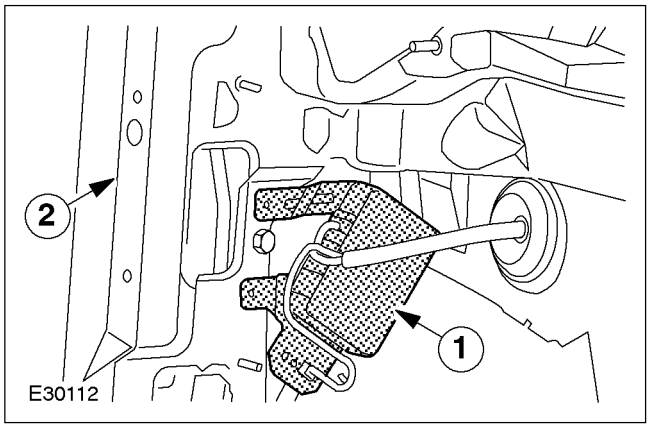
Overview



DESCRIPTION AND OPERATION

Item	Part Number	Description
1	-	Transmission control unit
2	-	Data Link Connector (DLC)
3	-	Turbine Shaft Speed (TSS) sensor
4	-	Intermediate shaft speed sensor
5	-	Output Shaft Speed (OSS) sensor
6	-	Transmission Fluid Temperature (TFT) sensor
7	-	Transmission Range (TR) sensor
8	-	Backup lamp relay
9	-	Select-Shift switch
10	-	Brake pressure switch (only on vehicles with a diesel engine and no ESP)
11	-	Stoplamp switch
12	-	Selector lever lock solenoid
13	-	Solenoid for the ignition key removal inhibitor
14	-	Generic Electronic Module (GEM)
15	-	Park display in the instrument cluster
16	-	Instrument Cluster
17	-	Solenoid valves in the main control body
18	-	ESP control unit
19	-	Powertrain Control Module (PCM)

Transmission control unit



Item	Part Number	Description
1	-	Transmission control unit
2	-	A-pillar

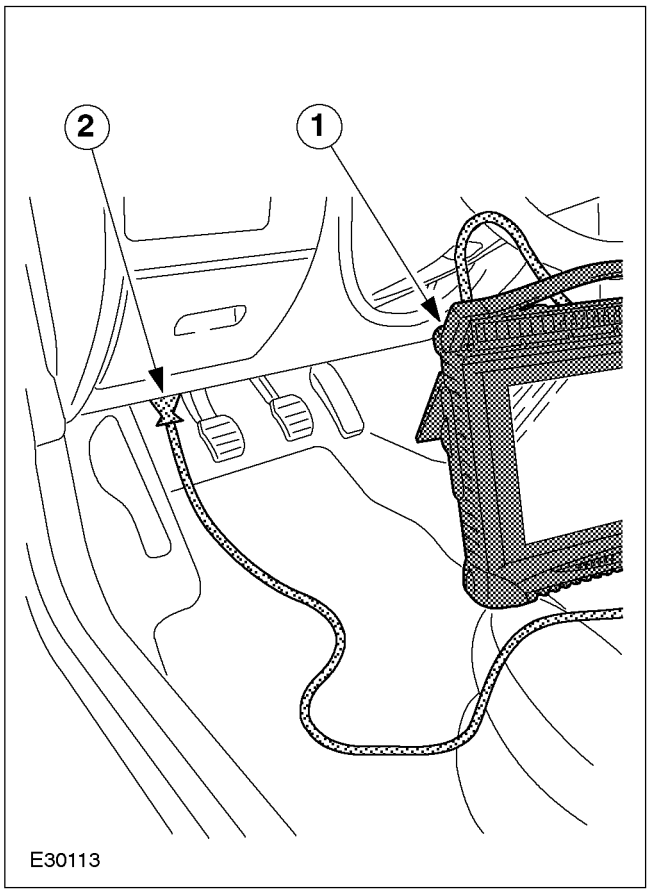
Installation position.

- The transmission control unit is located in the passenger compartment at the left-hand A-pillar.

Function

DESCRIPTION AND OPERATION (Continued)

- The transmission control unit evaluates incoming signals and controls the actuators accordingly.



Item	Part Number	Description
1	-	WDS
2	-	DLC

Diagnosis

- The transmission control can be diagnosed via the data link connector (DLC) in the passenger compartment.

Shift strategy

The shift strategy employed by the transmission control unit depends on various operating conditions. The transmission control unit makes an overall distinction between ten different strategies, which are applied in a defined order of priority.

The following table shows the different strategies (modes) together with their assigned priority (lowest number = highest priority).

Mode	Priority
Normal	9
Auto/sport	8
Hill climb	7
Cold start	6
Overheating protection	5
Stop & go	4
Fast off	3
Hill descent	2
Select-Shift	1
Emergency running	0

Normal mode

Normal mode is the shift strategy employed when the selector lever is in position "D".

In normal mode the transmission control unit selects the shift strategy according to the following criteria transmitted by the PCM:

- Throttle valve slightly open
- Throttle valve approximately half open
- Throttle valve wide open

When the throttle valve is slightly open, the shift pattern is calculated to minimise fuel consumption and pollutant emissions, whilst simultaneously providing a comfortable ride.

With the throttle valve around half open, the shift timing is mostly adapted to ride comfort.

When the throttle valve is in the wide open position, the timing of the gearshifts is calculated for maximum power.

Auto/sport mode

The auto/sport mode is designed to offer drivers with a more sporty driving style a shift strategy to suit their needs. The transmission control unit shifts down earlier (at higher engine speeds), particularly under part load conditions.

The PCM detects the speed with which the accelerator pedal is depressed and passes this information on to the transmission control unit Once the speed with which the accelerator pedal is depressed exceeds a certain threshold, the transmission control unit switches into auto/sport mode and alters the shift timing accordingly.

Hill climb mode

The hill climb mode is utilised to avoid unnecessary switching back and forth between gears.

DESCRIPTION AND OPERATION (Continued)

The transmission control unit calculates the gradient according to the change in the accelerator pedal position detected by the PCM in relation to the acceleration of the vehicle.

Depending on the calculated gradient, upshifts from 4th to 5th gear, 3rd to 4th gear or 2nd to 3rd gear are prevented.

Cold start mode

Cold start mode is employed when it is important to get the transmission fluid up to operating temperature as quickly as possible.

At transmission fluid temperatures below approx. 30 °C, the Torque Converter Clutch (TCC) is not engaged.

At transmission fluid temperatures below approx. 5 °C, gearshifts into 5th gear are disabled.

The transmission control unit exits the cold start mode when the transmission fluid temperature exceeds 10 °C, or after a maximum of 10 minutes.

Overheating protection mode

The overheating protection mode serves to protect the transmission against overheating and the serious damage it can cause.

If the transmission fluid temperature reaches a temperature of around 120 °C or if the Engine Coolant Temperature (ECT) reaches approx. 115 °C, the transmission control employs a shift pattern designed to prevent a further increase in the transmission fluid temperature. In addition, the TCC is also engaged in 2nd gear in order to reduce the temperature of the transmission fluid.

When the transmission fluid temperature drops back below approx. 117 °C or the ECT drops back below approx. 111 °C, the transmission control exits the overheating protection mode.

Stop & go mode

NOTE: Stop & go mode only applies to vehicles with a 2.5L Duratec engine.

Stop & go mode prevents over-frequent gearshifts when the vehicle is in stop & go traffic.

The transmission control unit counts the number of accelerator pedal actuations transmitted by the PCM within a certain time and compares them to the vehicle speed. If the transmission control unit detects stop & go mode it suppresses gearshifts into 1st gear. The vehicle will then also pull away from standing in 2nd gear.

If the transmission control unit detects higher vehicle speeds or wider opening of the throttle valve, then it automatically exits the stop & go mode.

Fast off mode

The fast off mode prevents instantaneous upshifts when the accelerator pedal is suddenly released.

In order to give the driver a more direct driving experience and to better exploit engine braking (e.g. during fast cornering), the system suppresses an immediate upshift to the next higher gear at vehicle speeds above approx. 50 km/h if the accelerator pedal is suddenly released.

Hill descent mode

The hill descent mode is used to take better advantage of engine braking during hill descents.

At vehicle speeds above approx. 25 km/h the transmission control unit prevents upshifts if the throttle valve is closed. Depending on the current driving conditions, the system suppresses gearshifts into 3rd, 4th or 5th gear.

If under these conditions the brake is depressed for approx. 0.2 seconds, then the transmission control unit also shifts down a gear if the conditions permit.

NOTE: Repeated operation of the brake pedal can lead to further downshifts.

If the throttle valve is opened further or the vehicle speed drops below around 25 km/h then the transmission control exits the hill descent mode.

Select-Shift-Mode

The Select-Shift-Mode is selected directly by the driver and is designed to give the driver a more direct driving experience.

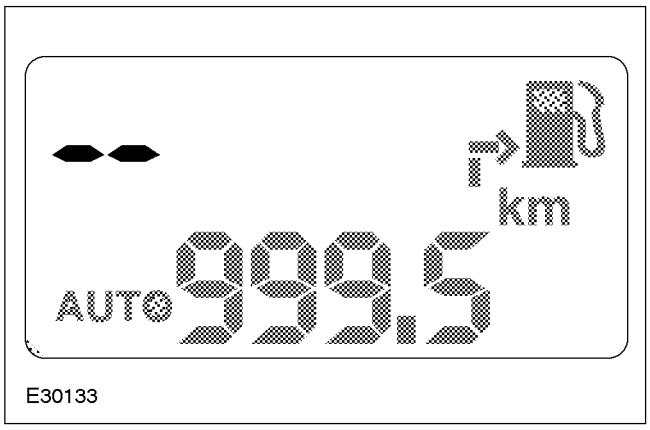
The transmission control ensures that no damage can be caused as a result of inappropriate operation of the system.

DESCRIPTION AND OPERATION (Continued)

- If the upper engine speed limit is reached then the transmission control unit automatically shifts up to the next gear.
- If the engine speed drops below a certain value then the transmission control unit automatically shifts down a gear.
- If the action of shifting down a gear would cause the engine to rev above its maximum speed limit then the transmission control unit does not allow the downshift to take place.

Select-Shift-Mode allows the driver to pull away from standing in 2nd gear (winter operation) and enables kick-down up to around 80 km/h.

Emergency running mode



E30133

If due to the failure of certain signals the transmission control unit can no longer ensure that the correct gearshifts are performed, then it automatically switches into emergency running mode. In this case the transmission control unit no longer actuates the solenoids in the main control body.

The driver can drive on, but the following restrictions apply:

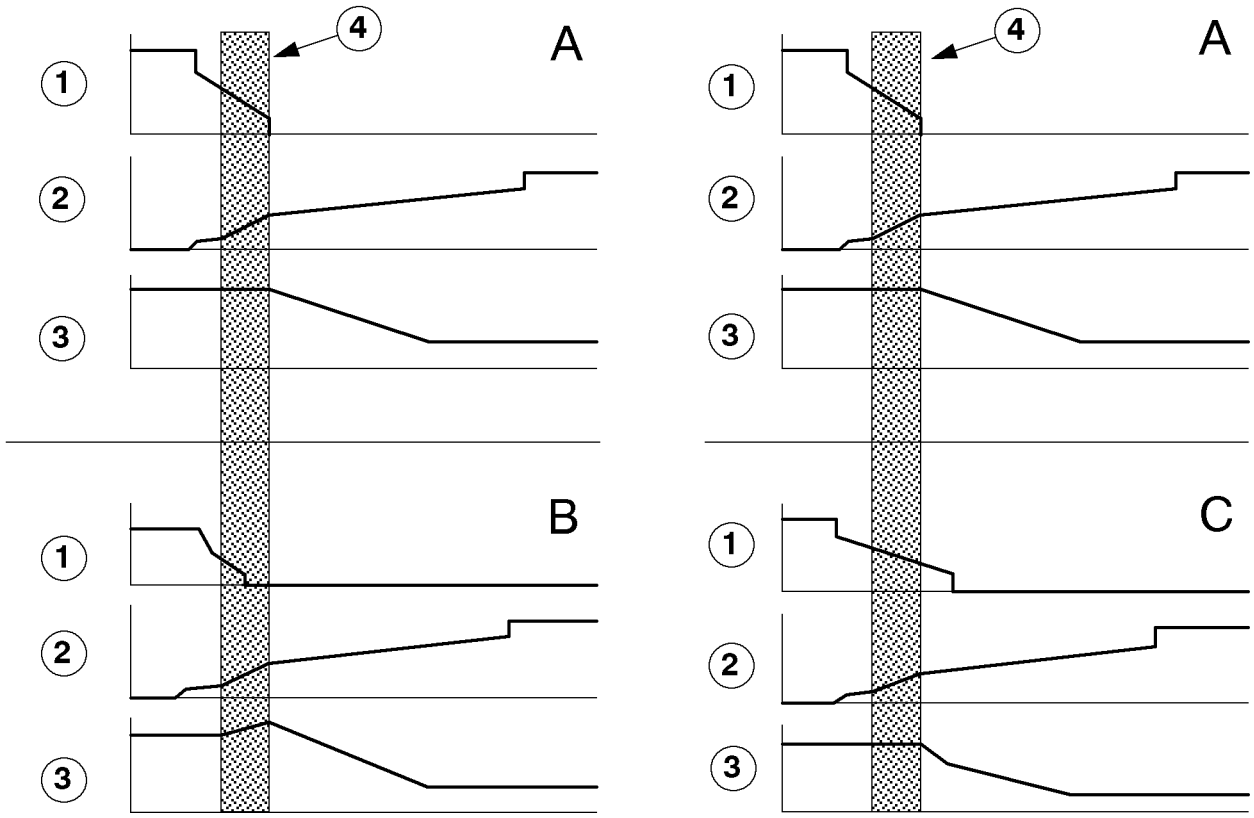
- Maximum line pressure (harsh engagement).
- 4th gear in selector lever position "D" without TCC ,
- Reverse gear in selector lever position "R".

The emergency running mode is implemented via the manual selector lever in the main control body. All gearshifts are controlled purely hydraulically.

The emergency running mode is indicated with two horizontal lines on the instrument cluster (see illustration).

DESCRIPTION AND OPERATION (Continued)

Electronically synchronised gearshift control



E31007

Gearshift

Item	Part Number	Description
1	-	Pressure of the component which is to be disengaged
2	-	Pressure of the component which is to be engaged
3	-	Turbine shaft speed
4	-	Synchronisation range for the gearshift
A	-	Synchronous gearshift

Item	Part Number	Description
B	-	Asynchronous gearshift (pressure released too early on the component which is to be disengaged)
C	-	Asynchronous gearshift (pressure released too late on the component which is to be disengaged)

Control of the gearshifts with an electronically synchronised gearshift control

During a gearshift, certain gearshift elements are released while others are simultaneously pressurised. Ideally this process should be

DESCRIPTION AND OPERATION (Continued)

synchronised, i.e. the two parts should take place simultaneously in order to avoid judder during the gearshift.

If the pressure is released too early (B) at the element which is to be disengaged, this would cause an unwanted increase in the turbine shaft speed and the engine speed, as the element which is to be engaged cannot yet transmit the input torque.

If the pressure is released too late (C) at the element which is to be disengaged, this would cause a drop in the turbine shaft speed, as both gearshift elements would transmit the input torque. An internal lock-up would cause the torque to be transmitted to the transmission housing in this case.

In both cases a judder would be felt during the gearshift.

A timeframe is also set for the gearshift which should not be exceeded. Normal wear on the gearshift elements would, after a long service life, cause an increase in the time taken for the gearshift.

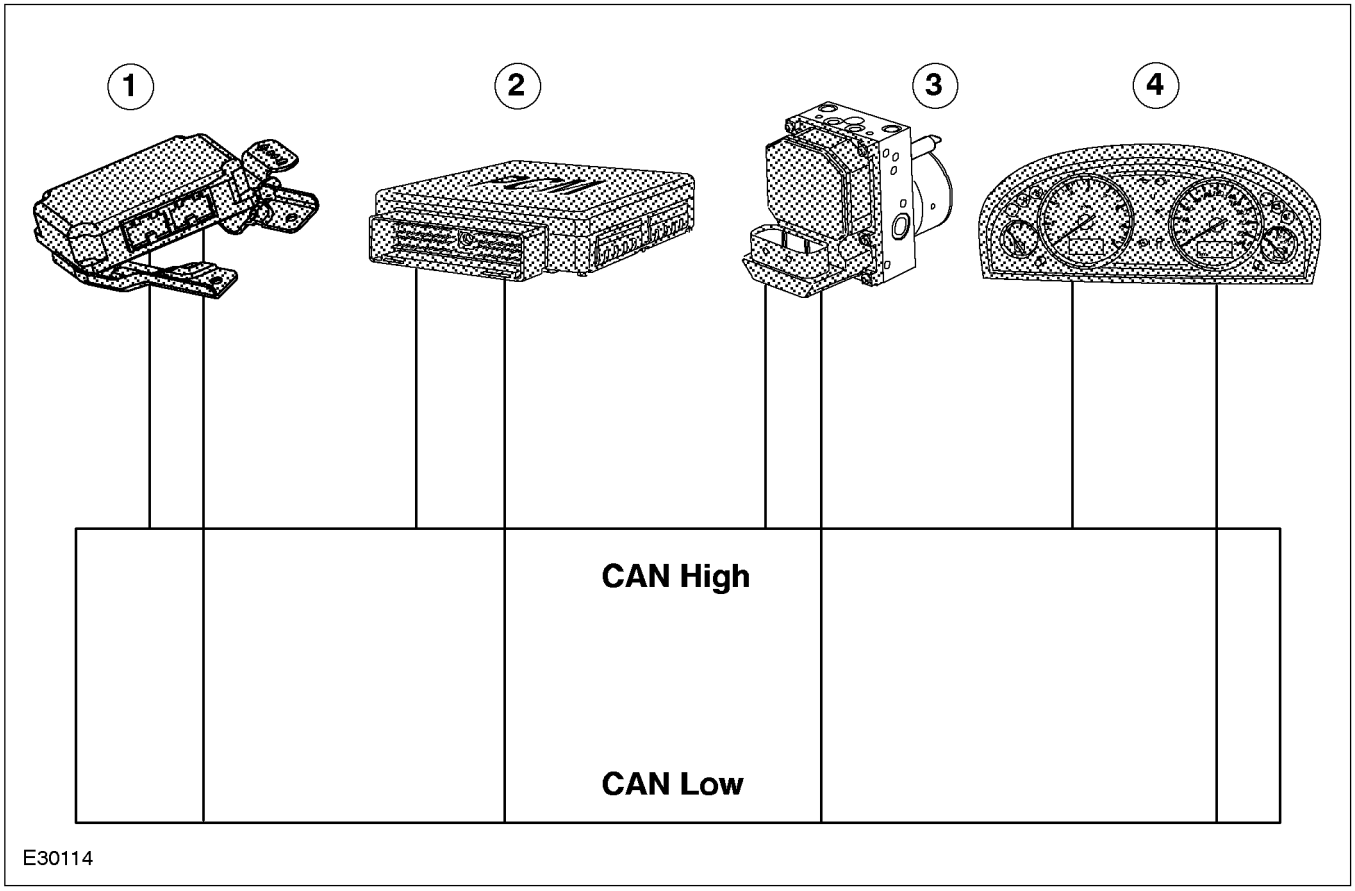
The electronically synchronised gearshift control monitors the gearshift time on the one hand, and on the other hand checks that the gearshift is synchronised.

If the electronically synchronised gearshift control detects a deviation from the values programmed into the transmission control unit then the hydraulic pressure is adapted for the gearshift.

This enables the transmission control to adapt the gearshift patterns over the service life of the transmission to the changing requirements resulting from component wear, so that good gearshift quality is maintained throughout.

Signal transmission on the CAN databus

NOTE: On vehicles without electronic stability program (ESP), the Anti-lock Brake System (ABS) control unit is not connected to the CAN databus.



Item	Part Number	Description
1	-	Transmission control unit

Item	Part Number	Description
2	-	PCM

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
3	-	ESP control unit
4	-	Instrument Cluster

Installation position.

The PCM is located on the right-hand side of the interior near the bulkhead. The electrical connector is accessible from the engine compartment.

The ESP control unit forms a single component together with the hydraulic unit. The hydraulic unit is located in the engine compartment underneath the brake booster.

Engine speed

The PCM receives an engine speed signal from the Crankshaft Position (CKP) sensor.

This signal is transmitted via the CAN databus to the transmission control unit.

The transmission control unit uses this signal for the following functions:

- controlling the TCC
- automatically engaging neutral when the vehicle is stationary (vehicles with a diesel engine only)

Load signal

The PCM determines a load signal, which is transmitted via the CAN databus to the transmission control unit.

The transmission control unit uses this signal for the following functions:

- determination of the shift strategy
- determination of the main line pressure
- determination of the gearshift timing

Brake pressure signal

NOTE: Vehicles with a diesel engine and no ESP are equipped with a separate brake pressure switch, which sends the brake pressure signal directly (not via the CAN databus) to the transmission control unit.

On vehicles with a diesel engine and ESP, a brake pressure signal is sent from the ESP control unit to the transmission control unit. This signal is used by the transmission control unit for automatic engagement of neutral when the vehicle is stationary.

Torque reduction signal

The transmission control unit signals its intention to perform a gearshift via the CAN databus to the PCM.

The PCM then reduces the engine torque, ensuring that the gearshift is as smooth and judder-free as possible.

Vehicle speed signal

The vehicle speed signal is sent from the transmission control unit via the CAN databus to the PCM.

The PCM processes the signal and forwards it, again via the CAN databus, as the vehicle speed to the instrument cluster.

On vehicles with ESP, the PCM utilises the signal from the ABS wheel sensors, which is received via the CAN databus.

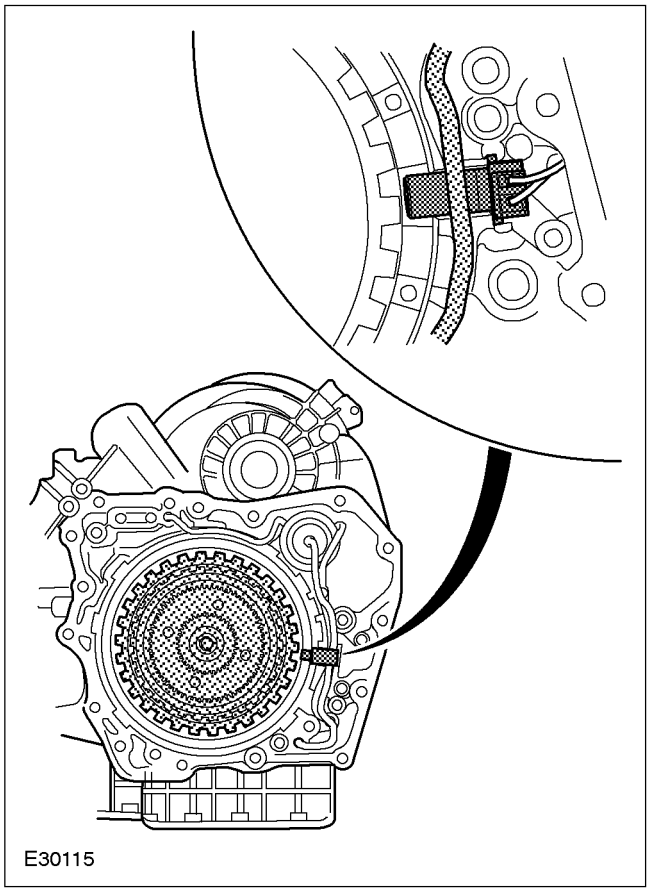
Selector lever position

The transmission control unit broadcasts the selector lever position and the engaged gear via the CAN databus.

The instrument cluster indicates the selector lever position or the engaged gear (Select-Shift-Mode) to the driver.

DESCRIPTION AND OPERATION (Continued)

TSS sensor



Installation position.

- The TSS sensor is located in the transmission above the reverse clutch.

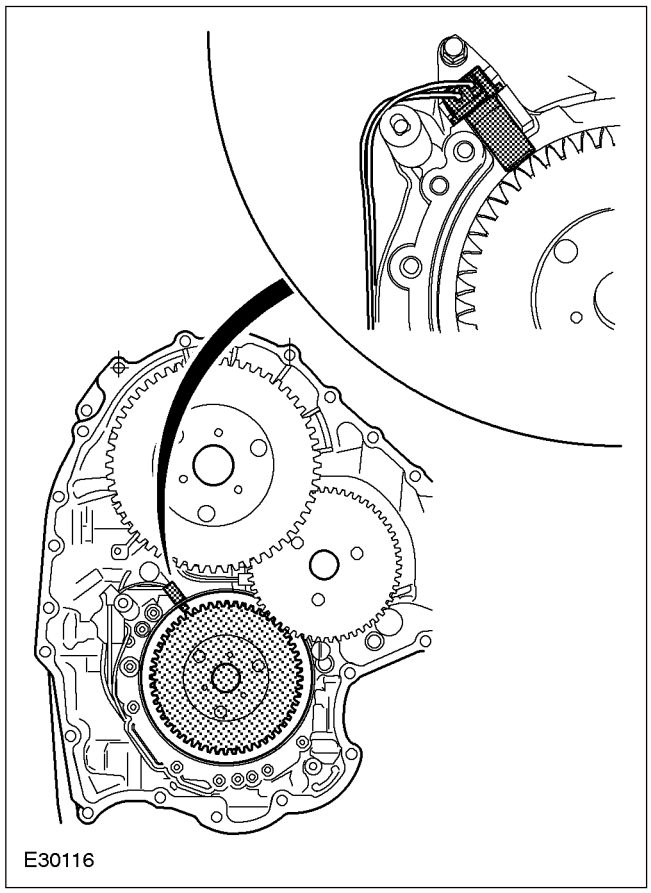
Use of the signal

- The TSS sensor is an inductive pickup which detects the rotational speed of the transmission input shaft via the outer side of the reverse clutch.
- The signal is used for the following functions:
  - controlling the main line pressure,
  - controlling the TCC.

Consequences of signal failure

- harsher gearshifts
- no automatic engagement of neutral when the vehicle is stationary (vehicles with a diesel engine only)
- hill climb mode and hill descent mode unavailable

Intermediate shaft speed sensor



Installation position.

- The intermediate shaft speed sensor is located in the transmission above the driven gear of the 1st and 2nd planetary gearset.

Use of the signal

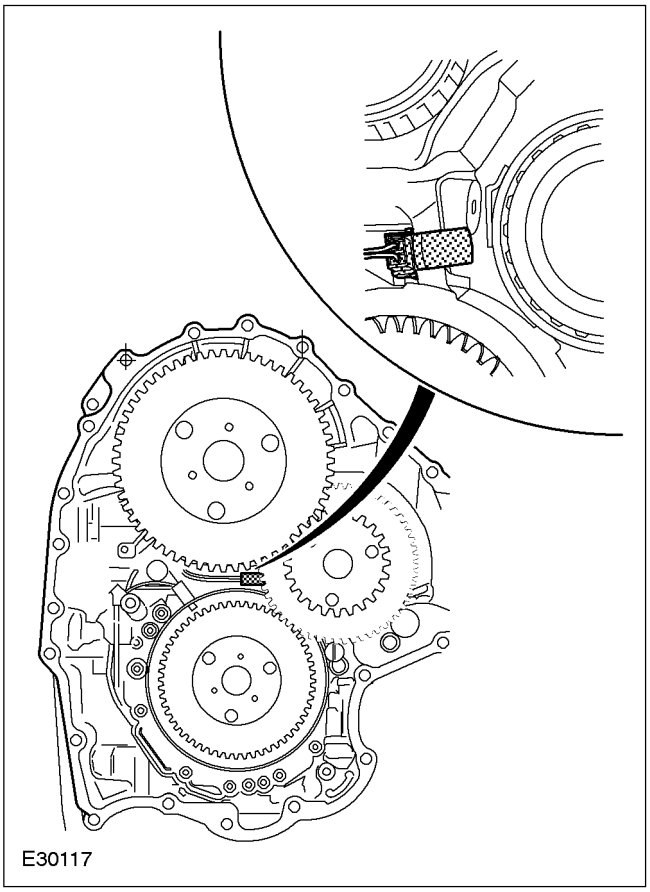
- The intermediate shaft speed sensor is an inductive pickup which detects the rotational speed via the driven gear of the 1st and 2nd planetary gearset.
- The signal is used to calculate the timing for engagement and disengagement of the clutches and brakes.

Consequences of signal failure

DESCRIPTION AND OPERATION (Continued)

- harsher gearshifts

OSS sensor



Installation position.

- The OSS sensor is located in the transmission above the parking gear.

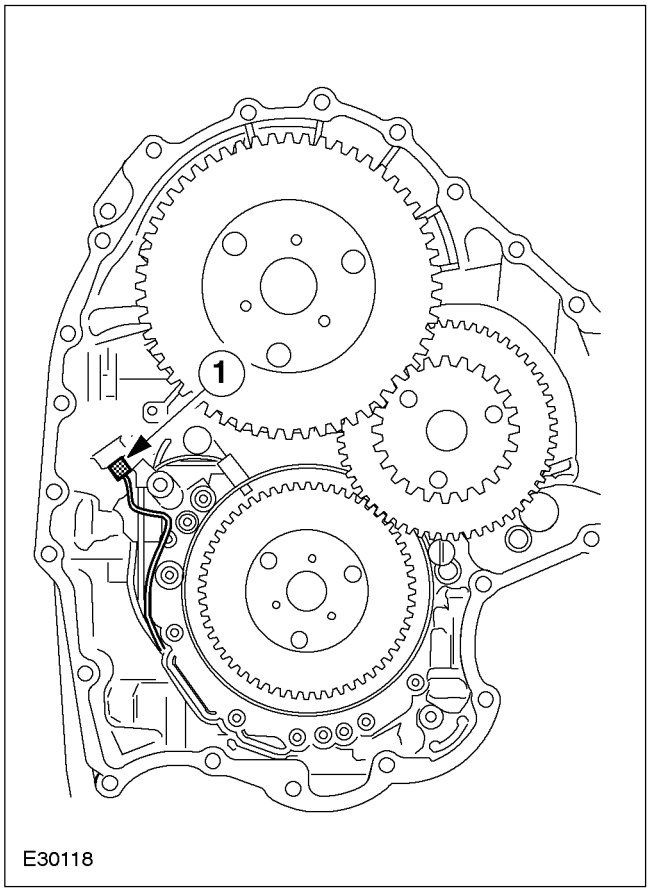
Use of the signal

- The OSS sensor is an inductive pickup which detects the rotational output speed of the reduction planetary gearset via the parking gear.
- The parking gear sits on the planetary gear carrier of the reduction gearset.
- The signal is used for the following functions:
  - determination of the gearshift timing
  - determination of the main line pressure
  - controlling the TCC
  - as an input signal for the vehicle speed.

Consequences of signal failure

- harsher gearshifts
- no automatic engagement of neutral when the vehicle is stationary (vehicles with a diesel engine only)
- hill climb mode and hill descent mode unavailable

TFT sensor



Item	Part Number	Description
1	-	TFT sensor

Installation position.

- The TFT sensor is located in the transmission underneath the oil filter.

Use of the signal

- The TFT sensor is an NTC resistor which determines the transmission fluid temperature.
- The transmission fluid temperature is used by the transmission control unit for the following functions:

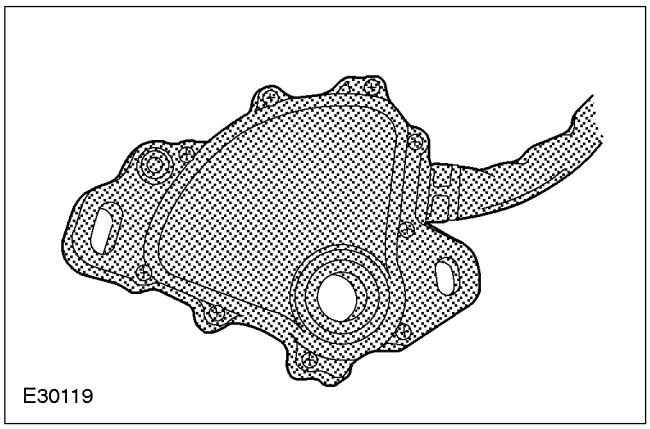
DESCRIPTION AND OPERATION (Continued)

- determination of the gearshift timing
- determination of the main line pressure
- controlling the TCC
- overheating protection mode
- cold start mode

Consequences of signal failure

- The signal from the ECT sensor is used as a substitute value.
- Cold start mode is unavailable.

TR sensor



Installation position.

- The TR sensor is located on the selector shaft near the top of the transmission housing.

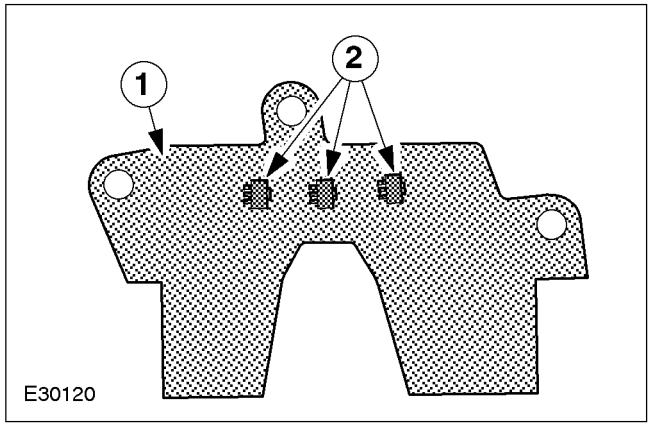
Use of the signal

- In the TR sensor there are four Hall senders with an integrated circuit which enable contact-free detection of the selector lever position.
- Their output signals are digital.
- The signal from the TR sensor is used for the following functions:
  - detecting the selector lever position,
  - actuating the backup lamp relay
  - determining the main line pressure

Consequences of signal failure

- harsher gearshifts
- auto/sport, hill climb and hill descent modes unavailable
- no automatic engagement of neutral when the vehicle is stationary (vehicles with a diesel engine only)

Select-Shift switch



Item	Part Number	Description
1	-	Carrier plate
2	-	Hall sensors

Installation position.

- The Select-Shift switch is located on the selector lever.

Use of the signal

- The Select-Shift consists of three Hall sensors and an integrated circuit.
- The signals from the Hall sensors are converted in the integrated circuit to two digital output signals which are then transmitted to the transmission control unit. The transmission control unit uses these signals to detect driver demands.
- If the driver moves the selector lever to the right-hand shift gate, then the transmission control goes into Select-Shift mode.
- When the selector lever is pulled backwards (+), the transmission control shifts up a gear if the vehicle speed permits.
- When the selector lever is pushed forwards (-), the transmission control shifts down a gear if the vehicle speed permits.
- If the transmission control unit does not allow the gearshift to take place because the engine speed is too high or too low, then it

DESCRIPTION AND OPERATION (Continued)

does not store the desired gear change and perform it at a later stage.

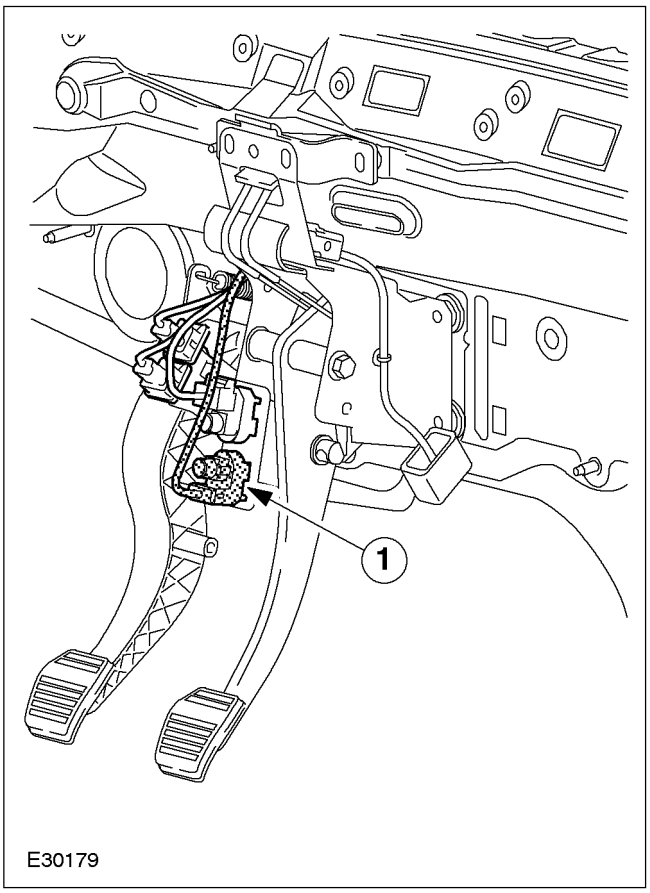
Consequences of signal failure

- Select-Shift-Mode is unavailable.

Internal and external signals

Selector lever position	Hall sensor 1 (+)	Hall sensor 2 (M)	Hall sensor 3 (-)	Output of line 1	Output of line 2
D	Off	Off	Off	1	1
M	Off	On	Off	0	0
+	Off	On	On	1	0
-	On	On	Off	0	1

Stoplamp switch



Item	Part Number	Description
1	-	Stoplamp switch

Installation position.

- The stoplamp switch is located on the brake pedal.

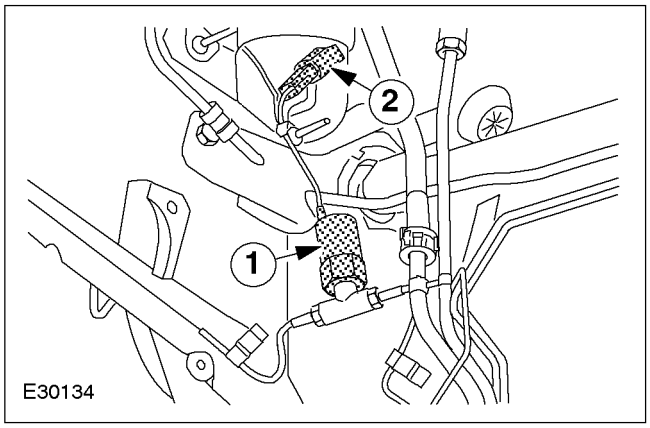
Use of the signal

- The signal from the stoplamp switch is used for the following functions:
  - release of the selector lever lock solenoid
  - for disengagement of the TCC
  - for hill descent mode

Consequences of signal failure

- The selector lever cannot be moved out of the "P" position.
- Hill descent mode is unavailable.

Brake pressure switch



Item	Part Number	Description
1	-	Brake pressure switch
2	-	Plug connection

NOTE: The brake pressure switch is only fitted on vehicles with a diesel engine and **no** ESP.

Installation position.

- The brake pressure switch is located in the engine compartment underneath the fuel filter. It is integrated in the brake circuit leading to the front right-hand brake caliper.

Use of the signal

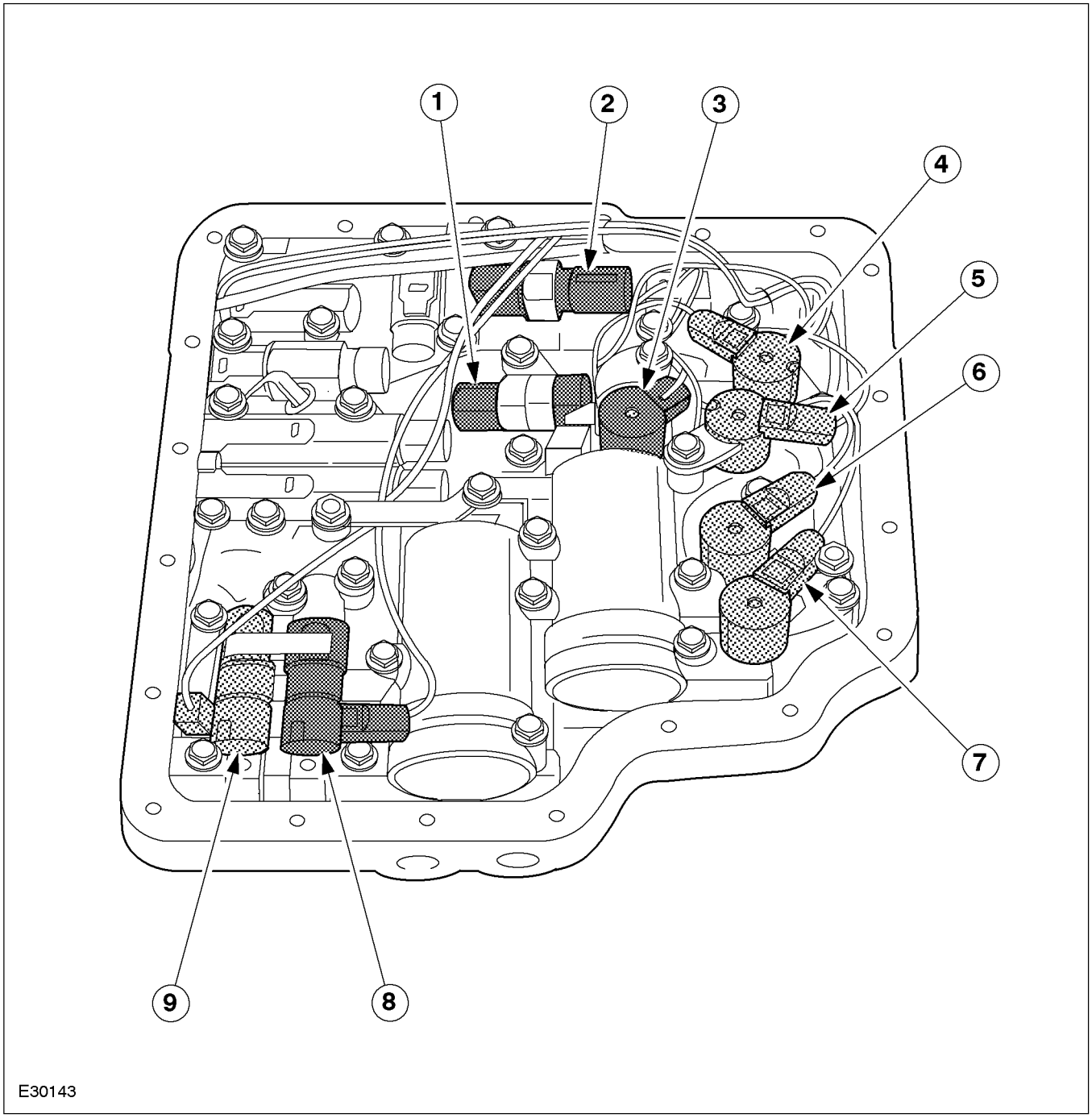
DESCRIPTION AND OPERATION (Continued)

- The brake pressure switch supplies a signal to the transmission control unit whenever brake pressure is built up.
- The signal is only used for automatic engagement of neutral when the vehicle is stationary (only on vehicles with a diesel engine).

Consequences of signal failure

- no automatic engagement of neutral when the vehicle is stationary (vehicles with a diesel engine only)

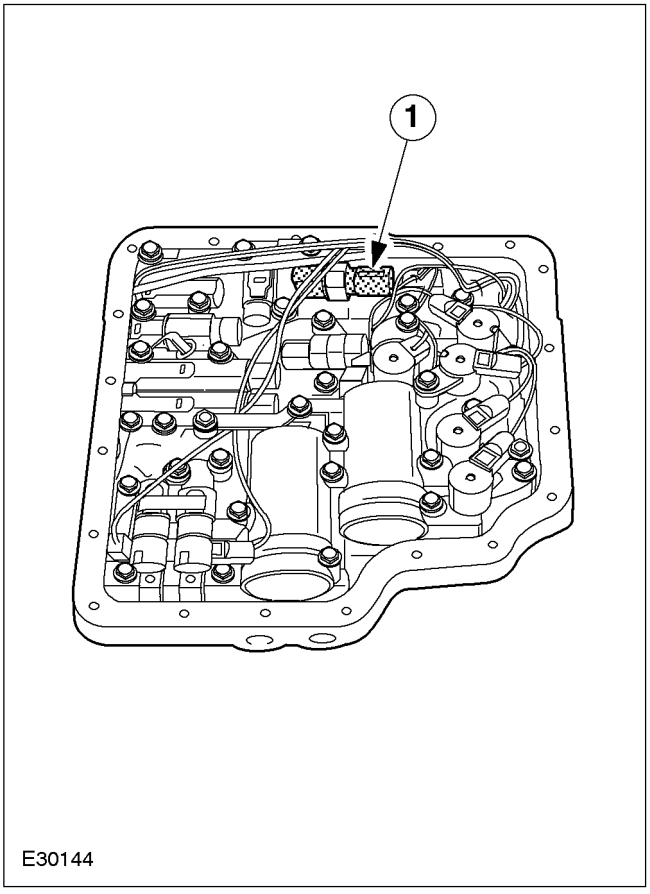
Overview of solenoids in the main control body



DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1	-	PWM solenoid - 3rd-5th gear clutch
2	-	Main regulating valve
3	-	PWM solenoid - TCC
4	-	Shift solenoid SSA
5	-	Shift solenoid - reduction brake band
6	-	Shift solenoid SSB
7	-	Shift solenoid SSC
8	-	PWM solenoid - 2nd/4th/5th gear brake
9	-	Shift solenoid - engagement of neutral

Main regulating valve



Item	Part Number	Description
1	-	Main regulating valve

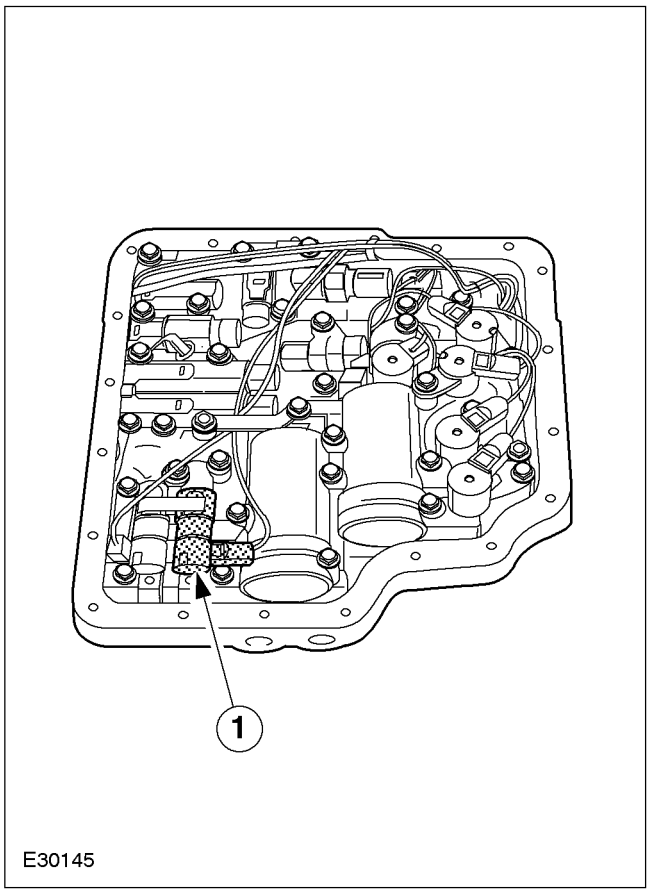
Function

- The main regulating valve is a pulse-width modulated (PWM) solenoid.
- It controls the main line pressure according to the driving conditions. This ensures smooth, judder-free gearshifts.

Consequences of component failure

- maximum line pressure
- harsh gearshifts

PWM solenoid - 2nd/4th/5th gear brake



Item	Part Number	Description
1	-	PWM solenoid - 2nd/4th/5th gear brake

Function

- The PWM solenoid - 2nd/4th/5th controls the fluid pressure during engagement and

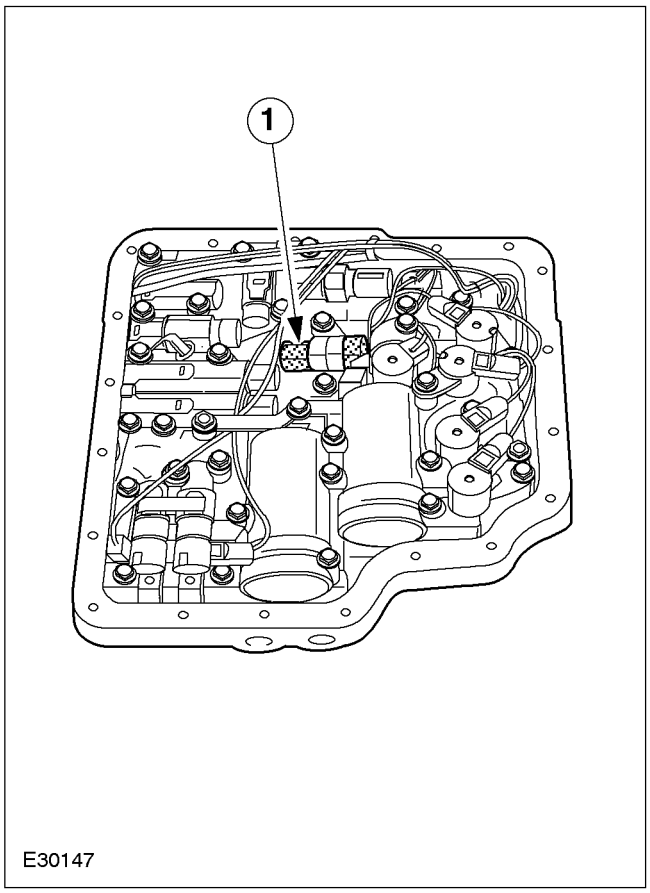
DESCRIPTION AND OPERATION (Continued)

disengagement of the 2nd/4th/5th gear brake. gear brake

Consequences of component failure

- maximum line pressure
- harsh gearshifts

PWM solenoid - 3rd-5th gear clutch



Item	Part Number	Description
1	-	PWM solenoid - 3rd-5th gear clutch

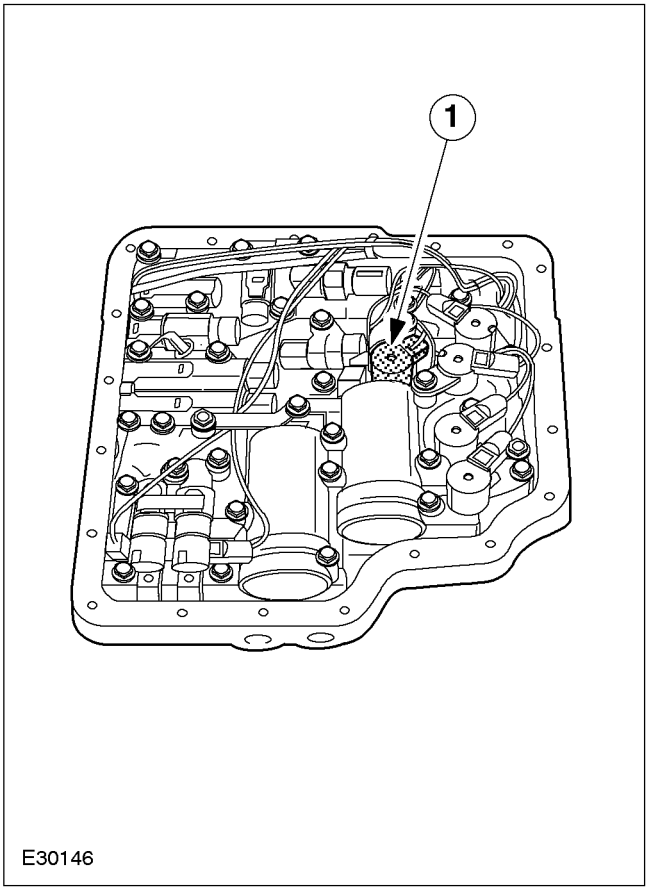
Function

- The PWM solenoid - 3rd-5th gear clutch controls the fluid pressure during engagement and disengagement of the 3rd-5th gear clutch.

Consequences of component failure

- maximum line pressure
- harsh gearshifts

PWM solenoid - TCC



Item	Part Number	Description
1	-	PWM solenoid - TCC

Function

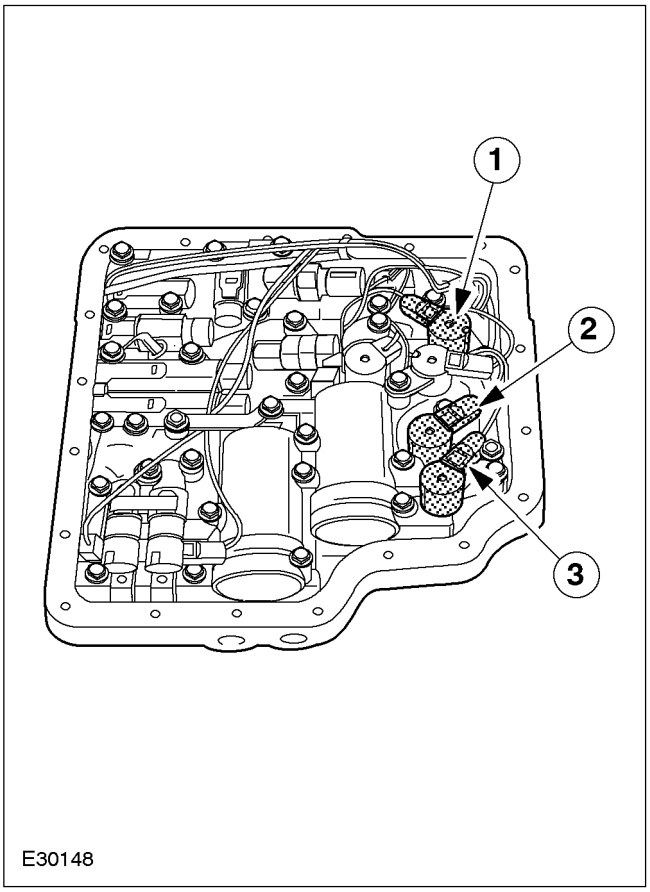
- The TCC PWM solenoid controls the pressure during engagement and disengagement of the TCC.
- When there is no electrical supply, the TCC is disengaged.

Consequences of component failure

DESCRIPTION AND OPERATION (Continued)

- TCC cannot be engaged.

Shift solenoids SSA, SSB and SSC



Item	Part Number	Description
1	-	SSA
2	-	SSB
3	-	SSC

Function

- Shift solenoids SSA, SSB and SSC connect the different hydraulic paths to the clutches and brakes in the main control body.

Consequences of component failure

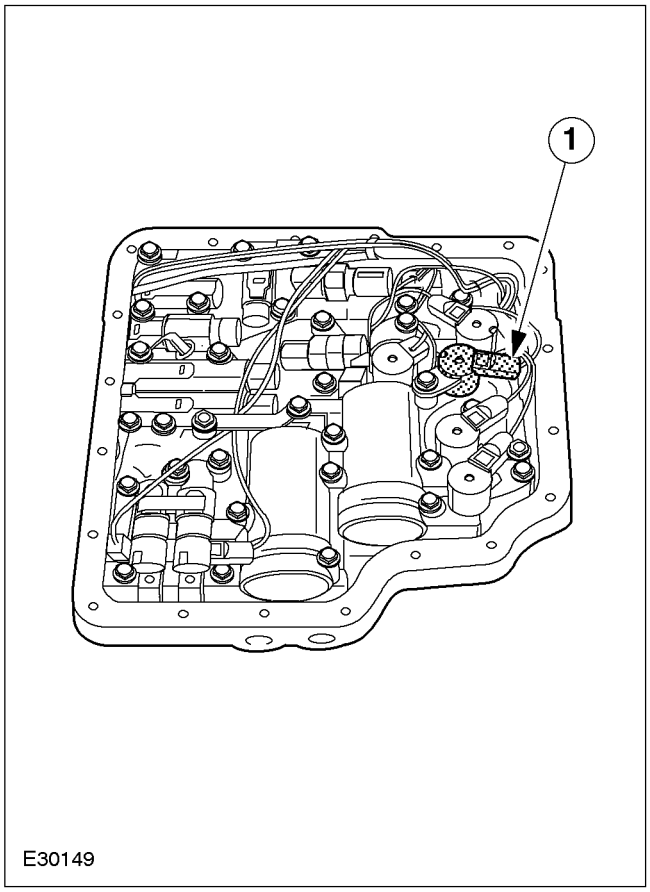
- If the transmission control unit detects a malfunction in the SSA, SSB or SSC, it automatically changes into emergency running mode.

Shift solenoid	Engaged gear					
	1	1*	2	3	4	5
SSA	On	Off	On	Off	Off	On
SSB	On	On	On	On	Off	Off
SSC	On	On	Off	Off	On	On

* 1. gear with engine braking (Select-Shift-Mode)

DESCRIPTION AND OPERATION (Continued)

Shift solenoid - reduction brake band



Item	Part Number	Description
1	-	Shift solenoid - reduction brake band

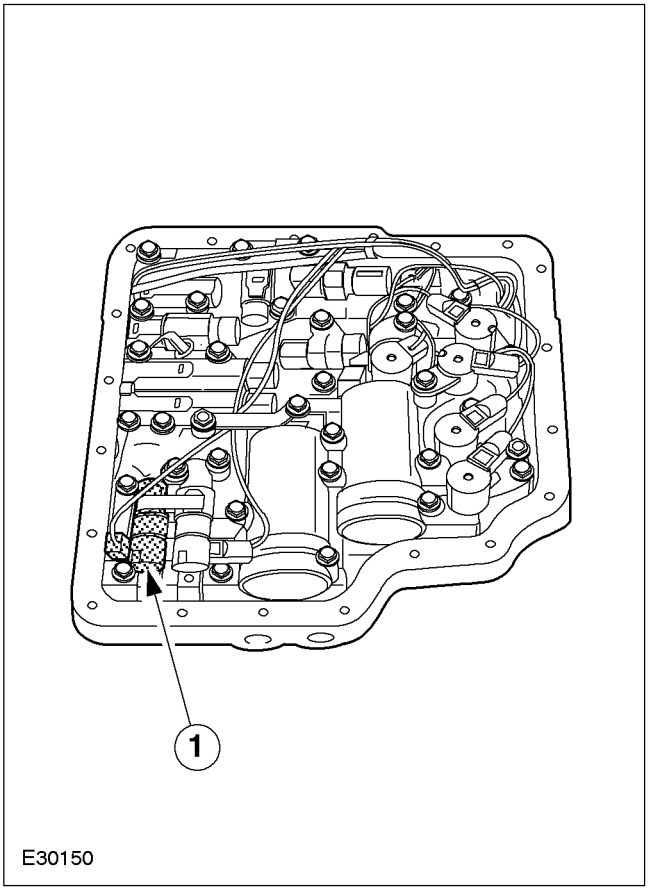
Function

- The reduction brake band shift solenoid controls the engagement and disengagement of the reduction brake band.

Consequences of component failure

- harsher downshifts

Shift solenoid - engagement of neutral



Item	Part Number	Description
1	-	Shift solenoid - engagement of neutral

Function

- The shift solenoid for engagement of neutral performs the following tasks:
  - realisation of the automatic function for engaging neutral when the vehicle is stationary (vehicles with a diesel engine only)
  - prevention of severe transmission damage if reverse gear is engaged at a forward vehicle speed above around 8 km/h.

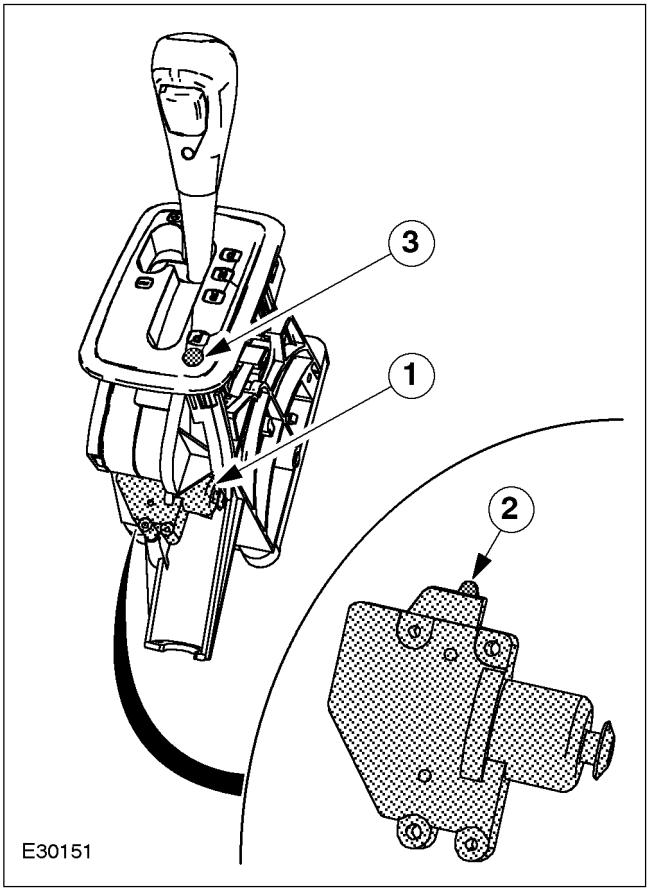
Consequences of component failure

- No automatic engagement of neutral when the vehicle is stationary (vehicles with a diesel engine only)
- It would not be possible to prevent severe transmission damage if reverse gear was

DESCRIPTION AND OPERATION (Continued)

engaged while the vehicle was driving forwards.

Selector lever lock solenoid



Item	Part Number	Description
1	-	Selector lever lock solenoid
2	-	Locking pin
3	-	Opening for manual release

Installation position.

- The selector lever lock solenoid is located in the selector lever console.

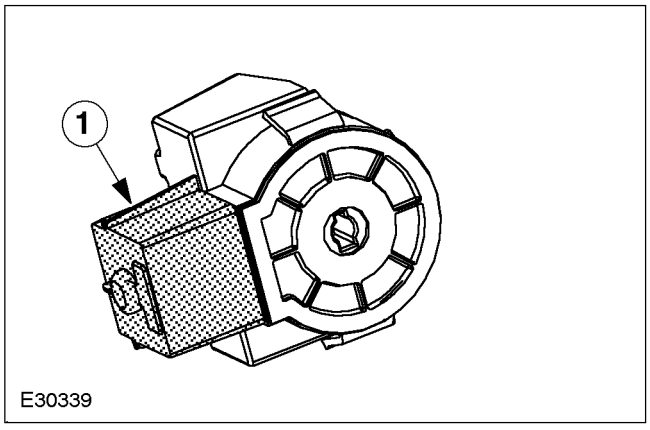
Function

- When the ignition is switched on, the selector lever lock solenoid is actuated by depressing the brake pedal (signal from the stoplamp switch). This results in the locking pin being pulled back, and the selector lever can be moved out of "P".
- The ground connection to the solenoid for the ignition key removal inhibitor is also made via the selector lever lock solenoid in all selector lever positions except "P".
- This ground connection is also used to inform the instrument cluster and the GEM whether or not the selector lever is in position "P".

Consequences of component failure

- If the selector lever lock solenoid is defective, or if the signal from the stoplamp switch is missing or the ground connection is interrupted, then the selector lever cannot be moved out of the position "P".
- The selector lever lock can be manually released by removing the cover and pressing a suitable object into the opening until the selector lever can be moved out of the position "P".
- The selector lever then re-locks if it is moved back to "P".

Solenoid for the ignition key removal inhibitor



Item	Part Number	Description
1	-	Solenoid for the ignition key removal inhibitor

Installation position.

- The solenoid for the ignition key removal inhibitor is integrated in the ignition lock.

Function

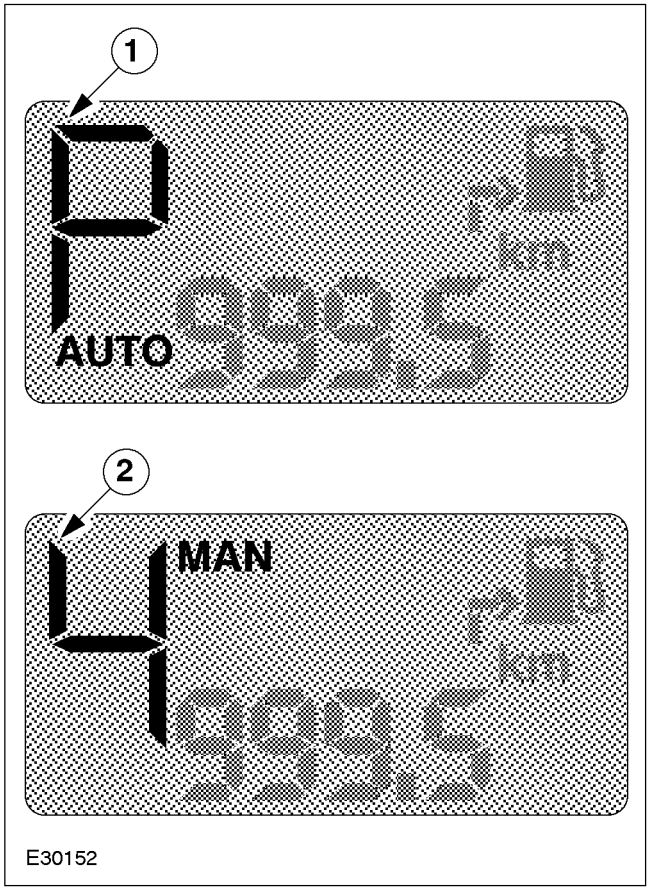
DESCRIPTION AND OPERATION (Continued)

- With the selector lever in position "P", the ground connection via the selector lever lock solenoid is interrupted. The locking pin of the solenoid for the ignition key removal inhibitor does not engage in the ignition lock. The ignition key can be turned to "0" and removed from the ignition lock.
- In all other selector lever positions the ground connection is made via the selector lever lock solenoid. The locking pin of the solenoid for the ignition key removal inhibitor engages in the ignition lock. It is not possible to turn the ignition key to "0" and remove it from the ignition lock.

Consequences of component failure

- A short to ground will make it impossible to remove the ignition key from the ignition lock.
- A break in the electrical circuit will make it possible to remove the ignition key from the ignition lock in all selector lever positions.

Instrument Cluster



Item	Part Number	Description
1	-	Current selector lever position
2	-	Engaged gear

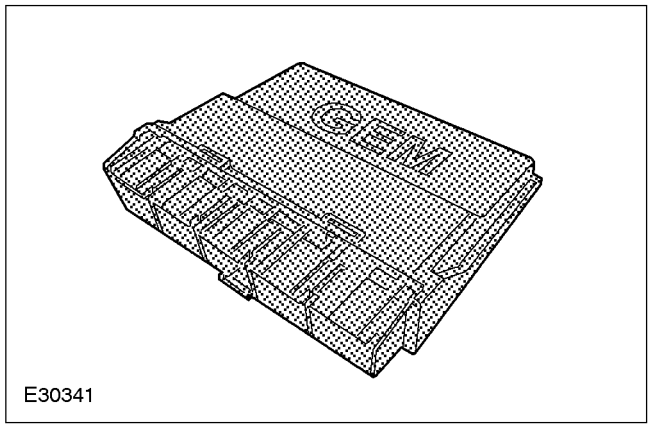
Function

- The instrument cluster indicates the current selector lever position or the engaged gear (Select-Shift mode) to the driver. This signal is transmitted from the transmission control unit via the CAN databus .
- In selector lever position "P", the instrument cluster also receives a signal from the selector lever lock solenoid confirming whether the selector lever is actually in "P".
- The instrument cluster performs a plausibility check with this signal and does not display "P" (for reasons of safety) until both signals from the transmission control unit and the selector lever lock solenoid are present.

Consequences of component failure

- The instrument cluster cannot display the selector lever position or the engaged gear if the signals are not received via the CAN databus.
- If the connection to the selector lever lock solenoid is interrupted then "P" is not displayed.

GEM



Installation position.

- The GEM is located in the passenger compartment underneath the glove compartment.

Function

- In conjunction with the automatic transmission, the GEM warns the driver with a warning tone if the selector lever is not in

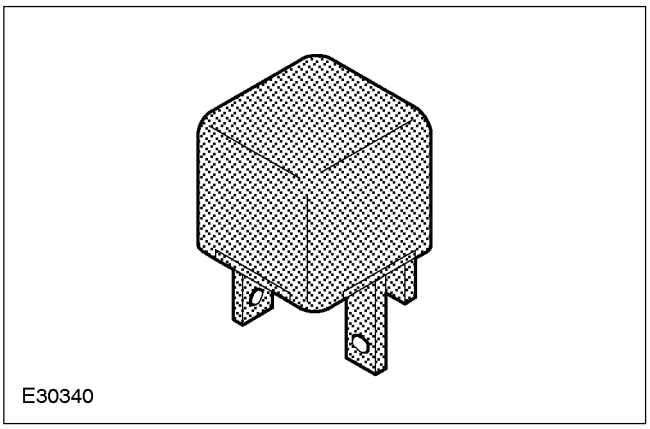
DESCRIPTION AND OPERATION (Continued)

position "P" and the ignition key is turned to position "1". The GEM receives the information whether or not the selector lever is in position "P" from the selector lever lock solenoid.

Consequences of component failure

- If the connection is interrupted then the GEM will not give out a warning tone.

Backup lamp relay



Installation position.

- The backup lamp relay is located in the central junction box (CJB).

Function

- The backup lamp relay receives a signal from the TR sensor if the selector lever position "R" is engaged, and then switches on the backup lamps.

Consequences of component failure

- If the connection to the TR sensor is interrupted then the backup lamps will not be switched on.

DIAGNOSIS AND TESTING

Diagnostic Trouble Code Charts

Condition	Possible Sources	Action
•P0701 Transmission fluid temperature circuit error	•Automatic transmission fluid temperature sensor. •Circuit(s).	•REFER to WDS.
•P0705 Transmission range (TR) sensor error	•Inhibitor switch circuit(s).	•REFER to WDS.
•P0715 Turbine speed sensor (TSS) error	•Turbine speed sensor.	•REFER to WDS.
•P0720 Output shaft speed (OSS) sensor	•Output shaft speed sensor.	•REFER to WDS.
•P0725 Engine revolution speed error	•Powertrain control module. •Circuit(s).	•REFER to WDS.
•P0731 Gear ratio 1 incorrect	•Incorrect transmission fluid level.	•Carry out the transmission fluid level check. REFER to Transmission Fluid Level Check in this section.
	•Incorrect transmission fluid condition.	•Carry out the transmission fluid condition check. REFER to Transmission Fluid Drain and Refill in this section.
	•Incorrect throttle signal. •Line pressure is low. •Control valve error. •Reduction one-way clutch error. •Low clutch error. •Low one-way clutch error.	•Go to Pinpoint Test A.
•P0732 Gear ratio 2 incorrect	•Incorrect transmission fluid level.	•Carry out the transmission fluid level check. REFER to Transmission Fluid Level Check in this section.
	•Incorrect transmission fluid condition.	•Carry out the transmission fluid condition check. REFER to Transmission Fluid Drain and Refill in this section.
	•Incorrect throttle signal. •Vehicle speed sensor (VSS) short/open/disconnected. •Line pressure is high. •Line pressure is low. •Control valve error. •2-4 Duty solenoid short/open/disconnected. •Reduction one-way clutch error. •Low clutch error. •2-4 Brake and servo error.	•Go to Pinpoint Test B.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
•P0733 Gear ratio 3 incorrect	•Incorrect transmission fluid level.	•Carry out the transmission fluid level check. REFER to Transmission Fluid Level Check in this section.
	•Incorrect transmission fluid condition.	•Carry out the transmission fluid condition check. REFER to Transmission Fluid Drain and Refill in this section.
	•Incorrect throttle signal. •Vehicle speed sensor (VSS) short/open/disconnected. •Line pressure is high. •Line pressure is low. •Control valve error. •High clutch error (burn/stick/slip). •Reduction one-way clutch error. •Low clutch error. •2-4 Brake and servo error.	•Go to Pinpoint Test C.
•P0734 Gear ratio 4 incorrect	•Incorrect transmission fluid level.	•Carry out the transmission fluid level check. REFER to Transmission Fluid Level Check in this section.
	•Incorrect transmission fluid condition.	•Carry out the transmission fluid condition check. REFER to Transmission Fluid Drain and Refill in this section.
	•Incorrect throttle signal. •Vehicle speed sensor (VSS) short/open/disconnected. •Line pressure is high. •Line pressure is low. •Control valve error. •2-4 Duty solenoid short/open/disconnected. •High clutch error (burn/stick/slip). •Reduction one-way clutch error. •Low clutch error. •2-4 Brake and servo error.	•Go to Pinpoint Test D.
•P0735 Gear ratio 5 incorrect	•Incorrect transmission fluid level.	•Carry out the transmission fluid level check. REFER to Transmission Fluid Level Check in this section.
	•Incorrect transmission fluid condition.	•Carry out the transmission fluid condition check. REFER to Transmission Fluid Drain and Refill in this section.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
	•Incorrect throttle signal. •Vehicle speed sensor (VSS) short/open/disconnected. •Line pressure is high. •Line pressure is low. •Control valve error. •High clutch error (burn/stick/slip). •Direct clutch error (burn/stick/slip).	•Go to Pinpoint Test E.
•P0743 Lock-up duty/torque converter clutch solenoid failure	•Lock-up duty solenoid. •Circuit(s).	•REFER to WDS.
•P0745 Pressure control solenoid A electrical	•Line pressure duty solenoid. •Circuit(s).	•REFER to WDS.
•P0750 Shift solenoid A	•Shift solenoid A. •Circuit(s).	•REFER to WDS.
•P0760 Shift solenoid B	•Shift solenoid B. •Circuit(s).	•REFER to WDS.
•P0765 Shift solenoid C	•Shift solenoid C. •Circuit(s).	•REFER to WDS.
•P0778 2/4 Brake duty solenoid	•2/4 Brake duty solenoid. •Circuit(s).	•REFER to WDS
•P0799 Intermediate speed sensor	•Intermediate speed sensor. •Circuit(s).	•REFER to WDS.
•P0800 Timing solenoid A	•Neutral shift timing solenoid. •Circuit(s).	•REFER to WDS.
•P0801 Timing solenoid B	•Reduction timing solenoid. •Circuit(s).	•REFER to WDS.
•P0802 Pressure control solenoid B	•2/4 Brake duty solenoid. •Circuit(s).	•REFER to WDS.
•P0803 Pressure control solenoid C	•High clutch pressure duty solenoid. •Circuit(s).	•REFER to WDS.
•P0804 Lock-up clutch error	•Incorrect automatic transmission fluid level.	•Carry out the transmission fluid level check. REFER to Transmission Fluid Level Check in this section.
	•Incorrect automatic transmission fluid condition.	•Carry out the transmission fluid condition check. REFER to Transmission Fluid Drain and Refill in this section.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
	•Incorrect throttle signal. •Vehicle speed sensor (VSS) short/open/disconnected. •Engine speed sensor short/open/disconnected. •Automatic transmission fluid temperature sensor short/open/disconnected. •Control valve error. •Lock-up solenoid short/open/disconnected. •Torque converter error (burn/stick/slip).	•Go to Pinpoint Test F.
•P805 Torque reduction error request	•Powertrain control module (PCM). •Circuit(s).	•REFER to WDS.
•P0806 Module ignition supply input error	•Ignition voltage out of range (8 – 18v).	•REFER to WDS.
•P0808 Manual switches	•Incorrect pattern.	•REFER to WDS.
•P0809 Gear ratio R incorrect	•Incorrect transmission fluid level.	•Carry out the transmission fluid level check. REFER to Transmission Fluid Level Check in this section.
	•Incorrect transmission fluid condition.	•Carry out the transmission fluid condition check. REFER to Transmission Fluid Drain and Refill in this section.
	•Inhibitor switch "N" position is out of adjustment.	•Adjust the "N" position using the special tool.
	•Line pressure is low. •Control valve error. •Reverse clutch error (burn/stick/slip). •Low and reverse brake error (burn/stick/slip).	•Go to Pinpoint Test G.
•P0810 CAN Communication bus error	•CAN bus.	•REFER to WDS.
•P0812 Torque reduction error	•Powertrain control module (PCM). •Circuit(s).	•REFER to WDS.
•P1603 EEPROM failure	•Circuit(s). •Transmission control module (TCM).	•REFER to WDS.
•P1710 Transmission control module (TCM) ground return electrical check	•Circuit(s).	•REFER to WDS.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
•P1745 Low clutch timing solenoid	•Low clutch timing solenoid. •Circuit(s).	•REFER to WDS.
•P1746 Reduction timing solenoid	•Reduction timing solenoid. •Circuit(s).	•REFER to WDS.
•P1747 2/4 Brake timing solenoid	•2/4 Brake duty solenoid. •Circuit(s).	•REFER to WDS.
•P1777 Torque reduction error	•Reported engine failure.	•REFER to WDS.
•P1791 Throttle angle error	•Powertrain control module (PCM). •Circuit(s).	•REFER to WDS.
•P1793 Module ignition supply input error	•Ignition Voltage out of range (8 – 18v).	•REFER to WDS.
•P1796 CAN Communication bus error	•CAN bus.	•REFER to WDS.
•P1797 CAN EMS error	•CAN bus.	•REFER to WDS.

DIAGNOSIS AND TESTING

Diagnostic Strategy

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Damaged shift mechanism • Transaxle fluid leaks • Damaged transaxle casing	• Fuse(s) • Electrical connector(s)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to WDS.

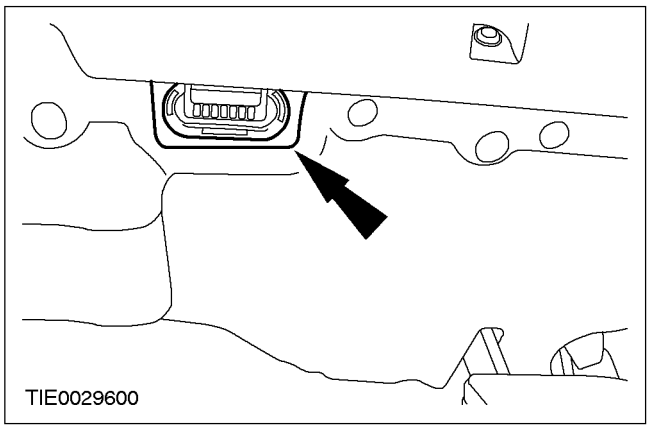
GENERAL PROCEDURES

Transmission Fluid Level Check

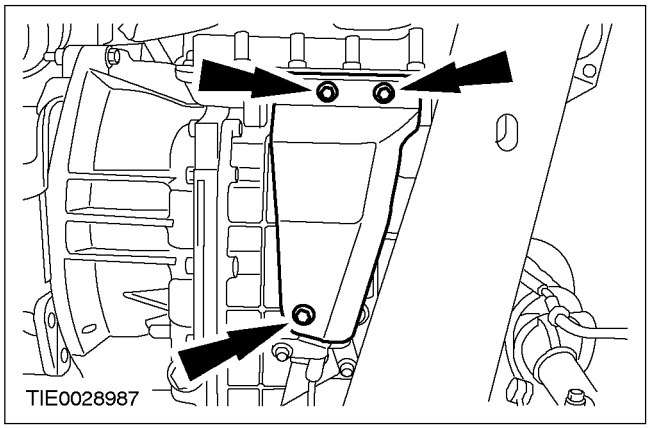
CAUTION: If a new transmission fluid cooler has been installed, make sure that the active bypass valve was open, before checking the transmission fluid level. The active bypass valve opens at a temperature above 77°C.

1. **NOTE:** Make sure that the transaxle is not in emergency run operation.

   Connect the diagnostic tool to the data link connector (DLC).



2. **Check that the transmission fluid temperature is below 30°C.**
3. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
4. **Remove the selector lever cable cover.**



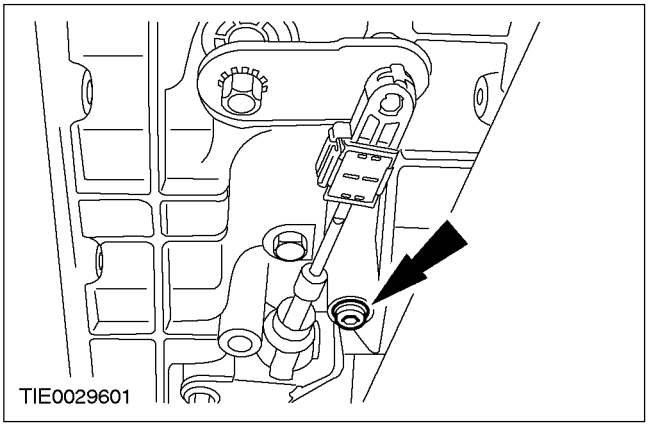
5. **Lower the vehicle.**
6. **Start the engine.**
7. **WARNING: Make sure that the parking brake control lever is in the fully applied position. Failure to follow this instruction may result in personal injury.**

   Move the transmission range selector lever through all the gear ranges, allowing sufficient time for each position to engage.
8. **Move the transmission range selector lever to the "P" (PARK) position.**
9. **When the transmission fluid temperature reaches 30°C, move the transmission range selector lever from "P" (PARK) position to "D" (DRIVE) position and back to "P" (PARK) position.**
10. **CAUTION: Make sure that the transmission range selector lever is in the "P" (PARK) position.**

    Raise and support the vehicle. For additional information, refer to Section 100-02.
11. **NOTE:** The transmission fluid temperature must be between 35°C and 45°C.

    Check the transmission fluid temperature.
12. **WARNING: Whenever releasing the transmission fluid, take care to prevent scalding. Failure to follow this instruction may result in personal injury.**

    Remove the test plug.
    - Allow the fluid to drain into a suitable container.
    - Discard the test plug seal.



GENERAL PROCEDURES (Continued)

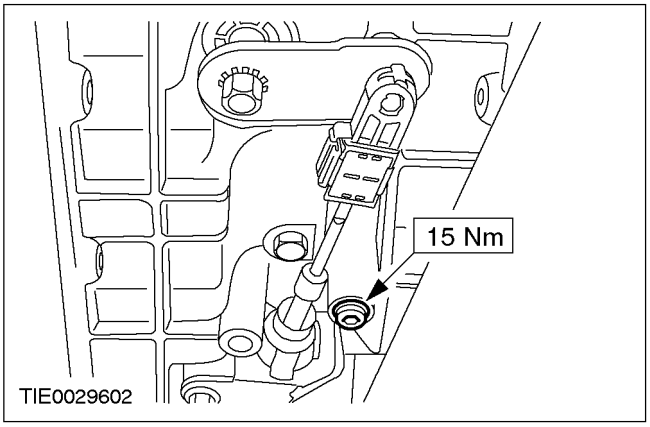
13. **WARNING: Whenever releasing the transmission fluid, take care to prevent scalding. Failure to follow this instruction may result in personal injury.**

NOTE: Transmission fluid should escape from the test outlet.

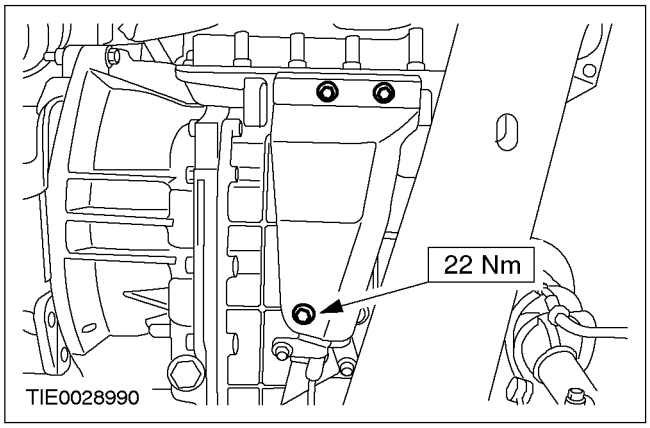
Check for escaping transmission fluid.

14. **If no transmission fluid escapes, fill the transaxle with transmission fluid. For additional information, refer to Transmission Fluid Drain and Refill in this section.**
15. **NOTE:** Install a new test plug seal.

Install the test plug.



16. **Lower the vehicle.**
17. **Switch off the engine.**
18. **Disconnect the diagnostic tool from the DLC.**
19. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
20. **Install the selector lever cable cover.**

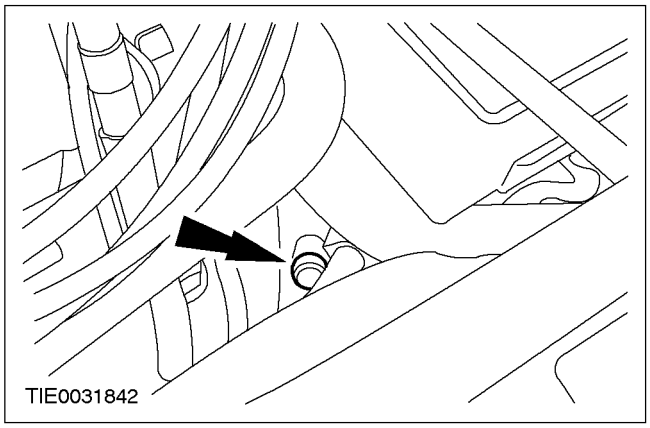


21. **Lower the vehicle.**

GENERAL PROCEDURES

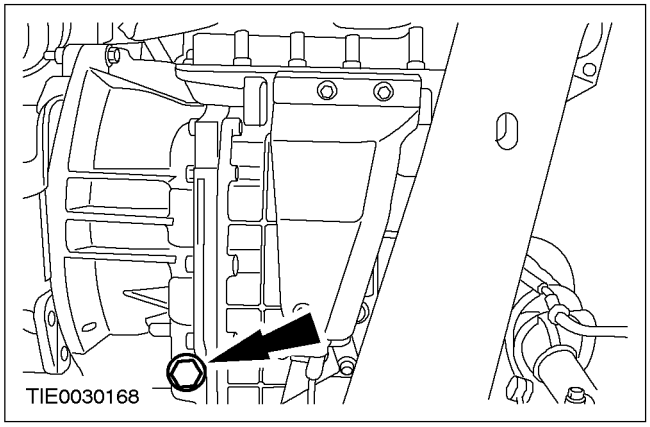
Transmission Fluid Drain and Refill

1. **Remove the transaxle oil filler tube plug.**



2. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
3. **NOTE:** If an internal transaxle concern is suspected, drain the fluid through a paper filter. A small amount of metal or friction particles may be found from normal wear. However, if excessive metal or friction particles are present, a detailed inspection of the transaxle will be required.

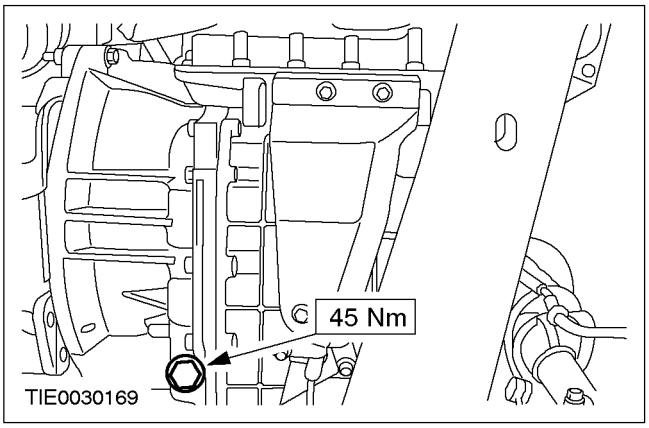
   Drain the transaxle.
   - Allow the fluid to drain into a suitable container.
   - Discard the drain plug seal.



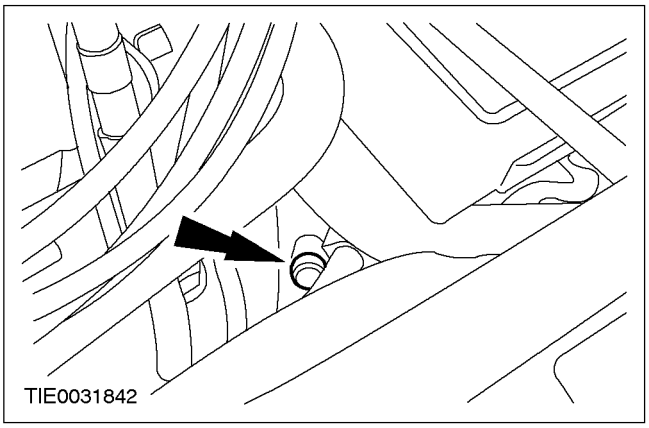
4. **NOTE:** Install a new drain plug seal.

   NOTE: Clean the drain plug thread.

   Install the drain plug.



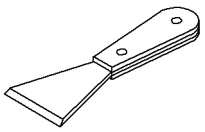
5. **Lower the vehicle.**
6. **Fill the transaxle with automatic transmission fluid . For additional information, refer to Specifications in this section.**
7. **Install the transaxle oil filler tube plug.**



8. **Check the transmission fluid level. For additional information, refer to Transmission Fluid Level Check in this section.**

IN-VEHICLE REPAIR

Fluid Pan, Gasket and Filter

Special Tool(s)	
 21179	Separator, Oil Pan 303-428 (21-179)

Name	Specification
Metal Surface Cleaner	WSE-M5B-392-A
Sealer	WSS-M4G320-A3

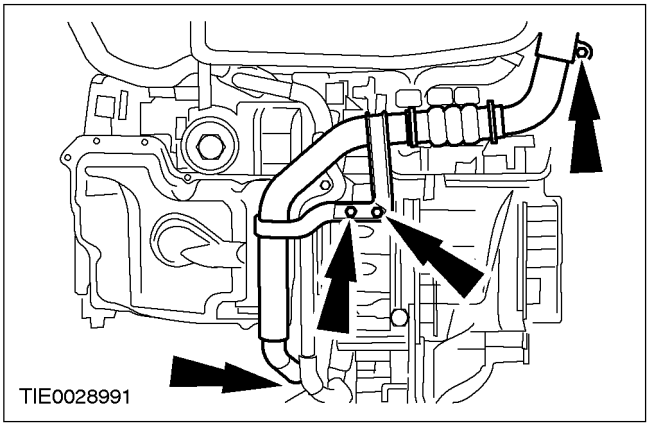
Removal

All vehicles

1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Raise and support the vehicle. For additional information, refer to Section 100-02.**

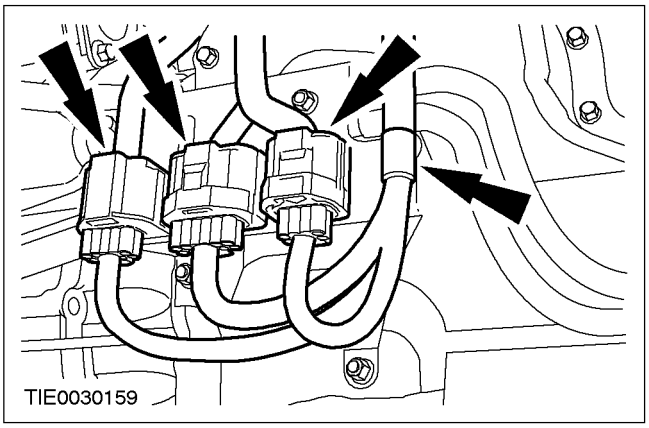
Vehicles with diesel engine

3. **Remove the charge air cooler intake hose.**

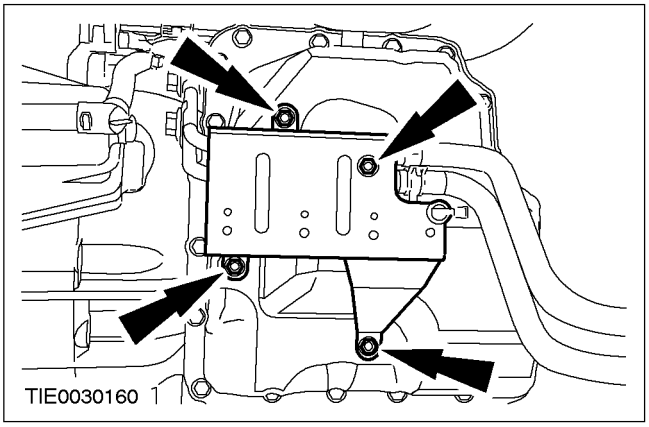


All vehicles

4. **Disconnect the transaxle electrical connectors and detach the wiring harness from the wiring harness bracket.**



5. **Remove the transaxle wiring harness bracket from the transaxle.**
   - Detach the fluid cooler pipes from the bracket.

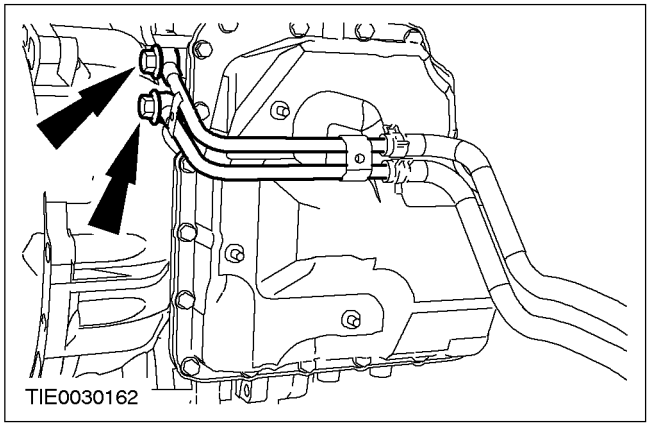


IN-VEHICLE REPAIR (Continued)

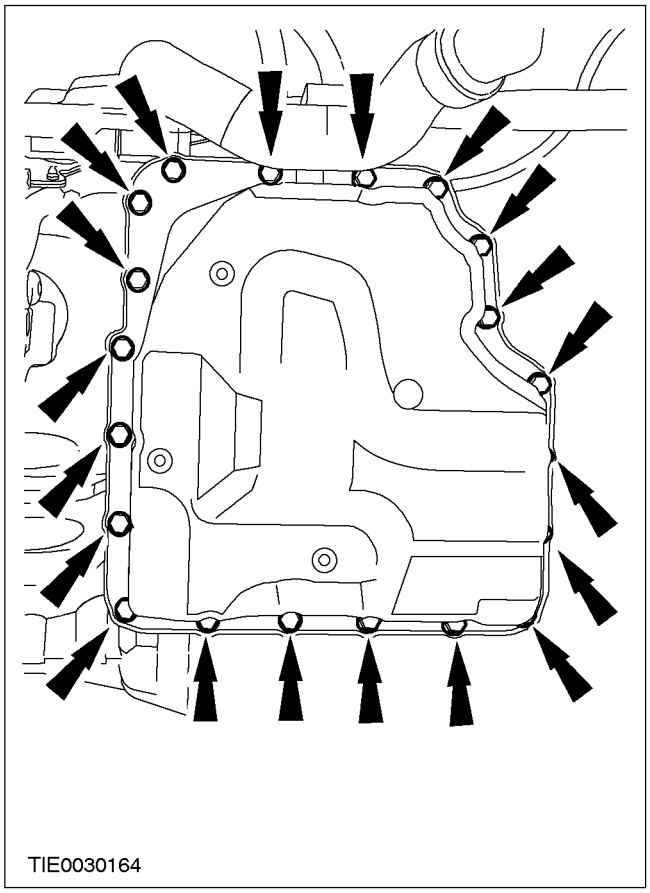
6. **NOTE:** Plug the fluid cooler pipes to prevent oil loss or dirt ingress.

   Detach the fluid cooler pipes from the transaxle.

   - Allow the fluid to drain into a suitable container.



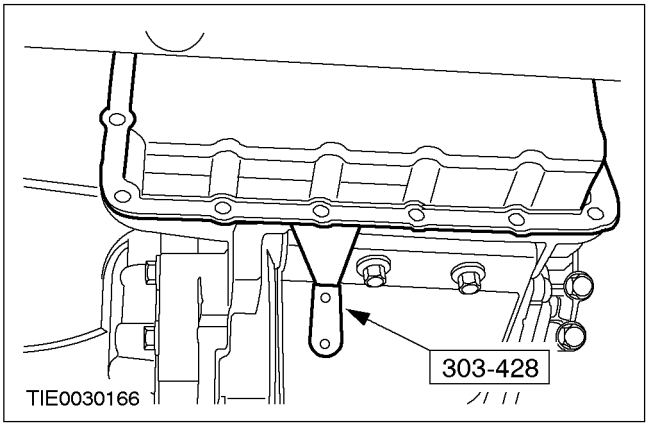
7. **Remove the fluid pan retaining bolts.**



8. **CAUTION: Do not damage the transaxle fluid pan.**

   Using the special tool, remove the transaxle fluid pan.

   - Slide the special tool around the profile of the pan.



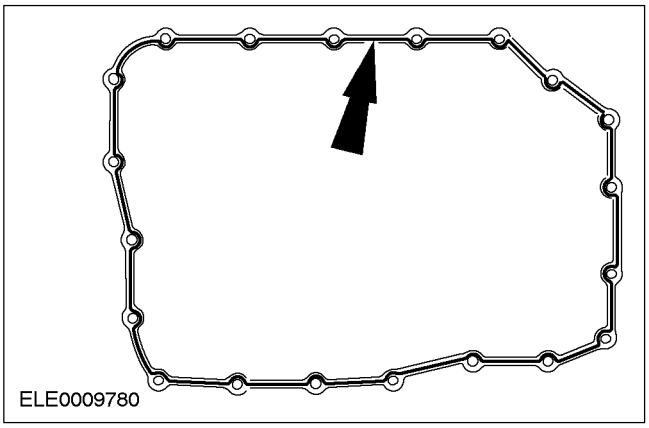
Installation

All vehicles

1. **NOTE:** Make sure that the fluid pan and transaxle case mating faces are clean and oil free.

   Clean all mating faces using metal surface cleaner.

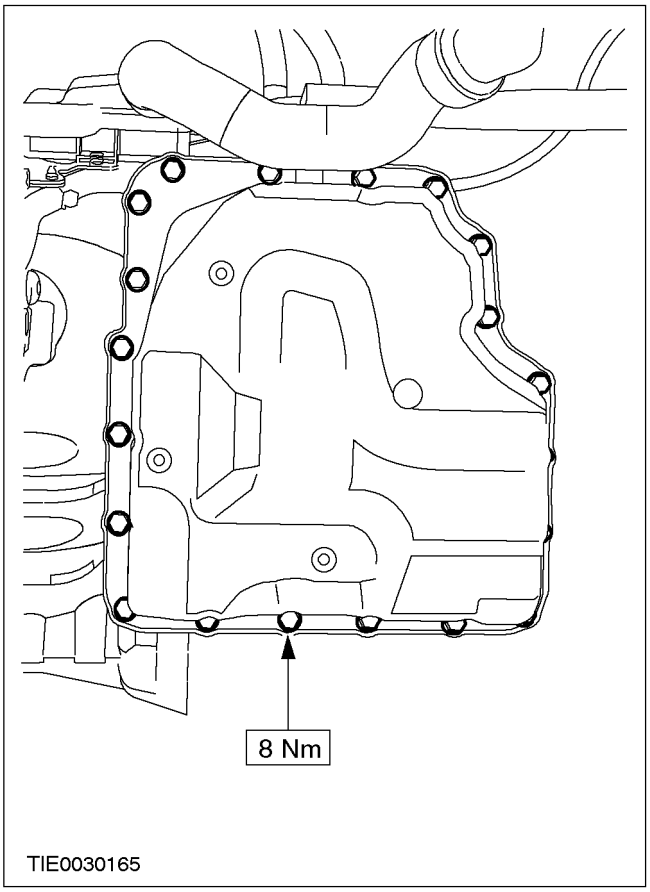
2. **Apply a 5 mm diameter bead of sealer to the inside edge of the fluid pan mating face.**



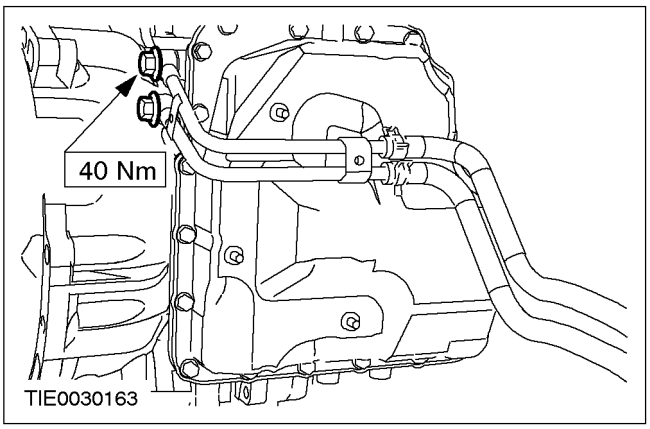
IN-VEHICLE REPAIR (Continued)

3. **NOTE:** Tighten the fluid pan retaining bolts evenly working diagonally.

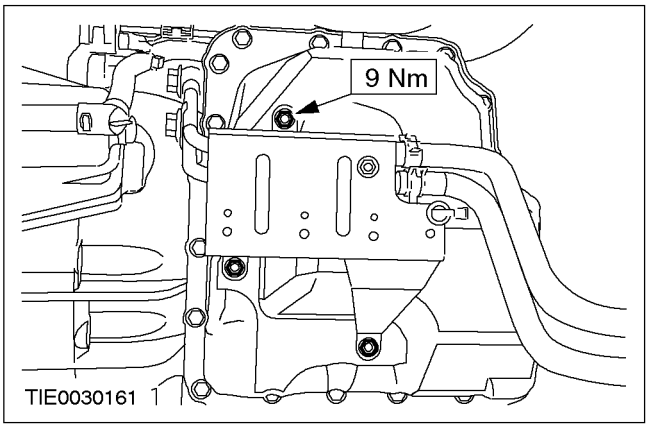
Install the fluid pan.



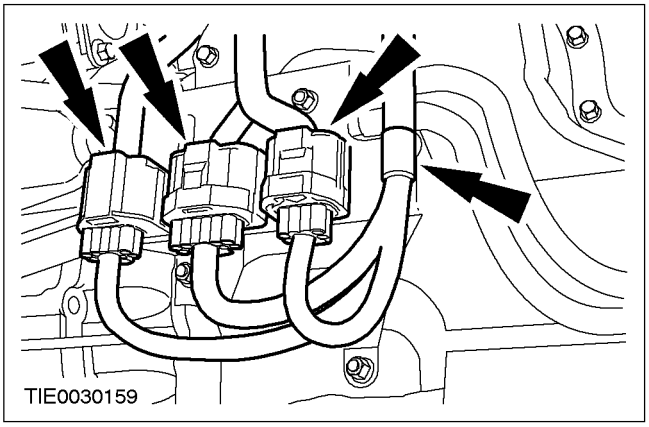
4. **Attach the fluid cooler pipes to the transaxle.**



5. **Install the transaxle wiring harness bracket to the transaxle.**
   - Attach the fluid cooler pipes to the bracket.

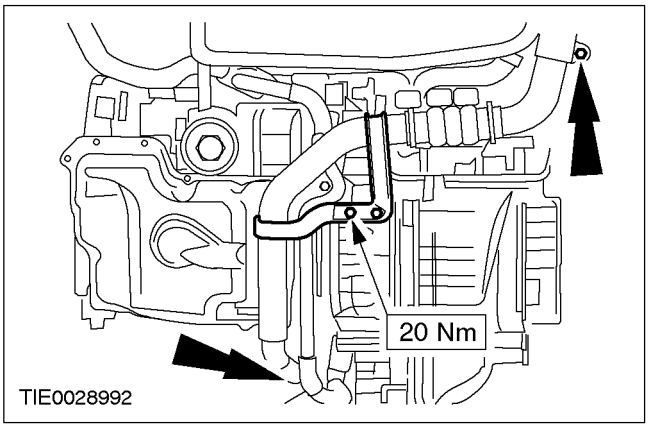


6. **Attach the transaxle wiring harness to the wiring harness bracket and connect the transaxle electrical connectors.**



Vehicles with diesel engine

7. **Install the charge air cooler intake hose.**



All vehicles

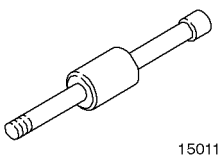
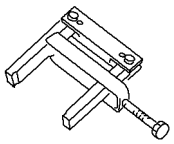
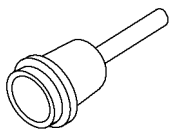
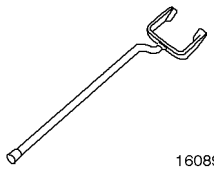
8. **Lower the vehicle.**

IN-VEHICLE REPAIR (Continued)

9. Fill the transaxle with automatic transmission fluid. For additional information, refer to Transmission Fluid Drain and Refill in this section.
10. Connect the battery ground cable. For additional information, refer to Section 414-01.
11. Check the transmission fluid level. For additional information, refer to Transmission Fluid Level Check in this section.
12. Initialize the door window motors. For additional information, refer to Section 501-11.

IN-VEHICLE REPAIR

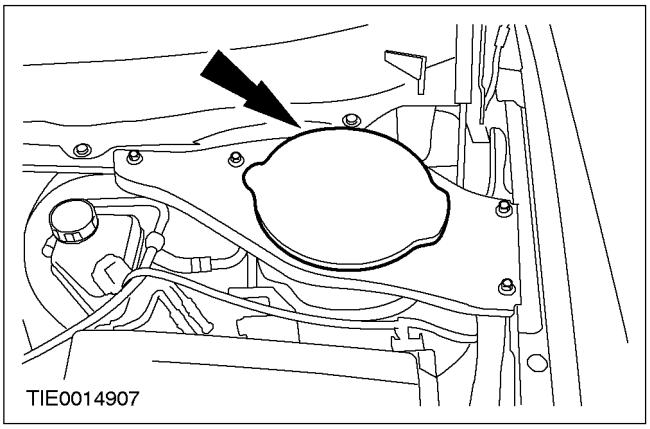
Halfshaft Seal LH (14 303 0)

Special Tool(s)	
 15011	Slide Hammer 205-047 (15-011)
 17061	Remover, Torque Converter Oil Seal 307-272 (17-061)
 16066	Installer, Differential Double Lip Oil Seal 308-203 (16-066)
 16089	Remover, Halfshaft 308-256 (16-089)

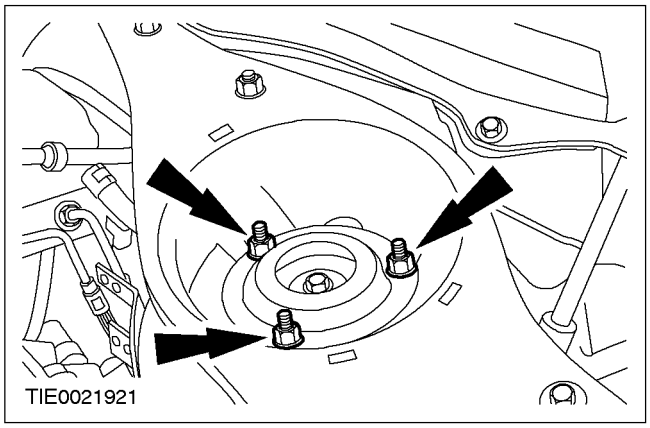
Name	Specification
Grease	WSD-M1C230-A

Removal

1. **Remove the strut and spring assembly top mount brace cover.**

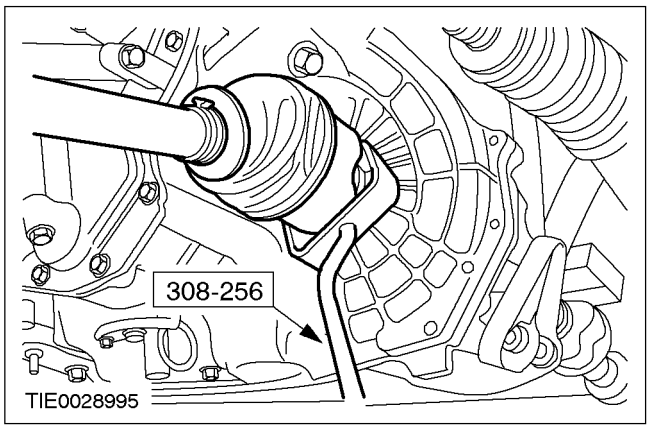


2. **Loosen the strut and spring assembly top mount nuts by four turns.**



3. **Remove the subframe. For additional information, refer to Section 502-00.**
4. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

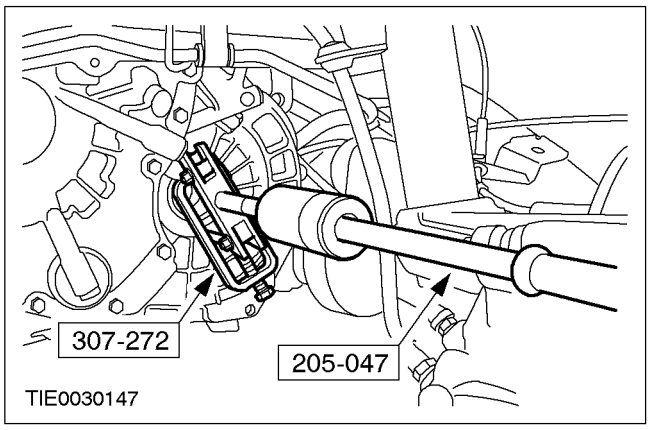
   Using the special tool, detach the left-hand halfshaft from the transaxle and secure it to one side.
   - Discard the O-ring seal.
   - Remove and discard the snap ring.



IN-VEHICLE REPAIR (Continued)

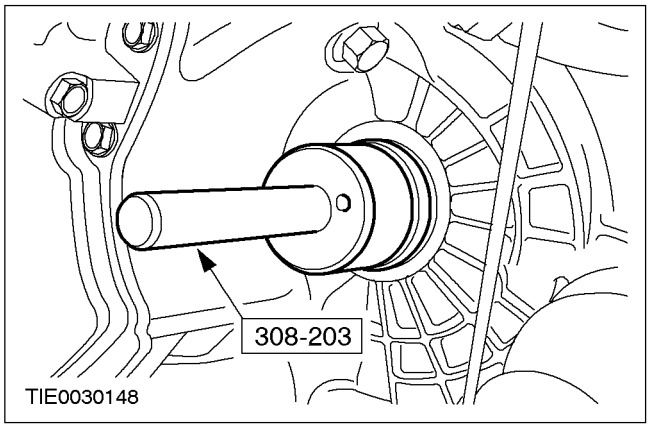
5. Using the special tools, remove the halfshaft oil seal.

- Allow the oil to drain into a suitable container.



Installation

1. Using the special tool, install the halfshaft oil seal.



2. CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.

CAUTION: Do not damage the halfshaft oil seal.

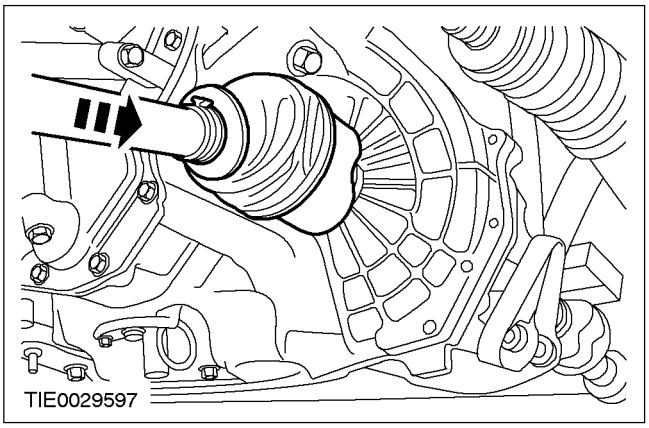
CAUTION: Make sure the snap ring is correctly seated.

CAUTION: Lubricate the O-ring seal with grease.

NOTE: Install a new O-ring seal.

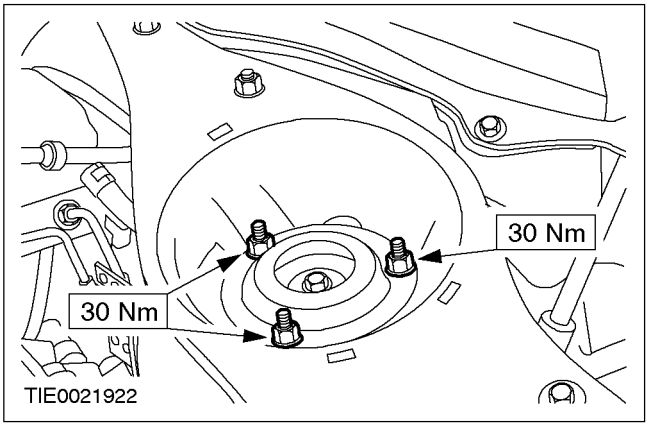
NOTE: Install a new snap ring.

Attach the halfshaft to the transaxle.



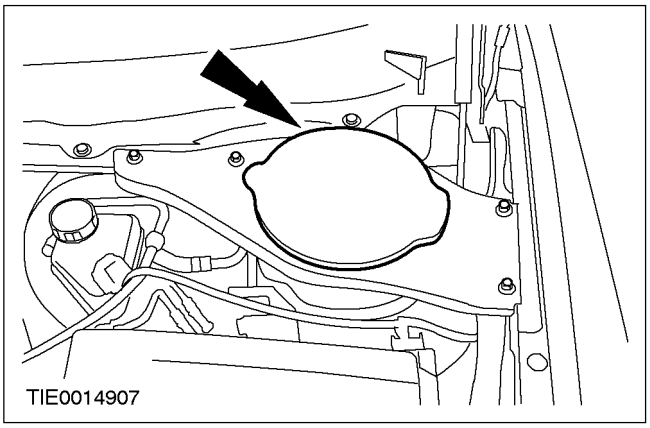
3. Install the subframe. For additional information, refer to Section 502-00.

4. Tighten the strut and spring assembly top mount nuts.



IN-VEHICLE REPAIR (Continued)

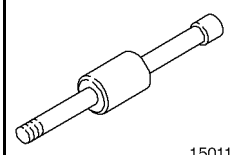
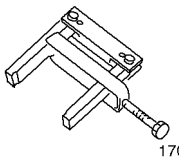
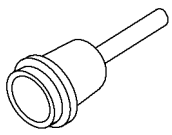
5. Install the strut and spring assembly top mount brace cover.



6. Check the transmission fluid level. For additional information, refer to Transmission Fluid Level Check in this section.

IN-VEHICLE REPAIR

Halfshaft Seal RH (14 304 0)

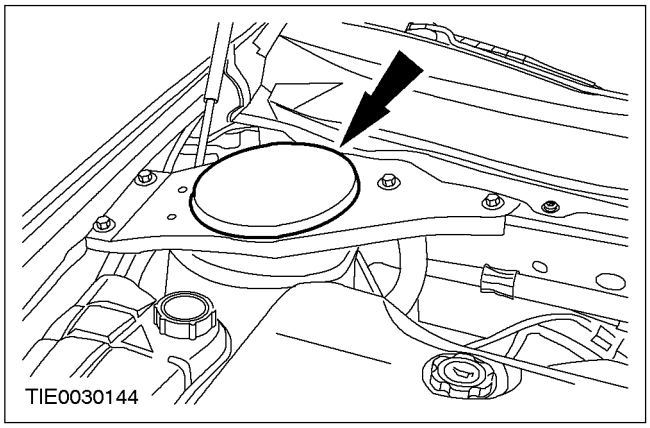
Special Tool(s)	
 15011	Slide Hammer 205-047 (15-011)
 17061	Remover, Torque Converter Oil Seal 307-272 (17-061)
 16066	Installer, Differential Double Lip Oil Seal 308-203 (16-066)

Name	Specification
Grease	WSD-M1C230-A

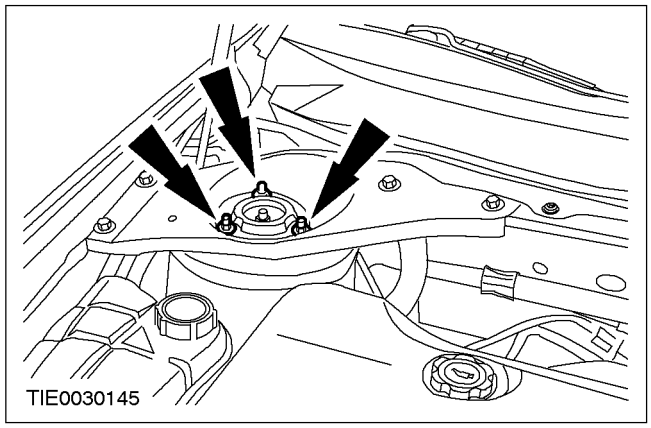
Removal

All vehicles

1. **Remove the strut and spring assembly top mount brace cover.**



2. **Loosen the strut and spring assembly top mount nuts by four turns.**



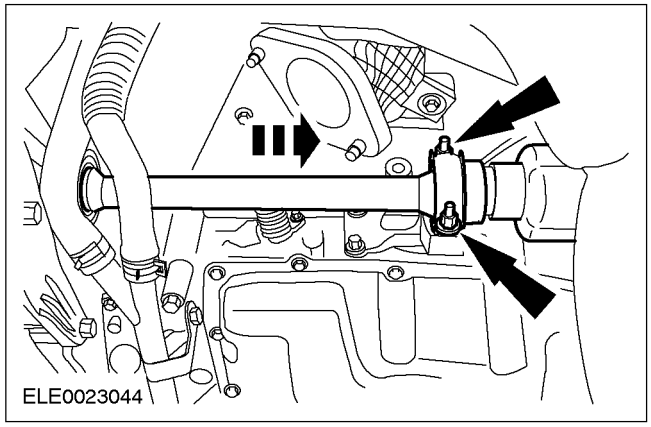
3. **Remove the subframe. For additional information, refer to Section 502-00.**

Vehicles with diesel engine

4. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

   Detach the right-hand halfshaft and the intermediate shaft from the transaxle and secure it to one side.

   - Remove and discard the center bearing cap and locknuts.
   - Discard the O-ring seal.



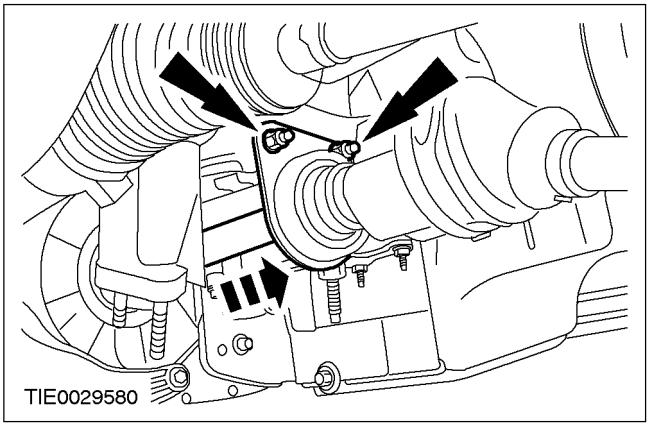
IN-VEHICLE REPAIR (Continued)

Vehicles with 2.5L engine

5. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

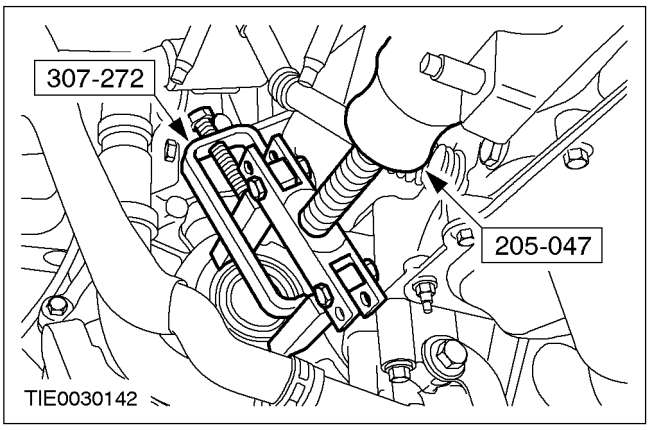
   Detach the right-hand halfshaft and the intermediate shaft from the transaxle and secure it to one side.

   - Remove and discard the locknuts.
   - Discard the O-ring seal.



All vehicles

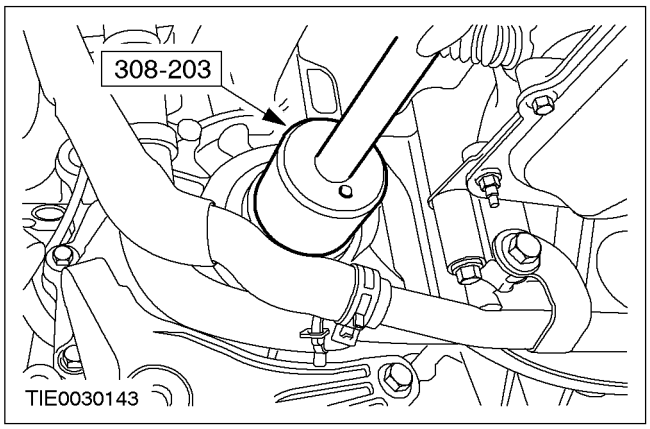
6. **Using the special tools, remove the halfshaft oil seal.**
   - Allow the oil to drain into a suitable container.



Installation

All vehicles

1. **Using the special tool, install the halfshaft oil seal.**



Vehicles with 2.5L engine

2. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

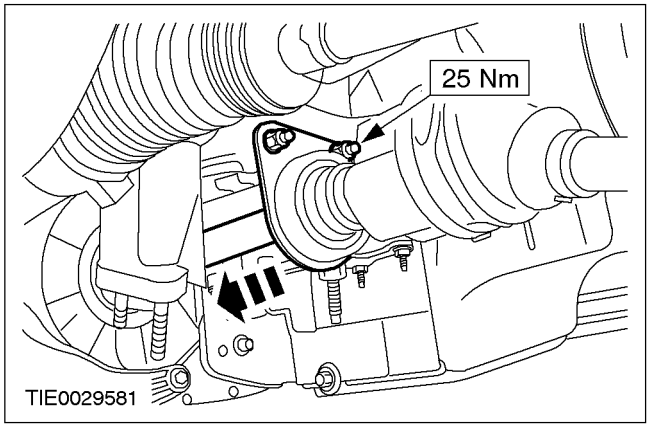
CAUTION: Do not damage the halfshaft oil seal.

CAUTION: Lubricate the O-ring seal with grease.

NOTE: Install a new O-ring seal.

NOTE: Install new locknuts.

Attach the right-hand halfshaft and the intermediate shaft to the transaxle.



IN-VEHICLE REPAIR (Continued)

Vehicles with diesel engine

3. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

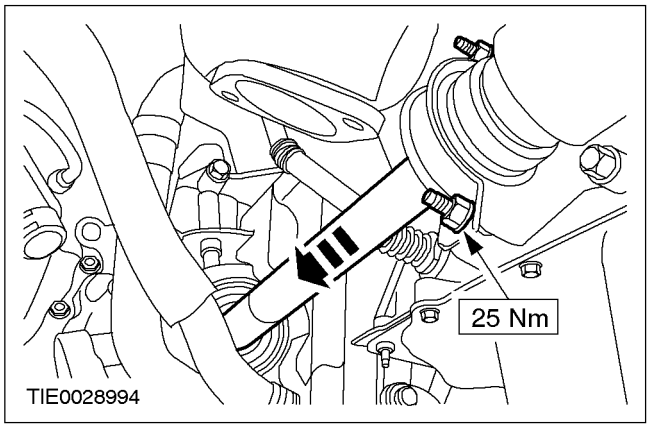
CAUTION: Do not damage the halfshaft oil seal.

CAUTION: Lubricate the O-ring seal with grease.

NOTE: Install a new O-ring seal.

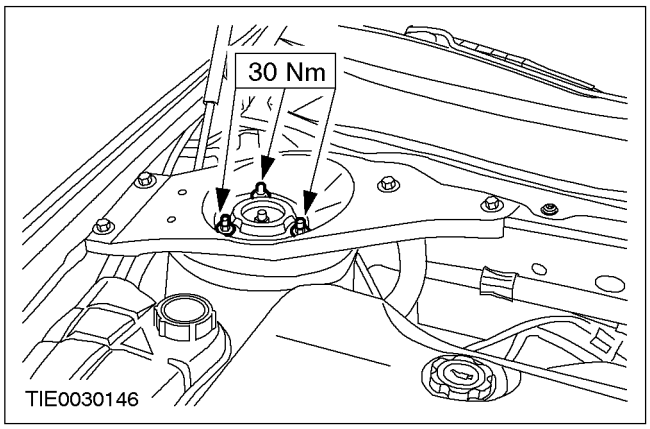
NOTE: Install a new center bearing cap and locknuts.

Attach the right-hand halfshaft and the intermediate shaft to the transaxle.

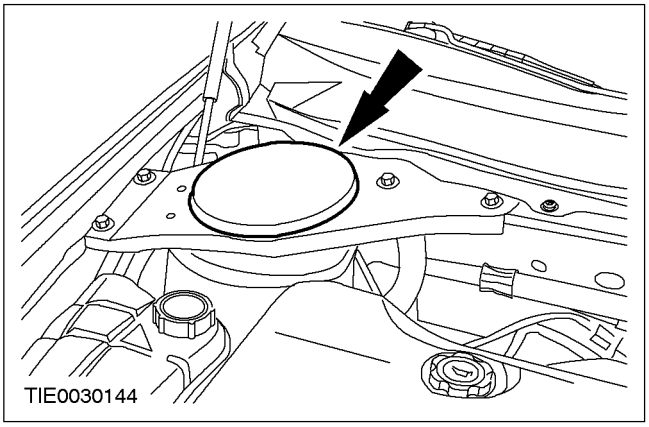


All vehicles

4. **Install the subframe. For additional information, refer to Section 502-00.**
5. **Tighten the strut and spring assembly top mount nuts.**



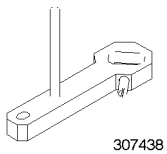
6. **Install the strut and spring assembly top mount brace cover.**



7. **Check the transmission fluid level. For additional information, refer to Transmission Fluid Level Check in this section.**

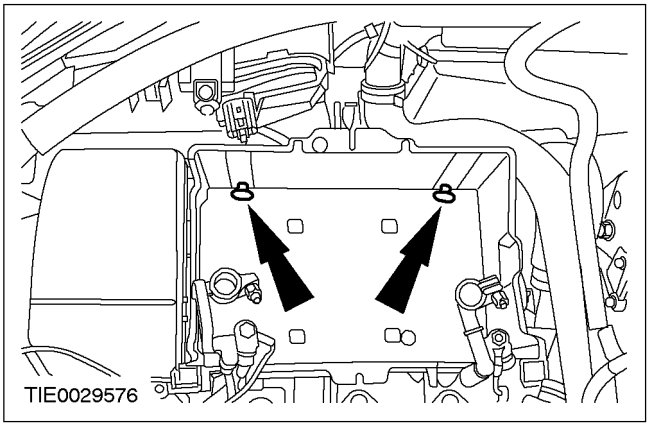
IN-VEHICLE REPAIR

Transmission Range (TR) Sensor (17 705 0)

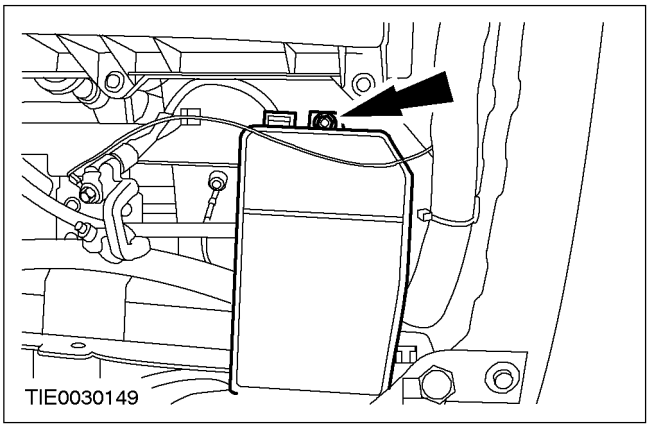
Special Tool(s)	
 307438	Alignment Gauge TR Sensor 307-438 (17–087)

Removal

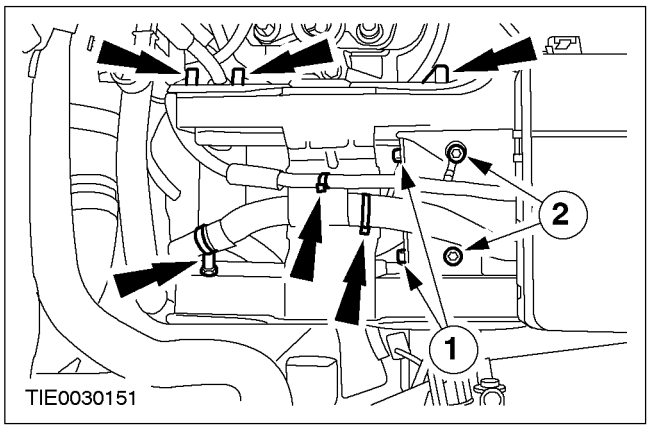
1. **Move the selector lever to the "D" (DRIVE) position.**
2. **Remove the battery. For additional information, refer to Section 414-01.**
3. **Remove the battery tray.**
   - Remove the clips.



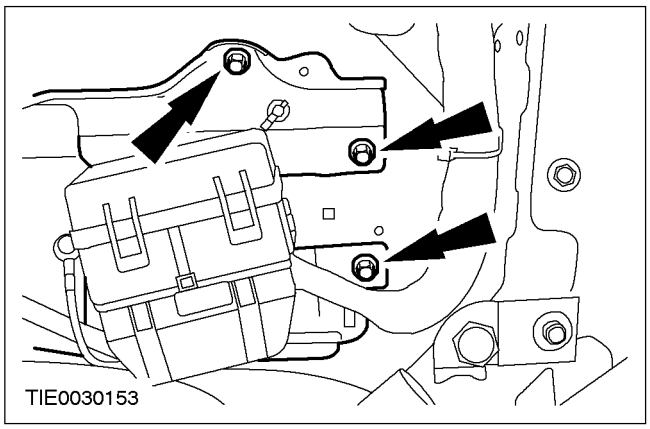
4. **Detach the central junction box (CJB) from the battery tray and position to one side.**



5. **Remove the battery tray support bracket lower retaining bolts and detach the wiring harnesses.**
   1. Remove the bolts.
   2. Detach the ground cables from the battery tray support bracket.
   - Detach the wiring harness from the battery tray support bracket.



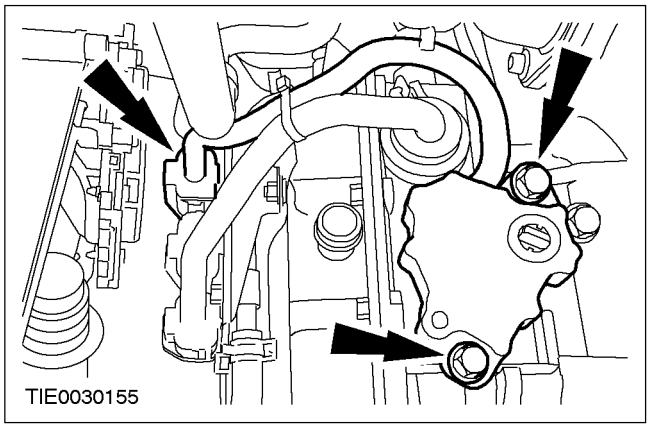
6. **Remove the battery tray support bracket.**



IN-VEHICLE REPAIR (Continued)

7. Remove the transmission range (TR) sensor.

- Disconnect the electrical connector.
- Remove the bolts.

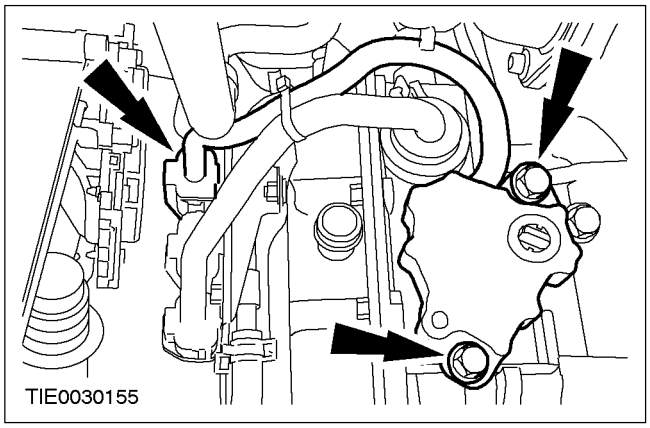


Installation

1. NOTE: Do not fully tighten the transmission range (TR) sensor retaining bolts at this stage.

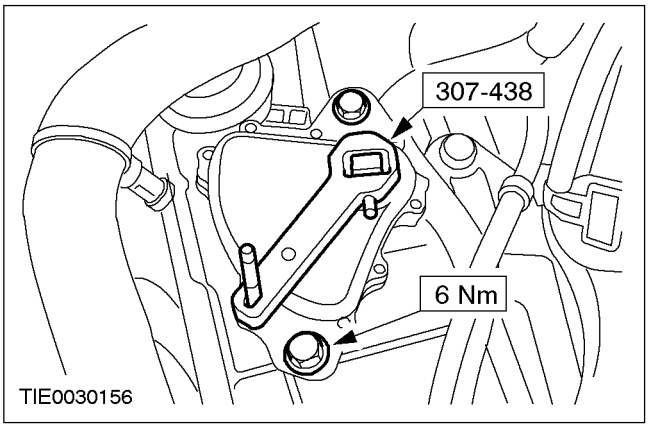
Install the TR sensor.

- Connect the electrical connector.
- Install the bolts.



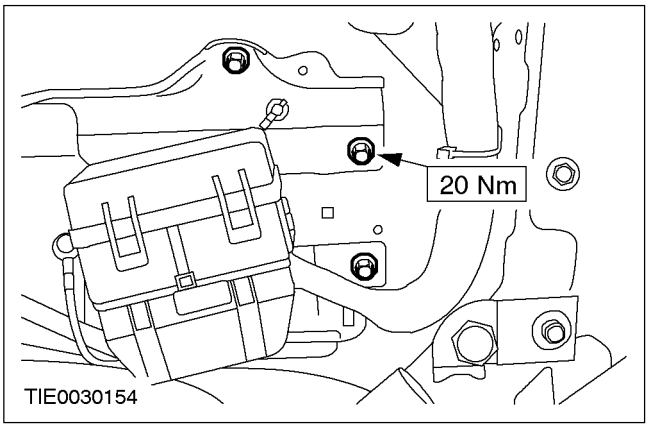
2. NOTE: Make sure the transaxle is in the "N" (NEUTRAL) position.

Using the special tool, align the TR sensor and tighten the retaining bolts.



3. Remove the special tool.

4. Install the battery tray support bracket.

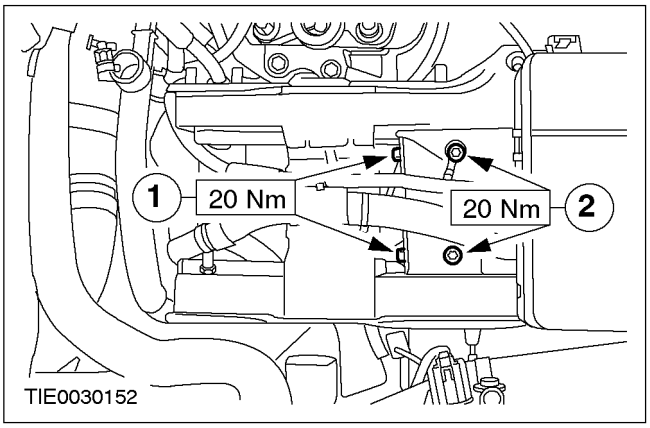


IN-VEHICLE REPAIR (Continued)

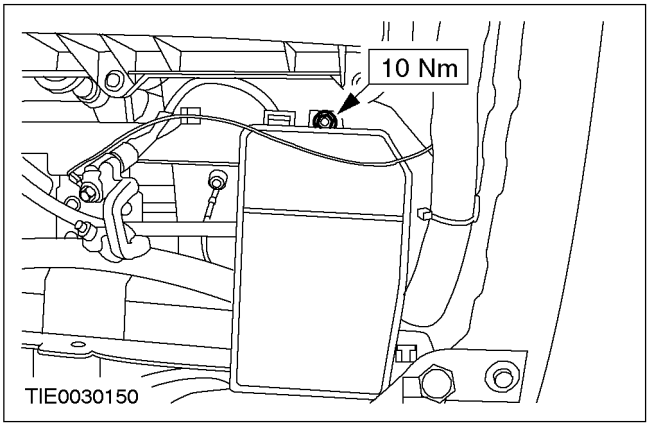
5. Install the battery tray support bracket lower retaining bolts and attach the wiring harnesses.

1. Install the bolts.
2. Attach the ground cables to the battery tray support bracket.

- Attach the wiring harness to the battery tray support bracket.

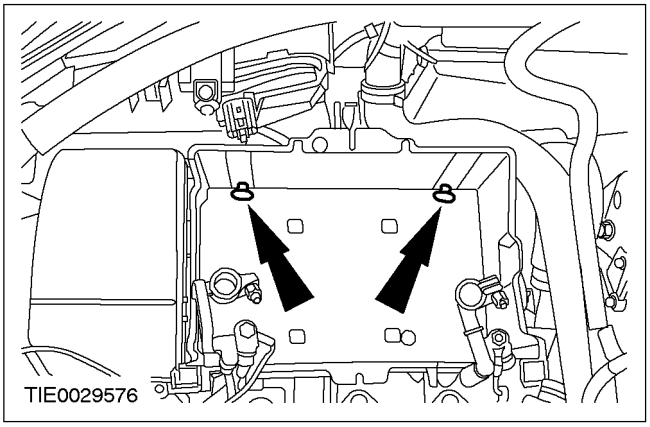


6. Attach the central junction box (CJB) to the battery tray.



7. Install the battery tray.

- Install the clips.



8. Install the battery. For additional information, refer to Section 414-01.

9. Check the transaxle for correct operation.

- With the parking brake applied the engine should start only in "P" (PARK) or "N" (NEUTRAL). Reversing lamps should illuminate only when "R" (REVERSE) is selected.

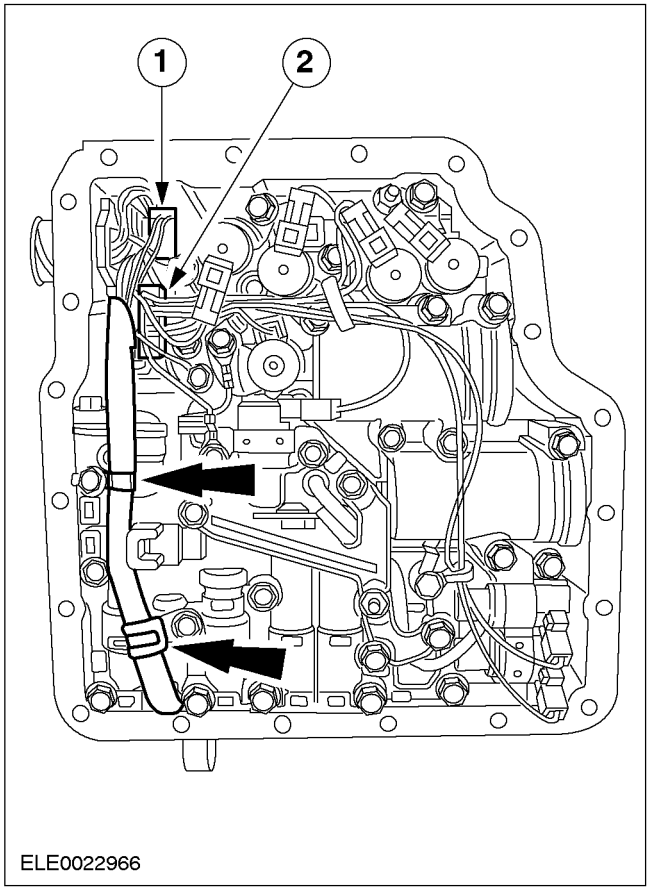
10. Initialize the door window motors. For additional information, refer to Section 501-11.

IN-VEHICLE REPAIR

Main Control Valve Body

Removal

1. **Remove the fluid pan.** **For additional information, refer to Fluid Pan, Gasket and Filter in this section.**
2. **Disconnect the transaxle electrical connectors.**
   1. Disconnect the transaxle wiring harness electrical connector.
   2. Disconnect the solenoid valves electrical connector.
   - Detach the wiring harness from the main control valve body.



ELE0022966

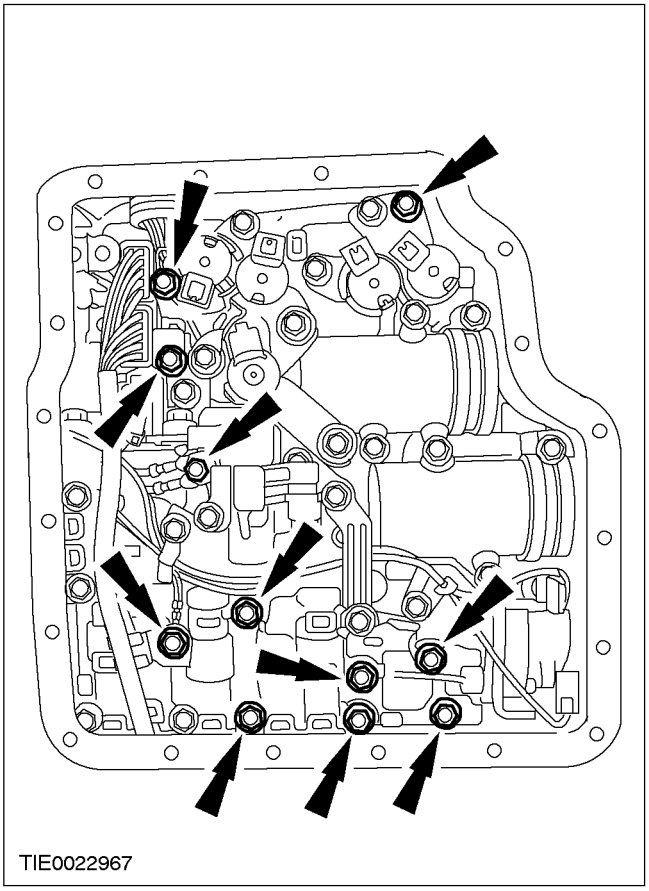
3. **CAUTION: Only remove the indicated bolts.**

CAUTION: Make sure the manual valve remains in place while removing the main control valve body.

NOTE: The indicated bolts are colored silver.

Remove the main control valve body.

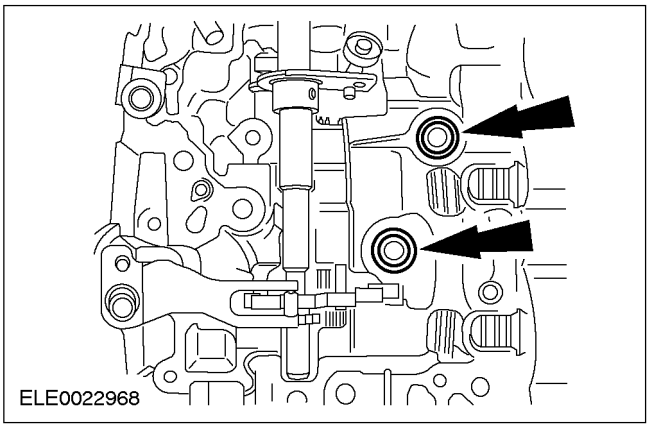
- Remove the bolts.


TIE0022967

IN-VEHICLE REPAIR (Continued)

4. Remove the transaxle case O-ring seals.

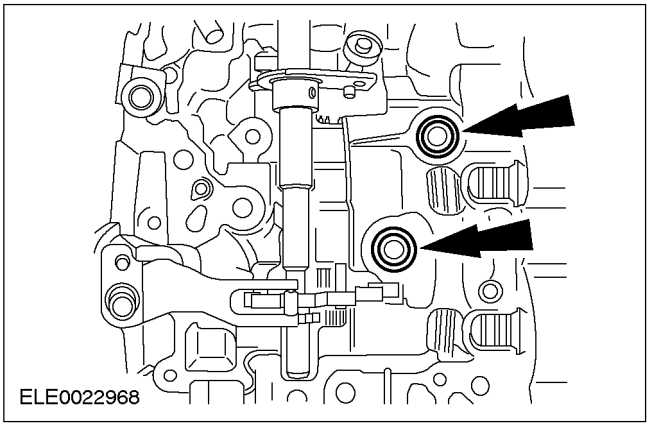
- Discard the O-ring seals.



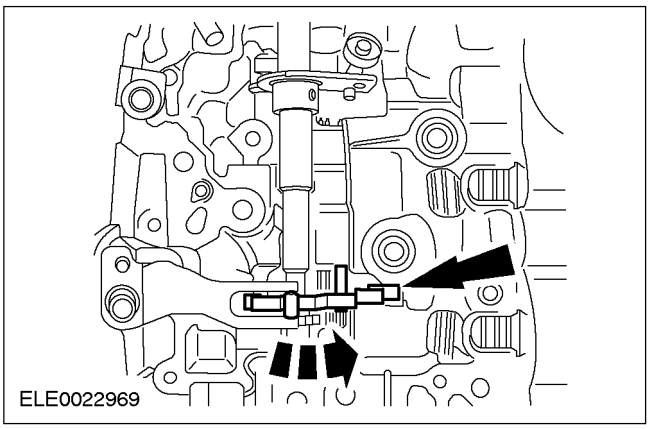
Installation

1. NOTE: Install new transaxle case O-ring seals.

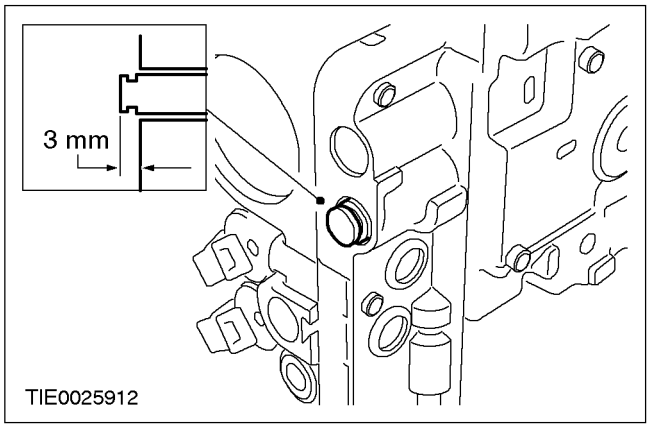
Install the transaxle case O-ring seals.



2. Move the manual valve detent lever into position "1".



3. Move the manual valve to the indicated position as shown.

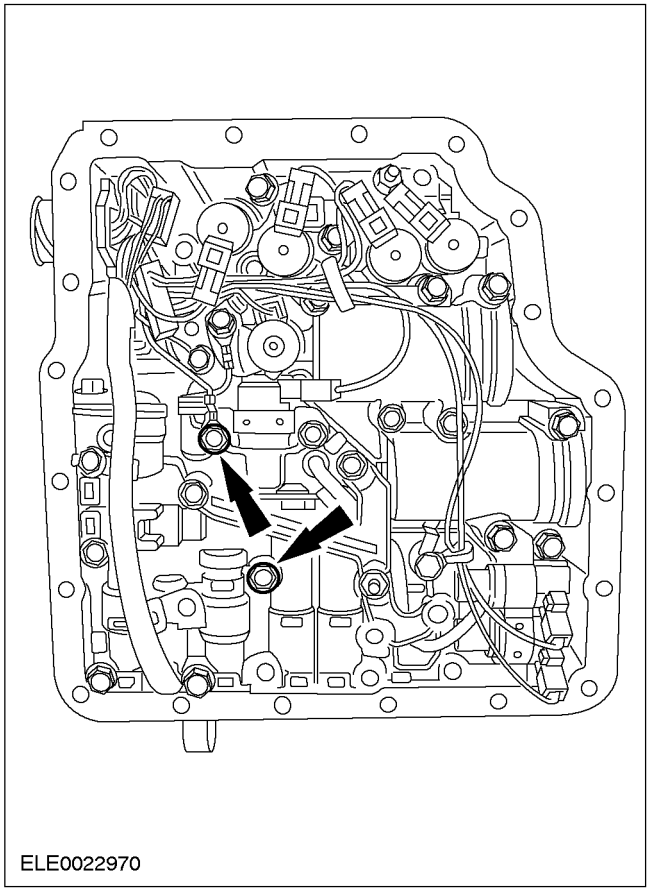


4. NOTE: Make sure that the O-ring seals are correctly seated.

NOTE: Make sure that the manual valve is located in the manual valve lever groove.

NOTE: Do not tighten the main control valve body retaining bolts at this stage.

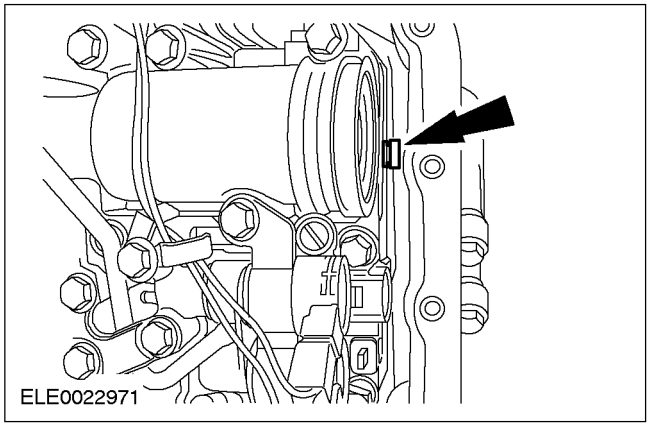
Position the main control valve body and loosely install two retaining bolts.



IN-VEHICLE REPAIR (Continued)

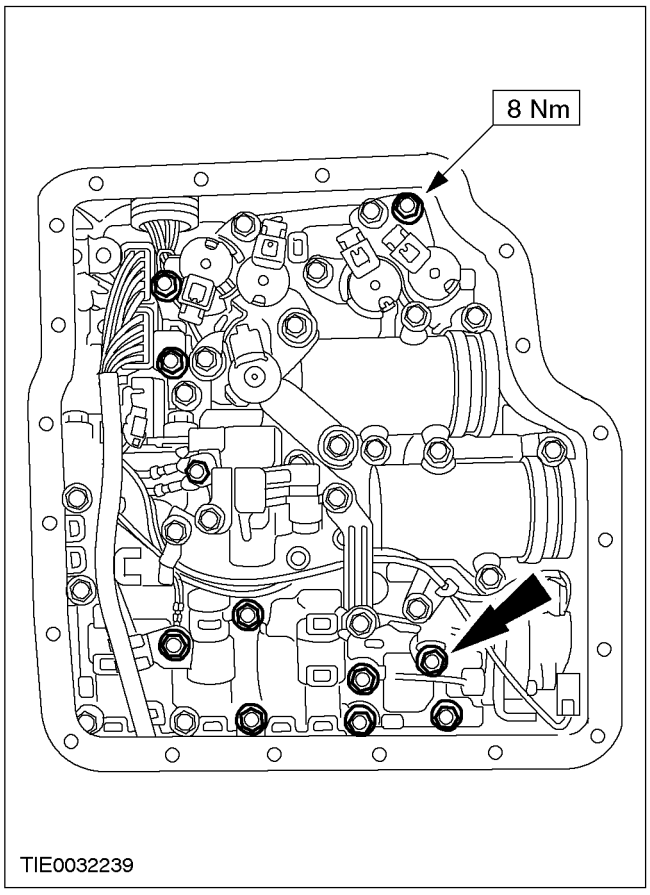
5. Check the function and the position of the manual valve.

- Rotate the manual valve detent lever through all positions.
- Move the manual valve detent lever into position "2" and check the indicated position in the main control valve body.



6. Install the remaining main control valve body retaining bolts.

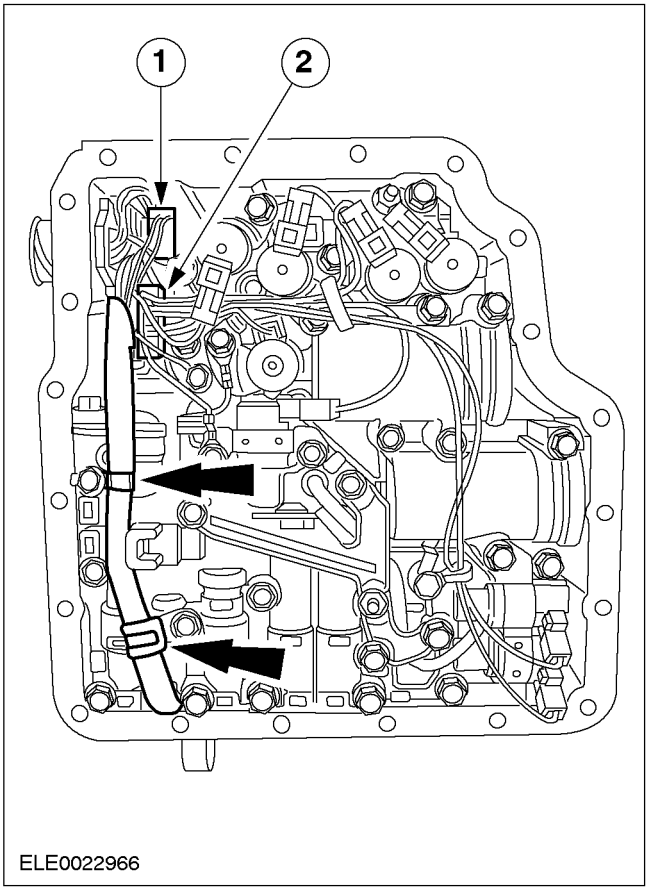
- The length of the bolt indicated is 105.5 mm.



7. Connect the transaxle electrical connectors.

1. Connect the transaxle wiring harness electrical connector.
2. Connect the solenoid valves electrical connector.

- Attach the wiring harness to the main control valve body.



8. Install the fluid pan. **For additional information, refer to Fluid Pan, Gasket and Filter in this section.**

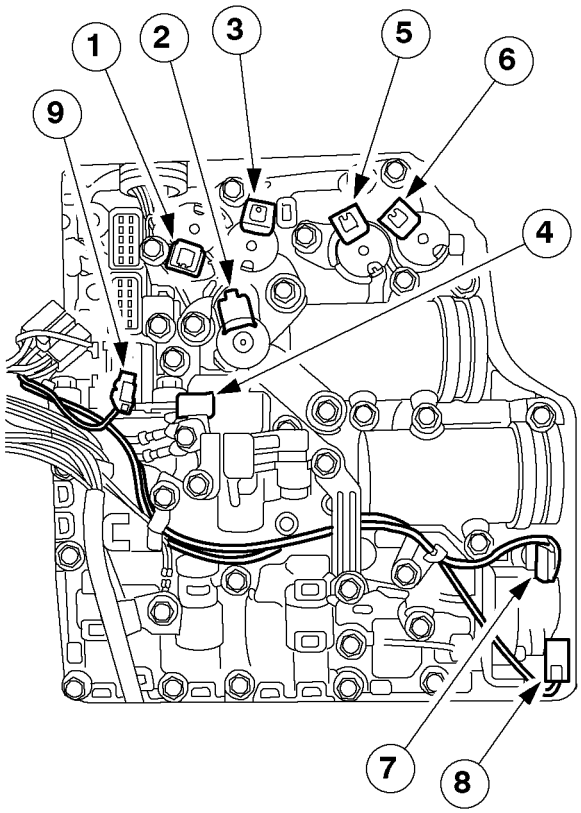
IN-VEHICLE REPAIR

Solenoids - Shift, TCC and EPC

Removal

NOTE: This procedure covers all solenoids contained in the main control valve body.

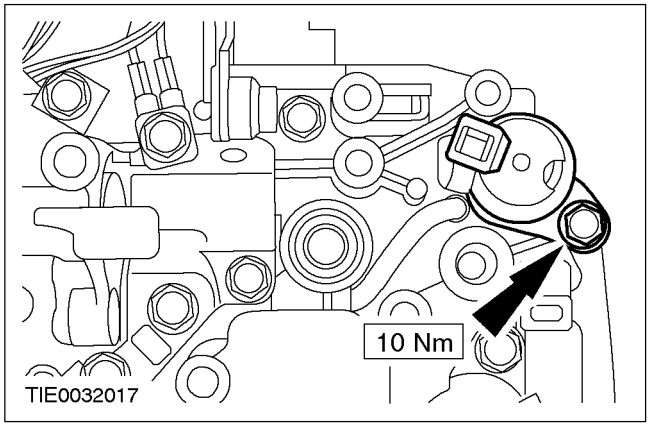
1. **Remove the main control valve body.** **For additional information, refer to Main Control Valve Body in this section.**
2. **Disconnect the shift solenoid electrical connectors.**
   1. Disconnect the shift solenoid A electrical connector (colored brown).
   2. Disconnect the torque converter clutch (TCC) solenoid electrical connector (colored white).
   3. Disconnect the reduction solenoid electrical connector (colored white).
   4. Disconnect the low clutch timing solenoid electrical connector (colored white).
   5. Disconnect the shift solenoid B electrical connector (colored brown).
   6. Disconnect the shift solenoid C electrical connector (colored green).
   7. Disconnect the second, third and fourth gear brake duty solenoid electrical connector (colored white).
   8. Disconnect the neutral shift solenoid electrical connector (colored black).
   9. Disconnect the electronic pressure control (EPC) solenoid electrical connector (colored green).



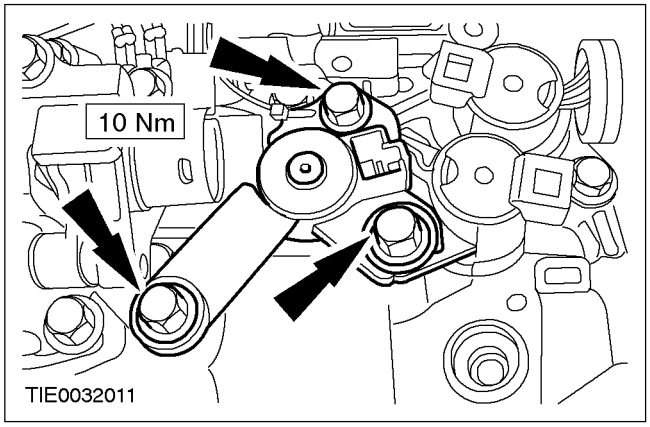
TIE0032021

IN-VEHICLE REPAIR (Continued)

3. Remove the shift solenoid A.

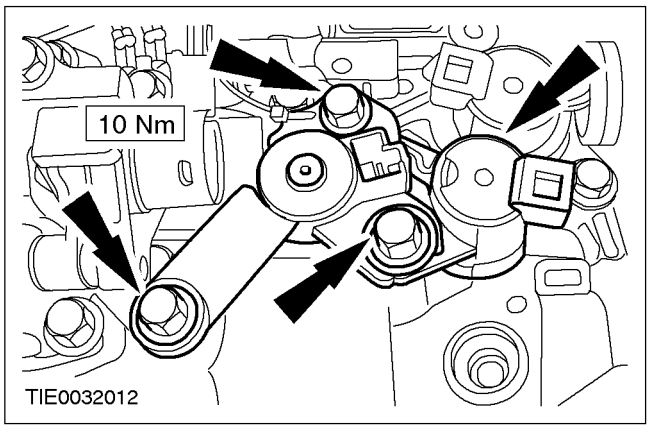


4. Remove the TCC solenoid.

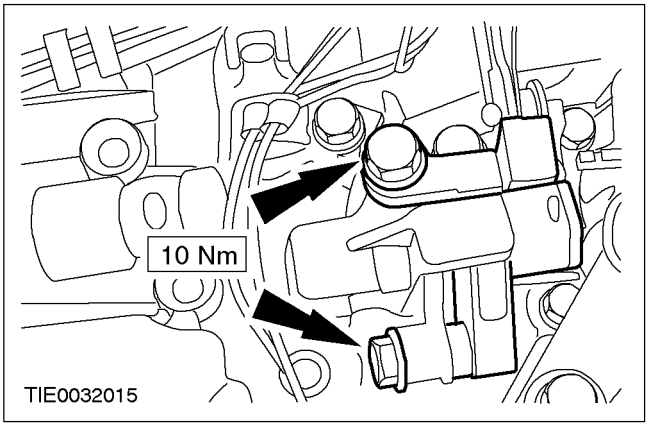


5. Remove the reduction timing solenoid.

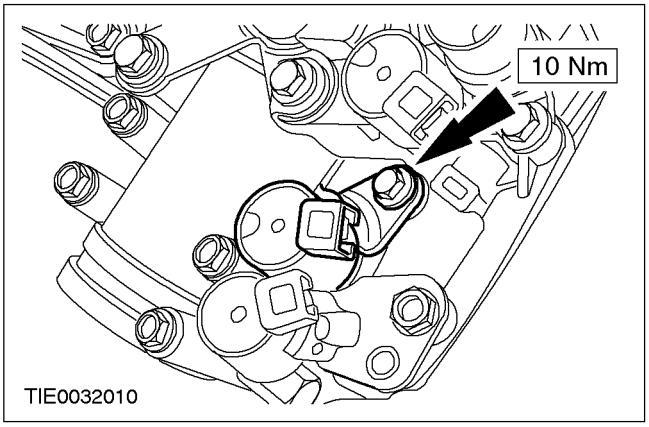
- Remove the TCC solenoid retaining bracket.



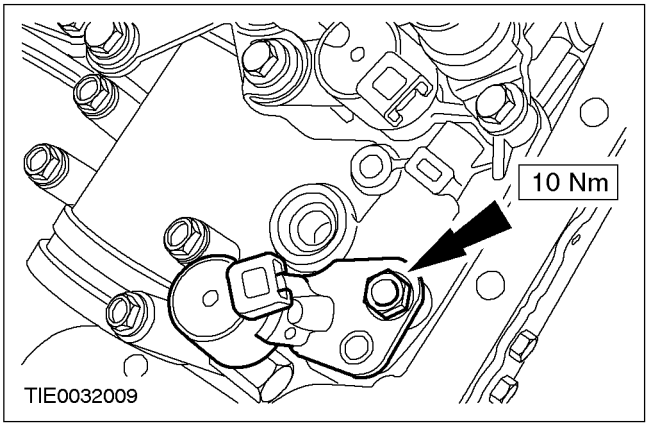
6. Remove the low clutch timing solenoid.



7. Remove the shift solenoid B.

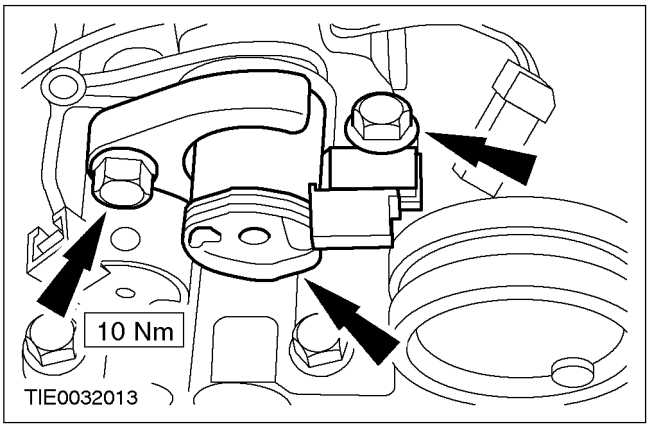


8. Remove the shift solenoid C.



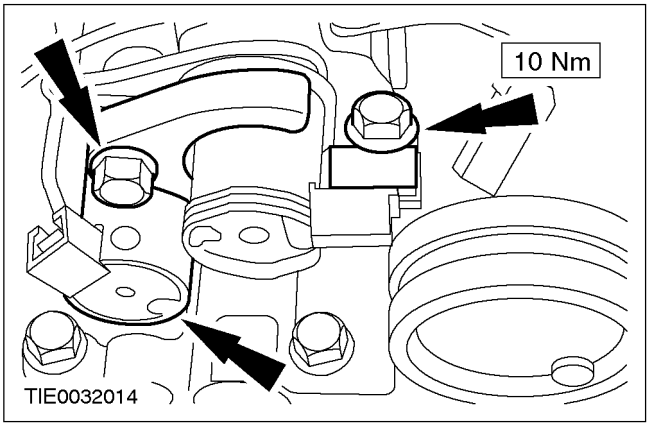
IN-VEHICLE REPAIR (Continued)

9. Remove the second, third and fourth gear brake duty solenoid.

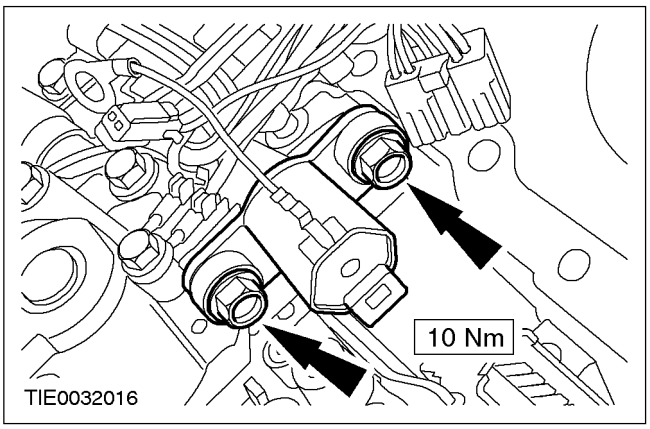


10. Remove the neutral shift solenoid.

- Remove the second, third and fourth gear brake duty solenoid bracket.



11. Remove the EPC solenoid.



Installation

1. NOTE: Install all new components supplied with the service kit.

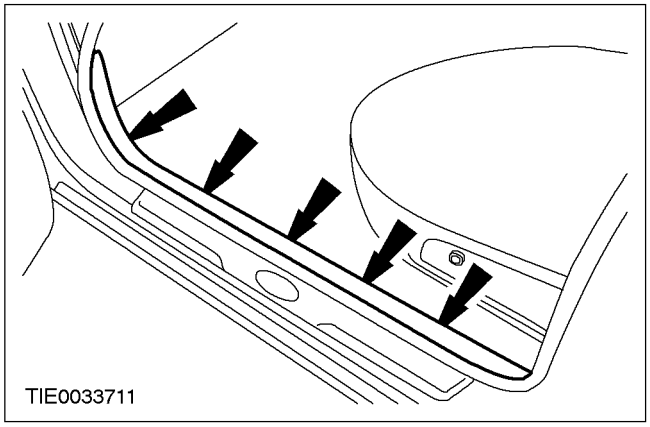
To install, reverse the removal procedure.

IN-VEHICLE REPAIR

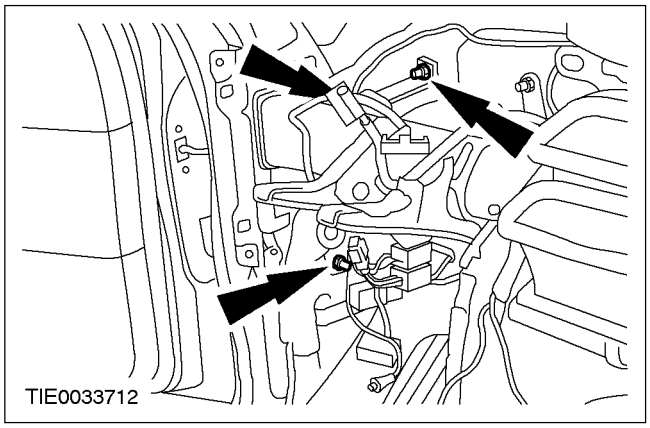
Transmission Control Module (TCM)

Removal

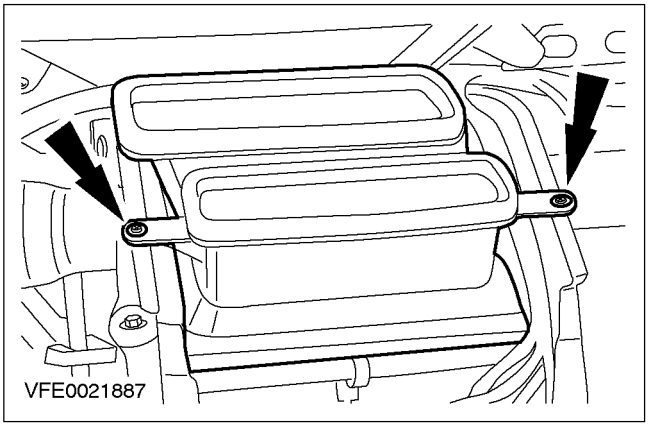
1. **Remove the instrument panel. For additional information, refer to Section 501-12.**
2. **Locally detach the left-hand front scuff plate from the inner sill panel.**



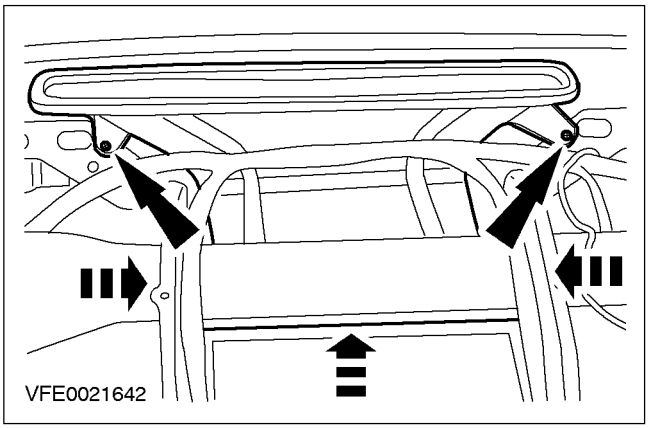
3. **Detach the central junction box (CJB) from the A-pillar and position it to one side.**



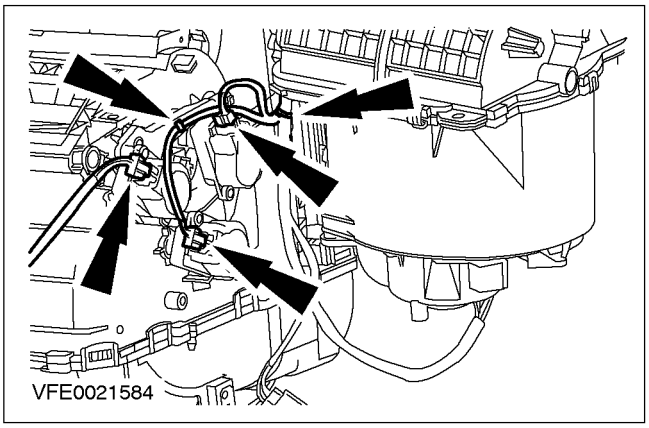
4. **Remove the air duct from the heater core and evaporator housing.**



5. **Remove the defroster duct.**

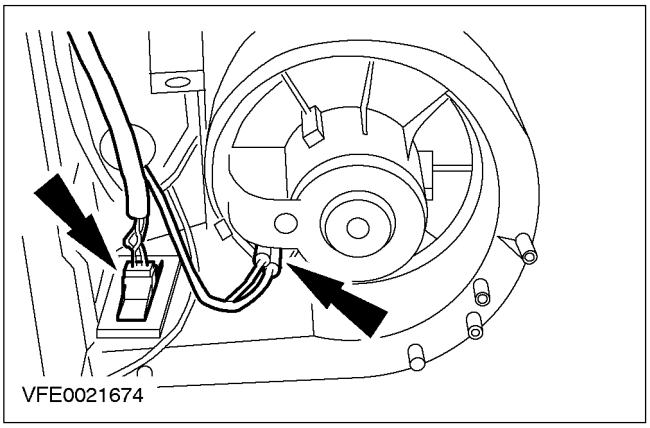


6. **Disconnect the temperature blend door and the air distribution blend door actuator electrical connectors.**
   - Detach the wiring harness.

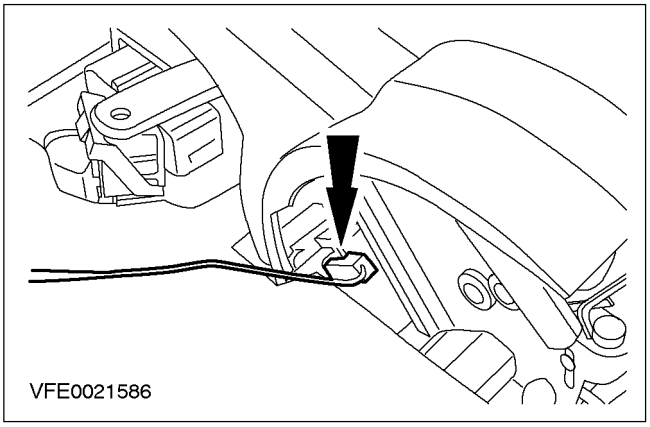


IN-VEHICLE REPAIR (Continued)

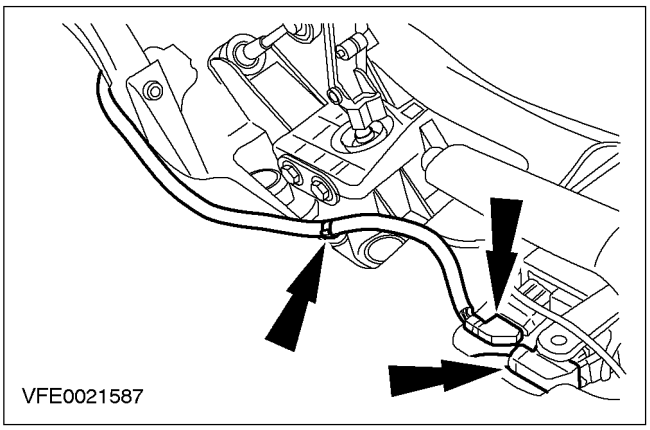
7. **Disconnect the blower motor and blower motor resistor electrical connectors.**



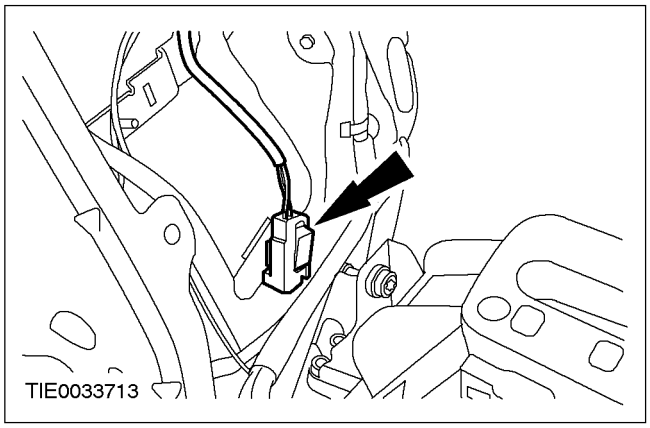
8. **Disconnect the parking brake warning indicator switch electrical connector.**
   - Depress the tang.



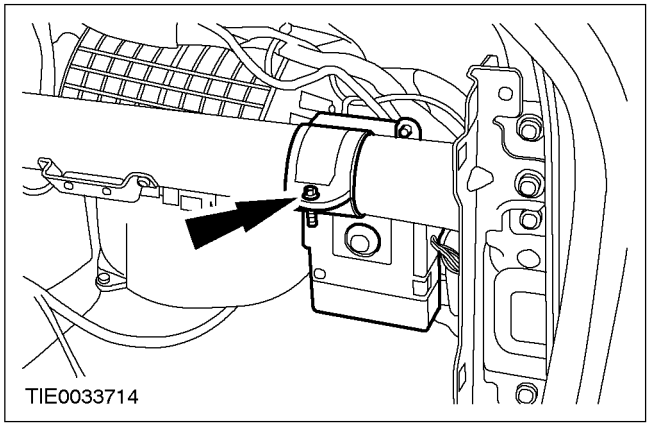
9. **Disconnect the air bag control module electrical connectors.**
   - Detach the wiring harness.



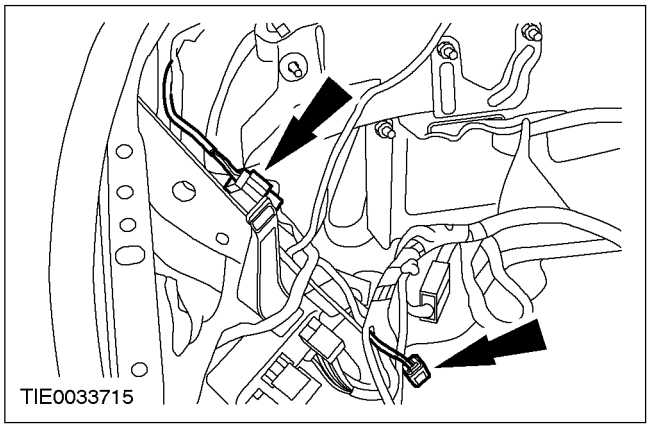
10. **Disconnect the in-car entertainment electrical connector.**



11. **Detach the telematics control module from the cross-vehicle beam.**
    - Detach the clamp.



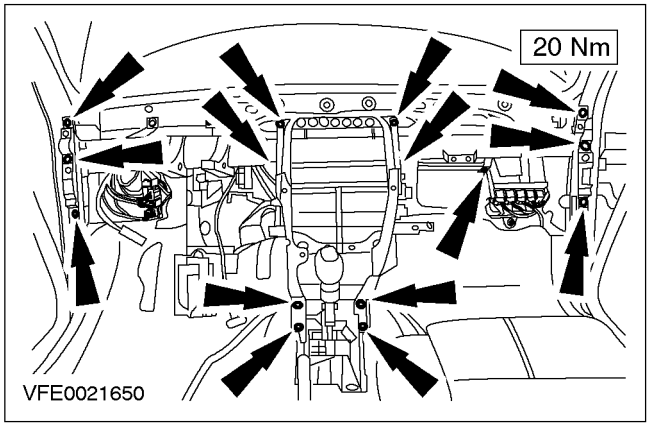
12. **Disconnect the auto-dimming interior mirror and interior lamp electrical connectors.**



IN-VEHICLE REPAIR (Continued)

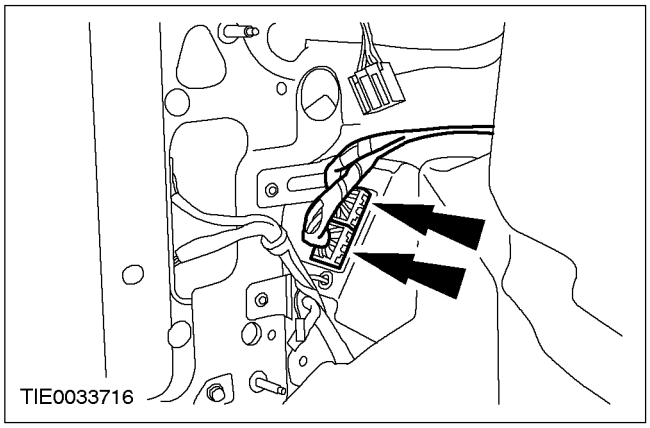
13. Remove the cross-vehicle beam.

- Detach the wiring harness.



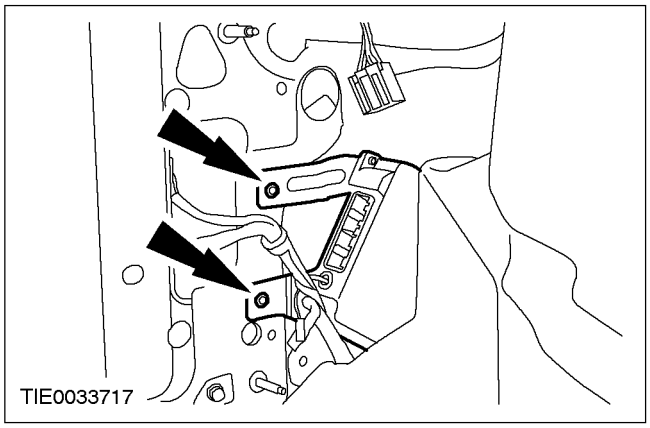
14. Disconnect the transmission control module (TCM) electrical connectors.

- Locally detach the insulation pad.



15. Remove the TCM.

- Remove and discard the rivets.



Installation

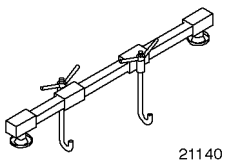
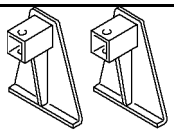
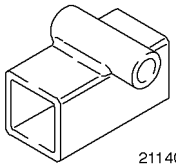
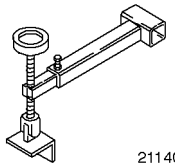
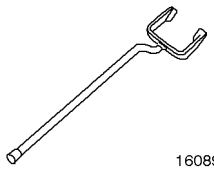
1. **CAUTION: Make sure that the correct transmission control module (TCM) is installed or irregular driving conditions may occur.**

NOTE: Install new rivets.

To install, reverse the removal procedure.

REMOVAL

Transaxle — 2.0L Diesel (17 214 0)

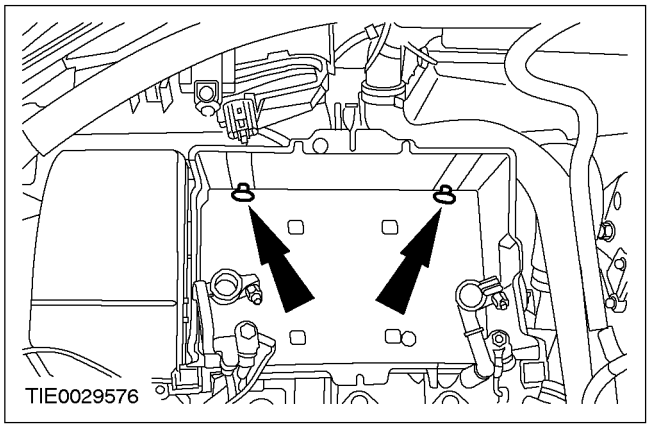
Special Tool(s)	
 21140	Support Bar, Engine 303-290A (21-140)
 2114001	Adapter for 303-290A 303–290–01 (21–140–01)
 2114002	Adapter for 303-290A 303-290-02 (21-140-02)
 2114003	Adapter for 303-290A 303-290-03A (21-140-03A)
 16089	Remover, Halfshaft 308-256 (16-089)

General Equipment
Securing straps
Transmission jack

1. Remove the battery. For additional information, refer to Section 414-01.

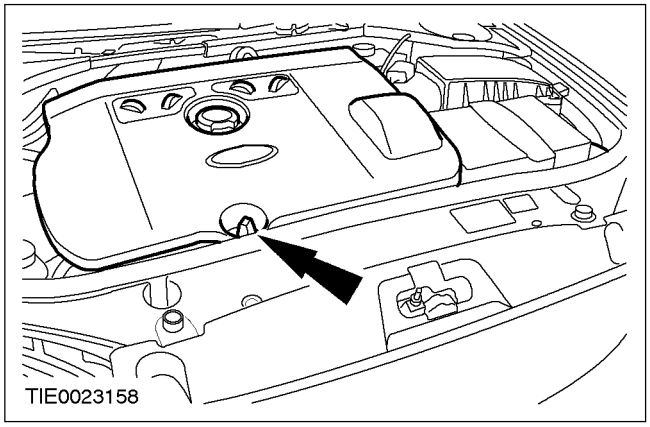
2. Remove the battery tray.

- Remove the clips.

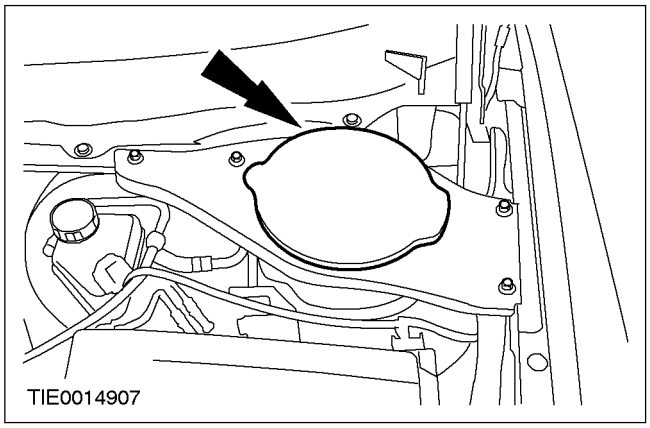


3. Remove the engine upper cover.

- Remove the oil level indicator.

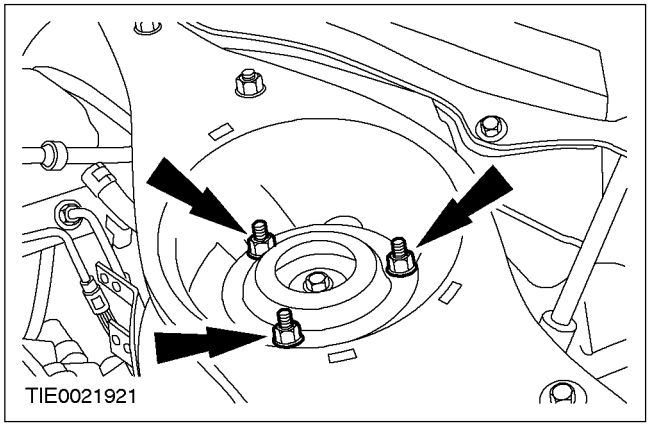


4. Remove the strut and spring assembly top mount brace cover on both sides.

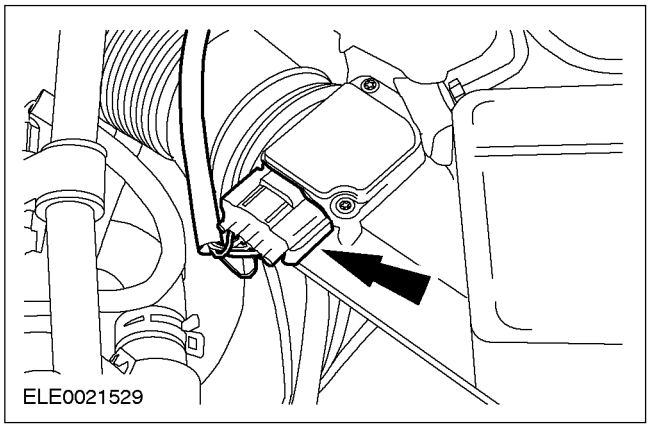


REMOVAL (Continued)

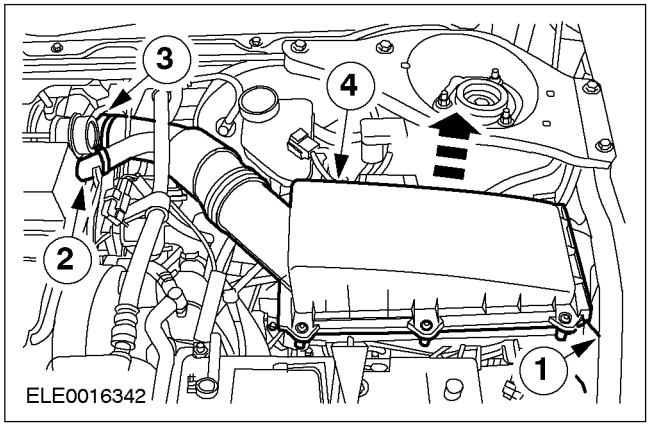
5. **Loosen the strut and spring assembly top mount nuts by four turns on both sides.**



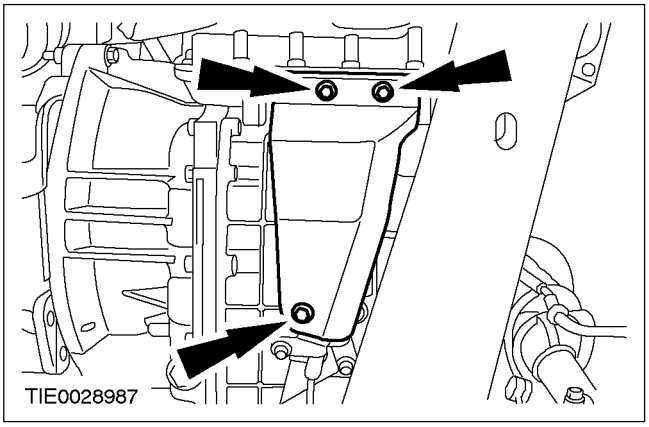
6. **Disconnect the mass air flow (MAF) sensor electrical connector.**



7. **Remove the air cleaner.**
   1. Disconnect the air cleaner intake pipe.
   2. Disconnect the positive crankcase ventilation (PCV) hose.
   3. Disconnect the turbocharger air intake pipe.
   4. Disconnect the vacuum hose.

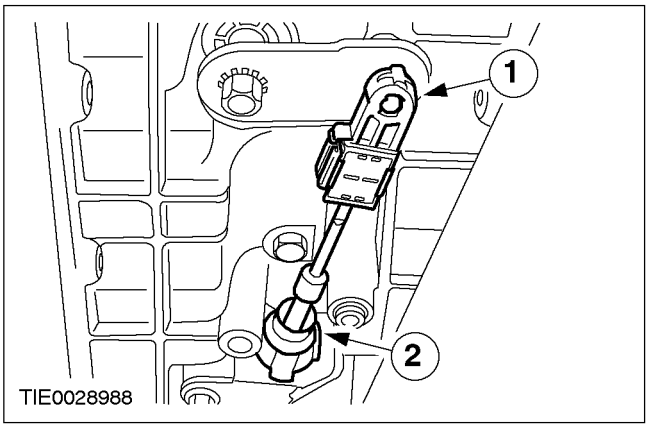


8. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
9. **Remove the selector lever cable cover.**



10. **NOTE:** Make sure the transaxle selector lever is in the "D" (DRIVE) position.

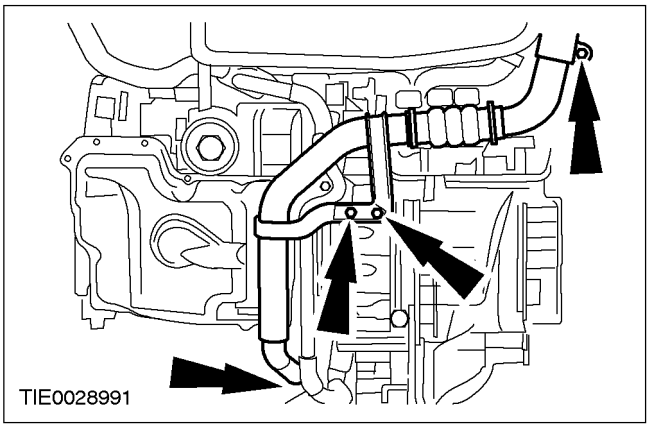
    Detach the selector lever cable from the selector shaft lever.
    1. Detach the selector lever cable from the selector shaft lever pin.
    2. Detach the selector lever cable from the selector lever cable bracket.



11. **Remove the subframe. For additional information, refer to Section 502-00.**

REMOVAL (Continued)

12. **Remove the charge air cooler intake hose.**

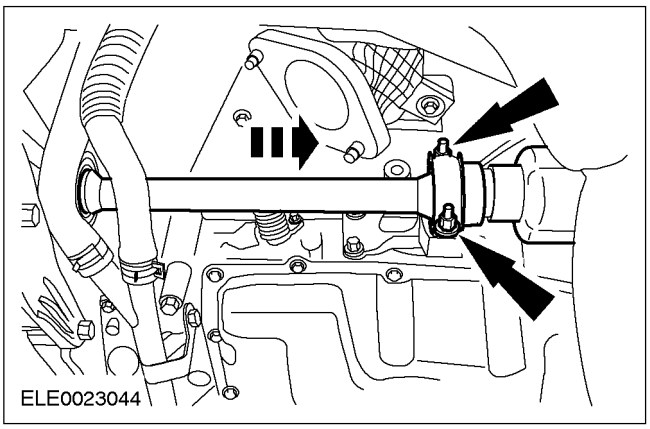


13. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

CAUTION: Do not damage the halfshaft oil seal.

Detach the right-hand halfshaft and the intermediate shaft from the transaxle and secure it to one side.

- Remove and discard the center bearing cap and locknuts.
- Discard the O-ring seal.

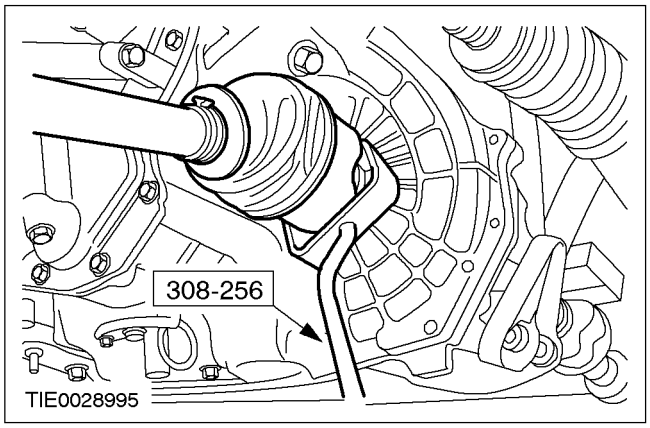


14. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

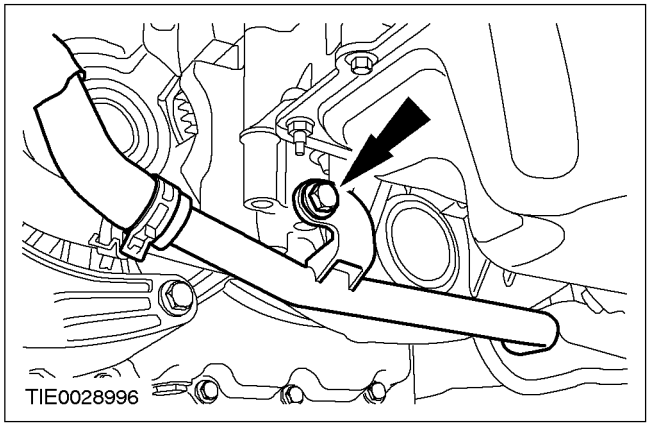
CAUTION: Do not damage the halfshaft oil seal.

Using the special tool, detach the left-hand halfshaft from the transaxle and secure it to one side.

- Discard the snap ring.
- Discard the O-ring seal.

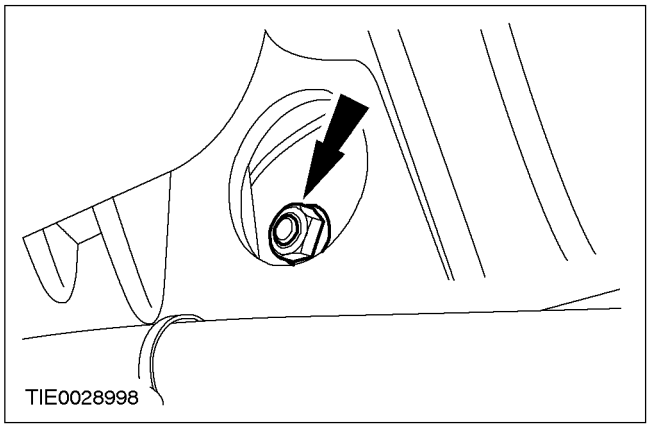


15. **Detach the heater pipe from the transaxle.**

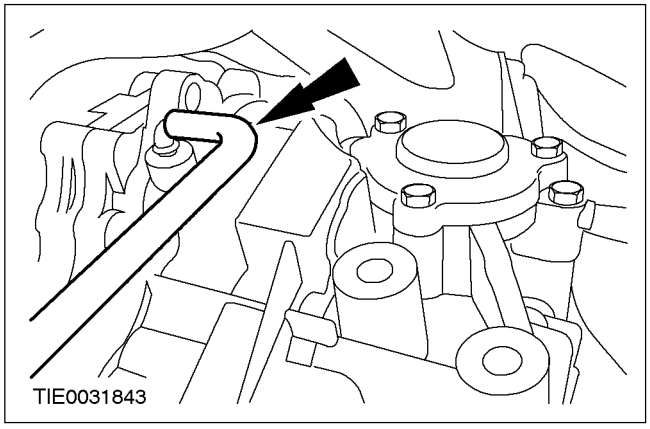


REMOVAL (Continued)

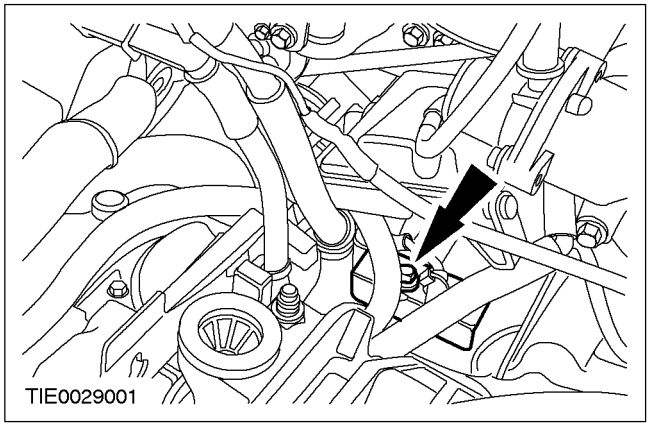
16. **Remove the torque converter retaining nuts.**
    - Remove the cover.
    - Rotate the engine to gain access to the nuts.
    - Discard the nuts.



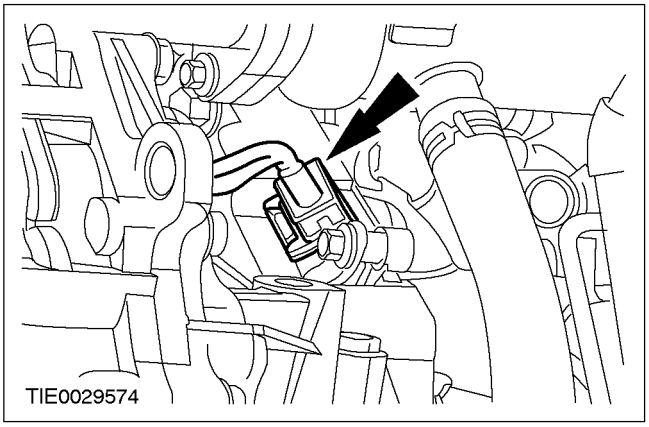
17. **Lower the vehicle.**
18. **Disconnect the vent hose from the transaxle.**



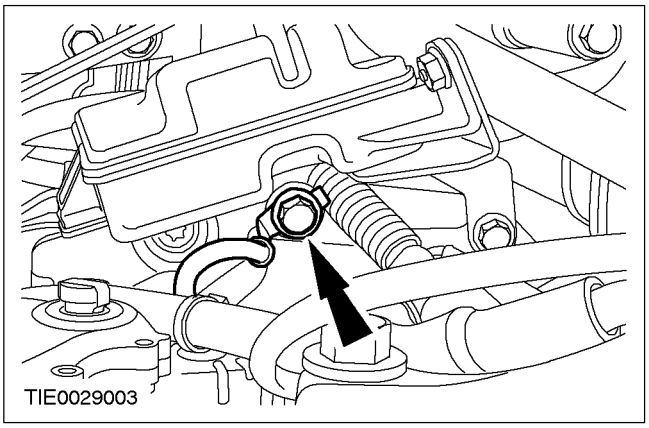
19. **Detach the cable bracket from the transaxle.**



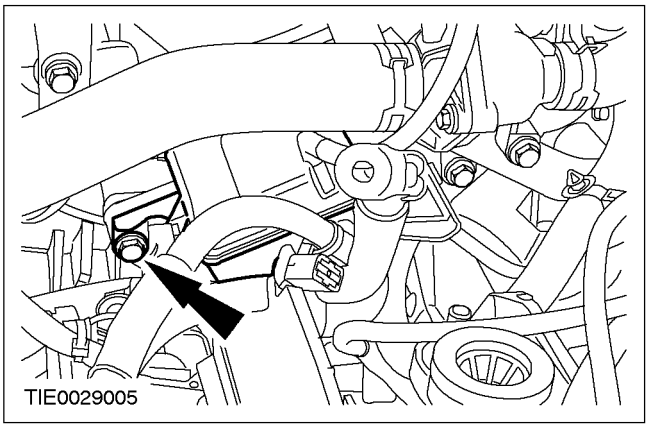
20. **Disconnect the crankshaft position (CKP) sensor electrical connector.**



21. **Detach the ground cable from the transaxle.**



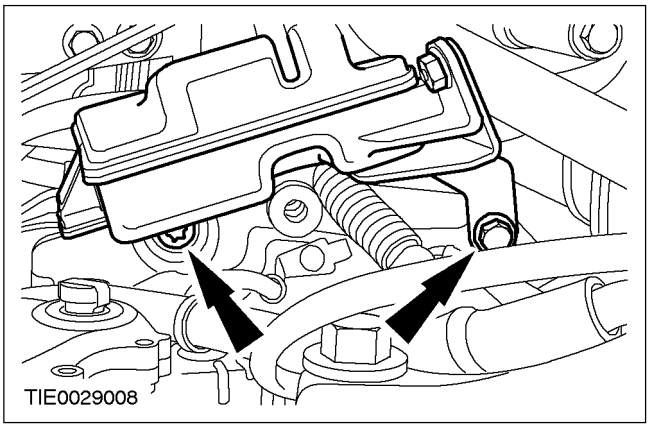
22. **Remove the transaxle left-hand upper retaining bolt.**



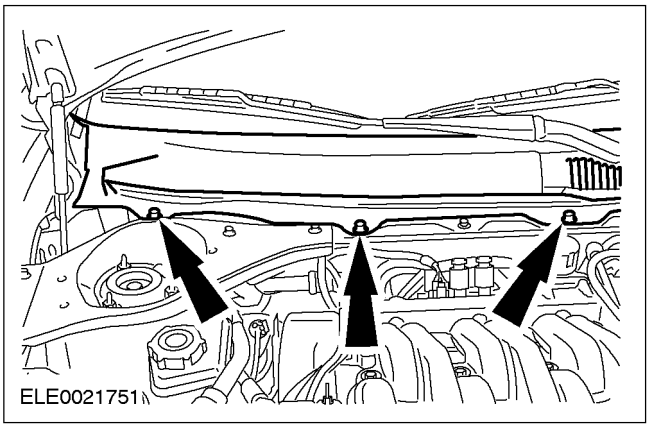
REMOVAL (Continued)

23. Remove the transaxle right-hand upper retaining bolt.

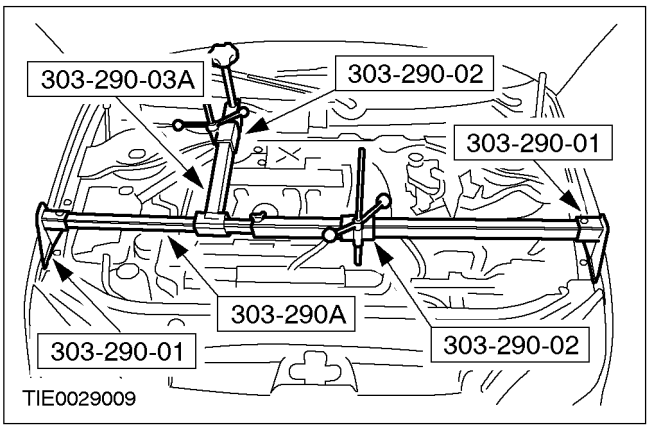
- Detach the vacuum reservoir bracket.



24. Remove the bulkhead cover.

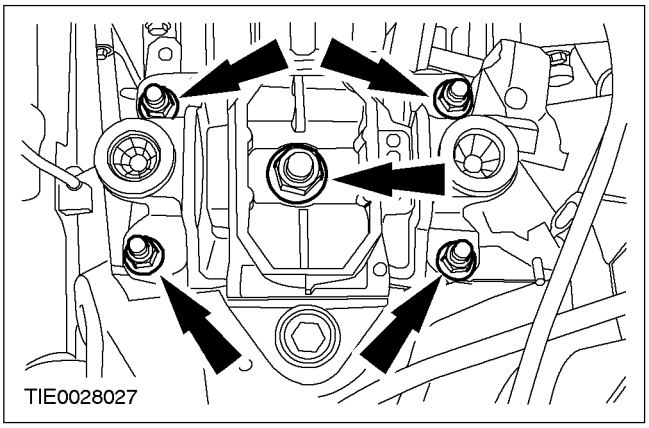


25. Install the special tools.

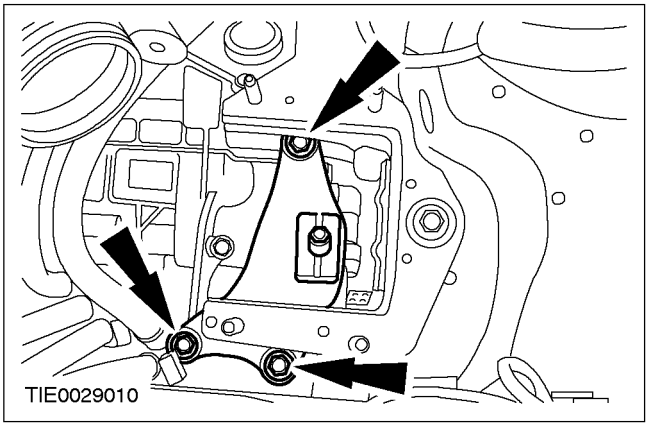


26. Remove the engine rear mount.

- Discard the center nut.



27. Remove the engine rear mount bracket.

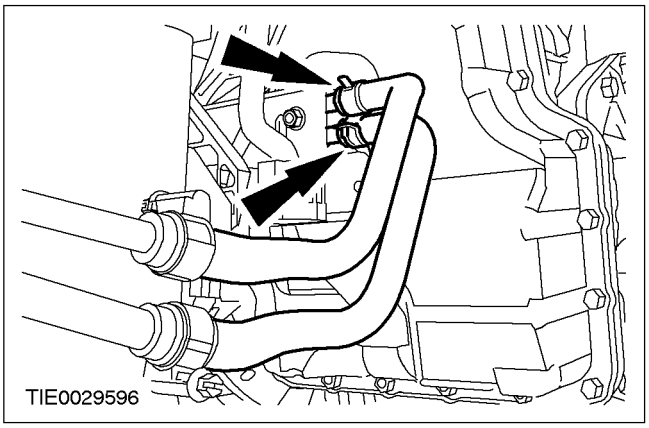


28. Raise and support the vehicle. For additional information, refer to Section 100-02.

29. NOTE: Plug the fluid cooler pipes to prevent oil loss or dirt ingress.

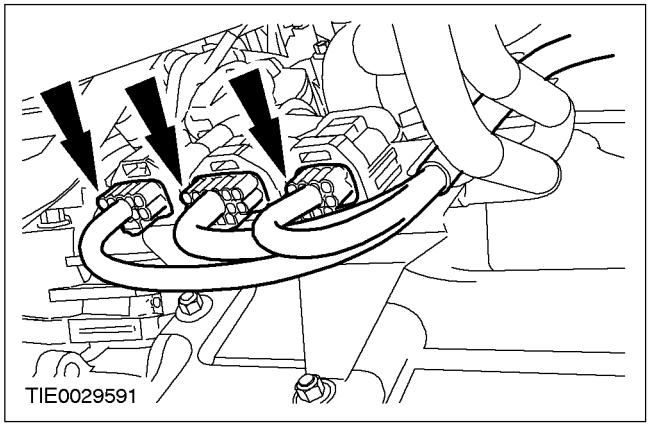
Disconnect the fluid cooler pipes from the transaxle.

- Allow the fluid to drain into a suitable container.

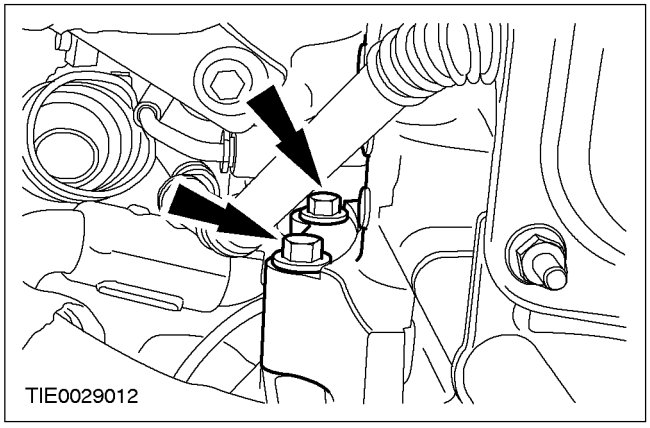


REMOVAL (Continued)

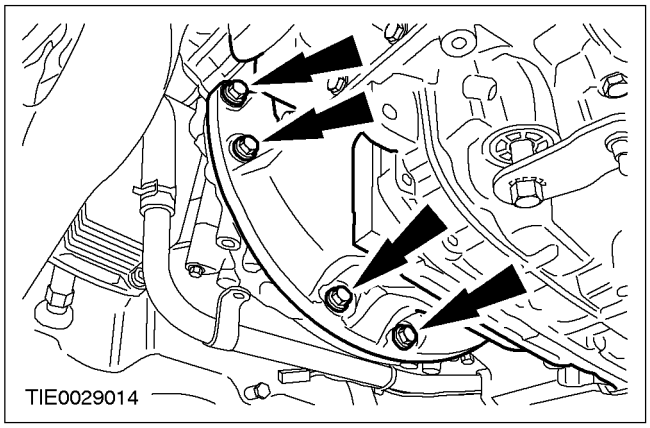
30. **Disconnect the transaxle electrical connectors.**



31. **Remove the transaxle right-hand retaining bolts.**



32. **Remove the transaxle left-hand and lower retaining bolts.**

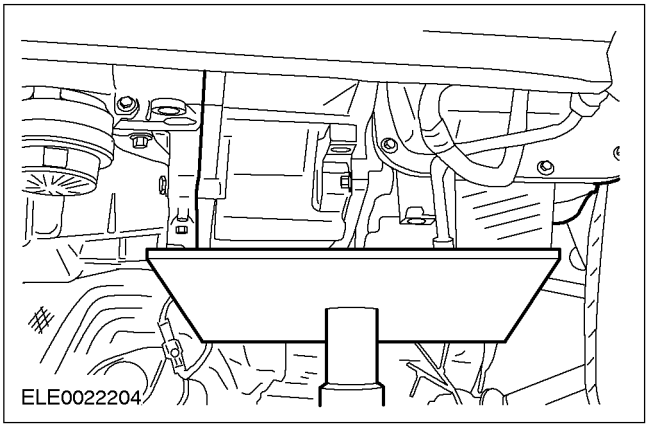


33. **WARNING: Make sure the torque converter remains in the torque converter housing.**

NOTE: Use a suitable wooden block to protect the transaxle.

NOTE: Secure the transaxle with securing straps.

Using a suitable transmission jack remove the transaxle.

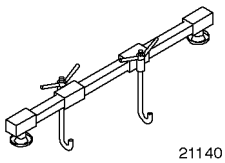
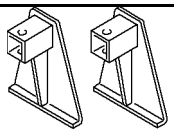
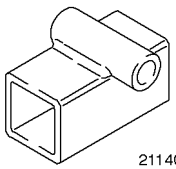
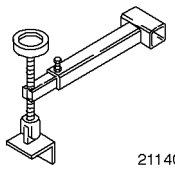
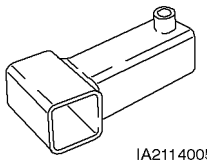
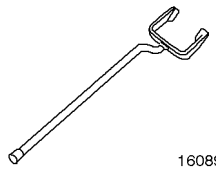


34. **NOTE:** Make a note of the position of the dowel pins in the engine flange, to aid installation.

Lower the transaxle.

REMOVAL

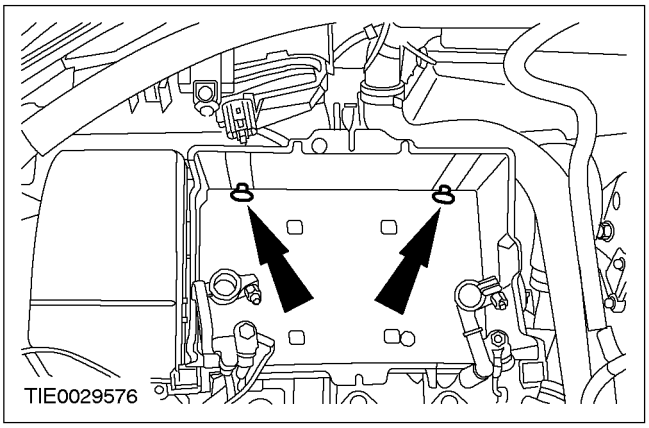
Transaxle — 2.5L (17 214 0)

Special Tool(s)	
 21140	Support Bar, Engine 303-290A (21-140)
 2114001	Adapter for 303-290A 303–290–01 (21–140–01)
 2114002	Adapter for 303-290A 303-290-02 (21-140-02)
 2114003	Adapter for 303-290A 303-290-03A (21-140-03A)
 IA2114005	Adapter for 303-290A 303-290-05A (21-140-05A)
 16089	Remover, Halfshaft 308-256 (16-089)

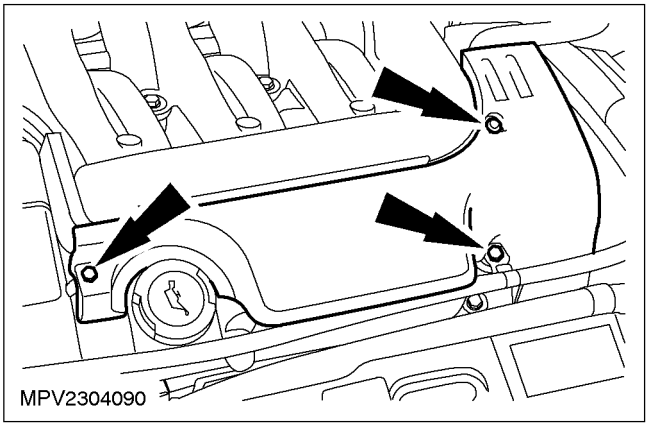
General Equipment
Securing straps
Transmission jack

1. Remove the battery. For additional information, refer to Section 414-01.

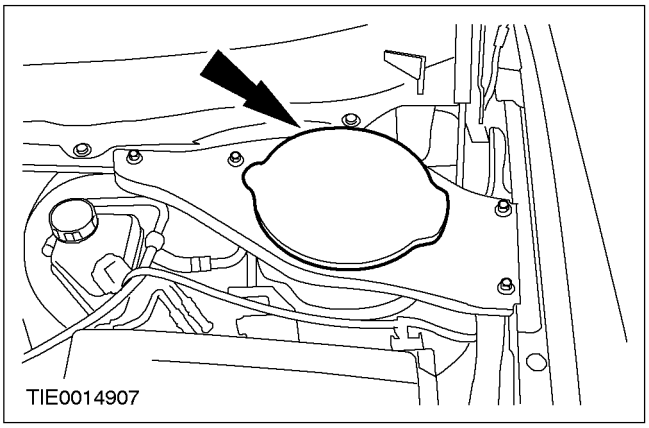
2. Remove the battery tray.



3. Remove the engine upper cover.

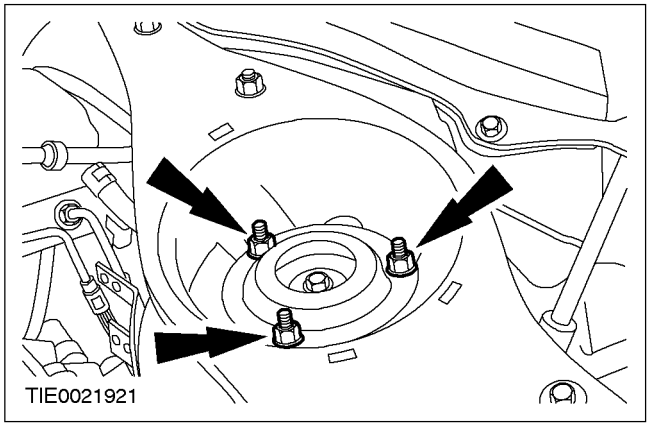


4. Remove the strut and spring assembly top mount brace cover on both sides.



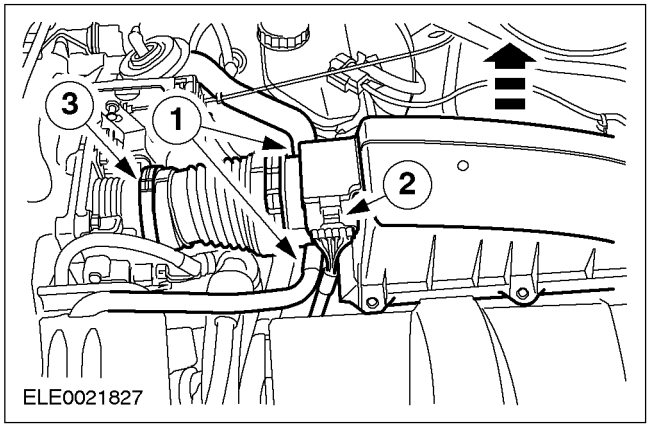
REMOVAL (Continued)

5. Loosen the strut and spring assembly top mount nuts by four turns on both sides.

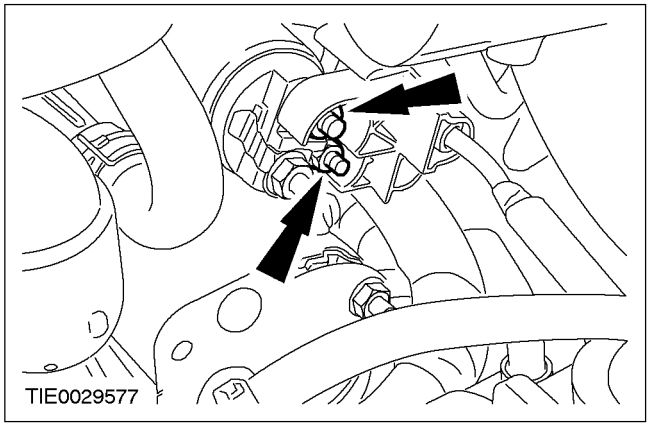


6. Remove the air cleaner.

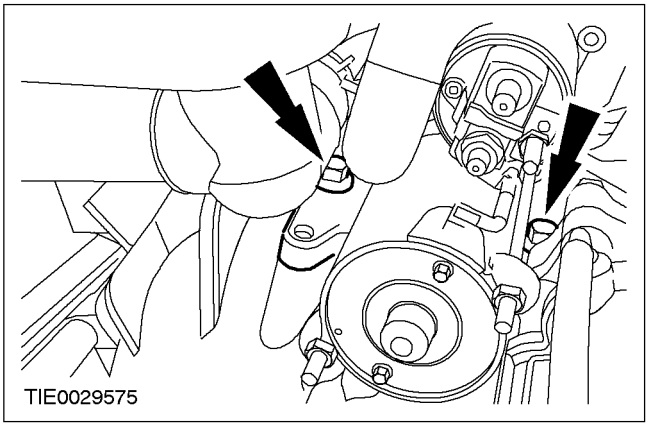
1. Disconnect the positive crankcase ventilation (PCV) hoses.
2. Disconnect the mass air flow (MAF) sensor electrical connector.
3. Disconnect the air cleaner intake hose.



7. Disconnect the starter motor electrical connectors.

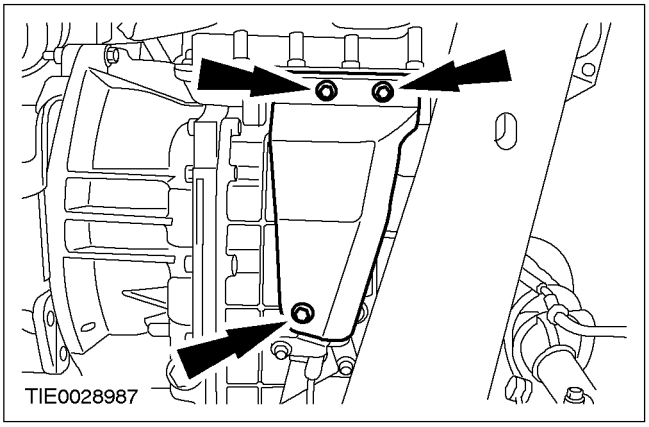


8. Remove the starter motor.



9. Raise and support the vehicle. For additional information, refer to Section 100-02.

10. Remove the selector lever cable cover.

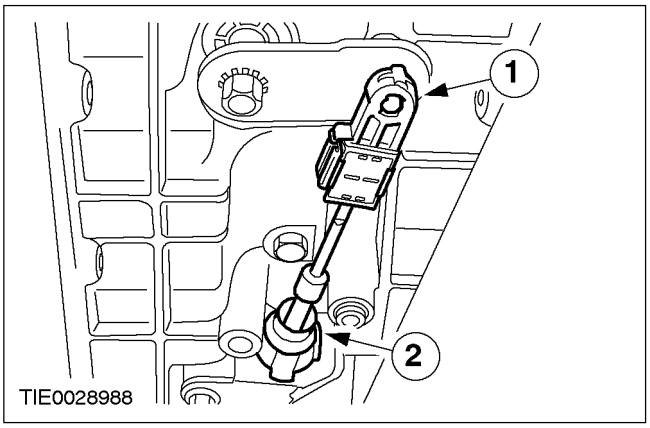


REMOVAL (Continued)

11. **NOTE:** Make sure the transaxle selector lever is in "D" (DRIVE) position.

    Detach the selector lever cable from the selector shaft lever.

    1. Detach the selector lever cable from the selector shaft lever pin.
    2. Detach the selector lever cable from the selector lever cable bracket.



12. **Remove the subframe. For additional information, refer to Section 502-00.**

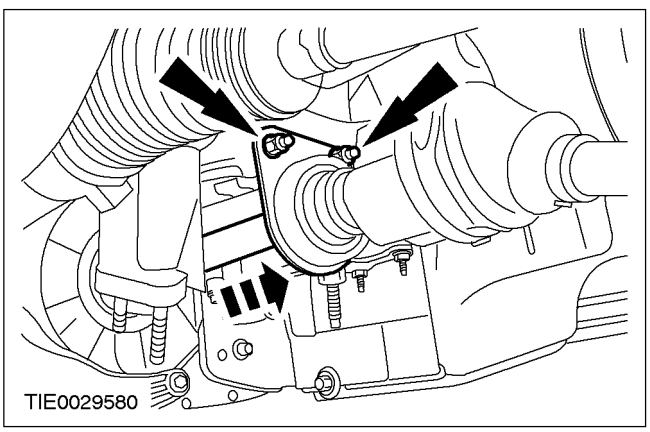
13. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

CAUTION: Do not damage the halfshaft oil seal.

NOTE: Plug the transaxle to prevent oil loss or dirt ingress.

Detach the right-hand halfshaft and the intermediate shaft from the transaxle and secure it to one side.

- Remove and discard the locknuts.
- Discard the O-ring seal.



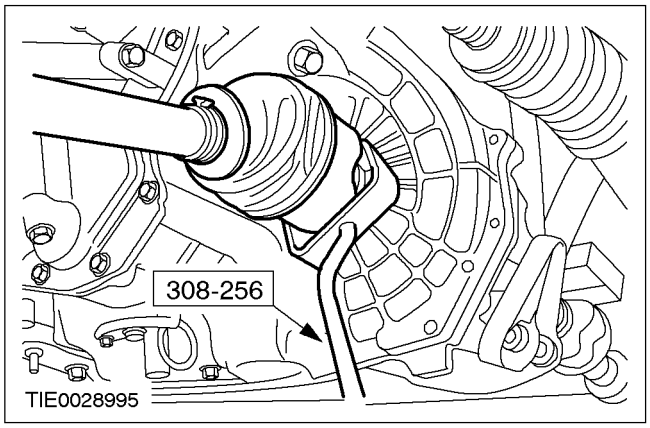
14. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

CAUTION: Do not damage the halfshaft oil seal.

NOTE: Plug the transaxle to prevent oil loss or dirt ingress.

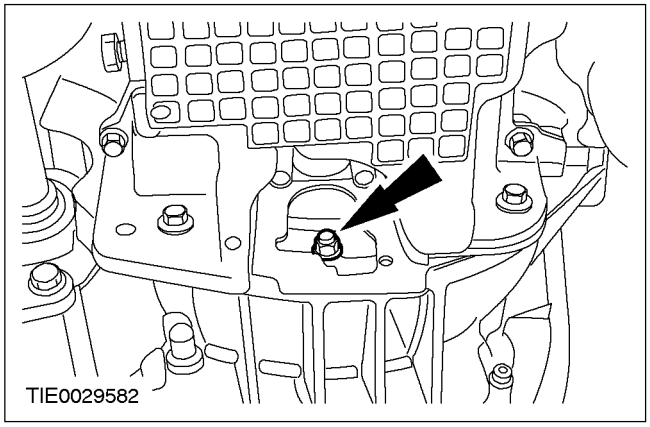
Using the special tool, detach the left-hand halfshaft from the transaxle and secure it to one side.

- Discard the snap ring.
- Discard the O-ring seal.



15. **Remove the torque converter retaining nuts.**

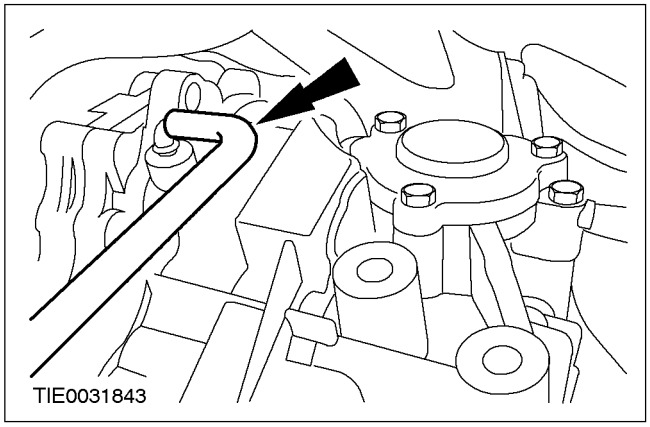
- Remove the cover.
- Rotate the engine to gain access to the nuts.
- Discard the nuts.



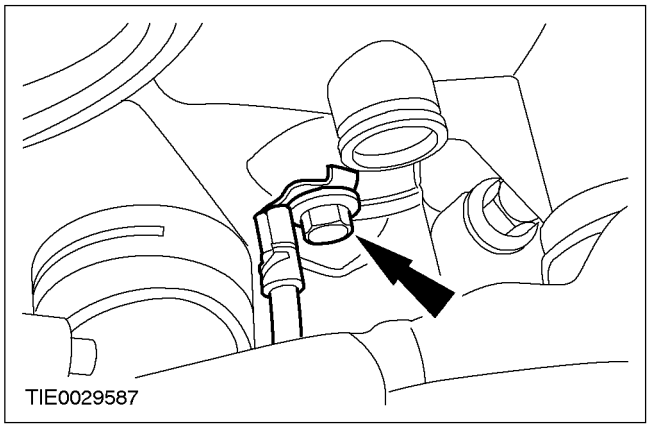
16. **Lower the vehicle.**

REMOVAL (Continued)

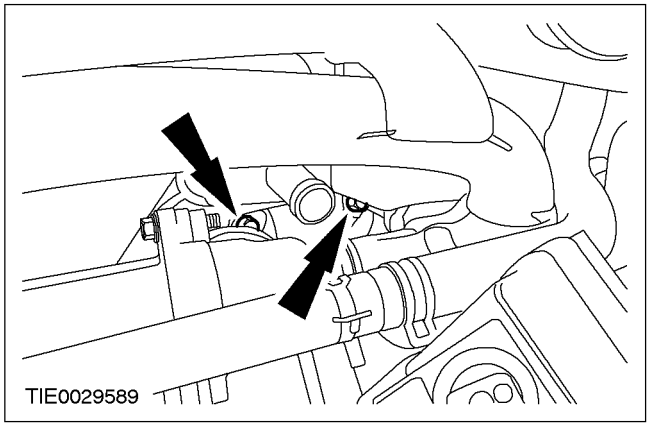
17. **Disconnect the vent hose from the transaxle.**



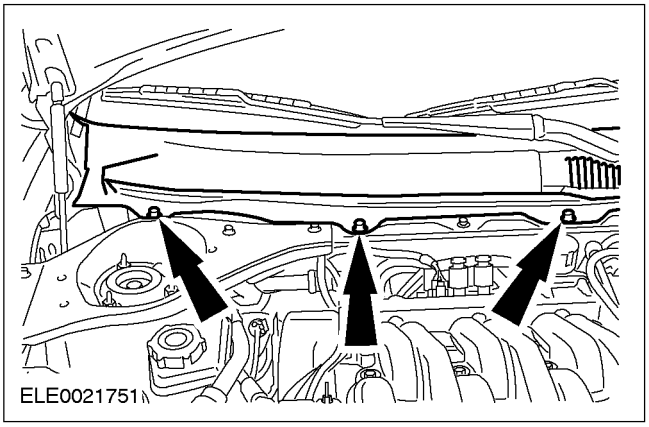
18. **Detach the ground cable from the transaxle.**



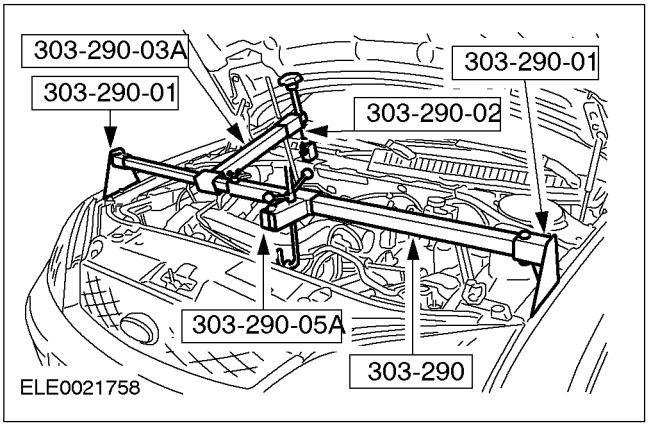
19. **Remove the transaxle upper retaining bolts.**



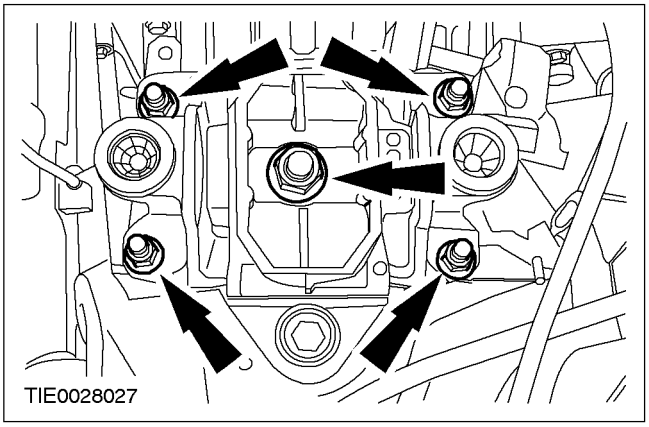
20. **Remove the bulkhead cover.**



21. **Install the special tools.**

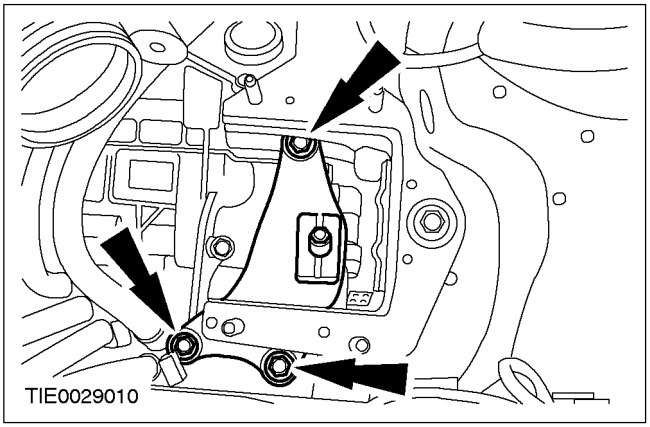


22. **Remove the engine rear mount.**
    - Discard the center nut.



REMOVAL (Continued)

23. Remove the engine rear mount bracket.

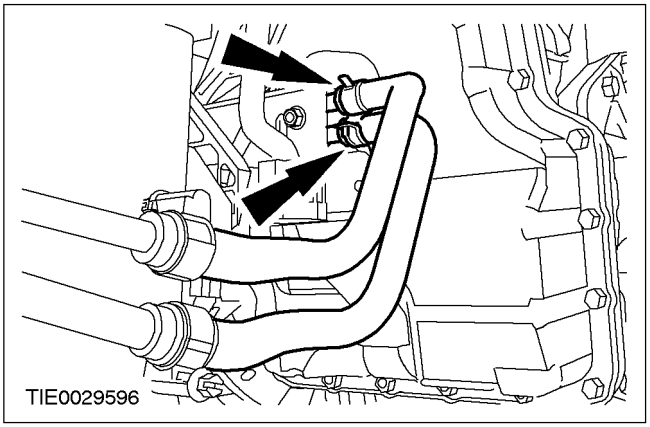


24. Raise and support the vehicle. For additional information, refer to Section 100-02.

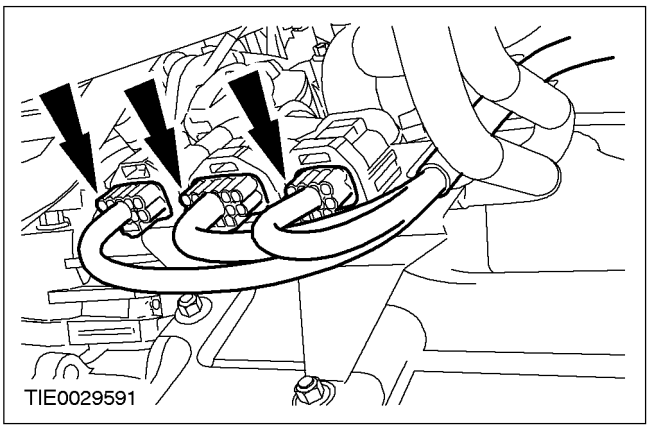
25. NOTE: Plug the fluid cooler pipes to prevent oil loss or dirt ingress.

Disconnect the fluid cooler pipes from the transaxle.

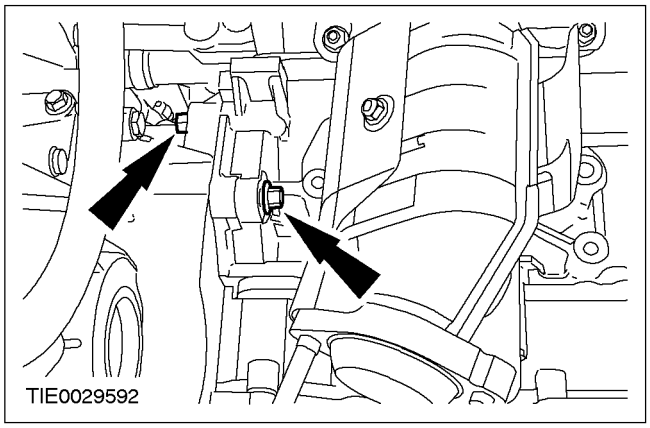
- Allow the fluid to drain into a suitable container.



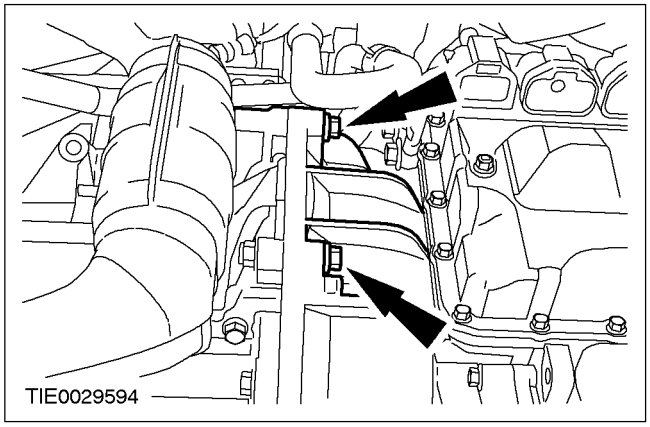
26. Disconnect the transaxle electrical connectors.



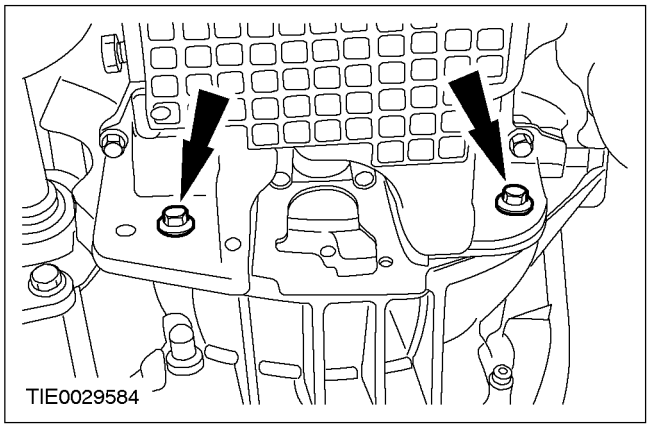
27. Remove the transaxle right-hand retaining bolts.



28. Remove the transaxle left-hand retaining bolts.



29. Remove the transaxle lower retaining bolts.



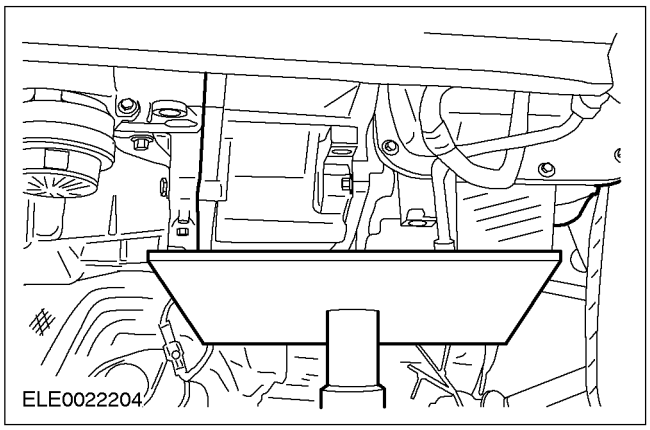
REMOVAL (Continued)

30. **WARNING: Make sure the torque converter remains in the torque converter housing.**

NOTE: Use a suitable wooden block to protect the transaxle.

NOTE: Secure the transaxle with securing straps.

Using a suitable transmission jack remove the transaxle.

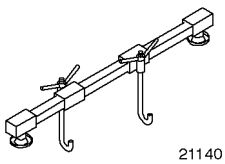
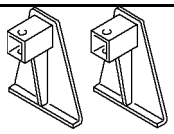
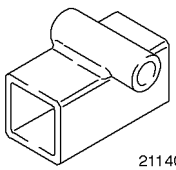
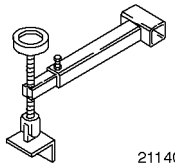


31. **NOTE:** Make a note of the position the dowel pins in the engine flange, to aid installation.

Lower the transaxle.

INSTALLATION

Transaxle — 2.0L Diesel (17 214 0)

Special Tool(s)	
 21140	Support Bar, Engine 303-290A (21-140)
 2114001	Adapter for 303-290A 303-290-01 (21-140-01)
 2114002	Adapter for 303-290A 303-290-02 (21-140-02)
 2114003	Adapter for 303-290A 303-290-03A (21-140-03A)

General Equipment
Securing straps
Transmission jack
Steel straight edge

Name	Specification
Grease	WSD-M1C230-A

1. **CAUTION: The torque converter hub must remain at the correct installation depth throughout the whole installation procedure.**

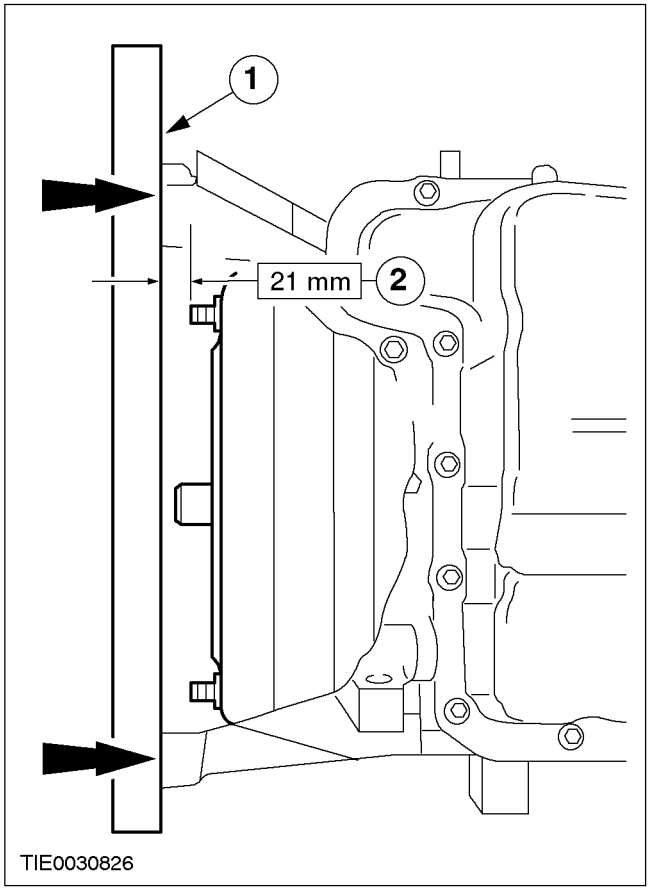
NOTE: The torque converter studs must be aligned with the engine drive plate holes before any transaxle bolts are installed.

Install the torque converter.

2. **CAUTION: The torque converter hub must engage fully in the oil pump drive gear.**

Check the installation depth of the torque converter.

1. Lay a steel straight edge across the transaxle flange.
2. Check the installation depth between the steel straight edge and the drive plate stud.



INSTALLATION (Continued)

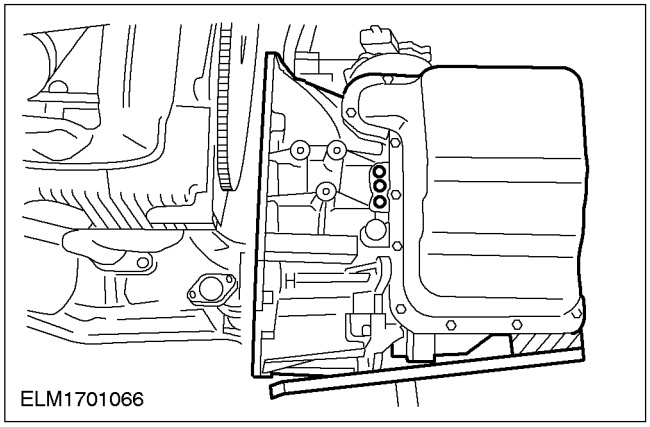
3. **CAUTION: The torque converter must remain at the correct installation depth throughout the entire installation procedure.**

NOTE: Secure the transaxle with securing straps.

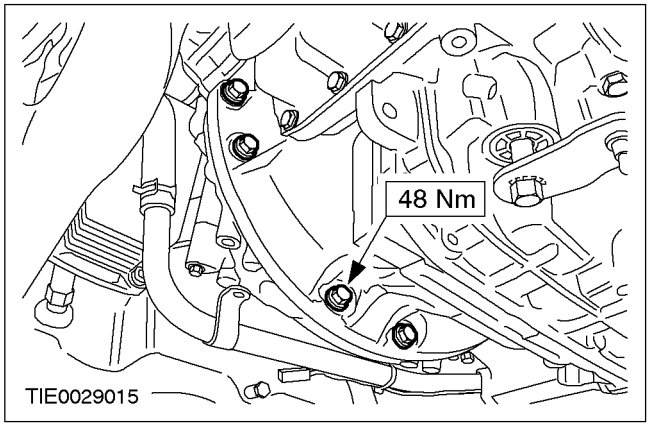
NOTE: Use a suitable wooden block to protect the transaxle.

NOTE: Make sure that the dowel pins are correctly installed in the engine flange.

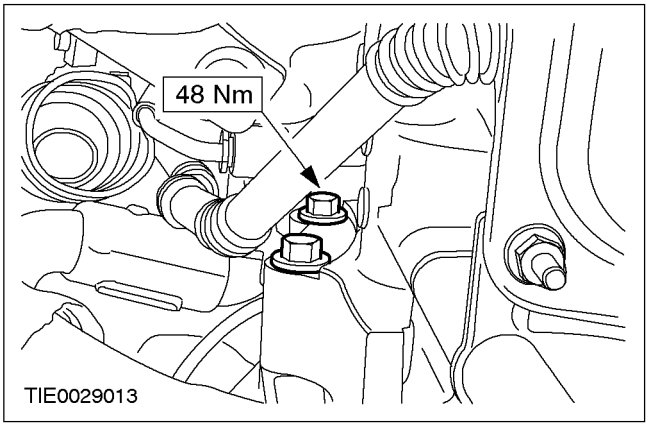
Using a suitable transmission jack install the transaxle.



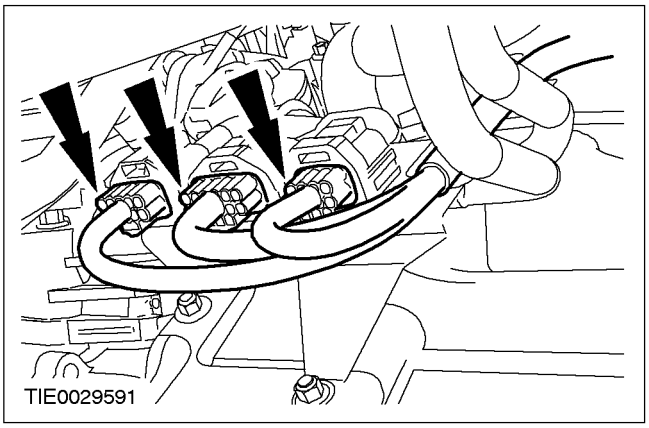
4. **Remove the securing straps.**
5. **Tighten the transaxle left-hand and lower retaining bolts.**



6. **Tighten the transaxle right-hand retaining bolts.**



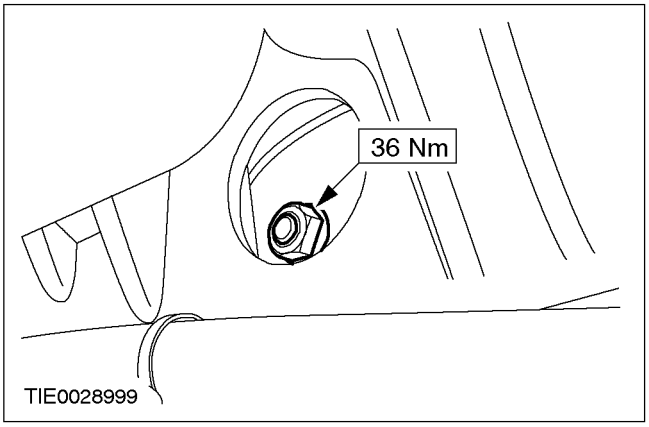
7. **Connect the transaxle electrical connectors.**



8. **NOTE:** Install new torque converter retaining nuts.

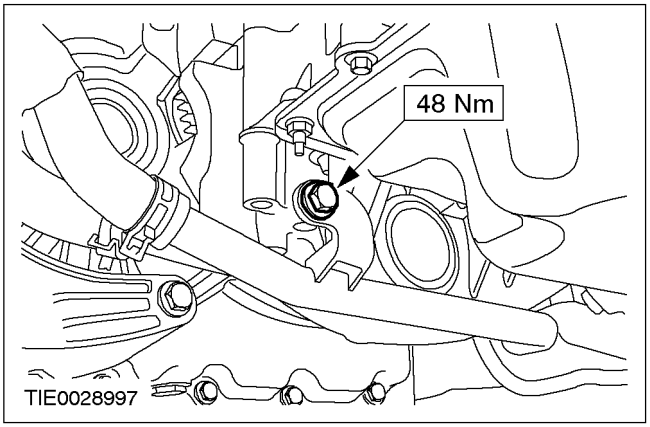
Install the torque converter retaining nuts.

- Rotate the engine to gain access to the nuts.
- Install the cover.

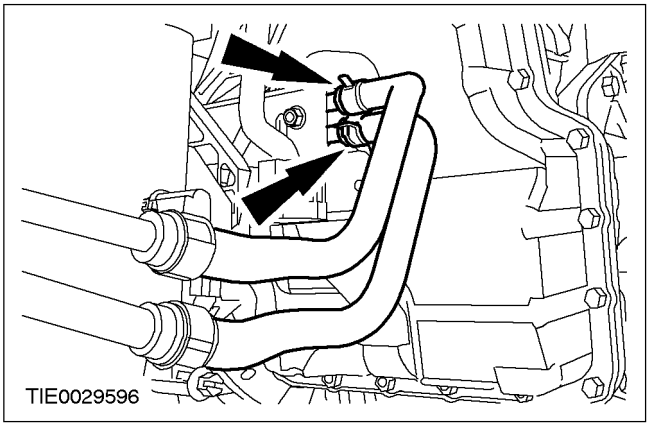


INSTALLATION (Continued)

9. Attach the heater pipe to the transaxle.

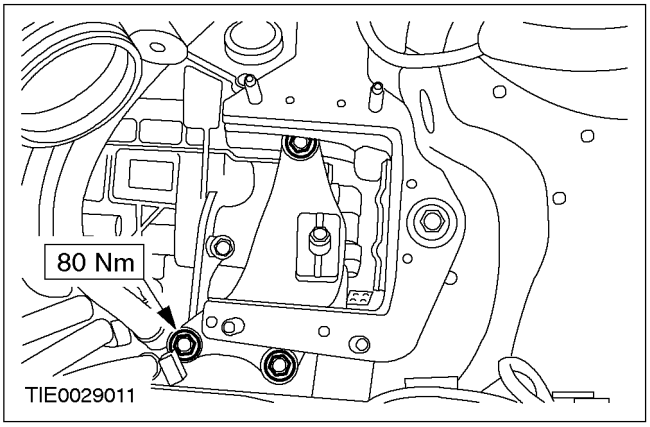


10. Connect the fluid cooler pipes to the transaxle.



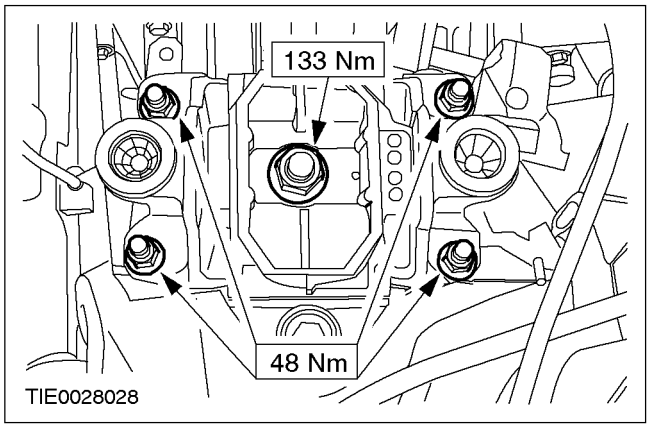
11. Lower the vehicle.

12. Install the engine rear mount bracket.

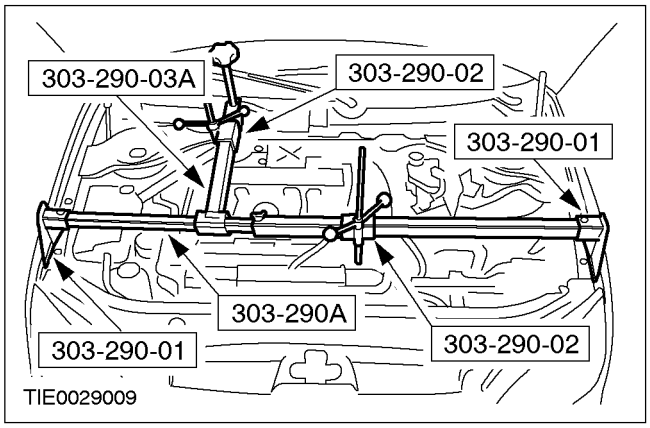


13. NOTE: Install a new engine rear mount center retaining nut.

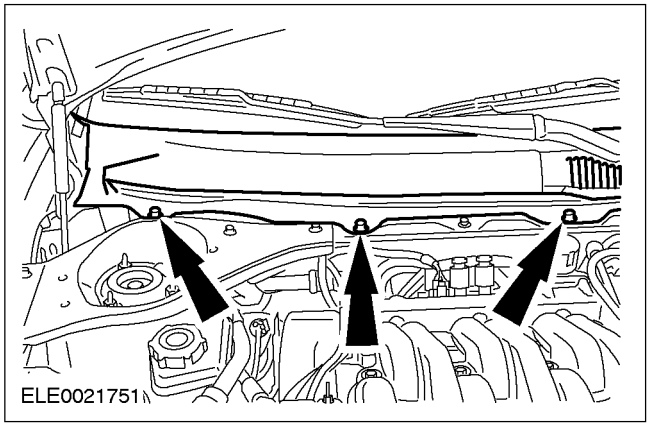
Install the engine rear mount.



14. Remove the special tools.

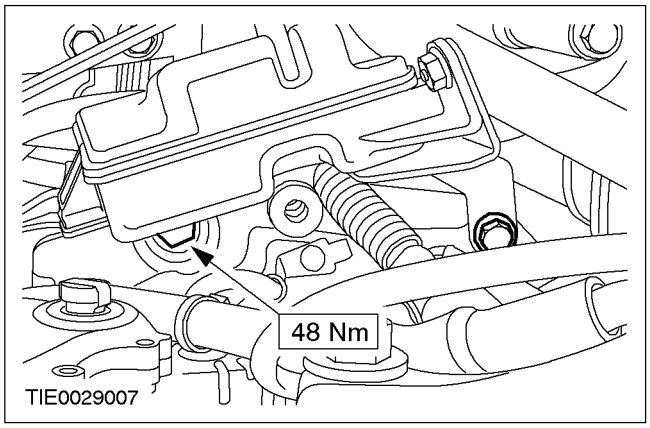


15. Install the bulkhead cover.

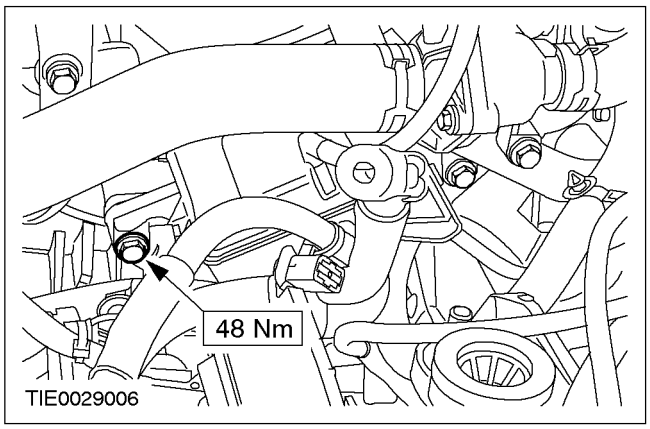


INSTALLATION (Continued)

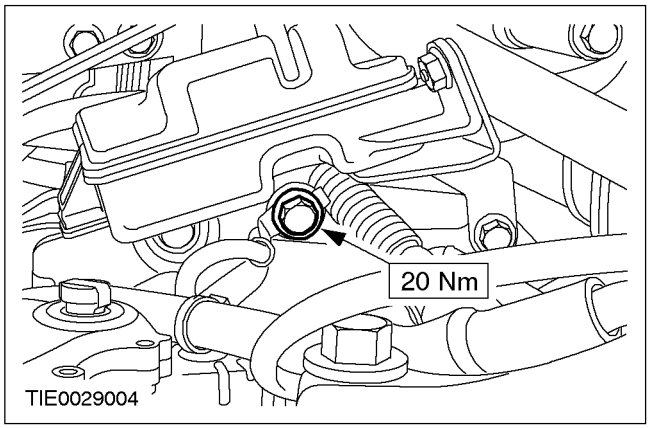
16. **Install the transaxle right-hand upper retaining bolts.**
    - Attach the vacuum reservoir bracket.



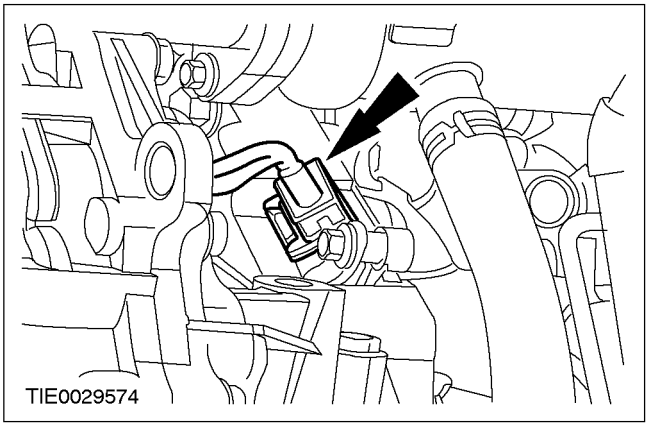
17. **Install the transaxle left-hand upper retaining bolt.**



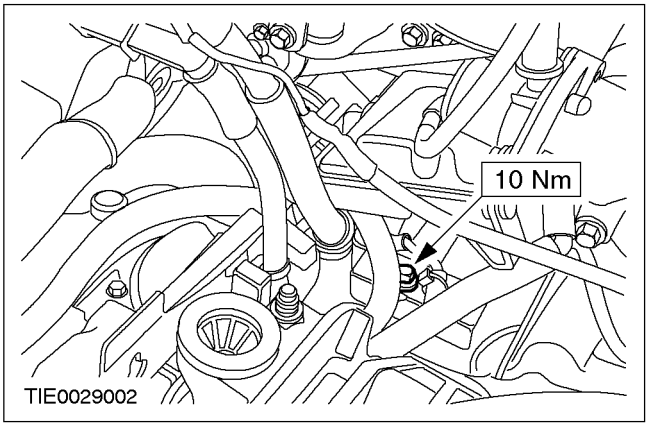
18. **Attach the ground cable to the transaxle.**



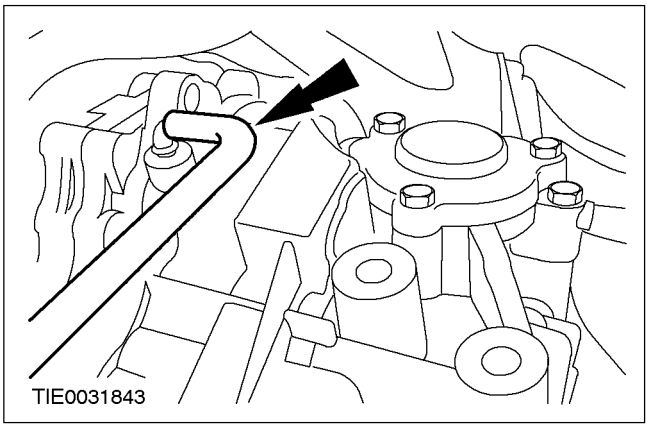
19. **Connect the crankshaft position (CKP) sensor electrical connector.**



20. **Attach the cable bracket to the transaxle.**



21. **Connect the vent hose to the transaxle.**



22. **Raise and support the vehicle. For additional information, refer to Section 100-02.**

INSTALLATION (Continued)

23. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

CAUTION: Do not damage the halfshaft oil seal.

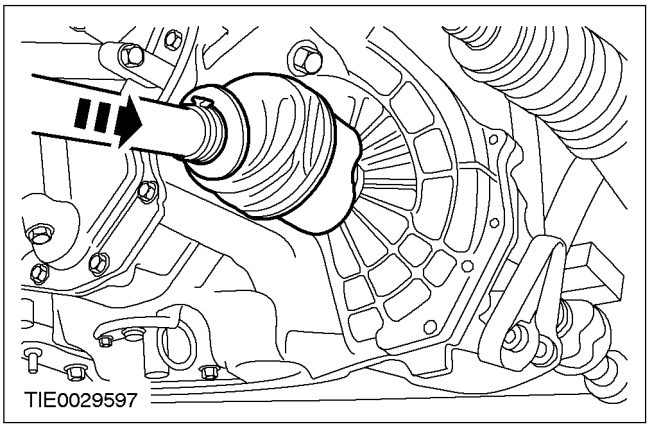
CAUTION: Make sure the snap ring is correctly seated.

CAUTION: Lubricate the O-ring seal with grease.

NOTE: Install a new O-ring seal.

NOTE: Install a new snap ring.

Attach the left-hand halfshaft to the transaxle.



24. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

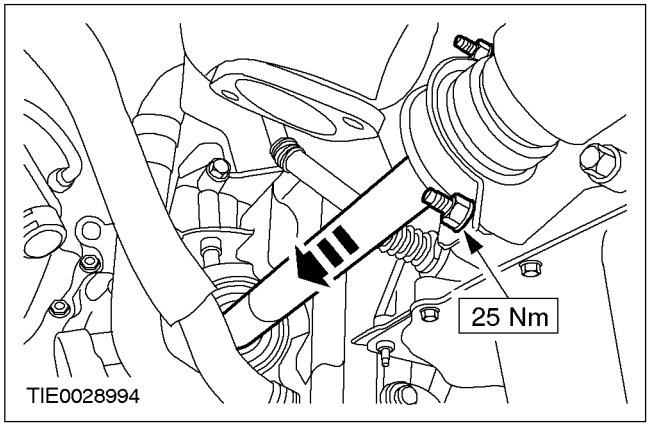
CAUTION: Do not damage the halfshaft oil seal.

CAUTION: Lubricate the O-ring seal with grease.

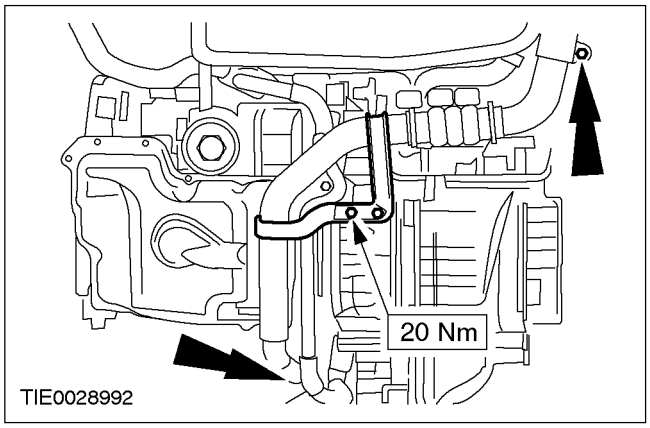
NOTE: Install a new O-ring seal.

NOTE: Install a new center bearing cap and new locknuts.

Attach the right-hand halfshaft and the intermediate shaft to the transaxle.



25. Install the charge air cooler intake hose.



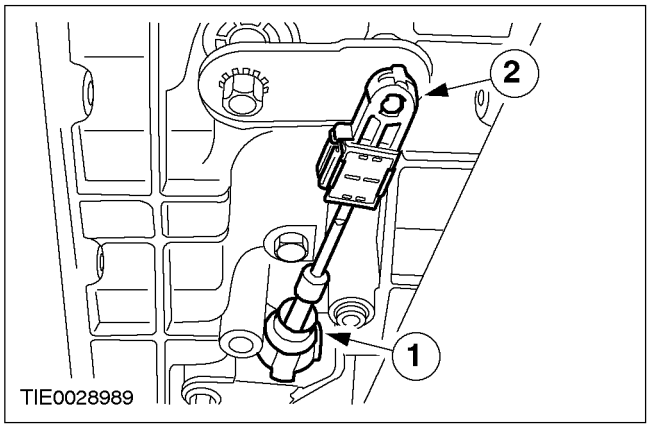
26. Install the subframe. For additional information, refer to Section 502-00.

INSTALLATION (Continued)

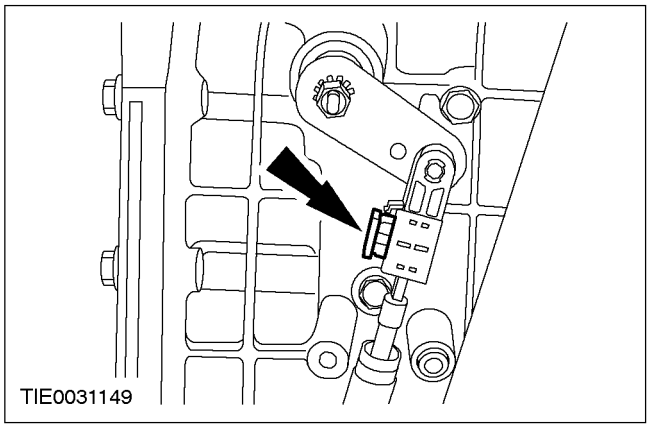
27. **NOTE:** Make sure the transaxle selector lever is in the "D" (DRIVE) position.

    Attach the selector lever cable to the selector shaft lever.

    1. Attach the selector lever cable to the selector lever cable bracket.
    2. Attach the selector lever cable to the selector shaft lever pin.

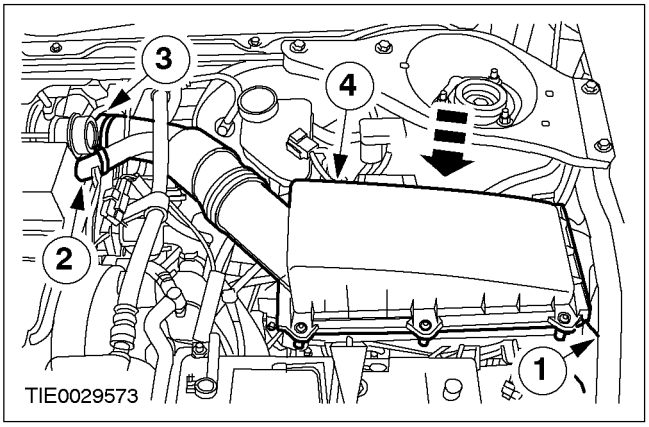


28. **Open the yellow locking clip on the select lever cable adjustment mechanism.**

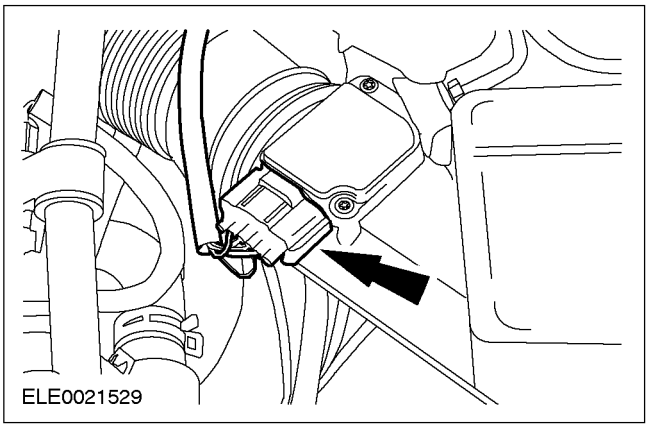


29. **Adjust the selector lever cable. For additional information, refer to Section 307-05A / 307-05B.**
30. **Lower the vehicle.**

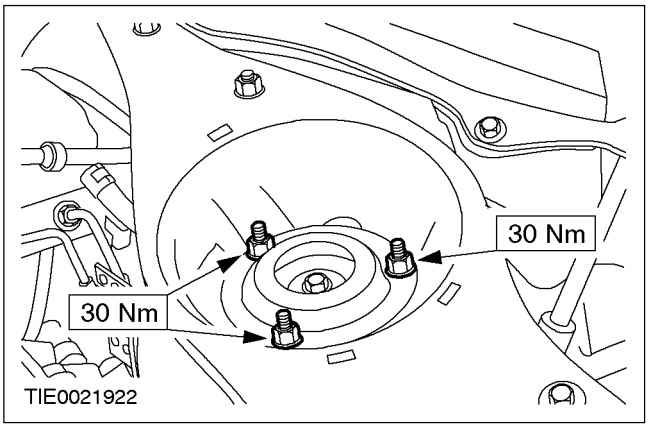
31. **Install the air cleaner.**
    1. Connect the air cleaner intake pipe.
    2. Connect the positive crankcase ventilation (PCV) hose.
    3. Connect the turbocharger air intake pipe.
    4. Connect the vacuum hose.



32. **Connect the mass air flow (MAF) sensor electrical connector.**

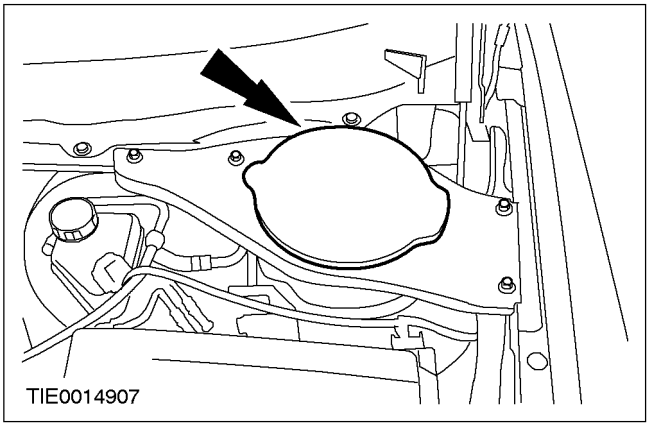


33. **Tighten the strut and spring assembly top mount nuts on both sides.**



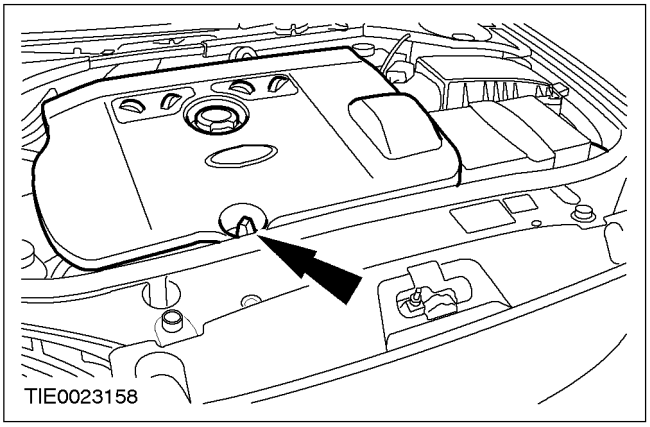
INSTALLATION (Continued)

34. Install the strut and spring assembly top mount brace cover on both sides.



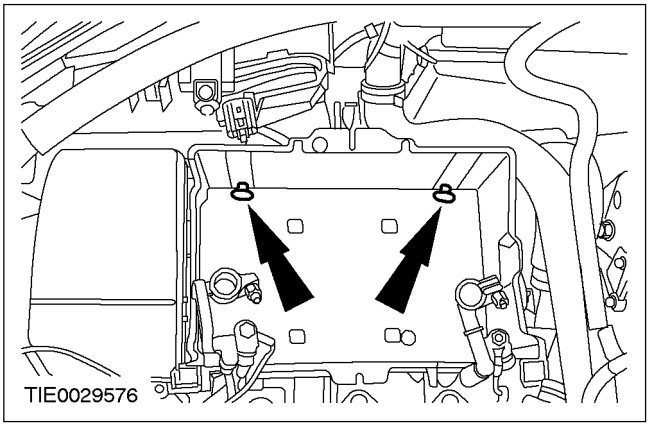
35. Install the engine upper cover.

- Install the oil level indicator.



36. Install the battery tray.

- Install the clips.



37. Install the battery. For additional information, refer to Section 414-01.

38. CAUTION: If a new transaxle is being installed, a new transmission fluid oil cooler and new transmission fluid cooler tubes must be installed.

Install a new transmission fluid cooler and new transmission fluid cooler tubes if necessary. For additional information, refer to Section 307-02A / 307-02B.

39. Fill the transaxle.

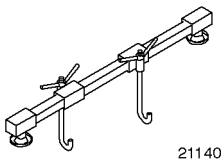
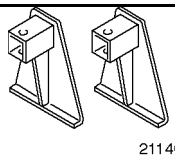
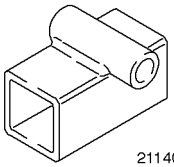
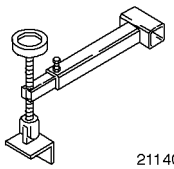
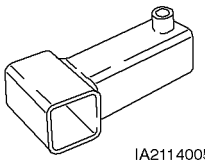
40. NOTE: Only carry out the following step when a new transaxle has been installed.

Using worldwide diagnostic system (WDS), reset the transmission control module (TCM).

41. Initialize the door window motors. For additional information, refer to Section 501-11.

INSTALLATION

Transaxle — 2.5L (17 214 0)

Special Tool(s)	
 21140	Support Bar, Engine 303-290A (21-140A)
 2114001	Adapter for 303-290A 303-290-01 (21-140-01)
 2114002	Adapter for 303-290A 303-290-02 (21-140-02)
 2114003	Adapter for 303-290A 303-290-03A (21-140-03A)
 IA2114005	Adapter for 303-290A 303-290-05A (21-140-05A)

General Equipment
Securing straps
Transmission jack
Steel straight edge

Name	Specification
Grease	WSD-M1C230-A

1. **CAUTION: The torque converter must remain at the correct installation depth throughout the whole installation procedure.**

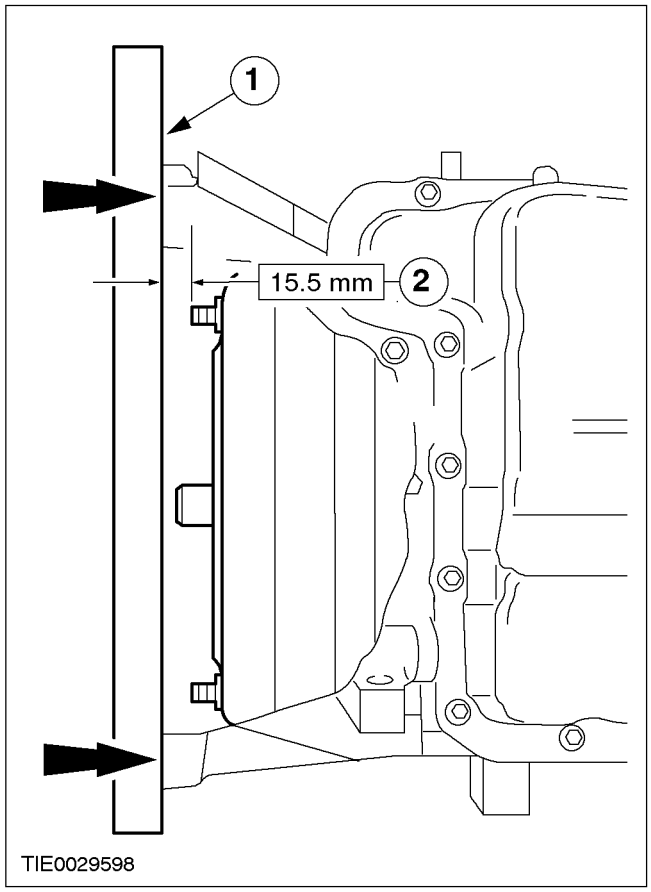
NOTE: The torque converter studs must be aligned with the engine drive plate holes before any transaxle bolts are installed.

Install the torque converter.

2. **CAUTION: The torque converter hub must engage fully in the oil pump drive gear.**

Check the installation depth of the torque converter.

1. Lay a steel straight edge across the automatic transaxle flange.
2. Check the installation depth between the steel straight edge and the drive plate stud.



INSTALLATION (Continued)

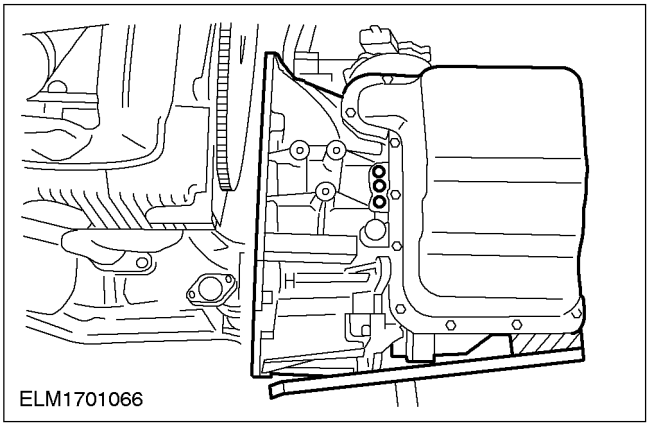
3. **CAUTION: The torque converter must remain at the correct installation depth throughout the entire installation procedure.**

NOTE: Secure the transaxle with securing straps.

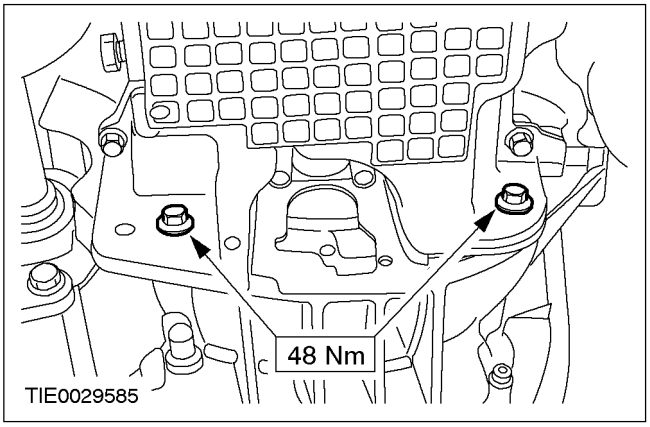
NOTE: Use a suitable wooden block to protect the transaxle.

NOTE: Make sure that the dowel pins are correctly installed in the engine flange.

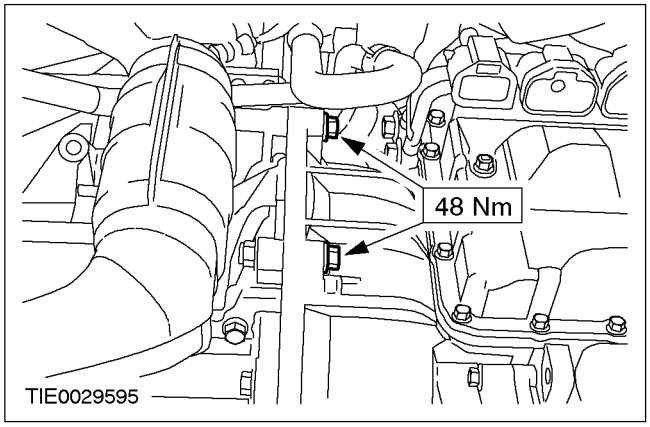
Using a suitable transmission jack, install the transaxle.



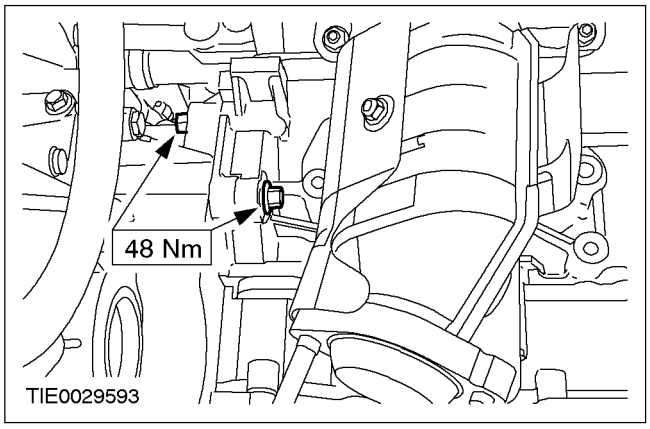
4. **Remove the securing straps.**
5. **Install the transaxle lower retaining bolts.**



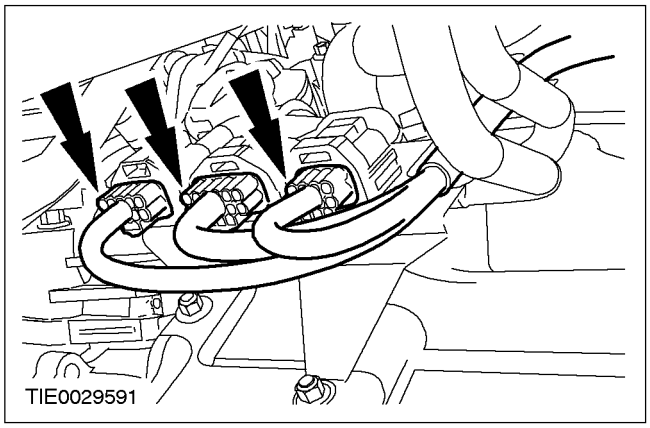
6. **Install the transaxle left-hand retaining bolts.**



7. **Install the transaxle right-hand retaining bolts.**



8. **Connect the transaxle electrical connectors.**

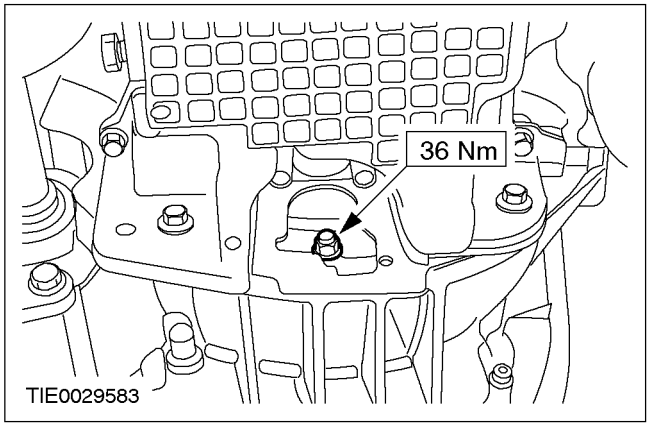


INSTALLATION (Continued)

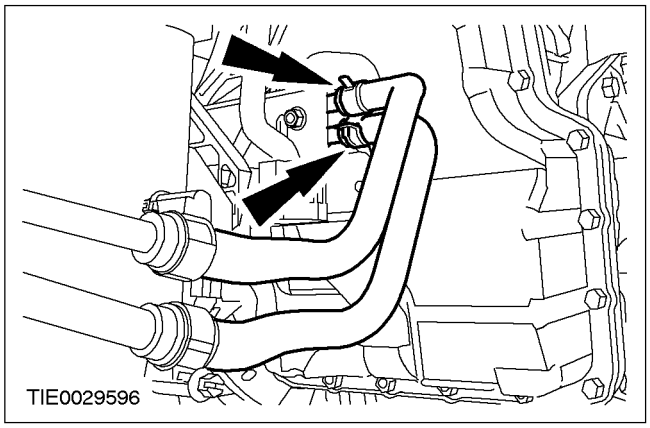
9. **NOTE:** Install new torque converter retaining nuts.

Install the torque converter retaining nuts.

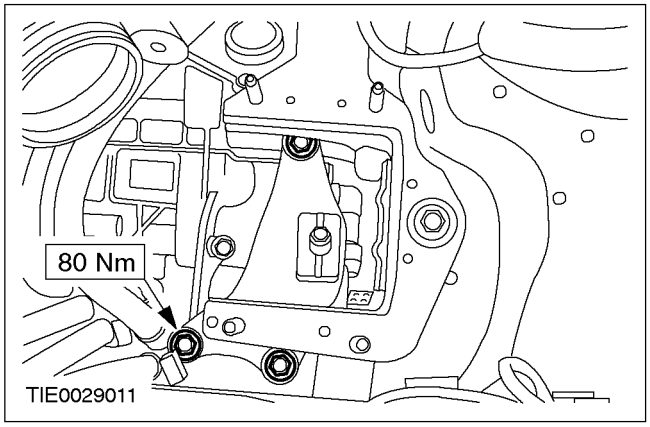
1. Rotate the engine to gain access to the nuts.
2. Install the cover.



10. **Connect the fluid cooler pipes to the transaxle.**

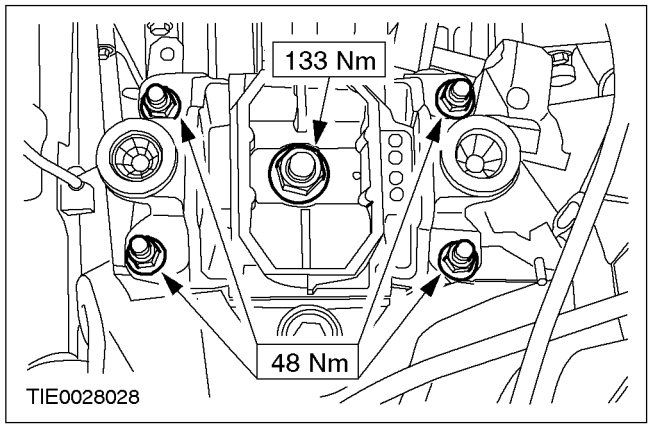


11. **Lower the vehicle.**
12. **Install the engine rear mount bracket.**

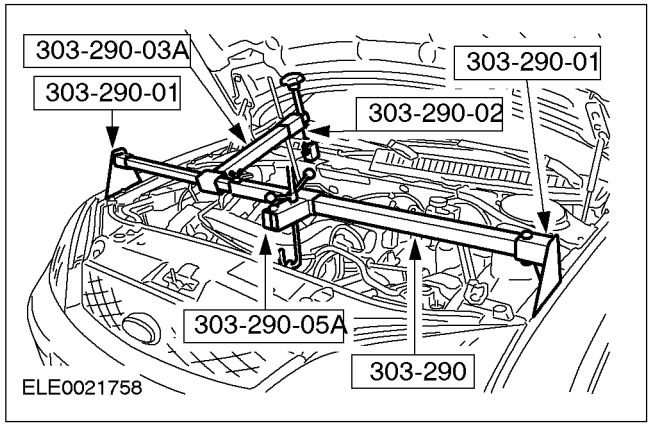


13. **NOTE:** Install a new engine rear mount center retaining nut.

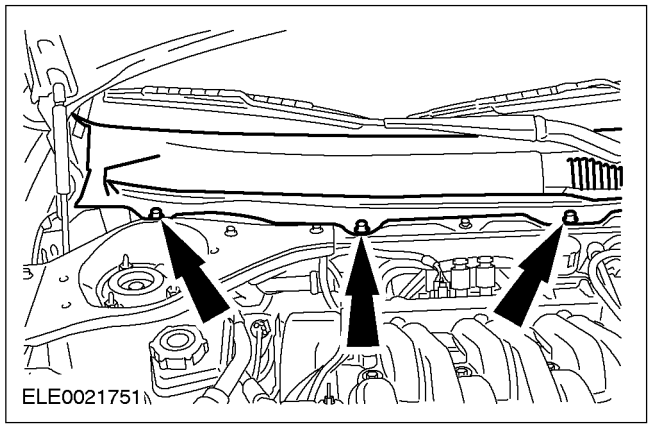
Install the engine rear mount.



14. **Remove the special tools.**

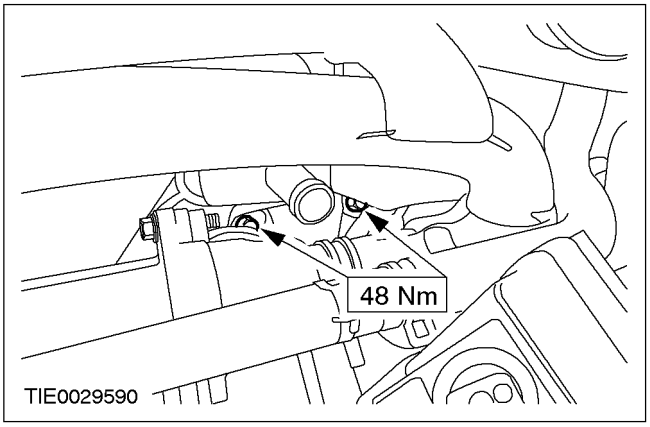


15. **Install the bulkhead cover.**

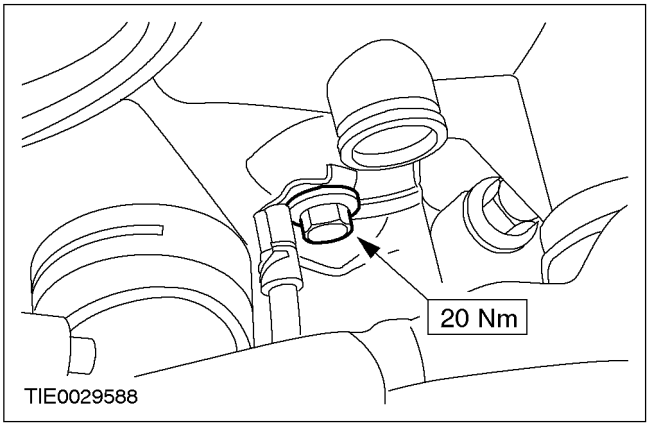


INSTALLATION (Continued)

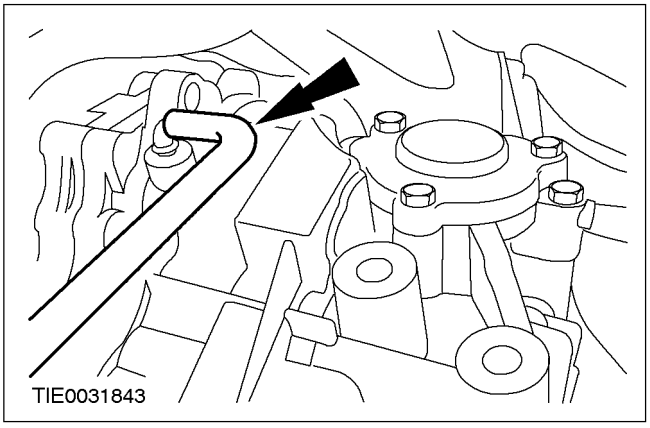
16. **Tighten the transaxle upper retaining bolts.**



17. **Attach the ground cable to the transaxle.**



18. **Connect the vent hose to the transaxle.**



19. **Raise and support the vehicle. For additional information, refer to Section 100-02.**

20. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

CAUTION: Do not damage the halfshaft oil seal.

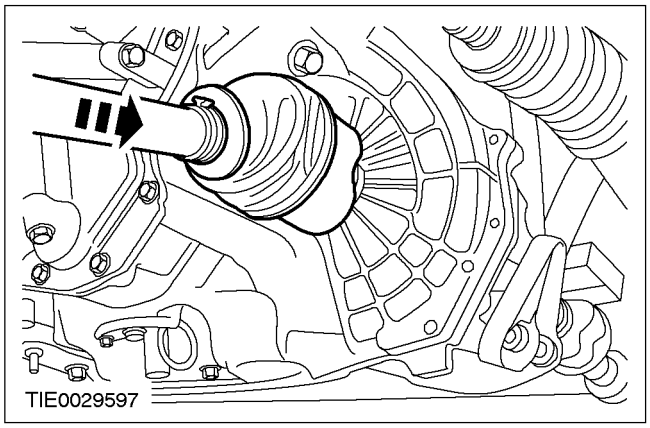
CAUTION: Make sure the snap ring is correctly seated.

CAUTION: Lubricate the O-ring seal with grease.

NOTE: Install a new O-ring seal.

NOTE: Install a new snap ring.

Attach the left-hand halfshaft to the transaxle.



INSTALLATION (Continued)

21. **CAUTION: Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

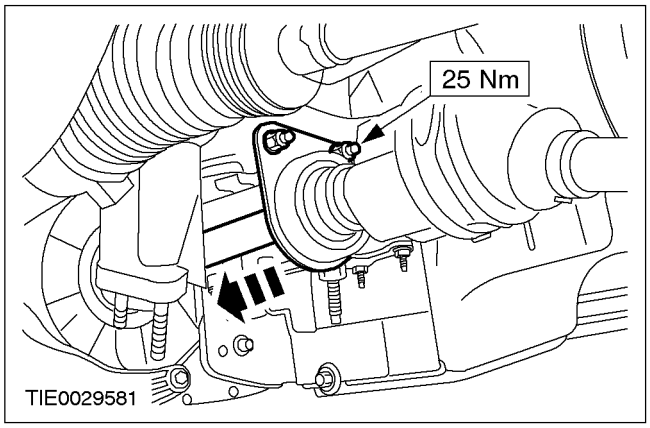
CAUTION: Do not damage the halfshaft oil seal.

CAUTION: Lubricate the O-ring seal with grease.

NOTE: Install a new O-ring seal.

NOTE: Install new locknuts.

Attach the right-hand front drive halfshaft and the intermediate shaft to the transaxle.

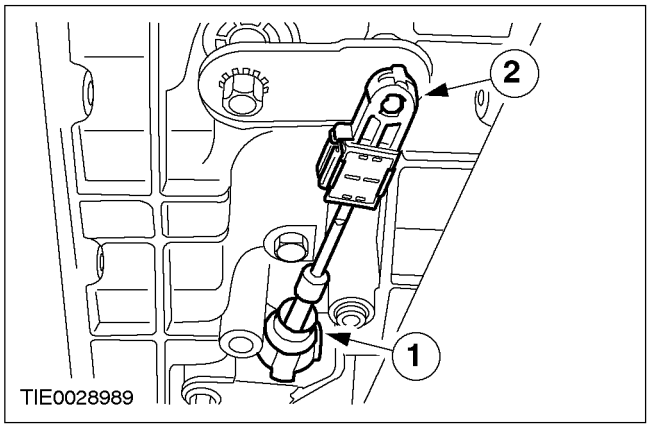


22. **Install the subframe. For additional information, refer to Section 502-00.**

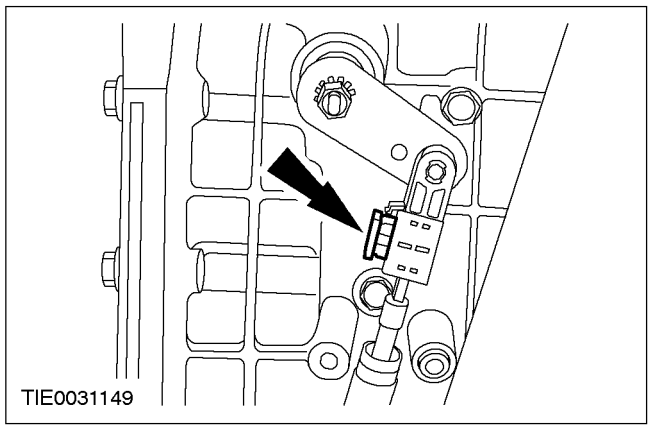
23. **NOTE:** Make sure the transaxle selector lever is in the "D" (DRIVE) position.

Connect the selector lever cable to the selector shaft lever.

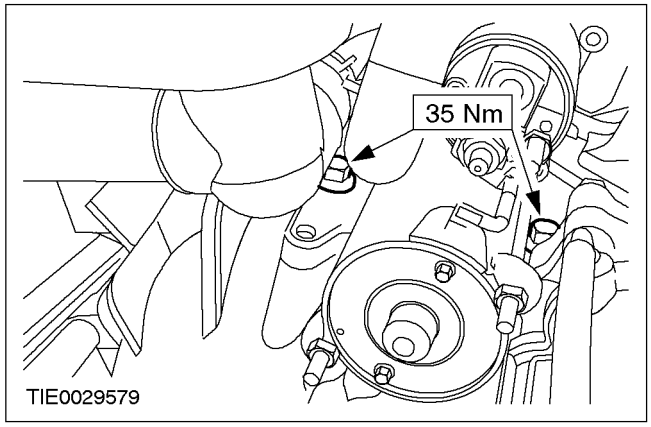
1. Attach the selector lever cable to the selector lever cable bracket.
2. Attach the selector lever cable to the selector shaft lever pin.



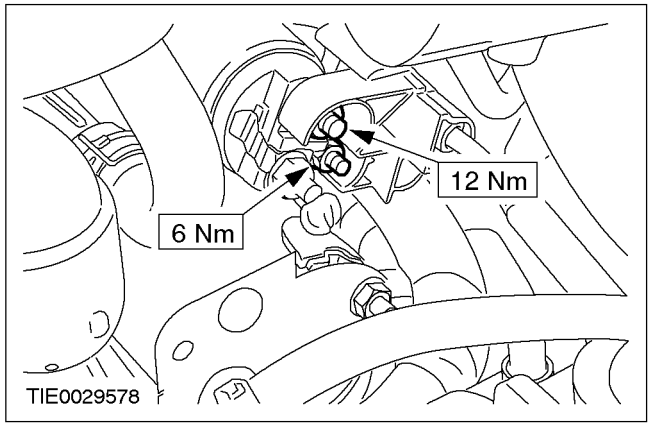
24. **Open the yellow locking clip on the selector lever cable adjustment mechanism.**



25. **Adjust the selector lever cable. For additional information, refer to Section 307-05A / 307-05B.**
26. **Lower the vehicle.**
27. **Install the starter motor.**



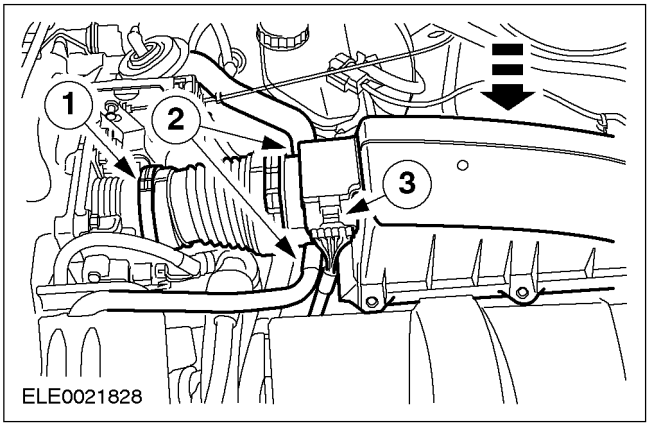
28. **Connect the starter motor electrical connectors.**



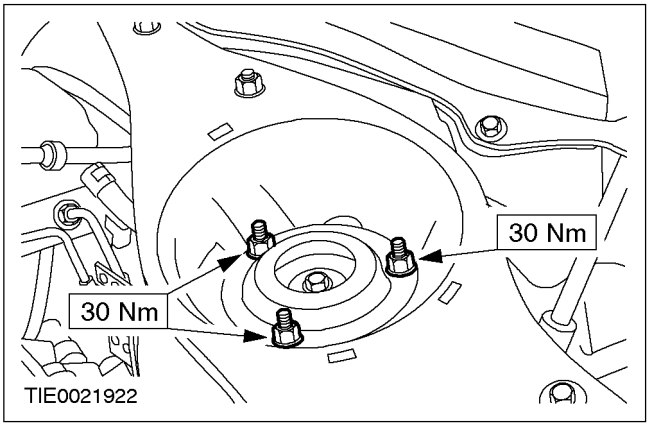
INSTALLATION (Continued)

29. Install the air cleaner.

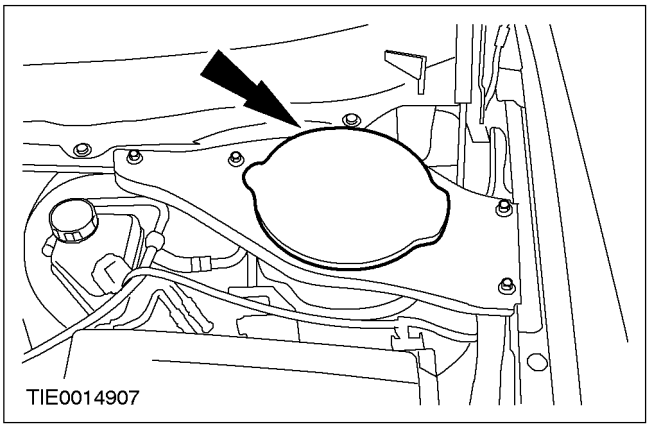
1. Connect the air cleaner intake hose.
2. Connect the positive crankcase ventilation (PCV) hoses.
3. Connect the mass air flow (MAF) sensor electrical connector.



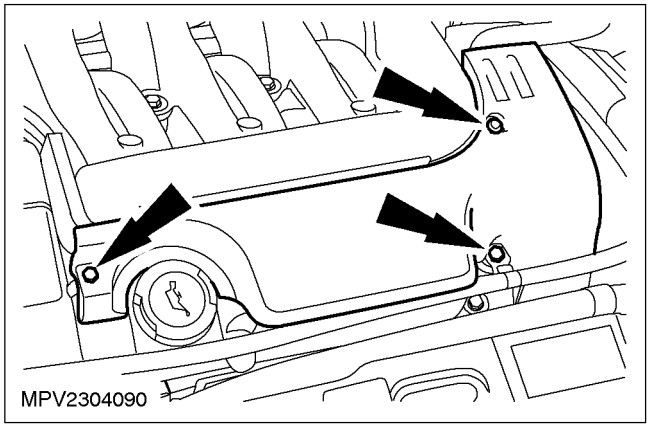
30. Tighten the strut and spring assembly top mount nuts on both sides.



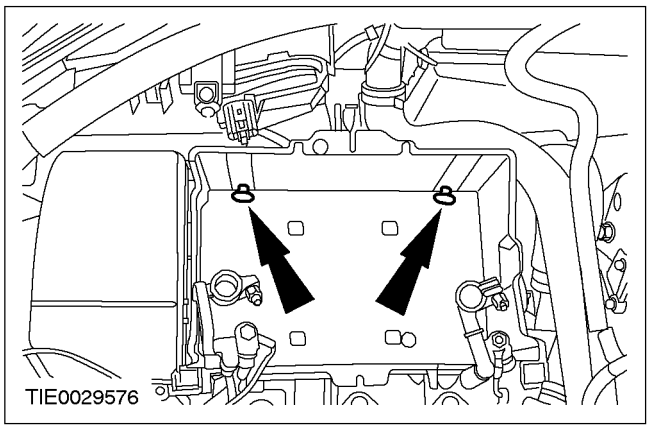
31. Install the strut and spring assembly top mount brace cover on both sides.



32. Install the engine upper cover.



33. Install the battery tray.



34. Install the battery. For additional information, refer to Section 414-01.

35. CAUTION: If a new transaxle is being installed, a new transmission fluid oil cooler and new transmission fluid cooler tubes must be installed.

Install a new transmission fluid cooler and new transmission fluid cooler tubes if necessary. For additional information, refer to Section 307-02A / 307-02B.

36. Fill the transaxle. For additional information, refer to Transmission Fluid Drain and Refill in this section.

37. NOTE: Only carry out the following step when a new transaxle has been installed.

Using worldwide diagnostic system (WDS), reset the transmission control module (TCM).

INSTALLATION (Continued)

38. **Initialize the door window motors. For additional information, refer to Section 501-11.**

SECTION 307-02A Transmission/Transaxle Cooling

VEHICLE APPLICATION: 2003.0 Mondeo

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DESCRIPTION AND OPERATION

Transaxle Cooling..... 307-02-3

REMOVAL AND INSTALLATION

Transmission Fluid Cooler ..... (17 834 0) 307-02-4
Transmission Fluid Cooler Tubes ..... (17 857 0) 307-02-6

SPECIFICATIONS

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Automatic transmission fluid	ESP-M2C166-H

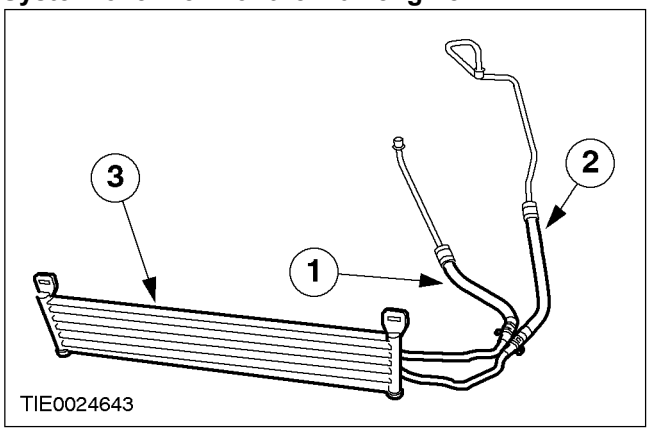
Torque Specifications

Description	Nm	lb-ft	lb-in
Feed and return tube – automatic transmission fluid cooler	23	17	–

DESCRIPTION AND OPERATION

Transaxle Cooling

System overview for the 2.0L engine



Item	Part Number	Description
1	-	Feed line
2	-	Return line
3	-	Transmission fluid cooler

The transmission fluid cooler is located in front of the engine coolant radiator and is fitted by means of two bolts.

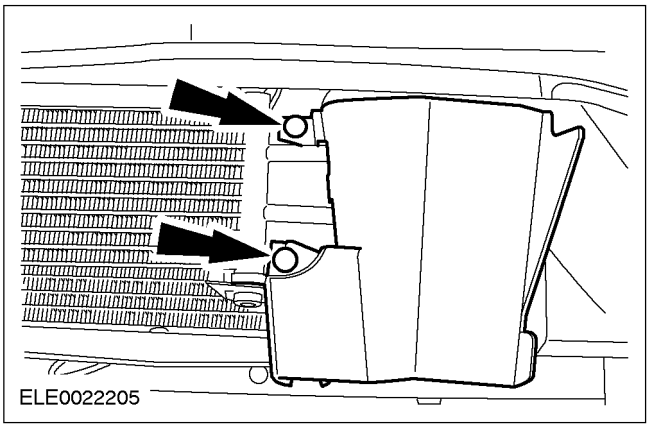
REMOVAL AND INSTALLATION

Transmission Fluid Cooler (17 834 0)

Name	Specification
Automatic transmission fluid	ESP-M2C166-H

Removal

1. **Remove the front bumper. For additional information, refer to Section 501-19.**
2. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
3. **Remove the clips and the left-hand cover.**


ELE0022205

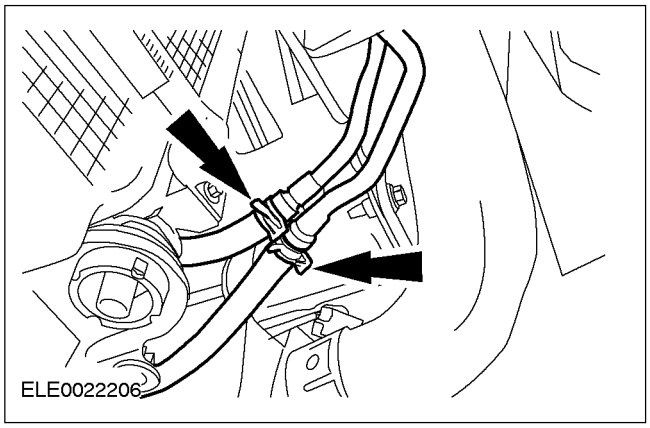
4. **WARNING: Whenever releasing the transaxle cooling system fluid, take care to prevent fluid scalding. Failure to follow these instructions may result in personal injury.**

CAUTION: Plug the fluid cooler tubes to prevent fluid loss or dirt ingress.

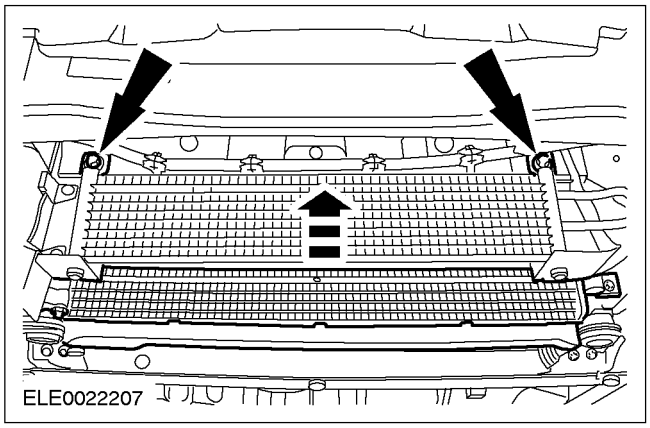
NOTE: Mark the position of the feed and return hose.

NOTE: Collect escaping fluid using a drain pan.

Disconnect the feed and return hose from the transmission fluid cooler.


ELE0022206

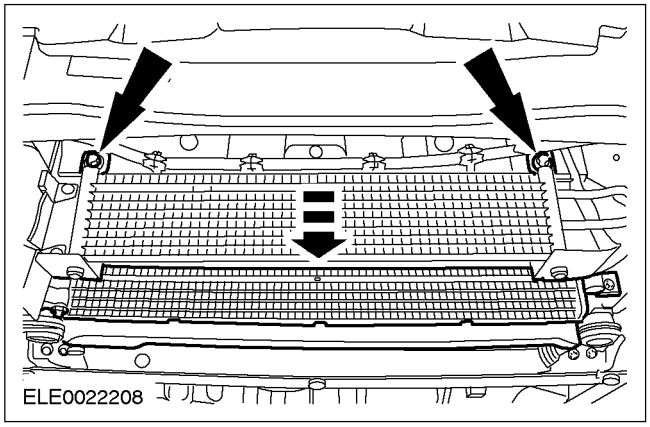
5. **Remove the transmission fluid cooler.**
   - Lift the cooler off the bracket.


ELE0022207

REMOVAL AND INSTALLATION (Continued)

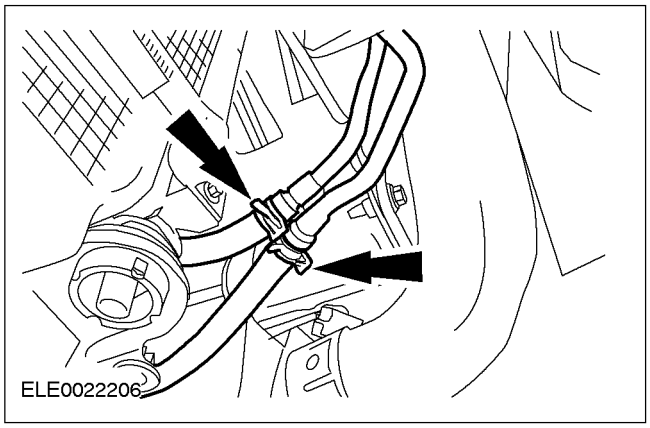
Installation

1. **Install the transmission fluid cooler.**
   - Push the cooler into the bracket holes.

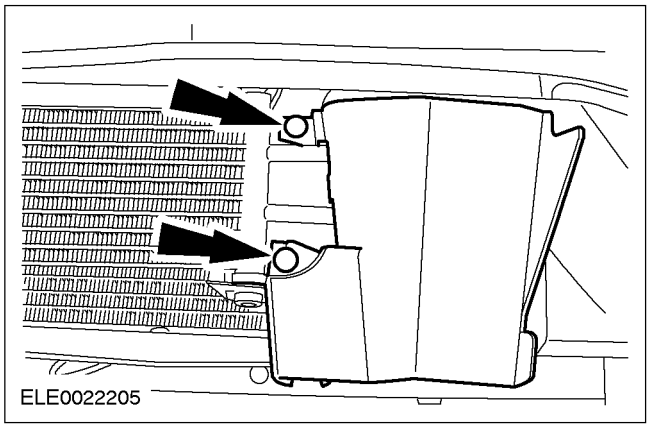


2. **NOTE:** Position marks.

   Connect the feed and the return hose to the transmission fluid cooler.



3. **Install the clips and the left-hand cover.**



4. **Lower the vehicle.**
5. **Install the front bumper. For additional information, refer to Section 501-19.**
6. **Check the transmission fluid level. For additional information, refer to Section 307-01A / 307-01B.**

REMOVAL AND INSTALLATION

Transmission Fluid Cooler Tubes (17 857 0)

Name	Specification
Automatic transmission fluid	ESP-M2C166-H

Removal

1. **WARNING: Whenever releasing the transaxle cooling system fluid, take care to prevent fluid scalding. Failure to follow these instructions may result in personal injury.**

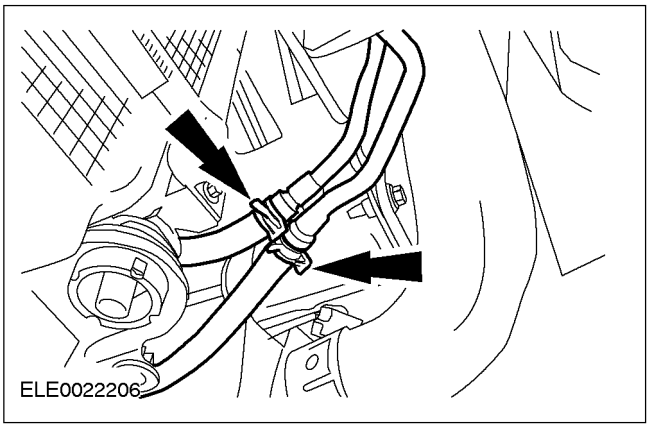
NOTE: Plug the fluid cooler tubes to prevent fluid loss and dirt ingress.

Raise and support the vehicle. For additional information, refer to Section 100-02.

2. **NOTE:** Mark the positions of the feed and return hose.

NOTE: Collect escaping fluid in a drain pan.

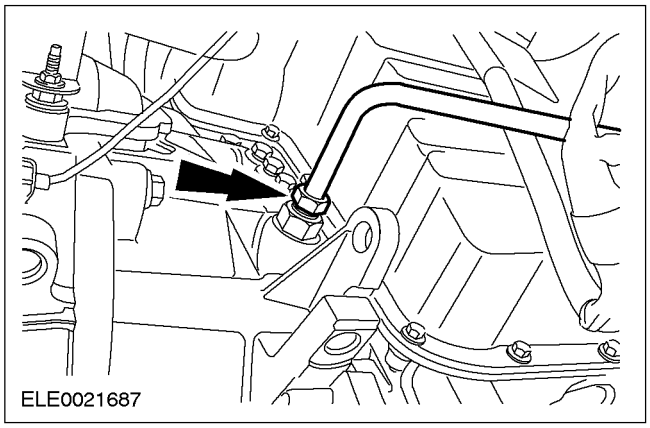
Disconnect the feed and return hose from the transmission fluid cooler.



3. **CAUTION: Prevent the fluid pipe adapter from turning using an open end spanner, do not remove it from the transaxle housing.**

Detach the fluid cooler return pipe from the transaxle.

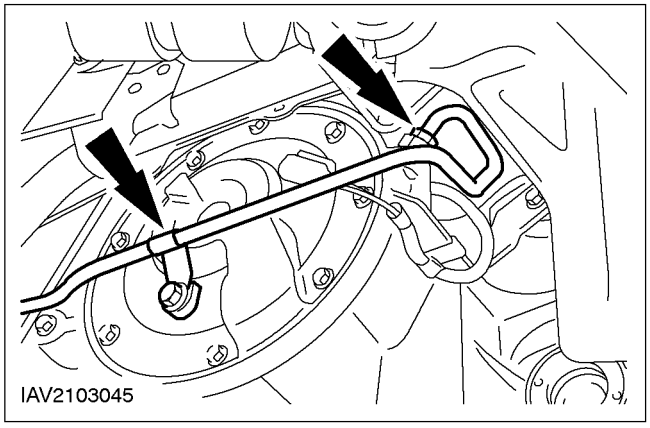
- Close off the openings using suitable plugs.



4. **CAUTION: Prevent the fluid pipe adapter from turning using an open end spanner, do not remove it from the transaxle housing.**

Detach the fluid cooler pipe from the transaxle.

- Detach the fluid pipe bracket from the transaxle.
- Close off the openings using suitable plugs.



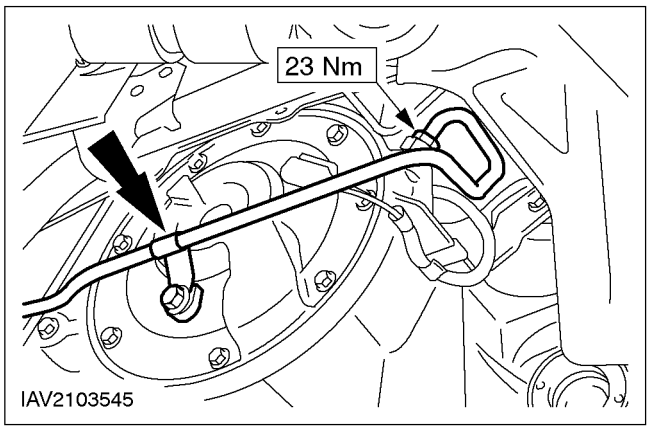
REMOVAL AND INSTALLATION (Continued)

Installation

1. **CAUTION: Prevent the fluid pipe adapter from turning using an open end spanner, do not remove it from the transaxle housing.**

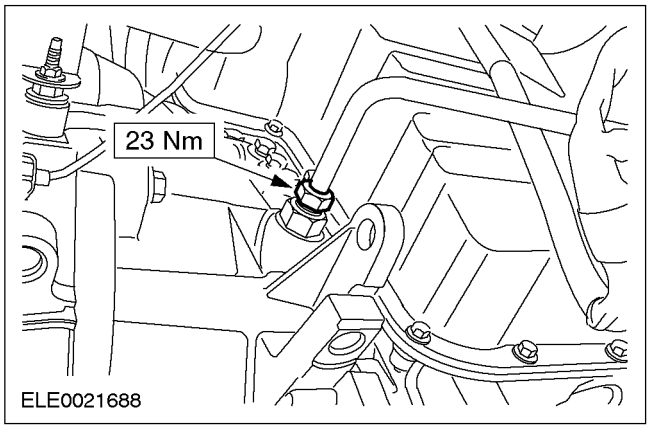
   Attach the fluid cooler pipe to the transaxle.

   - Attach the fluid pipe bracket to the transaxle.



2. **CAUTION: Prevent the fluid pipe adapter from turning using an open end spanner, do not remove it from the transaxle housing.**

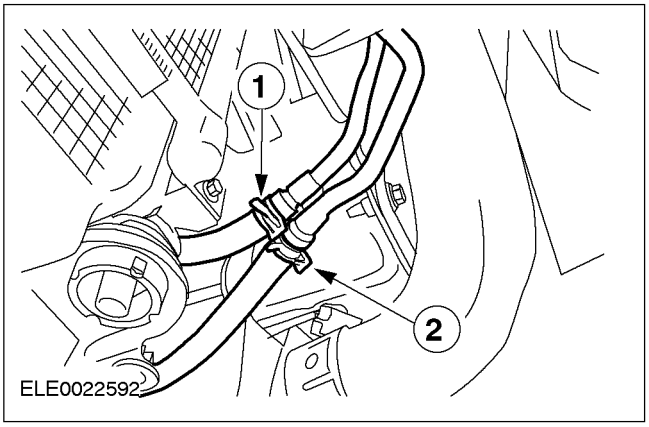
   Attach the fluid cooler return pipe to the transaxle.



3. **NOTE:** Position marks.

   Connect the feed and return hose to the transaxle.

   1. Connect the feed tube.
   2. Connect the return tube.



4. **Lower the vehicle.**
5. **Check the transmission fluid level. For additional information, refer to Section 307-01A / 307-01B.**

SECTION 307-02B Transmission/Transaxle Cooling

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS **PAGE**

SPECIFICATIONS

Specifications 307-02-2

REMOVAL AND INSTALLATION

Transmission Fluid Cooler — 2.5L..... (17 834 0) 307-02-3

SPECIFICATIONS

Lubricants, Fluids, Sealers and Adhesives

	Specifications
Automatic transmission fluid	WSS-M2C922-A1

Torque Specifications

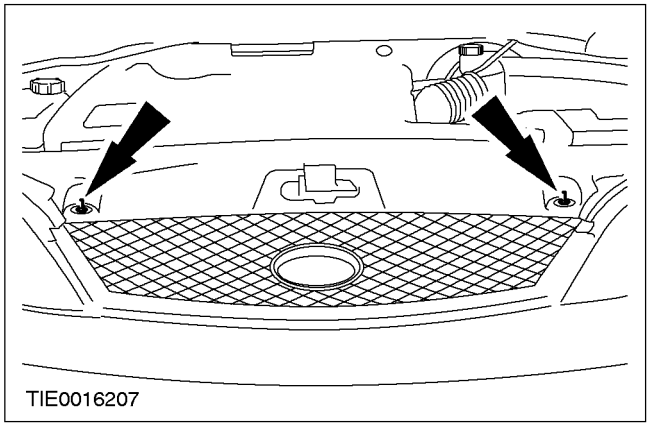
Item	Nm	lb-ft	lb-in
Transmission fluid cooler	10	-	89

REMOVAL AND INSTALLATION

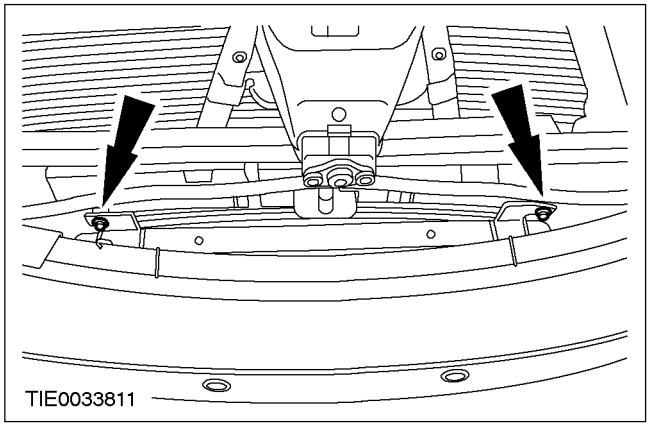
Transmission Fluid Cooler — 2.5L (17 834 0)

Removal

1. Remove the radiator grille.

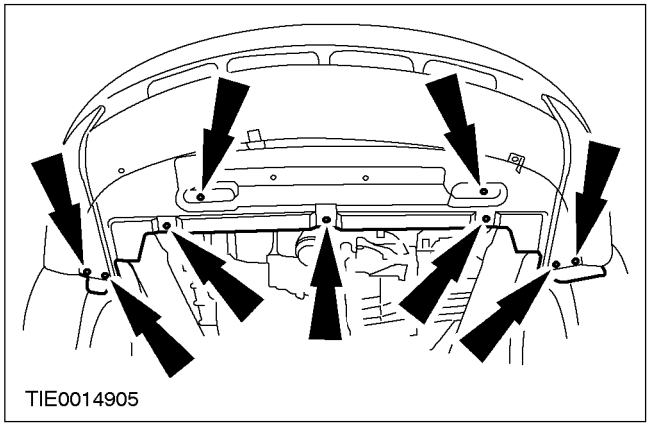


2. Remove the transmission fluid cooler retaining bolts.

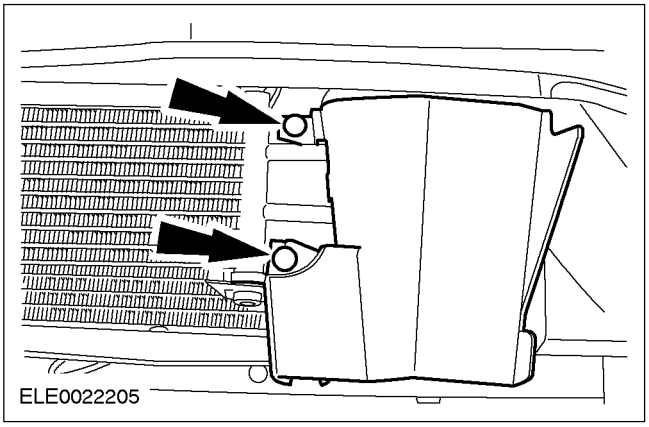


3. Raise and support the vehicle. For additional information, refer to Section 100-02.

4. Remove the radiator undershield.



5. Remove the left-hand duct (front bumper cover shown removed for clarity).



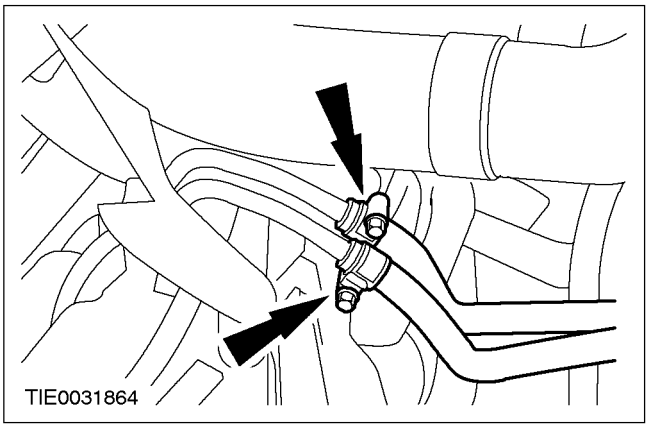
6. WARNING: Whenever releasing the transaxle cooling system fluid, take care to prevent fluid scalding. Failure to follow these instructions may result in personal injury.

CAUTION: Plug the fluid cooler tubes to prevent fluid loss or dirt ingress.

NOTE: Mark the position of the feed and return hose.

Disconnect the feed and return hose from the transmission fluid cooler.

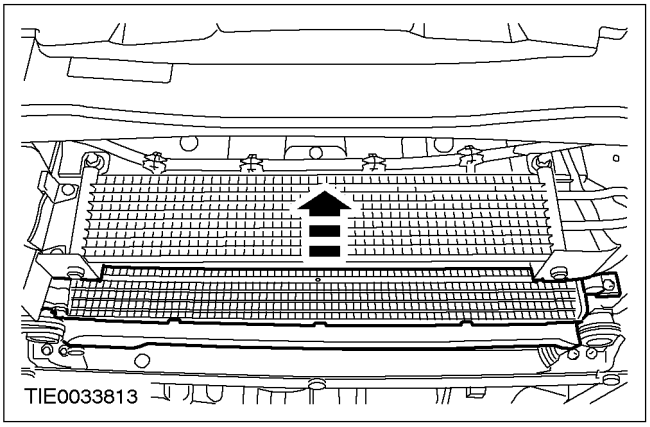
- Allow the fluid to drain into a suitable container.



REMOVAL AND INSTALLATION (Continued)

7. Remove the transmission fluid cooler.

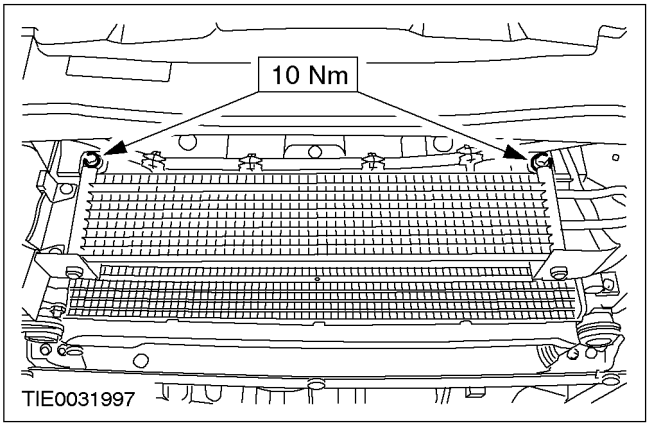
- Lift the transmission fluid cooler off the bracket.



Installation

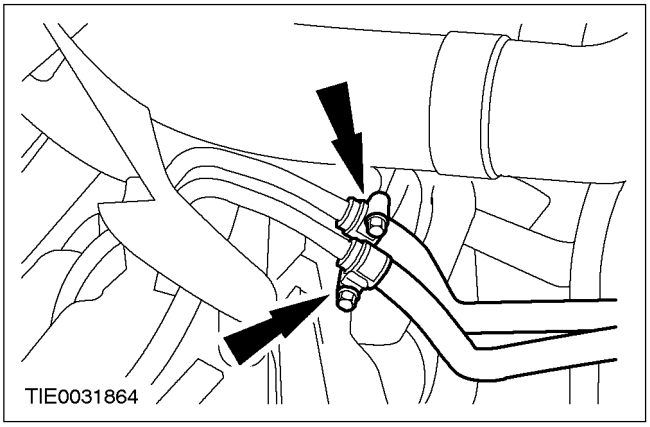
1. Install the transmission fluid cooler.

- Push the transmission fluid cooler into the bracket holes.

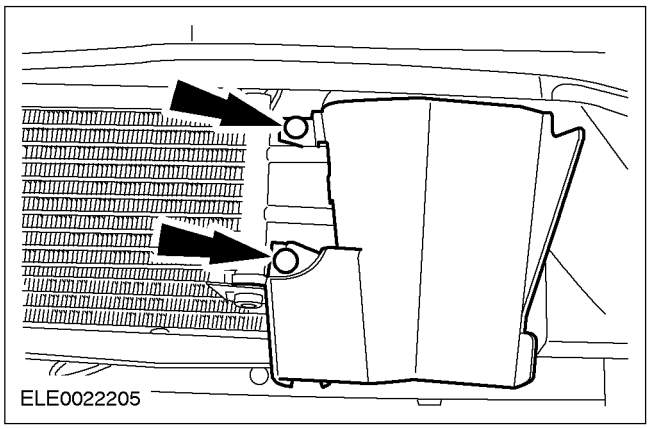


2. NOTE: Position marks.

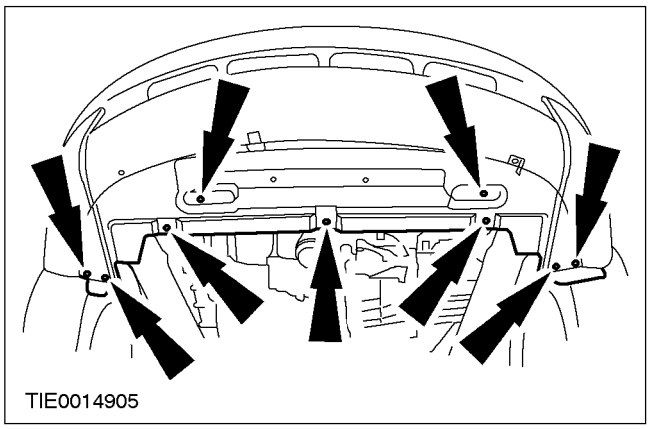
Connect the feed and the return hose to the transmission fluid cooler.



3. Install the left-hand duct (front bumper cover shown removed for clarity).

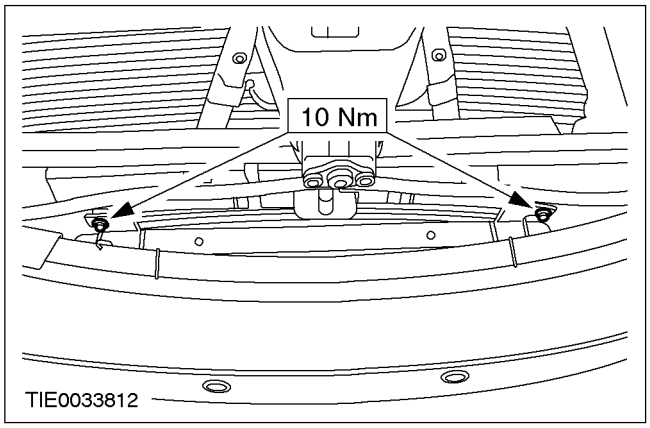


4. Install the radiator undershield.



5. Lower the vehicle.

6. Install the transmission fluid cooler retaining bolts.



REMOVAL AND INSTALLATION (Continued)

7. **CAUTION: If a new transmission fluid cooler has been installed, make sure that the active bypass valve was open, before checking the transmission fluid level. The active bypass valve opens at a temperature above 77 °C.**

   Check the transmission fluid level. For additional information, refer to Section 307-01A / 307-01B.

SECTION 307-05A Automatic Transmission/Transaxle External Controls

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

Specifications 307-05-2

DESCRIPTION AND OPERATION

External Controls 307-05-3
Selector lever 307-05-3
Selector lever lock 307-05-3
Overdrive inhibitor button 307-05-3
Selector lever lock button 307-05-4

DIAGNOSIS AND TESTING

External Controls 307-05-5

GENERAL PROCEDURES

Selector Lever Cable Adjustment 307-05-6

REMOVAL AND INSTALLATION

Selector Lever Cable 307-05-8
Transmission Selector Lever 307-05-14

DISASSEMBLY AND ASSEMBLY

Selector Lever 307-05-16

SPECIFICATIONS

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Grease	SM-1C1021-A

Torque Specifications

Description	Nm	lb-ft	lb-in
Selector lever knob bolt	1	–	9
Selector lever cable grommet	9	–	80
Selector lever assembly	9	–	80

DESCRIPTION AND OPERATION

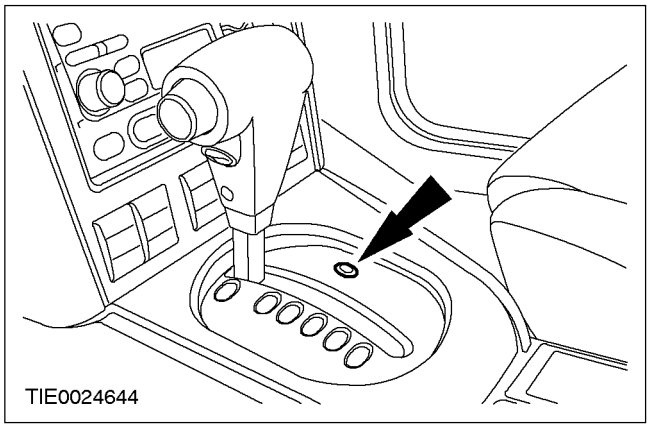
External Controls

The selector cable assembly must be renewed as a complete unit.

Selector lever

Position	Description	
P	PARK	**WARNING: Only engage when the vehicle is stationary. PARK should be engaged during repairs on a running engine. The selector lever can only be moved out of the "P" position if the ignition key is in position II and the footbrake is depressed. In an emergency (discharged battery) it can also be released manually - see selector lever lock.** For securing the vehicle. The engine can be started.
R	REVERSE	Only engage when the vehicle is stationary and the engine is idling.
N	NEUTRAL	The engine can be started - no power transfer to the drive wheels.
D	First to fourth gear (with overdrive)	Normal driving position. All four gears are shifted electronically. Driving with and without overdrive - see overdrive inhibitor button.
D	First to third gear (without overdrive)	Normal driving position, but no fourth gear. Driving with and without overdrive - see overdrive inhibitor button.
2	Second gear	The transmission stays in second gear.
1	First gear	The transmission stays in first gear.

Selector lever lock

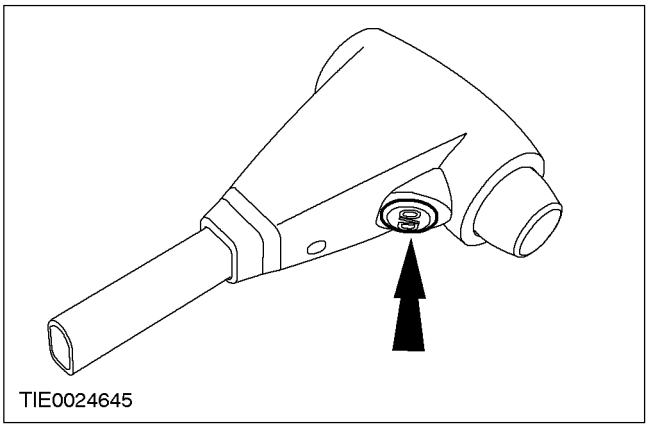


NOTE: Returning the selector lever to "P" immobilizes the selector lever again.

It is possible to release the selector lever immobiliser mechanically from position "P" if for example the battery is drained or disconnected.

1. Remove the cover.
2. Using the ignition key, depress the release lever.
3. Shift the selector lever out of position "P".

Overdrive inhibitor button



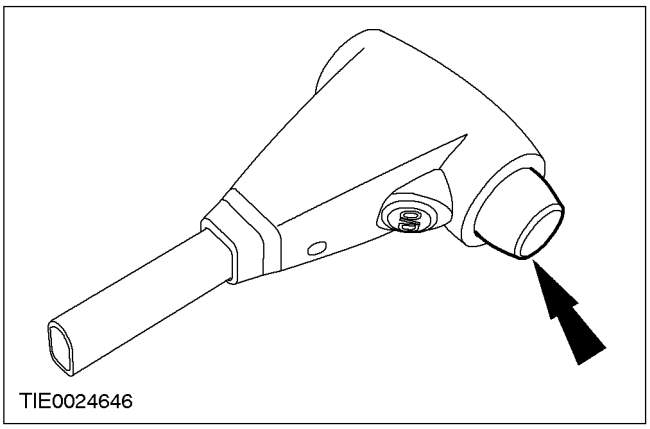
The overdrive function (suppression of gearshifts into fourth gear) can be switched on or off by the inhibitor button on the selector lever knob. The corresponding indicator lamp in the instrument

DESCRIPTION AND OPERATION (Continued)

panel lights up showing that the overdrive function is switched off.

To activate the overdrive function, press the button and the lamp will extinguish.

Selector lever lock button



To move the selector lever out of "P"

- Set ignition switch to position II
- Apply the foot brake
- Depress the lock button on the selector lever and shift the lever out of "P".

The lock button needs to be depressed when shifting from "R" to "P", from "N" to "R" and from "D" to "2".

DIAGNOSIS AND TESTING

External Controls

Since troubleshooting starts as soon as the vehicle is taken in for repair, the following procedure is recommended:

1. Check customer concern is clear. If necessary, reproduce the concern on the vehicle.
2. If the concern cannot be reconstructed, perform a test drive and/or carry out a visual check with the aid of the following table:

Visual Inspection Chart

Mechanical
– Visibly damaged or worn parts.
– Loose or missing screws or nuts.

Visual Inspection Chart

Electrical
– Check connections for seating and corrosion.
– Battery not connected.

3. If the concern can be clearly identified during a visual check, rectify the concern and test the proper operation of the system.
4. If it cannot be clearly determined, use the symptom chart below to locate the source of the concern.

⚠ WARNING: Danger of an accident. Apply the parking brake. Shift the automatic transmission to position "P".

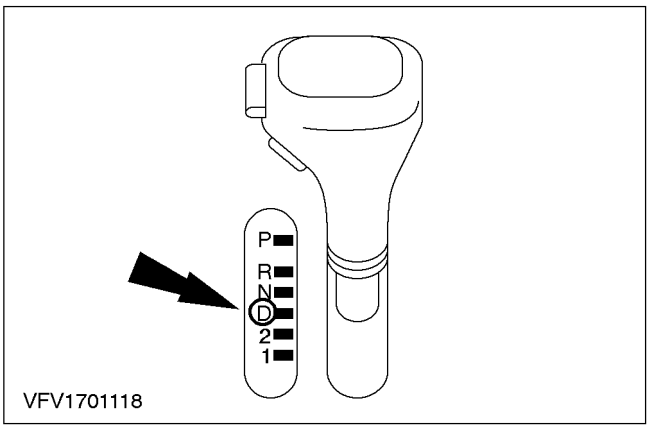
Condition	Possible Sources	Action
•Selector lever lock perminently locked.	•Selector lever lock cannot be operated. – Battery flat. – Steering column lock/ignition switch not in position "II" and foot brake not depressed. – Fuse F24 in the central junction box (CJB) faulty. – Fuse F23 in the CJB faulty. – Instrument interface module - no power supply.	•Check the relevant electric components and circuits by means of circuit diagrams.
	•Solenoid (on the selector lever) not functioning.	•Check the relevant electric components and circuits by means of circuit diagrams.
•Selector lever lock not functioning.	•Selector cable adjusted incorrectly.	•Adjust the selector cable (see relevant subsection).
	•Mechanical damage to the selector lever.	•Repair the selector cable (see relevant subsection).
•Selector lever position display does not line up with the gear that is engaged.	•Faulty adjustment of the selector cable.	•Adjust the selector cable (see relevant subsection).
	•The selector lever assembly is not in alignment with the cover.	•Release the selector lever assembly from the floor assembly and adjust.
•The selector lever cannot be shifted into position "P" or "1".	•Incorrect adjustment of the selector cable.	•Adjust the selector cable (see relevant subsection).
	•Mechanical fault on the selector lever	•Remove the selector lever and repair.

GENERAL PROCEDURES

Selector Lever Cable Adjustment

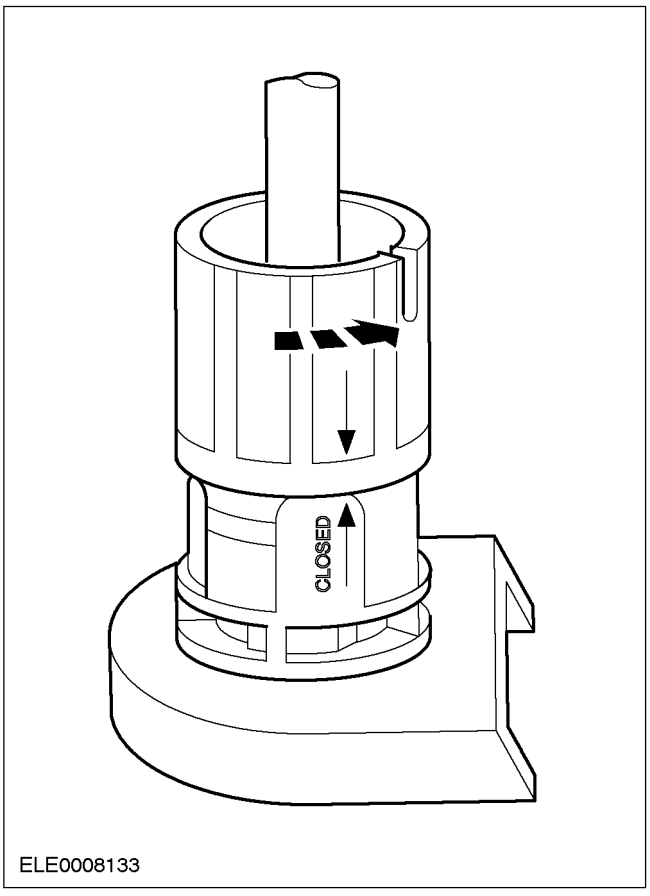
Adjustment

1. Shift selector lever to position ""D".



2. NOTE: Make sure the selector lever cable outer sleeve is free for moving after unlocking.

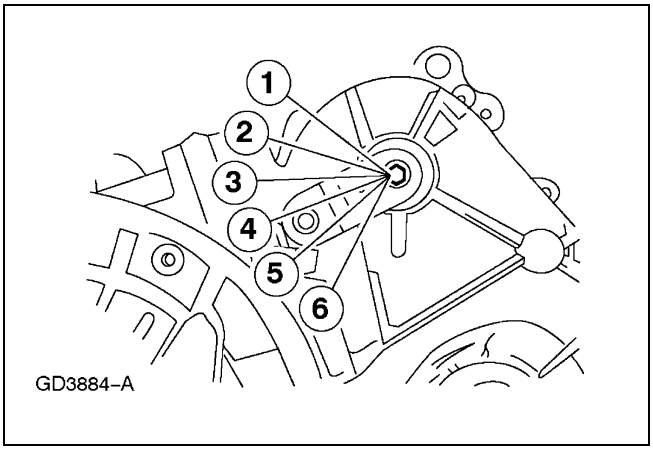
Open the selector lever cable locking mechanism (turn counterclockwise).



3. Raise and support the vehicle. For additional information, refer to Section 100-02.

4. Rotate the manual valve detent lever assembly to the ""D" position.

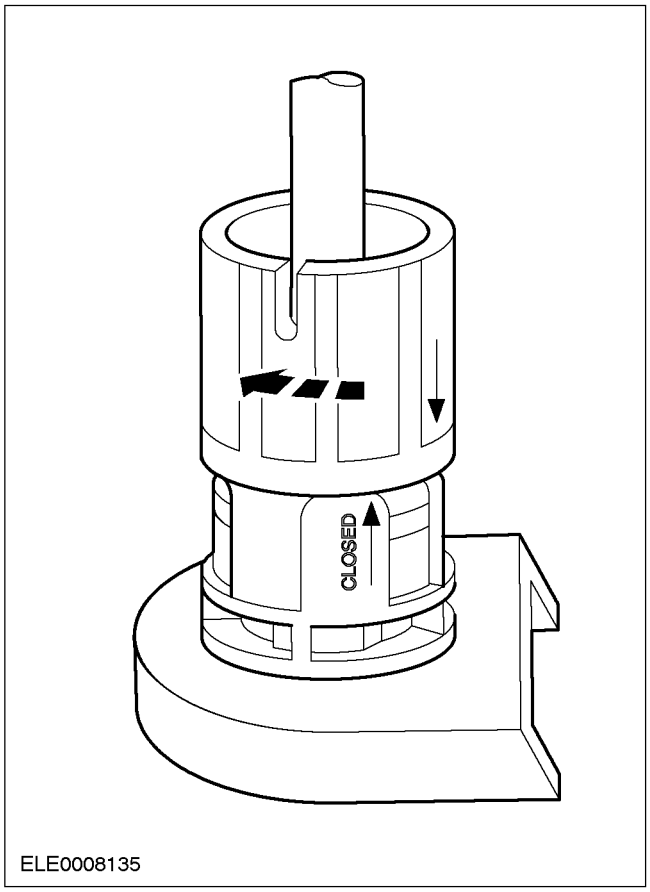
1. Low 1
2. Low 2
3. Drive
4. Neutral
5. Reverse
6. Park



5. Lower the vehicle.

GENERAL PROCEDURES (Continued)

6. **Close the selector lever cable outer sleeve by turning the locking mechanism clockwise.**



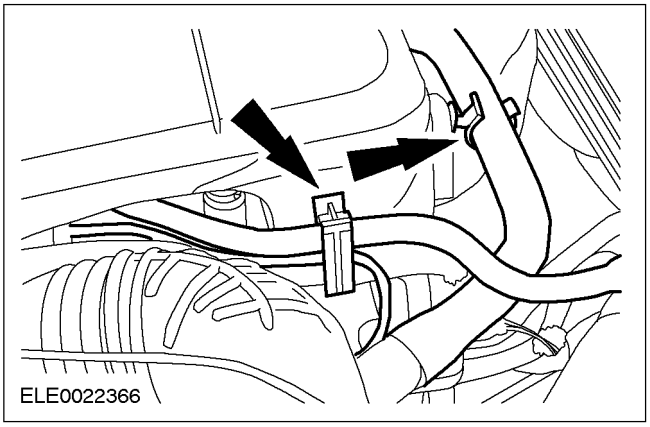
7. **Check the selector lever cable adjustment.**

REMOVAL AND INSTALLATION

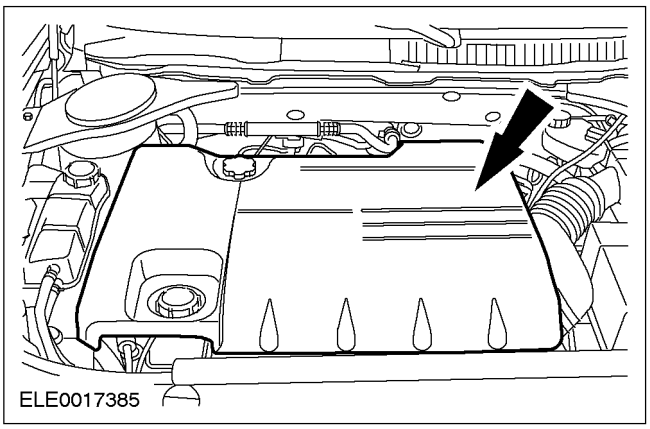
Selector Lever Cable

Removal

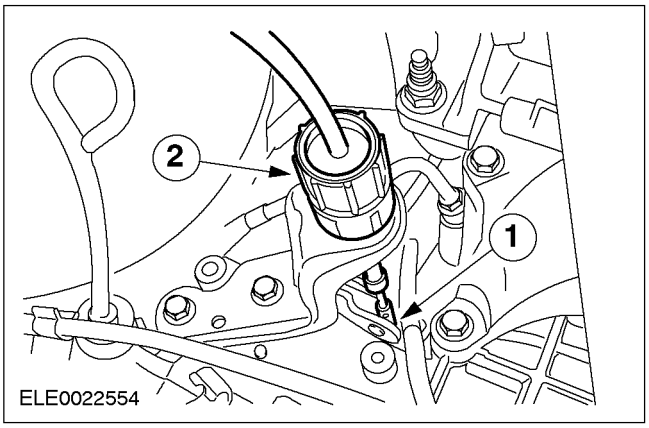
1. **Detach the positive crankcase ventilation (PCV) hose and the vacuum hose from the engine upper cover.**



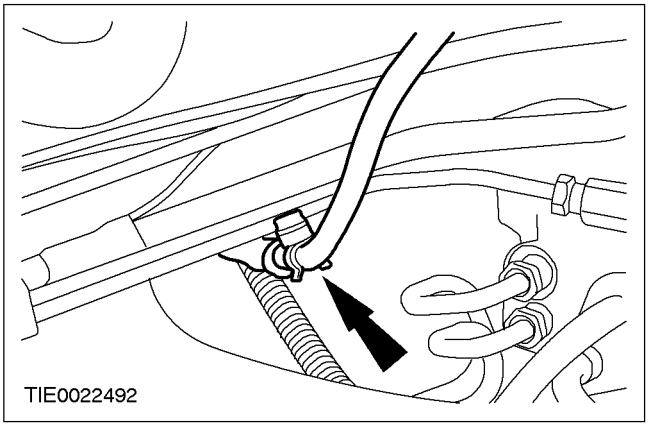
2. **Remove the engine upper cover.**



3. **Detach the selector lever cable from the transaxle.**
   1. Detach the selector lever cable.
   2. Remove the selector lever cable from the bracket.



4. **Unclip the selector lever cable from the brake pipe.**

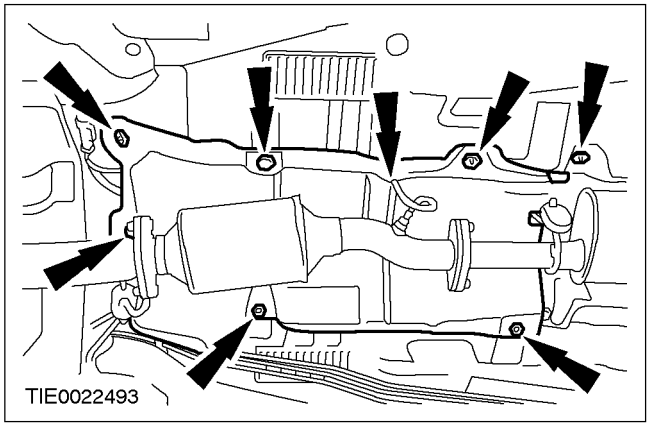


5. **Raise and support the vehicle. For additional information, refer to Section 100-02.**

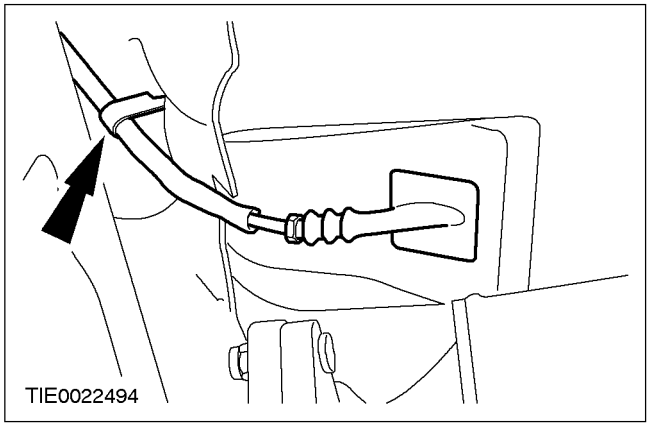
REMOVAL AND INSTALLATION (Continued)

6. Remove the catalytic converter heat shield.

- Detach the catalyst monitor sensor wiring harness.



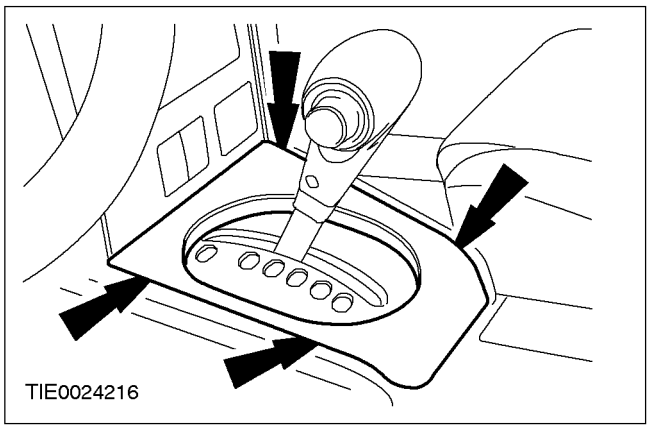
7. Detach the selector lever cable from the bracket.



8. Lower the vehicle.

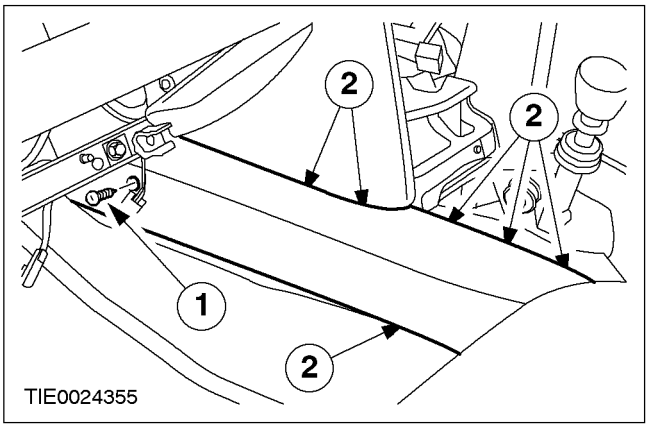
9. Move the selector lever to the ""N" position.

10. Remove the selector lever trim panel.

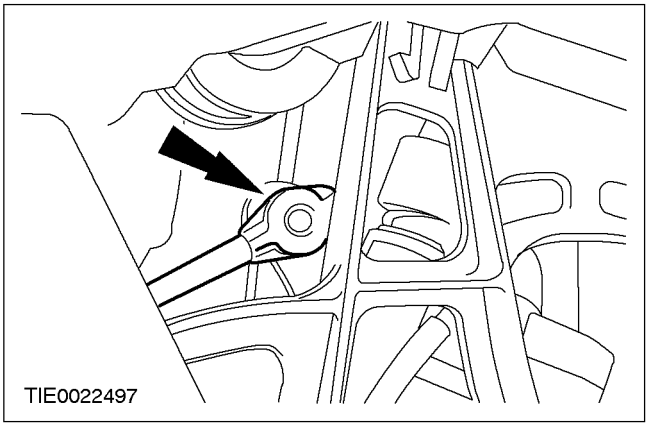


11. Remove the floor console side trim panels.

1. Remove the retaining bolt.
2. Detach the retaining clips.

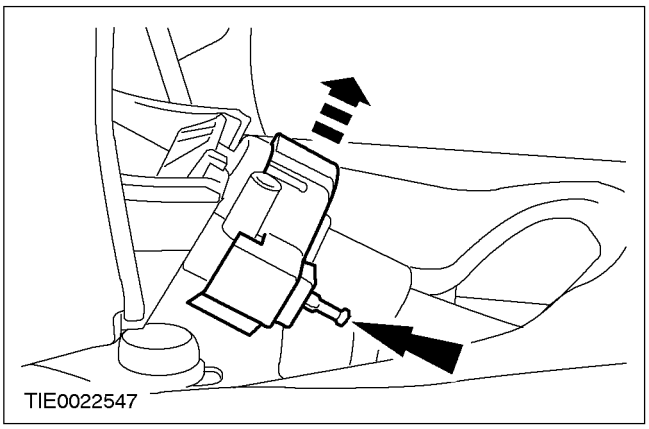


12. Unclip the selector lever cable retaining clip from the selector.



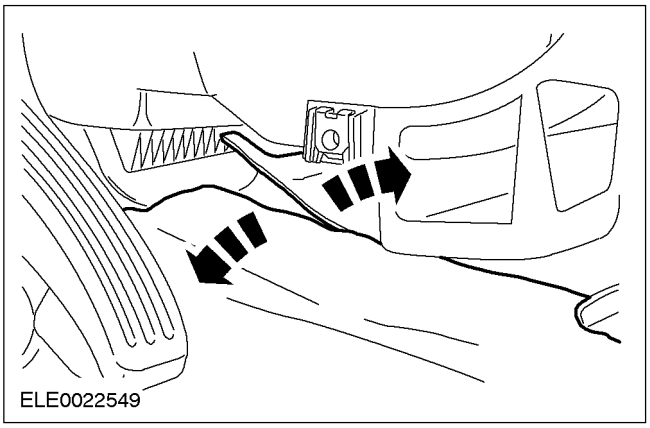
13. Remove the selector lever cable from the selector lever.

- Pull the retaining pin and push out the selector lever cable.

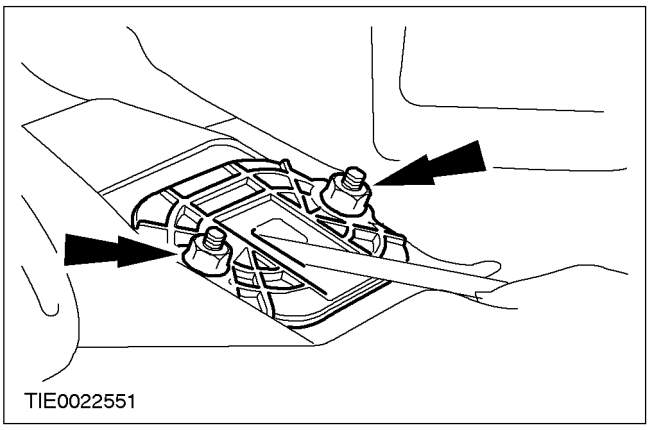


REMOVAL AND INSTALLATION (Continued)

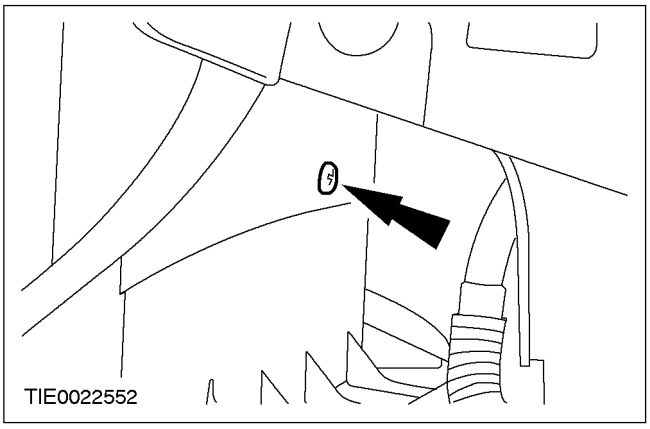
14. **Lift the floor carpet and the insulator material and position it to one side.**



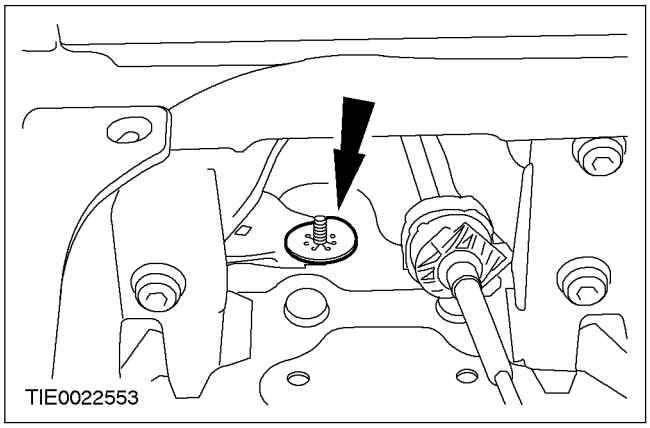
15. **Remove the selector lever cable grommet.**



16. **Remove the air pipe screw and raise the air pipe until the stop.**



17. **Detach the air pipe (selector lever removed shown).**



18. **NOTE:** Before pulling through the selector lever cable, tie a guide wire to the selector lever cable transaxle end.

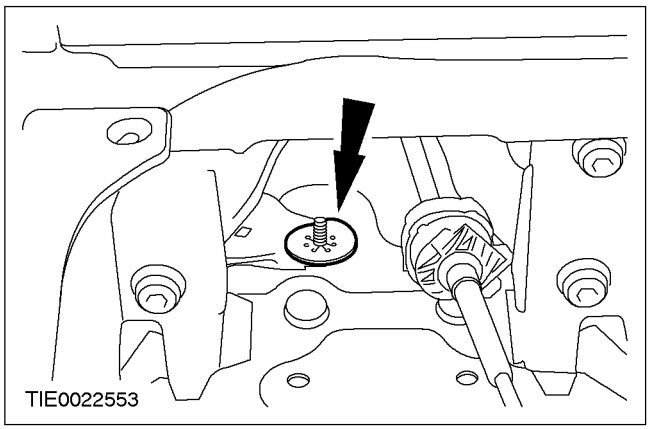
    Remove the selector lever cable from the front.

Installation

1. **NOTE:** Tie the selector lever cable to the pulled-in wire and pull the selector lever cable into position.

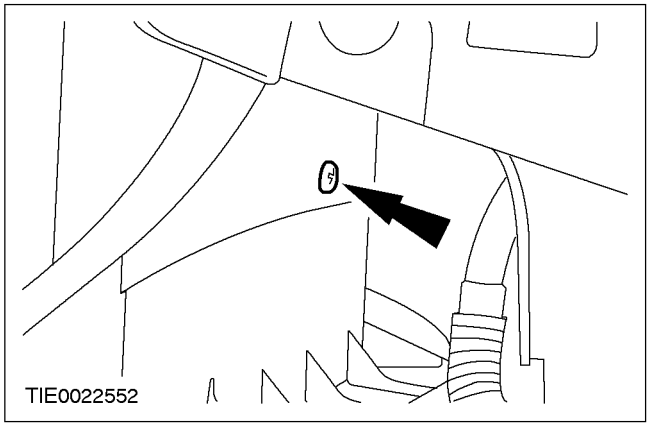
   Install the selector lever cable to the front.

2. **Attach the air pipe (selector lever removed shown).**

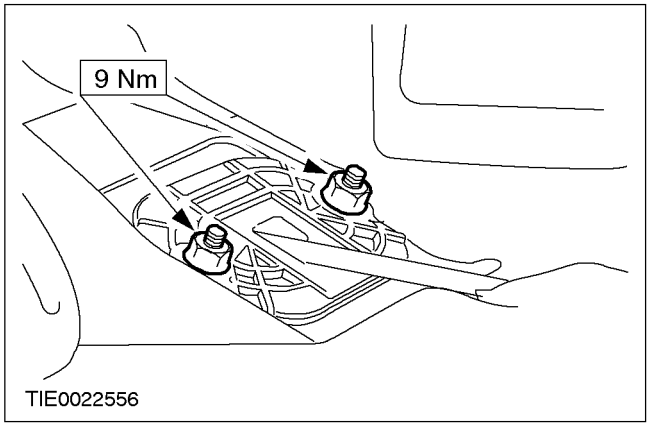


REMOVAL AND INSTALLATION (Continued)

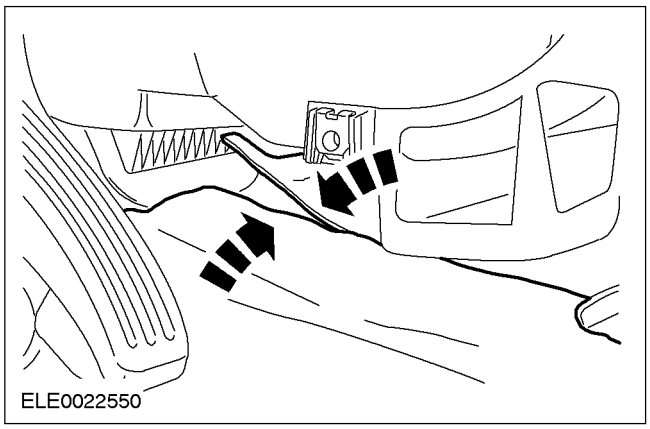
3. Push down the air pipe until the stop and install the air pipe screw.



4. Install the selector lever cable grommet.

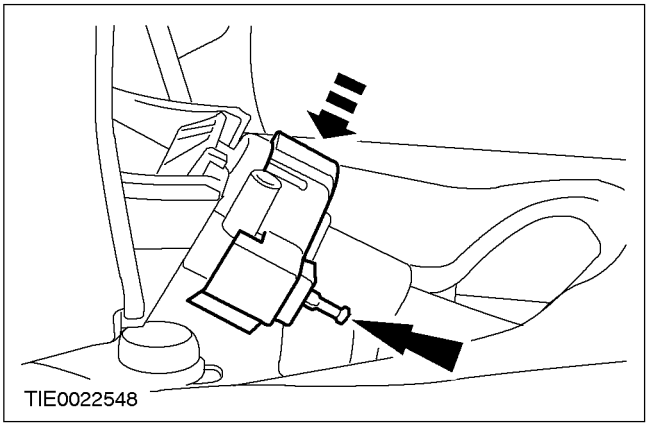


5. Secure the insulator material and the floor carpet with adhesive straps.

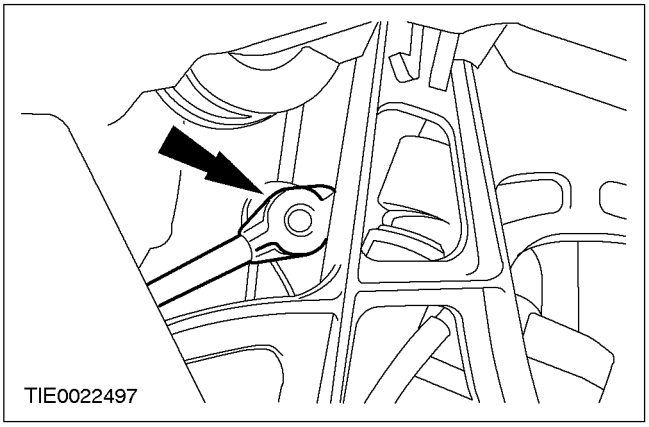


6. Install the selector lever cable to the selector lever.

- Pull the retaining pin and push in the selector lever cable.

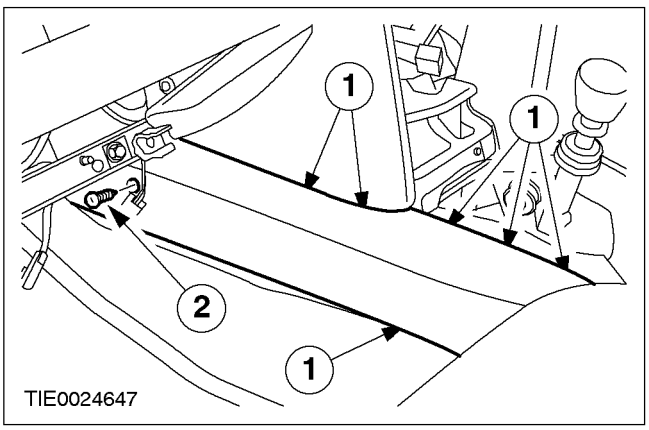


7. Clip the selector lever cable retaining clip into the selector.



8. Install the floor console side trim panels.

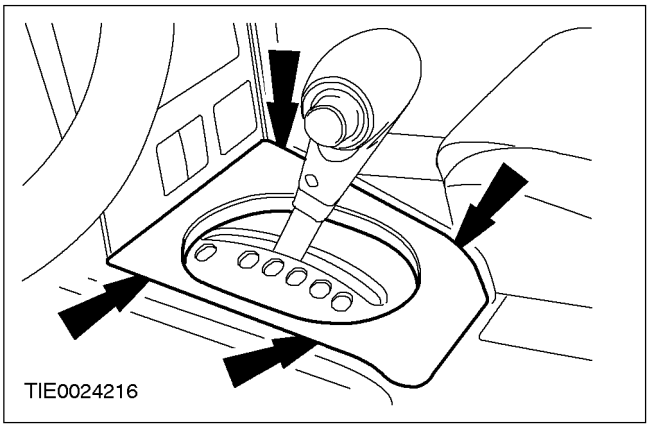
1. Detach the retaining clips.
2. Remove the retaining bolt.



REMOVAL AND INSTALLATION (Continued)

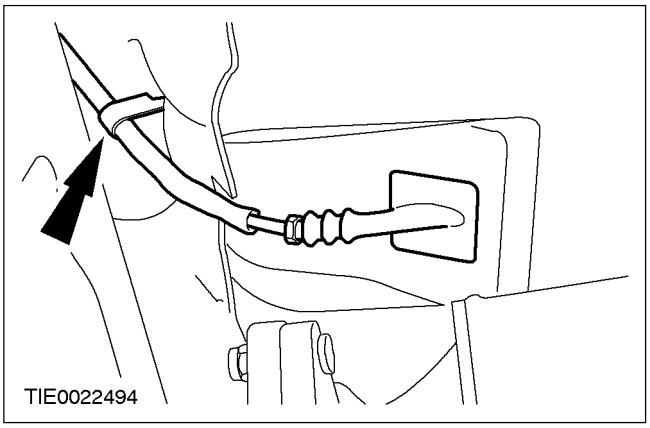
9. Clip in the selector gate cover.

- Install the selector lever trim panel.



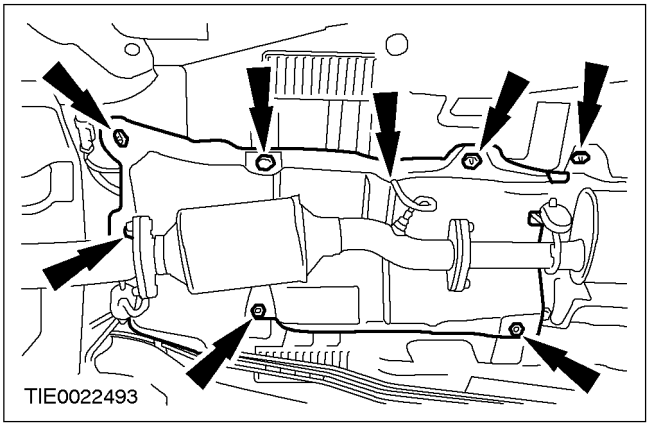
10. Raise and support the vehicle. For additional information, refer to Section 100-02.

11. Attach the selector lever cable to the bracket.



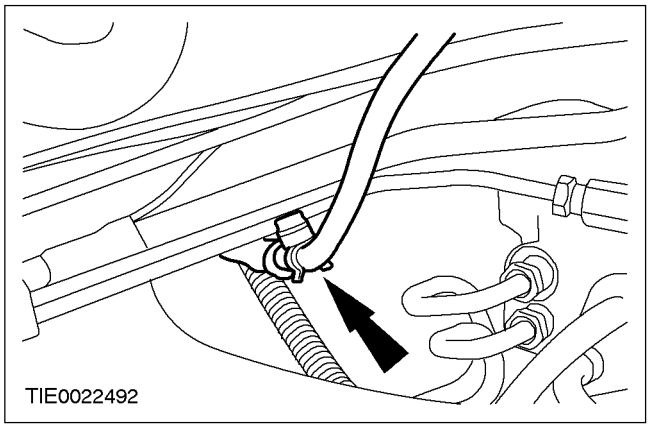
12. Install the catalytic converter heat shield.

- Attach the catalyst monitor sensor wiring harness.



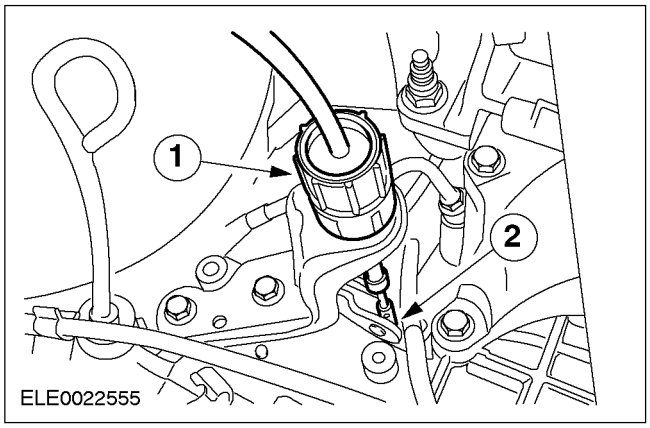
13. Lower the vehicle.

14. Clip the selector lever cable to the brake pipe.

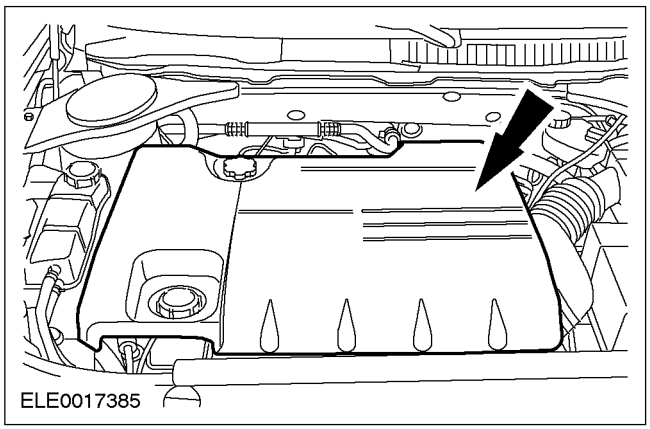


15. Attach the selector lever cable to the transaxle.

1. Install the selector lever cable to the bracket.
2. Attach the selector lever cable.

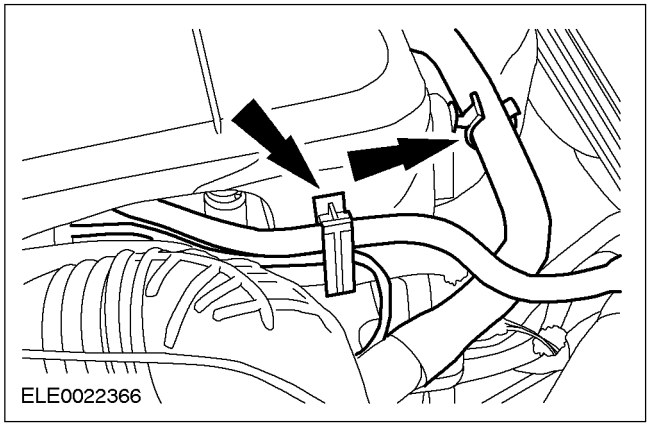


16. Install the engine upper cover.



REMOVAL AND INSTALLATION (Continued)

17. Attach the PCV hose and the vacuum hose to the engine upper cover.



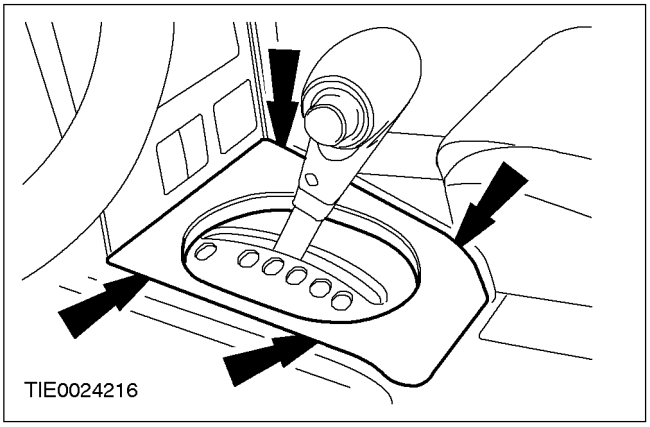
18. Adjust the selector lever cable. For additional information, refer to Selector Lever Cable Adjustment in this section.

REMOVAL AND INSTALLATION

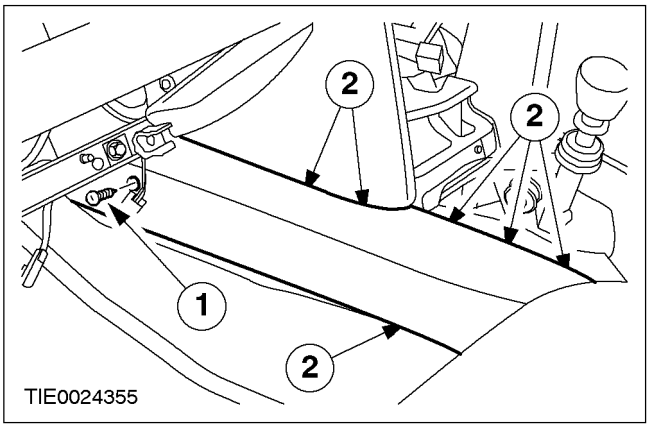
Transmission Selector Lever

Removal

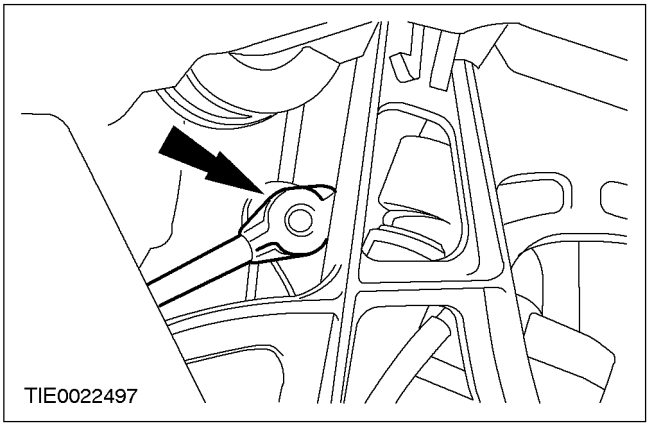
1. **Move the selector lever to the ""N" position.**
2. **Remove the selector lever trim panel.**



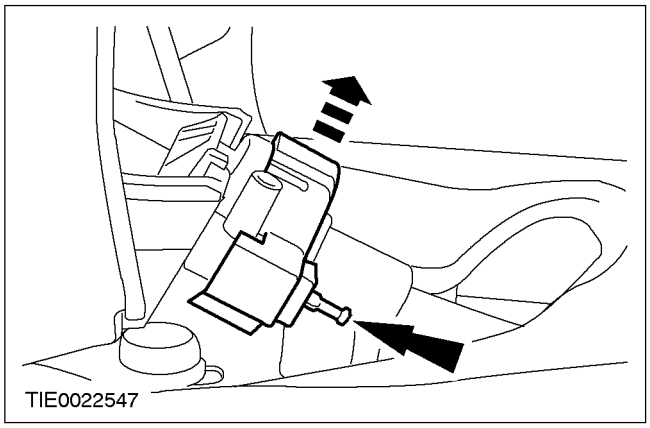
3. **Remove the floor console side trim panels.**
   1. Remove the retaining bolt.
   2. Detach the retaining clips.



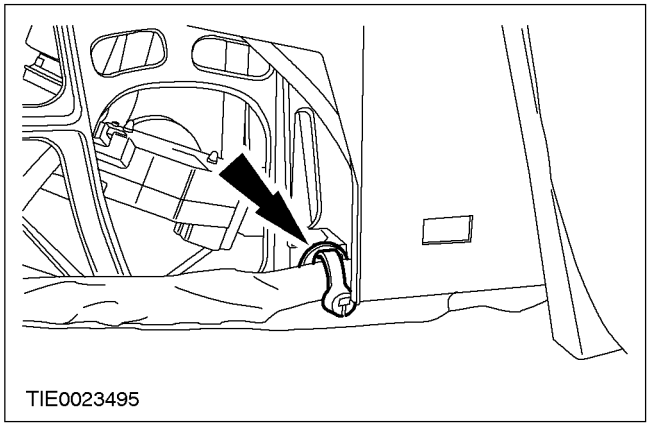
4. **Detach the selector lever cable retaining clip from the selector.**



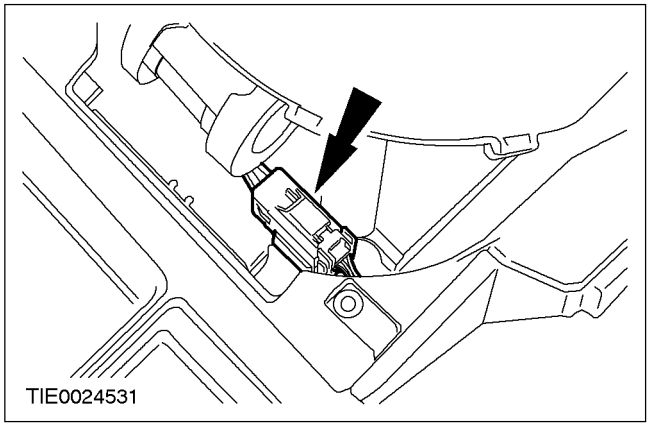
5. **Remove the selector lever cable from the selector lever.**
   - Pull the retaining pin and push out the selector lever cable.



6. **Detach the selector lever cable retaining clip from the selector lever.**



7. **Disconnect the selector lever electrical connector.**

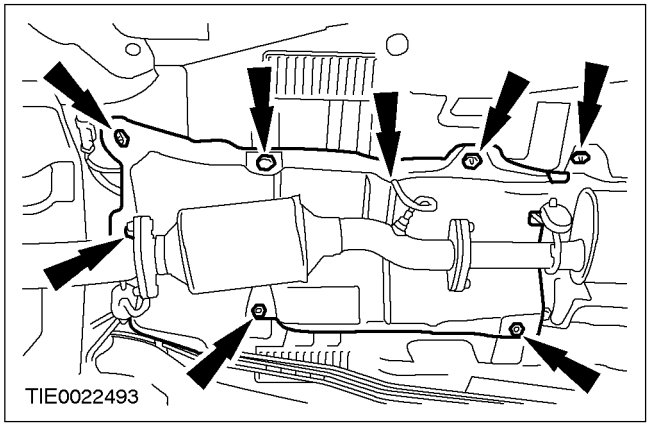


REMOVAL AND INSTALLATION (Continued)

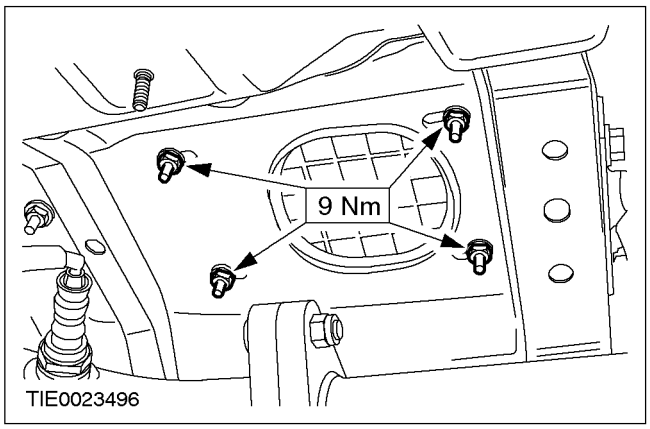
8. Raise and support the vehicle. For additional information, refer to Section 100-02.

9. Remove the catalytic converter heat shield.

- Detach the catalyst monitor sensor wiring harness.

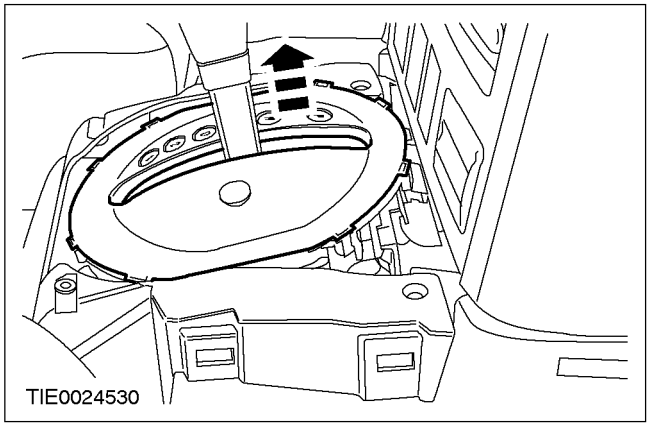


10. Remove the selector lever retaining nuts.



11. Lower the vehicle.

12. Remove the selector lever.



Installation

1. To install, reverse the removal procedure.

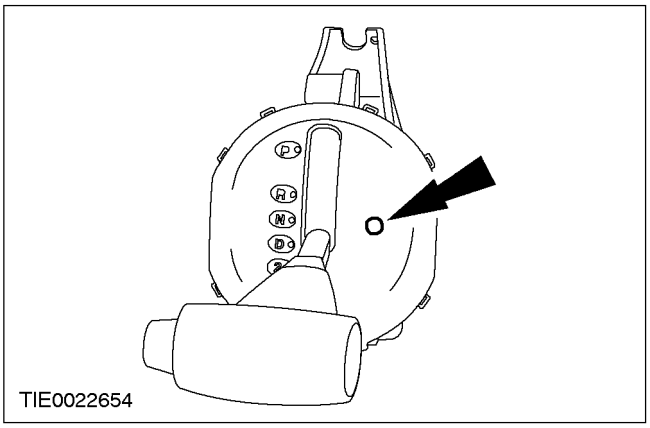
DISASSEMBLY AND ASSEMBLY

Selector Lever

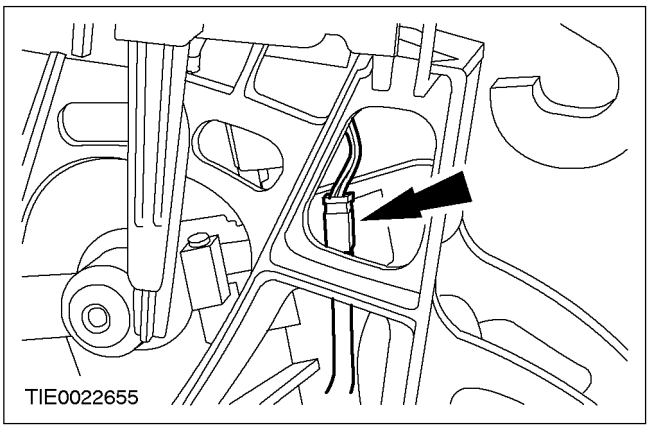
Name	Specification
Grease	SM-1C1021-A

Disassembly

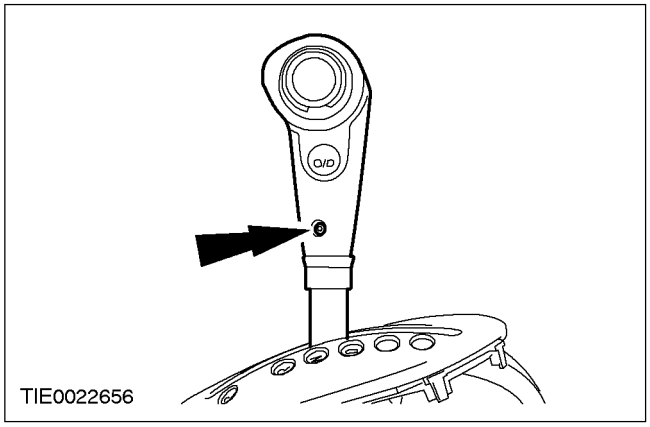
1. **Remove the selector lever shift lock solenoid cover.**



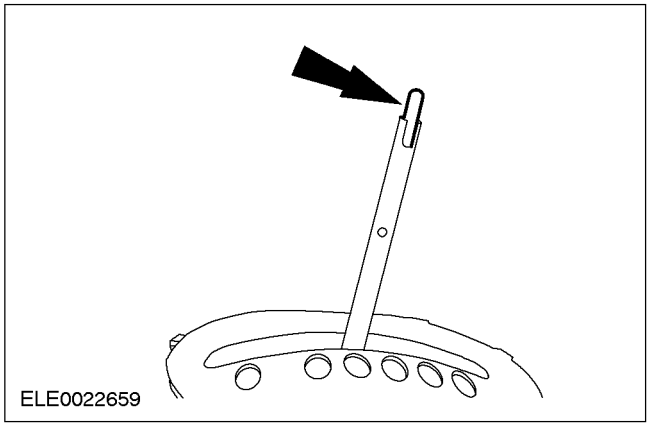
2. **Disconnect the overdrive (O/D) switch electrical connector.**



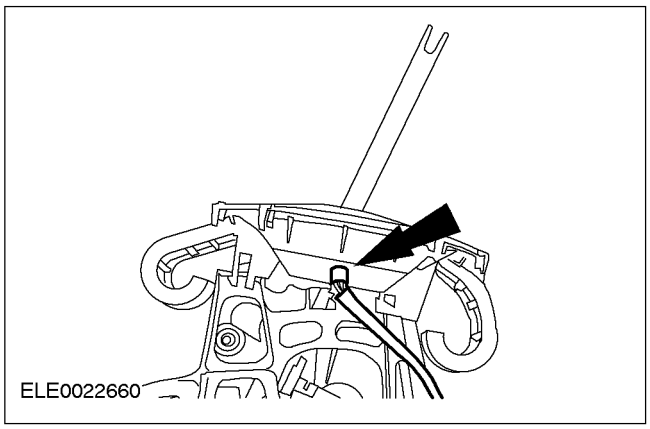
3. **Remove the selector lever knob.**
   - Remove the screw.



4. **Remove the selector lever plunger.**



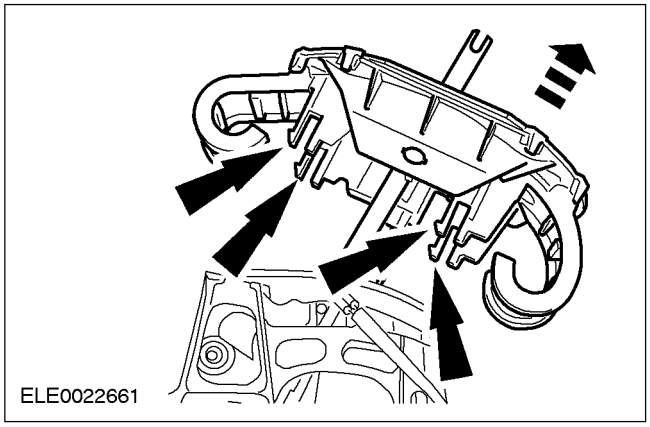
5. **Turn the socket counter-clockwise and detach the socket and lamp.**



DISASSEMBLY AND ASSEMBLY (Continued)

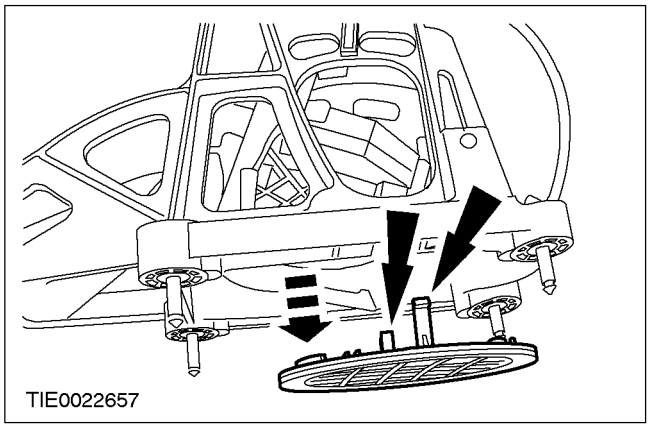
6. Remove the selector lever upper cover.

- Depress the four retaining lugs.



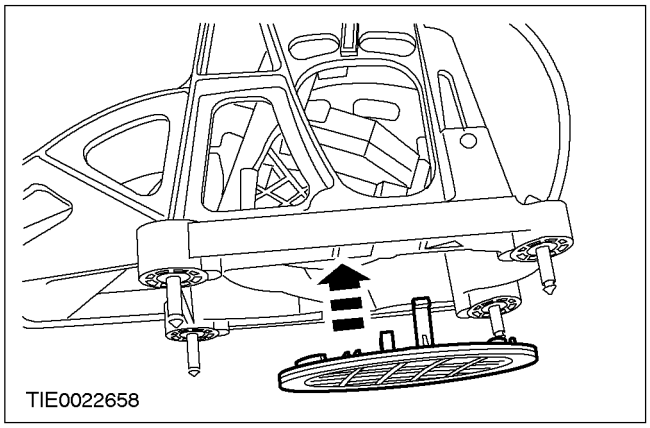
7. Remove the selector lever lower cover.

1. Depress the two retaining lugs.

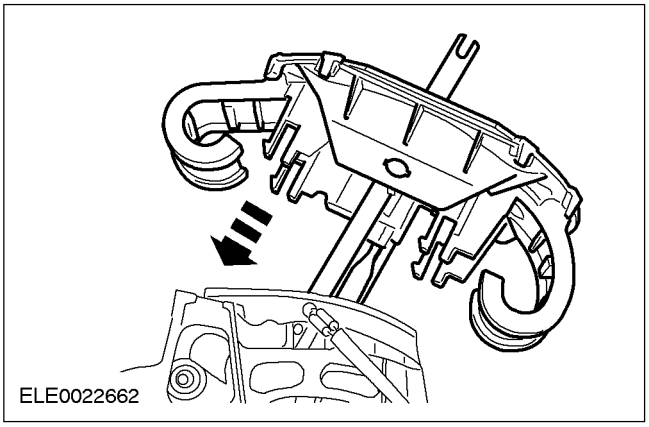


Assembly

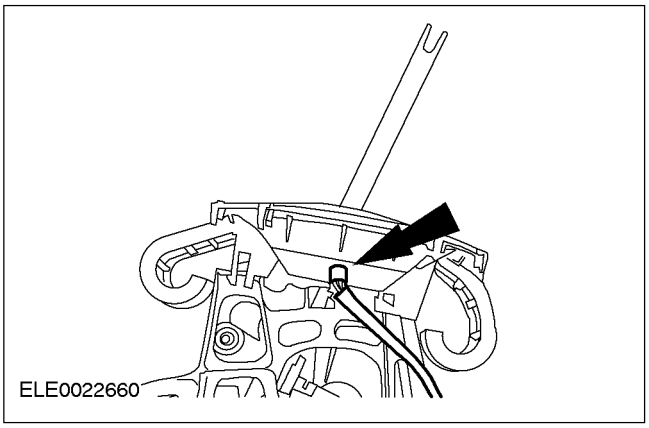
1. Install the selector lever lower cover (two retaining lugs).



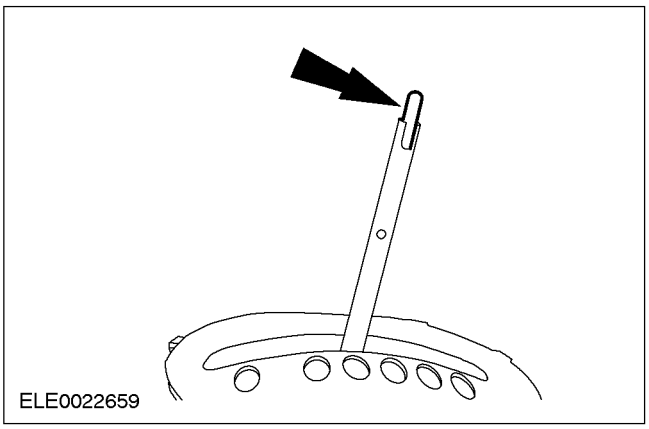
2. Install the selector lever upper cover (four retaining lugs).



3. Attach the socket and lamp and turn the socket clockwise.



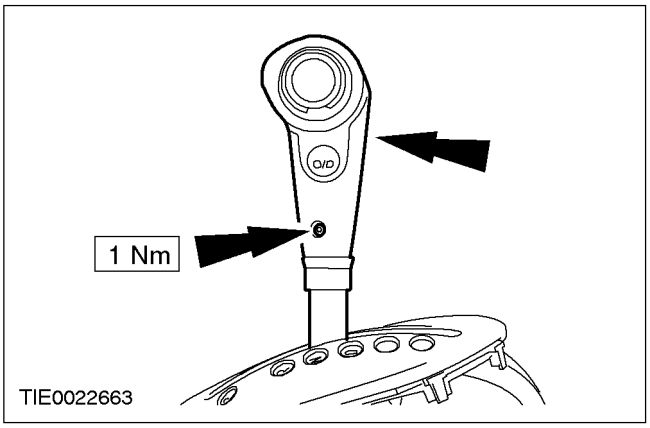
4. Install the selector lever plunger.



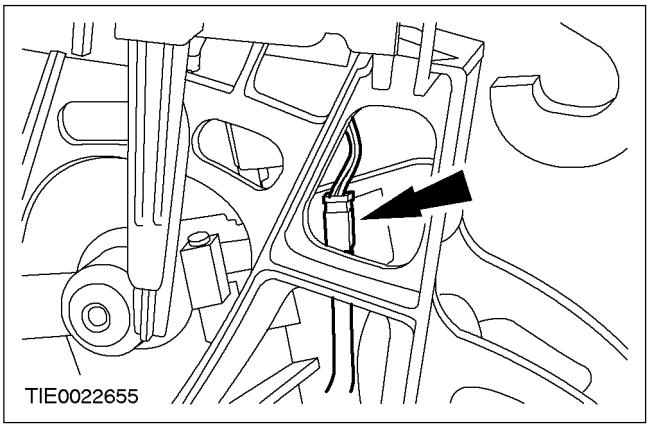
DISASSEMBLY AND ASSEMBLY (Continued)

5. 5. Install the selector lever knob.

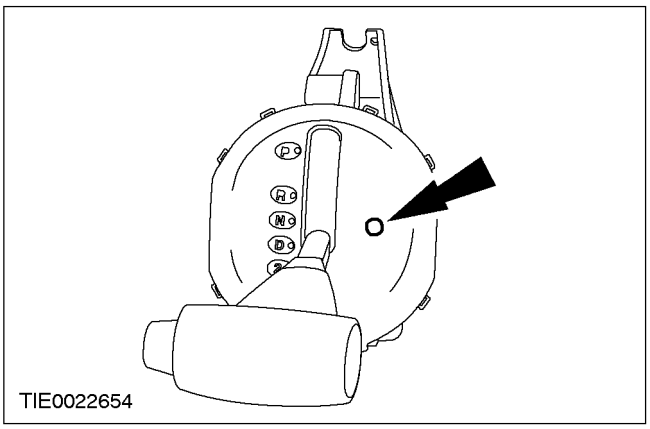
- Install the screw.



6. Connect the O/D switch electrical connector.



7. Install the selector lever shift lock solenoid cover.



SECTION 307-05B Automatic Transmission/Transaxle External Controls

VEHICLE APPLICATION: 2003.0 Mondeo

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Transmission Selector Lever 307-05-12

DISASSEMBLY AND ASSEMBLY

Selector Lever 307-05-14

SPECIFICATIONS

Torque Specifications

Item	Nm	lb-ft	lb-in
Selector lever knob retaining bolt	1	-	9
Selector lever cable grommet	9	-	80
Selector lever assembly	9	-	80
Selector lever cable cover retaining bolts	22	16	-

DIAGNOSIS AND TESTING

External Controls

Refer to Wiring Diagrams Section 307-05 for schematic and connector information.

Inspection and Verification

WARNING: Make sure the vehicle road wheels are chocked and the parking brake is applied before carrying out this procedure. Failure to follow this instruction may result in personal injury.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical and electrical damage.

Mechanical	Electrical
• Visibly damaged or worn components • Loose or missing nuts or bolts.	• Fuse(s) • Electrical connector(s) • Selector lever lock switch

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Visual Inspection Chart

Condition	Possible Sources	Action
NOTE: The selector lever immobilizer can be released mechanically from the "P" (PARK) position, if for example the battery is drained or disconnected.		
•Selector lever locked in the "P" (PARK) position.	•Brake pedal switch.	•CHECK the brake pedal switch and circuit(s). REFER to Wiring Diagrams.
	•Selector lever lock solenoid.	•CHECK the selector lever lock solenoid and circuit(s). REFER to Wiring Diagrams.
	•Selector lever cable.	•CHECK the selector lever cable operation and adjustment. REFER to Selector Lever Cable / Selector Lever Cable Adjustment in this section.
	•Selector Lever	•DISASSEMBLE the selector lever and INSTALL new component as necessary. REFER to Selector Lever in this section.
•Selector lever does not lock.	•Selector lever lock solenoid.	•CHECK the selector lever lock solenoid and circuit(s). REFER to Wiring Diagrams.
	•Selector lever cable adjustment.	•ADJUST the selector lever cable. REFER to Selector Lever Cable Adjustment in this section.
	•Selector lever.	•DISASSEMBLE the selector lever and INSTALL new component as necessary. REFER to Selector Lever in this section.

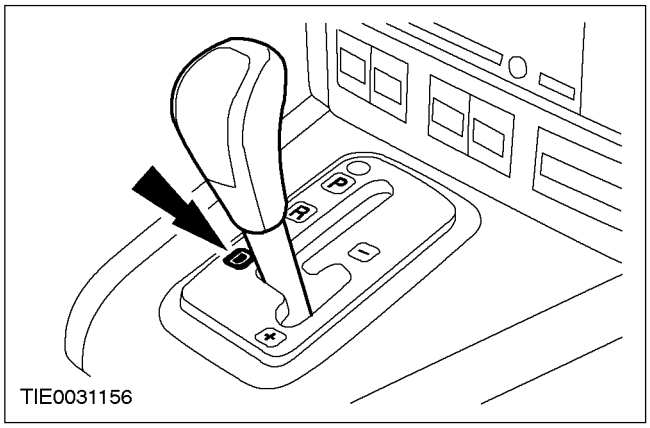
DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
•Instrument cluster selector lever position indicator does not display the correct selector lever position.	•Selector lever cable adjustment.	•ADJUST the selector lever cable. REFER to Selector Lever Cable Adjustment in this section.
	•Instrument Cluster.	•CHECK the instrument cluster. REFER to WDS.
•"P" (PARK) or "D" (DRIVE) cannot be selected.	•Selector lever cable adjustment.	•ADJUST the selector lever cable. REFER to Selector Lever Cable Adjustment in this section.
	•Selector lever.	•DISASSEMBLE the selector lever and INSTALL new component as necessary. REFER to Selector Lever in this section.
	•Transaxle internal failure.	•REFER to Section 307-01A / 307-01B.

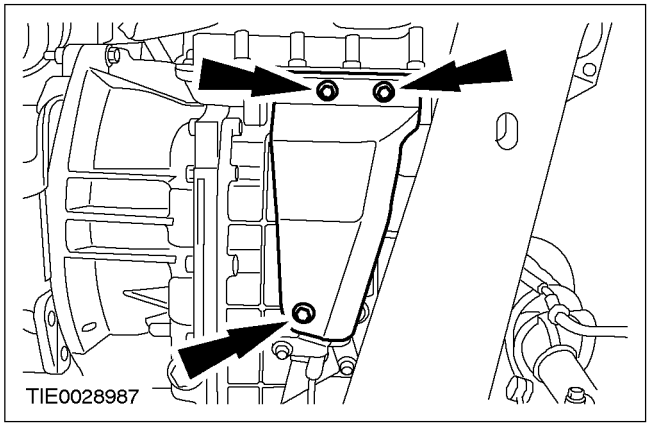
GENERAL PROCEDURES

Selector Lever Cable Adjustment

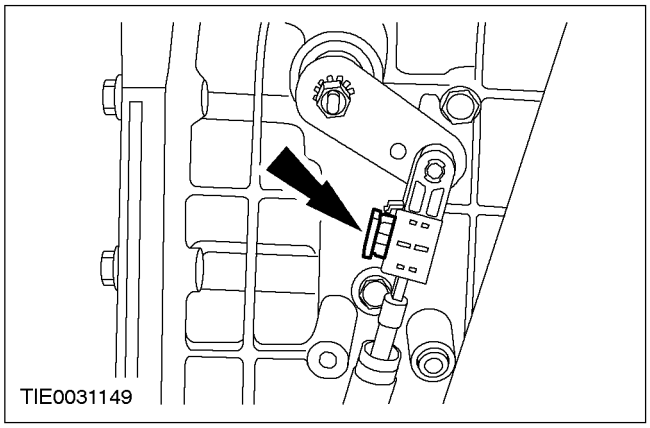
1. **Shift the selector lever to the "D" (DRIVE) position.**



2. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
3. **Remove the selector lever cable cover.**

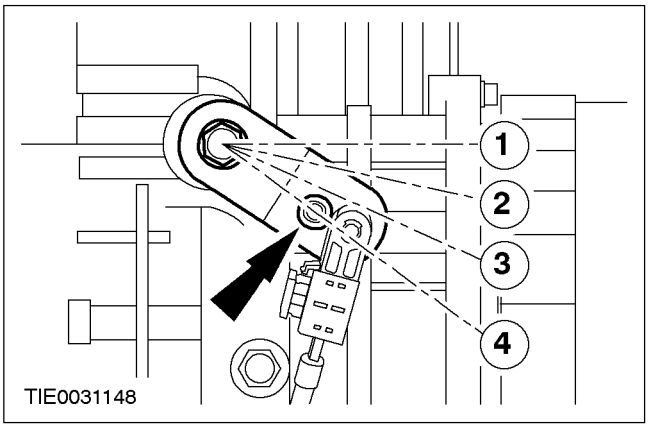


4. **Open the yellow locking clip of the selector lever cable adjustment mechanism.**



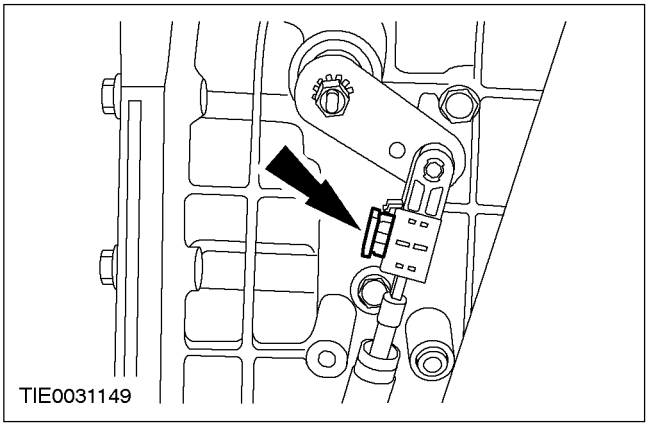
5. **NOTE:** The dot on the transaxle housing must align with the hole on the manual control lever when in the "D" (DRIVE) position.

   Rotate the manual control lever to the "D" (DRIVE) position.
   1. "P" (PARK) position.
   2. "R" (REVERSE) position.
   3. "N" (NEUTRAL) position.
   4. "D" (DRIVE) position.



6. **NOTE:** Make sure that the selector lever cable adjustment mechanism is locked.

   Fully depress the yellow selector lever cable locking clip.

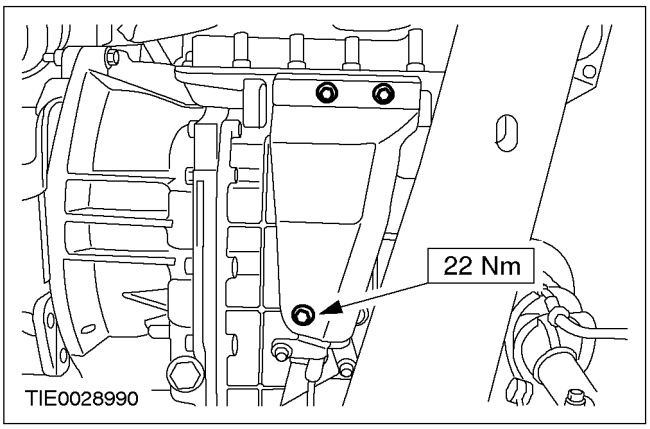


7. **Lower the vehicle.**
8. **NOTE:** If any gear range fails to select, repeat the procedure.

   Start the engine and move the transmission selector lever through all of the gear ranges, allowing sufficient time for each range to engage.

GENERAL PROCEDURES (Continued)

9. Shift the transmission selector lever to the "P" (PARK) position and switch OFF the engine.
10. Raise and support the vehicle. For additional information, refer to Section 100-02.
11. Install the selector lever cable cover.



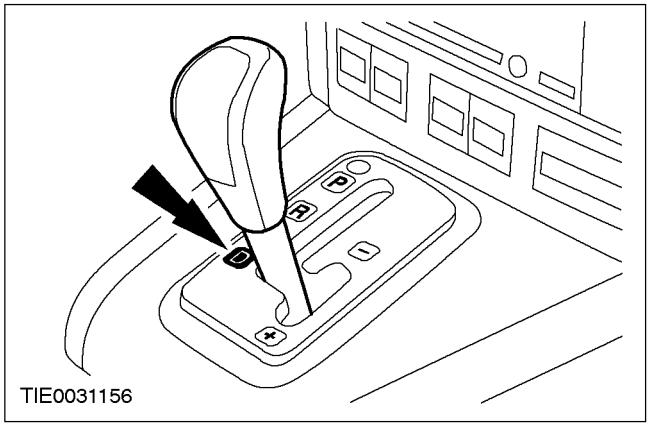
REMOVAL AND INSTALLATION

Selector Lever Cable

Removal

All vehicles

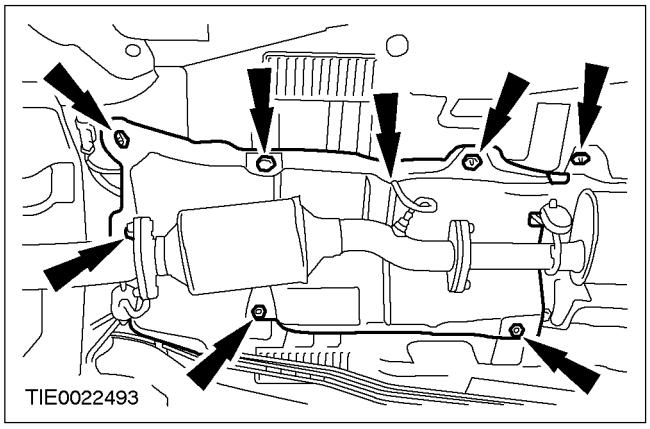
1. **Shift the selector lever to the "D" (DRIVE) position.**



2. **Remove the floor console. For additional information, refer to Section 501-12.**
3. **Raise and support the vehicle. For additional information, refer to Section 100-02.**

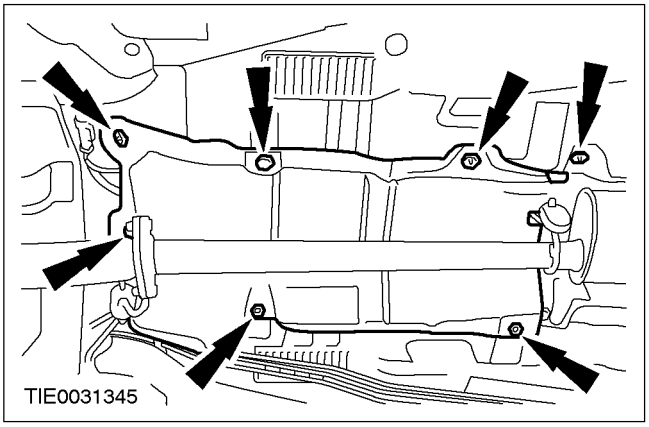
Vehicles with 2.5L engine

4. **Remove the catalytic converter heat shield.**
   - Detach the catalyst monitor sensor wiring harness.



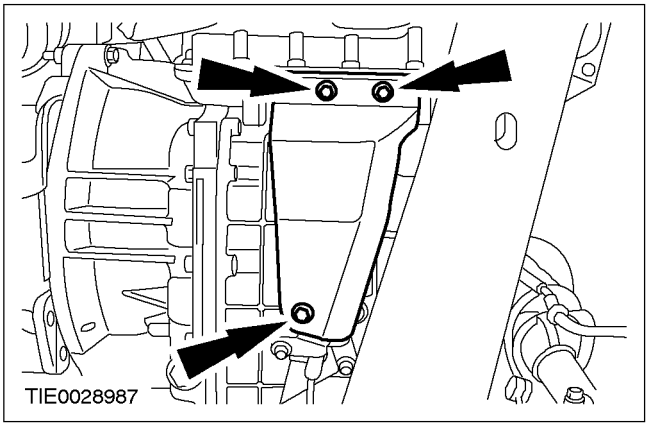
Vehicles with diesel engine

5. **Remove the insulation pad.**



All vehicles

6. **Remove the selector lever cable cover.**

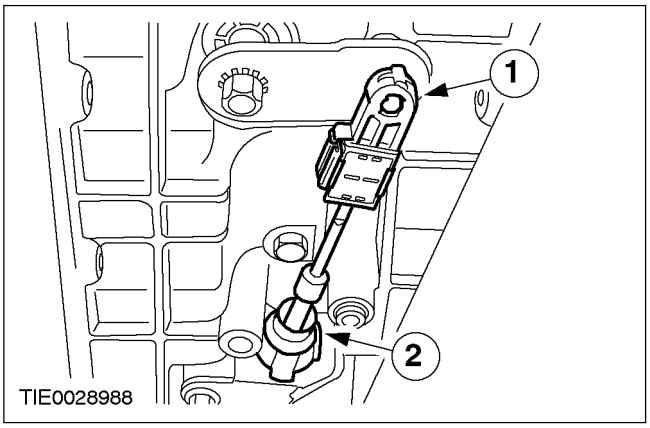


REMOVAL AND INSTALLATION (Continued)

7. NOTE: Make sure the transaxle selector lever is in the "D" (DRIVE) position.

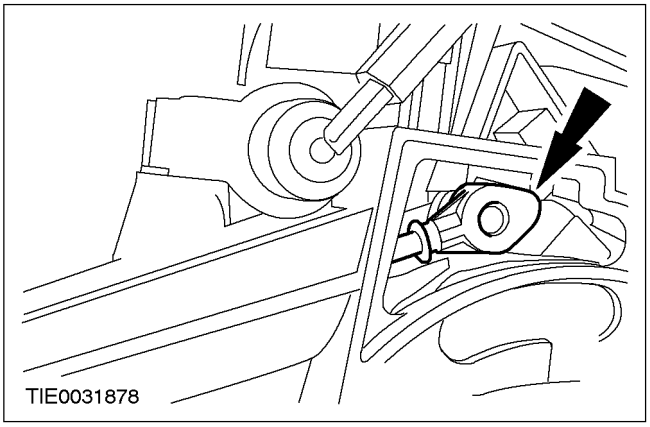
Detach the selector lever cable from the selector shaft lever.

1. Detach the selector lever cable from the selector shaft lever pin.
2. Detach the selector lever cable from the selector lever cable bracket.



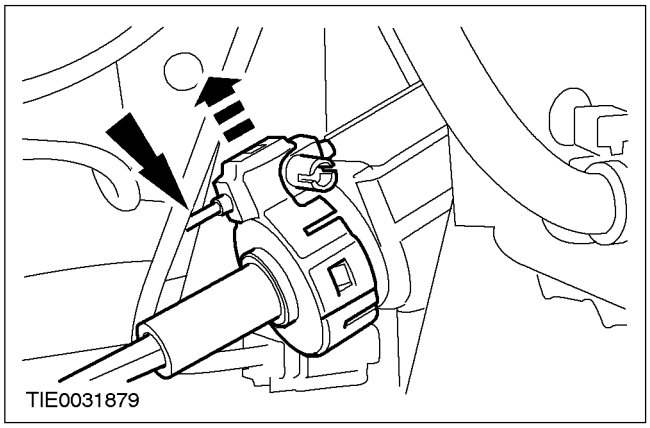
8. Lower the vehicle.

9. Detach the selector lever cable retaining clip from the selector.

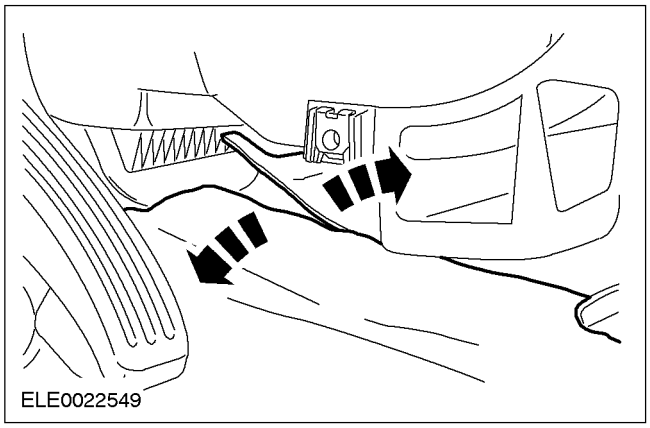


10. Remove the selector lever cable from the selector lever.

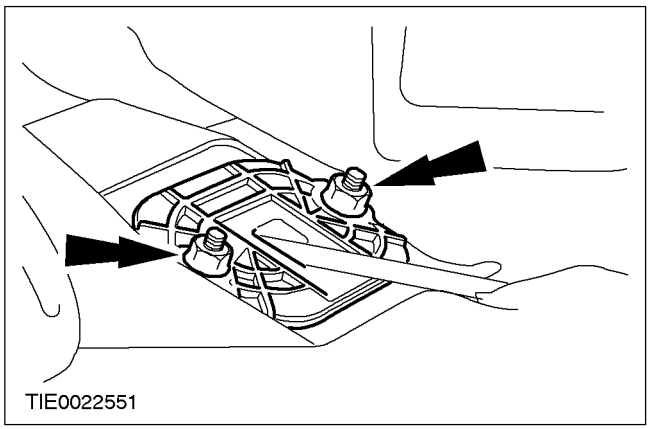
- Pull the retaining pin and push out the selector lever cable.



11. Lift the floor carpet and the insulation material and position it to one side.

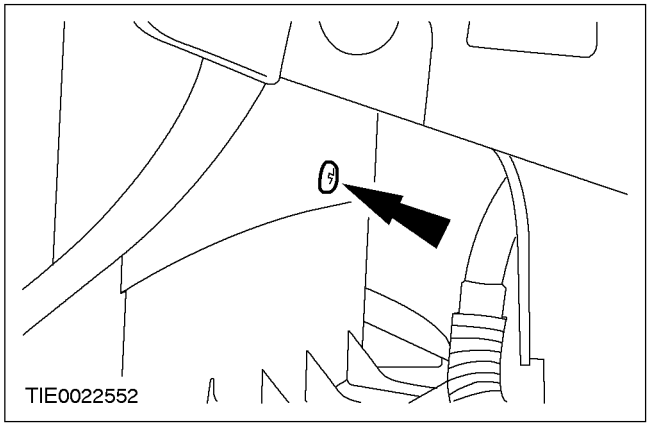


12. Remove the selector lever cable grommet.

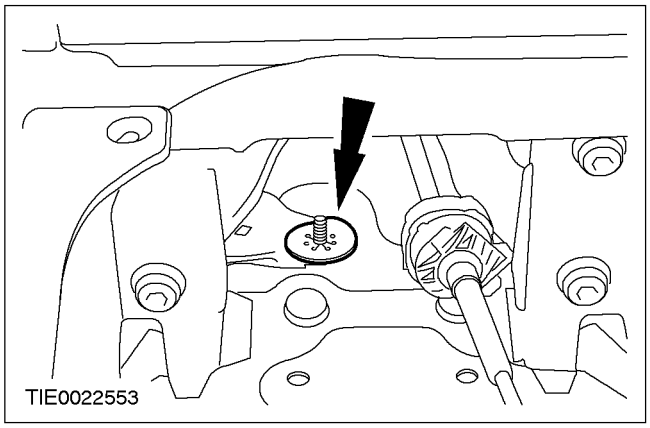


REMOVAL AND INSTALLATION (Continued)

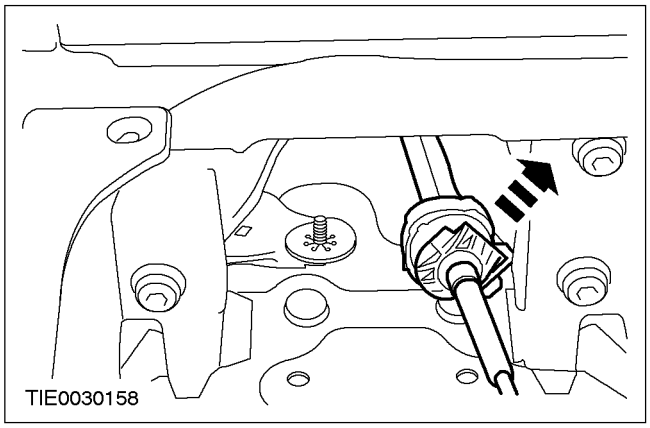
13. **Remove the air pipe screw and raise the air pipe to the stop.**



14. **Detach the air pipe (selector lever shown removed for clarity).**



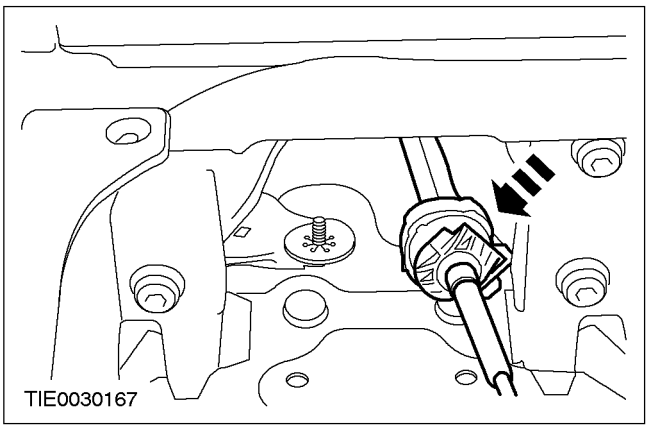
15. **Remove the selector lever cable (selector lever shown removed for clarity).**



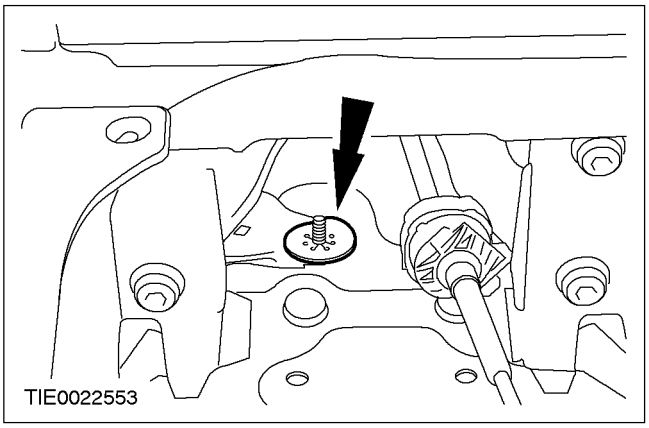
Installation

All vehicles

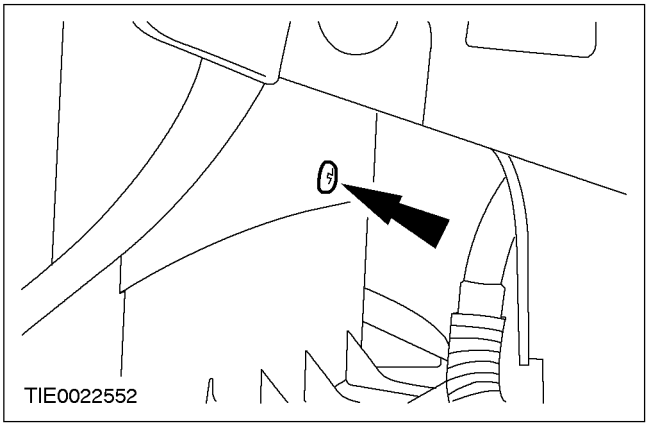
1. **Install the selector lever cable (selector lever shown removed for clarity).**



2. **Attach the air pipe (selector lever shown removed for clarity).**

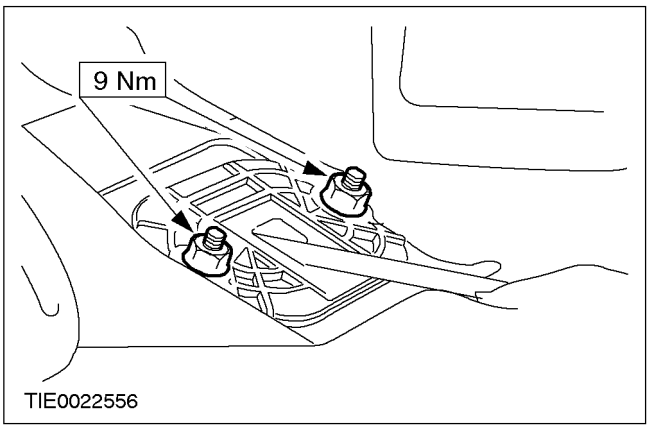


3. **Push down the air pipe to the stop and install the air pipe screw.**

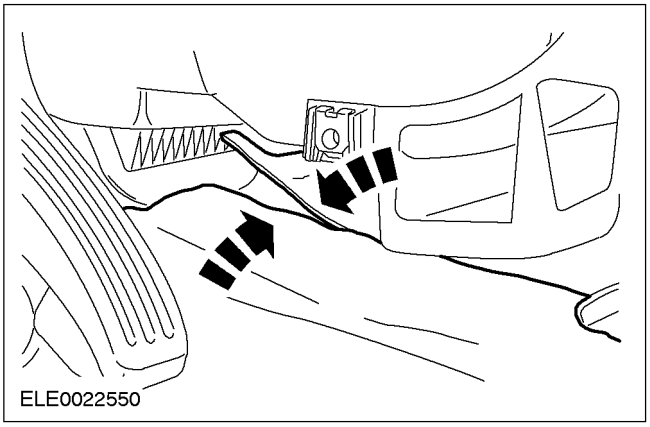


REMOVAL AND INSTALLATION (Continued)

4. Install the selector lever cable grommet.

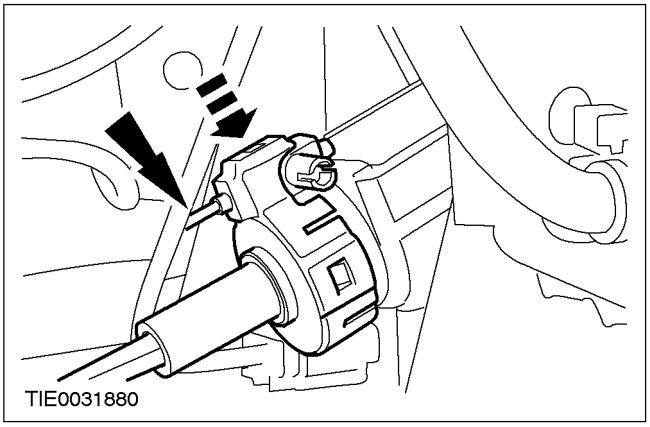


5. Secure the insulation material and the floor carpet with adhesive strips.

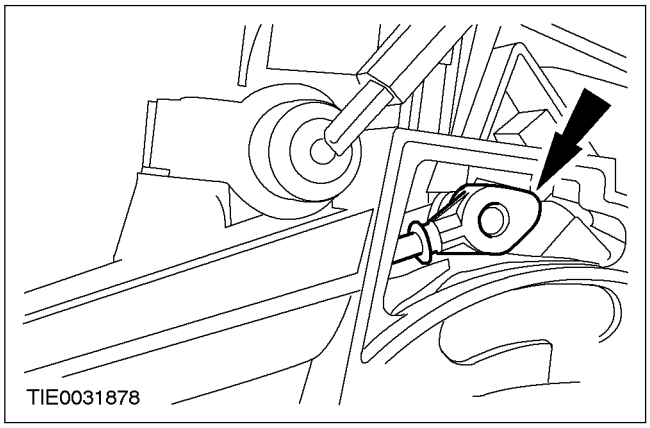


6. Install the selector lever cable to the selector lever.

- Pull the retaining pin and push in the selector lever cable.



7. Attach the selector lever cable retaining clip into the selector.



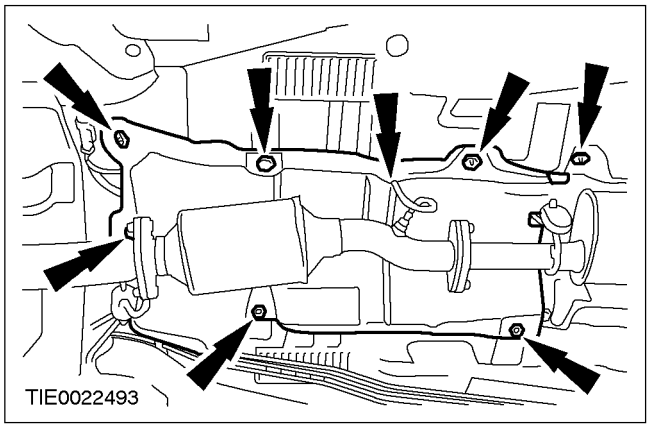
8. Install the floor console. For additional information, refer to Section 501-12.

9. Raise and support the vehicle. For additional information, refer to Section 100-02.

Vehicles with 2.5L engine

10. Install the catalytic converter heat shield.

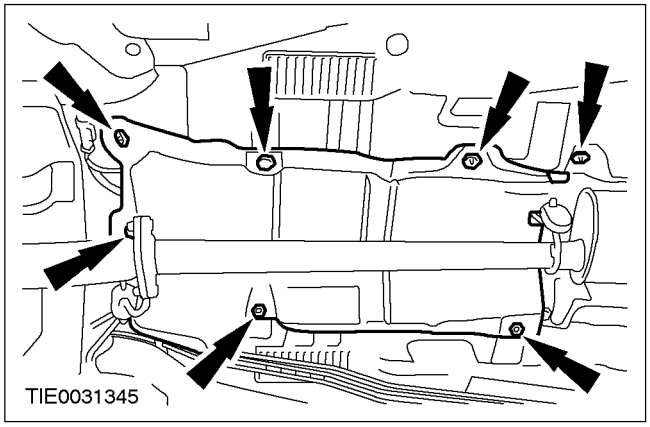
- Attach the catalyst monitor sensor wiring harness.



REMOVAL AND INSTALLATION (Continued)

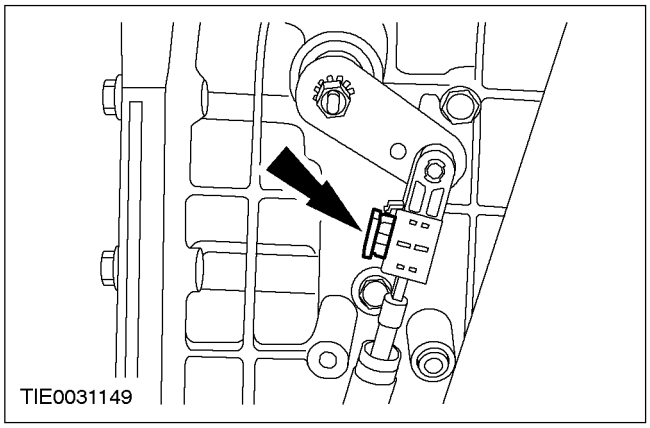
Vehicles with diesel engine

11. Install the insulation pad.



All vehicles

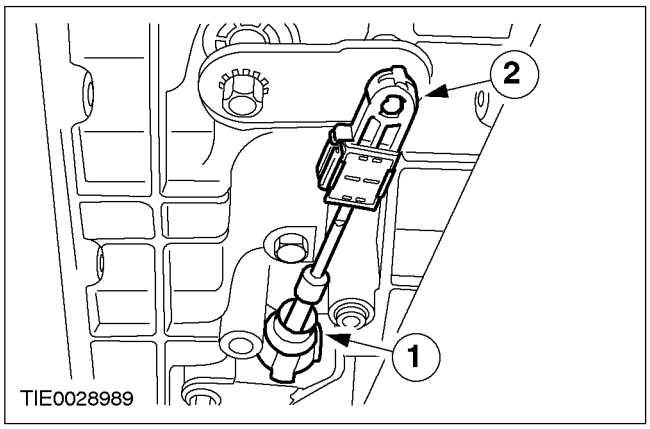
12. Open the yellow locking clip on the select lever cable adjustment mechanism.



13. NOTE: Make sure the transaxle selector lever is in the "D" (DRIVE) position.

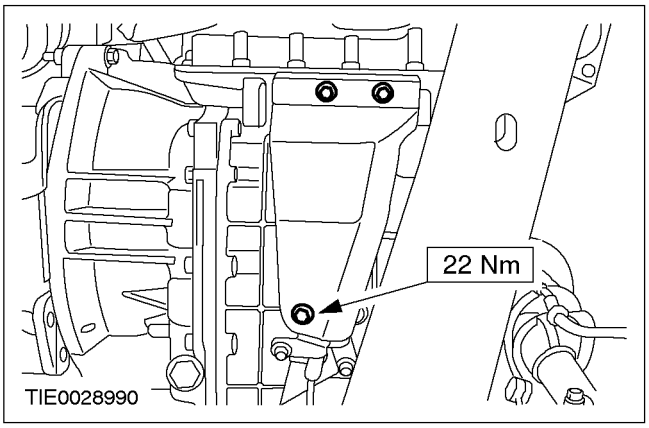
Attach the selector lever cable to the selector shaft lever.

1. Attach the selector lever cable to the selector lever cable bracket.
2. Attach the selector lever cable to the selector shaft lever pin.



14. Adjust the selector lever cable. For additional information, refer to Section 307-05A / 307-05B.

15. Install the selector lever cable cover.



16. Lower the vehicle.

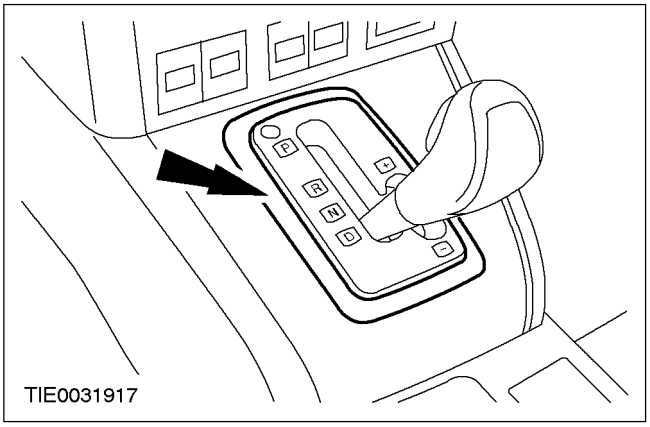
REMOVAL AND INSTALLATION

Transmission Selector Lever

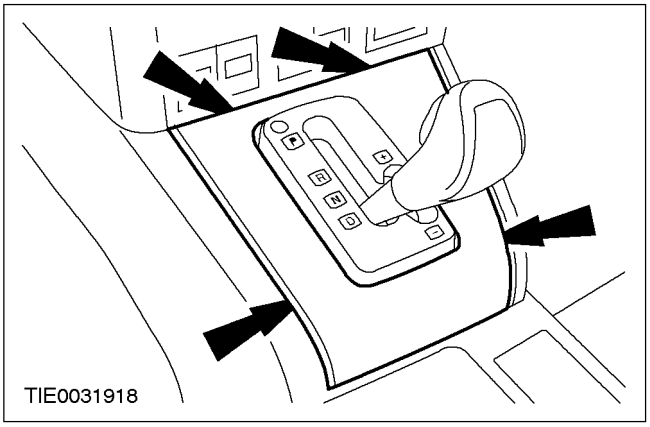
Removal

All vehicles

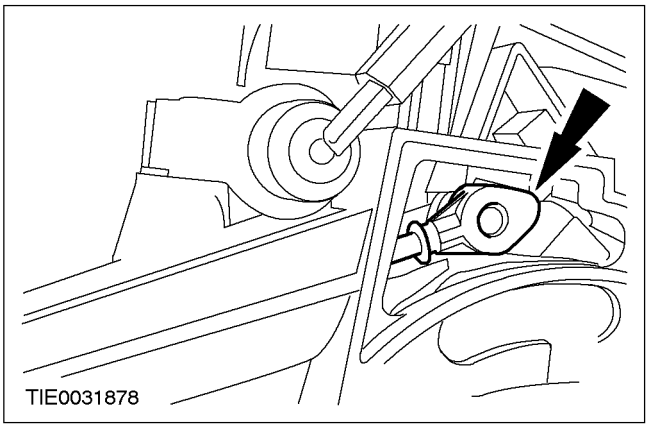
1. **Shift the selector lever to the "D" (DRIVE) position.**
2. **Remove the selector lever adapter ring.**



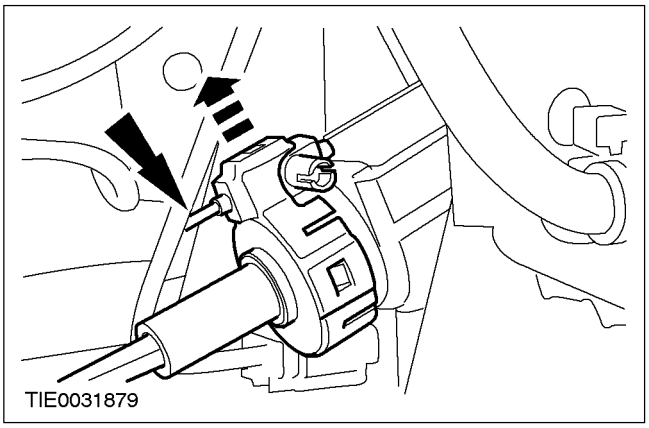
3. **Remove the selector lever trim panel.**



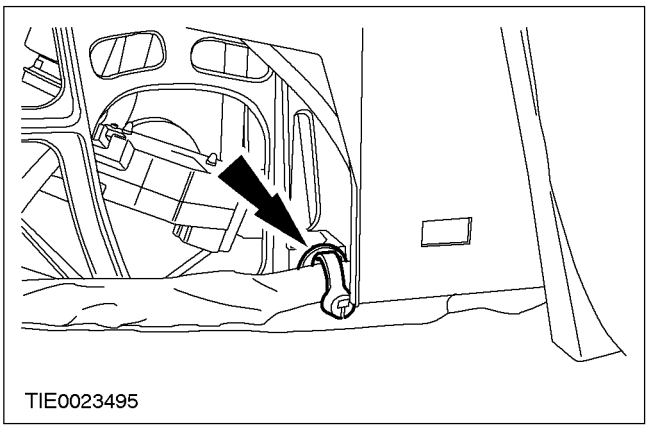
4. **Remove the floor console. For additional information, refer to Section 501-12.**
5. **Detach the selector lever cable retaining clip from the selector lever.**



6. **Remove the selector lever cable from the selector lever.**
   - Pull the retaining pin and push out the selector lever cable.

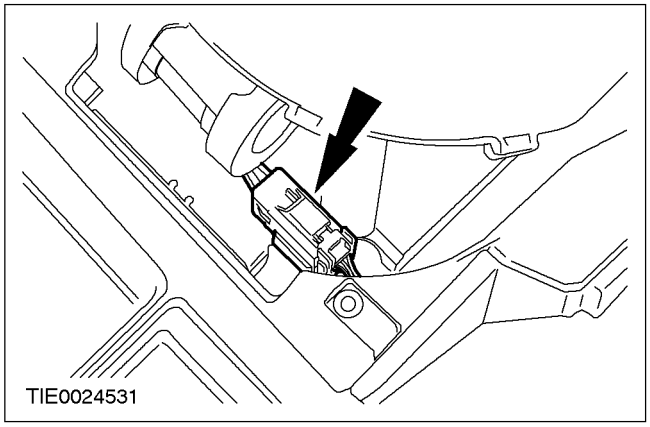


7. **Detach the selector lever cable retaining clip from the selector lever.**



REMOVAL AND INSTALLATION (Continued)

8. Disconnect the selector lever electrical connector.

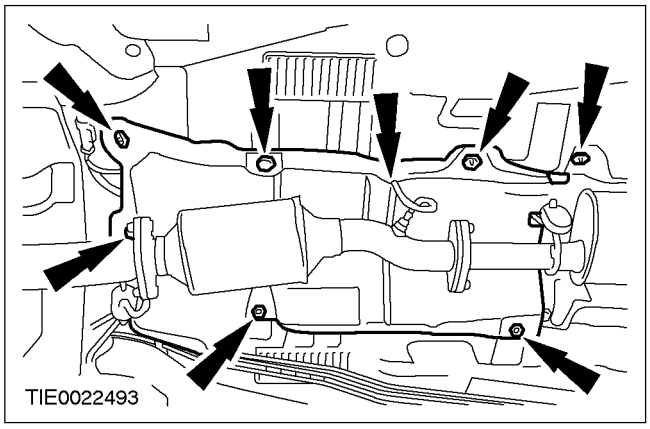


9. Raise and support the vehicle. For additional information, refer to Section 100-02.

Vehicles with 2.5L engine

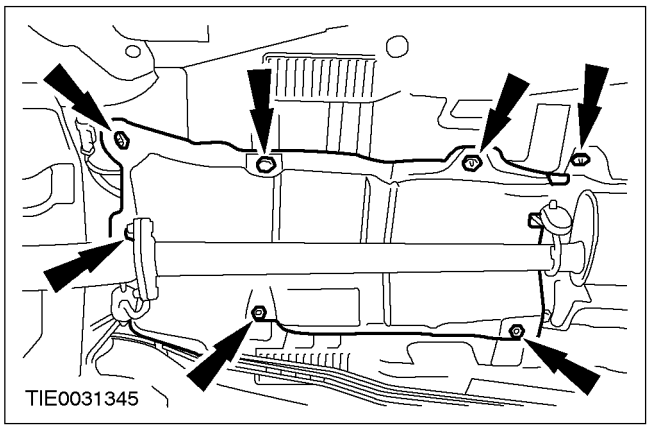
10. Remove the catalytic converter heat shield.

- Detach the catalyst monitor sensor wiring harness.



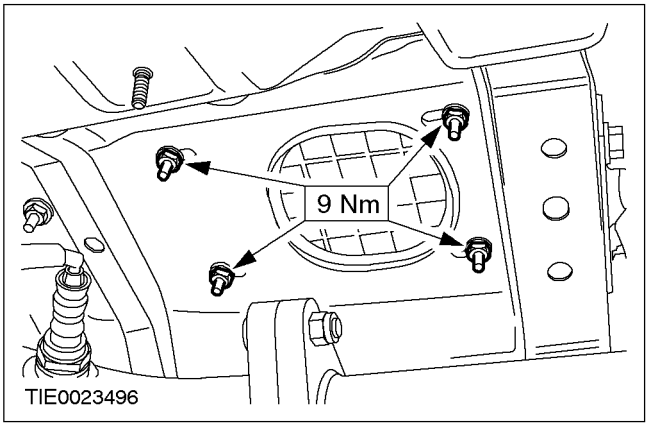
Vehicles with diesel engine

11. Remove the insulation pad.



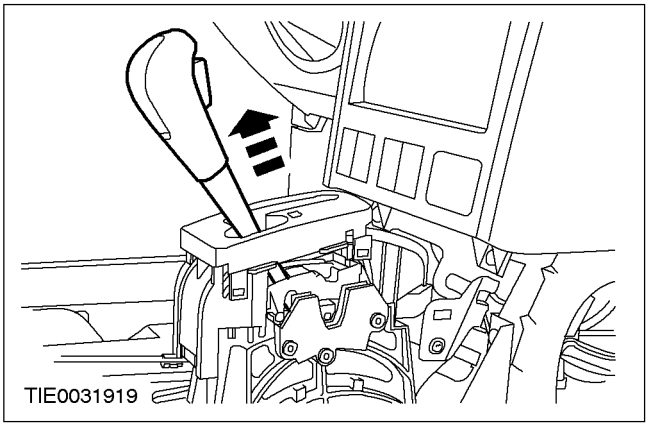
All vehicles

12. Remove the selector lever retaining nuts.



13. Lower the vehicle.

14. Remove the selector lever.



Installation

1. To install, reverse the removal procedure.

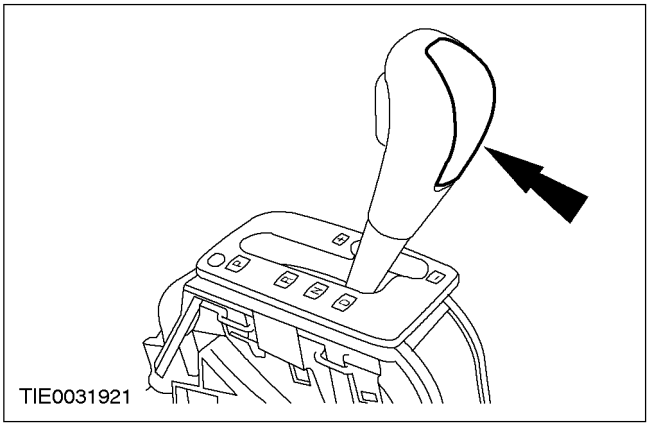
2. Adjust the selector lever cable. For additional information, refer to Section 307-05A / 307-05B.

DISASSEMBLY AND ASSEMBLY

Selector Lever

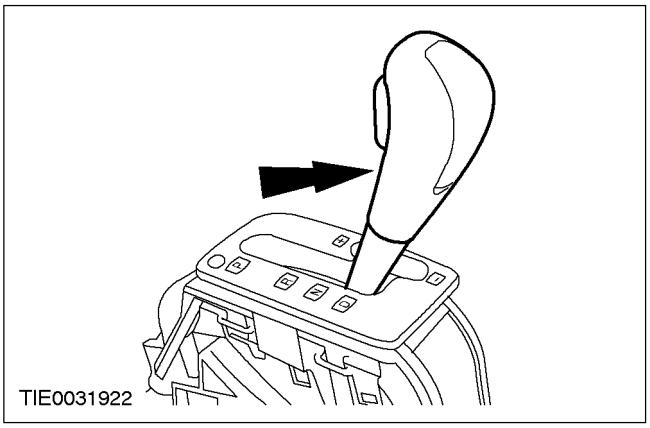
Disassembly

1. Remove the transaxle selector lever cover.

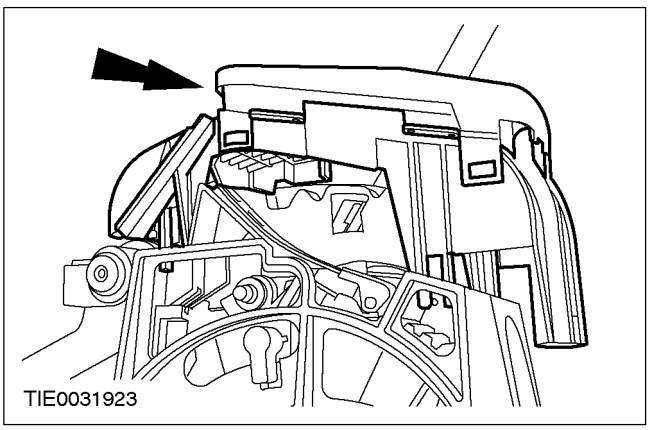


2. Remove the selector lever knob.

- Remove the retaining bolt.

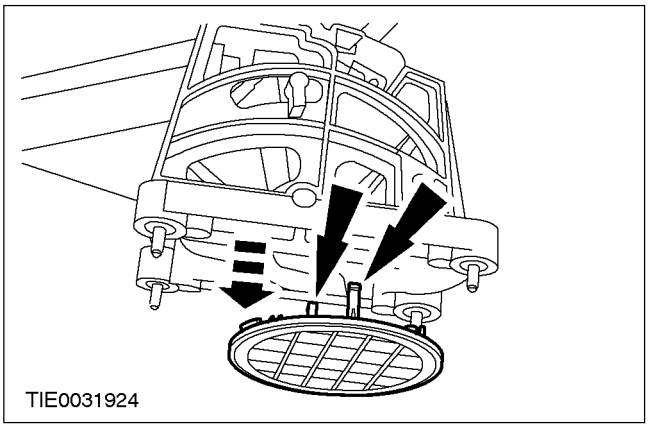


3. Remove the selector lever upper cover.



4. Remove the selector lever lower cover.

- Depress the two retaining lugs.



Assembly

1. To assemble, reverse the disassembly procedure.

SECTION 309-00 Exhaust System

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

SPECIFICATIONS

Specifications 309-00-2

DESCRIPTION AND OPERATION

Exhaust System 309-00-3
Vehicles with 1.8L and 2.0L engine 309-00-3
Vehicles with 2.5L engine 309-00-4
Vehicles with Diesel engine 309-00-5

REMOVAL AND INSTALLATION

Dual Converter Y-Pipe ..... (25 002 0) 309-00-6
Catalytic Converter — 1.8L/2.0L ..... (25 250 0) 309-00-8
Catalytic Converter — 2.5L ..... (25 250 0) 309-00-10
Exhaust Flexible Pipe ..... (25 004 0) 309-00-12

SPECIFICATIONS

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Lubricant	ESE-M99B144-B
Anti-seize grease	SAM-1C907-A

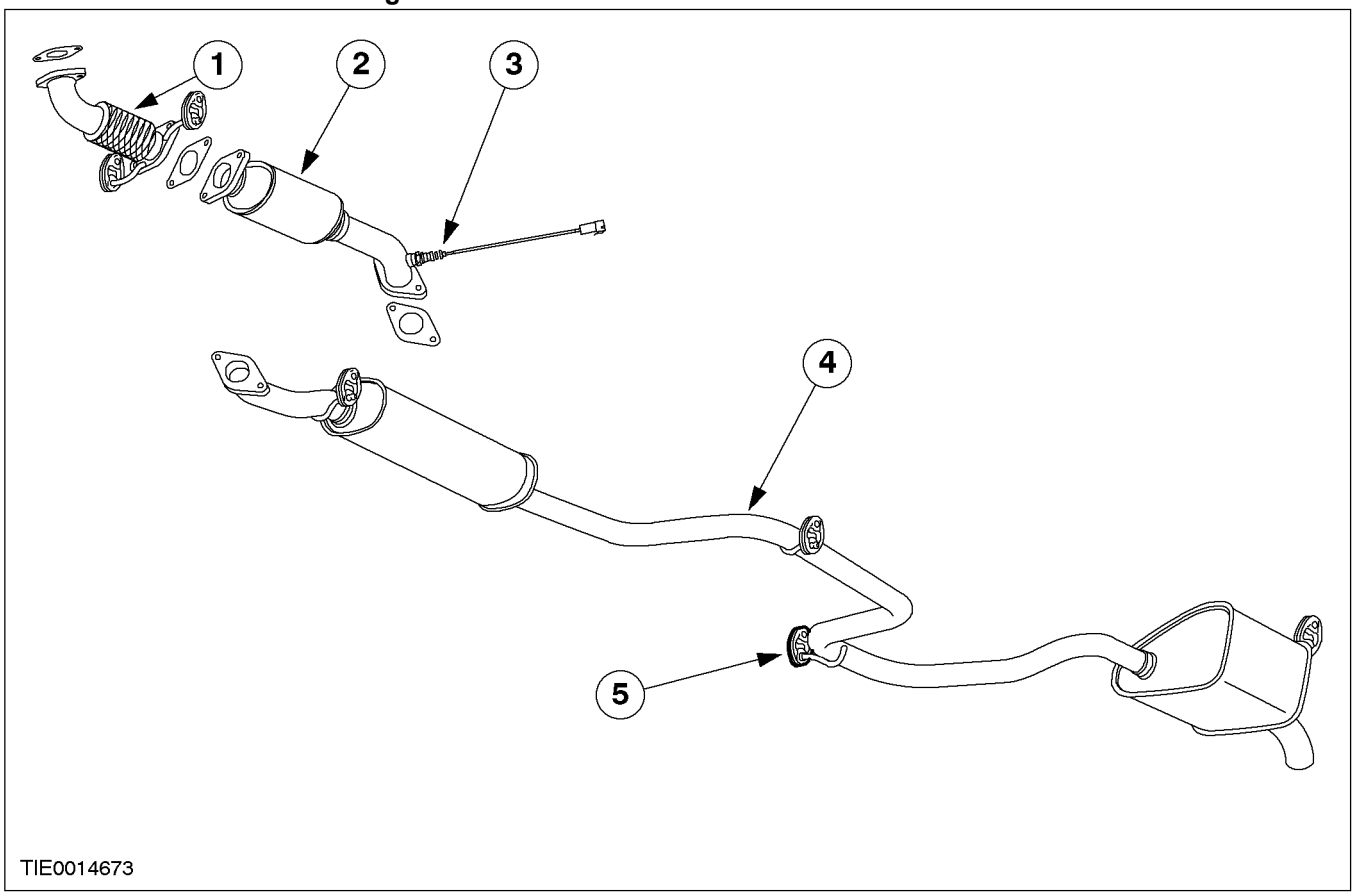
Torque Specifications

Description	Nm	lb-ft	lb-in
Exhaust flexible pipe to exhaust manifold nuts	46	34	–
Exhaust flexible pipe to catalytic converter nuts	46	34	–
Exhaust flexible pipe to front muffler pipe nuts	46	34	–
Exhaust flexible pipe to catalytic converter clamp nuts – Vehicles with 3.0L engine	55	41	–
Exhaust flexible pipe support bracket retaining nut – Vehicles with 3.0L engine	10	–	89
Exhaust manifold heat shield retaining bolts – Vehicles with 3.0L engine	11	8	–
Heated oxygen sensor	48	35	–
Catalytic monitor sensor	46	34	–
Catalytic converter support bracket retaining bolts	46	34	–
Catalytic converter to turbocharger nuts	46	34	–
Catalytic converter to front muffler pipe nuts	46	34	–
Catalytic converter to exhaust manifold nuts	46	34	–
Catalytic converter to exhaust manifold nuts – Vehicles with 3.0L engine	25	18	–
Catalytic converter heat shield retaining bolts – Vehicles with 3.0L engine	11	8	–
Catalytic converter to engine block nuts – Vehicles with 3.0L engine	23	17	–
Turbocharger heatshield retaining bolts	8	–	71
Dual converter Y-pipe support bracket retaining nut	10	–	89
Dual converter Y-pipe to rear catalytic converter nuts	46	34	–
Dual converter Y-pipe to left-hand side catalytic converter nuts	46	34	–
Dual converter Y-pipe to right-hand side catalytic converter nuts	46	34	–
Right-hand wiring rail retaining nuts – Vehicles with 3.0L engine	6	–	53

DESCRIPTION AND OPERATION

Exhaust System

Vehicles with 1.8L and 2.0L engine

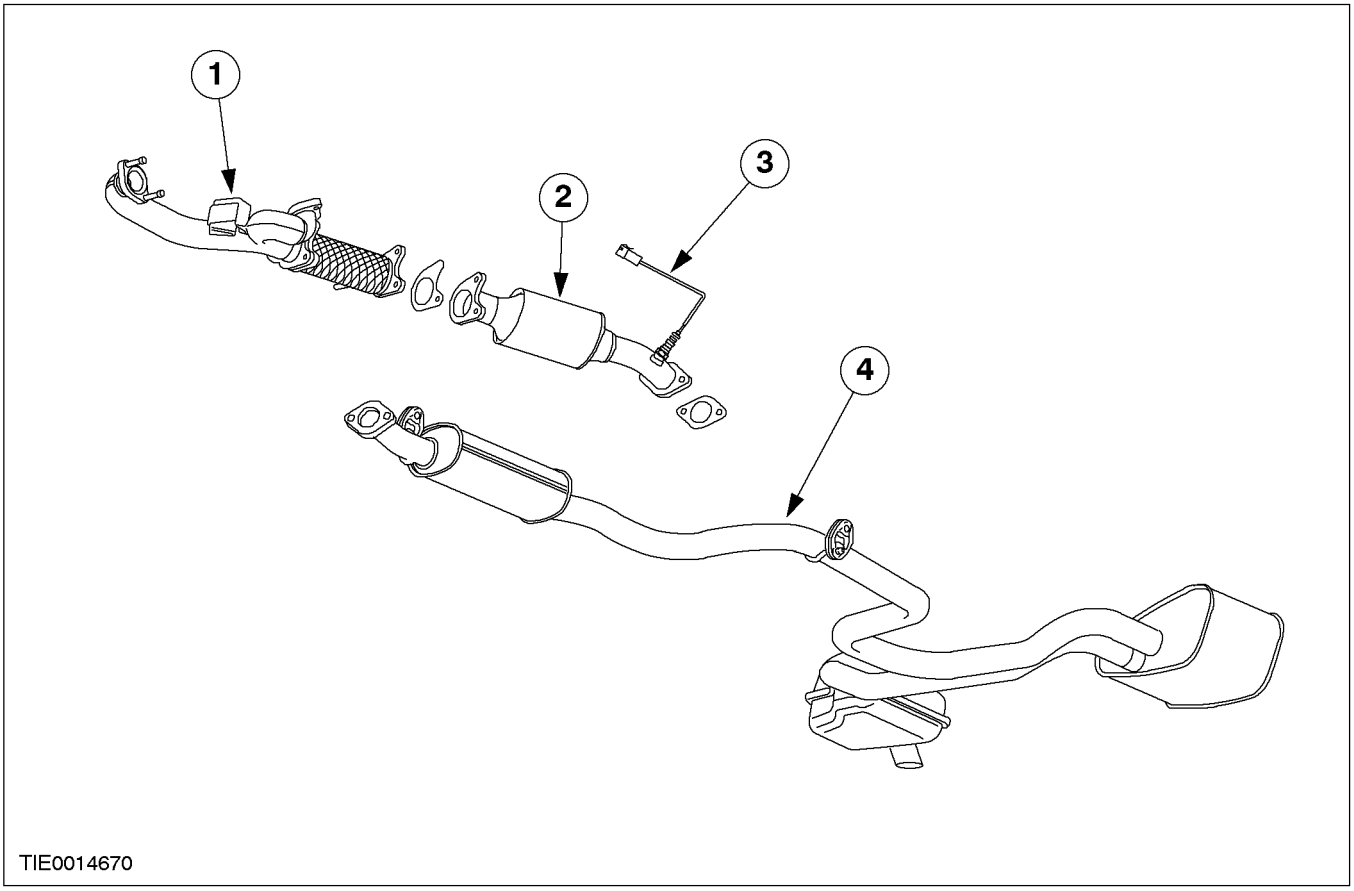


Item	Part Number	Description
1		Exhaust flexible pipe
2		Catalytic converter
3		Heated oxygen sensor

Item	Part Number	Description
4		Muffler and tailpipe assembly
5		Hanger and insulator - sedan only

DESCRIPTION AND OPERATION

Vehicles with 2.5L engine

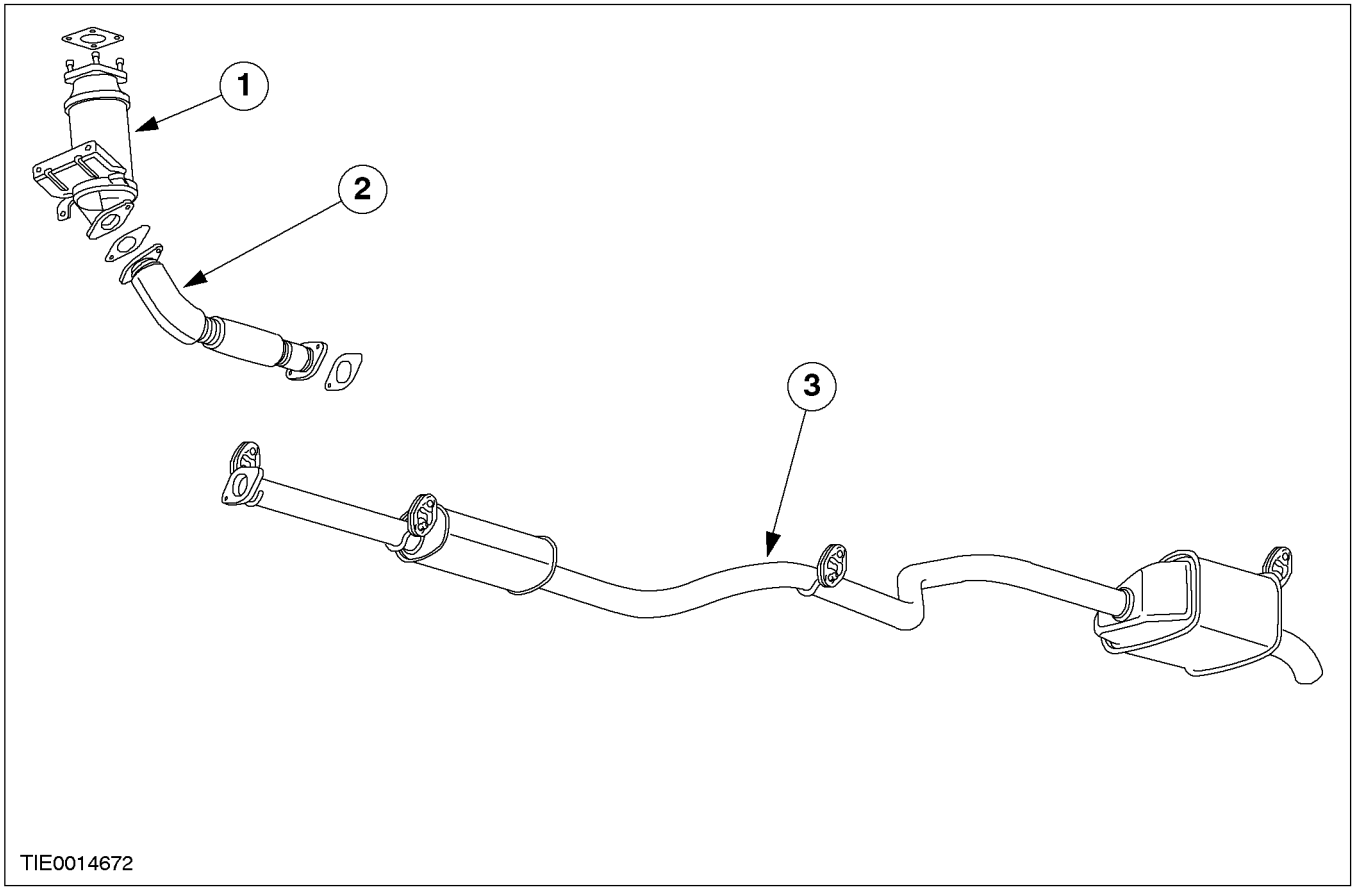


Item	Part Number	Description
1		Dual converter Y-pipe
2		Catalytic converter

Item	Part Number	Description
3		Heated oxygen sensor
4		Muffler and tailpipe assembly

DESCRIPTION AND OPERATION

Vehicles with Diesel engine



Item	Part Number	Description
1		Catalytic converter
2		Exhaust flexible pipe
3		Muffler and tailpipe assembly

REMOVAL AND INSTALLATION

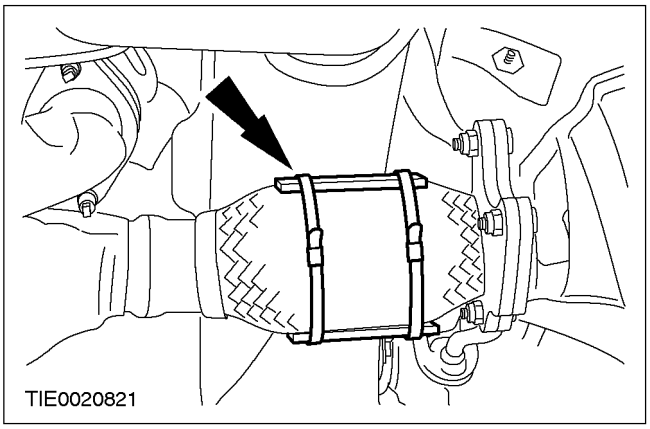
Dual Converter Y-Pipe (25 002 0)

Name	Specification
Lubricant	ESE-M99B144-B
Anti-seize grease	SAM-1C9107A

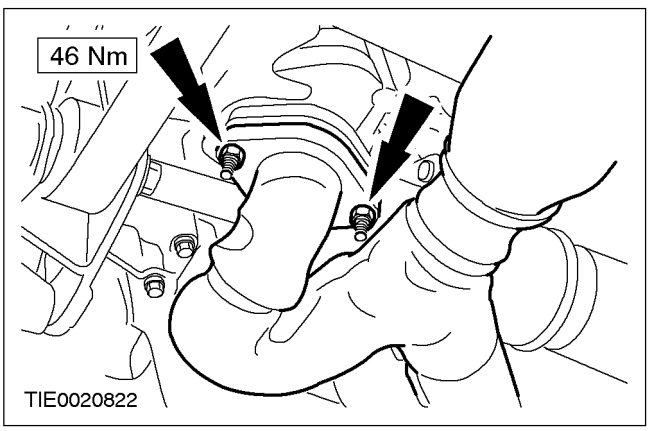
Removal

1. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
2. **CAUTION: Over bending of the exhaust flexible pipe may cause damage resulting in failure.**

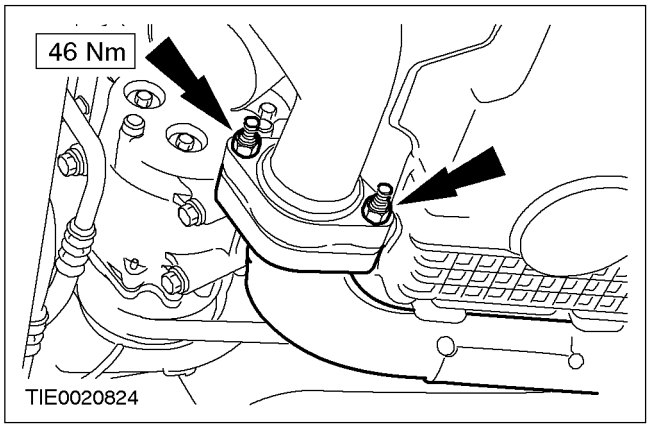
   Support the exhaust flexible pipe with a support wrap or suitable splint.



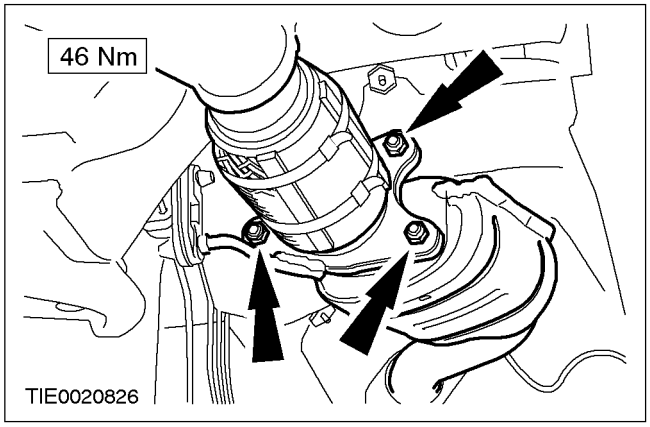
3. **Detach the dual converter Y-pipe from the left-hand exhaust manifold flange.**
   - Discard the nuts.



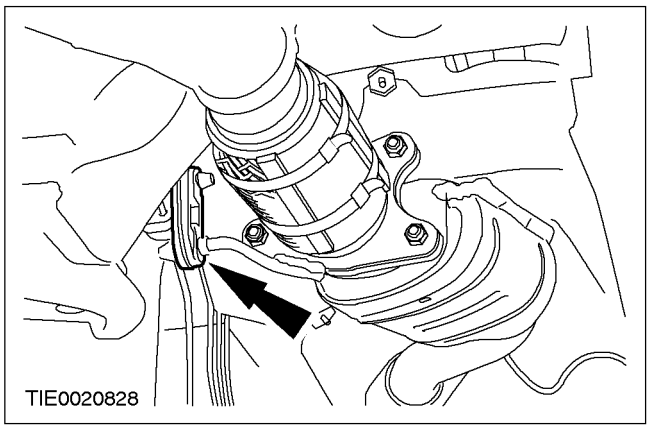
4. **Detach the dual converter Y-pipe from the right-hand exhaust manifold flange.**
   - Discard the nuts.



5. **Detach the dual converter Y-pipe from the catalytic converter.**
   - Discard the gasket and nuts.

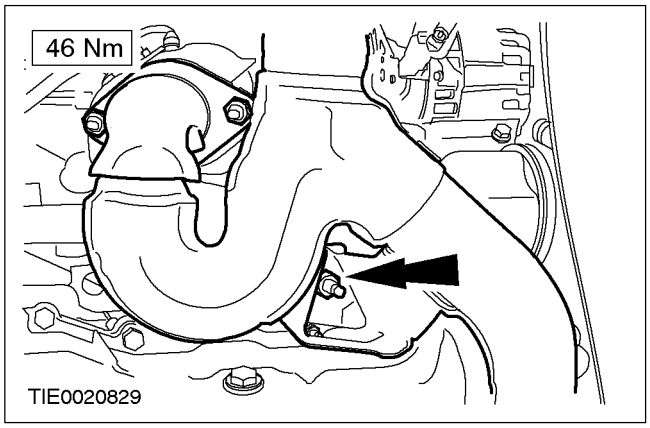


6. **Remove the dual converter Y-pipe exhaust hanger insulator.**



REMOVAL AND INSTALLATION (Continued)

7. Remove the dual converter Y-pipe.



Installation

1. CAUTION: Never use a jointing compound forward of the catalytic converter.

NOTE: Coat the catalytic converter studs with anti-seize grease.

NOTE: Install new gaskets and nuts.

NOTE: Check the exhaust hanger insulator for damage and fatigue. Install a new exhaust hanger insulator as required, using a suitable lubricant.

To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

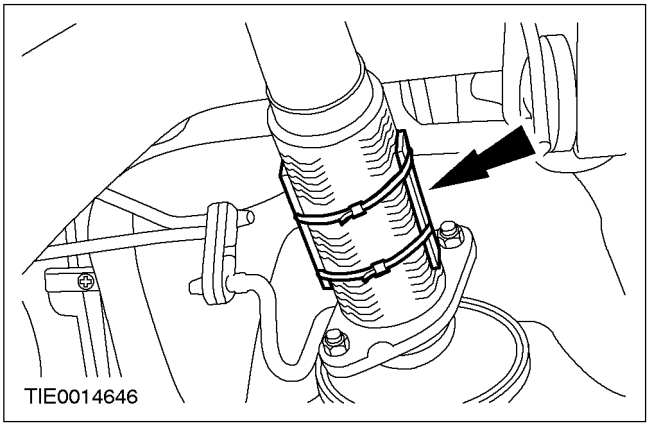
Catalytic Converter — 1.8L/2.0L (25 250 0)

Name	Specification
Anti-seize grease	SAM-1C9107A

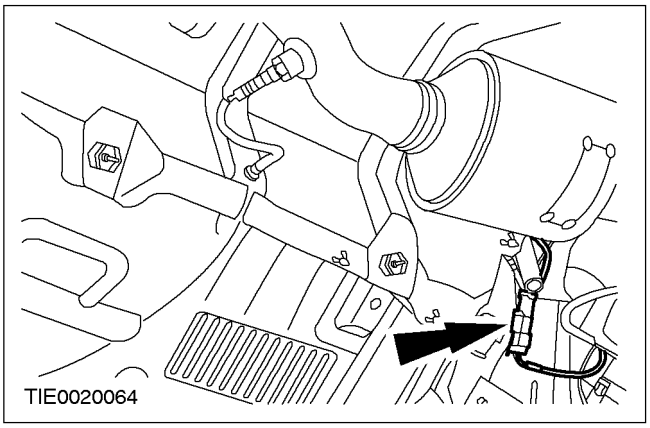
Removal

1. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
2. **CAUTION: Over bending of the exhaust flexible pipe may cause damage resulting in failure.**

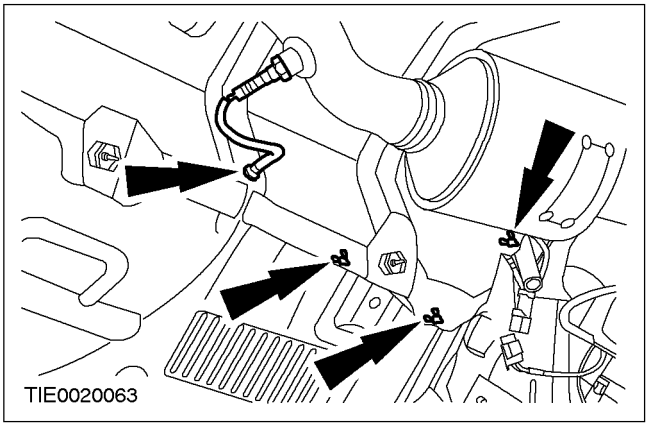
   Support the exhaust flexible pipe with a support wrap or suitable splint.



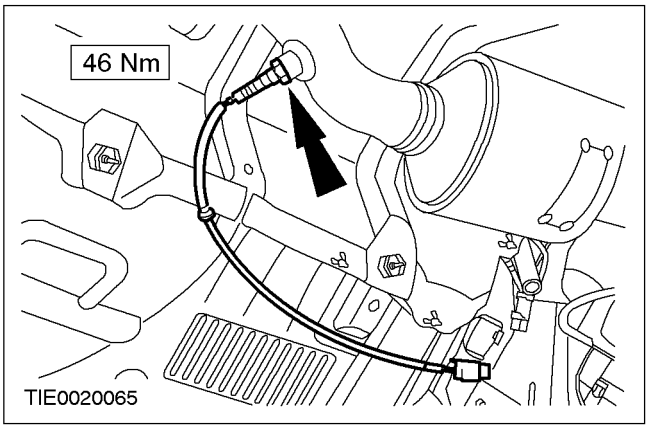
3. **Disconnect the catalyst monitor sensor electrical connector.**



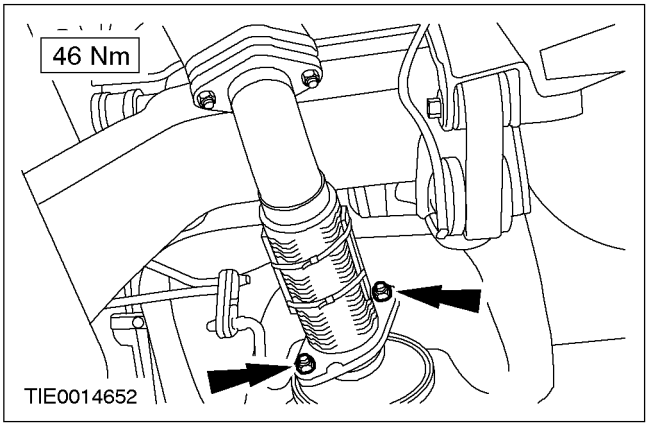
4. **Detach the catalyst monitor sensor wiring harness.**



5. **Remove the catalyst monitor sensor.**



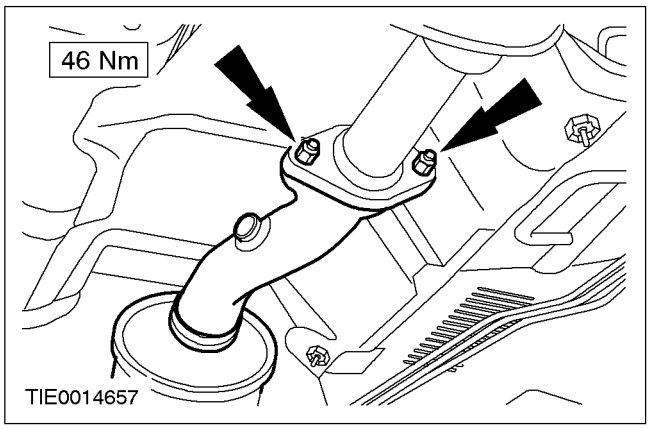
6. **Detach the exhaust flexible pipe from the catalytic converter.**
   - Discard the gasket and nuts.



REMOVAL AND INSTALLATION (Continued)

7. Remove the catalytic converter.

- Discard the gasket and nuts.



Installation

1. CAUTION: Never use jointing compound forward of the catalytic converter.

NOTE: Coat the catalytic converter studs with anti-seize grease.

NOTE: Install new gaskets and nuts.

To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

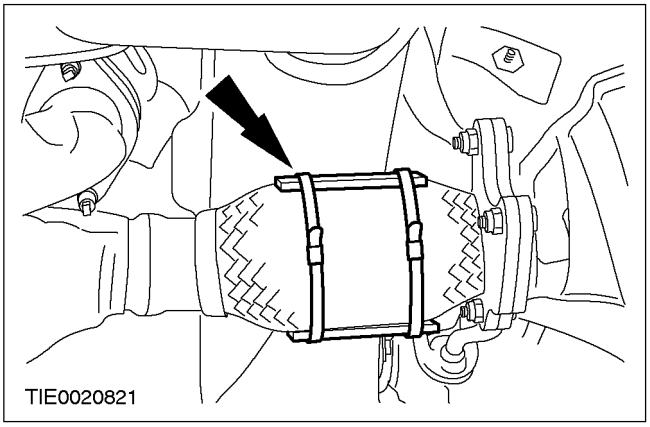
Catalytic Converter — 2.5L (25 250 0)

Name	Specification
Anti-seize grease	SAM-1C9107A

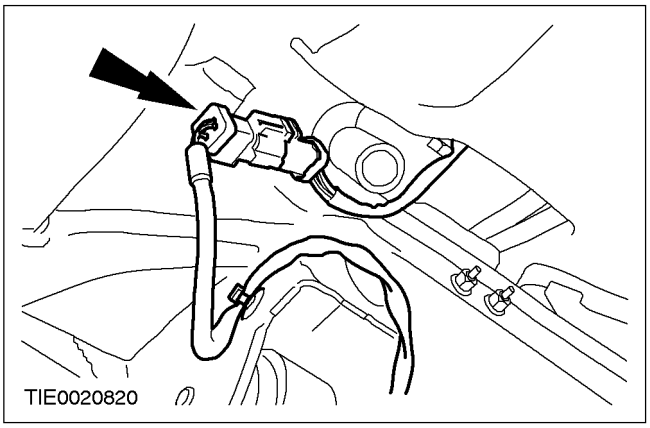
Removal

1. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
2. **CAUTION: Over bending of the flexible pipe may cause damage resulting in failure.**

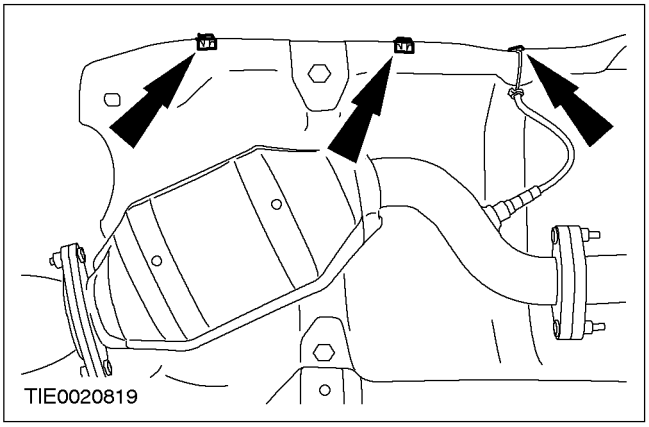
   Support the flexible pipe with a support wrap or suitable splint.



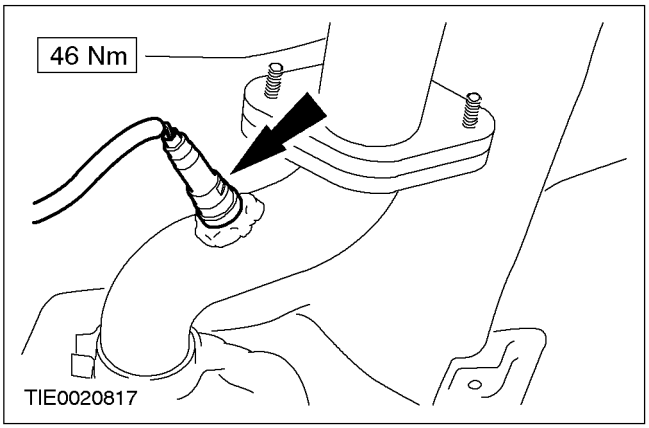
3. **Disconnect the catalyst monitor sensor electrical connector.**



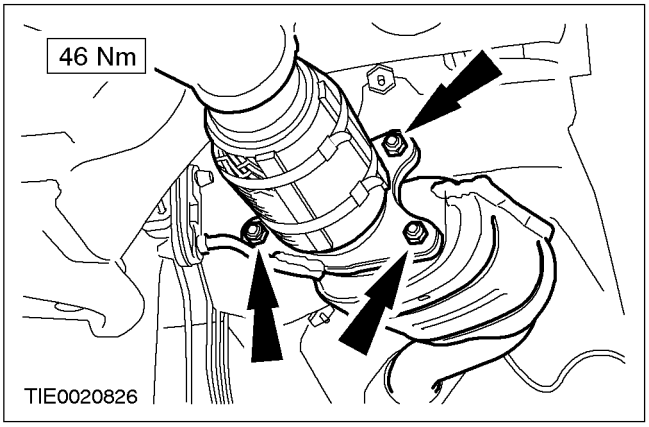
4. **Detach the catalyst monitor sensor wiring harness.**



5. **Remove the catalyst monitor sensor.**



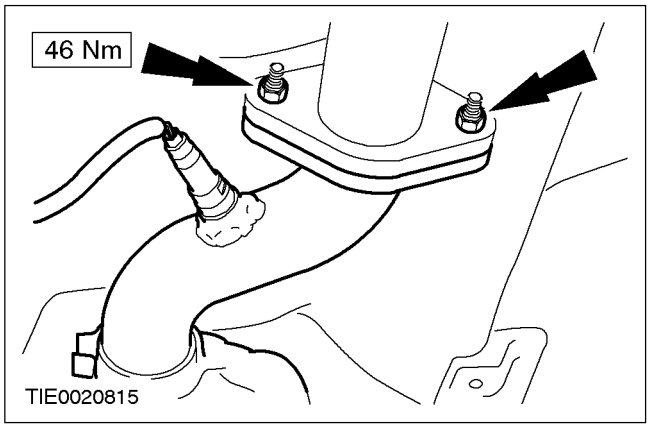
6. **Detach the dual converter Y-pipe from the catalytic converter.**
   - Discard the gasket and nuts.



REMOVAL AND INSTALLATION (Continued)

7. Detach the catalytic converter from the front muffler pipe.

- Discard the gasket and nuts.



8. Remove the catalytic converter.

Installation

1. CAUTION: Never use a jointing compound forward of the catalytic converter.

NOTE: Coat the catalytic converter studs with anti-seize grease.

NOTE: Install a new gasket and nuts.

To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

Exhaust Flexible Pipe (25 004 0)

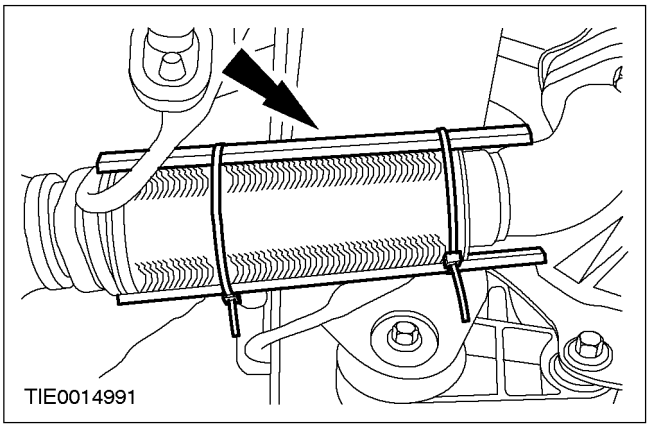
Name	Specification
Anti-seize grease	SAM-1C9107-A

Removal

All vehicles

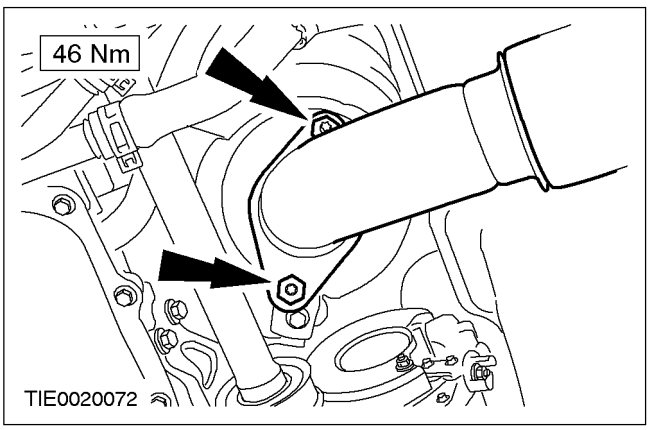
1. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
2. **CAUTION: Over bending of the exhaust flexible pipe may cause damage resulting in failure.**

   Support the exhaust flexible pipe with a support wrap or suitable splint.

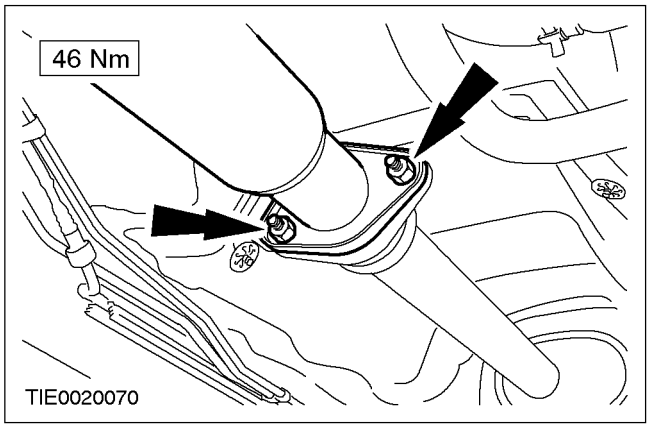


Vehicles with diesel engine

3. **Detach the exhaust flexible pipe from the catalytic converter.**
   - Discard the gasket and nuts.

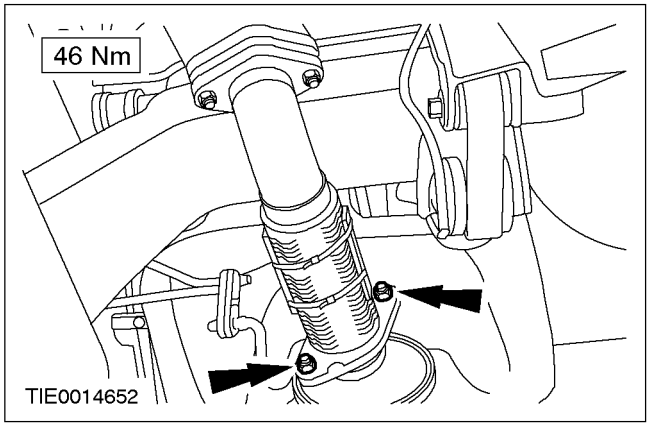


4. **Remove the exhaust flexible pipe.**
   - Discard the gasket and nuts.

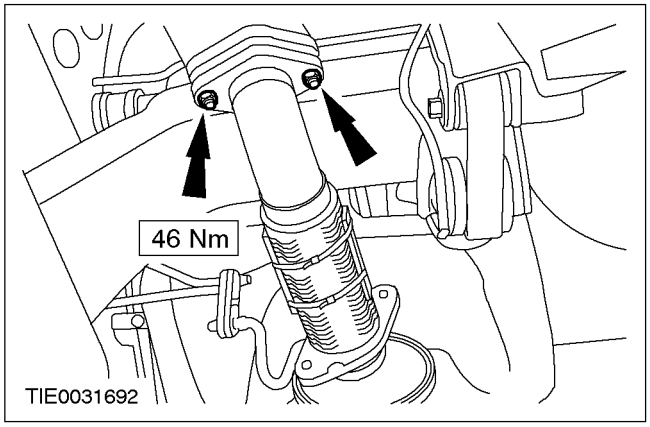


Vehicles with 1.8L or 2.0L engine

5. **Detach the exhaust flexible pipe from the catalytic converter.**
   - Discard the gasket and nuts.



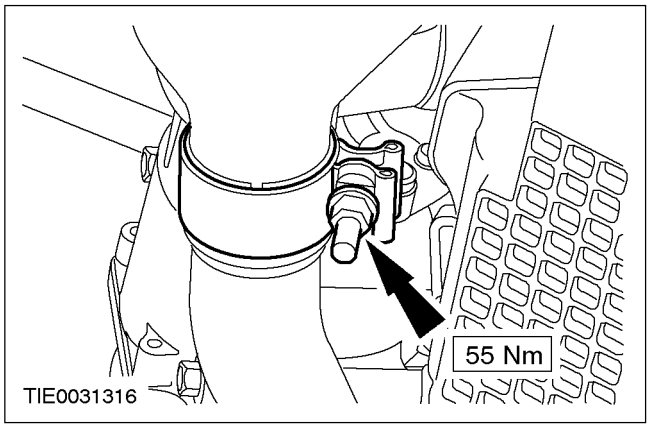
6. **Remove the exhaust flexible pipe.**
   - Discard the gasket and nuts.



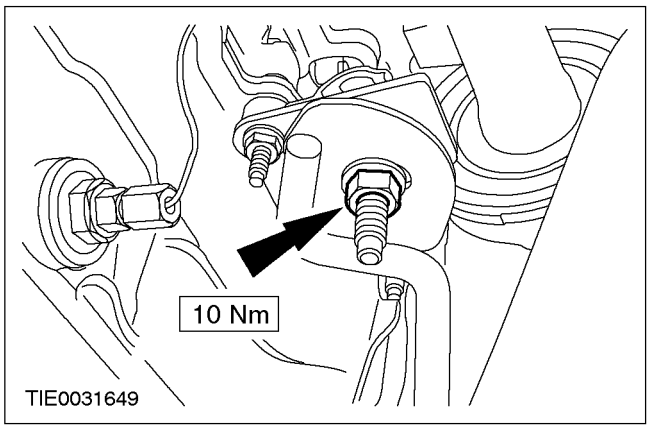
REMOVAL AND INSTALLATION (Continued)

Vehicles with 3.0L engine

7. Detach the exhaust flexible pipe from the catalytic converter (left-hand shown).

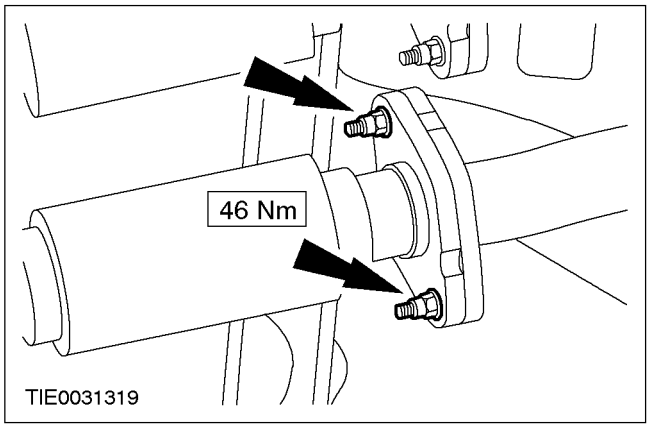


8. Detach the exhaust flexible pipe from the exhaust flexible pipe support bracket (if equipped).



9. Remove the exhaust flexible pipe (left-hand shown).

- Discard the gasket and nuts.



Installation

1. CAUTION: Never use jointing compound forward of the catalytic converter.

NOTE: Coat the front muffler pipe and catalytic converter studs with anti-seize grease.

NOTE: Install new exhaust flexible pipe gasket(s) and nuts.

To install reverse the removal procedure.

SECTION 310-00 Fuel System - General Information

VEHICLE APPLICATION: 2003.0 Mondeo

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DIAGNOSIS AND TESTING

Fuel System — 1.8L/2.0L/2.5L/3.0L 310-00-2
Inspection and Verification 310-00-2

GENERAL PROCEDURES

Fuel System Pressure Release ..... (23 420 0) 310-00-3
Fuel Tank Draining ..... (23 551 0) 310-00-4
Spring Lock Couplings ..... (23 004 0) 310-00-5
Quick Release Coupling 310-00-8

DIAGNOSIS AND TESTING

Fuel System — 1.8L/2.0L/2.5L/3.0L

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Fuel level – Fuel leak(s) – Fuel line(s) – Fuel filter – Fuel tank – Fuel tank filler pipe – Fuel filler cap	– Electrical connector(s) – Wiring harness – Inertia fuel shutoff (IFS) switch

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to WDS to diagnose the system.

GENERAL PROCEDURES

Fuel System Pressure Release (23 420 0)

Release

1. **WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.**

   WARNING: The fuel system remains pressurized for a long time after the ignition is switched off. The fuel pressure must be released before attempting any repairs. Failure to follow this instruction may result in personal injury.

   Remove the fuel pump fuse.
2. **Start the engine and allow to idle until the engine stalls.**
3. **Crank the engine for approximately five seconds to make sure the fuel injection supply manifold pressure has been released.**
4. **Install the fuel pump fuse.**

GENERAL PROCEDURES

Fuel Tank Draining (23 551 0)

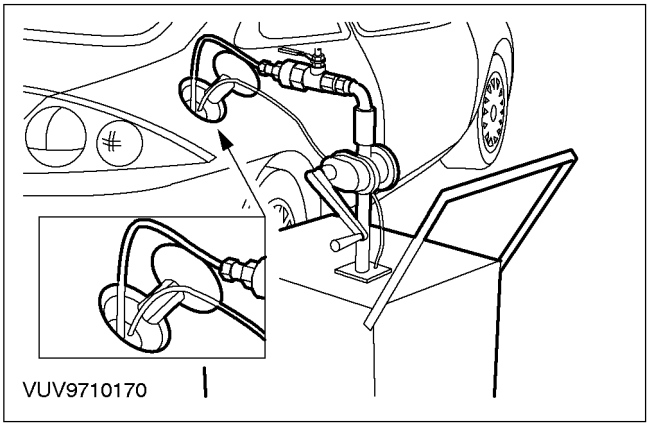
Draining

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: The fuel system remains pressurized for a long time after the ignition is switched off. The fuel pressure must be relieved before attempting any repairs. Failure to follow these instructions may result in personal injury.

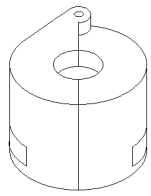
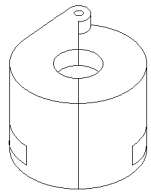
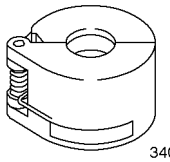
1. **Disconnect the battery ground cable.**
2. **Remove the fuel filler cap.**
3. **NOTE:** To enable the hose to enter the fuel tank it is necessary to cut a 40mm long taper at the end.

   Drain the fuel from the fuel tank using a 12.5mm nylon drain tube with the approved ford fuel drain tank.



GENERAL PROCEDURES

Spring Lock Couplings (23 004 0)

Special Tool(s)	
 D87L-9280-B	Disconnect Tool, Spring Lock Coupling (3/8"yellow) 310-D004 (23-039)
 D87L-9280-B	Disconnect Tool, Spring Lock Coupling (1/2"green) 310-D005 (23-040)
 34003	Disconnect Tool, Spring Lock Coupling (5/8" black) 412-038 (34-003)
 23041	Disconnect Tool, Fuel Line (5/16") 310-040 (23-041)

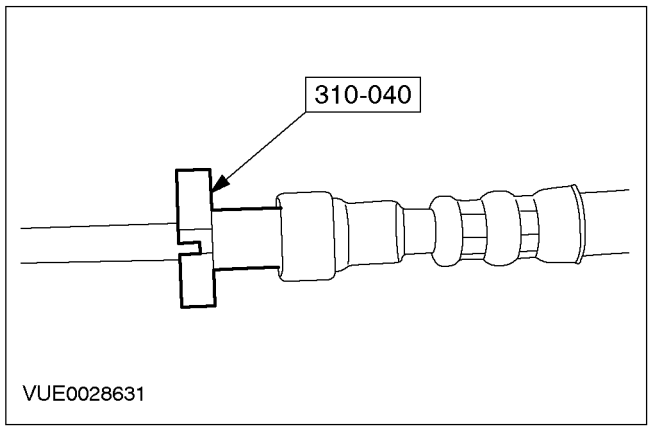
Disconnection

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: The fuel system remains pressurized for a long time after the ignition is switched off. The fuel pressure must be released before attempting any repairs. Failure to follow these instructions may result in personal injury.

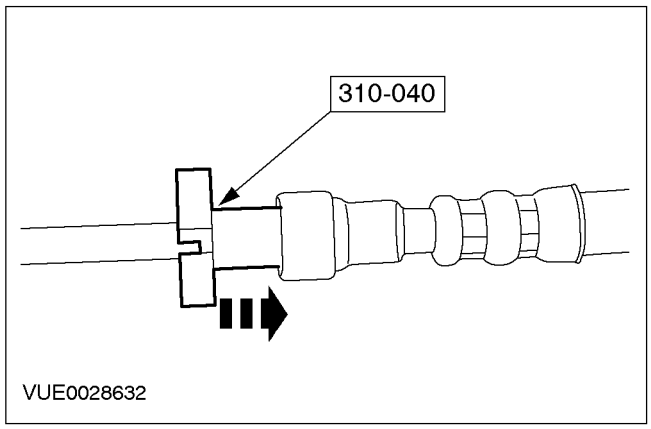
WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

1. **Release the fuel system pressure.** **For additional information, refer to Fuel System Pressure Release in this section.**
2. **Install the special tool to the fuel line.**



3. **NOTE:** Both sides of the spring lock coupling fuel line must be pushed together to enable the special tool to release the spring lock coupling locking tangs.

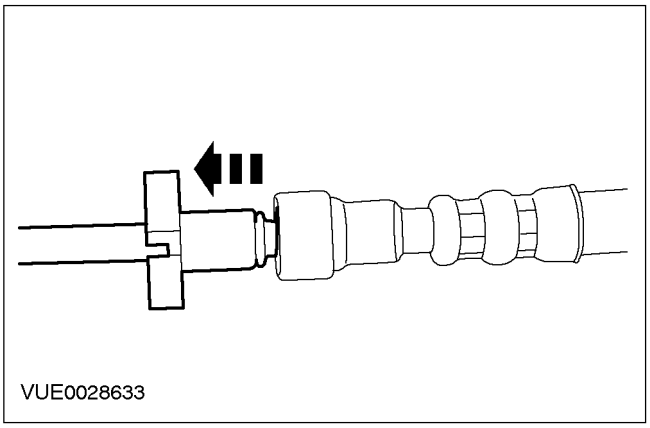
   Slide the special tool into the spring lock coupling to release the locking tangs.



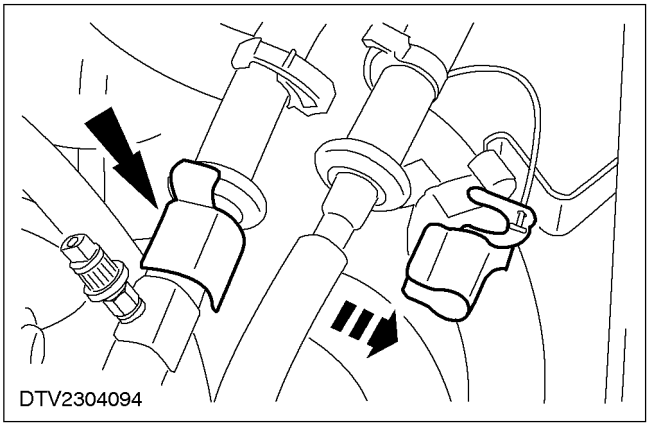
GENERAL PROCEDURES (Continued)

4. Disconnect the fuel line from the spring lock coupling.

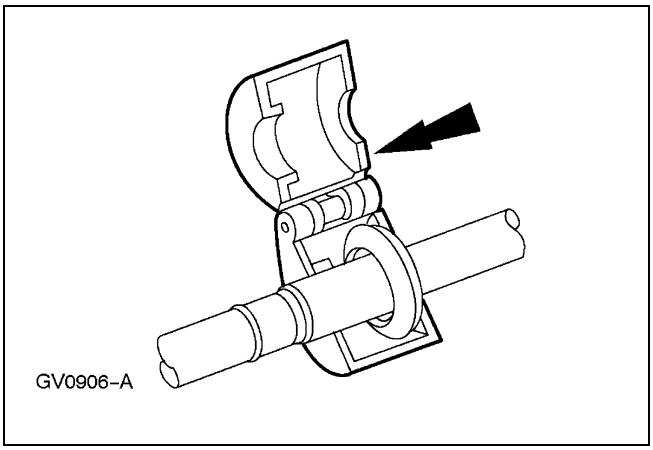
- Allow the fuel to drain into a suitable container.



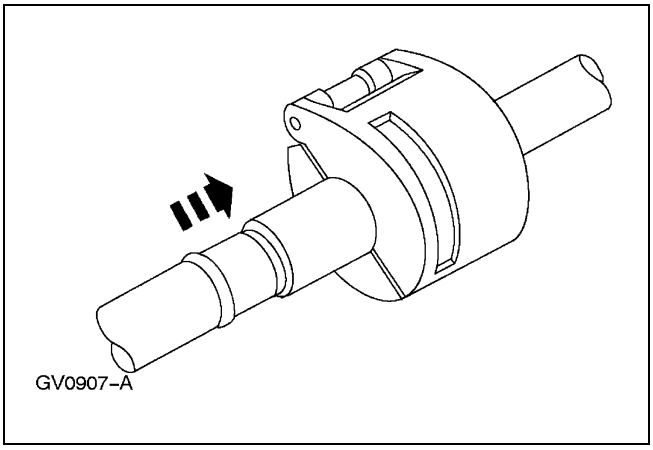
5. Remove the safety clips from the fuel line spring lock couplings.



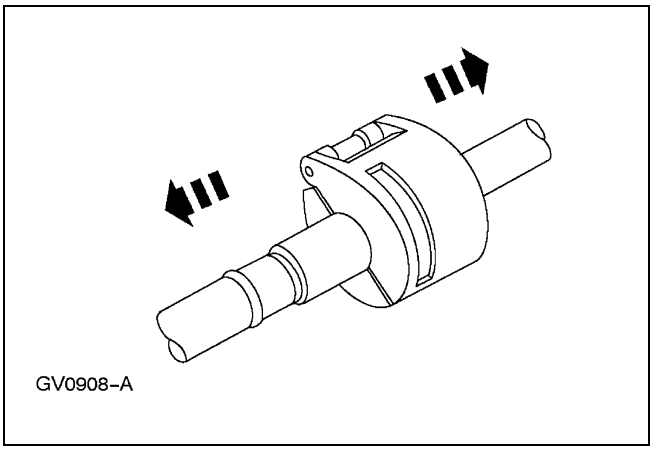
6. Install the special tool onto the fuel line spring lock coupling.



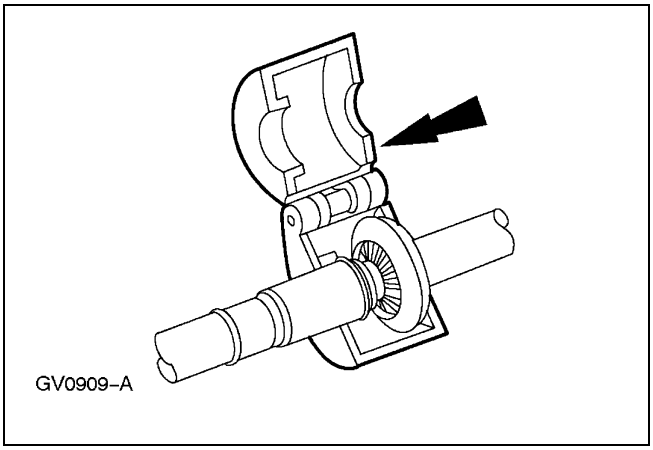
7. Close and push the fuel line spring lock coupling tool into the open side of the cage.



8. Separate the fuel line spring lock coupling.



9. Remove the special tool.



GENERAL PROCEDURES (Continued)

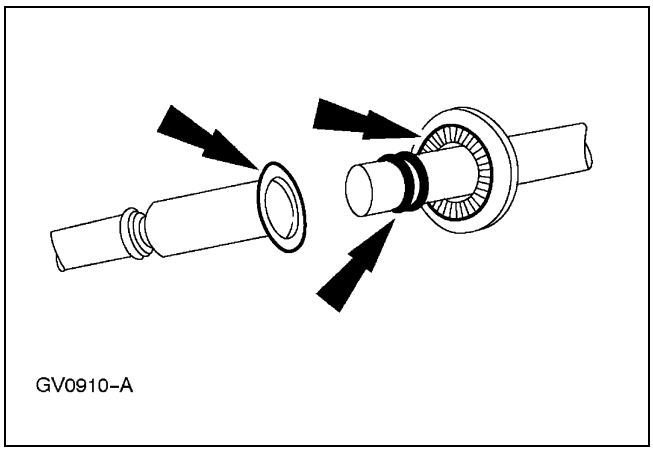
Installation

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: The fuel system remains pressurized for a long time after the ignition is switched off. The fuel pressure must be released before attempting any repairs. Failure to follow these instructions may result in personal injury.

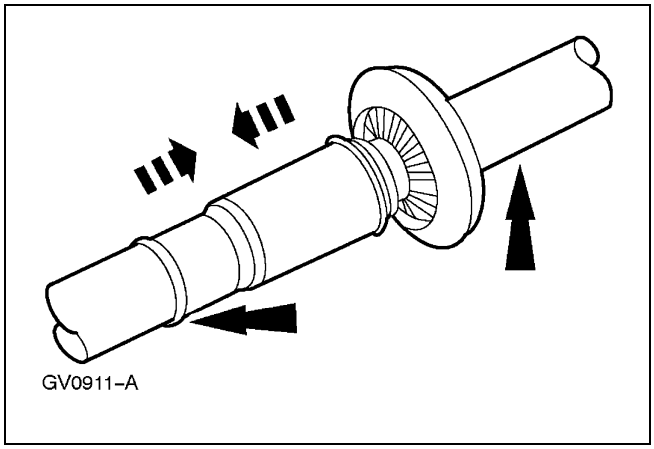
WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

1. **Inspect and clean both fuel line spring lock coupling ends. Install new O-rings and garter springs if necessary.**

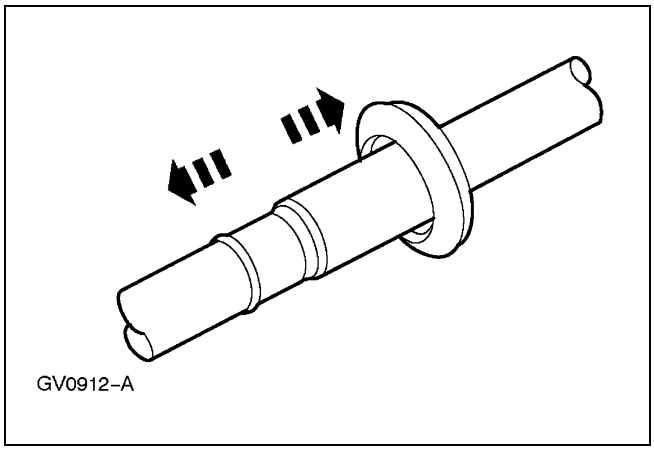

GV0910-A

2. **NOTE:** Lubricate the O-rings seals with clean engine oil.

   Insert the male fitting into the female end and push until the garter spring snaps over the flared end of the female fitting.

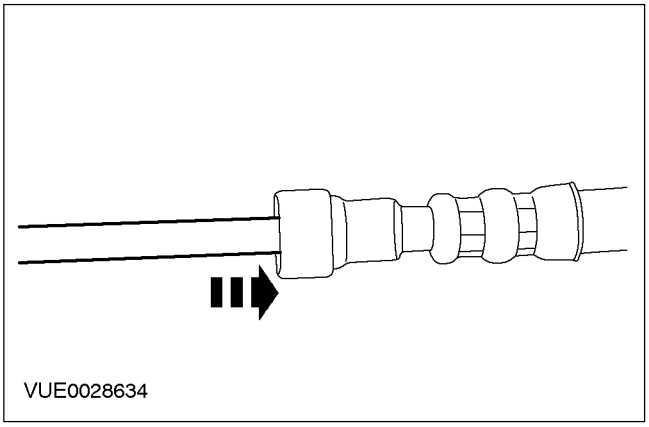

GV0911-A

3. **Make sure the fuel line spring lock coupling is engaged by pulling on the lines.**


GV0912-A

4. **NOTE:** Make sure the collar on the fuel line is inserted fully into the fuel line spring lock coupling and an audible click is heard.

   Install the spring lock coupling to the fuel line.


VUE0028634

GENERAL PROCEDURES

Quick Release Coupling

Disconnection

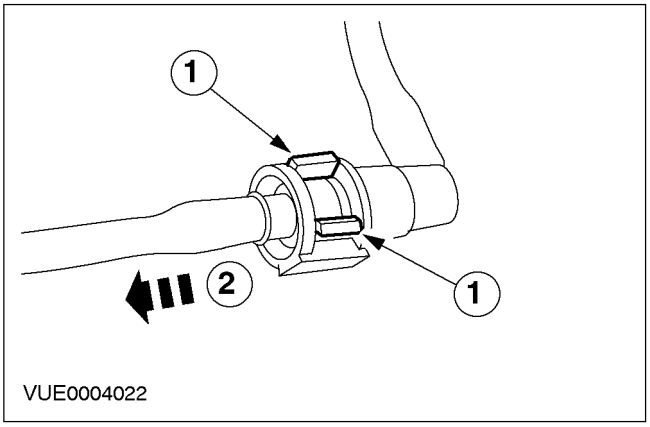
WARNING: Do not carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and can ignite. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

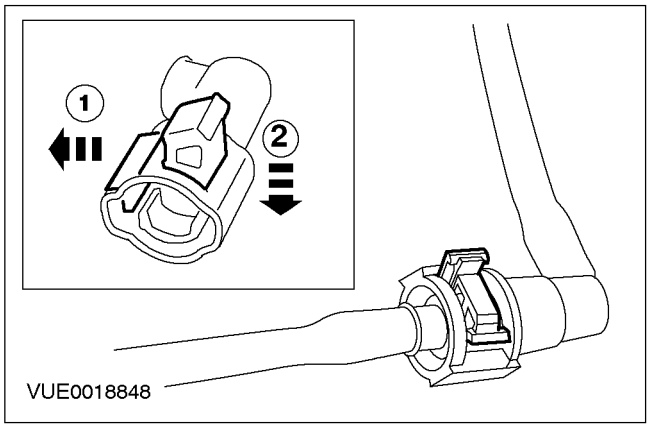
CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

NOTE: Fuel supply line connectors are white or are identified by a white band. Fuel return line connectors are red or are identified by a red band.

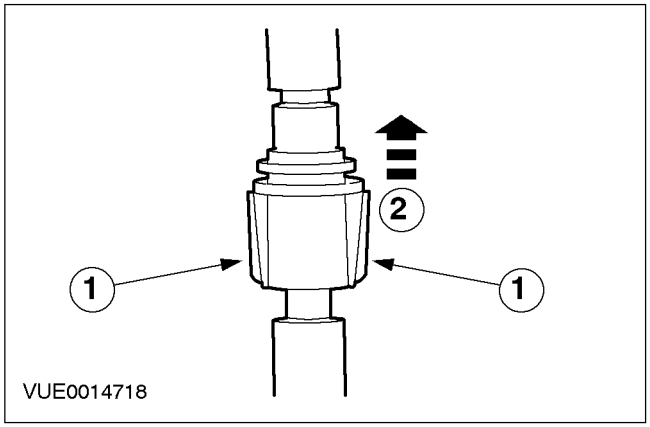
1. **Release the fuel system pressure. For additional information, refer to Fuel System Pressure Release in this section.**
2. **Disconnect the fuel line quick release coupling.**
   1. Press the fuel line quick release coupling locking tangs.
   2. Disconnect the fuel line quick release coupling.



3. **Disconnect the fuel line quick release coupling.**
   1. Pull the fuel line quick release coupling locking tang.
   2. Push the clip through the fuel line quick release coupling to release the fuel line.



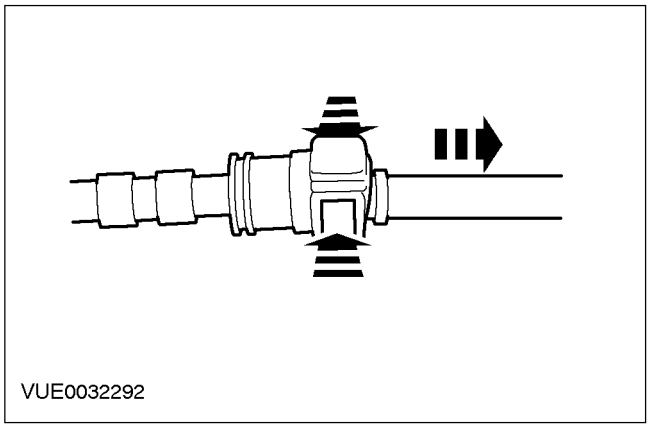
4. **Disconnect the fuel line quick release coupling.**
   1. Press the fuel line quick release coupling locking tangs.
   2. Disconnect the fuel line quick release coupling.



GENERAL PROCEDURES (Continued)

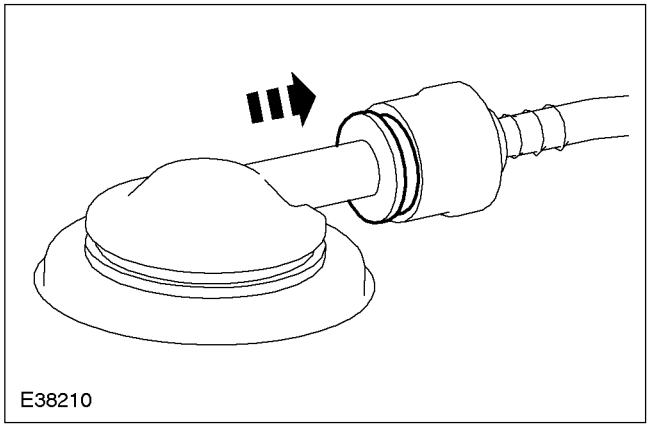
5. Disconnect the fuel line quick release coupling.

- Press the fuel line quick release coupling buttons and pull the fuel line to disconnect.

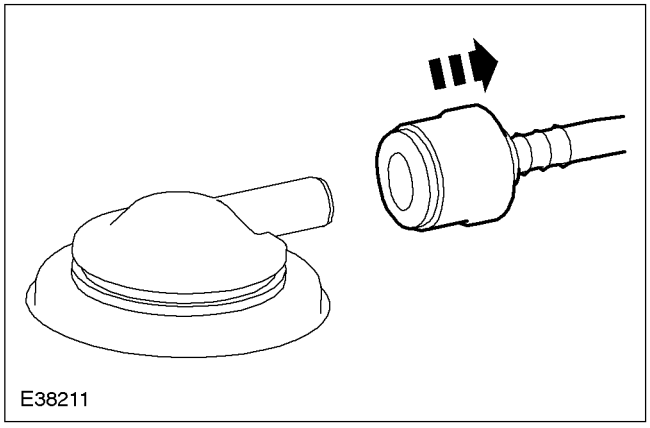


6. Release the fuel tank vent line quick release coupling.

- Press the fuel tank vent line quick release coupling locking release collar.

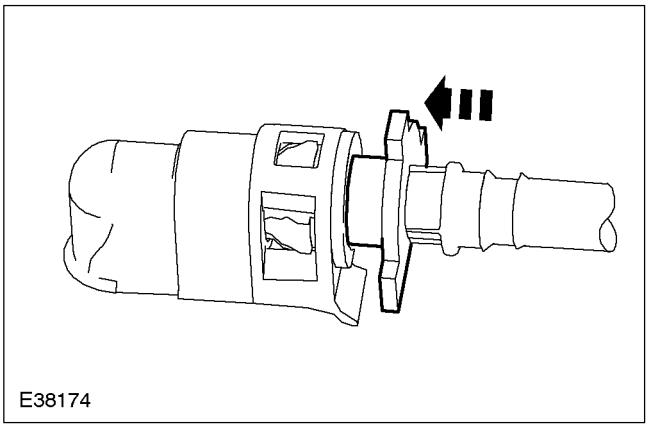


7. Disconnect the fuel tank vent line quick release coupling.

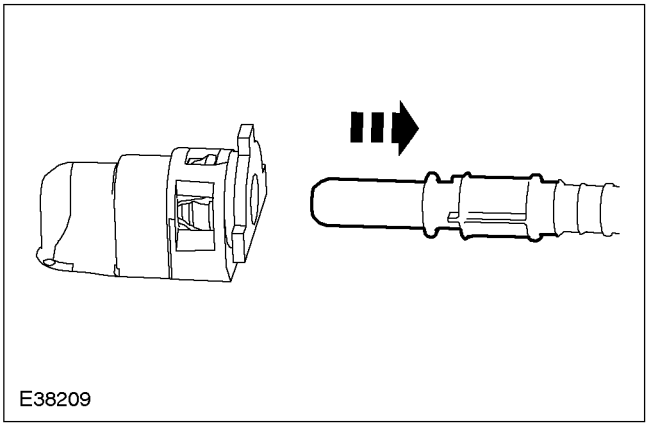


8. Release the fuel line quick release coupling.

- Press the fuel line quick release coupling locking release collar.



9. Disconnect the fuel line quick release coupling.



Connect

WARNING: Do not carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and can ignite. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

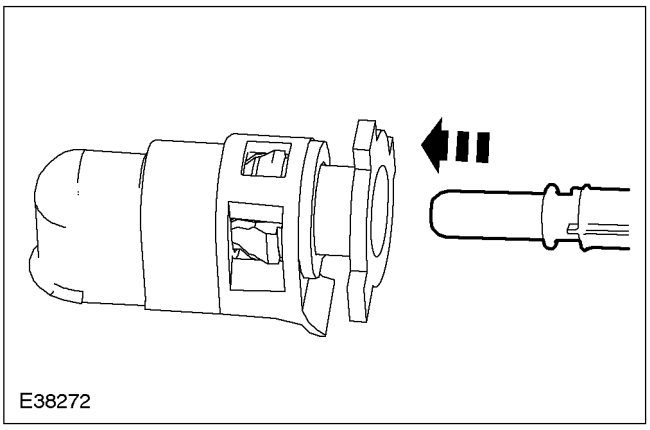
GENERAL PROCEDURES (Continued)

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

NOTE: Fuel supply line connectors are white or are identified by a white band. Fuel return line connectors are red or are identified by a red band.

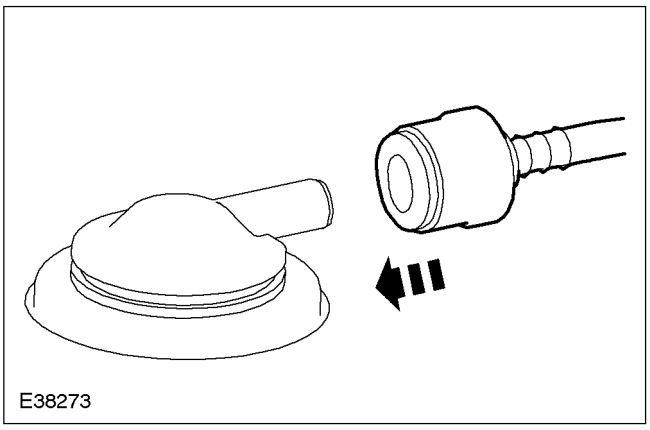
1. **CAUTION: After installation, to make sure that the fuel line is fully seated, pull on the line.**

   Install the fuel line quick release coupling.



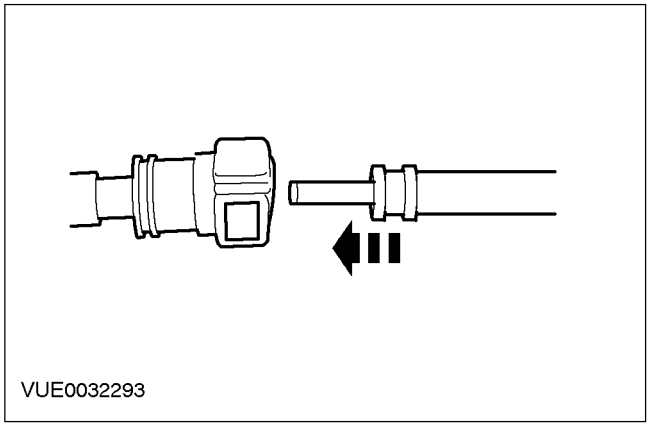
2. **CAUTION: After installation , to make sure that the vent line is fully seated, pull on the line.**

   Install the fuel tank vent line quick release coupling.



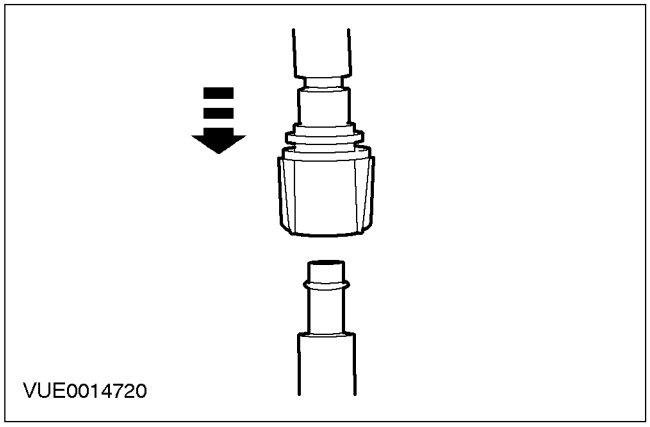
3. **CAUTION: Make sure the fuel line clicks into place when installing the line. To make sure that the fuel line is fully seated, pull on the line.**

   Install the fuel line quick release coupling.



4. **NOTE:** Make sure the collar on the fuel line is inserted fully into the fuel line quick release coupling.

   Install the fuel line quick release coupling.

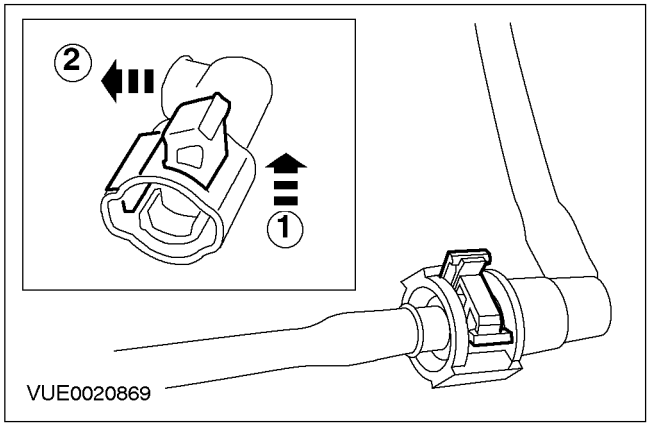


GENERAL PROCEDURES (Continued)

5. **NOTE:** Make sure the collar on the fuel line is inserted fully into the fuel line quick release coupling before the locking tang is locked.

   Install the fuel line quick release coupling.

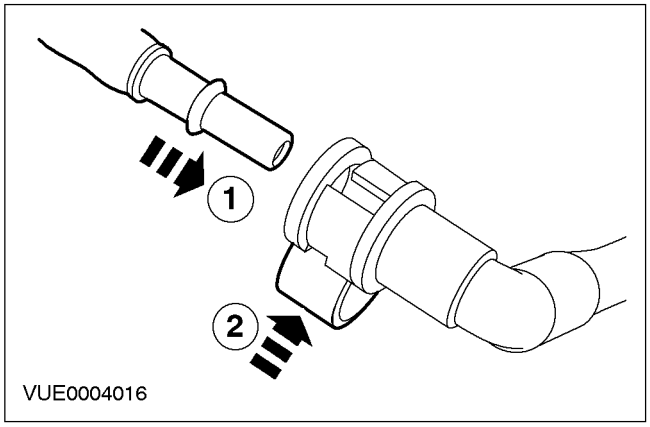
   1. Install the fuel line quick release coupling locking tang.
   2. Rotate the fuel line quick release coupling locking tang into position.



6. **NOTE:** Make sure the collar on the fuel line is inserted fully into the fuel line quick release coupling before the locking tang is locked.

   Install the fuel line quick release coupling.

   1. Install the fuel line quick release coupling.
   2. Press the fuel line quick release coupling locking tang into position.



SECTION 310-01 Fuel Tank and Lines

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

SPECIFICATIONS

Specifications 310-01-2

DESCRIPTION AND OPERATION

Fuel Tank and Lines 310-01-3

DIAGNOSIS AND TESTING

Fuel Tank and Lines 310-01-9
Inspection and Verification 310-01-9

REMOVAL AND INSTALLATION

Fuel Tank ..... (23 554 0) 310-01-10
Fuel Pump Module ..... (23 534 0) 310-01-16
Fuel Level Sensor..... 310-01-17
Fuel Tank Filler Pipe..... (23 572 0) 310-01-18
Fuel Filter — 1.8L/2.0L/2.5L/3.0L ..... (23 545 0) 310-01-21

SPECIFICATIONS

Torque Specifications

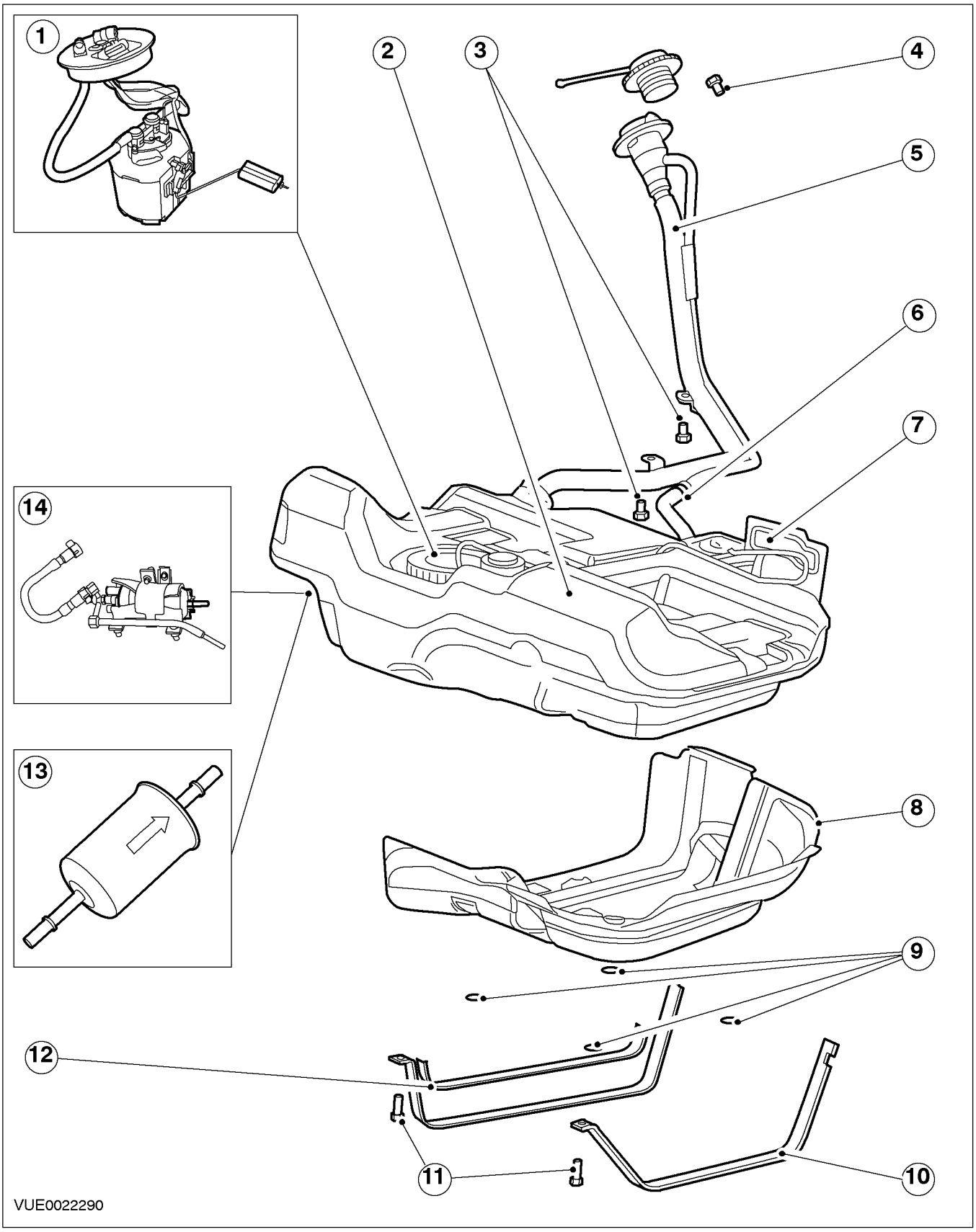
Description	Nm	lb-ft	lb-in
Fuel tank support strap retaining bolts	25	18	-
Fuel filter retaining bolt - All except vehicles with diesel engine	9	-	80
Fuel pump retaining bolts - Vehicles with 115 PS diesel engine	9	-	80
Fuel pump module - All except vehicles with diesel engine	85	63	-
Fuel level sensor - Vehicles with diesel engine	85	63	-
Rear crossmember retaining bolts	120	89	-
Rear stabilizer bar connecting link retaining nuts	48	35	-

DESCRIPTION AND OPERATION

Fuel Tank and Lines

DESCRIPTION AND OPERATION (Continued)

Fuel Tank and Lines

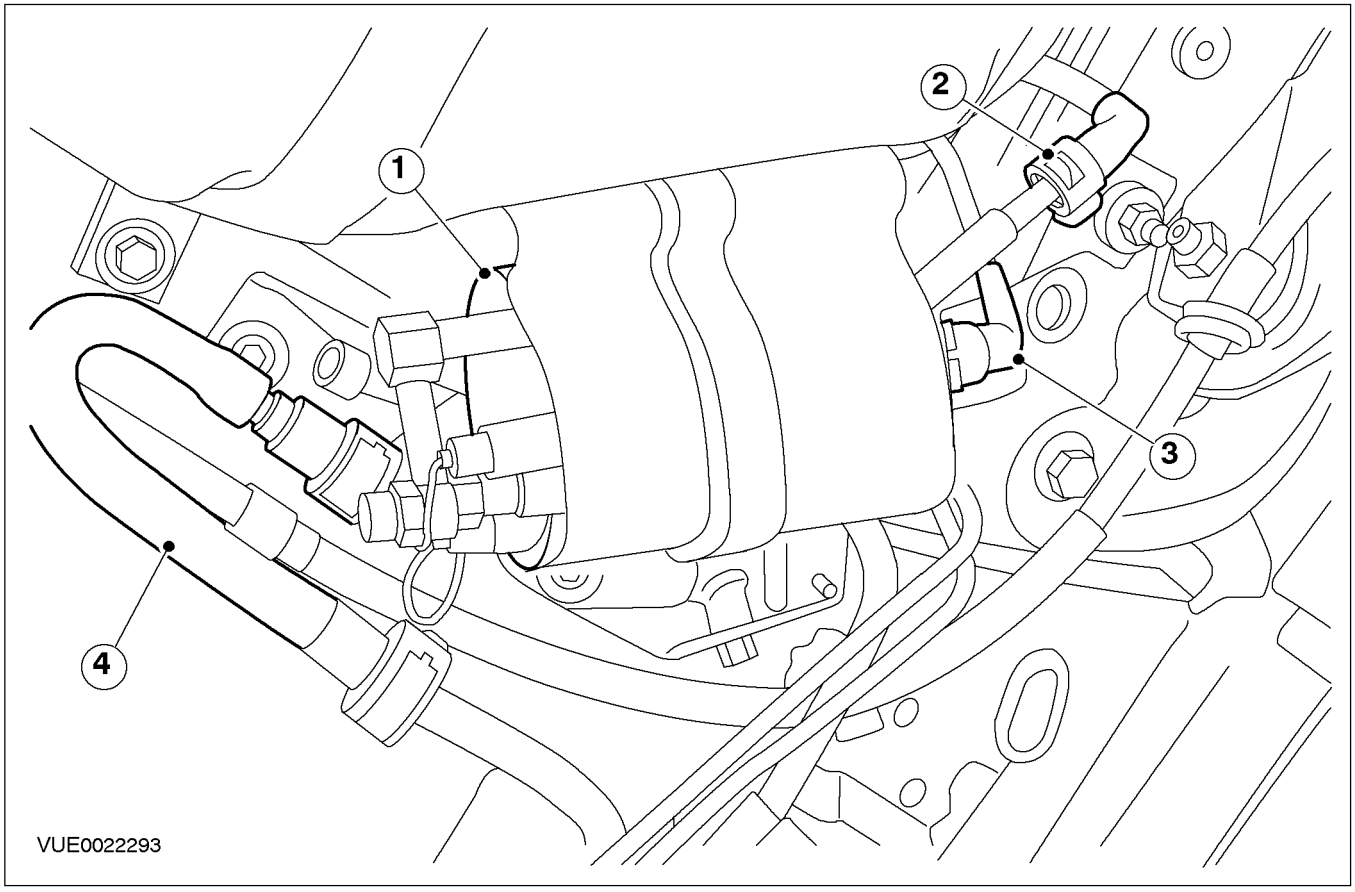


DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1	-	Fuel pump module/fuel level sensor
2	-	Fuel tank
3	-	Lower fuel tank filler pipe retaining bolts
4	-	Upper Fuel tank filler pipe retaining bolt
5	-	Fuel tank filler pipe
6	-	Fuel tank filler pipe breather hose
7	-	Heat shield - Wagon
8	-	Fuel tank heat shield

Item	Part Number	Description
9	-	Fuel tank heat shield retaining clips
10	-	Fuel tank support straps
11	-	Fuel tank support strap retaining bolts
12	-	Fuel tank support strap insulator
13	-	Fuel filter - All except vehicles with diesel engine
14	-	Fuel pump - Vehicles with 115 PS diesel engine

Fuel Pump - Vehicles with 115 PS Diesel Engine



Item	Part Number	Description
1	-	Fuel pump

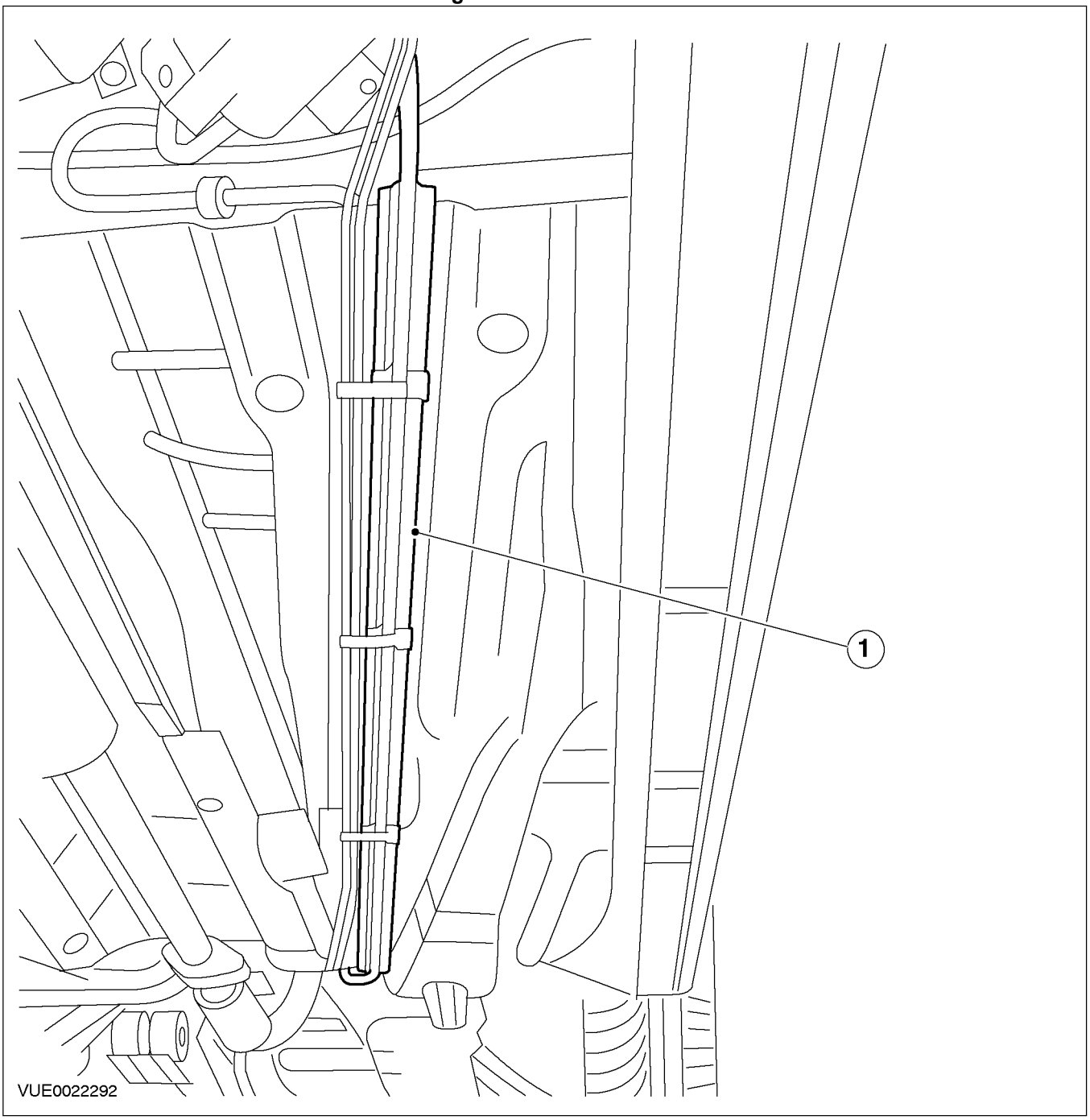
Item	Part Number	Description
2	-	Fuel pump to fuel tank return line

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
3	-	Fuel tank to fuel pump supply line

Item	Part Number	Description
4	-	Fuel pump to fuel filter supply line

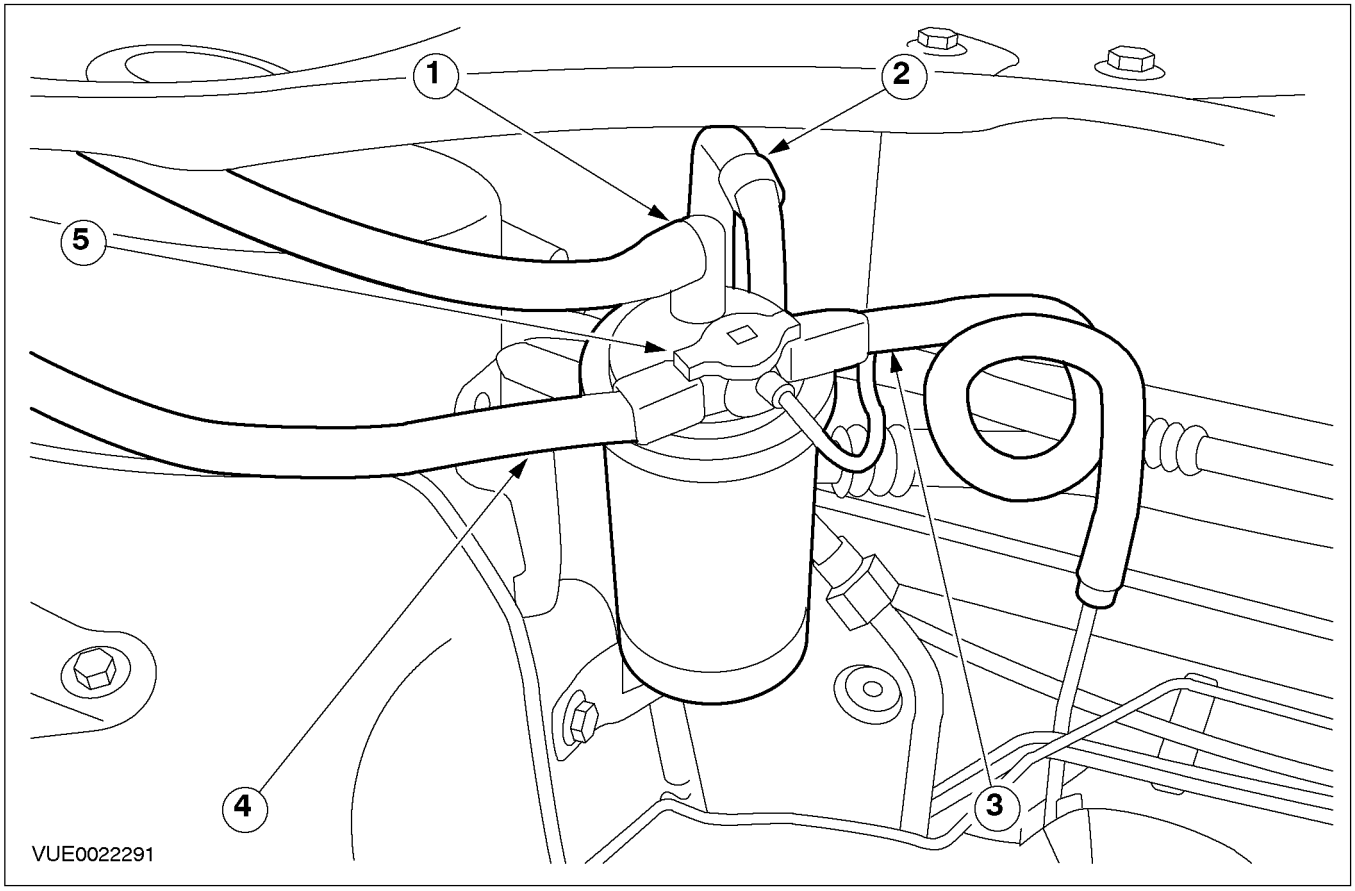
Fuel Cooler - Vehicles with 115 PS Diesel Engine



Item	Part Number	Description
1	-	Cooling fins

DESCRIPTION AND OPERATION

Fuel Filter - Vehicles with 2.0L Diesel Engine

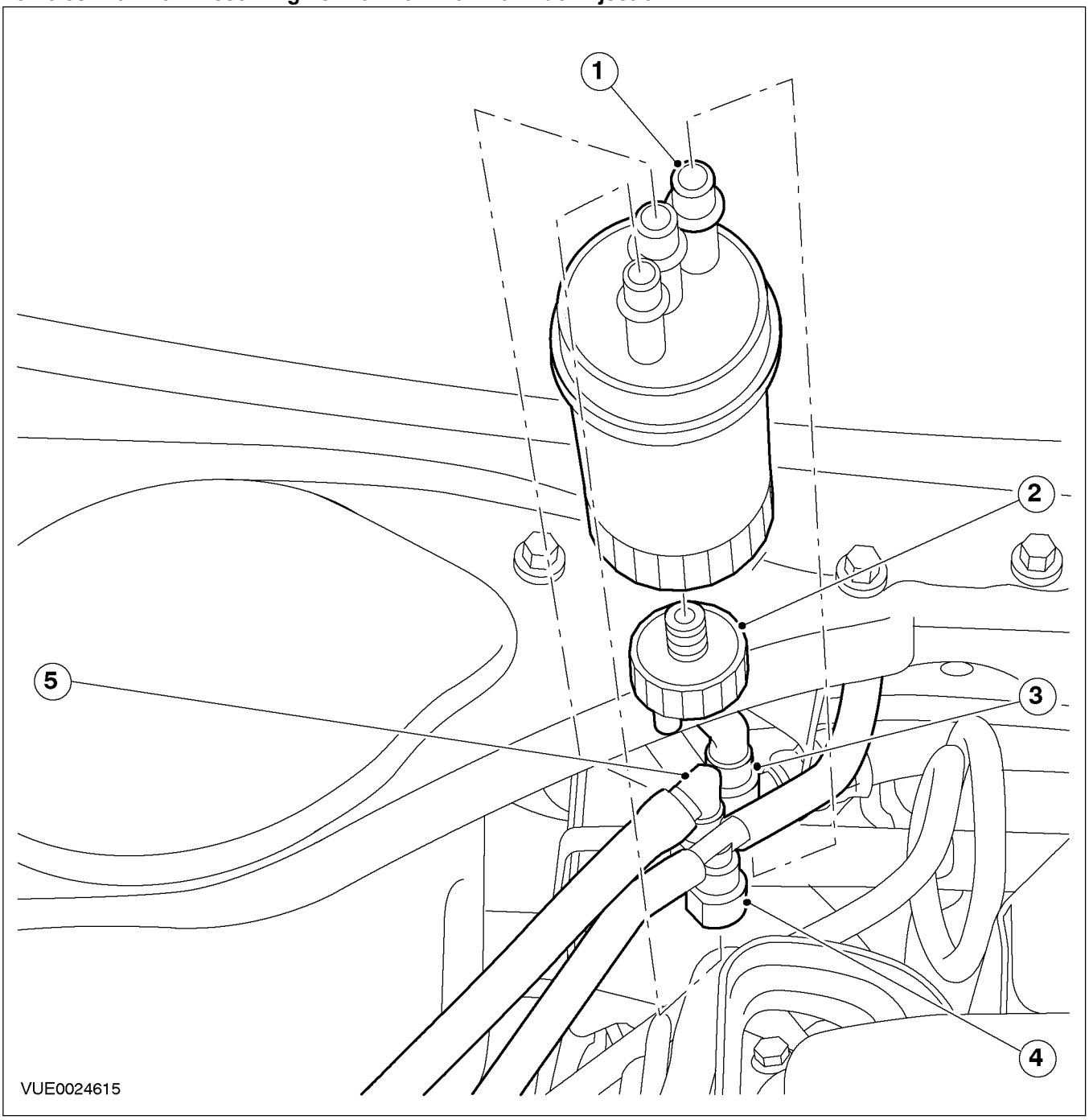


Item	Part Number	Description
1	-	Fuel filter to fuel injection pump fuel supply line
2	-	Fuel tank to fuel filter fuel supply line

Item	Part Number	Description
3	-	Fuel filter to fuel tank fuel return line
4	-	Fuel injection pump to fuel filter fuel return line
5	-	Fuel return line regulating valve

DESCRIPTION AND OPERATION

Vehicles with 2.0L Diesel Engine with Common Rail Fuel Injection



Item	Part Number	Description
1	-	Fuel filter
2	-	Water drain plug
3	-	Fuel tank to fuel filter fuel supply line

Item	Part Number	Description
4	-	Fuel pump to fuel filter fuel return line
5	-	Fuel filter to fuel pump fuel supply line

If carrying out a fuel filter water drain procedure the fuel filter must be removed.

DIAGNOSIS AND TESTING

Fuel Tank and Lines

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

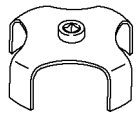
Visual Inspection Chart

Mechanical	Electrical
– Fuel leak(s) – Fuel line(s) – Fuel filler cap – Fuel filter – Fuel tank – Fuel tank filler pipe – Fuel tank roll–over valve(s)	– Fuse(s) – Wiring harness – Electrical connector(s) – Inertia fuel shutoff (IFS) switch – Fuel pump module - All except vehicles with diesel engine – Fuel level sensor - Vehicles with 2.0L diesel engine – Fuel pump - Vehicles with 2.0L diesel engine

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to WDS to diagnose the system.

REMOVAL AND INSTALLATION

Fuel Tank (23 554 0)

Special Tool(s)	
 23055	Wrench, Sender Unit, Fuel Tank 310-069 (23-055)

General Equipment
Transmission jack

Name	Specification
Petroleum Jelly	WSM-M1C226-A

Removal

All vehicles

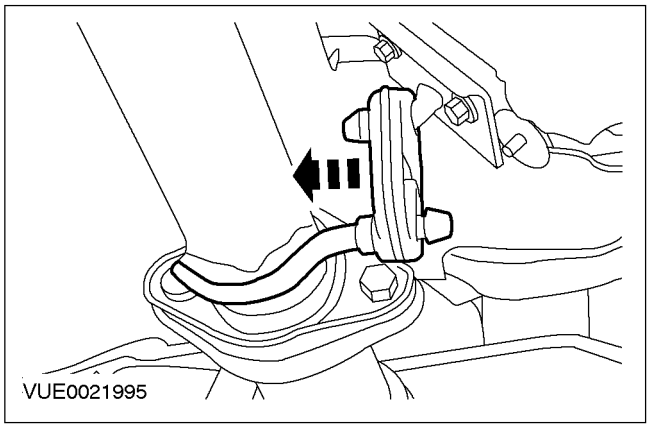
WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

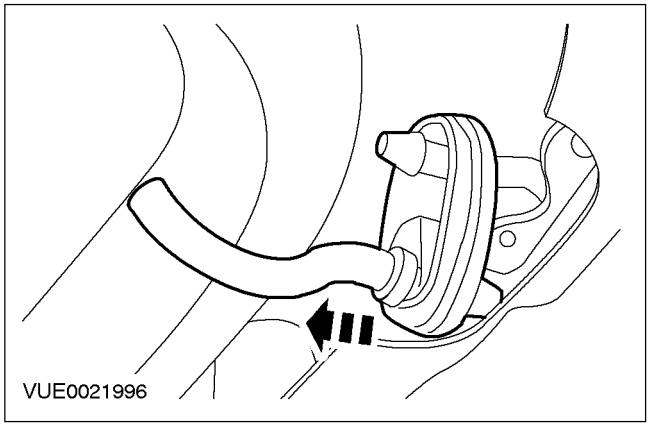
1. **Release the fuel system pressure. For additional information, refer to Section 310-00.**
2. **Drain the fuel tank. For additional information, refer to Section 310-00.**
3. **Raise and support the vehicle. For additional information, refer to Section 100-02.**

Wagon

4. **Detach the exhaust system from the front exhaust hanger insulator.**

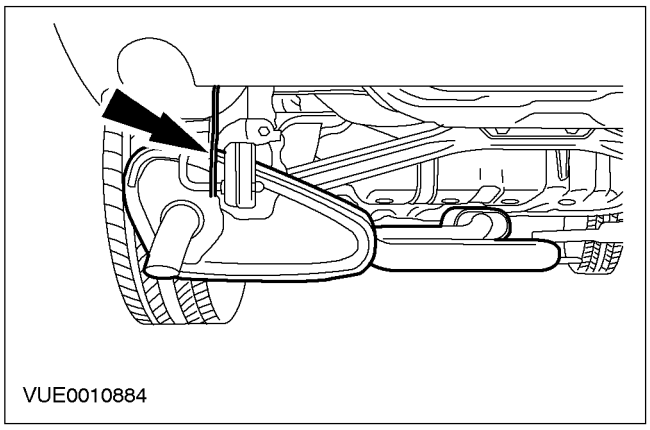


5. **Detach the exhaust system from the middle exhaust hanger insulator.**



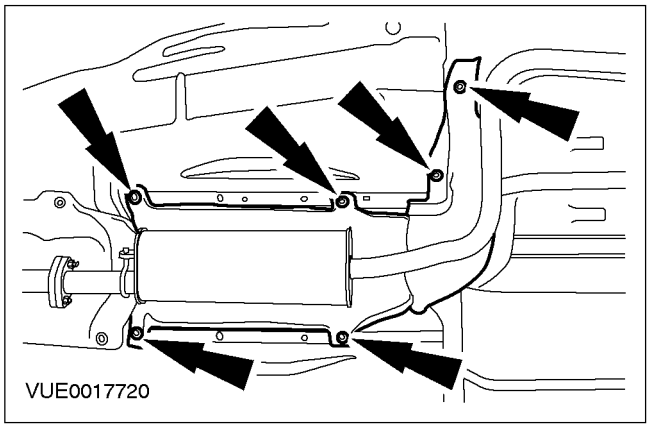
All vehicles

6. **Detach the exhaust system from the rear exhaust hanger insulator.**



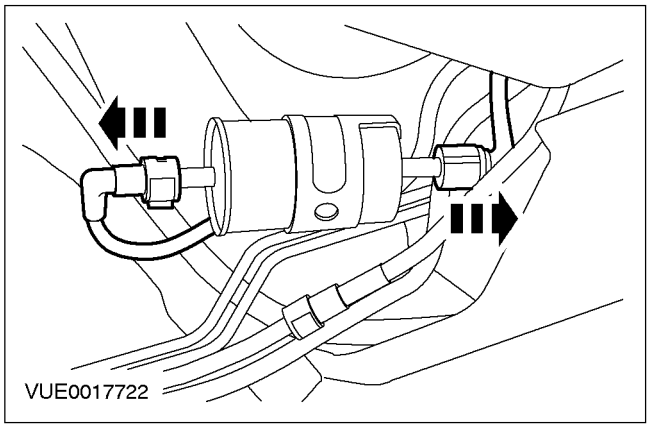
REMOVAL AND INSTALLATION (Continued)

7. Remove the exhaust system heat shield.

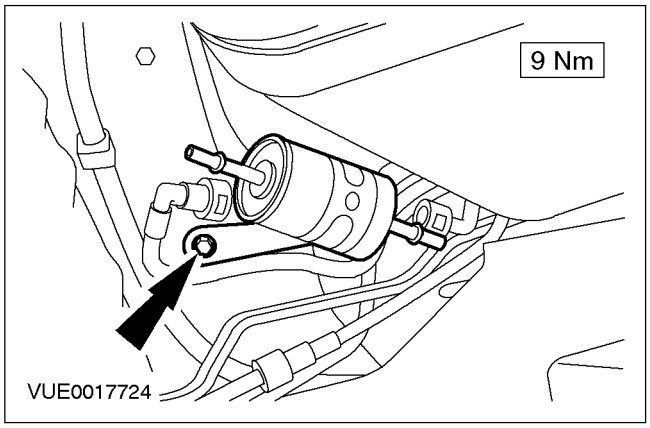


All except vehicles with diesel engine

8. Disconnect the fuel tank to fuel filter fuel supply line and the fuel filter to fuel injection supply manifold fuel supply line from the fuel filter. For additional information, refer to Section 310-00.



9. Remove the fuel filter.

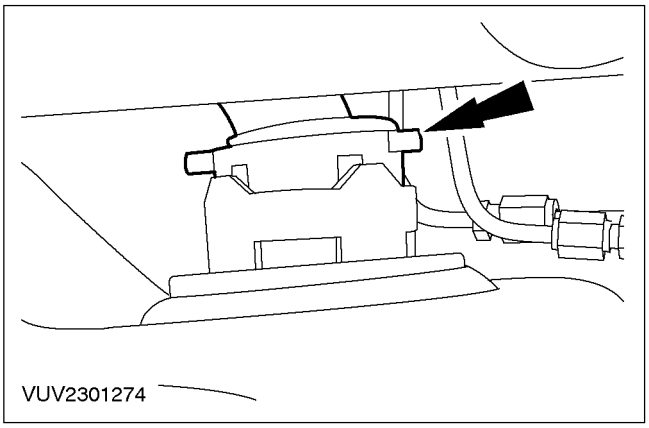


Vehicles with 115 PS diesel engine

10. Remove the fuel pump. For additional information, refer to Fuel Pump in this section.

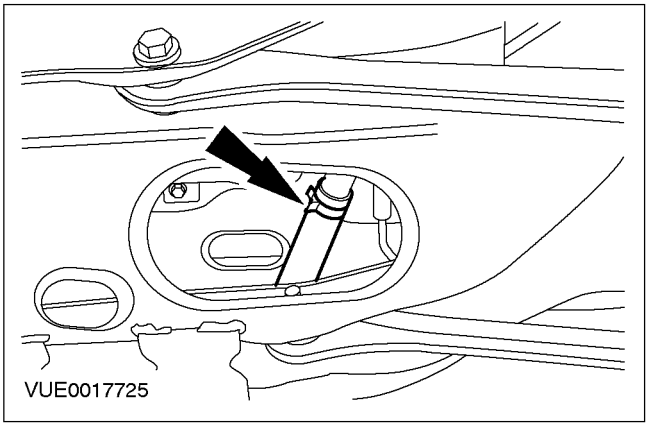
All vehicles

11. Disconnect the fuel tank filler pipe from the fuel tank.



12. ⚠ CAUTION: When removing the fuel tank vent pipe, do not use any sharp edged tools to lever off the pipe. Failure to follow this instruction may cause damage to the vent pipe.

Disconnect the fuel tank vent pipe from the fuel tank.



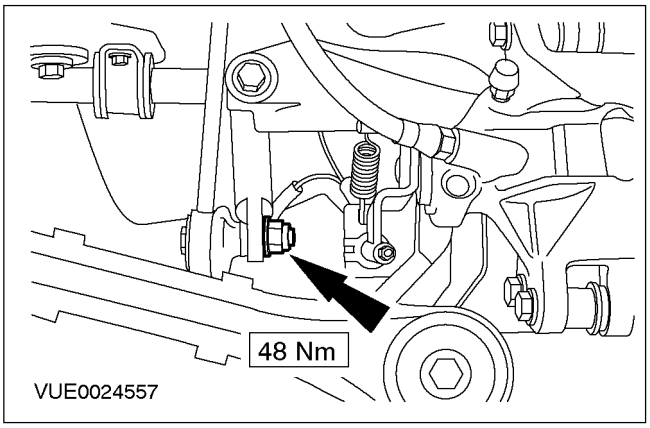
Vehicles with xenon headlamps

13. Remove the headlamp leveling sensor. For additional information, refer to Section 417-01.

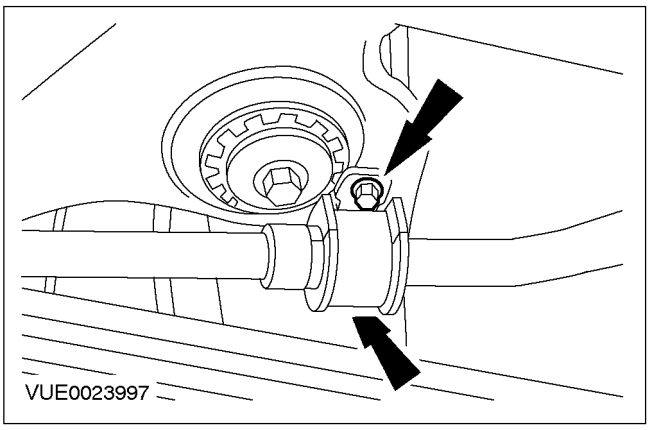
REMOVAL AND INSTALLATION (Continued)

All Vehicles

14. Detach the stabilizer bar connecting link from the stabilizer bar on both sides.

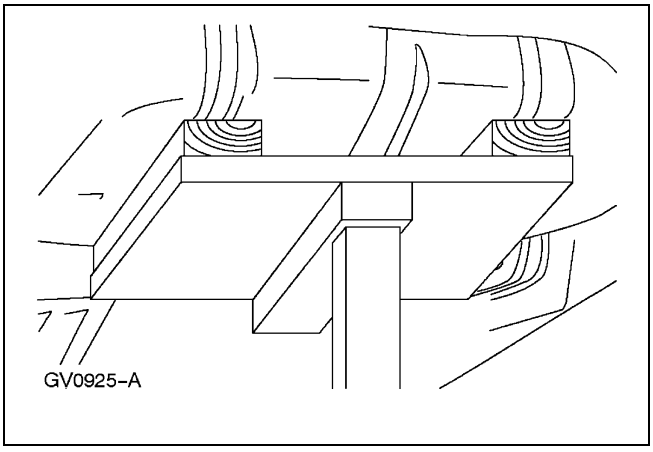


15. Remove the stabilizer bar bush retaining clamps from both sides and remove the stabilizer bar.

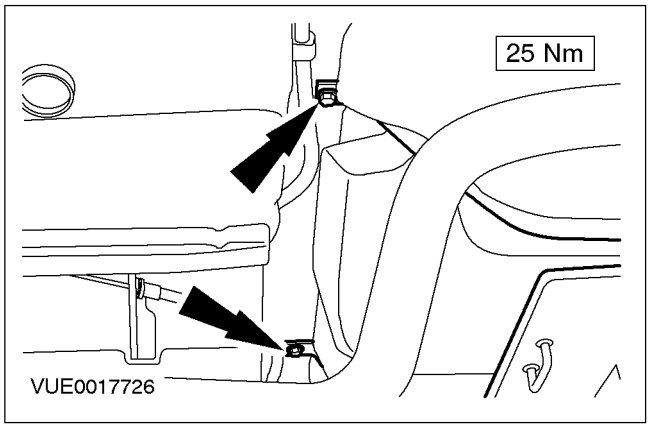


16. ⚠ CAUTION: Use a suitable packing material to prevent damage to the underside of the fuel tank and heat shield.

Using a suitabletransmission jack, support the fuel tank.

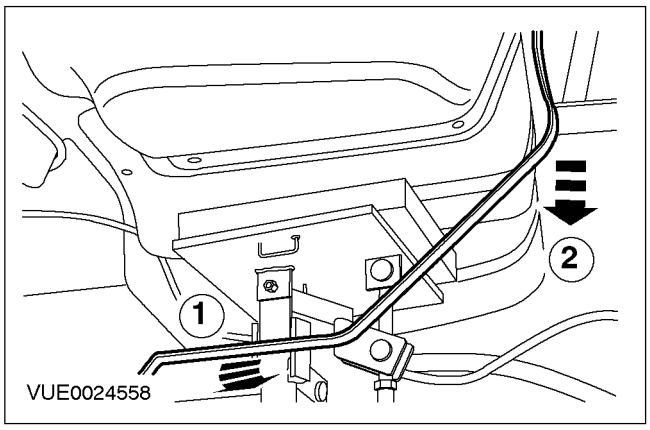


17. Detach the fuel tank support straps.

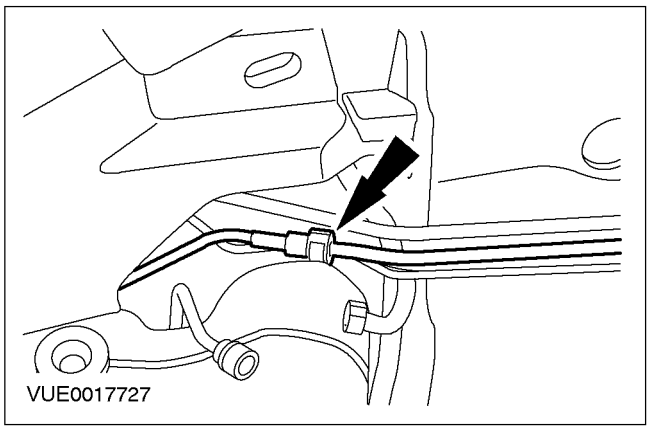


18. Remove the fuel tank support straps.

1. Rotate the fuel tank support straps.
2. Pull the fuel tank support straps down to remove.



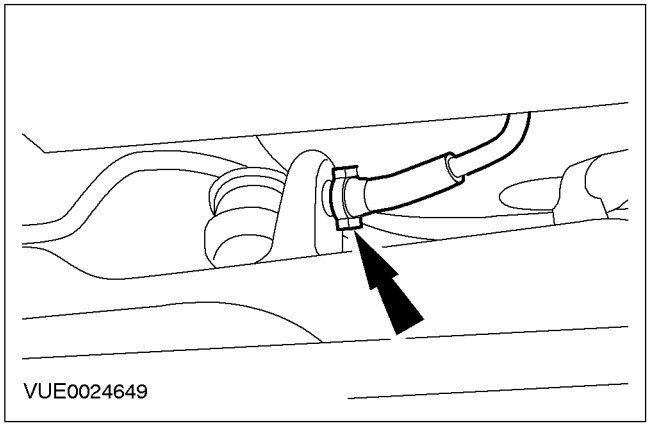
19. Disconnect the fuel return line. For additional information, refer to Section 310-00.



REMOVAL AND INSTALLATION (Continued)

All except vehicles with diesel engine

20. Disconnect the evaporative emission canister purge valve hose from the fuel tank.



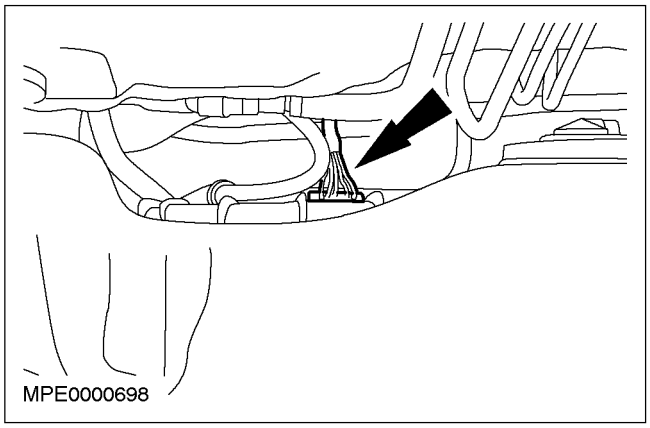
All vehicles

21. CAUTION: When lowering the fuel tank, make sure that excessive strain is not placed on the fuel lines and electrical connectors.

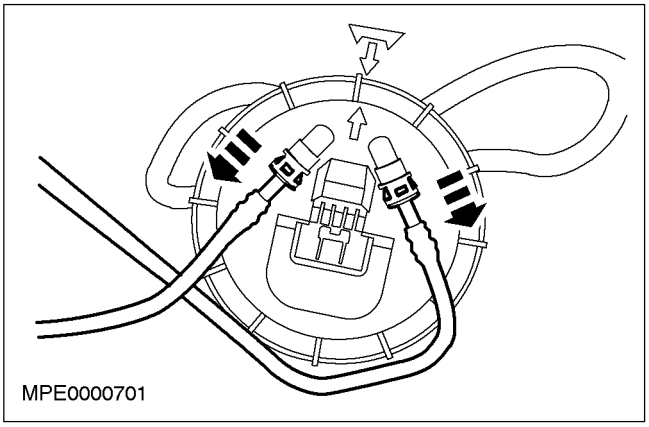
Partially lower the fuel tank.

All except vehicles with diesel engine

22. Disconnect the fuel pump module electrical connector.

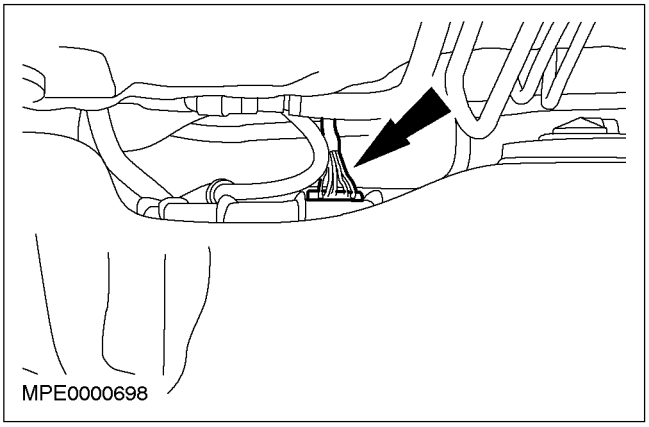


23. Disconnect the fuel supply and fuel return lines from the fuel pump module. For additional information, refer to Section 310-00.

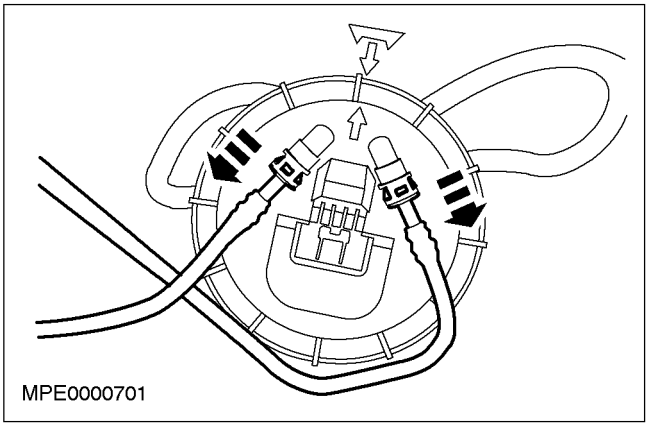


Vehicles with diesel engine

24. Disconnect the fuel level sensor electrical connector.



25. Disconnect the fuel supply and fuel return lines from the fuel level sensor. For additional information, refer to Section 310-00.



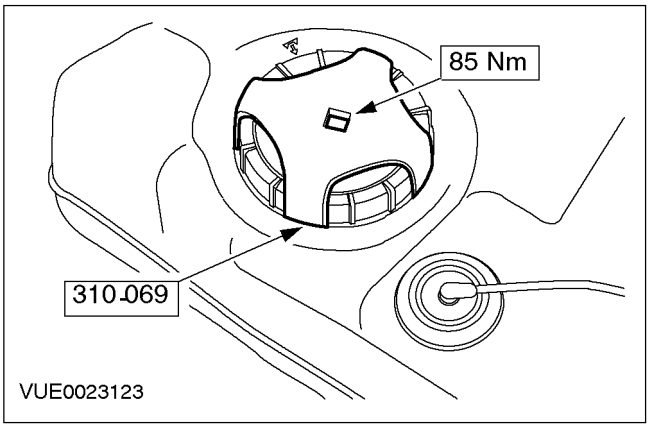
REMOVAL AND INSTALLATION (Continued)

All vehicles

26. Remove the fuel tank.

All except vehicles with diesel engine

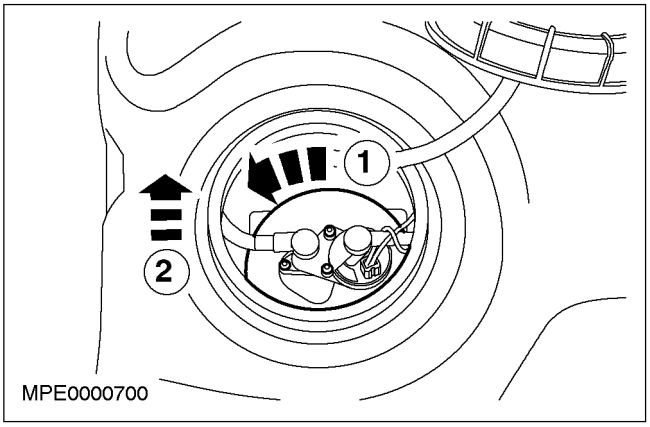
27. Using the special tool, remove the fuel pump module locking ring.



28. CAUTION: Make sure that the float or arm are not damaged while removing or installing the fuel pump module.

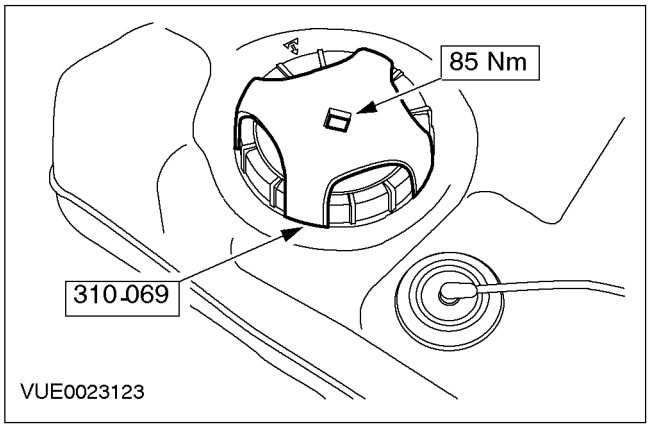
Remove the fuel pump module.

1. Rotate the module counterclockwise.
2. Lift the module from the fuel tank.
   - Discard the O-ring seal.



Vehicles with diesel engine

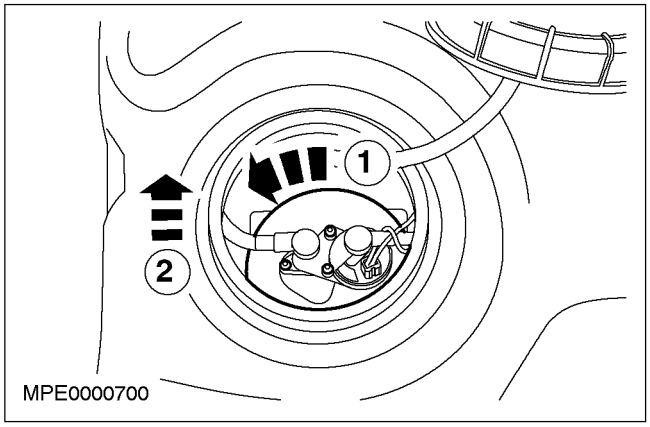
29. Using the special tool, remove the fuel level sensor locking ring.



30. CAUTION: Make sure that the float or arm are not damaged while removing or installing the fuel level sensor.

Remove the fuel level sensor.

1. Rotate the sensor counterclockwise.
2. Lift the sensor from the fuel tank.
   - Discard the O-ring seal.



Installation

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

REMOVAL AND INSTALLATION (Continued)

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

CAUTION: Lubricate the fuel tank filler pipe lower end to aid installation and to make sure that the fuel tank filler pipe seal in the fuel tank is not damaged during installation of the fuel tank filler pipe.

NOTE: Inspect the fuel tank filler pipe seal inside the fuel tank for damage. Install a new fuel tank if the seal is damaged.

NOTE: Install a new O-ring seal and make sure it is seated correctly on the fuel tank.

NOTE: Make sure that the arrows on the fuel tank and fuel pump module or fuel level sensor are aligned correctly.

NOTE: Make sure that the insulator pads are fitted to the fuel tank support straps.

1. **To install, reverse the removal procedure.**
   - Using suitable petroleum jelly lubricate the fuel tank filler pipe before inserting it into the fuel tank.

REMOVAL AND INSTALLATION

Fuel Pump Module (23 534 0)

Removal

1. **Remove the fuel pump module. For additional information, refer to Fuel Tank in this section.**

Installation

1. **To install, reverse the removal procedure.**

REMOVAL AND INSTALLATION

Fuel Level Sensor

Removal

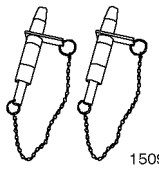
1. **Remove the fuel level sensor. For additional information, refer to Fuel Tank in this section.**

Installation

1. **To install, reverse the removal procedure.**

REMOVAL AND INSTALLATION

Fuel Tank Filler Pipe (23 572 0)

Special Tool(s)	
 15097A	Alignment pins, Subframe 205-136 (15-197A)

General Equipment
Transmission jack

Name	Specification
Petroleum Jelly	WSM-M1C226-A

Removal

All vehicles

1. **WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.**

   Remove the right-hand rear road wheel. For additional information, refer to Section 204-04.

4-door and 5-door

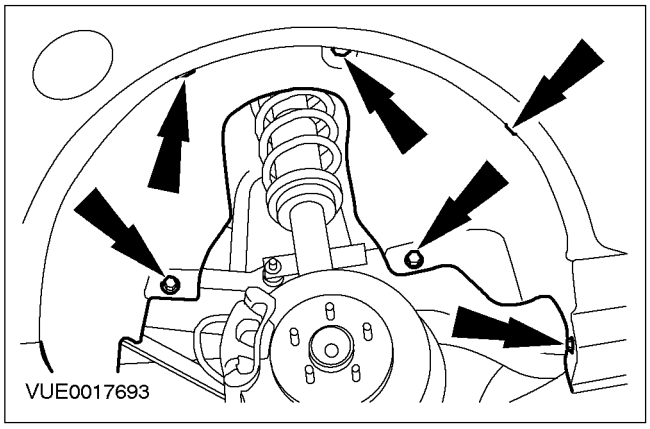
2. **Remove the fuel tank. For additional information, refer to Fuel Tank in this section.**

Wagon

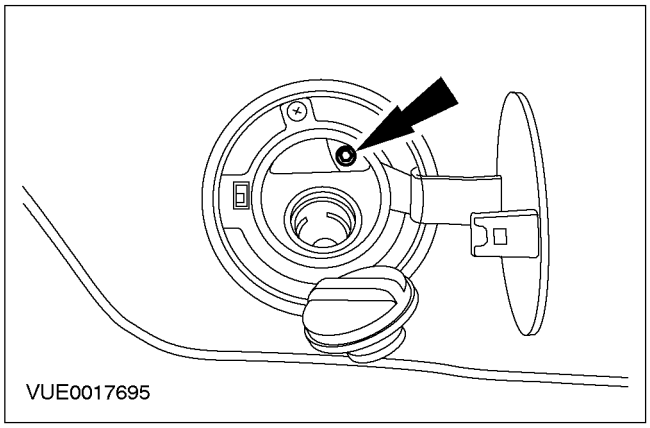
3. **Drain the fuel tank. For additional information, refer to Section 310-00.**

All vehicles

4. **Remove the fender splash shield.**

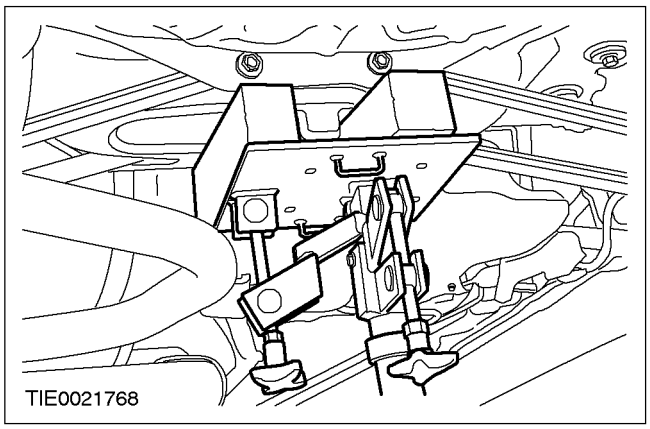


5. **Remove the fuel tank filler pipe upper retaining bolt.**
   - Detach the ground wire from the fuel tank filler pipe upper retaining bolt.



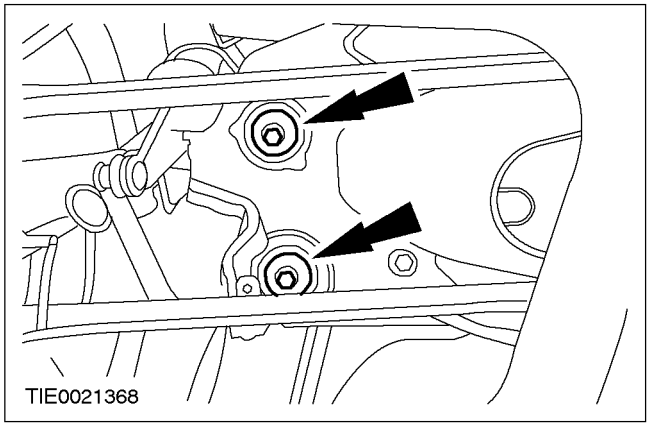
4-door and 5-door

6. **Using a suitable transmission jack and suitable wooden blocks, support the rear crossmember.**



REMOVAL AND INSTALLATION (Continued)

7. Detach the rear crossmember (two bolts each side).

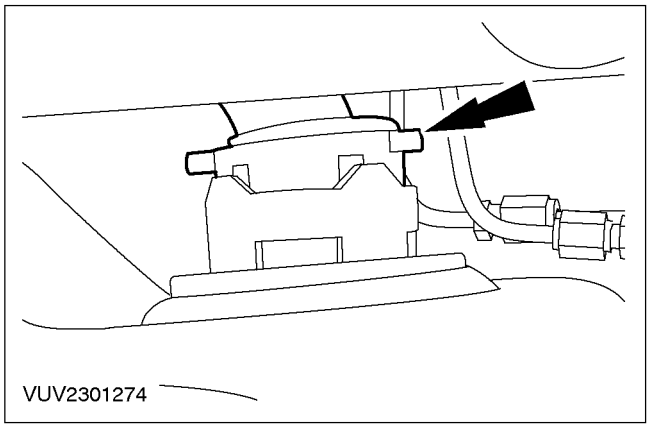


8. CAUTION: Do not place excessive strain on the brake hoses.

Partially lower the rear crossmember.

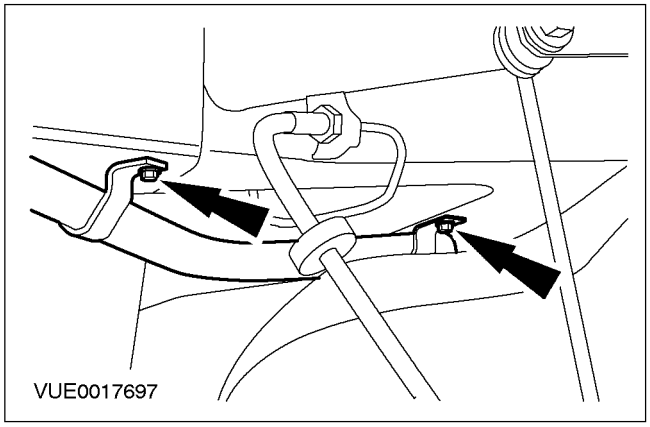
Wagon

9. Disconnect the fuel tank filler pipe from the fuel tank.



All vehicles

10. Remove the fuel tank filler pipe retaining bolts and remove the fuel tank filler pipe.



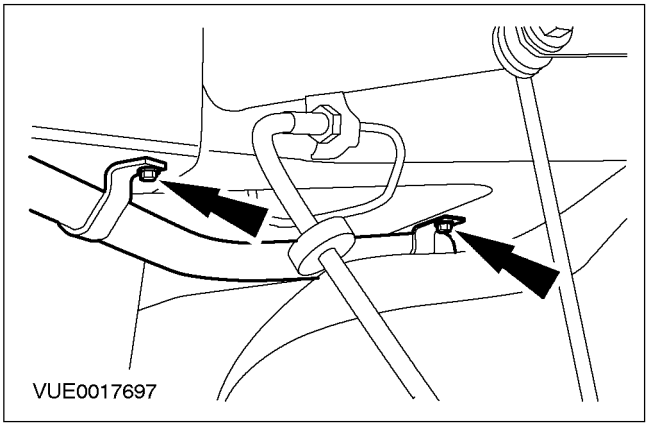
Installation

All vehicles

1. WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

NOTE: Inspect the fuel tank filler pipe seal inside the fuel tank for damage. Install a new fuel tank if the seal is damaged.

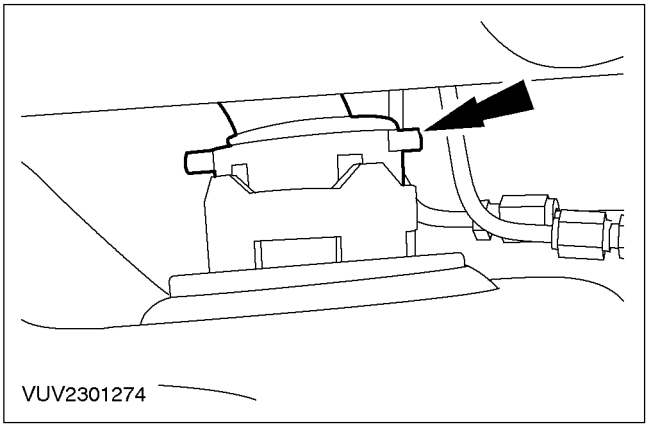
Install the fuel tank filler pipe and install the fuel tank filler pipe retaining bolts.



Wagon

2. CAUTION: Lubricate the fuel tank filler pipe bottom end to aid installation and make sure that the fuel tank filler pipe seal in the fuel tank is not damaged during installation of the fuel tank filler pipe.

Using a suitable petroleum jelly lubricate the fuel tank filler pipe before inserting it into the fuel tank.



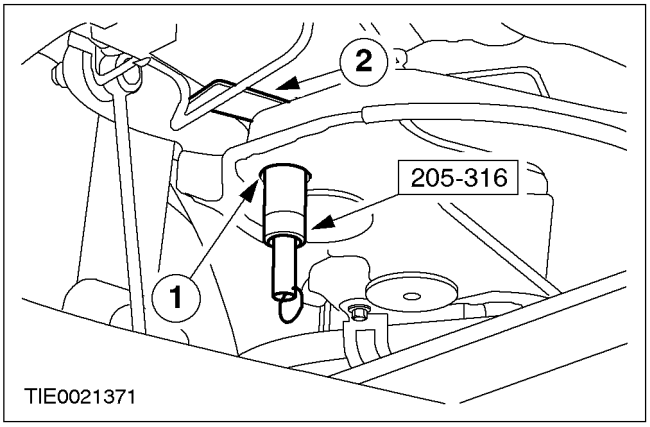
REMOVAL AND INSTALLATION (Continued)

4-door and 5-door

3. Raise the rear crossmember.

4. Using the special tool, align the crossmember.

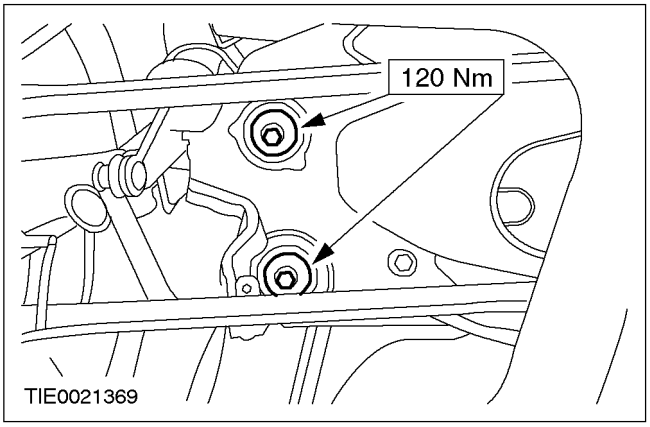
1. Insert the alignment pins through the crossmember alignment holes.
2. Slide the locking plates into the groove and tighten the alignment pin sleeve.



5. NOTE: Final tightening of the rear suspension components should be carried out when the vehicle weight is on the road wheels.

Install the rear crossmember bolts.

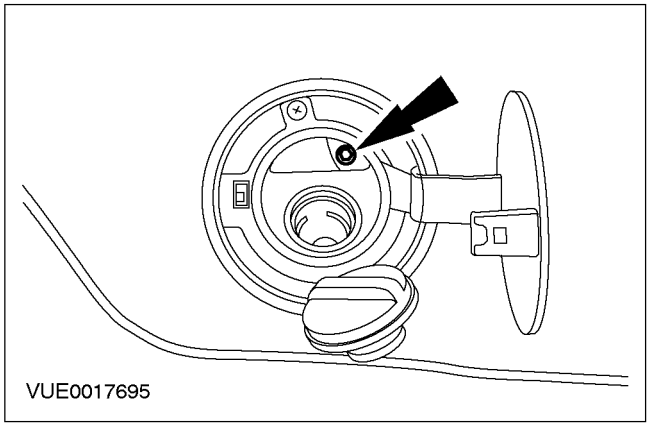
- Remove the transmission jack.



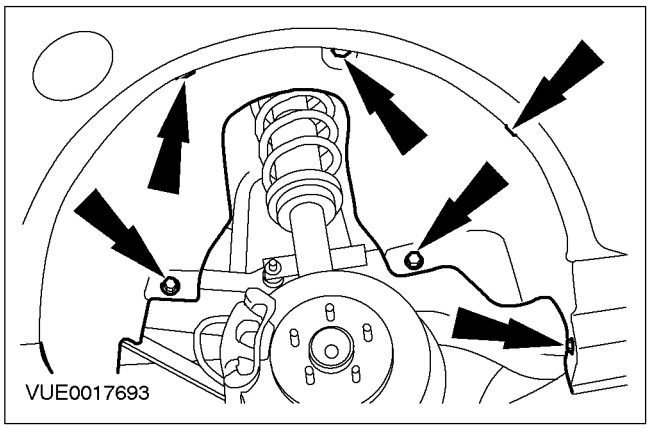
All vehicles

6. NOTE: Make sure that the ground wire is attached when installing the fuel tank filler pipe upper retaining bolt.

Install the fuel tank filler pipe upper retaining bolt.



7. Install the fender splash shield.



8. Install the right-hand rear road wheel. For additional information, refer to Section 204-04.

4-door and 5-door

9. Install the fuel tank. For additional information, refer to Fuel Tank in this section.

REMOVAL AND INSTALLATION

Fuel Filter — 1.8L/2.0L/2.5L/3.0L (23 545 0)

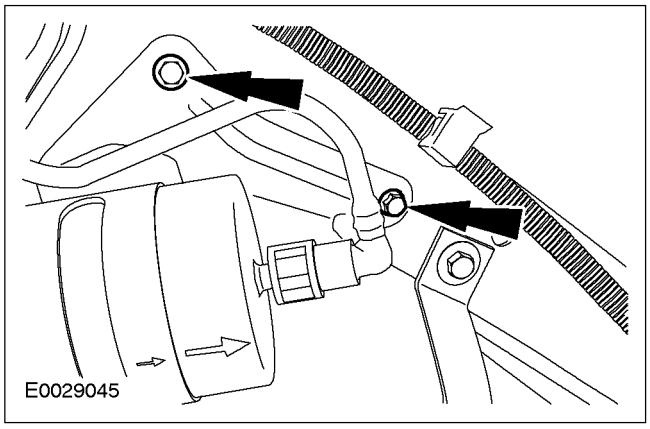
Removal

1. **WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and can ignite. Failure to follow these instructions may result in personal injury.**

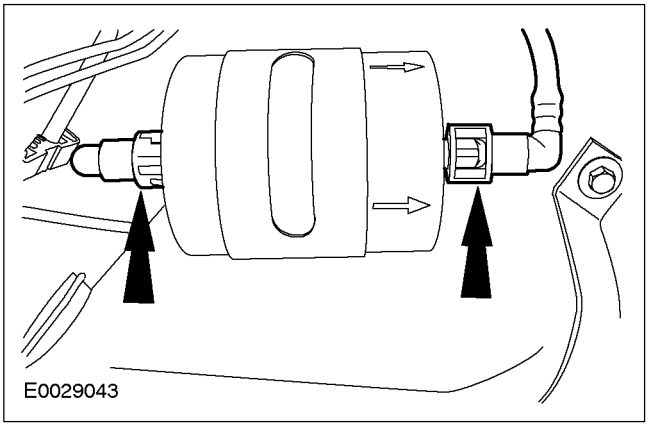
WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

Release the fuel system pressure. For additional information, refer to Section 310-00.

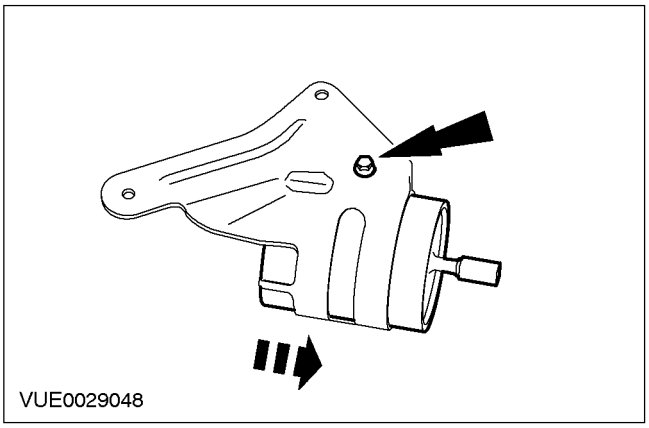
2. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
3. **Remove the fuel filter bracket retaining bolts.**


E0029045

4. **Disconnect the fuel tank to fuel filter fuel supply line and the fuel filter to fuel injection supply manifold fuel supply line from the fuel filter. For additional information, refer to Section 310-00.**


E0029043

5. **Remove the fuel filter from the fuel filter retaining bracket.**
   - Loosen the fuel filter retaining bracket bolt.


VUE0029048

REMOVAL AND INSTALLATION (Continued)

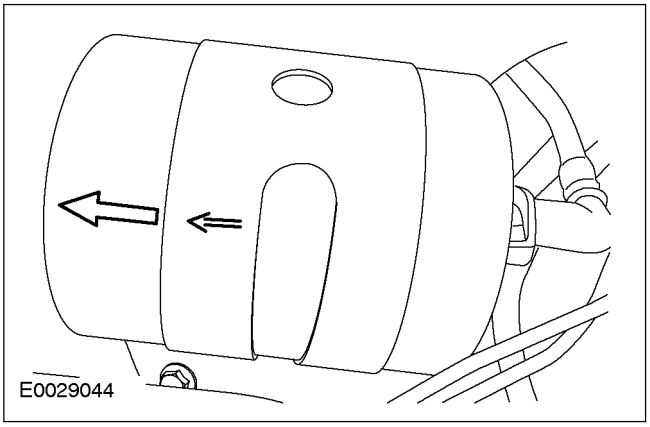
Installation

1. **WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and can ignite. Failure to follow these instructions may result in personal injury.**

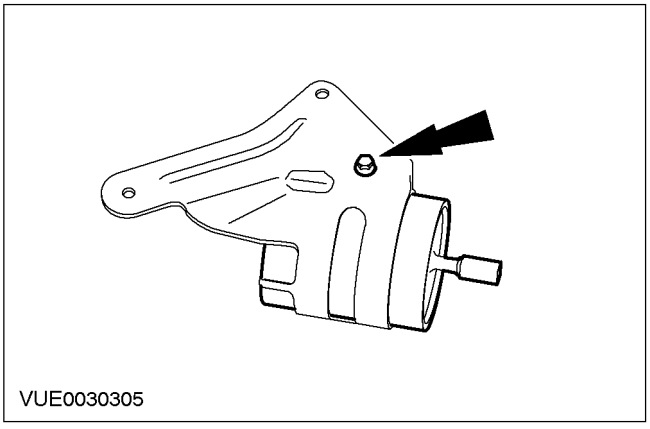
WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

NOTE: Make sure the fuel filter is fully installed into the fuel filter retaining bracket. Observe the direction of flow arrows on the fuel filter and the fuel filter bracket.

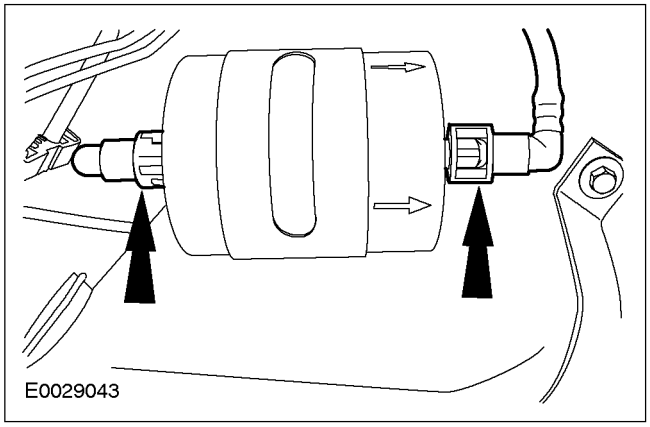
Install the fuel filter to the fuel filter bracket.



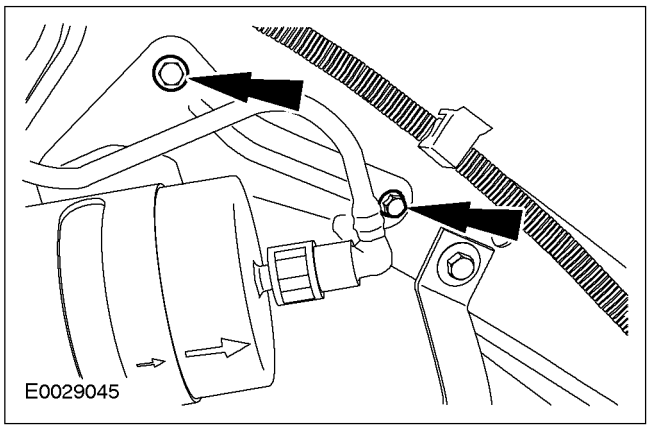
2. **Tighten the fuel filter retaining bracket bolt.**



3. **Connect the fuel tank to fuel filter fuel supply line and the fuel filter to fuel injection supply manifold fuel supply line to the fuel filter. For additional information, refer to Section 310-00.**



4. **Install the fuel filter bracket retaining bolts.**



5. **Lower the vehicle.**

SECTION 310-02 Acceleration Control

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS **PAGE**

DIAGNOSIS AND TESTING

Acceleration Control 310-02-2
Inspection and Verification 310-02-2
Symptom Chart 310-02-2

DIAGNOSIS AND TESTING

Acceleration Control

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Accelerator pedal – Linkage – Accelerator cable	• Fuse(s) • Relay(s) • Wiring harness • Electrical connector(s) • Powertrain control module (PCM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to Symptom Chart.

Symptom Chart

Condition	Possible Sources	Action
•Accelerator pedal is hard to depress or has a rough/raspy or sticky feel	•Damaged accelerator cable.	•INSTALL a new accelerator cable.
	•Accelerator cable incorrectly installed.	•CHECK the accelerator cable for the correct installation.
	•Worn or damaged throttle body.	•INSTALL a new throttle body. REFER to Section 303-04A / 303-04B.
•Accelerator pedal does not return freely	•Weak or broken throttle body return spring.	•INSTALL a new throttle body. REFER to Section 303-04A / 303-04B.
	•Worn or damaged throttle body.	•INSTALL a new throttle body. REFER to Section 303-04A / 303-04B.
•High engine idle speed	•Damaged accelerator cable.	•INSTALL a new accelerator cable.
	•Accelerator cable incorrectly installed.	•CHECK the accelerator cable for the correct installation.

SECTION 310-03 Speed Control

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

SPECIFICATIONS

Specifications 310-03-2

DESCRIPTION AND OPERATION

Speed Control 310-03-3

DIAGNOSIS AND TESTING

Speed Control 310-03-6
Inspection and Verification 310-03-6
Symptom Chart 310-03-6
Pinpoint Test 310-03-7
Component Tests - Speed Control Switch 310-03-17

GENERAL PROCEDURES

Speed Control Deactivator Switch Adjustment ..... (33 504 0) 310-03-19

REMOVAL AND INSTALLATION

Speed Control Actuator ..... (33 678 0) 310-03-20
Speed Control Switch ..... (33 500 0) 310-03-25

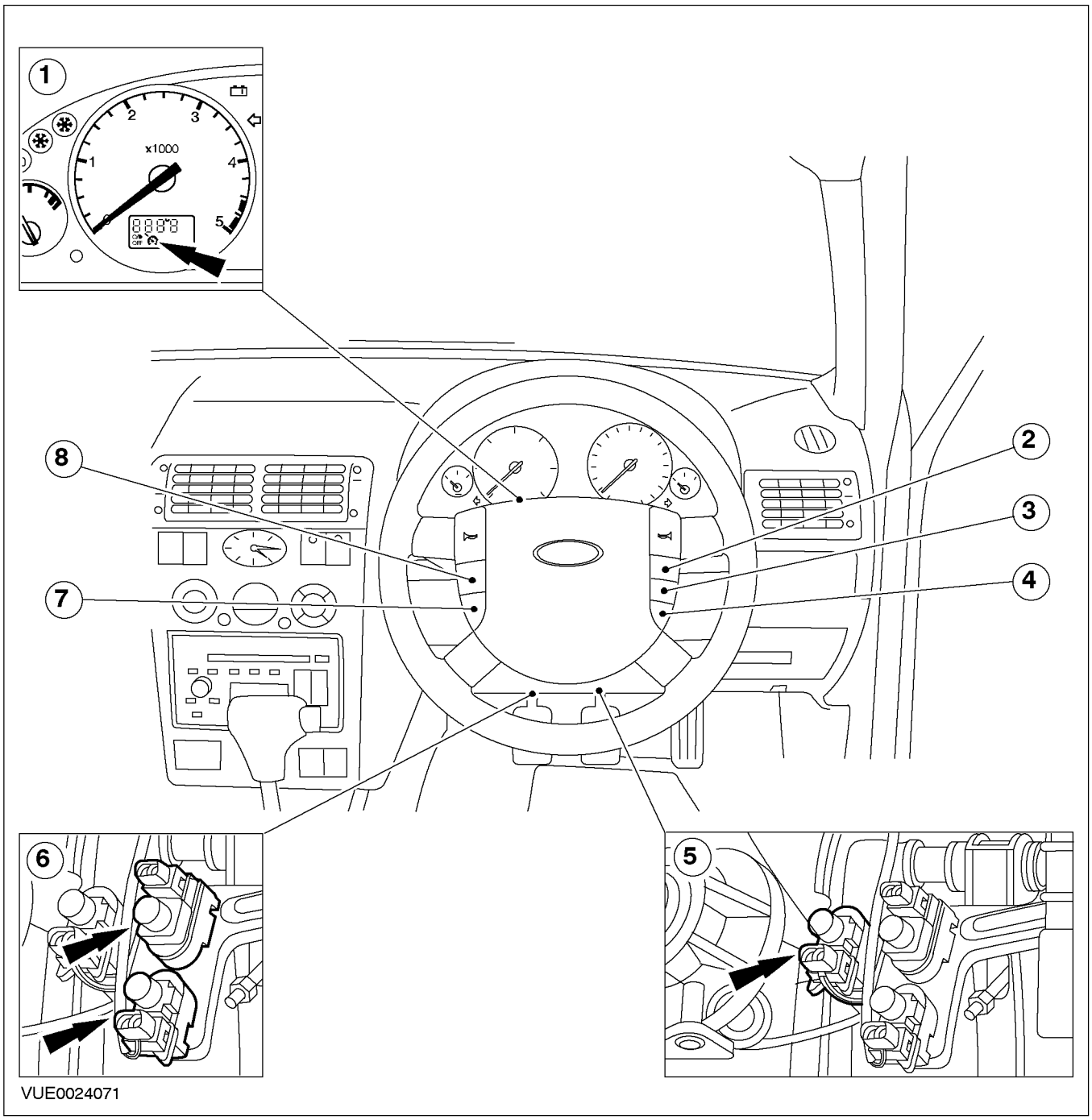
SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Speed control actuator retaining nuts	9	-	80
Speed control actuator retaining screw	6	-	53
Speed control switch retaining bolts	5	-	44

DESCRIPTION AND OPERATION

Speed Control



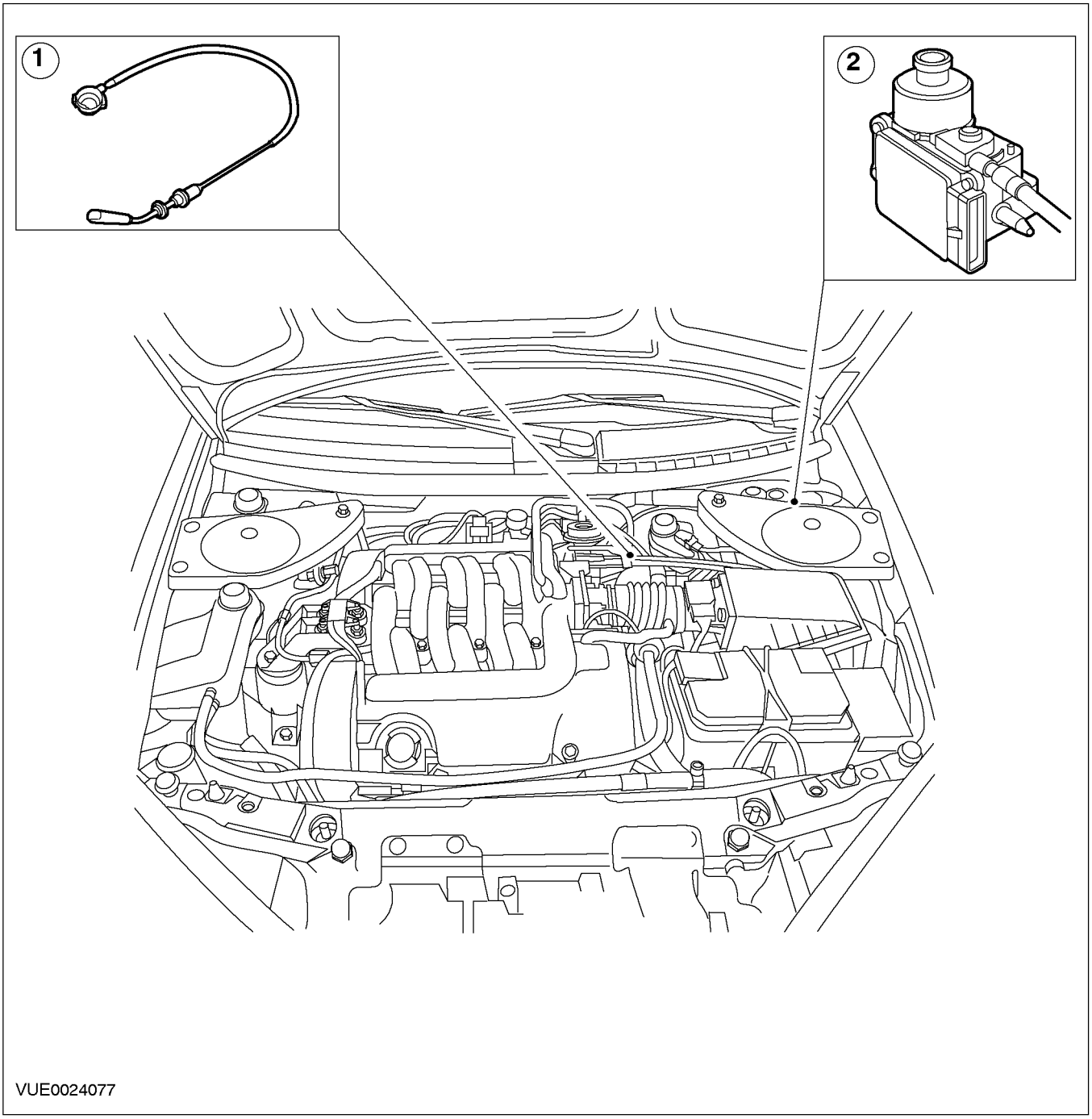
Item	Part Number	Description
1	-	Speed control status indicator
2	-	Speed control resume switch

Item	Part Number	Description
3	-	Speed control set/accelerate and tap up switch
4	-	Speed control coast and tap down switch

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
5	-	Speed control deactivator switch
6	-	Speed control deactivator switches

Item	Part Number	Description
7	-	Speed control de-activate switch
8	-	Speed control activate switch



Item	Part Number	Description
1	-	Speed control actuator cable

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
2	-	Speed control actuator

DIAGNOSIS AND TESTING

Speed Control

Refer to Wiring Diagrams Section 310-03 for schematic and connector information.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to WDS to diagnose the fault, vehicles with diesel engine.
5. If the concern is not visually evident verify the symptom and refer to the Symptom chart, all except vehicles with diesel engine.

Visual Inspection Chart

Mechanical	Electrical
– Speed control actuator cable.	– Fuse(s) – Wiring harness – Electrical connector(s) – Speed control switch(es) – Speed control actuator – Powertrain control module (PCM) – Brake pedal position (BPP) switch – Clutch pedal position (CPP) switch

Symptom Chart

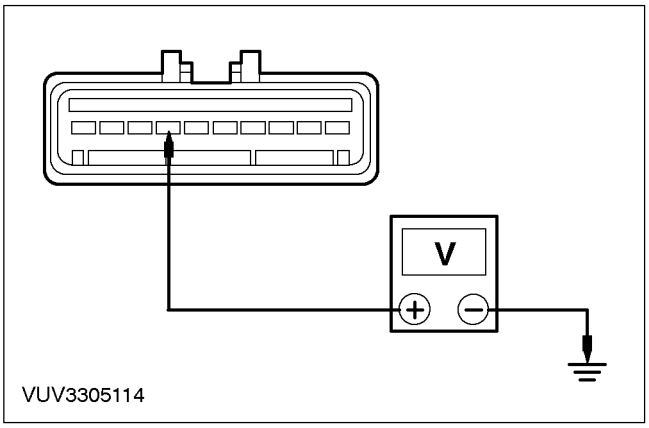
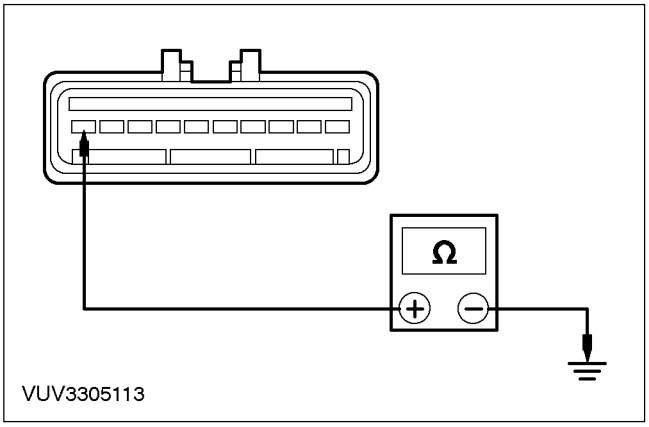
Condition	Possible Sources	Action
•The speed control is inoperative	•Fuse(s) •Circuit(s). •Speed control actuator. •Steering wheel/speed control switch. •PCM. •BPP switch. •CPP switch.	• GO to Pinpoint Test A .
•The speed control does not disengage when the brakes are applied.	•Circuit(s). •BBP switch. •Speed control actuator.	• GO to Pinpoint Test B .
•The speed control does not disengage when the clutch is applied.	•Circuit(s). •CPP switch. •Speed control actuator.	• GO to Pinpoint Test C .
•The speed control switch does not operate correctly	•Steering wheel/speed control switch.	•CARRY OUT the speed control switch component test in this section.

DIAGNOSIS AND TESTING

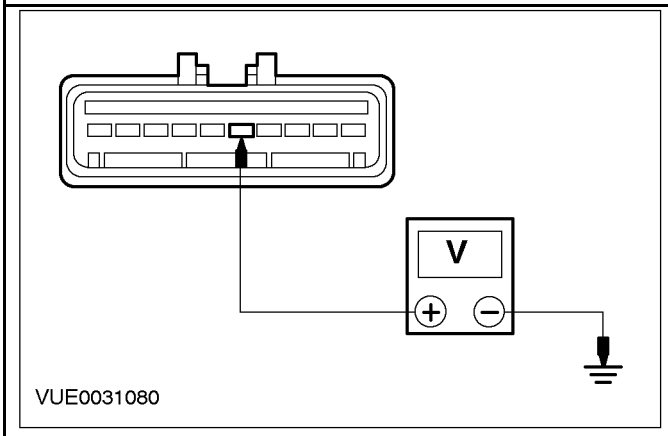
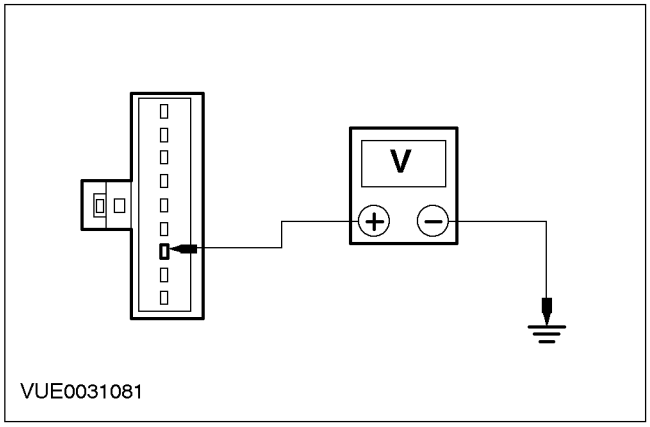
NOTE: Use a digital multimeter for all electrical measurements.

Pinpoint Test

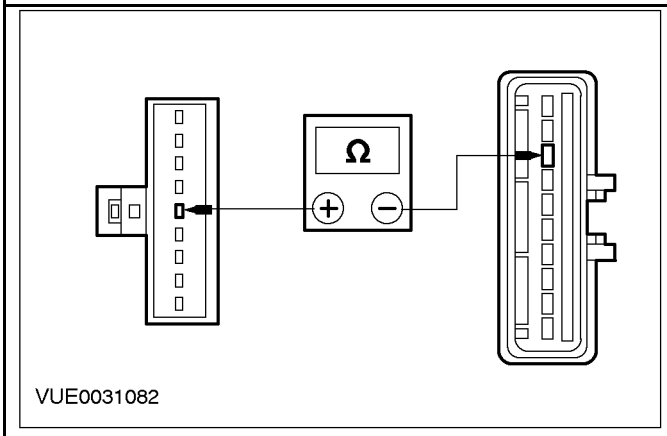
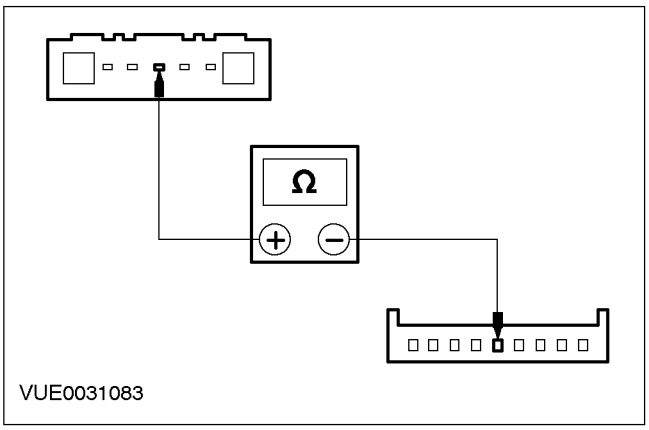
PINPOINT TEST A: THE SPEED CONTROL IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK CIRCUIT 15-PG12 (GN/WH) FOR POWER	
	1 Disconnect Speed control actuator C175. 2 Key in ON position. 3 Measure the voltage between the speed control actuator C175 pin 7, circuit 15-PG12 (GN/WH), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **A2**. → **No** REPAIR the circuit. TEST the system for normal operation.
A2: CHECK CIRCUIT 31-PG12 (BK) TO GROUND	
	1 Key in OFF position. 2 Measure the resistance between the speed control actuator C175 pin 10, circuit 31-PG12 (BK), harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **A3**. → **No** REPAIR the circuit. TEST the system for normal operation.
A3: CHECK CIRCUIT 8-PG13 (WH) FOR POWER	
	1 Key in ON position.

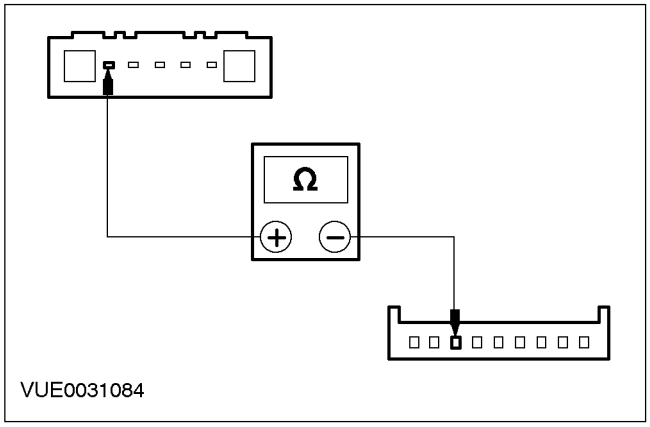
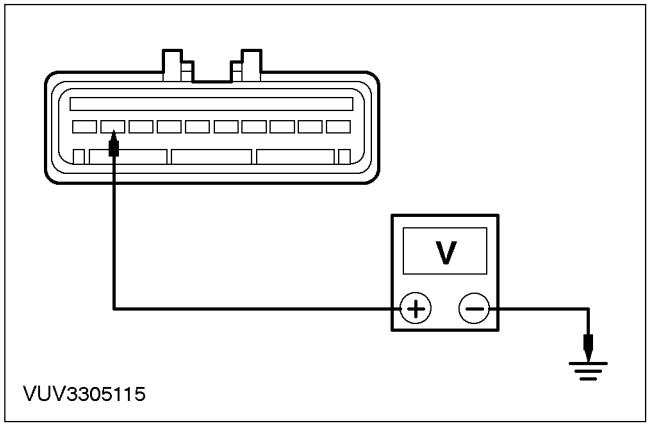
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VUE0031080	**2** Measure the voltage between the speed control actuator C175 pin 5, circuit 8-PG13 (WH), harness side and ground. When the speed control switch is in the ON position. • Is the voltage greater than 10 volts? → **Yes** GO to **A8**. → **No** GO to **A4**.
A4: CHECK CIRCUIT 15-PG13 (GN/YE) FOR POWER	
WARNING: To deactivate the air bag module, refer to the procedure in Section 501-20B for the correct air bag module deactivation procedure. Failure to follow this instruction may result in personal injury.	
 VUE0031081	**1** Remove the driver air bag module, REFER to Section 501-20A / 501-20B. **2** Disconnect Clock spring C413. **3** Connect the battery ground cable. **4** Key in ON position. **5** Measure the voltage between the clock spring C413 pin 7, circuit 15-PG13 (GN/YE), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **A5**. → **No** REPAIR the circuit. TEST the system for normal operation.
A5: CHECK CIRCUIT 8-PG13 (WH) FOR OPEN	
	1 Key in OFF position.

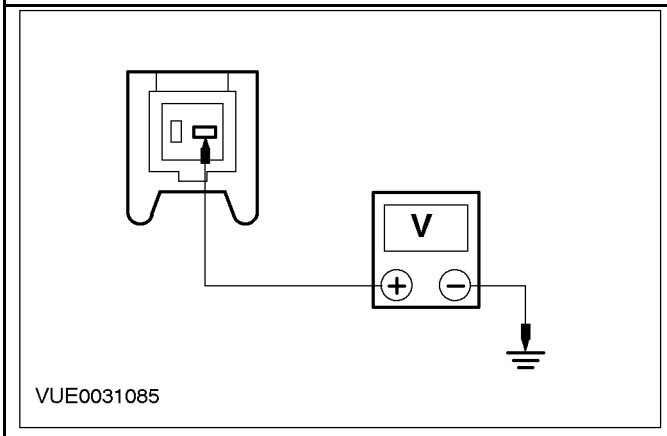
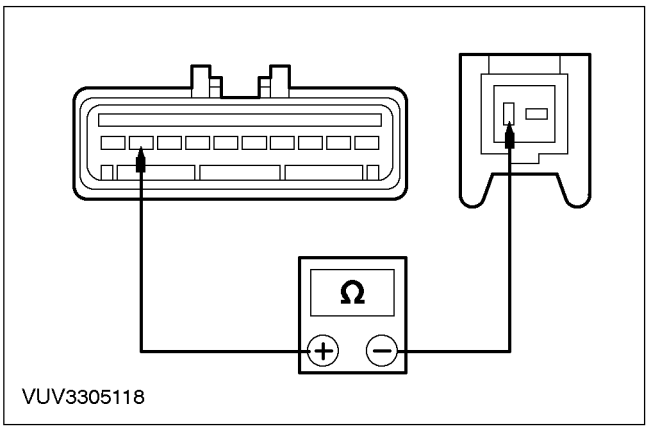
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**2** Measure the resistance between the clock spring C413 pin 5 circuit 8-PG13 (WH), harness side and the speed control actuator C175 pin 5 circuit 8-PG13 (WH), harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **A6**. → **No** REPAIR the circuit. TEST the system for normal operation.
A6: CHECK THE CLOCK SPRING FOR OPEN	
	**1** Disconnect Speed Control Switch. **2** Measure the resistance between the clock spring pin 5, component side and the clock spring to speed control switch connector. • Is the resistance less than 1 ohms? → **Yes** GO to **A7**. → **No** INSTALL a new clock spring, REFER to Section 501-20A / 501-20B. TEST the system for normal operation.

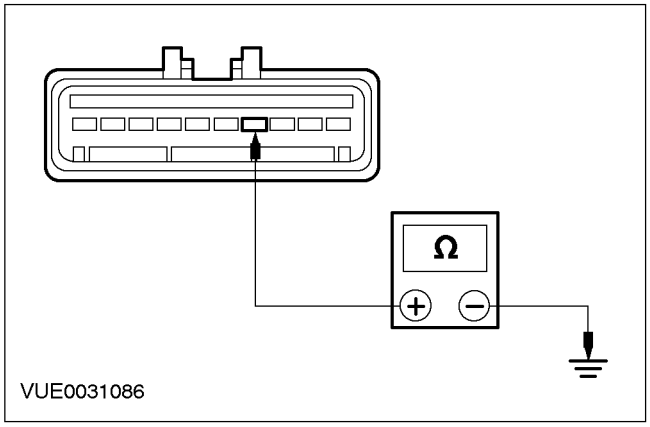
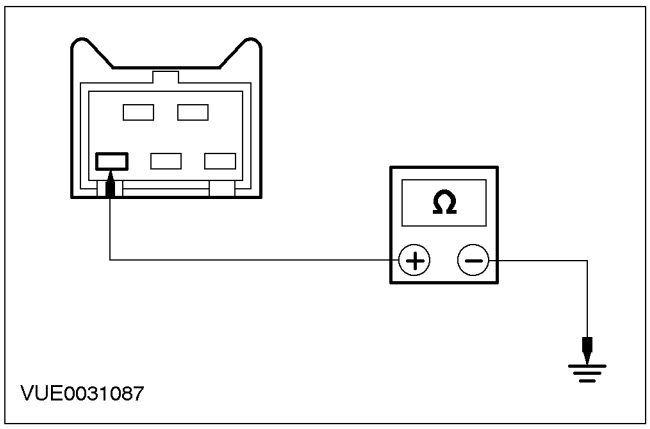
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A7: CHECK THE CLOCK SPRING FOR OPEN	
	1 Measure the resistance between the clock spring pin 7, component side and the clock spring to speed control switch connector. • Is the resistance less than 1 ohms? → **Yes** INSTALL a new speed control switch. REFER to Speed Control Switch in this section. TEST the system for normal operation. → **No** INSTALL a new clock spring, REFER to Section 501-20A / 501-20B. TEST the system for normal operation.
A8: CHECK CIRCUIT 15S-PG16 (GN/YE) FOR POWER	
	1 Measure the voltage between the speed control actuator C175 pin 9, circuit 15S-PG16 (GN/YE), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **A11**. → **No** GO to **A9**.
A9: CHECK CIRCUIT 15-PG6 (GN/YE) FOR POWER	
	1 Disconnect BPP switch C406.

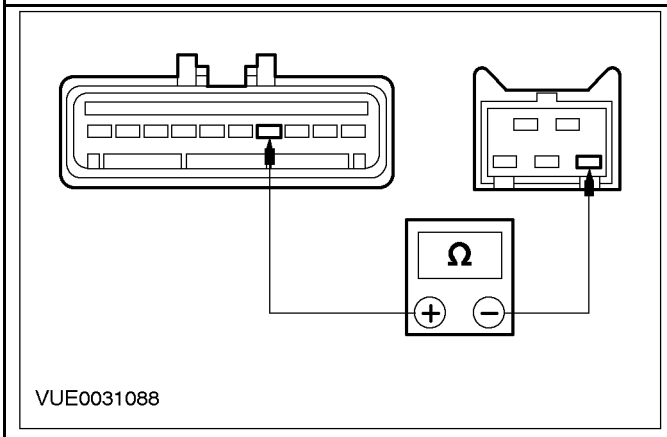
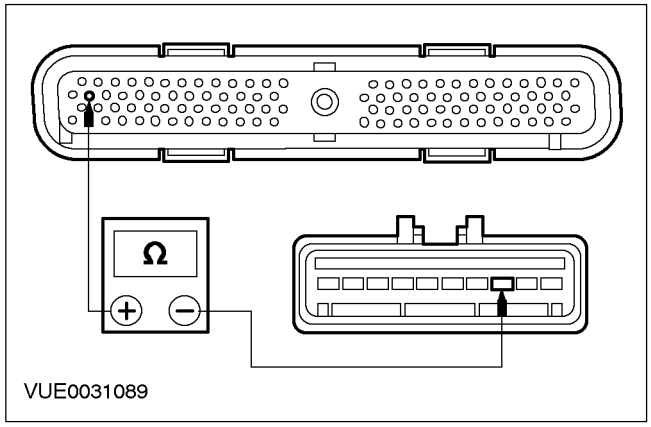
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VUE0031085	**2** Measure the voltage between the BPP switch C406 pin 2, circuit 15-PG6 (GN/YE), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **A10**. → **No** REPAIR the circuit. TEST the system for normal operation.
A10: CHECK CIRCUIT 15S-PG16 (GN/YE) FOR OPEN	
 VUV3305118	**1** Key in OFF position. **2** Measure the resistance between the speed control module C175 pin 9, circuit 15S-PG16 (GN/YE), harness side and the BPP switch C406 pin 1, circuit 15S-PG16 (GN/YE), harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new BPP switch. TEST the system for normal operation. → **No** REPAIR the circuit. TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A11: CHECK CIRCUIT 15S-PG17 (GN/BU) TO GROUND	
 VUE0031086	1 Measure the resistance between the speed control actuator C175 pin 4, circuit 15S-PG17 (GN/BU), harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **A14**. → **No** IF the stop lamps operate correctly, GO to **A12**. IF the stoplamps do not operate correctly. REFER to Section 417-01.
A12: CHECK CIRCUIT 15S-PG7 (GN/BU) TO GROUND	
 VUE0031087	1 Disconnect CPP switch C414. 2 Measure the resistance between the CPP switch C414 pin 3, circuit 15S-PG7 (GN/BU), harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **A13**. → **No** REPAIR the circuit. TEST the system for normal operation.

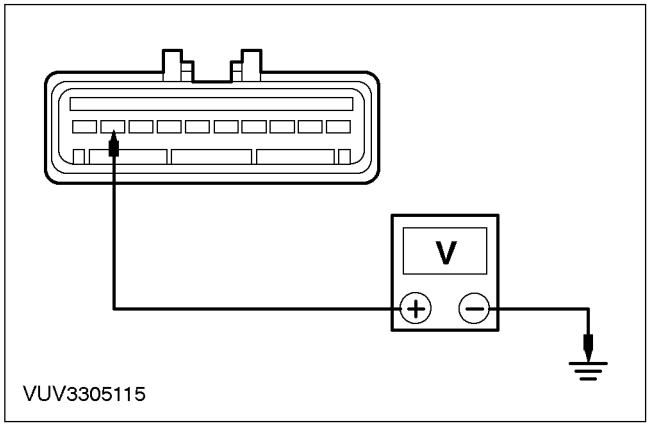
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A13: CHECK CIRCUIT 15S-PG17 (GN/BU) FOR OPEN	
 VUE0031088	**1** Measure the resistance between the CPP switch C414 pin 1, circuit 15S-PG17 (GN/BU) harness side and the speed control actuator C175 pin 4, circuit 15S-PG17 (GN/BU), harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new CPP switch. TEST the system for normal operation. → **No** REPAIR the circuit. TEST the system for normal operation.
A14: CHECK THE VEHICLE SPEED SENSOR (VSS) FOR CORRECT OPERATION	
	1 Check the trip computer and speedometer for correct operation. • Is the instrument cluster working correctly. → **Yes** GO to **A15**. → **No** REFER to Section 413-01.
A15: CHECK CIRCUIT 8-PG18 (WH/BU) FOR OPEN	
 VUE0031089	**1** Disconnect PCM C100. **2** Measure the resistance between the PCM C100 pin 28, circuit 8-GB8 (WH/BU), harness side and the speed control module C175 pin 3, circuit 8-PG18 (WH/BU), harness side. • Is the resistance less than 5 ohms? → **Yes**

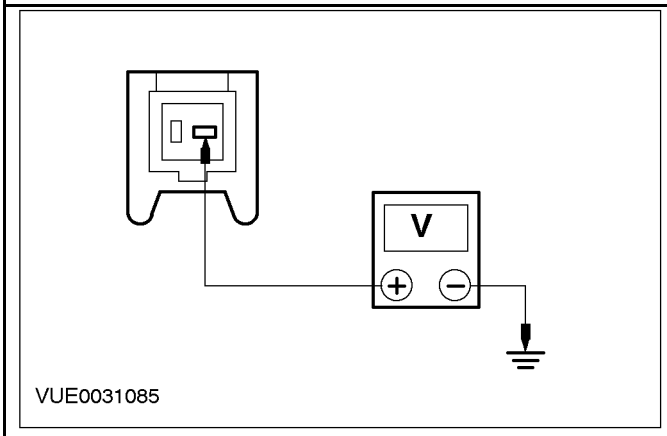
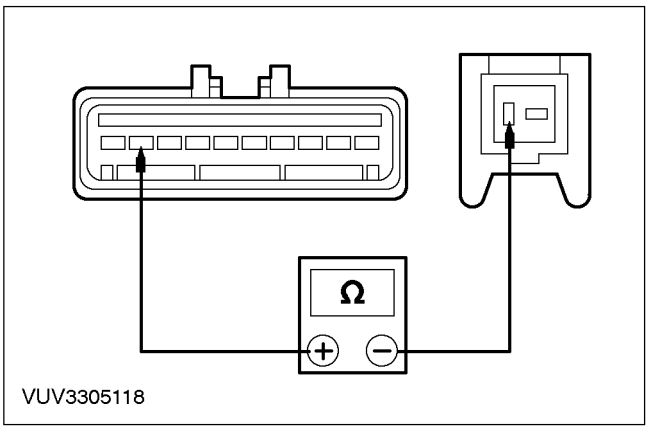
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	INSTALL a new speed control actuator. REFER to Speed Control Actuator in this section. TEST the system for normal operation. → **No** REPAIR the circuit(s). TEST the system for normal operation.

PINPOINT TEST B: THE SPEED CONTROL DOES NOT DISENGAGE WHEN THE BRAKES ARE APPLIED.

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK CIRCUIT 15S-PG16 (GN/YE) FOR POWER	
	1 Disconnect Speed control module C175. 2 Key in ON position. 3 Measure the voltage between the speed control actuator C175 pin 9, circuit 15S-PG16 (GN/YE), harness side and ground. • Is the voltage greater than 10 volts when the brakes are applied? → **Yes** INSTALL a new speed control actuator. REFER to Speed Control Actuator in this section. TEST the system for normal operation. → **No** GO to **B2**
B2: CHECK CIRCUIT 15-PG6 (GN/YE) FOR POWER	
	1 Disconnect BPP Switch C406.

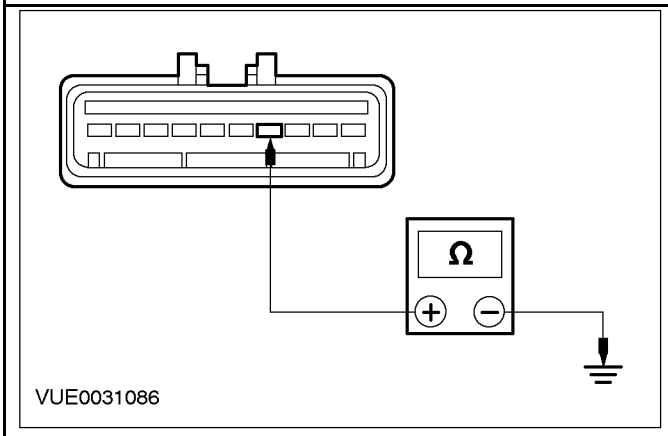
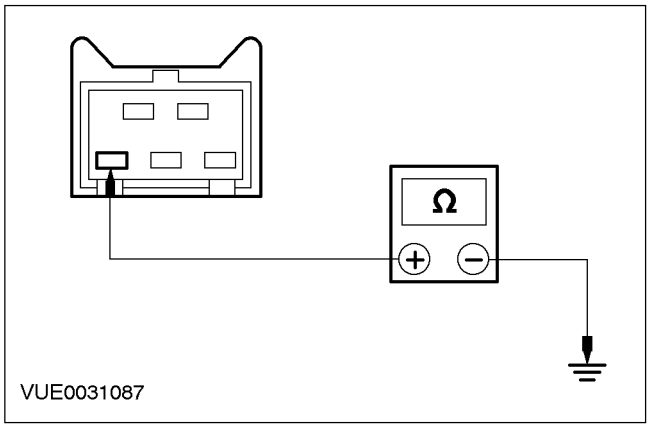
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VUE0031085	2 Measure the voltage between the BPP switch C406 pin 2, circuit 15-PG6 (GN/YE), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **B3**. → **No** REPAIR the circuit. TEST the system for normal operation.
B3: CHECK CIRCUIT 15S-PG16 (GN/YE) FOR OPEN	
 VUV3305118	1 Key in OFF position. 2 Measure the resistance between the BPP switch C406 pin 1, circuit 15S-PG16 (GN/YE), harness side and the speed control actuator C175 pin 9, circuit 15S-PG16 (GN/YE), harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a BPP switch. TEST the system for normal operation. → **No** REPAIR the circuit. TEST the system for normal operation.

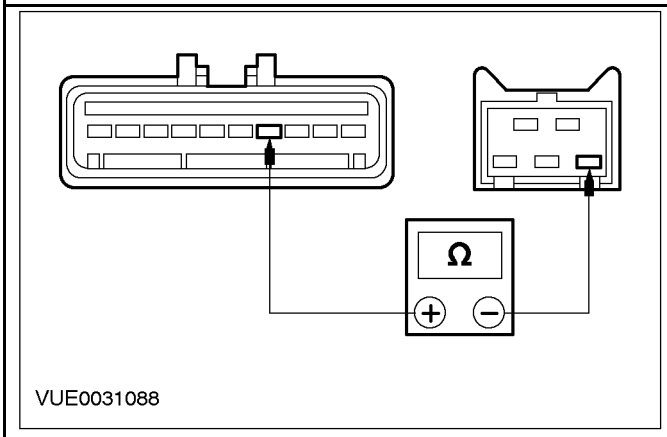
PINPOINT TEST C: THE SPEED CONTROL DOES NOT DISENGAGE WHEN THE CLUTCH IS APPLIED.

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK CIRCUIT 15S-PG17 (GN/BU) FOR OPEN	
	1 Key in OFF position. 2 Disconnect Speed Control Actuator C175.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**3** Measure the resistance between the speed control module C175 pin 4, circuit 15S-PG17 (GN/BU), harness side and ground. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new speed control actuator. REFER to Speed Control Actuator in this section. TEST the system for normal operation. → **No** IF the stop lamps operate correctly, GO to **C2**. IF the stoplamps do not operate correctly. REFER to Section 417-01.
C2: CHECK CIRCUIT 15S-PG7 (GN/BU) FOR OPEN	
	**1** Disconnect CPP switch C414. **2** Measure the resistance between the CPP switch C414 pin 3, circuit 15S-PG7 (GN/BU), harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **C3**. → **No** REPAIR the circuit. TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

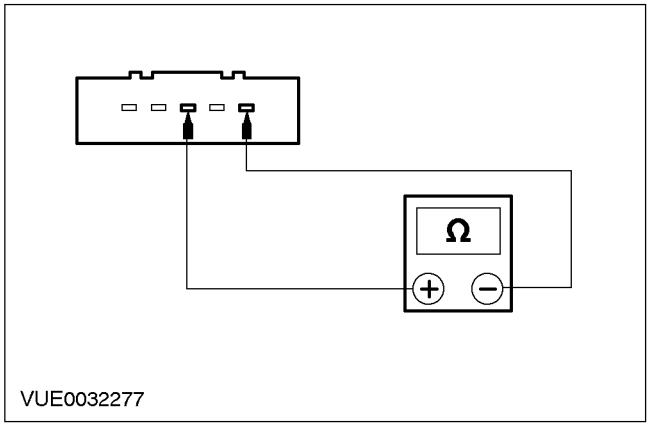
CONDITIONS	DETAILS/RESULTS/ACTIONS
C3: CHECK CIRCUIT 15S-PG17 (GN/BU) FOR OPEN	
 VUE0031088	1 Measure the resistance between the CPP switch C414 pin 1, circuit 15S-PG17 (GN/BU) harness side and the speed control actuator C175 pin 4, circuit 15S-PG17 (GN/BU), harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new CPP switch. TEST the system for normal operation. → **No** REPAIR the circuit. TEST the system for normal operation.

Component Tests - Speed Control Switch

WARNING: To deactivate the air bag module, refer to the procedure in Section 501-20B for the correct air bag module deactivation procedure. Failure to follow this instruction may result in personal injury.

Remove the driver air bag. REFER to Section 501-20A / 501-20B.

Test 1



VUE0032277

Hold the speed control switch in the ON position.

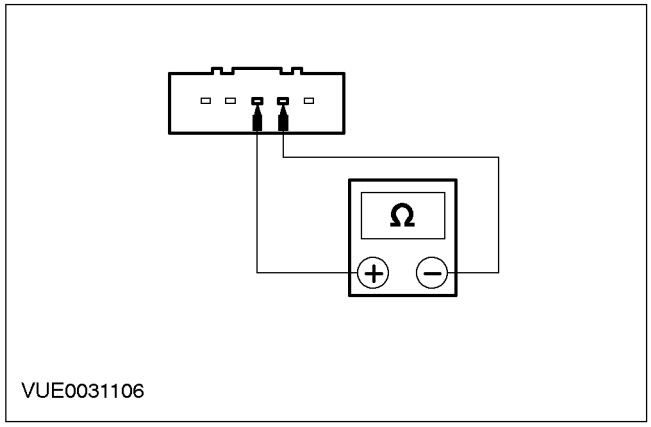
Measure resistance between pin 1 and pin 3.

Is the resistance less than 830 ohms?

If yes, continue with Test 2.

If no, INSTALL a new speed control switch. REFER to Speed Control Switch in this section. TEST the system for normal operation.

Test 2



VUE0031106

Hold the speed control switch in the OFF position.

Measure resistance between pin 2 and pin 3.

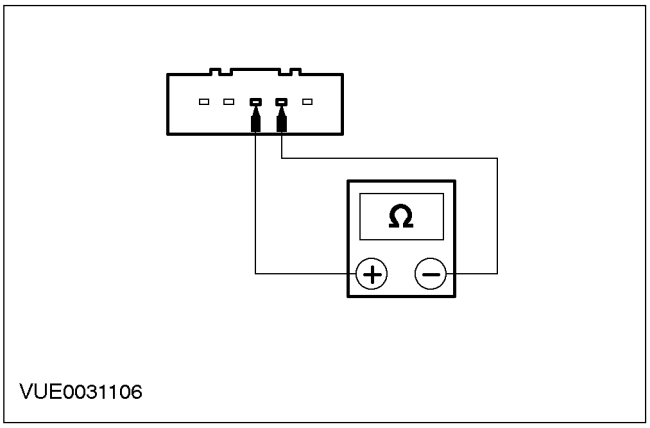
Is the resistance 0 ohms?

DIAGNOSIS AND TESTING (Continued)

If yes, continue with Test 3.

If no, INSTALL a new speed control switch. REFER to Speed Control Switch in this section. TEST the system for normal operation.

Test 3



Hold the speed control switch in the SET position.

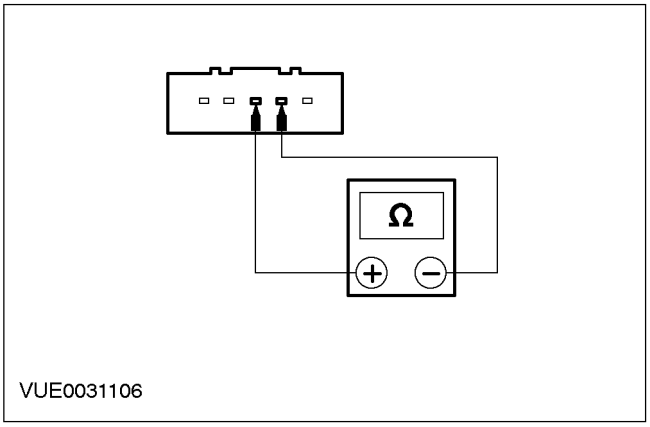
Measure resistance between pin 2 and pin 3.

Is the resistance less than 690 ohms?

If yes, continue with Test 4.

If no, INSTALL a new speed control switch. REFER to Speed Control Switch in this section. TEST the system for normal operation.

Test 4



Hold the speed control switch in the RESUME position.

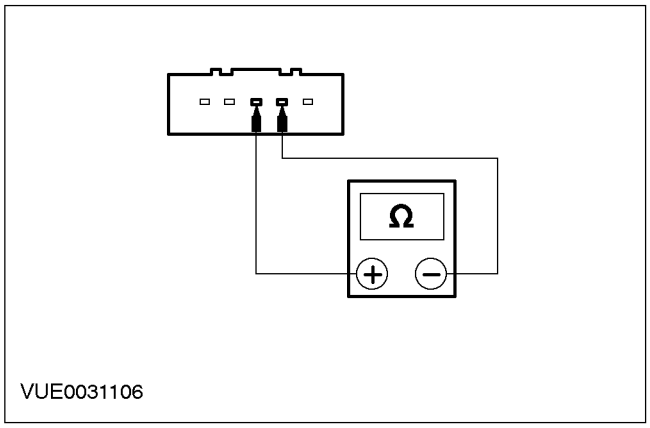
Measure resistance between pin 2 and pin 3.

Is the resistance less than 2250 ohms?

If yes, continue with Test 5.

If no, INSTALL a new speed control switch. REFER to Speed Control Switch in this section. TEST the system for normal operation.

Test 5



Hold the speed control switch in the DECELERATE position.

Measure resistance between pin 2 and pin 3.

Is the resistance less than 120 ohms?

If yes, INSTALL a new speed control module. TEST the system for normal operation.

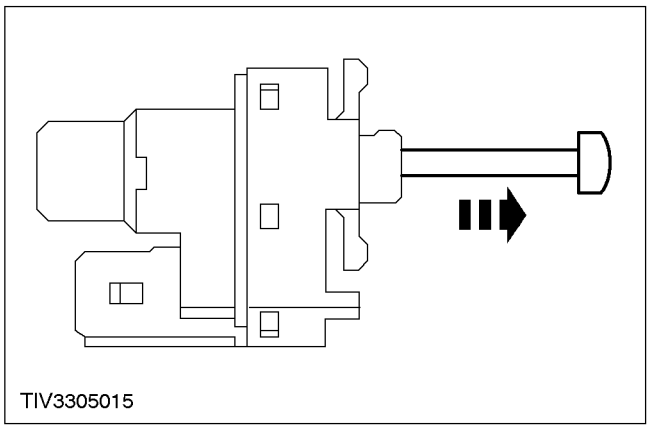
If no, INSTALL a new speed control switch. REFER to Speed Control Switch in this section. TEST the system for normal operation.

GENERAL PROCEDURES

Speed Control Deactivator Switch Adjustment (33 504 0)

1. Adjust the switch.

1. Pull the switch plunger out to its full extent.
2. Fully depress the pedal.
3. Install the switch.
4. Slowly release the pedal.

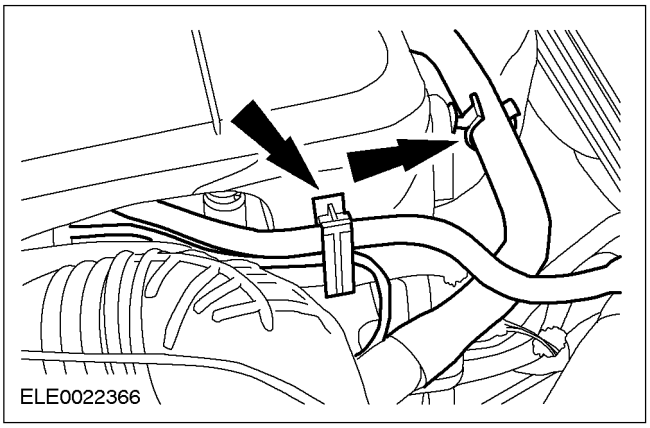


REMOVAL AND INSTALLATION

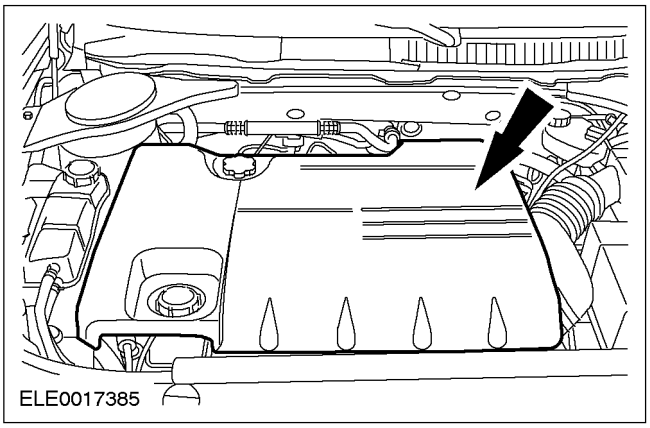
Speed Control Actuator (33 678 0)

Removal

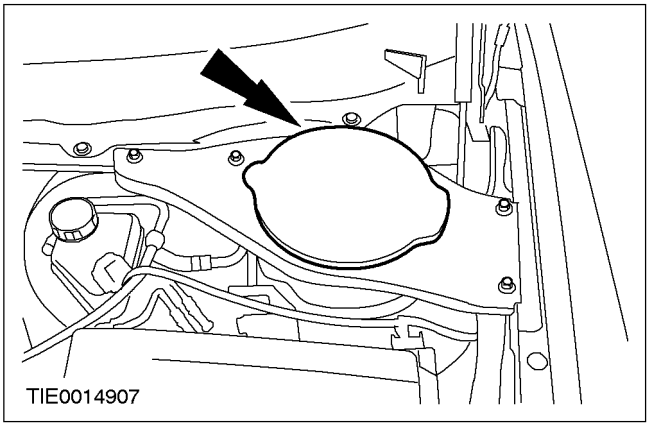
1. **Detach the positive crankcase ventilation (PCV) hose and the vacuum hose from the engine upper cover.**



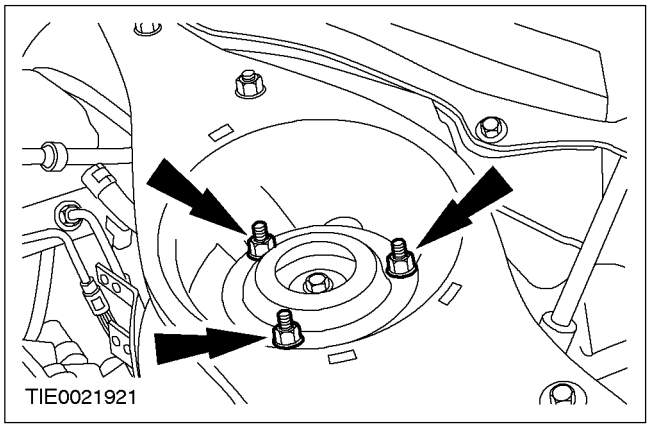
2. **Remove the engine upper cover.**



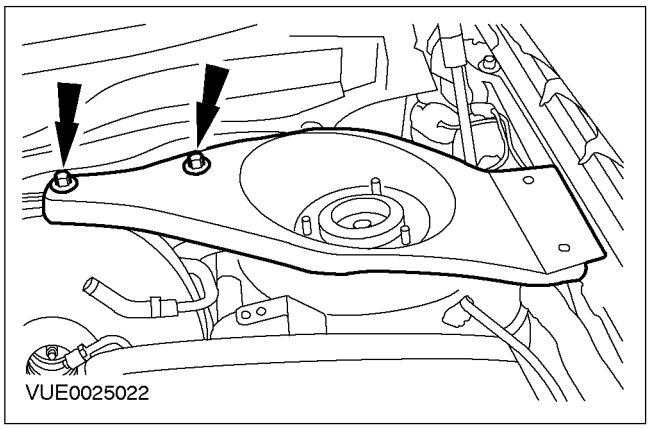
3. **Remove the strut and spring assembly top mount brace cover.**



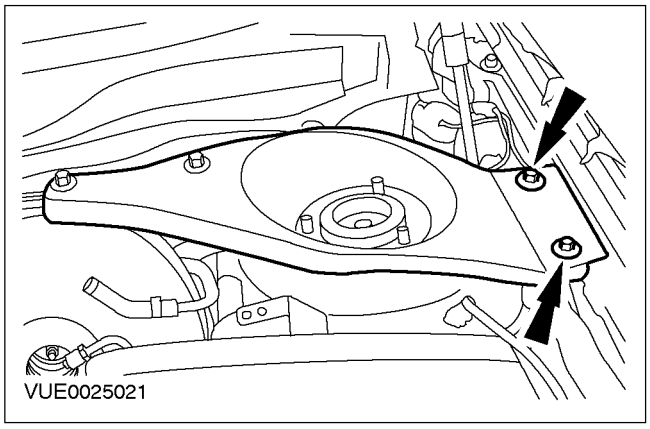
4. **Detach the strut and spring assembly top mount from the strut and spring assembly top mount brace.**



5. **Detach the strut and spring assembly top mount brace from the cowl.**



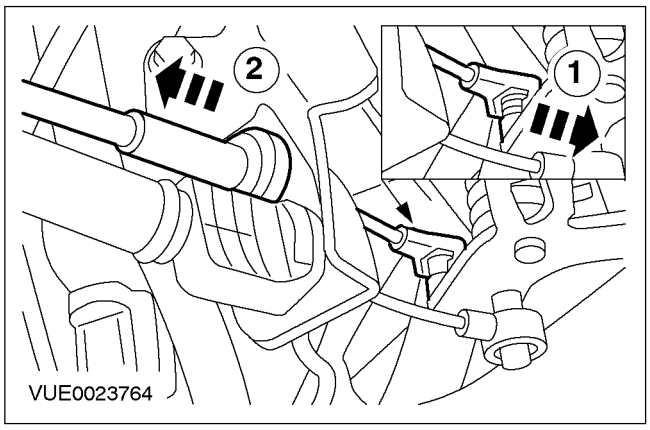
6. **Remove the strut and spring assembly top mount brace.**



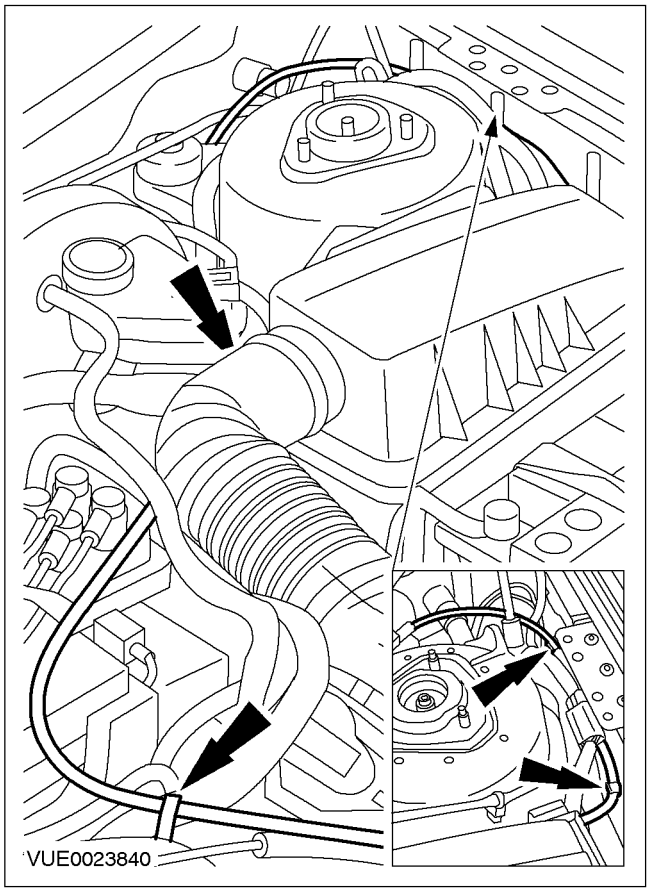
REMOVAL AND INSTALLATION (Continued)

7. Detach the speed control cable from the throttle body.

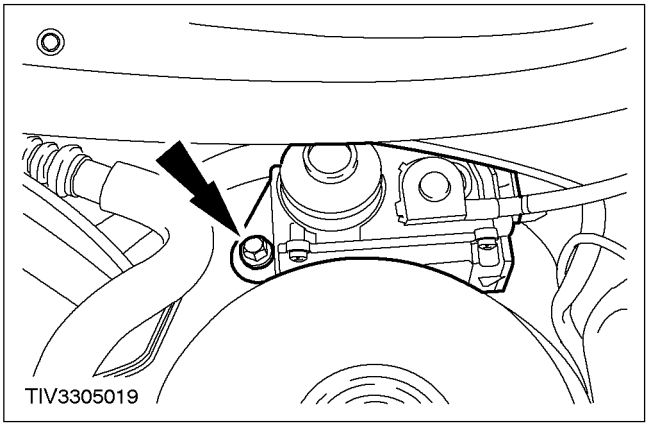
1. Disconnect the speed control cable from the throttle linkage.
2. Unclip the speed control cable.



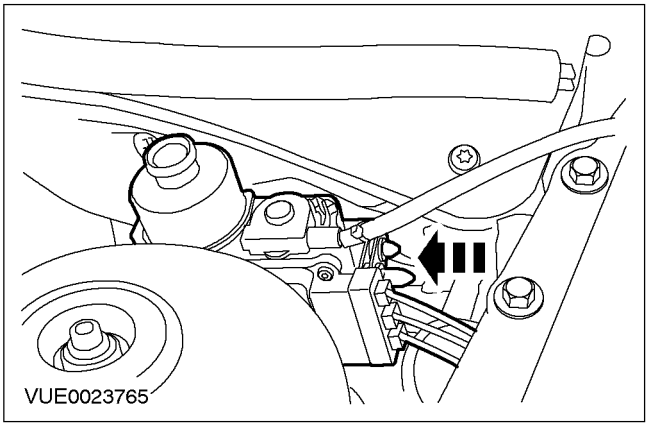
8. Detach the speed control cable.



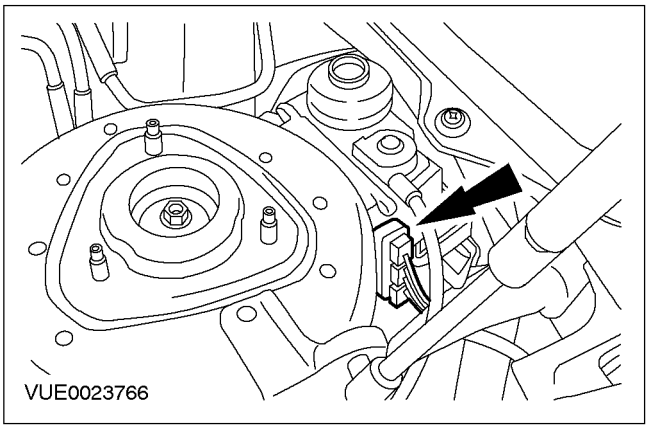
9. Remove the speed control actuator retaining bolt.



10. Detach the speed control actuator from the retaining bracket.

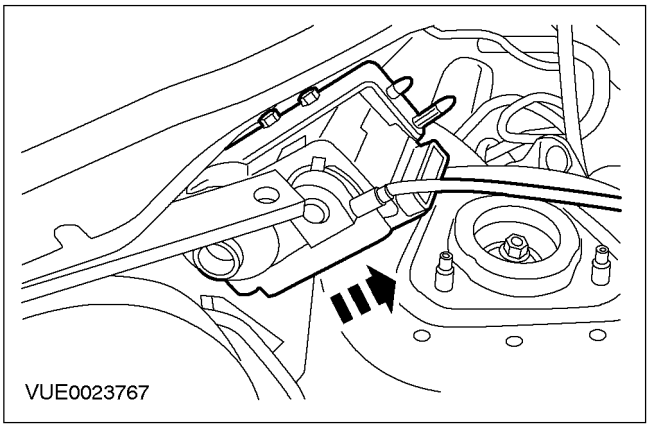


11. Disconnect the speed control actuator electrical connector.



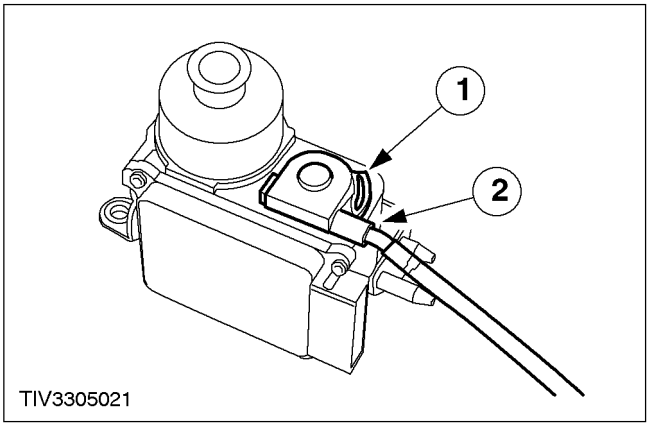
REMOVAL AND INSTALLATION (Continued)

12. Remove the speed control actuator.



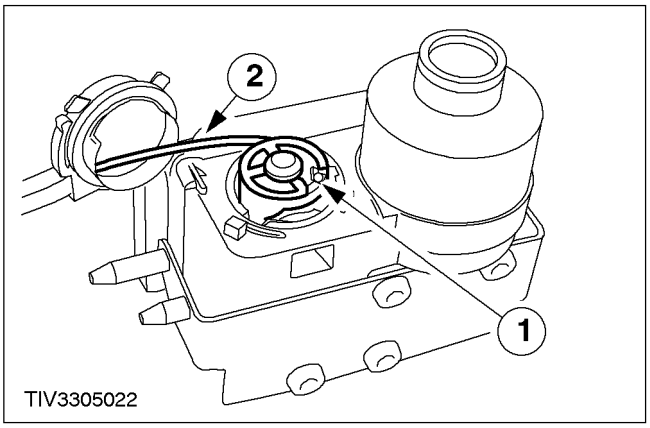
13. Detach the speed control cable from the actuator.

1. Press and hold the locking clip.
2. Rotate the cap counterclockwise.



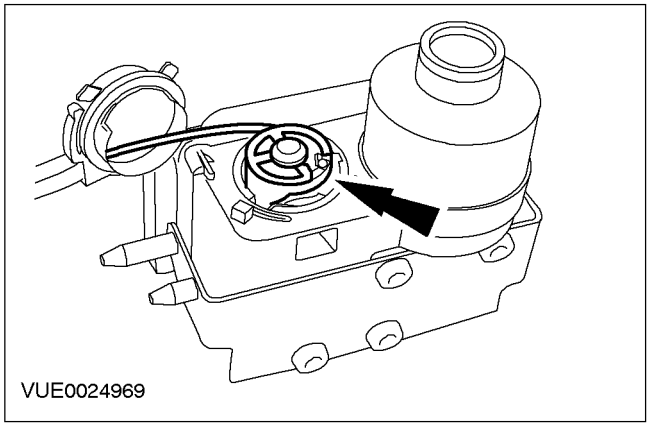
14. Remove the speed control cable from the speed control actuator.

1. Gently release the cable locking spring.
2. Push the cable end out of the speed control actuator pulley slot.

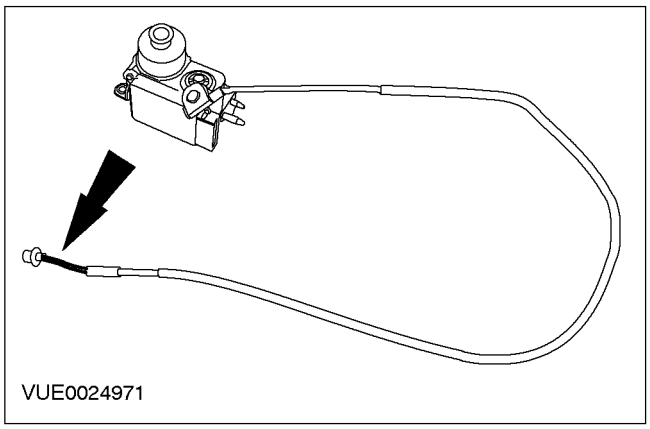


Installation

1. Install the speed control cable onto the speed control actuator.

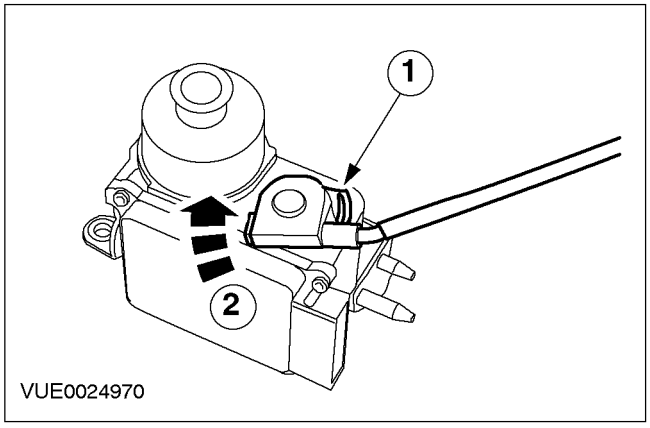


2. Pull the speed control cable to make sure that there is no free play at the speed control actuator.



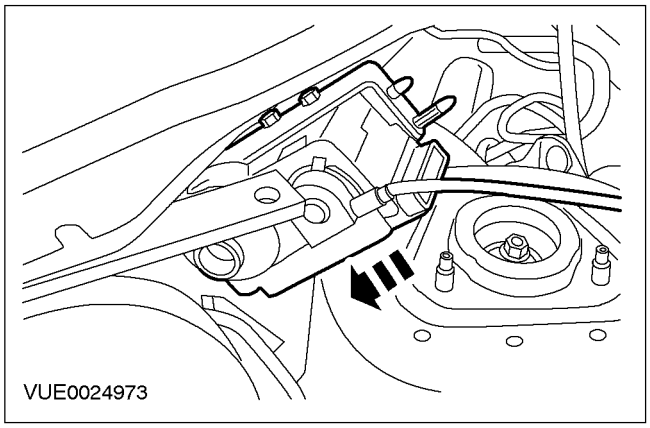
3. Install the speed control cable cap.

1. Install the speed control cable cap into the speed control actuator.
2. Rotate the speed control cable cap clockwise 90 degrees.

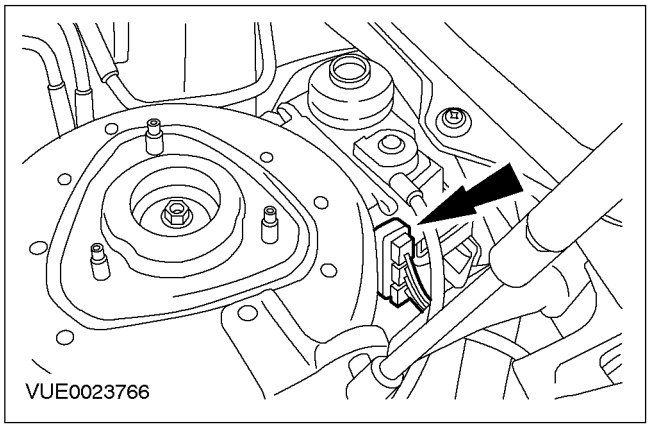


REMOVAL AND INSTALLATION (Continued)

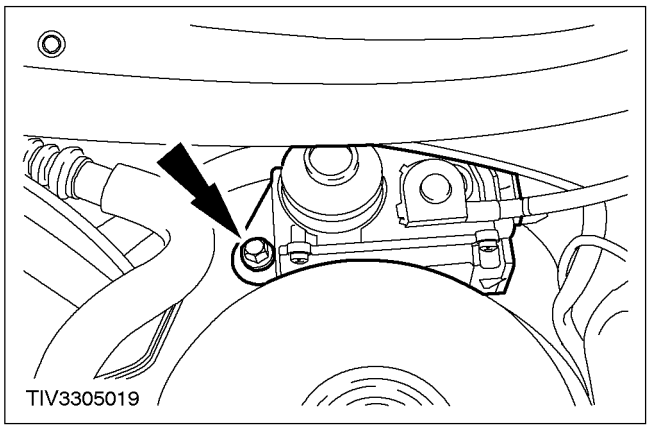
4. Install the speed control actuator.



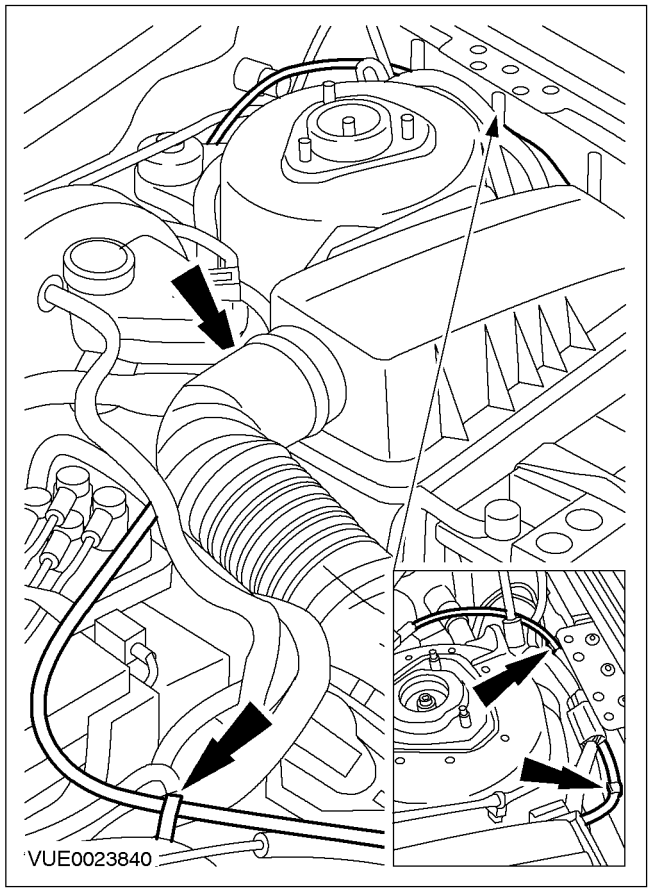
5. Connect the speed control actuator electrical connector.



6. Install the speed control actuator retaining bolt.

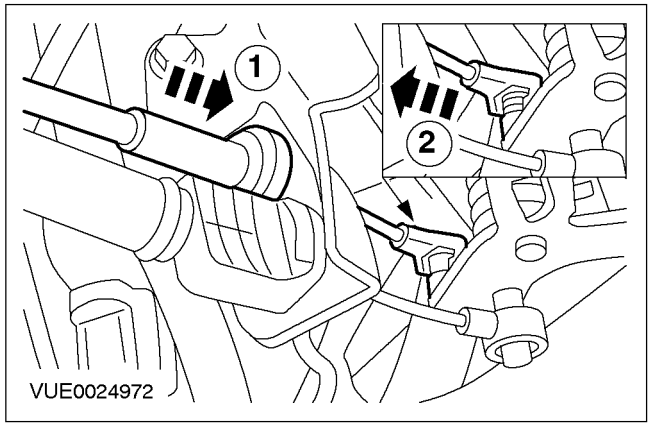


7. Attach the speed control cable.



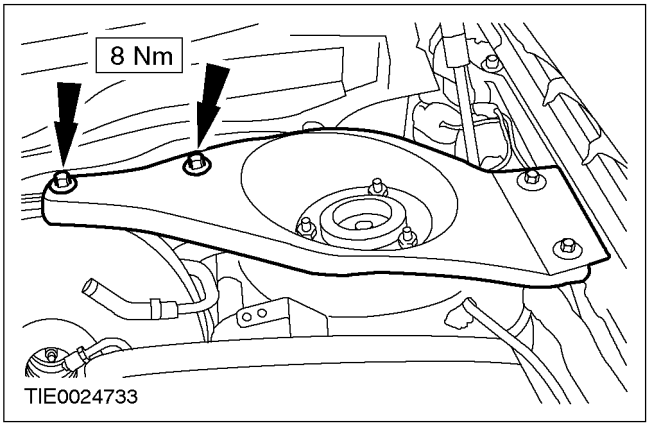
8. Attach the speed control cable to the throttle body.

1. Attach the speed control cable.
2. Connect the speed control cable to the throttle linkage.

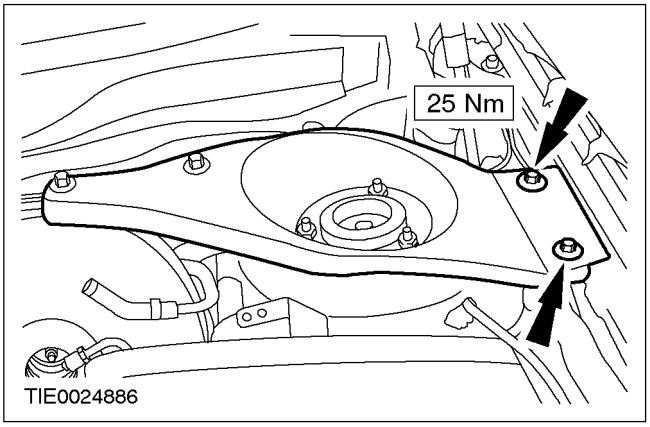


REMOVAL AND INSTALLATION (Continued)

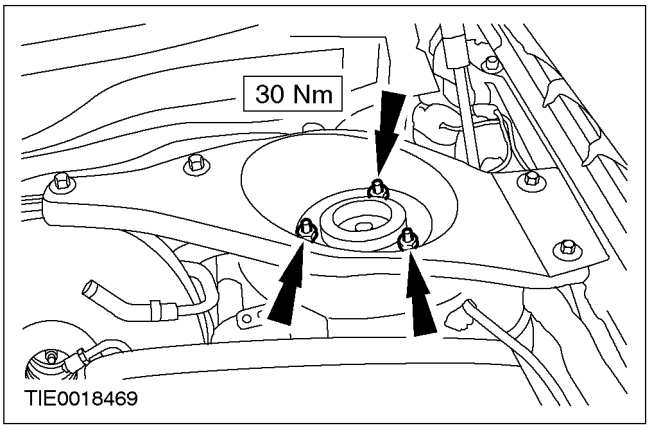
9. Install the strut and spring assembly top mount brace.



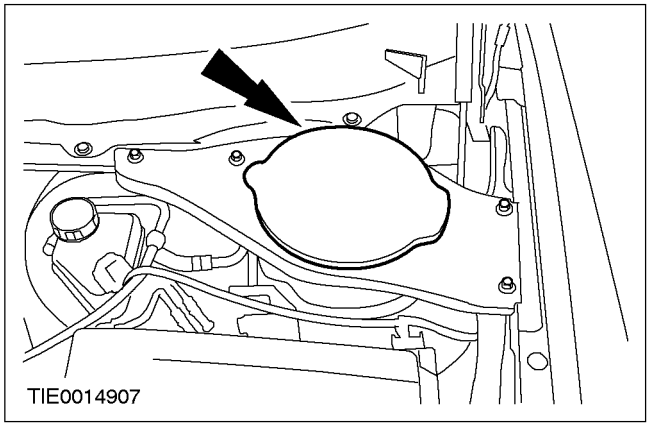
10. Install the strut and spring assembly top mount brace retaining bolts.



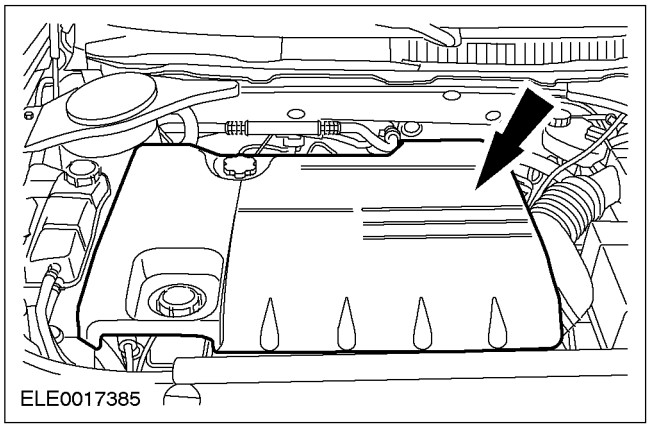
11. Install the strut and spring assembly retaining nuts.



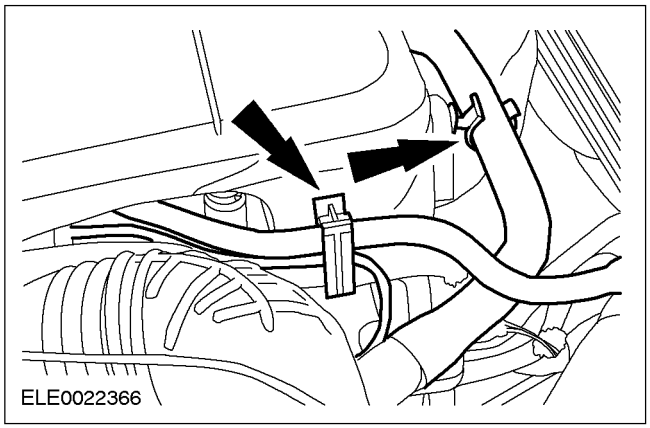
12. Install the strut and spring assembly top mount brace cover.



13. Install the engine upper cover.



14. Attach the positive crankcase ventilation (PCV) hose and the vacuum hose to the engine upper cover.

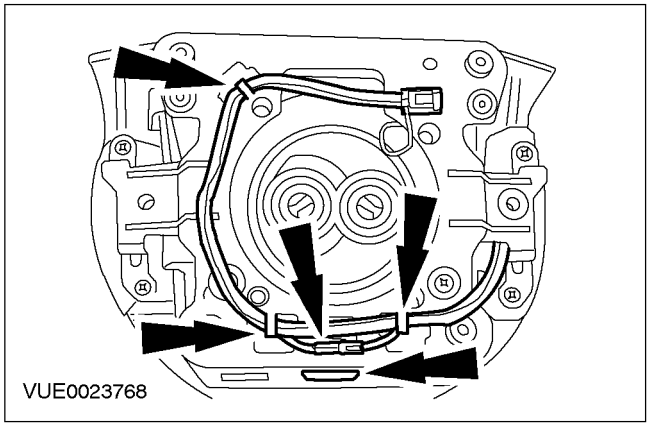


REMOVAL AND INSTALLATION

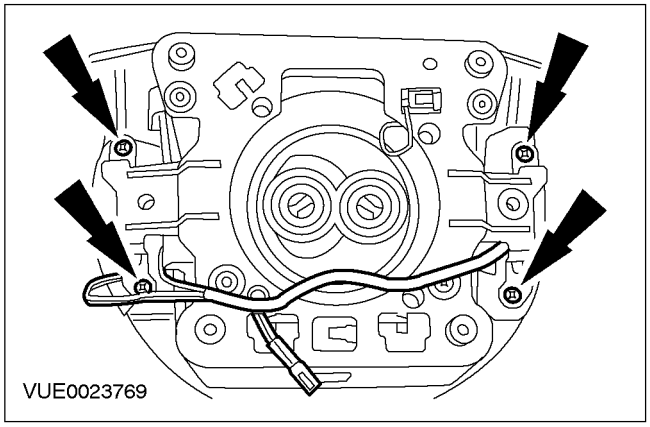
Speed Control Switch (33 500 0)

Removal

1. **Remove the driver air bag module. For additional information, refer to Section 501-20A / 501-20B.**
2. **Detach the vehicle speed control wiring harness from the horn switch.**



3. **Remove the speed control switches from the driver air bag module.**



Installation

1. **To install, reverse the removal procedure.**

Group

4

Electrical

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Auxiliary Heating	412-02B-1
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Module Configuration	418-01-1
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SECTION 412-00 Climate Control System - General Information

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
R134a refrigerant	WSH-M17B19-A
Refrigerant oil	WSH-M1C231-B

Refrigerant Capacities (when charging)

	Grams
Air conditioning (A/C) system	820 ± 17

Refrigerant Oil Capacities

	Milliliters
Air conditioning (A/C) system	200

Addition of Air Conditioning Refrigerant Oil (when components are renewed)

	Milliliters
Air conditioning (A/C) compressor, if the quantity of refrigerant oil taken from the A/C compressor is less than 90 ml.	Add 90.
Air conditioning (A/C) compressor, if the quantity of refrigerant oil taken from the A/C compressor is between 90 and 150 ml.	Fill with the same quantity + 30.
Air conditioning (A/C) compressor, if the quantity of refrigerant oil taken from the A/C compressor is greater than 150 ml.	Fill with the same quantity.
Air conditioning (A/C) condenser core	Add 30.
Air conditioning (A/C) evaporator core	Add 90.
When all lines are renewed.	Fill with the same quantity + 2.
When all lines and components are renewed.	Add 0.
Every time if refrigerant oil is collected after refrigerant is extracted.	Fill with the same quantity.
Suction accumulator	Fill with the same quantity + 90.

Air Conditioning (A/C) Clutch

	mm
Air conditioning (A/C) clutch air gap	0.35 - 0.75

Torque Specifications

Description	Nm	lb-ft	lb-in
Air conditioning (A/C) compressor drive plate retaining bolt	13	10	-

DIAGNOSIS AND TESTING

Climate Control System

Refer to Wiring Diagrams Section 412-00 for schematic and connector information.

Inspection and Verification

1. VERIFY the customer concern.
2. PERFORM visual inspection for obvious signs of mechanical or electrical damage.

Visual inspection

Mechanical	Electrical
– Drive belt – Refrigerant lines – Condenser	– Fuses – Wiring harness – Electrical connectors

3. If an obvious cause for a concern is found during visual inspection, RECTIFY the cause before performing further tests. CHECK operation of the system.
4. If the concern persists after the visual inspection, PERFORM a fault diagnosis on the climate control system with WDS and RECTIFY any displayed faults in accordance with the displayed fault description. CHECK operation of the system.
5. If no fault is stored in the fault memory, PROCEED with the Symptom Chart according to the fault symptom.

Fault Memory Interrogation without WDS (Vehicles with EATC System only)

The climate control system features a self-diagnosis function which can detect and store both current permanent faults as well as intermittent faults which have occurred during normal operation of the vehicle. It is also possible to read out these faults via the display of the EATC module.

Read-out of current faults

On the EATC module, briefly press the "OFF" and "FOOTWELL" buttons simultaneously, then press "AUTO" within 2 seconds. The self-diagnosis which then starts lasts a few seconds. An animated display appears during this time in the EATC display. Any faults found are displayed in the form of trouble codes. Example: First of all, "12" flashes for 2 seconds, then "51" flashes for 2 seconds - DTC B1251. If no faults are stored, then all of the segments in the display are actuated. The following table gives information on the possible DTCs and their corresponding meanings. Diagnosis mode can be stopped at any time by PRESSING any button on the EATC module.

Read-out of intermittent faults

On the EATC module, briefly press the "OFF" and "FOOTWELL" buttons simultaneously, then press "FACE LEVEL" within 2 seconds. Any stored intermittent faults are output on the EATC display and should be noted for safety reasons. By PRESSING the "DEFROST" button, the fault memory is cleared and diagnosis mode is ended. To end diagnosis mode without clearing the DTCs, PRESS any other button on the EATC module.

Reading out the EATC software version

On the EATC module, briefly ACTUATE the "OFF" and "FOOTWELL" buttons simultaneously, then PRESS "A/C" within 2 seconds. The SW version is output on the EATC display. The output mode is ended by PRESSING any button.

Trouble Code Table (Vehicles with EATC System only)

Self-test code	Description	Action
B1200	Internal control module fault	CLEAR fault memory. If the fault occurs again after a functional test, RENEW the EATC module.
B1242	Circuit of heater flap control motor, recirculated air fault	GO to Pinpoint Test D
B1251	Open circuit in interior temperature sensor circuit	GO to Pinpoint Test L

DIAGNOSIS AND TESTING (Continued)

Self-test code	Description	Action
B1253	Short circuit in interior temperature sensor circuit (short to ground)	GO to Pinpoint Test L
B1261	Short circuit in sun load sensor circuit (short to ground)	GO to Pinpoint Test K
B1262	Circuit of defrost actuator motor faulty	GO to Pinpoint Test E
B1263	Circuit of dashboard/footwell actuator motor faulty	GO to Pinpoint Test F
B1342	Internal control module fault	CLEAR fault memory. If the fault occurs again after a functional test, RENEW the EATC module.
B1676	Power supply voltage outside tolerance	CHECK charging system. For further information REFER to Section 414-00. If the charging system is OK, GO to Pinpoint Test I
B2266	Air temperature positioning motor circuit faulty	GO to Pinpoint Test G
B2297	Open circuit in the footwell outlet temperature sensor circuit	GO to Pinpoint Test H
B2298	Short circuit in the footwell outlet temperature sensor circuit (short to ground)	GO to Pinpoint Test H
B2308	Interior temperature sensor blower circuit faulty	GO to Pinpoint Test M
B2516	Heater blower control module circuit faulty	GO to Pinpoint Test J

Symptom Chart

Condition	Possible Sources	Action
•Heater blower motor inoperative/partially inoperative (vehicles without EATC only)	•Fuse(s) •Circuit(s) •Heater blower relay •Heater blower motor •Heater blower switch •Heater blower motor variable resistor	• GO to Pinpoint Test A
•Heater blower motor running continuously (vehicles without EATC only)	•Heater blower switch •Circuit(s) •Heater blower relay	• GO to Pinpoint Test B

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
•Air conditioning inoperative (heater blower function OK)	•Fuse(s) •Circuit(s) •Heating and air conditioning control module or EATC module •A/C compressor clutch diode •A/C compressor clutch •Air conditioning wide open throttle (WOT) relay. •Refrigerant quantity / circuit •A/C compressor switch •Dual pressure switch •Powertrain control module (PCM)	• GO to Pinpoint Test C
•Inadequate cooling performance of air conditioning (A/C compressor clutch function OK)	•Malfunction of the cooling fan •Refrigerant quantity •Refrigerant circuit	•PERFORM a fault diagnosis of the electronic engine management (PCM) with WDS. •CHECK the refrigerant quantity/circuit with the R134a refrigerant centre and REPAIR the system as required.
•Malfunction of the air recirculation flap	•Circuit(s) •Air recirculation flap •Heater flap positioning motor, recirculated air •Heating and air conditioning control module or EATC module	• GO to Pinpoint Test D
•Malfunction of the defrost flap	•Circuit(s) •Defrost flap •Defrost flap positioning motor	• GO to Pinpoint Test E
•Malfunction of the air distribution flap	•Circuit(s) •Air distribution flap •Dashboard/footwell flap positioning motor	• GO to Pinpoint Test F
•Malfunction of the air temperature flap	•Circuit(s) •Air temperature flap •Air temperature flap positioning motor	• GO to Pinpoint Test G
•Fault in the circuit of the footwell outlet temperature sensor	•Circuit(s) •Footwell outlet temperature sensor	• GO to Pinpoint Test H
•EATC module inoperative (no display on the climate control assembly)	•Fuse(s) •Circuit(s) •Central junction box •Heater blower relay •EATC module	• GO to Pinpoint Test I
•Malfunction of the heater blower (vehicles with EATC only, display on the climate control assembly OK)	•Circuit(s) •EATC module •Heater blower control module	• GO to Pinpoint Test J

DIAGNOSIS AND TESTING (Continued)

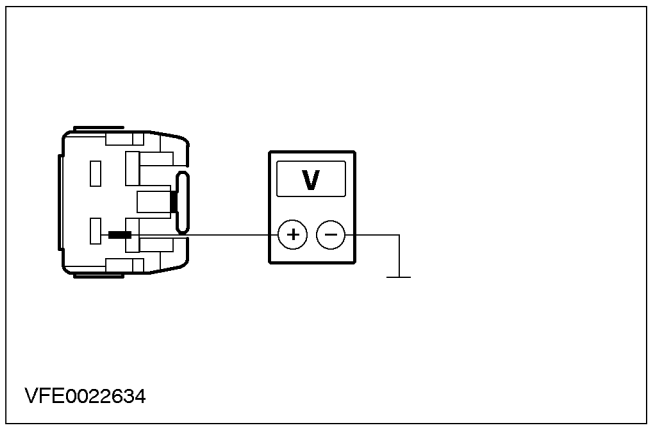
Condition	Possible Sources	Action
•Fault in the circuit of the sun load sensor (vehicles with EATC only)	•Circuit(s) •Sun load sensor	• GO to Pinpoint Test K
•Fault in the circuit of the interior temperature sensor (vehicles with EATC only)	•Circuit(s) •Interior temperature sensor	• GO to Pinpoint Test L
•Fault in the circuit of the interior temperature sensor blower (vehicles with EATC only)	•Fuse •Circuit(s) •Interior temperature sensor	• GO to Pinpoint Test M

Pinpoint Tests

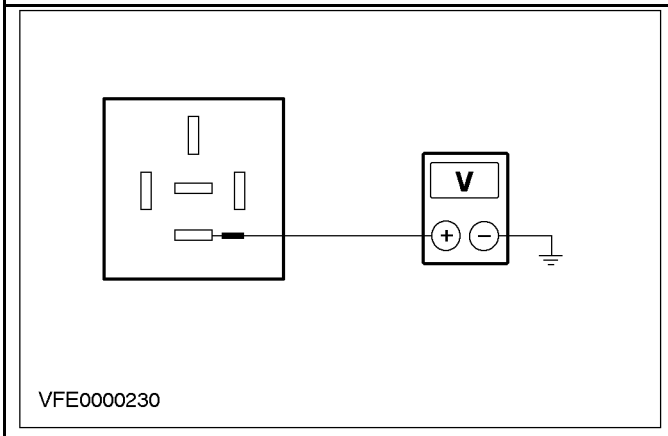
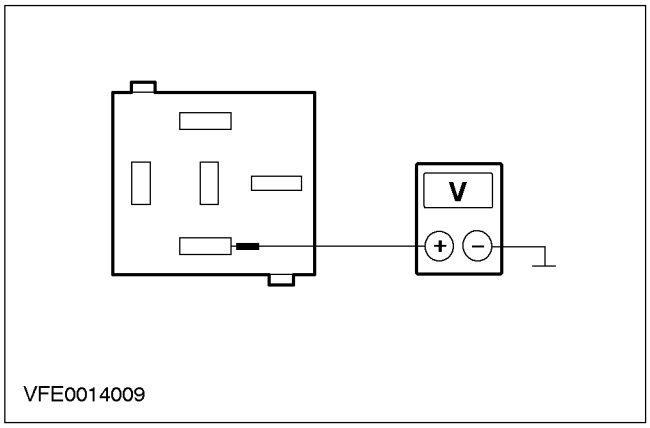
PINPOINT TEST A: HEATER BLOWER MOTOR INOPERATIVE/PARTIALLY INOPERATIVE (VEHICLES WITHOUT EATC ONLY)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: DETERMINE FAULT CONDITIONS	
	1 Key in ON position. 2 Switch the heater blower switch through all settings. • Is the heater blower motor inoperative in all switch positions? → **Yes** GO to **A2** → **No** GO to **A14**
A2: CHECK FUSE F6	
	1 Key in OFF position. 2 CHECK fuse F6 (BJB). • Is the fuse OK? → **Yes** GO to **A3** → **No** RENEW fuse F6 (40 A). CHECK operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams.
A3: CHECK VOLTAGE AT FUSE F6	
	1 Connect fuse F6 (BJB). 2 Measure the voltage between fuse F6 (40 A) and ground. • Is battery voltage measured? → **Yes** GO to **A4** → **No** RECTIFY the voltage supply to fuse F6 with the aid of the Wiring Diagrams. CHECK operation of the system.

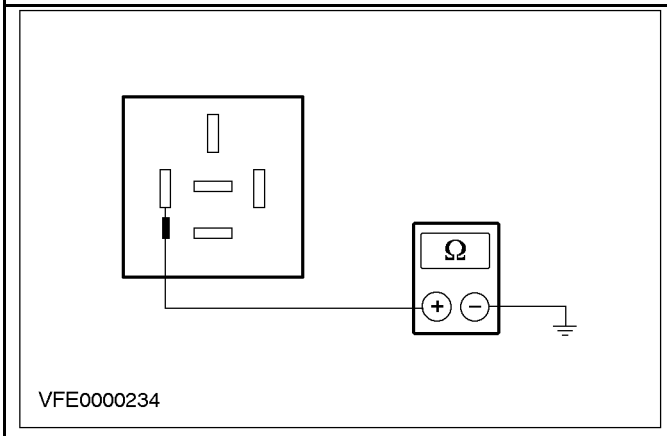
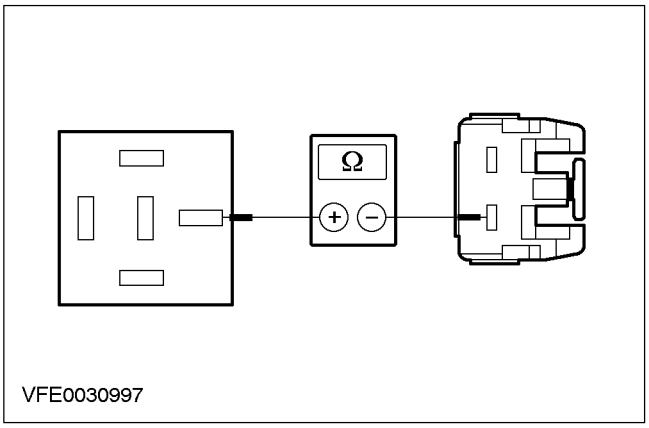
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A4: CHECK FUSE F93	
	1 CHECK fuse F93 (CJB). • Is the fuse OK? → **Yes** GO to **A5** → **No** RENEW fuse F93 (10 A). CHECK operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams.
A5: CHECK VOLTAGE AT FUSE F93	
	1 Connect fuse F93 (CJB). 2 Key in ON position. 3 Measure the voltage between fuse F93 (10 A) and ground. • Is battery voltage measured? → **Yes** GO to **A6** → **No** RECTIFY the voltage supply to fuse F93 with the aid of the Wiring Diagrams. CHECK operation of the system.
A6: CHECK THE VOLTAGE AT THE HEATER BLOWER MOTOR	
 VFE0022634	1 Key in OFF position. 2 Disconnect heater blower motor C442. 3 Key in ON position. 4 Measure the voltage between the heater blower motor, connector C442, pin 1, circuit 15S-FA45 (GN/RD), wiring harness side and ground. • Is battery voltage measured? → **Yes** GO to **A11** → **No** GO to **A7**
A7: CHECK THE VOLTAGE AT THE HEATER BLOWER RELAY	
	1 Key in OFF position. 2 Disconnect heater blower relay C920 (CJB).

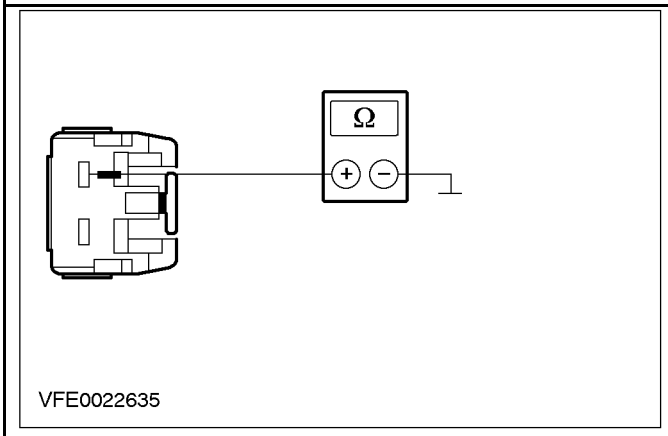
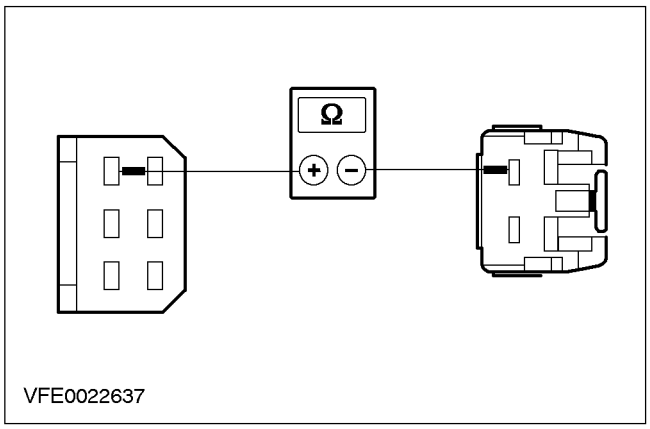
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0000230	3 Measure the voltage between the heater blower relay, socket C920, pin 5, wiring harness side and ground. • Is battery voltage measured? → **Yes** GO to **A8** → **No** LOCATE and RECTIFY the open circuit between the heater blower relay and fuse F6 with the aid of the Wiring Diagrams. CHECK operation of the system.
A8: CHECK THE CONTROL VOLTAGE AT THE HEATER BLOWER RELAY	
 VFE0014009	1 Key in ON position. 2 Measure the voltage between the heater blower relay, socket C920, pin 2, wiring harness side and ground. • Is battery voltage measured? → **Yes** GO to **A9** → **No** LOCATE and RECTIFY the open circuit between the heater blower relay and fuse F93 with the aid of the Wiring Diagrams. CHECK operation of the system.
A9: CHECK THE GROUND CONNECTION OF THE HEATER BLOWER RELAY	
	1 Key in OFF position.

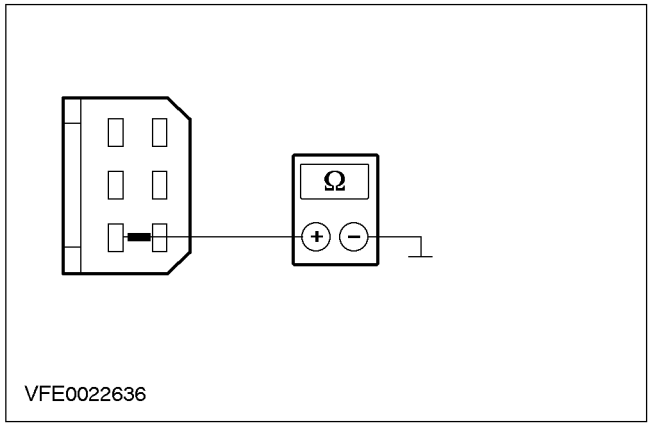
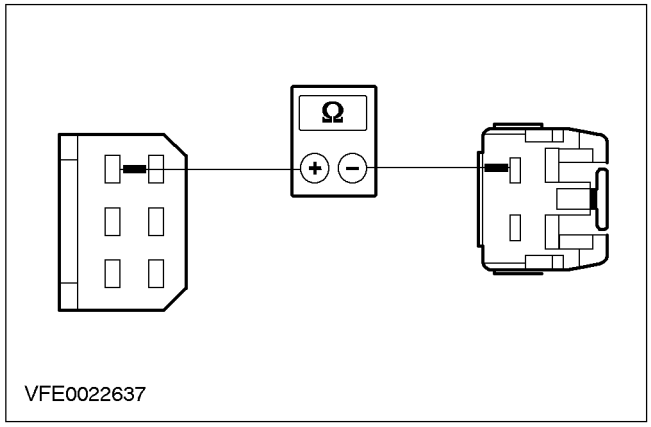
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0000234	**2** Measure the resistance between the heater blower relay, socket C920, pin 1, wiring harness side and ground. • Is a resistance of less than 2 Ohms registered? → **Yes** GO to **A10** → **No** LOCATE and RECTIFY the open circuit between the heater blower relay and ground connection G200 with the aid of the Wiring Diagrams. CHECK operation of the system.
A10: CHECK THE CIRCUIT BETWEEN THE HEATER BLOWER RELAY AND THE HEATER BLOWER MOTOR FOR OPEN CIRCUIT	
 VFE0030997	**1** Measure the resistance between the heater blower relay, socket C920, pin 3, wiring harness side and the heater blower motor, connector C442, pin 1, circuit 15S-FA45 (GN/RD), wiring harness side. • Is a resistance of less than 2 Ohms registered? → **Yes** RENEW the heater blower relay. CHECK operation of the system. → **No** LOCATE and RECTIFY the open circuit between the heater blower relay and the heater blower motor with the aid of the Wiring Diagrams. CHECK operation of the system.
A11: CHECK THE GROUND CONNECTION OF THE HEATER BLOWER MOTOR	
	1 Key in OFF position. **2** Set the heater blower switch to "maximum".

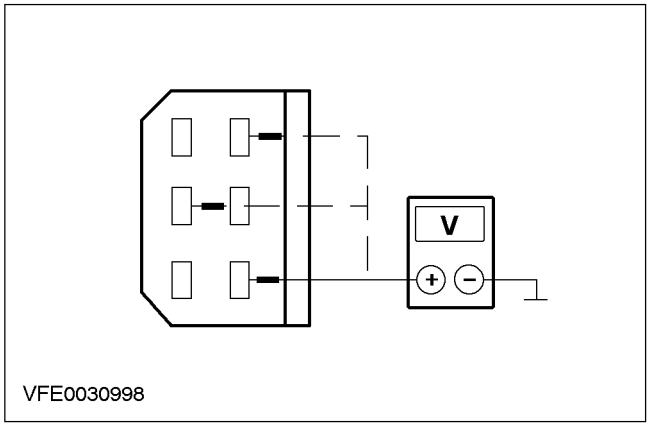
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022635	3 Measure the resistance between the heater blower motor connector C442, pin 2, circuit 31S-FA45 (BK/OG), wiring harness side and ground. • Is a resistance of less than 2 Ohms registered? → **Yes** RENEW the heater blower motor. CHECK operation of the system. → **No** GO to **A12**
A12: CHECK THE CIRCUIT BETWEEN THE HEATER BLOWER MOTOR AND THE HEATER BLOWER SWITCH FOR OPEN CIRCUIT	
 VFE0022637	1 Disconnect heater blower switch C448. 2 Measure the resistance between the heater blower motor, connector C442, pin 2, circuit 31S-FA45 (BK/OG), wiring harness side and the heater blower switch, connector C448, pin 1, circuit 31S-FA33 (BK/OG), wiring harness side. • Is a resistance of less than 2 Ohms registered? → **Yes** GO to **A13** → **No** LOCATE and RECTIFY the open circuit in circuit 31S-FA45 (BK/OG) between the heater blower motor and soldered connection S113 with the aid of the Wiring Diagrams. CHECK operation of the system.

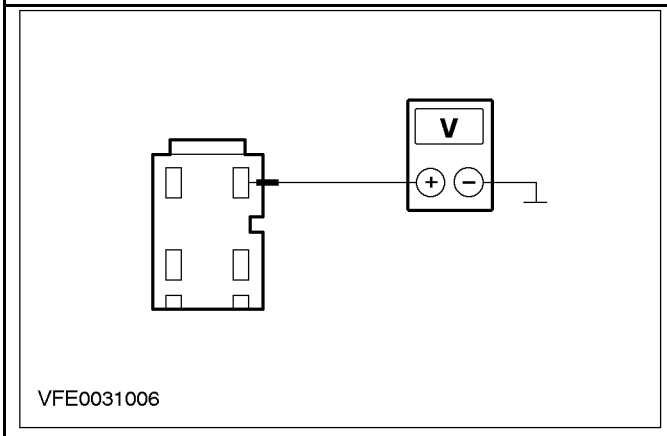
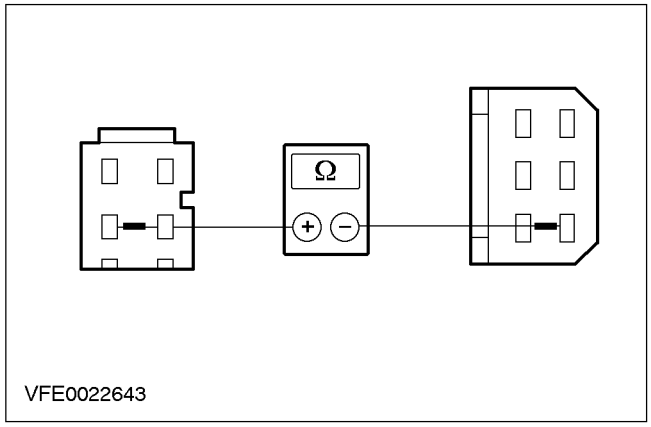
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A13: CHECK THE GROUND CONNECTION OF THE HEATER BLOWER SWITCH	
 VFE0022636	1 Measure the resistance between the heater blower switch, connector C448, pin 3, circuit 31-FA1 (BK), wiring harness side and ground. • Is a resistance of less than 2 Ohms registered? → **Yes** RENEW the heater blower switch. CHECK operation of the system. → **No** LOCATE and RECTIFY the open circuit in circuit 31-FA1 (BK) between the heater blower switch and ground connection G204 with the aid of the Wiring Diagrams. CHECK operation of the system.
A14: DETERMINE FAULT CONDITIONS	
	1 Set the heater blower switch to "maximum". • Is the heater blower motor inoperative? → **Yes** GO to **A15** → **No** GO to **A16**
A15: CHECK THE CIRCUIT BETWEEN THE HEATER BLOWER MOTOR AND THE HEATER BLOWER SWITCH FOR OPEN CIRCUIT	
 VFE0022637	1 Key in OFF position. 2 Disconnect heater blower switch C448. 3 Disconnect heater blower motor C442. 4 Measure the resistance between the heater blower motor, connector C442, pin 2, circuit 31S-FA45 (BK/OG), wiring harness side and the heater blower switch, connector C448, pin 1, circuit 31S-FA33 (BK/OG), wiring harness side.

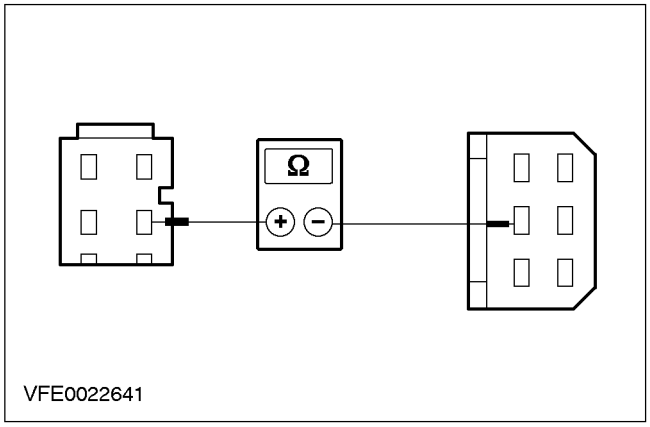
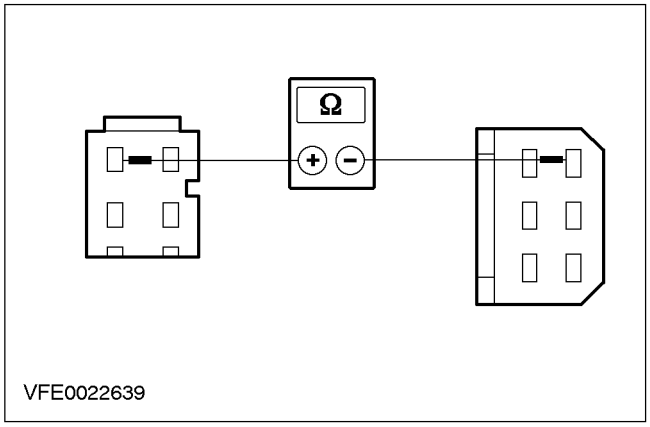
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is a resistance of less than 2 Ohms registered? → **Yes** RENEW the heater blower switch. CHECK operation of the system. → **No** LOCATE and RECTIFY the open circuit in circuit 31S-FA33 (BK/OG) between soldered connection S113 and the heater blower switch with the aid of the Wiring Diagrams. CHECK operation of the system.
A16: CHECK THE HEATER BLOWER SWITCH	
	1 Key in OFF position. 2 Disconnect Heater blower switch C448. 3 Key in ON position. 4 Measure the voltage between the heater blower switch, connector C448, pin 6, circuit 31S-FA32 (BK/BU), wiring harness side and ground. 5 Measure the voltage between the heater blower switch, connector C448, pin 2, circuit 31S-FA31 (BK/YE), wiring harness side and ground. 6 Measure the voltage between the heater blower switch, connector C448, pin 4, circuit 31S-FA30 (BK/WH), wiring harness side and ground. • Is battery voltage measured in all cases? → **Yes** RENEW the heater blower switch. CHECK operation of the system. → **No** GO to **A17**
A17: CHECK THE CIRCUIT BETWEEN THE HEATER BLOWER MOTOR AND THE VARIABLE HEATER BLOWER RESISTOR.	
	1 Key in OFF position. 2 Disconnect heater blower variable resistor C443. 3 Key in ON position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031006	**4** Measure the voltage between the heater blower motor variable resistor, connector C443, pin 1, circuit 31S-FA1 (BK/WH), wiring harness side and ground. • Is battery voltage measured? → **Yes** GO to **A18** → **No** LOCATE and RECTIFY the open circuit in circuit 31S-FA19 (BK/WH) between soldered connection S113 and the heater blower motor variable resistor with the aid of the Wiring Diagrams. CHECK operation of the system.
A18: CHECK THE CIRCUIT BETWEEN THE HEATER BLOWER MOTOR VARIABLE RESISTOR AND THE HEATER BLOWER SWITCH FOR OPEN CIRCUIT	
 VFE0022643	**1** Key in OFF position. **2** Measure the resistance between the heater blower motor variable resistor, connector C443, pin 4, circuit 31S-FA32 (BK/BU), wiring harness side and the heater blower switch, connector C448, pin 6, circuit 31S-FA32 (BK/BU), wiring harness side. • Is a resistance of less than 2 Ohms registered? → **Yes** GO to **A19** → **No** LOCATE and RECTIFY the open circuit in circuit 31S-FA32 (BK/BU) between the heater blower motor variable resistor and the heater blower switch with the aid of the Wiring Diagrams. CHECK operation of the system.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A19: CHECK THE CIRCUIT BETWEEN THE HEATER BLOWER MOTOR VARIABLE RESISTOR AND THE HEATER BLOWER SWITCH FOR OPEN CIRCUIT	
 VFE0022641	**1** Measure the resistance between the heater blower motor variable resistor, connector C443, pin 2, circuit 31S-FA31 (BK/YE), wiring harness side and the heater blower switch, connector C448, pin 2, circuit 31S-FA31 (BK/YE), wiring harness side. • Is a resistance of less than 2 Ohms registered? → **Yes** GO to **A20** → **No** LOCATE and RECTIFY the open circuit in circuit 31S-FA31 (BK/YE) between the heater blower motor variable resistor and the heater blower switch with the aid of the Wiring Diagrams. CHECK operation of the system.
A20: CHECK THE CIRCUIT BETWEEN THE HEATER BLOWER MOTOR VARIABLE RESISTOR AND THE HEATER BLOWER SWITCH FOR OPEN CIRCUIT	
 VFE0022639	**1** Measure the resistance between the heater blower motor variable resistor, connector C443, pin 3, circuit 31S-FA30 (BK/WH), wiring harness side and the heater blower switch, connector C448, pin 4, circuit 31S-FA30 (BK/WH), wiring harness side. • Is a resistance of less than 2 Ohms registered? → **Yes** RENEW the heater blower motor variable resistor. CHECK operation of the system. → **No**

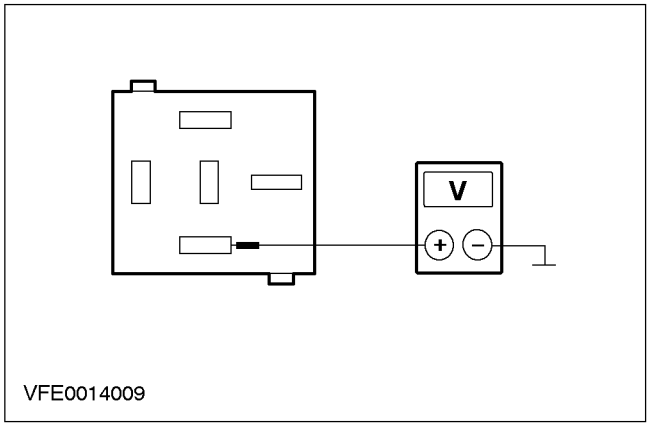
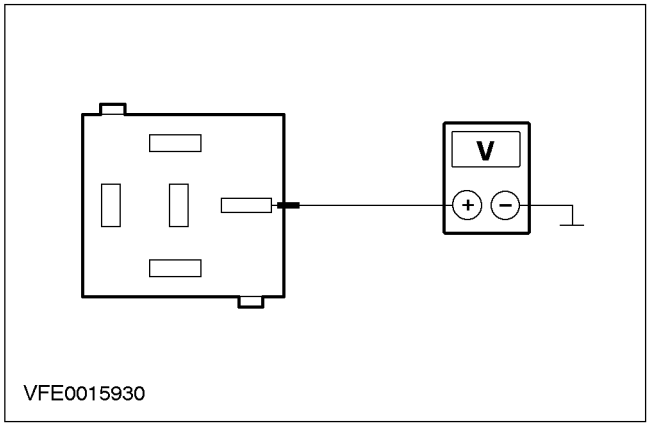
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	LOCATE and RECTIFY the open circuit in circuit 31S-FA30 (BK/WH) between the heater blower motor variable resistor and the heater blower switch with the aid of the Wiring Diagrams. CHECK operation of the system.

PINPOINT TEST B: HEATER BLOWER MOTOR RUNNING CONTINUOUSLY (VEHICLES WITHOUT EATC ONLY)

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK FAULT CONDITIONS	
	1 Key in OFF position. 2 Set the heater blower switch to "stage 1". • Does the heater blower motor run? → **Yes** GO to **B4** → **No** The heater blower motor only runs with the ignition in the position "ON": GO to **B2**
B2: CHECK THE HEATER BLOWER SWITCH	
	1 Disconnect heater blower switch C448. 2 Key in ON position. • Does the heater blower motor run continuously? → **Yes** GO to **B3** → **No** RENEW the heater blower switch. CHECK operation of the system.
B3: CHECK THE CIRCUITS BETWEEN THE HEATER BLOWER VARIABLE RESISTOR AND THE HEATER BLOWER SWITCH FOR A SHORT TO GROUND	
	1 Key in OFF position. 2 Disconnect heater blower variable resistor C443. 3 Key in ON position. • Does the heater blower motor run continuously? → **Yes** CHECK all circuits that are connected to soldered connection S113 for a short to ground with the aid of the Wiring Diagrams and RECTIFY any short circuit(s) found. CHECK operation of the system. → **No** CHECK all circuits between the heater blower variable resistor and the heater blower switch for a short to ground with the aid of the Wiring Diagrams and RECTIFY any short circuit(s) found. CHECK operation of the system.

DIAGNOSIS AND TESTING (Continued)

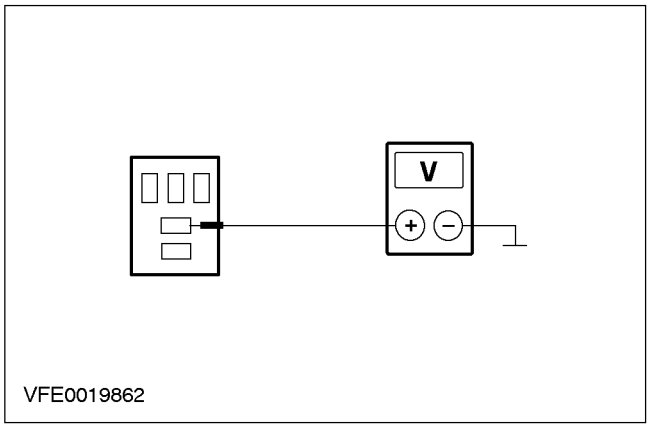
CONDITIONS	DETAILS/RESULTS/ACTIONS
B4: CHECK THE CONTROL VOLTAGE AT THE HEATER BLOWER RELAY	
 VFE0014009	1 Disconnect heater blower relay C920 (CJB). 2 Measure the voltage between the heater blower relay, socket C920, pin 2, wiring harness side and ground. • Is a voltage registered? → **Yes** LOCATE and RECTIFY the short to voltage supply in the circuits connected to fuse F93 with the aid of the Wiring Diagrams. CHECK operation of the system. → **No** GO to **B5**
B5: CHECK THE VOLTAGE AT THE HEATER BLOWER RELAY	
 VFE0015930	1 Measure the voltage between the heater blower relay, socket C920, pin 3, wiring harness side and ground. • Is a voltage registered? → **Yes** LOCATE and RECTIFY the short to voltage supply in the circuits between the heater blower relay and the heater blower motor with the aid of the Wiring Diagrams. CHECK operation of the system. → **No** RENEW the heater blower relay. CHECK operation of the system.

DIAGNOSIS AND TESTING (Continued)

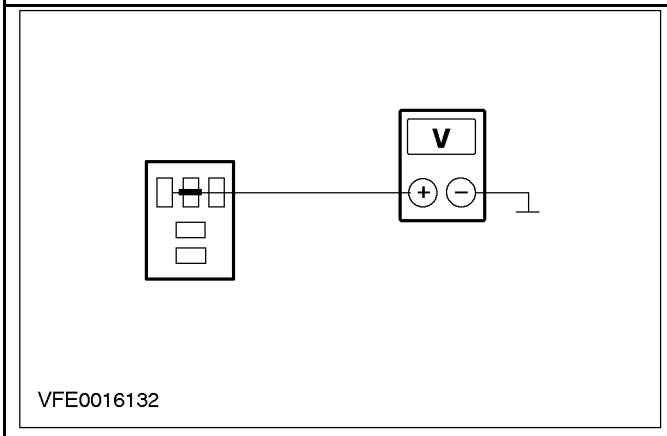
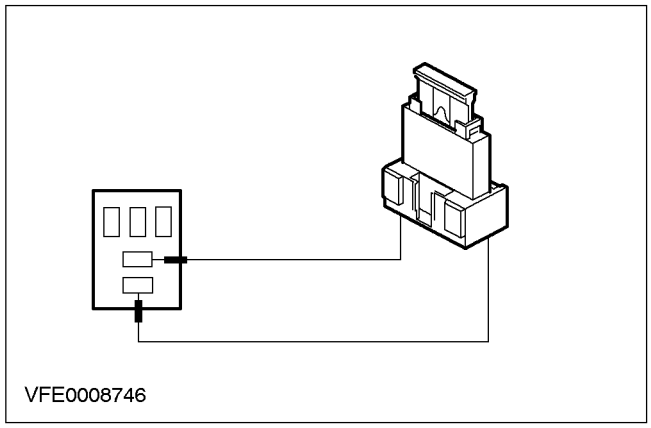
PINPOINT TEST C: AIR CONDITIONING INOPERATIVE (HEATER BLOWER FUNCTION OK)

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK THE ELECTRONIC ENGINE MANAGEMENT (PCM) WITH WDS	
	1 Key in OFF position. 2 Connect the diagnostic tool. 3 Key in START position. 4 Perform fault diagnosis on the electronic engine management (PCM) with WDS. • Are any faults displayed? → **Yes** RECTIFY the faults according to the WDS instructions. CHECK operation of the system. → **No** GO to **C2**
C2: CHECK FUSE F31	
	1 Key in OFF position. 2 CHECK fuse F31 (BJB). • Is the fuse OK? → **Yes** GO to **C3** → **No** RENEW fuse F31 (7.5 A). If the fuse blows again after switching on the air conditioning, CHECK the A/C compressor clutch diode and RENEW as necessary. If the diode is OK, LOCATE and RECTIFY the short to ground with the aid of the Wiring Diagrams. CHECK operation of the system.
C3: CHECK VOLTAGE AT FUSE F31	
	1 Connect fuse F31 (BJB). 2 Measure the voltage between fuse F31 (7.5 A) and ground. • Is battery voltage measured? → **Yes** GO to **C4** → **No** RECTIFY the voltage supply to fuse F31 with the aid of the Wiring Diagrams. CHECK operation of the system.
C4: CHECK FUSE F82	
	1 CHECK fuse F82 (CJB). • Is the fuse OK? → **Yes** GO to **C5** → **No**

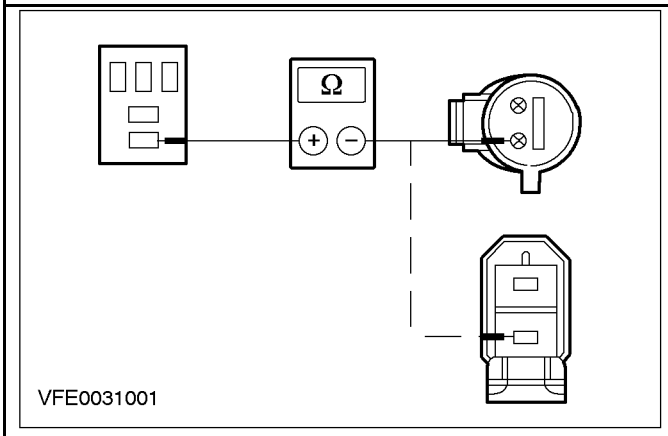
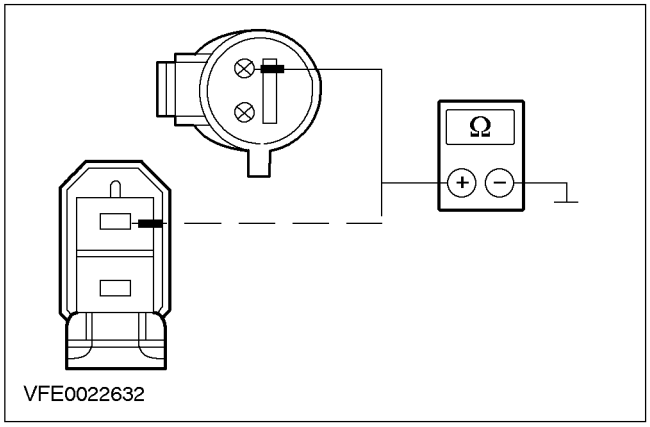
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	RENEW fuse F82 (7.5 A). If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK operation of the system.
C5: CHECK VOLTAGE AT FUSE F82	
	1 Connect fuse F82 (CJB). 2 Key in ON position. 3 Measure the voltage between fuse F82 (7.5 A) and ground. • Is battery voltage measured? → **Yes** GO to **C6** → **No** RECTIFY the voltage supply to fuse F82 with the aid of the Wiring Diagrams. CHECK operation of the system.
C6: CHECK THE VOLTAGE SUPPLY AT THE A/C SYSTEM WIDE OPEN THROTTLE RELAY (WOT)	
	1 Key in OFF position. 2 Disconnect A/C WOT relay C906 (BJB). 3 Measure the voltage between the A/C WOT relay, socket C906, pin 5, circuit 30-FA12 (GN/BU), wiring harness side and ground. • Is battery voltage measured? → **Yes** GO to **C7** → **No** LOCATE and RECTIFY the open circuit in circuit 30-FA12 (GN/BU) between fuse F31 and the A/C WOT relay with the aid of the Wiring Diagrams. CHECK operation of the system.
C7: CHECK THE CONTROL VOLTAGE AT THE A/C WOT RELAY	
	1 Key in ON position.

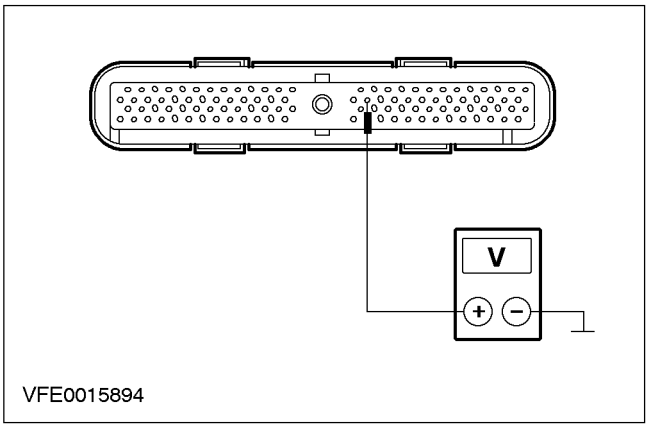
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0016132	**2** Measure the voltage between the A/C WOT relay, socket C906, pin 2, circuit 15-FA11 (GN/YE), wiring harness side and ground. • Is battery voltage measured? → **Yes** GO to **C8** → **No** LOCATE and RECTIFY the open circuit in circuit 15-FA11 (GN/YE) between soldered connection S437 and the A/C WOT relay with the aid of the Wiring Diagrams. CHECK operation of the system.
C8: CHECK THE A/C COMPRESSOR CLUTCH CIRCUIT	
 VFE0008746	**1** Key in OFF position. **2** Use a fused test cable (7,5 A) to bridge the A/C WOT relay, socket C906, pins 3 and 5, wiring harness side. **3** Check the operation of the A/C compressor clutch. • Does the A/C compressor clutch operate? → **Yes** GO to **C11** → **No** GO to **C9**
C9: CHECK THE CIRCUIT BETWEEN THE A/C WOT RELAY AND THE A/C COMPRESSOR CLUTCH FOR OPEN CIRCUIT	
	1 Disconnect A/C compressor clutch C101 (vehicles with diesel engines: C104).

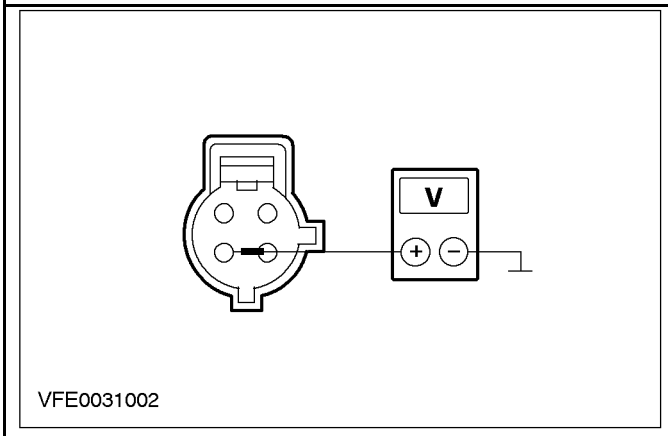
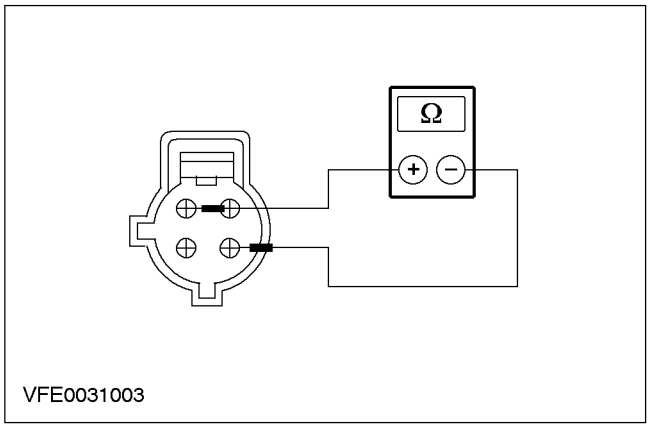
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**2** Measure the resistance between the A/C WOT relay, socket C906, pin 3, circuit 15S-FA12 (RD/BU), wiring harness side and the A/C compressor clutch, connector C101 (vehicles with diesel engines: C104), pin 1, circuit 15S-FA6 (GN/YE), wiring harness side. • Is a resistance of less than 2 Ohms registered? → **Yes** GO to **C10** → **No** LOCATE and RECTIFY the open circuit between the A/C WOT relay and the A/C compressor clutch with the aid of the Wiring Diagrams. CHECK operation of the system.
C10: CHECK THE GROUND CONNECTION OF THE A/C COMPRESSOR CLUTCH	
	**1** Measure the resistance between the A/C compressor clutch, connector C101 (vehicles with diesel engines: C104), pin 2, circuit 31-FA6 (BK), wiring harness side and ground. • Is a resistance of less than 2 Ohms registered? → **Yes** RENEW the A/C compressor clutch. CHECK operation of the system. → **No** LOCATE and RECTIFY the open circuit between the A/C compressor clutch and ground connection G102 with the aid of the Wiring Diagrams. CHECK operation of the system.
C11: CHECK THE A/C WOT RELAY	
	1 Check the A/C WOT relay according to the component check at the end of this section. • Is the A/C WOT relay OK?

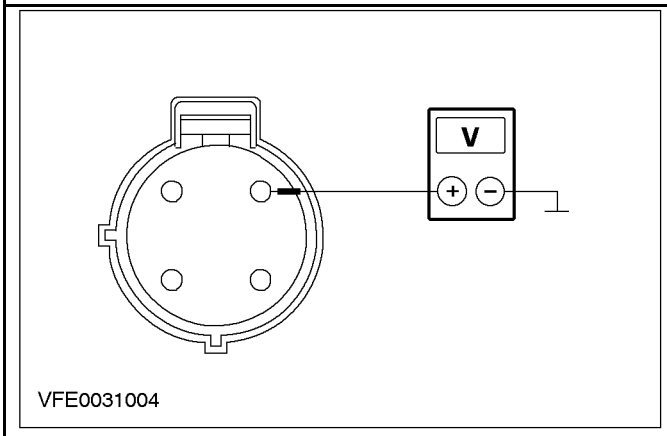
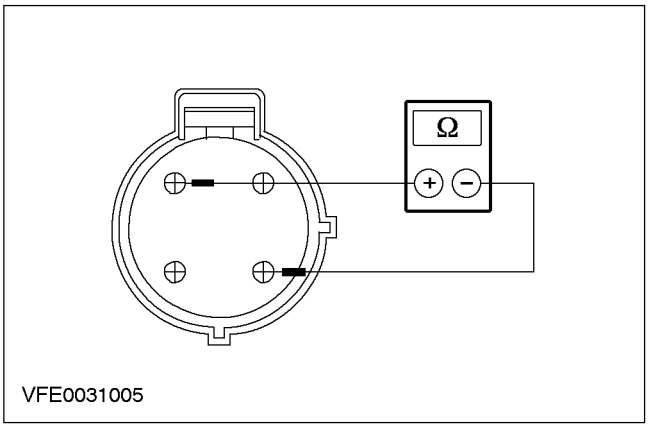
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** GO to **C12** → **No** RENEW the A/C WOT relay. CHECK and if necessary RENEW the A/C compressor clutch diode. CHECK operation of the system.
C12: CHECK THE CONTROL VOLTAGE AT THE POWERTRAIN CONTROL MODULE (PCM)	
	1 Disconnect PCM C100. 2 Key in ON position. 3 Measure the voltage between the PCM, connector C100, pin 41, circuit 15S-FA12 (GN/BU), wiring harness side and ground. • Is battery voltage measured? → **Yes** GO to **C18** → **No** GO to **C13**
C13: CHECK THE REFRIGERANT QUANTITY	
	1 Key in OFF position. 2 Check the quantity of refrigerant in the system.REFER to Section 412-00. • Is the quantity of refrigerant in the system in accordance with the manufacturer's specifications? → **Yes** GO to **C14** → **No** FILL the system with the correct quantity of refrigerant. CHECK the system for leaks and CHECK the operation of the system.
C14: CHECK THE VOLTAGE AT THE A/C COMPRESSOR SWITCH	
	1 Disconnect A/C compressor switch C105. 2 Key in ON position.

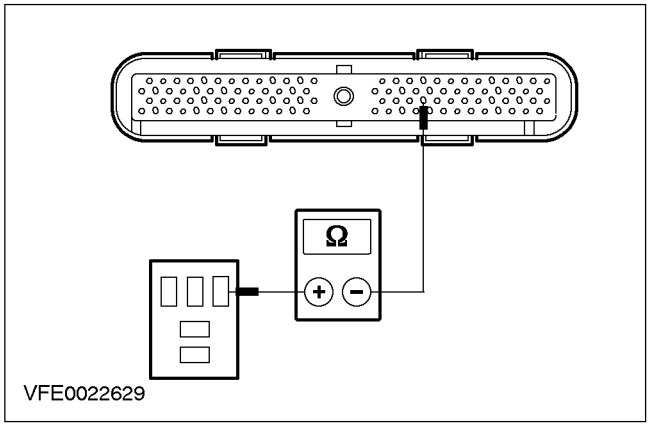
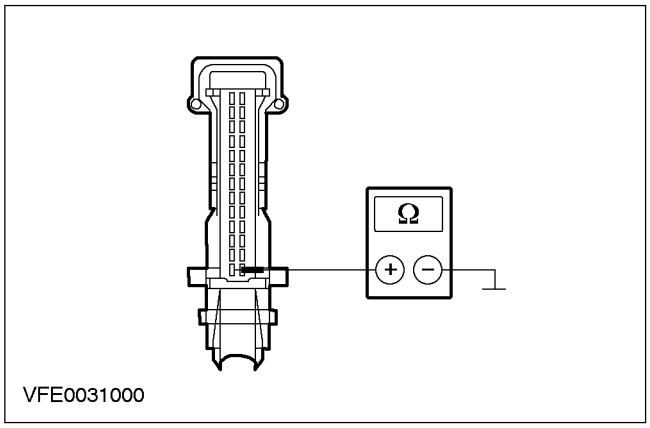
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031002	3 Measure the voltage between the A/C compressor switch, connector C105, pin 4, circuit 15-FA17 (GN/OG), wiring harness side and ground. • Is battery voltage measured? → **Yes** GO to **C15** → **No** LOCATE and RECTIFY the open circuit between the A/C compressor switch and fuse F82 with the aid of the Wiring Diagrams. CHECK operation of the system.
C15: CHECK THE A/C COMPRESSOR SWITCH	
 VFE0031003	1 Key in OFF position. 2 Measure the resistance at the A/C compressor switch, connector C105, between pin 1 and pin 4, component side. • Is a resistance of less than 2 Ohms registered? → **Yes** GO to **C16** → **No** RENEW the A/C compressor switch. CHECK operation of the system.
C16: CHECK THE VOLTAGE AT THE DUAL PRESSURE SWITCH	
	1 Connect A/C compressor switch C105. 2 Disconnect dual pressure switch C134. 3 Key in ON position.

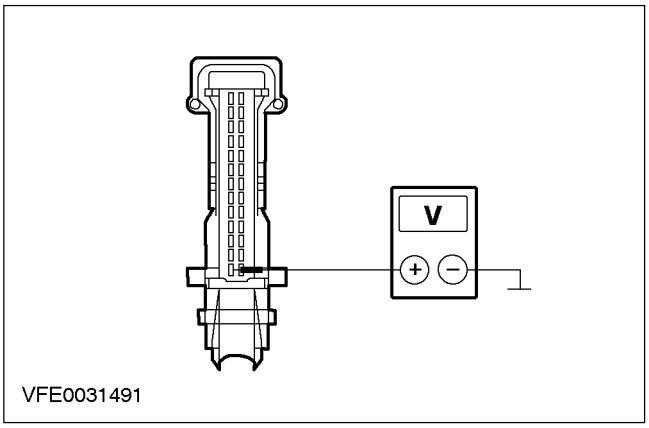
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031004	**4** Measure the voltage between the dual pressure switch, connector C134, pin 1, circuit 15S-FA17 (GN/OG) (vehicles with EATC system: circuit 15S-FA17A (GN/OG)), wiring harness side and ground. • Is battery voltage measured? → **Yes** GO to **C17** → **No** LOCATE and RECTIFY open circuit in 15S-FA17 (GN/OG) (vehicles with EATC system: circuit 15S-FA17A (GN/OG)) between the A/C compressor switch and the dual pressure switch with the aid of the Wiring Diagrams. CHECK operation of the system.
C17: CHECK THE DUAL PRESSURE SWITCH	
 VFE0031005	**1** Key in OFF position. **2** Measure the resistance at the dual pressure switch, connector C134, between pin 1 and pin 4, component side. • Is a resistance of less than 2 Ohms registered? → **Yes** LOCATE and RECTIFY the open circuit in 15S-FA12 (GN/BU) between the PCM and the dual pressure switch with the aid of the Wiring Diagrams. CHECK operation of the system. → **No** CHECK the system pressure in the refrigerant circuit. If the system pressure is OK, RENEW the dual pressure switch. CHECK operation of the system.

DIAGNOSIS AND TESTING (Continued)

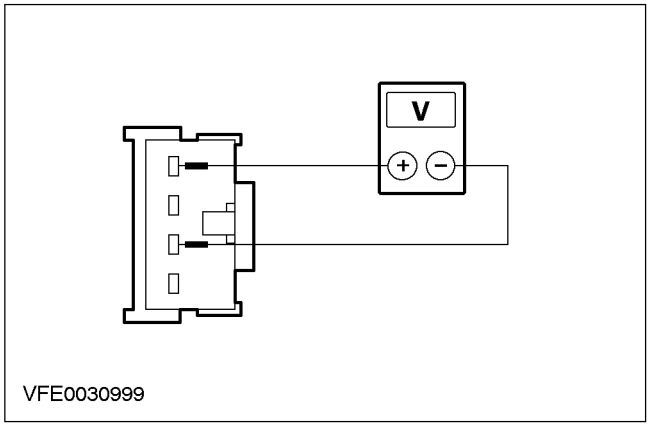
CONDITIONS	DETAILS/RESULTS/ACTIONS
C18: CHECK THE CIRCUIT BETWEEN THE PCM AND THE A/C WOT RELAY	
	1 Key in OFF position. 2 Measure the resistance between the PCM, connector C100, pin 69, circuit 91S-FA11 (BK/YE), wiring harness side and the A/C WOT relay, socket C906, pin 1, wiring harness side. • Is a resistance of less than 2 Ohms registered? → **Yes** Vehicles with EATC system: CHECK the PCM and RENEW if necessary. CHECK operation of the system. Vehicles without EATC system: GO to **C19** → **No** LOCATE and RECTIFY the break in the circuit between the PCM and the A/C WOT relay with the aid of the Wiring Diagrams. CHECK operation of the system.
C19: CHECK THE CIRCUIT BETWEEN THE HEATER BLOWER SWITCH AND THE HEATING AND AIR CONDITIONING CONTROL MODULE FOR OPEN CIRCUIT	
	1 Disconnect heating and air conditioning control module C539a. 2 Set the heater blower switch to "stage 1". 3 Measure the resistance between the heating and air conditioning control module, connector C539a, pin 1, circuit 31S-FA30A (BK/WH), wiring harness side and ground. • Is a resistance of less than 2 Ohms registered? → **Yes** GO to **C20** → **No**

DIAGNOSIS AND TESTING (Continued)

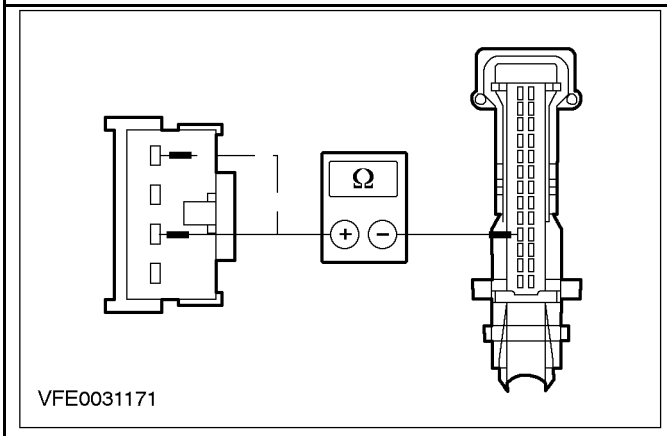
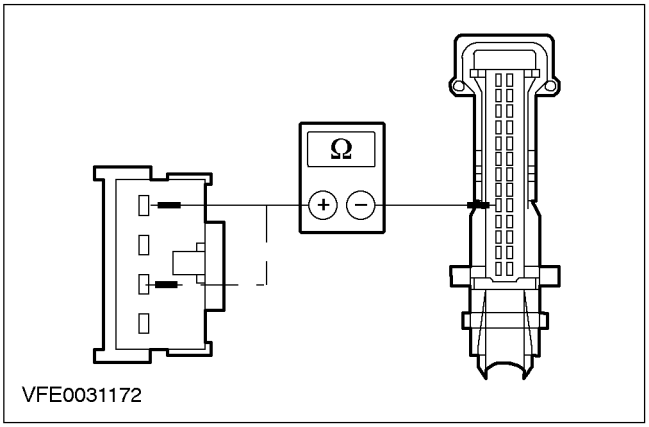
CONDITIONS	DETAILS/RESULTS/ACTIONS
	LOCATE and RECTIFY the open circuit in 31S-FA30A (BK/WH) between the heater blower switch and the heating and air conditioning control module with the aid of the Wiring Diagrams. CHECK operation of the system.
C20: CHECK THE CIRCUIT BETWEEN THE HEATER BLOWER SWITCH AND THE HEATING AND AIR CONDITIONING CONTROL MODULE FOR A SHORT TO VOLTAGE SUPPLY	
	1 Disconnect heater blower switch C448. 2 Key in ON position. 3 Measure the voltage between the heating and air conditioning control module, connector C539a, pin 1, circuit 31S-FA30A (BK/WH), wiring harness side and ground. • Is a voltage registered? → **Yes** LOCATE and RECTIFY the short to voltage supply in circuit 31S-FA30A (BK/WH) between the heater blower switch and the heating and air conditioning control module with the aid of the Wiring Diagrams. CHECK operation of the system. → **No** GO to **C21**
C21: CHECK THE HEATING AND AIR CONDITIONING CONTROL MODULE	
	1 Key in OFF position. 2 Connect heater blower switch C448. 3 Connect A/C WOT Relay C906. 4 Connect PCM C100. 5 Key in START position. 6 Check the operation of the A/C compressor clutch. • Does the A/C compressor clutch operate? → **Yes** CHECK the heating and air conditioning control module and RENEW if necessary. CHECK operation of the system. → **No** CHECK the PCM and RENEW if necessary. CHECK operation of the system.

DIAGNOSIS AND TESTING (Continued)

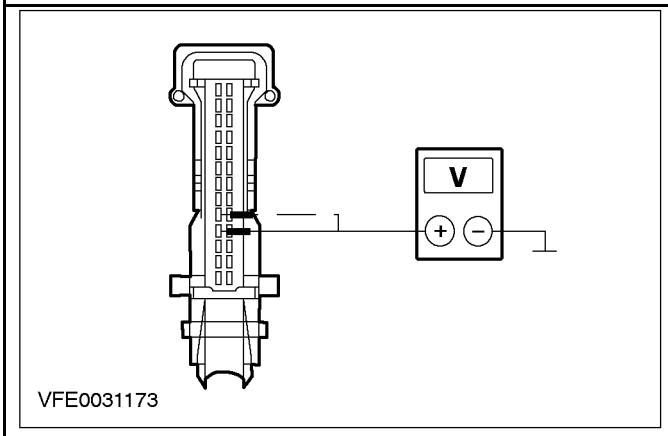
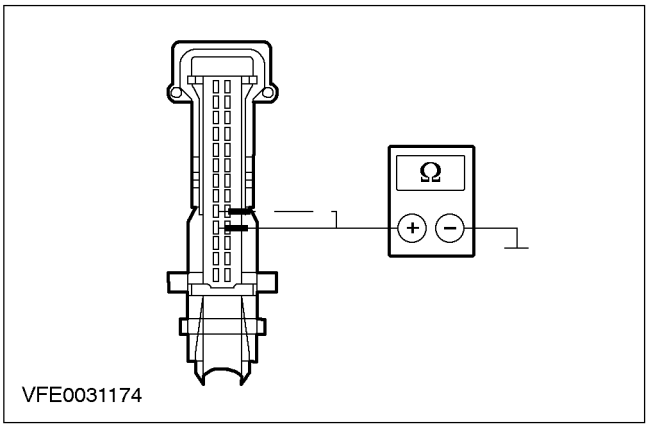
PINPOINT TEST D: MALFUNCTION OF THE AIR RECIRCULATION FLAP

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: The air recirculation flap is actuated by means of a DC motor. This motor is actuated by the EATC module or the heating and air conditioning module for a maximum of 7 seconds after pressing the air recirculation button. Opening and closing of the air recirculation flap is performed by reversing the polarity of the applied voltage.	
NOTE: Air recirculation mode is not available when the "Defrost/demist windscreen" function is active.	
D1: CHECK THE VOLTAGE AT THE HEATER FLAP POSITIONING MOTOR FOR RECIRCULATED AIR	
 VFE0030999	1 Key in OFF position. 2 Disconnect heater flap positioning motor, recirculated air C538. 3 Key in ON position. 4 Measure the voltage at the heater flap positioning motor for recirculated air, connector C538, between pin 2 and pin 4, wiring harness side. 5 Press the recirculated air button several times during the measurement. • Is a voltage of at least 10 V measured with alternating polarity? → **Yes** CHECK the air recirculation flap for ease of movement and correct operation. If the air recirculation flap is OK, RENEW the heater flap positioning motor for recirculated air. CHECK operation of the system. → **No** GO to **D2**
D2: CHECK FOR OPEN CIRCUIT BETWEEN HEATER FLAP POSITIONING MOTOR FOR RECIRCULATED AIR AND EATC MODULE OR HEATING AND AIR CONDITIONING CONTROL MODULE	
	1 Key in OFF position. 2 Disconnect EATC module or heating and air conditioning control module C539a.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031171	**3** Measure the resistance between the heater flap positioning motor for recirculated air, connector C538 and pin 2 (right-hand drive vehicles: pin 4), circuit 33-FA76 (YE/BU), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539a, pin 4, circuit 33-FA76 (YE/BU), wiring harness side.
 VFE0031172	**4** Measure the resistance between the heater flap positioning motor for recirculated air, connector C538, pin 4 (right-hand drive vehicles: pin 2), circuit 32-FA76 (WH/BU), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539a, pin 5, circuit 32-FA76 (WH/BU), wiring harness side.
	• Is a resistance of less than 2 Ohms measured in both cases? → **Yes** GO to **D3** → **No** LOCATE and RECTIFY the open circuit in 33-FA76 (YE/BU) or 32-FA76 (WH/BU) between the heater flap positioning motor for recirculated air and the EATC module or the heating and air conditioning control module with the aid of the Wiring Diagrams. CHECK operation of the system.
D3: CHECK FOR SHORT TO VOLTAGE SUPPLY BETWEEN HEATER FLAP POSITIONING MOTOR FOR RECIRCULATED AIR AND EATC MODULE OR HEATING AND AIR CONDITIONING CONTROL MODULE	
	1 Key in ON position.

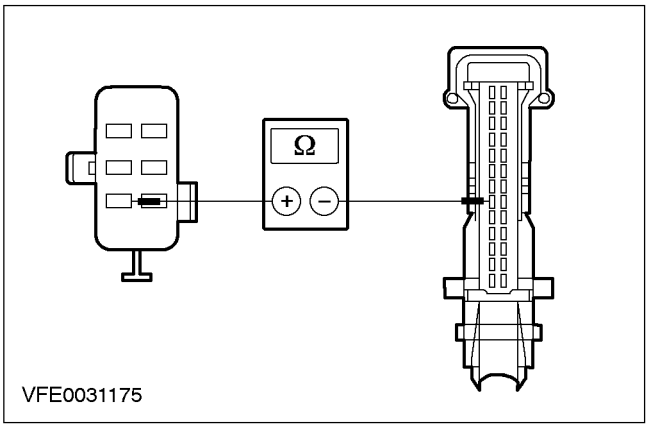
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**2** Measure the voltage between the EATC module or the heating and air conditioning control module, connector C539a, pin 4, circuit 33-FA76 (YE/BU), wiring harness side and ground. **3** Measure the voltage between the EATC module or the heating and air conditioning control module, connector C539a, pin 5, circuit 32-FA76 (WH/BU), wiring harness side and ground. • Is a voltage measured during any of these measurements? → **Yes** LOCATE and RECTIFY the short to voltage supply in circuit 33-FA76 (YE/BU) or 32-FA76 (WH/BU) between the heater flap positioning motor for recirculated air and the EATC module or the heating and air conditioning control module with the aid of the Wiring Diagrams. CHECK operation of the system. → **No** GO to **D4**
D4: CHECK FOR SHORT TO GROUND BETWEEN HEATER FLAP POSITIONING MOTOR FOR RECIRCULATED AIR AND EATC MODULE OR HEATING AND AIR CONDITIONING CONTROL MODULE	
	**1** Key in OFF position. **2** Measure the resistance between the EATC module or the heating and air conditioning control module, connector C539a, pin 4, circuit 33-FA76 (YE/BU), wiring harness side and ground.

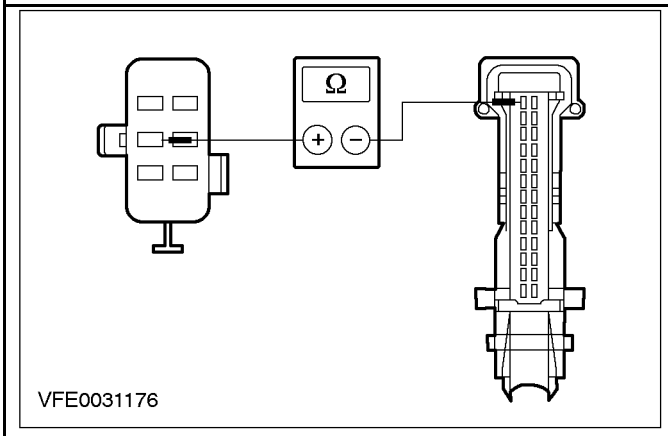
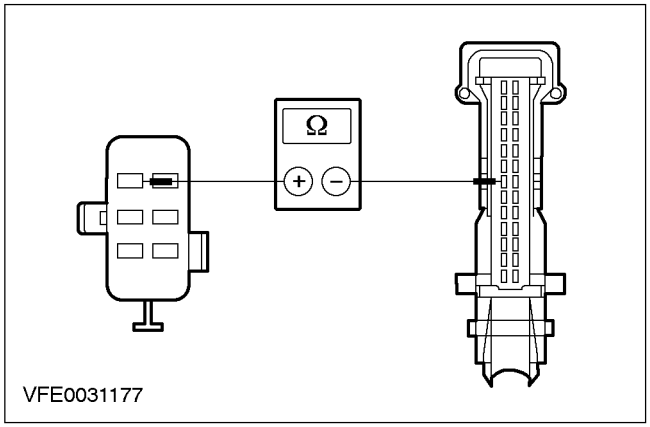
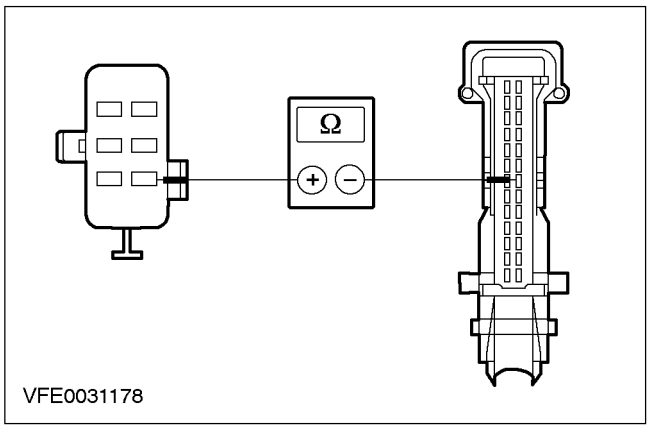
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	3 Measure the resistance between the EATC module or the heating and air conditioning control module, connector C539a, pin 5, circuit 32-FA76 (WH/BU), wiring harness side and ground. • Is a resistance greater than 10 kOhm measured in both cases? → **Yes** CHECK the EATC module or the heating and air conditioning control module and if necessary RENEW. CHECK operation of the system. → **No** LOCATE and RECTIFY the short to ground in circuit 33-FA76 (YE/BU) or 32-FA76 (WH/BU) between the heater flap positioning motor for recirculated air and the EATC module or the heating and air conditioning control module with the aid of the Wiring Diagrams. CHECK operation of the system.

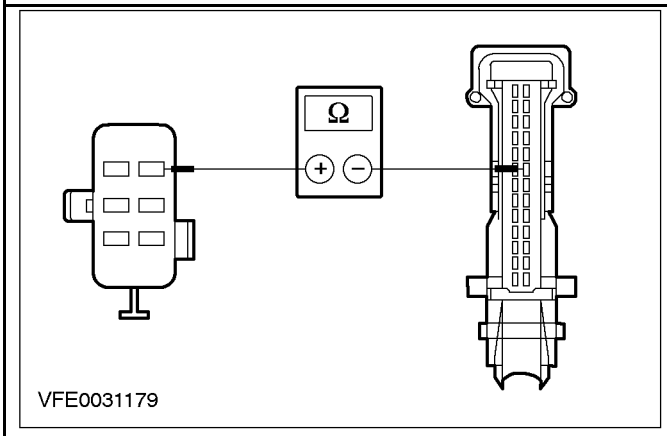
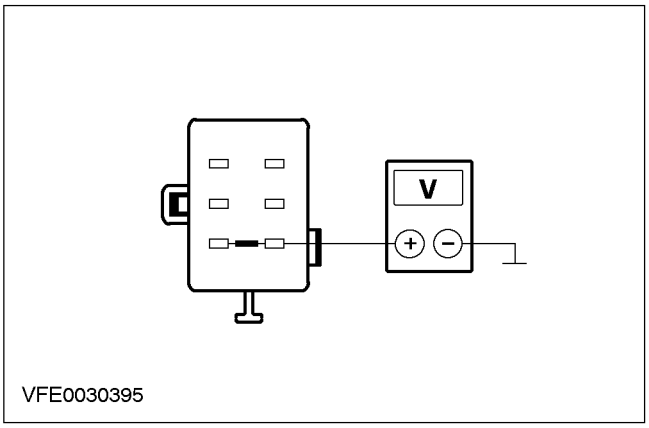
PINPOINT TEST E: MALFUNCTION OF THE DEFROST FLAP

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: CHECK FOR OPEN CIRCUIT BETWEEN DEFROST FLAP POSITIONING MOTOR AND EATC MODULE OR HEATING AND AIR CONDITIONING CONTROL MODULE	
 VFE0031175	**1** Key in OFF position. **2** Disconnect EATC module or heating and air conditioning control module C539a. **3** Disconnect defrost flap positioning motor C532. **4** Measure the resistance between the defrost flap positioning motor, connector C532, pin 1, circuit 31S-FB15 (BK/OG), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539a, pin 6, circuit 31S-FB15 (BK/OG), wiring harness side.

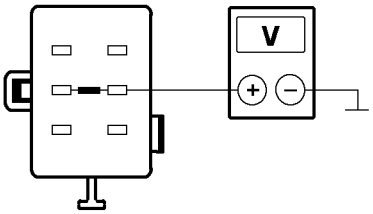
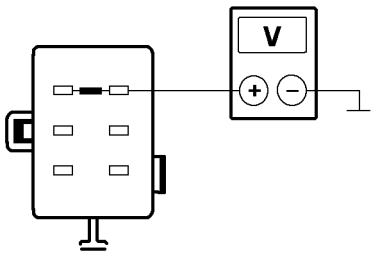
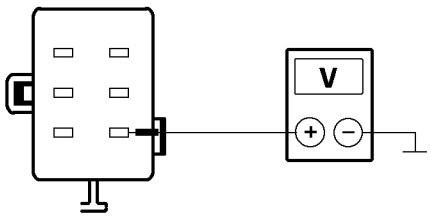
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**5** Measure the resistance between the defrost flap positioning motor, connector C532, pin 2, circuit 31S-FB14 (BK/BU), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539a, pin 13, circuit 31S-FB14 (BK/BU), wiring harness side.
	**6** Measure the resistance between the defrost flap positioning motor, connector C532, pin 3, circuit 31S-FB16 (BK/GN), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539a, pin 7, circuit 31S-FB16 (BK/GN), wiring harness side.
	**7** Measure the resistance between the defrost flap positioning motor, connector C532, pin 4, circuit 31S-FB17 (BK/RD), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539a, pin 20, circuit 31S-FB17 (BK/RD), wiring harness side.

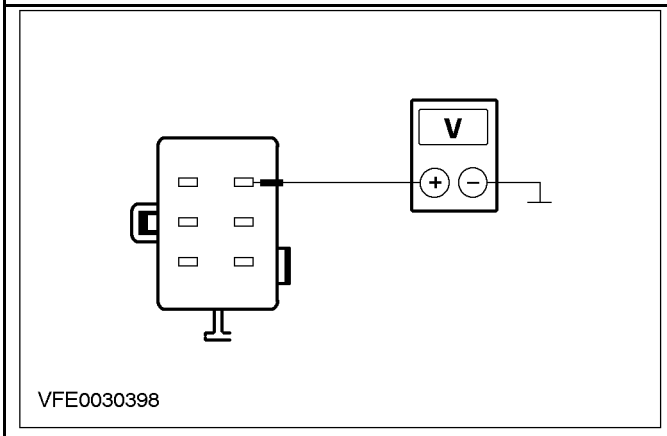
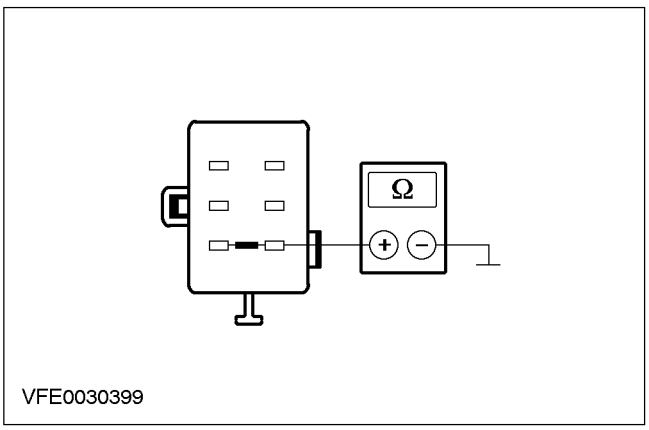
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031179	**8** Measure the resistance between the defrost flap positioning motor, connector C532, pin 6, circuit 31S-FB18 (BK/WH), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539a, pin 21, circuit 31S-FB18 (BK/WH), wiring harness side. • Is a resistance of less than 2 Ohms measured following all of the measurements? → **Yes** GO to **E2** → **No** LOCATE and RECTIFY the break in the affected circuit between the defrost flap positioning motor and the EATC module or the heating and air conditioning control module with the aid of the Wiring Diagrams. CHECK operation of the system.
E2: CHECK FOR SHORT TO VOLTAGE SUPPLY BETWEEN DEFROST FLAP POSITIONING MOTOR AND EATC MODULE OR HEATING AND AIR CONDITIONING CONTROL MODULE	
 VFE0030395	**1** Key in ON position. **2** Measure the voltage between the defrost flap positioning motor, connector C532, pin 1, circuit 31S-FB15 (BK/OG), wiring harness side and ground.

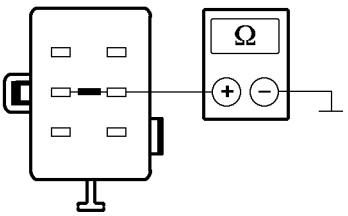
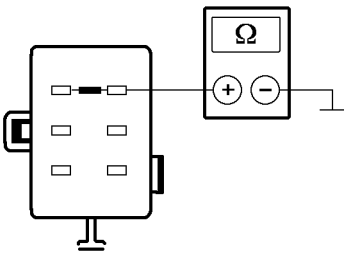
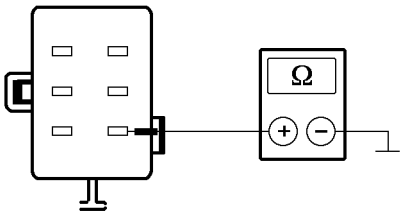
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0030336	**3** Measure the voltage between the defrost flap positioning motor, connector C532, pin 2, circuit 31S-FB14 (BK/BU), wiring harness side and ground.
 VFE0030396	**4** Measure the voltage between the defrost flap positioning motor, connector C532, pin 3, circuit 31S-FB16 (BK/GN), wiring harness side and ground.
 VFE0030397	**5** Measure the voltage between the defrost flap positioning motor, connector C532, pin 4, circuit 31S-FB17 (BK/RD), wiring harness side and ground.

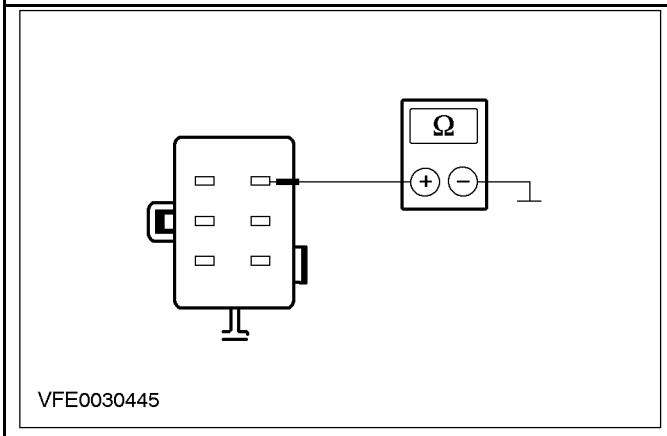
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0030398	**6** Measure the voltage between the defrost flap positioning motor, connector C532, pin 6, circuit 31S-FB18 (BK/WH), wiring harness side and ground. • Is a voltage measured during any of these measurements? → **Yes** LOCATE and RECTIFY the short to voltage supply in the affected circuit between the defrost flap positioning motor and the EATC module or the heating and air conditioning control module with the aid of the Wiring Diagrams. CHECK operation of the system. → **No** GO to **E3**
E3: CHECK FOR SHORT TO GROUND BETWEEN DEFROST FLAP POSITIONING MOTOR AND EATC MODULE OR HEATING AND AIR CONDITIONING CONTROL MODULE	
 VFE0030399	**1** Key in OFF position. **2** Measure the resistance between the defrost flap positioning motor, connector C532, pin 1, circuit 31S-FB15 (BK/OG), wiring harness side and ground.

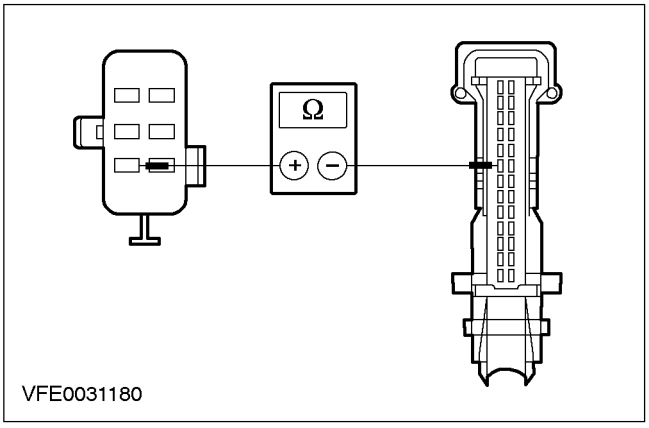
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0030337	**3** Measure the resistance between the defrost flap positioning motor, connector C532, pin 2, circuit 31S-FB14 (BK/BU), wiring harness side and ground.
 VFE0030443	**4** Measure the resistance between the defrost flap positioning motor, connector C532, pin 3, circuit 31S-FB16 (BK/GN), wiring harness side and ground.
 VFE0030444	**5** Measure the resistance between the defrost flap positioning motor, connector C532, pin 4, circuit 31S-FB17 (BK/RD), wiring harness side and ground.

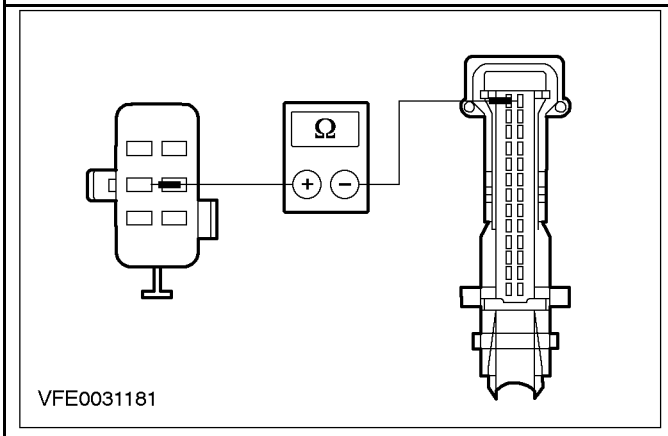
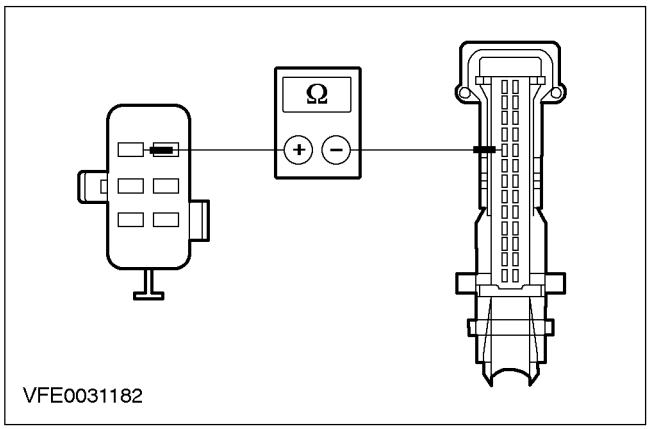
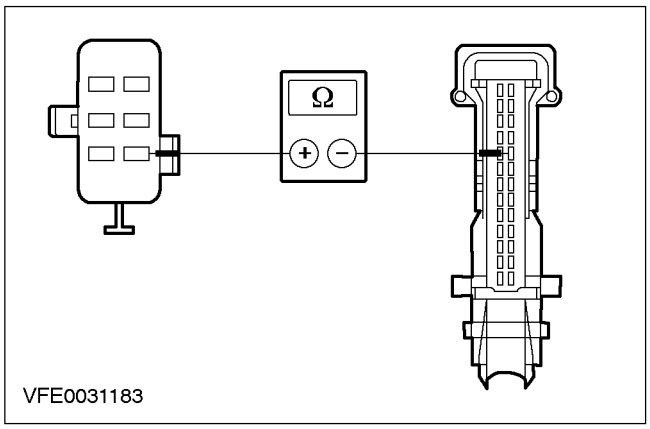
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0030445	**6** Measure the resistance between the defrost flap positioning motor, connector C532, pin 6, circuit 31S-FB18 (BK/WH), wiring harness side and ground. • Is a resistance of more than 10 kOhms measured in all of the measurements? → **Yes** CHECK the defrost flap for ease of movement and proper function. If the defrost flap is OK, RENEW the defrost flap positioning motor. CHECK operation of the system. → **No** LOCATE and RECTIFY the short to ground in the affected circuit between the defrost flap positioning motor and the EATC module or the heating and air conditioning control module with the aid of the Wiring Diagrams. CHECK operation of the system.

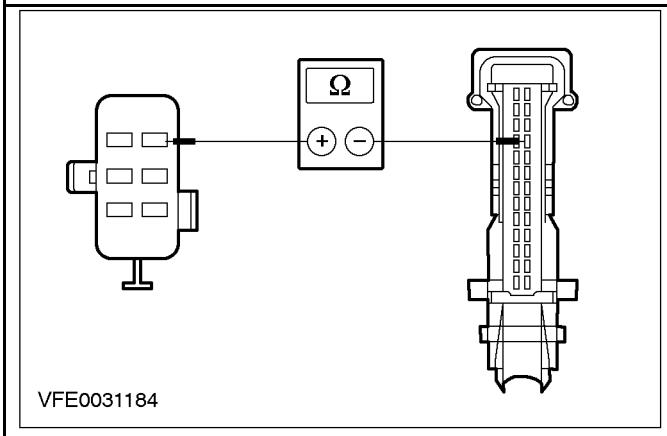
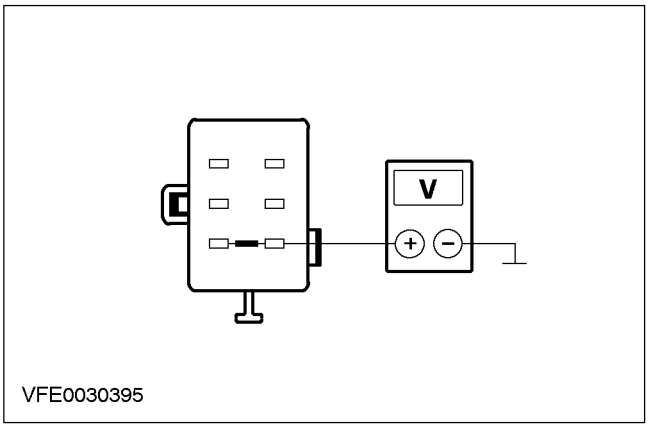
PINPOINT TEST F: MALFUNCTION OF THE AIR DISTRIBUTION FLAP

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1: CHECK FOR OPEN CIRCUIT BETWEEN DASHBOARD/FOOTWELL FLAP POSITIONING MOTOR AND EATC MODULE OR HEATING AND AIR CONDITIONING CONTROL MODULE	
 VFE0031180	**1** Key in OFF position. **2** Disconnect EATC module or heating and air conditioning control module C539a. **3** Disconnect dashboard/footwell flap positioning motor C533. **4** Measure the resistance between the dashboard/footwell flap positioning motor, connector C533, pin 1, circuit 31S-FB20 (BK/BU), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539a, pin 8, circuit 31S-FB20 (BK/BU), wiring harness side.

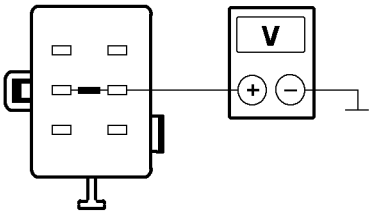
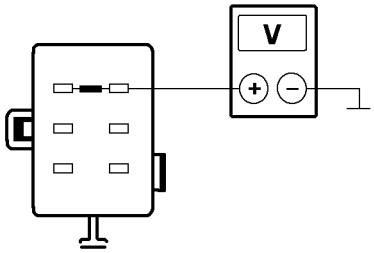
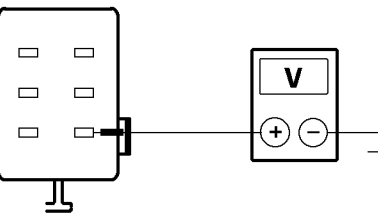
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**5** Measure the resistance between the dashboard/footwell flap positioning motor, connector C533, pin 2, circuit 31S-FB19 (BK/YE), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539a, pin 26, circuit 31S-FB19 (BK/YE), wiring harness side.
	**6** Measure the resistance between the dashboard/footwell flap positioning motor, connector C533, pin 3, circuit 31S-FB21 (BK/OG), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539a, pin 9, circuit 31S-FB21 (BK/OG), wiring harness side.
	**7** Measure the resistance between the dashboard/footwell flap positioning motor, connector C533, pin 4, circuit 31S-FB22 (BK/GN), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539a, pin 22, circuit 31S-FB22 (BK/GN), wiring harness side.

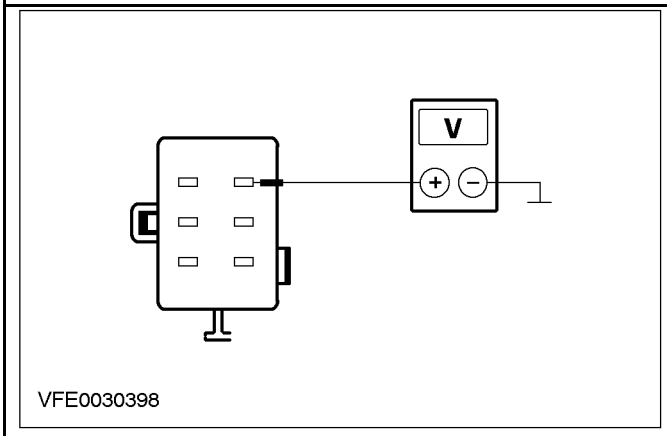
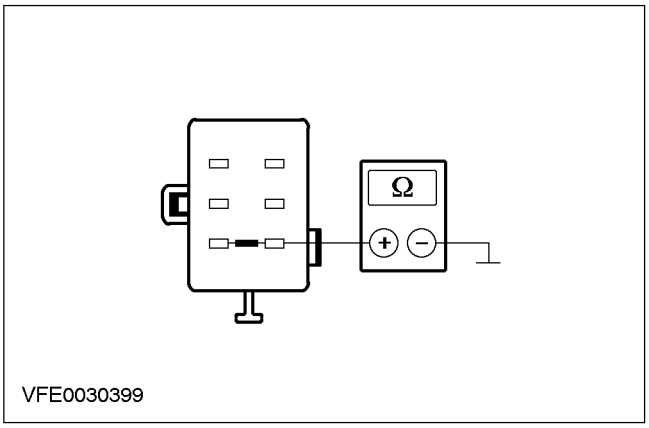
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031184	**8** Measure the resistance between the dashboard/footwell flap positioning motor, connector C533, pin 6, circuit 31S-FB23 (BK/RD), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539a, pin 23, circuit 31S-FB23 (BK/RD), wiring harness side. • Is a resistance of less than 2 Ohms measured following all of the measurements? → **Yes** GO to **F2** → **No** LOCATE and RECTIFY the break in the affected circuit between the dashboard/footwell flap positioning motor and the EATC module or the heating and air conditioning control module with the aid of the Wiring Diagrams. CHECK operation of the system.
F2: CHECK FOR SHORT TO VOLTAGE SUPPLY BETWEEN DASHBOARD/FOOTWELL FLAP POSITIONING MOTOR AND EATC MODULE OR HEATING AND AIR CONDITIONING CONTROL MODULE	
 VFE0030395	**1** Key in ON position. **2** Measure the voltage between the dashboard/footwell flap positioning motor, connector C533, pin 1, circuit 31S-FB20 (BK/BU), wiring harness side and ground.

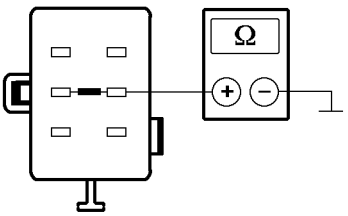
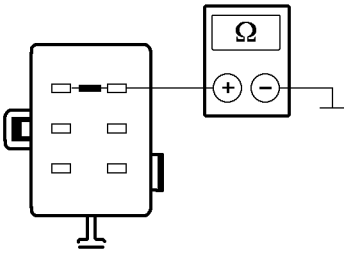
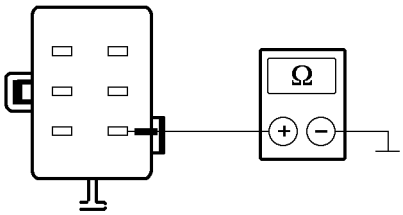
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0030336	**3** Measure the voltage between the dashboard/footwell flap positioning motor, connector C533, pin 2, circuit 31S-FB19 (BK/YE), wiring harness side and ground.
 VFE0030396	**4** Measure the voltage between the dashboard/footwell flap positioning motor, connector C533, pin 3, circuit 31S-FB21 (BK/OG), wiring harness side and ground.
 VFE0030397	**5** Measure the voltage between the dashboard/footwell flap positioning motor, connector C533, pin 4, circuit 31S-FB22 (BK/GN), wiring harness side and ground.

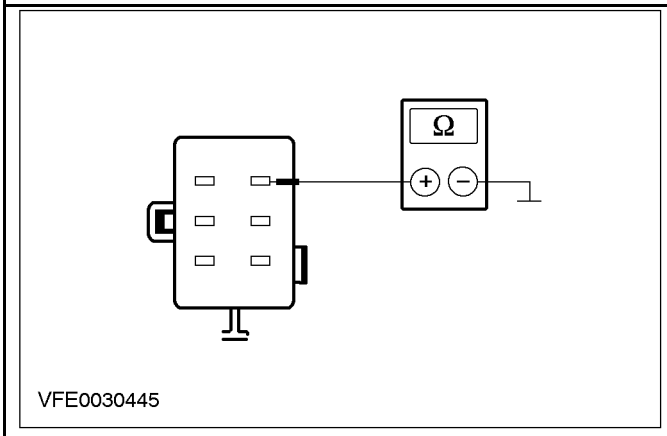
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0030398	**6** Measure the voltage between the dashboard/footwell flap positioning motor, connector C533, pin 6, circuit 31S-FB23 (BK/RD), wiring harness side and ground. • Is a voltage measured during any of these measurements? → **Yes** LOCATE and RECTIFY the short to voltage supply in the affected circuit between the dashboard/footwell flap positioning motor and the EATC module or the heating and air conditioning control module with the aid of the Wiring Diagrams. CHECK operation of the system. → **No** GO to **F3**
F3: CHECK FOR SHORT TO GROUND BETWEEN DASHBOARD/FOOTWELL FLAP POSITIONING MOTOR AND EATC MODULE OR HEATING AND AIR CONDITIONING CONTROL MODULE	
 VFE0030399	**1** Key in OFF position. **2** Measure the resistance between the dashboard/footwell flap positioning motor, connector C533, pin 1, circuit 31S-FB20 (BK/BU), wiring harness side and ground.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0030337	**3** Measure the resistance between the dashboard/footwell flap positioning motor, connector C533, pin 2, circuit 31S-FB19 (BK/YE), wiring harness side and ground.
 VFE0030443	**4** Measure the resistance between the dashboard/footwell flap positioning motor, connector C533, pin 3, circuit 31S-FB21 (BK/OG), wiring harness side and ground.
 VFE0030444	**5** Measure the resistance between the dashboard/footwell flap positioning motor, connector C533, pin 4, circuit 31S-FB22 (BK/GN), wiring harness side and ground.

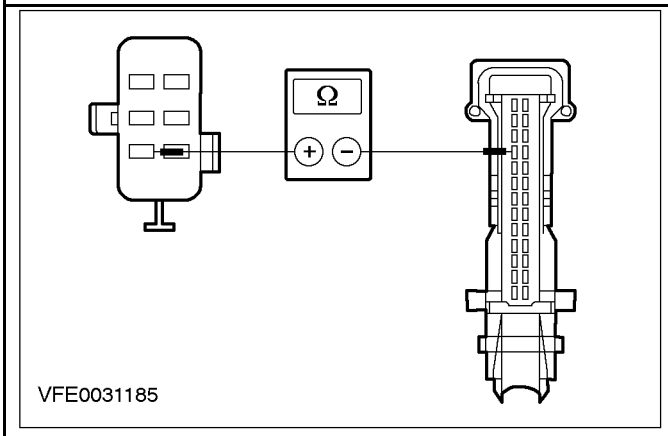
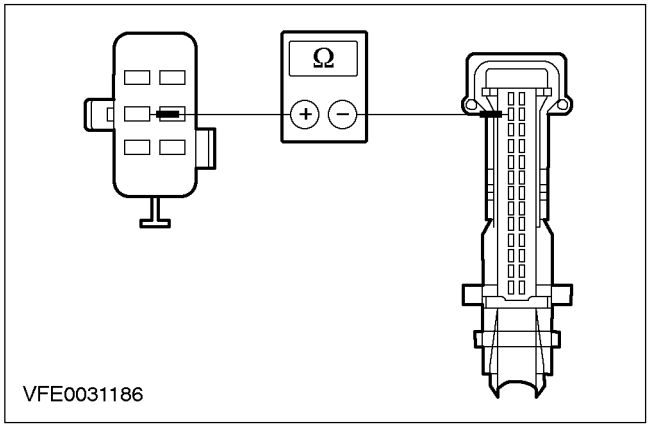
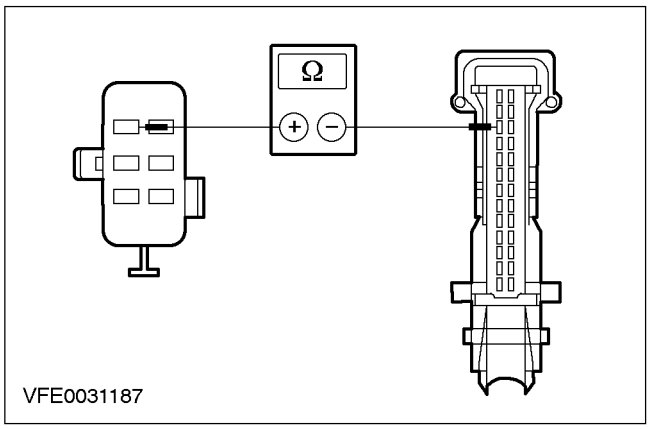
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0030445	**6** Measure the resistance between the dashboard/footwell flap positioning motor, connector C533, pin 6, circuit 31S-FB23 (BK/RD), wiring harness side and ground. • Is a resistance of more than 10 kOhms measured in all of the measurements? → **Yes** CHECK the air distribution flap for ease of movement and proper function. If the air distribution flap is OK, RENEW the defrost flap positioning motor. CHECK operation of the system. → **No** LOCATE and RECTIFY the short to ground in the affected circuit between the dashboard/footwell flap positioning motor and the EATC module or the heating and air conditioning control module with the aid of the Wiring Diagrams. CHECK operation of the system.

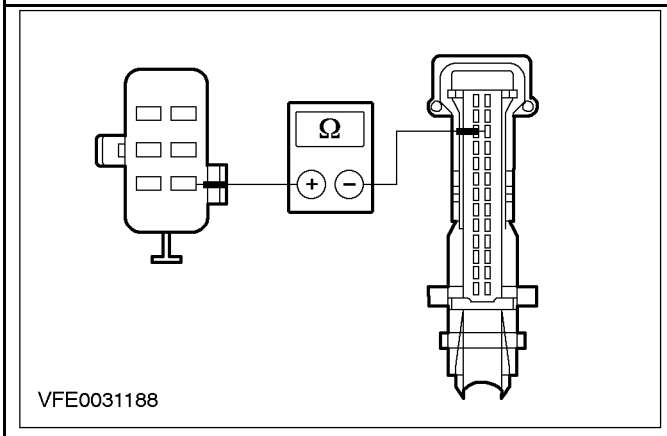
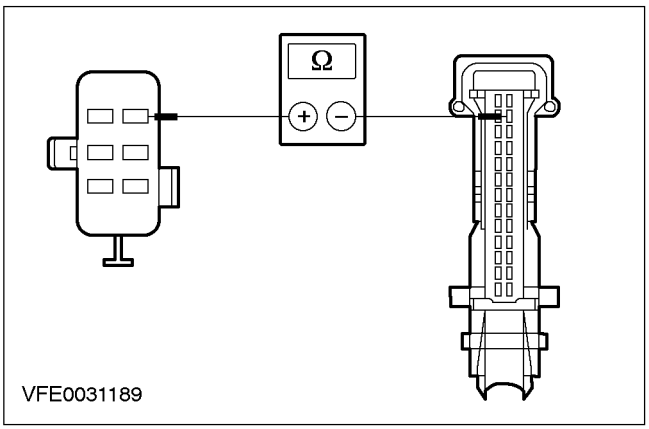
PINPOINT TEST G: MALFUNCTION OF THE AIR TEMPERATURE FLAP

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1: CHECK FOR OPEN CIRCUIT BETWEEN AIR TEMPERATURE FLAP POSITIONING MOTOR AND EATC MODULE OR HEATING AND AIR CONDITIONING CONTROL MODULE	
	1 Key in OFF position. **2** Disconnect EATC module or heating and air conditioning control module C539a. **3** Disconnect air temperature flap positioning motor C534.

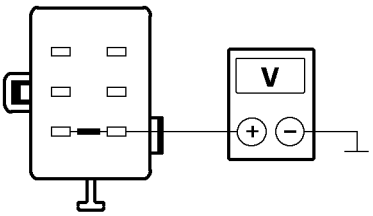
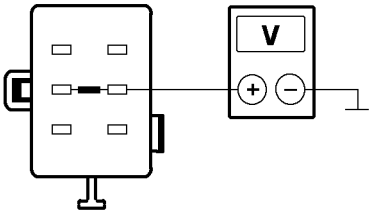
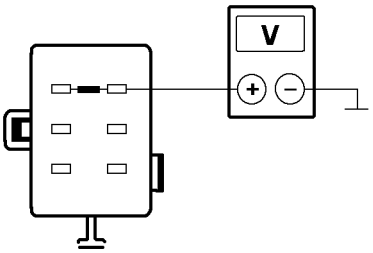
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**4** Measure the resistance between the air temperature flap positioning motor, connector C534, pin 1, circuit 31S-FB10 (BK/GN), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539a, pin 10, circuit 31S-FB10 (BK/GN), wiring harness side.
	**5** Measure the resistance between the air temperature flap positioning motor, connector C534, pin 2, circuit 31S-FB9 (BK/OG), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539a, pin 12, circuit 31S-FB9 (BK/OG), wiring harness side.
	**6** Measure the resistance between the air temperature flap positioning motor, connector C534, pin 3, circuit 31S-FB11 (BK/RD), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539a, pin 11, circuit 31S-FB11 (BK/RD), wiring harness side.

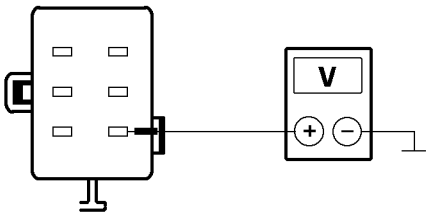
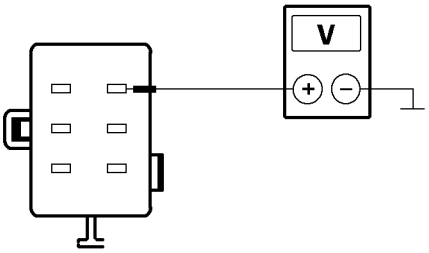
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031188	**7** Measure the resistance between the air temperature flap positioning motor, connector C534, pin 4, circuit 31S-FB12 (BK/WH), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539a, pin 24, circuit 31S-FB12 (BK/WH), wiring harness side.
 VFE0031189	**8** Measure the resistance between the air temperature flap positioning motor, connector C534, pin 6, circuit 31S-FB13 (BK/YE), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539a, pin 25, circuit 31S-FB13 (BK/YE), wiring harness side.
	• Is a resistance of less than 2 Ohms measured following all of the measurements? → **Yes** GO to **G2** → **No** LOCATE and RECTIFY the break in the affected circuit between the air temperature flap positioning motor and the EATC module or the heating and air conditioning control module with the aid of the Wiring Diagrams. CHECK operation of the system.
G2: CHECK FOR SHORT TO VOLTAGE SUPPLY BETWEEN AIR TEMPERATURE FLAP POSITIONING MOTOR AND EATC MODULE OR HEATING AND AIR CONDITIONING CONTROL MODULE	
	1 Key in ON position.

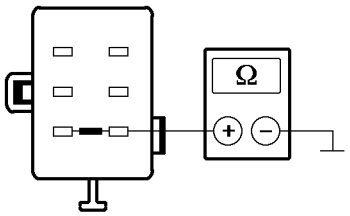
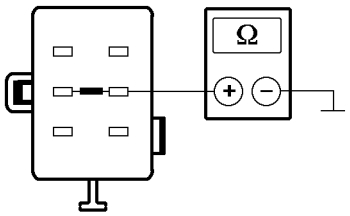
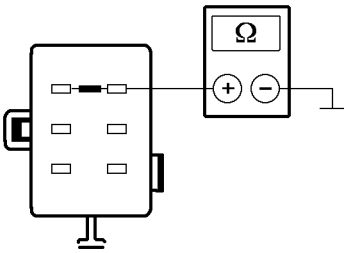
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0030395	**2** Measure the voltage between the air temperature flap positioning motor, connector C534, pin 1, circuit 31S-FB10 (BK/GN), wiring harness side and ground.
 VFE0030336	**3** Measure the voltage between the air temperature flap positioning motor, connector C534, pin 2, circuit 31S-FB9 (BK/OG), wiring harness side and ground.
 VFE0030396	**4** Measure the voltage between the air temperature flap positioning motor, connector C534, pin 3, circuit 31S-FB11 (BK/RD), wiring harness side and ground.

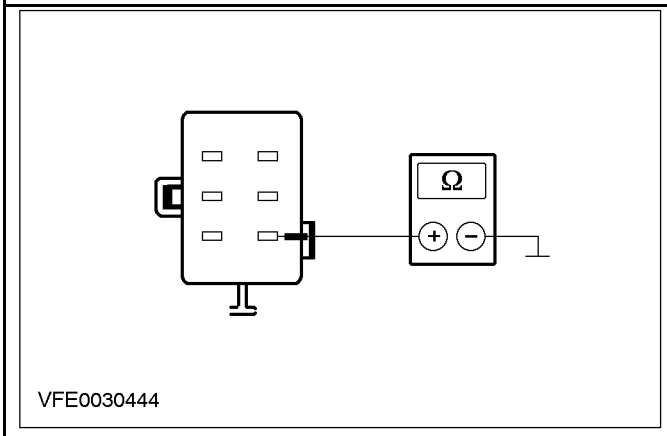
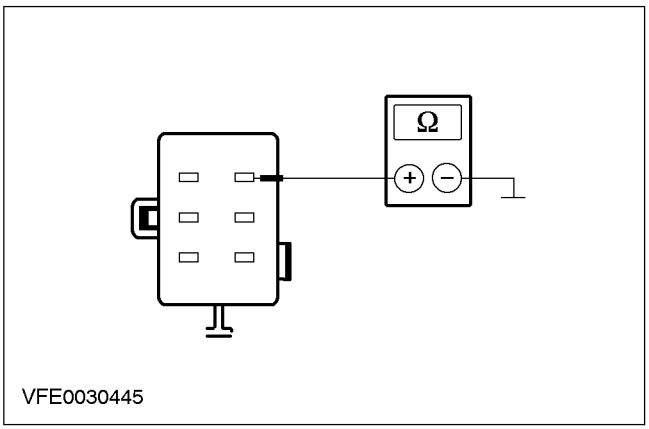
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0030397	**5** Measure the voltage between the air temperature flap positioning motor, connector C534, pin 4, circuit 31S-FB12 (BK/WH), wiring harness side and ground.
 VFE0030398	**6** Measure the voltage between the air temperature flap positioning motor, connector C534, pin 6, circuit 31S-FB13 (BK/YE), wiring harness side and ground.
	• Is a voltage measured during any of these measurements? → **Yes** LOCATE and RECTIFY the short to voltage supply in the affected circuit between the air temperature flap positioning motor and the EATC module or the heating and air conditioning control module with the aid of the Wiring Diagrams. CHECK operation of the system. → **No** GO to **G3**
G3: CHECK FOR SHORT TO GROUND BETWEEN AIR TEMPERATURE FLAP POSITIONING MOTOR AND EATC MODULE OR HEATING AND AIR CONDITIONING CONTROL MODULE	
	1 Key in OFF position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0030399	**2** Measure the resistance between the air temperature flap positioning motor, connector C534, pin 1, circuit 31S-FB10 (BK/GN), wiring harness side and ground.
 VFE0030337	**3** Measure the resistance between the air temperature flap positioning motor, connector C534, pin 2, circuit 31S-FB9 (BK/OG), wiring harness side and ground.
 VFE0030443	**4** Measure the resistance between the air temperature flap positioning motor, connector C534, pin 3, circuit 31S-FB11 (BK/RD), wiring harness side and ground.

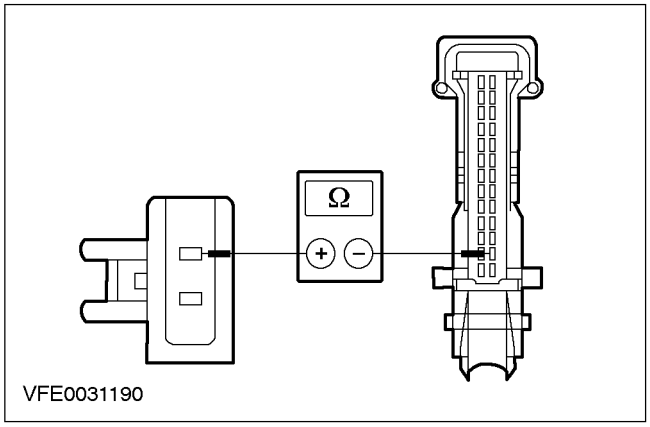
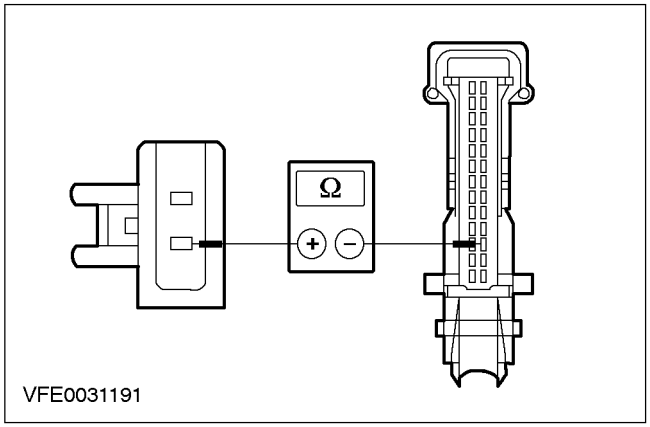
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0030444	**5** Measure the resistance between the air temperature flap positioning motor, connector C534, pin 4, circuit 31S-FB12 (BK/WH), wiring harness side and ground.
 VFE0030445	**6** Measure the resistance between the air temperature flap positioning motor, connector C534, pin 6, circuit 31S-FB13 (BK/YE), wiring harness side and ground.
	• Is a resistance of more than 10 kOhms measured in all of the measurements? → **Yes** CHECK the air temperature flap for ease of movement and proper function. If the air temperature flap is OK, RENEW the air temperature flap positioning motor. CHECK operation of the system. → **No** LOCATE and RECTIFY the short to ground in the affected circuit between the air temperature flap positioning motor and the EATC module or the heating and air conditioning control module with the aid of the Wiring Diagrams. CHECK operation of the system.

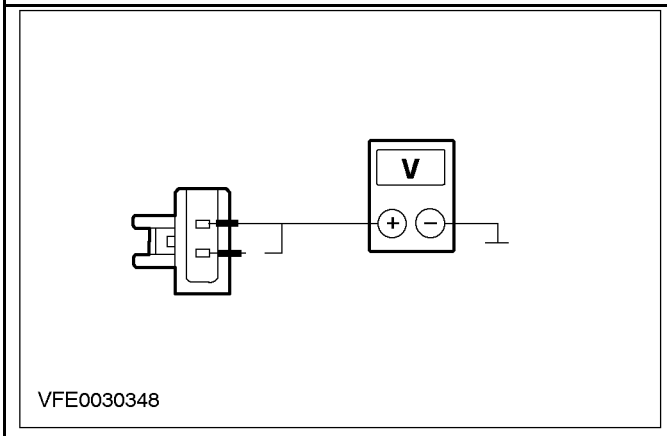
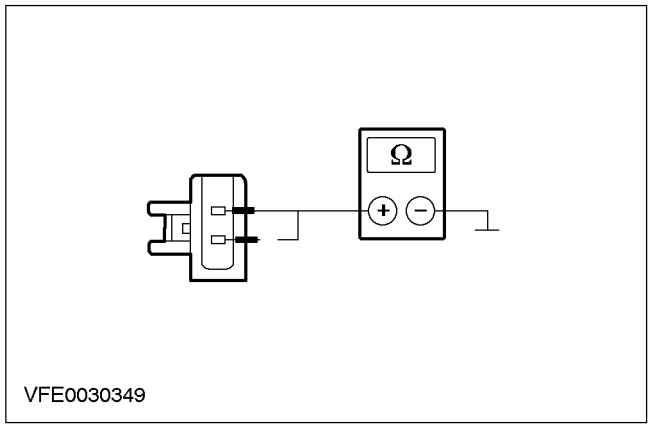
PINPOINT TEST H: FAULT IN THE CIRCUIT OF THE FOOTWELL OUTLET TEMPERATURE SENSOR

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1: CHECK FOR OPEN CIRCUIT BETWEEN FOOTWELL OUTLET TEMPERATURE SENSOR AND EATC MODULE OR HEATING AND AIR CONDITIONING CONTROL MODULE	
	1 Key in OFF position. **2** Disconnect EATC module or heating and air conditioning control module C539a.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031190	**3** Disconnect footwell outlet temperature sensor C535. **4** Measure the resistance between the footwell outlet temperature sensor, connector C535, pin 1, circuit 8-FA47 (WH/GN), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539a, pin 15, circuit 8-FA47 (WH/GN), wiring harness side.
 VFE0031191	**5** Measure the resistance between the footwell outlet temperature sensor, connector C535, pin 2, circuit 9-FA47 (BN/GN), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539a, pin 16, circuit 9-FA47 (BN/GN) (vehicles with EATC system: circuit 9-FA48A (BN/GN)), wiring harness side. • Is a resistance of less than 2 Ohms measured in both cases? → **Yes** GO to **H2** → **No** LOCATE and RECTIFY the break in the affected circuit between the footwell outlet temperature sensor and the EATC module or the heating and air conditioning control module with the aid of the Wiring Diagrams. CHECK operation of the system.
H2: CHECK FOR SHORT TO VOLTAGE SUPPLY BETWEEN FOOTWELL OUTLET TEMPERATURE SENSOR AND EATC MODULE OR HEATING AND AIR CONDITIONING CONTROL MODULE	
	1 Disconnect EATC module C539b (vehicles with EATC only). **2** Key in ON position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0030348	**3** Measure the voltage between the footwell outlet temperature sensor, connector C535, pin 1, circuit 8-FA47 (WH/GN), wiring harness side and ground.
	4 Measure the voltage between the footwell outlet temperature sensor, connector C535, pin 2, circuit 9-FA47 (BN/GN), wiring harness side and ground. • Is a voltage measured during any of these measurements? → **Yes** LOCATE and RECTIFY the short to voltage supply in the affected circuit between the footwell outlet temperature sensor and the EATC module or the heating and air conditioning control module with the aid of the Wiring Diagrams. CHECK operation of the system. → **No** GO to **H3**
H3: CHECK FOR SHORT TO GROUND BETWEEN FOOTWELL OUTLET TEMPERATURE SENSOR AND EATC MODULE OR HEATING AND AIR CONDITIONING CONTROL MODULE	
 VFE0030349	**1** Key in OFF position. **2** Measure the resistance between the footwell outlet temperature sensor, connector C535, pin 1, circuit 8-FA47 (WH/GN), wiring harness side and ground.
	3 Measure the resistance between the footwell outlet temperature sensor, connector C535, pin 2, circuit 9-FA47 (BN/GN), wiring harness side and ground.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is a resistance greater than 10 kOhm measured in both cases? → **Yes** RENEW the footwell outlet temperature sensor. CHECK operation of the system. → **No** LOCATE and RECTIFY the short to ground in the affected circuit between the footwell outlet temperature sensor and the EATC module or the heating and air conditioning control module with the aid of the Wiring Diagrams. CHECK operation of the system.

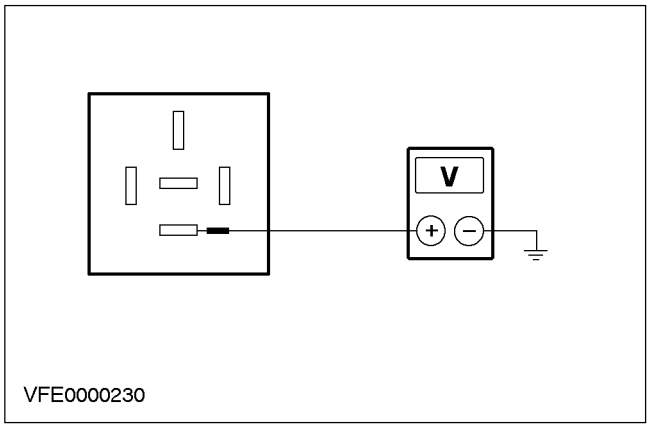
PINPOINT TEST I: EATC MODULE INOPERATIVE (NO DISPLAY ON THE CLIMATE CONTROL ASSEMBLY)

CONDITIONS	DETAILS/RESULTS/ACTIONS
I1: CHECK FUSE F65	
	1 Key in OFF position. 2 CHECK fuse F65 (CJB). • Is the fuse OK? → **Yes** GO to **I2** → **No** RENEW fuse F65 (7.5 A). CHECK operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams.
I2: CHECK VOLTAGE AT FUSE F65	
	1 Connect fuse F65 (CJB). 2 Measure the voltage between fuse F65 (7.5 A) and ground. • Is battery voltage measured? → **Yes** GO to **I3** → **No** RECTIFY the voltage supply to fuse F65 with the aid of the Wiring Diagrams. CHECK operation of the system.
I3: CHECK FUSE F76	
	1 CHECK fuse F76 (CJB). • Is the fuse OK? → **Yes** GO to **I4** → **No** RENEW fuse F76 (7.5 A). CHECK operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams.

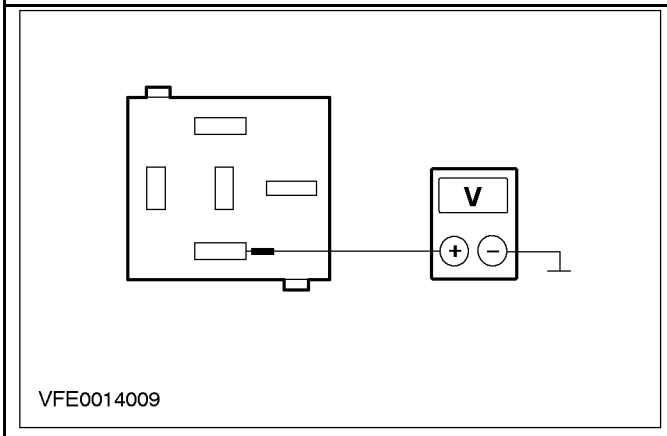
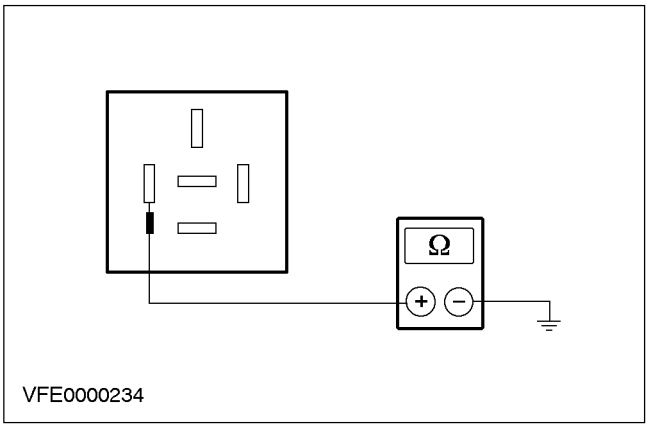
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
I4: CHECK VOLTAGE AT FUSE F76	
	1 Connect fuse F76 (CJB). 2 Key in ON position. 3 Measure the voltage between fuse F76 (7.5 A) and ground. • Is battery voltage measured? → **Yes** GO to **I14** → **No** GO to **I5**
I5: CHECK THE HEATER BLOWER MOTOR FOR LIMITED OPERATION	
	1 Check the operation of the heater blower motor. • Is the heater blower motor running at approximately 50 % power? → **Yes** LOCATE and RECTIFY the open circuit between the heater blower relay and fuse F76 in the central junction box with the aid of the Wiring Diagrams; if necessary RENEW the central junction box. CHECK operation of the system. → **No** GO to **I6**
I6: CHECK FUSE F6	
	1 Key in OFF position. 2 CHECK fuse F6 (BJB). • Is the fuse OK? → **Yes** GO to **I7** → **No** RENEW fuse F6 (40 A). CHECK operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams.
I7: CHECK VOLTAGE AT FUSE F6	
	1 Connect fuse F6 (BJB). 2 Measure the voltage between fuse F6 (40 A) and ground. • Is battery voltage measured? → **Yes** GO to **I8** → **No** RECTIFY the voltage supply to fuse F6 with the aid of the Wiring Diagrams. CHECK operation of the system.
I8: CHECK FUSE F93	
	1 CHECK fuse F93 (CJB).

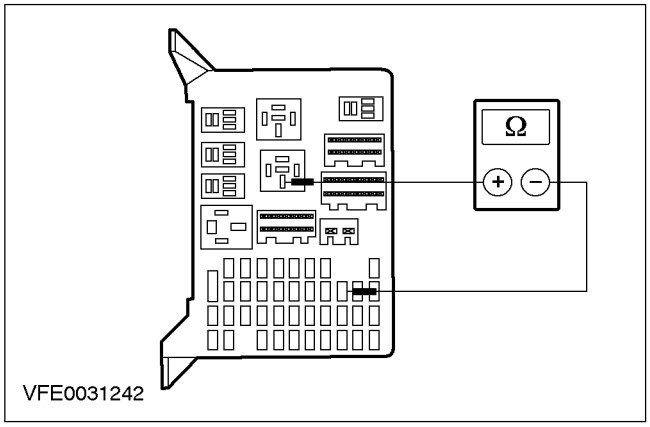
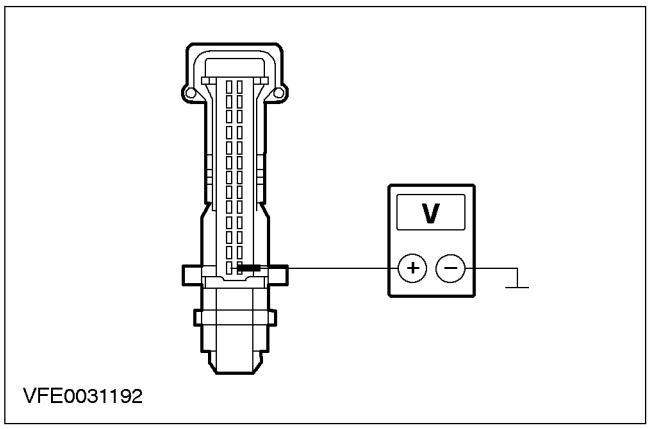
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is the fuse OK? → **Yes** GO to **I9** → **No** RENEW fuse F93 (10 A). CHECK operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams.
I9: CHECK VOLTAGE AT FUSE F93	
	1 Connect fuse F93 (CJB). 2 Key in ON position. 3 Measure the voltage between fuse F93 (10 A) and ground. • Is battery voltage measured? → **Yes** GO to **I10** → **No** RECTIFY the voltage supply to fuse F93 with the aid of the Wiring Diagrams. CHECK operation of the system.
I10: CHECK THE VOLTAGE AT THE HEATER BLOWER RELAY	
 VFE0000230	1 Key in OFF position. 2 Disconnect heater blower relay C920. 3 Measure the voltage between the heater blower relay, socket C920, pin 5, wiring harness side and ground. • Is battery voltage measured? → **Yes** GO to **I11** → **No** LOCATE and RECTIFY the break in the circuit between fuse F6 and the heater blower relay with the aid of the Wiring Diagrams. CHECK operation of the system.
I11: CHECK THE CONTROL VOLTAGE AT THE HEATER BLOWER RELAY	
	1 Key in ON position.

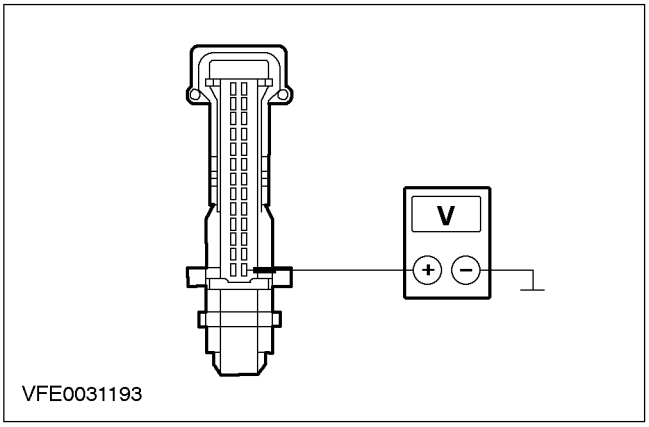
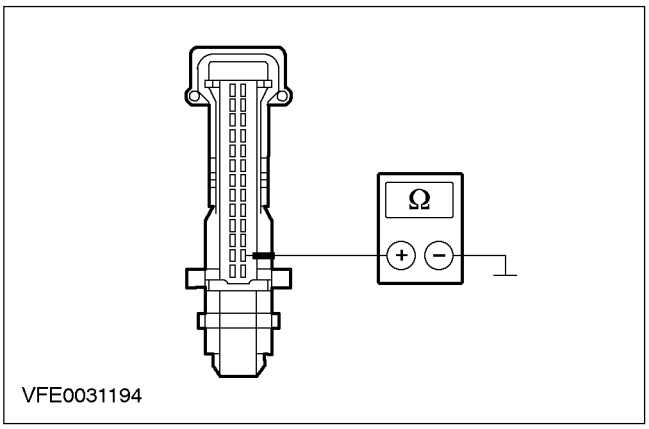
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0014009	**2** Measure the voltage between the heater blower relay, socket C920, pin 2, wiring harness side and ground. • Is battery voltage measured? → **Yes** GO to **I12** → **No** LOCATE and RECTIFY the open circuit between fuse F93 and the heater blower relay with the aid of the Wiring Diagrams. CHECK operation of the system.
I12: CHECK THE GROUND CONNECTION OF THE HEATER BLOWER RELAY	
 VFE0000234	**1** Key in OFF position. **2** Measure the resistance between the heater blower relay, socket C920, pin 1, wiring harness side and ground. • Is a resistance of less than 2 Ohms registered? → **Yes** GO to **I13** → **No** LOCATE and REPAIR the open circuit between the heater blower relay and ground connection G200 with the aid of the Wiring Diagrams. CHECK operation of the system.

DIAGNOSIS AND TESTING (Continued)

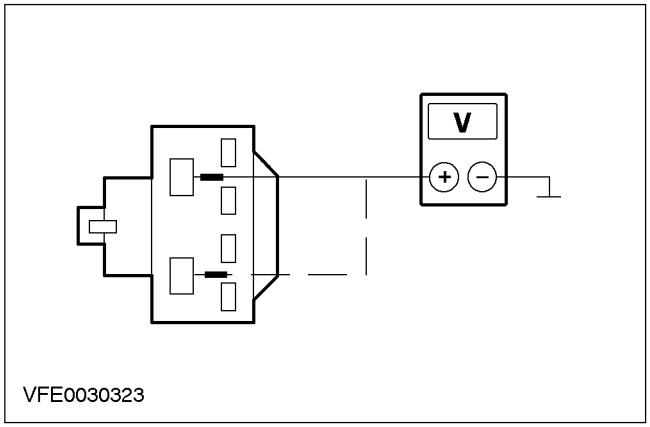
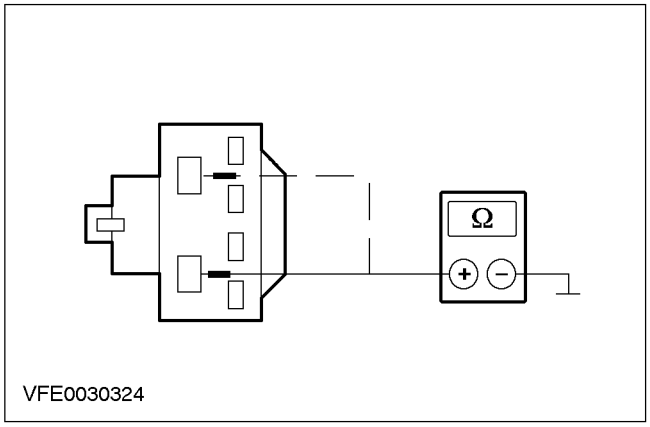
CONDITIONS	DETAILS/RESULTS/ACTIONS
I13: CHECK THE CENTRAL JUNCTION BOX	
 VFE0031242	1 Measure the resistance between the heater blower relay, socket C920, pin 3, wiring harness side and fuse F76. • Is a resistance of less than 2 Ohms registered? → **Yes** RENEW the heater blower relay. CHECK operation of the system. → **No** LOCATE and RECTIFY the open circuit between the heater blower relay and fuse F76 in the central junction box with the aid of the Wiring Diagrams; if necessary RENEW the central junction box. CHECK operation of the system.
I14: CHECK THE VOLTAGE AT THE EATC MODULE	
 VFE0031192	1 Key in OFF position. 2 Disconnect EATC module C539b. 3 Measure the voltage between the EATC module, connector C539b, pin 1, circuit 29-FA43 (OG/WH), wiring harness side and ground. • Is battery voltage measured? → **Yes** GO to **I15** → **No** LOCATE and RECTIFY the open circuit between fuse F65 and the EATC module with the aid of the Wiring Diagrams. CHECK operation of the system.

DIAGNOSIS AND TESTING (Continued)

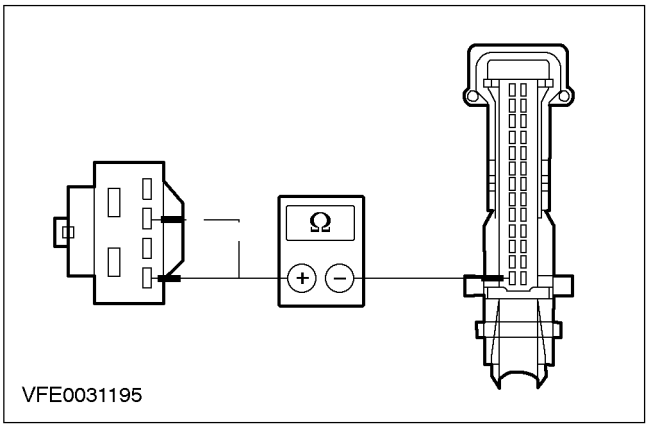
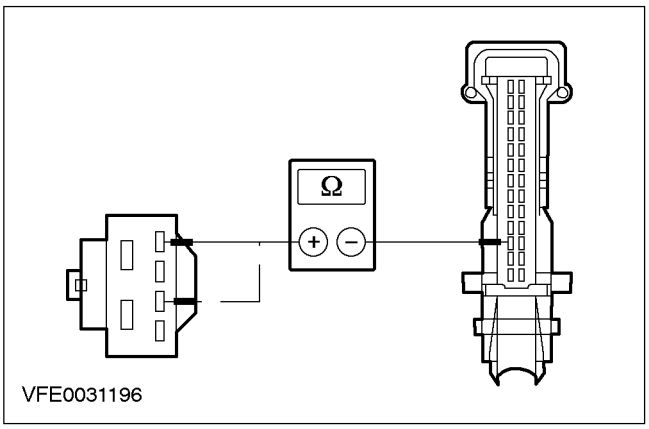
CONDITIONS	DETAILS/RESULTS/ACTIONS
I15: CHECK THE VOLTAGE AT THE EATC MODULE	
 VFE0031193	1 Key in ON position. 2 Measure the voltage between the EATC module, connector C539b, pin 14, circuit 15S-FA43 (GN/WH), wiring harness side and ground. • Is battery voltage measured? → **Yes** GO to **I16** → **No** LOCATE and RECTIFY the open circuit between fuse F76 and the EATC module with the aid of the Wiring Diagrams. CHECK operation of the system.
I16: CHECK THE GROUND CONNECTION OF THE EATC MODULE	
 VFE0031194	1 Key in OFF position. 2 Measure the resistance between the EATC module, connector C539b, pin 15, circuit 31-FA43 (BK), wiring harness side and ground. • Is a resistance of less than 2 Ohms registered? → **Yes** CHECK and if necessary RENEW the EATC module. CHECK operation of the system. → **No** LOCATE and RECTIFY the break in the circuit between the EATC module and ground connection G204 with the aid of the Wiring Diagrams. CHECK operation of the system.

DIAGNOSIS AND TESTING (Continued)

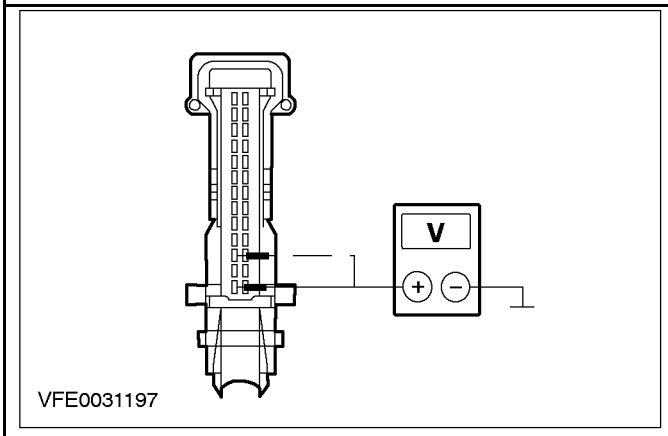
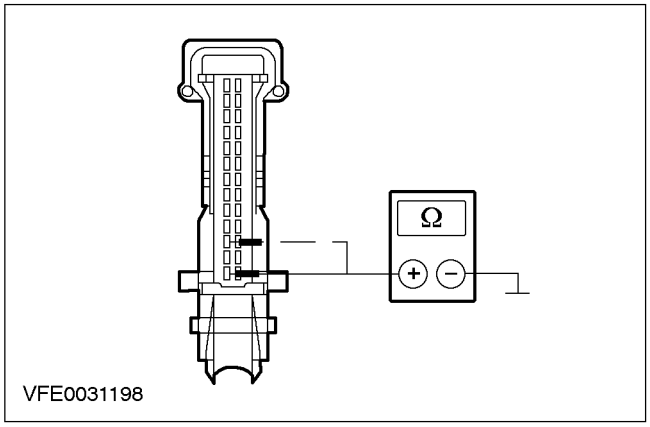
PINPOINT TEST J: MALFUNCTION OF THE HEATER BLOWER (VEHICLES WITH EATC ONLY, DISPLAY ON CLIMATE CONTROL ASSEMBLY OK)

CONDITIONS	DETAILS/RESULTS/ACTIONS
J1: CHECK THE VOLTAGE AT THE HEATER BLOWER CONTROL MODULE	
 VFE0030323	1 Key in OFF position. 2 Disconnect heater blower control module C537. 3 Key in ON position. 4 Measure the voltage between the heater blower control module, connector C537, pin 2 (right-hand drive vehicles: pin 1), circuit 15S-FA45 (GN/RD), wiring harness side and ground. • Is battery voltage measured? → **Yes** GO to **J2** → **No** LOCATE and RECTIFY the open circuit between the heater blower control module and the heater blower relay with the aid of the Wiring Diagrams. CHECK operation of the system.
J2: CHECK THE GROUND CONNECTION OF THE HEATER BLOWER CONTROL MODULE	
 VFE0030324	1 Key in OFF position. 2 Measure the resistance between the heater blower control module, connector C537, pin 1 (right-hand drive vehicles: Pin 2), circuit 31-FA45 (BK), wiring harness side and ground. • Is a resistance of less than 2 Ohms registered? → **Yes** GO to **J3** → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	LOCATE and RECTIFY the open circuit in 31-FA45 (BK) between the heater blower control module and ground connection G204 with the aid of the Wiring Diagrams. CHECK operation of the system.
J3: CHECK THE CIRCUITS BETWEEN THE HEATER BLOWER CONTROL MODULE AND THE EATC MODULE FOR OPEN CIRCUIT	
	**1** Disconnect EATC module C539a. **2** Measure the resistance between the heater blower control module, connector C537, pin 3 (right-hand drive vehicles: pin 5), circuit 9-FA45 (BN/BU), wiring harness side and the EATC module, connector C539a, pin 1, circuit 9-FA45 (BN/BU), wiring harness side.
	**3** Measure the resistance between the heater blower control module, connector C537, pin 6 (right-hand drive vehicles: pin 4), circuit 49S-FA45 (BU/WH), wiring harness side and the EATC module, connector C539a, pin 3, circuit 49S-FA45 (BU/WH), wiring harness side.
	• Is a resistance of less than 2 Ohms measured in both cases? → **Yes** GO to **J4** → **No** LOCATE and RECTIFY the open circuit in 9-FA45 (BN/BU) or 49S-FA45 (BU/WH) between the heater blower control module and the EATC module with the aid of the Wiring Diagrams. CHECK operation of the system.
J4: CHECK THE CIRCUITS BETWEEN THE EATC MODULE AND THE HEATER BLOWER CONTROL MODULE FOR SHORT TO VOLTAGE	
	1 Key in ON position.

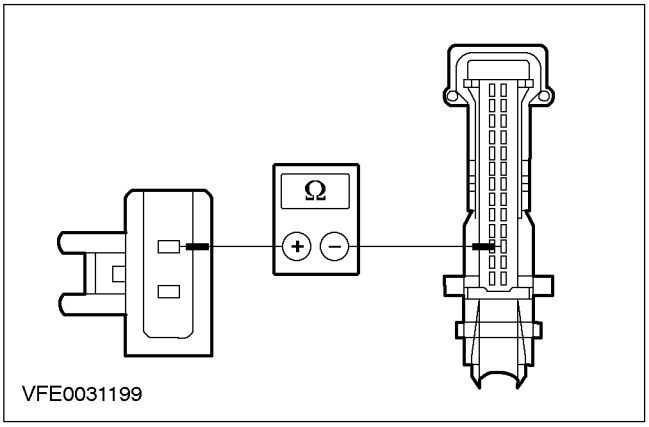
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**2** Measure the voltage between the EATC module, connector C539a, pin 1, circuit 9-FA45 (BN/BU), wiring harness side and ground. **3** Measure the voltage between the EATC module, connector C539a, pin 3, circuit 49S-FA45 (BU/WH), wiring harness side and ground. • Is a voltage measured during any of these measurements? → **Yes** LOCATE and RECTIFY the short to voltage in circuit 9-FA45 (BN/BU) or 49S-FA45 (BU/WH) between the EATC module and the heater blower control module with the aid of the Wiring Diagrams. CHECK operation of the system. → **No** GO to **J5**
J5: CHECK THE CIRCUITS BETWEEN THE EATC MODULE AND THE HEATER BLOWER CONTROL MODULE FOR SHORT TO GROUND	
	**1** Key in OFF position. **2** Measure the resistance between the EATC module, connector C539a, pin 1, circuit 9-FA45 (BN/BU), wiring harness side and ground. **3** Measure the resistance between the EATC module, connector C539a, pin 3, circuit 49S-FA45 (BU/WH), wiring harness side and ground. • Is a resistance greater than 10 kOhm measured in both cases? → **Yes**

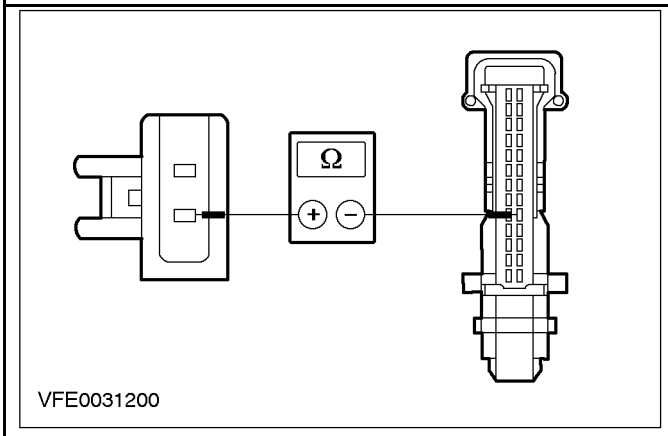
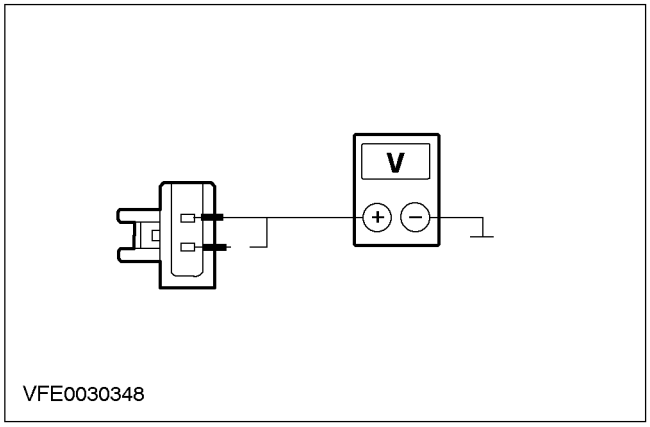
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	GO to **J6** → **No** LOCATE and RECTIFY the short to ground in circuit 9-FA45 (BN/BU) or 49S-FA45 (BU/WH) between the EATC module and the heater blower control module with the aid of the Wiring Diagrams. CHECK operation of the system.
J6: CHECK THE HEATER BLOWER CONTROL MODULE	
	1 Connect heater blower control module C537. 2 Key in ON position. • Is the heater blower motor running at approximately 50 % power? → **Yes** CHECK and if necessary RENEW the EATC module. CHECK operation of the system. → **No** Renew the heater blower control module CHECK operation of the system.

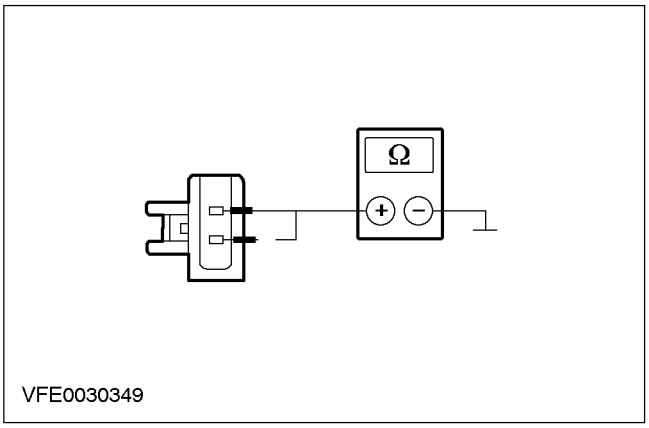
PINPOINT TEST K: FAULT IN THE CIRCUIT OF THE SUN LOAD SENSOR (VEHICLES WITH EATC SYSTEM ONLY)

CONDITIONS	DETAILS/RESULTS/ACTIONS
K1: CHECK FOR OPEN CIRCUIT BETWEEN THE SUN LOAD SENSOR AND THE EATC MODULE	
 VFE0031199	1 Key in OFF position. 2 Disconnect EATC module C539a. 3 Disconnect EATC module C539b. 4 Disconnect sun load sensor C524. 5 Measure the resistance between the sun load sensor, connector C524, pin 1, circuit 9-FA53 (BN/BU), wiring harness side and the EATC module, connector C539a, pin 16, circuit 9-FA48A (BN/GN), wiring harness side.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031200	**6** Measure the resistance between the sun load sensor, connector C524, pin 2, circuit 8-FA53 (WH/BU), wiring harness side and the EATC module, connector C539b, pin 18, circuit 8-FA53 (WH/BU), wiring harness side. • Is a resistance of less than 2 Ohms measured in both cases? → **Yes** GO to **K2** → **No** LOCATE and RECTIFY the break in the affected circuit between the sun load sensor and the EATC module with the aid of the Wiring Diagrams. CHECK operation of the system.
K2: CHECK THE CIRCUIT BETWEEN THE SUN LOAD SENSOR AND THE EATC MODULE FOR SHORT TO VOLTAGE SUPPLY	
 VFE0030348	**1** Key in ON position. **2** Measure the voltage between the sun load sensor, connector C524, pin 1, circuit 9-FA53 (BN/BU), wiring harness side and ground. **3** Measure the voltage between the sun load sensor, connector C524, pin 2, circuit 8-FA53 (WH/BU), wiring harness side and ground. • Is a voltage measured during any of these measurements? → **Yes** LOCATE and RECTIFY the short to voltage in the affected circuit between the sun load sensor and the EATC module with the aid of the Wiring Diagrams. CHECK operation of the system. → **No**

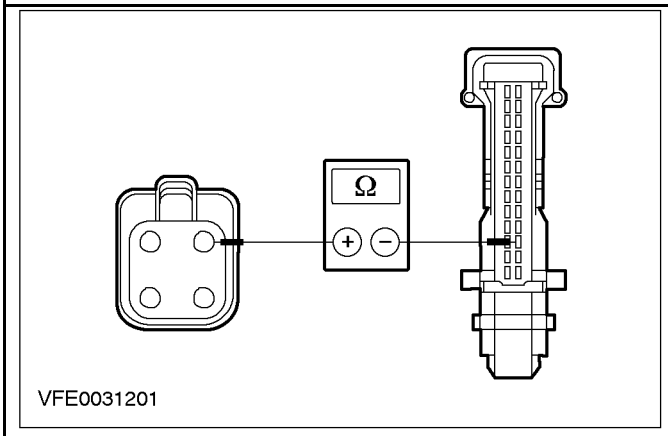
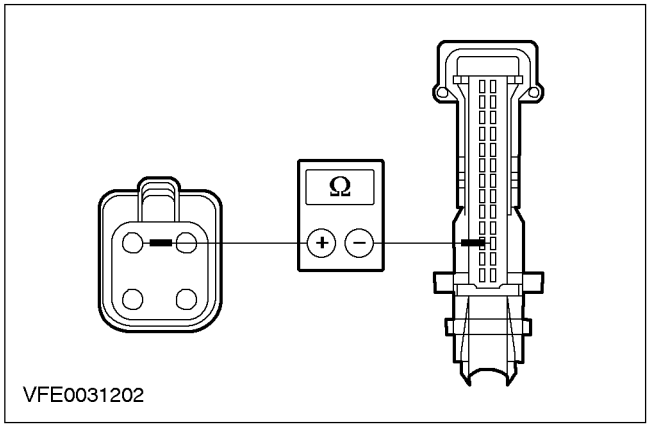
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	GO to **K3**
K3: CHECK THE CIRCUIT BETWEEN THE SUN LOAD SENSOR AND THE EATC MODULE FOR SHORT TO GROUND	
 VFE0030349	**1** Key in OFF position. **2** Measure the resistance between the sun load sensor, connector C524, pin 1, circuit 9-FA53 (BN/BU), wiring harness side and ground. **3** Measure the resistance between the sun load sensor, connector C524, pin 2, circuit 8-FA53 (WH/BU), wiring harness side and ground. • Is a resistance greater than 10 kOhm measured in both cases? → **Yes** RENEW the sun load sensor. CHECK operation of the system. → **No** LOCATE and RECTIFY the short to ground in the affected circuit between the sun load sensor and the EATC module with the aid of the Wiring Diagrams. CHECK operation of the system.

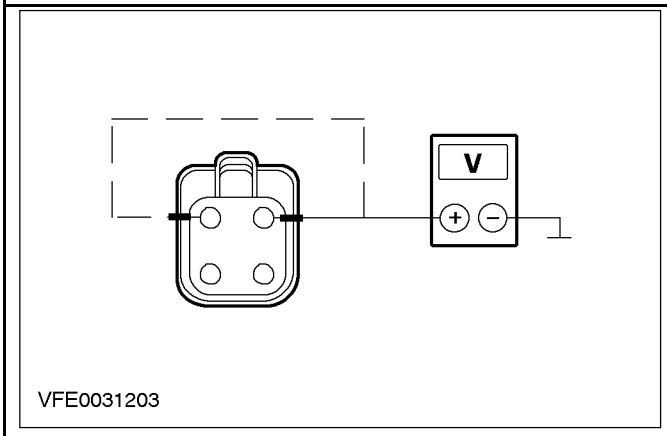
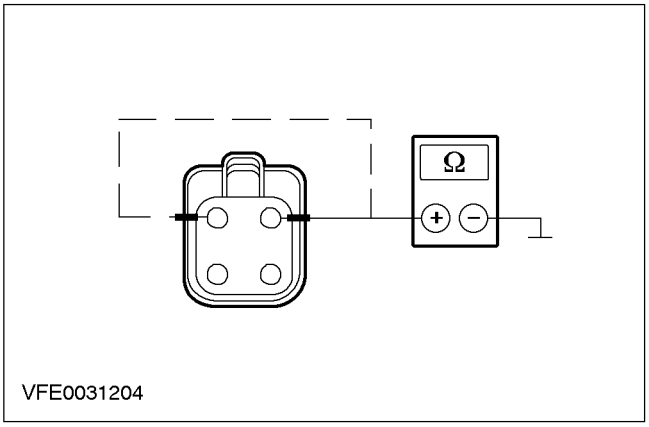
PINPOINT TEST L: FAULT IN THE CIRCUIT OF THE INTERIOR TEMPERATURE SENSOR (VEHICLES WITH EATC SYSTEM ONLY)

CONDITIONS	DETAILS/RESULTS/ACTIONS
L1: CHECK FOR OPEN CIRCUIT BETWEEN THE INTERIOR TEMPERATURE SENSOR AND THE EATC MODULE	
	1 Key in OFF position. **2** Disconnect EATC module C539a. **3** Disconnect EATC module C539b. **4** Disconnect interior temperature sensor C455.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031201	**5** Measure the resistance between the interior temperature sensor, connector C455, pin 1, circuit 8-FA48 (WH/GN), wiring harness side and the EATC module, connector C539b, pin 16, circuit 8-FA48 (WH/GN), wiring harness side.
 VFE0031202	**6** Measure the resistance between the interior temperature sensor, connector C455, pin 2, circuit 9-FA48 (BN/GN), wiring harness side and the EATC module, connector C539a, pin 16, circuit 9-FA48A (BN/GN), wiring harness side. • Is a resistance of less than 2 Ohms measured in both cases? → **Yes** GO to **L2** → **No** LOCATE and RECTIFY the break in the affected circuit between the internal temperature sensor and the EATC module or soldered connection S180 with the aid of the Wiring Diagrams. CHECK operation of the system.
L2: CHECK THE CIRCUIT BETWEEN THE INTERIOR TEMPERATURE SENSOR AND THE EATC MODULE FOR SHORT TO VOLTAGE SUPPLY	
	1 Key in ON position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031203	**2** Measure the voltage between the interior temperature sensor, connector C455, pin 1, circuit 8-FA48 (WH/GN), wiring harness side and ground. **3** Measure the voltage between the interior temperature sensor, connector C455, pin 2, circuit 9-FA48 (BN/GN), wiring harness side and ground. • Is a voltage measured during any of these measurements? → **Yes** LOCATE and RECTIFY the short to voltage in the affected circuit between the interior temperature sensor and the EATC module with the aid of the Wiring Diagrams. CHECK operation of the system. → **No** GO to **L3**
L3: CHECK THE CIRCUIT BETWEEN THE INTERIOR TEMPERATURE SENSOR AND THE EATC MODULE FOR SHORT TO GROUND	
 VFE0031204	**1** Key in OFF position. **2** Measure the resistance between the interior temperature sensor, connector C455, pin 1, circuit 8-FA48 (WH/GN), wiring harness side and ground. **3** Measure the resistance between the interior temperature sensor, connector C455, pin 2, circuit 9-FA48 (BN/GN), wiring harness side and ground. • Is a resistance greater than 10 kOhm measured in both cases? → **Yes**

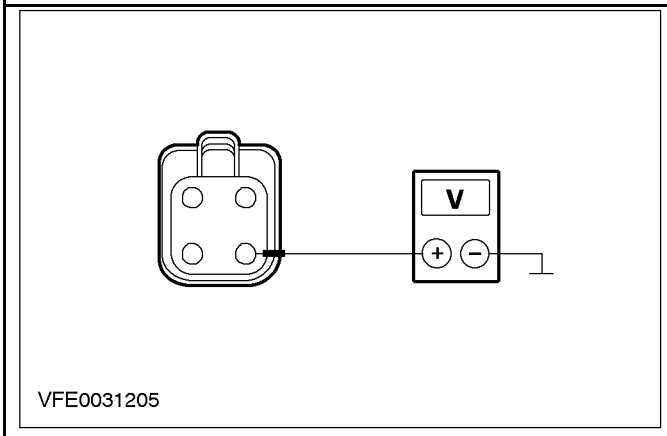
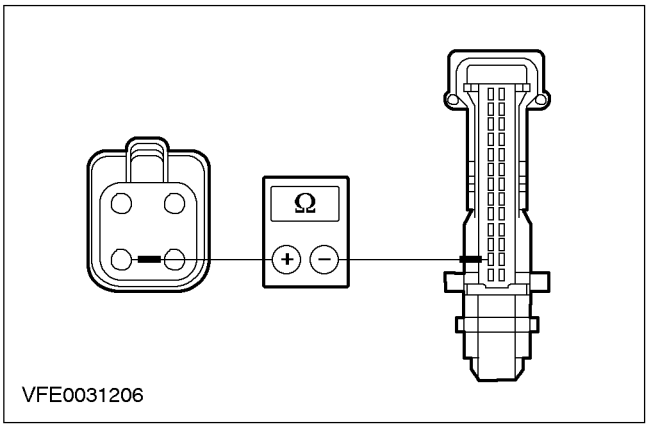
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	RENEW the interior temperature sensor. CHECK operation of the system. → **No** LOCATE and RECTIFY the short to ground in the affected circuit between the interior temperature sensor and the EATC module with the aid of the Wiring Diagrams. CHECK operation of the system.

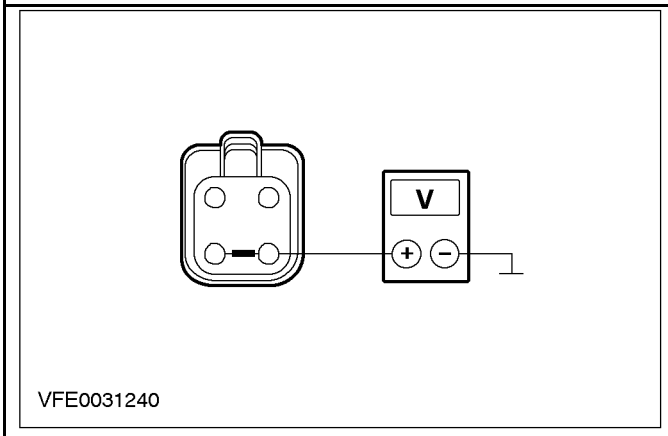
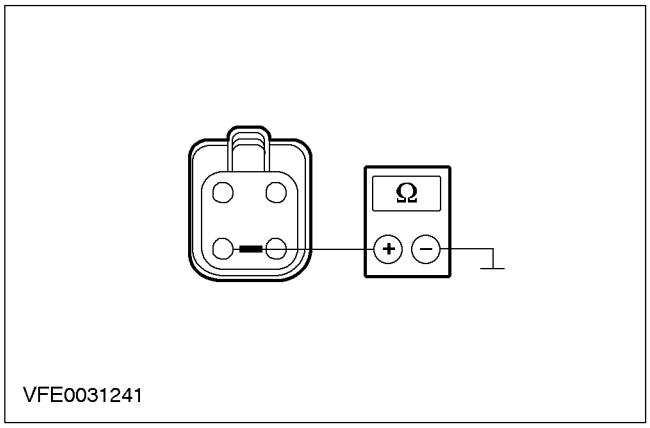
PINPOINT TEST M: FAULT IN THE CIRCUIT OF THE INTERIOR TEMPERATURE SENSOR BLOWER (VEHICLES WITH EATC SYSTEM ONLY)

CONDITIONS	DETAILS/RESULTS/ACTIONS
M1: CHECK FUSE F81	
	1 Key in OFF position. 2 CHECK fuse F81 (CJB). • Is the fuse OK? → **Yes** GO to **M2** → **No** RENEW fuse F81 (7.5 A). CHECK operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams.
M2: CHECK VOLTAGE AT FUSE F81	
	1 Connect fuse F81 (CJB). 2 Key in ON position. 3 Measure the voltage between fuse F81 (7.5 A) and ground. • Is battery voltage measured? → **Yes** GO to **M3** → **No** RECTIFY the voltage supply to fuse F81 with the aid of the Wiring Diagrams. CHECK operation of the system.
M3: CHECK THE VOLTAGE AT THE INTERIOR TEMPERATURE SENSOR	
	1 Key in OFF position. 2 Disconnect interior temperature sensor C455. 3 Key in ON position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031205	**4** Measure the voltage between the interior temperature sensor, connector C455, pin 3, circuit 15S-FA48 (GN/BK), wiring harness side and ground. • Is battery voltage measured? → **Yes** GO to **M4** → **No** LOCATE and RECTIFY the break in the circuit between fuse F81 and the interior temperature sensor with the aid of the Wiring Diagrams. CHECK operation of the system.
M4: CHECK FOR OPEN CIRCUIT BETWEEN THE INTERIOR TEMPERATURE SENSOR AND THE EATC MODULE	
 VFE0031206	**1** Key in OFF position. **2** Disconnect EATC module C539b. **3** Measure the resistance between the interior temperature sensor, connector C455, pin 4, circuit 31S-FA48 (BK/GN), wiring harness side and the EATC module, connector C539b, pin 2, circuit 31S-FA48 (BK/GN), wiring harness side. • Is a resistance of less than 2 Ohms registered? → **Yes** GO to **M5** → **No** LOCATE and RECTIFY the open circuit in circuit 31S-FA48 (BK/GN) between the interior temperature sensor and the EATC module with the aid of the Wiring Diagrams. CHECK operation of the system.
M5: CHECK THE CIRCUIT BETWEEN THE INTERIOR TEMPERATURE SENSOR AND THE EATC MODULE FOR SHORT TO VOLTAGE SUPPLY	
	1 Key in ON position.

DIAGNOSIS AND TESTING (Continued)

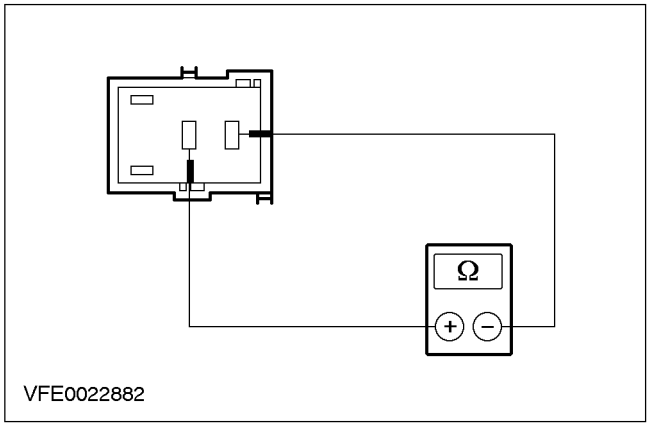
CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031240	2 Measure the voltage between the interior temperature sensor, connector C455, pin 4, circuit 31S-FA48 (BK/GN), wiring harness side and ground. • Is a voltage registered? → **Yes** LOCATE and RECTIFY the short to voltage supply in circuit 31S-FA48 (BK/GN) between the interior temperature sensor and the EATC module with the aid of the Wiring Diagrams. CHECK operation of the system. → **No** GO to **M6**
M6: CHECK THE CIRCUIT BETWEEN THE INTERIOR TEMPERATURE SENSOR AND THE EATC MODULE FOR SHORT TO GROUND	
 VFE0031241	1 Key in OFF position. 2 Measure the resistance between the interior temperature sensor, connector C455, pin 4, circuit 31S-FA48 (BK/GN), wiring harness side and ground. • Is a resistance of more than 10 kOhms registered? → **Yes** RENEW the interior temperature sensor. CHECK operation of the system. → **No** LOCATE and RECTIFY the short to ground in circuit 31S-FA48 (BK/GN) between the interior temperature sensor and the EATC module with the aid of the Wiring Diagrams. CHECK operation of the system.

DIAGNOSIS AND TESTING

Component Tests

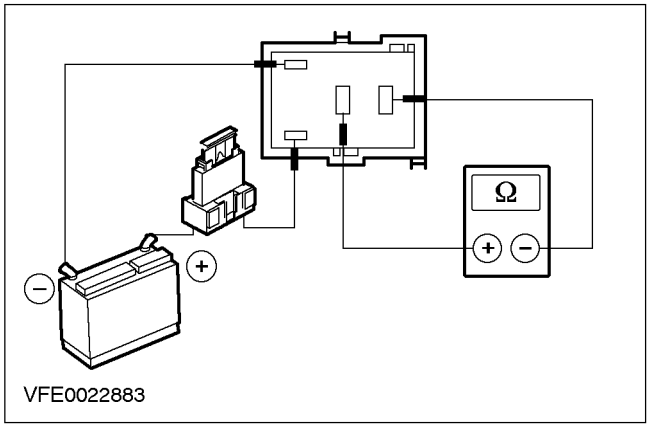
Air conditioning wide open throttle (WOT) relay.

1. Check the normally open contact in the unswitched state.
   - Measure the resistance at the relay, between pin 3 and pin 5, component side.
   - Is a resistance of more than 10 kOhms registered? If yes, go to 2. If no, RENEW the relay.



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2. Check the normally open contact in the switched state.
   - Using a fused test cable (1 A), connect pin 1 of the relay, component side, to the battery positive terminal.
   - Using a test cable, connect pin 2 of the relay, component side, to the battery negative terminal.
   - Measure the resistance at the relay, between pin 3 and pin 5, component side.
   - Is a resistance of less than 2 Ohms registered? If yes, then the relay is OK. If no, RENEW the relay.



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Testing the Refrigerant Circuit

Workshop Equipment

The following equipment is required for the tests:

- R134a refrigerant centre or set of R134a pressure gauges
- Stopwatch

Pinpoint Test: Refrigerant Circuit

WARNING: The air conditioning systems is filled with refrigerant R134a. Observe "Health and Safety Precautions". For further information REFER to Section 100-00.

NOTE: The following Pinpoint Test only applies to vehicles with compressors without low-pressure circuit control (vehicles with 2.0L diesel engine only).

The following values must be determined:

- Low pressure
- High pressure
- Cycle time

Test Preparations

The following steps must be carefully followed to guarantee accurate test results.

WARNING: The manufacturer's instructions must be followed when connecting the R-134a refrigerant centre or the set of R134a pressure gauges. Failure to observe this instruction can lead to injuries.

- Connect the R134a refrigerant centre or set of R134a pressure gauges to the refrigerant circuit.
- Start the engine.
- Switch on the air-conditioning system.
- Switch on the air recirculation.
- Set the heater blower switch to "maximum".
- Run the engine for approx. 10 minutes at 1500 rpm.

Check the cycle time and system pressures

Allow the engine to run at 1500 rpm during the test.

DIAGNOSIS AND TESTING (Continued)

1. Set the interior temperature in the vehicle to approx. 22 °C.
2. Measure the cycles (ON and OFF times of the A/C compressor clutch) with a stopwatch and note the results.
3. Take readings from the high and low pressure gauge and note the values.
4. Compare the obtained cycle times and pressure values with the following specified values and use the Symptom Chart to determine the cause of the fault.

Example:

- High pressure too low
- Low pressure normal
- Overall cycle time too short
- "A/C compressor clutch ON" cycle time too short
- "A/C compressor clutch OFF" cycle time too short

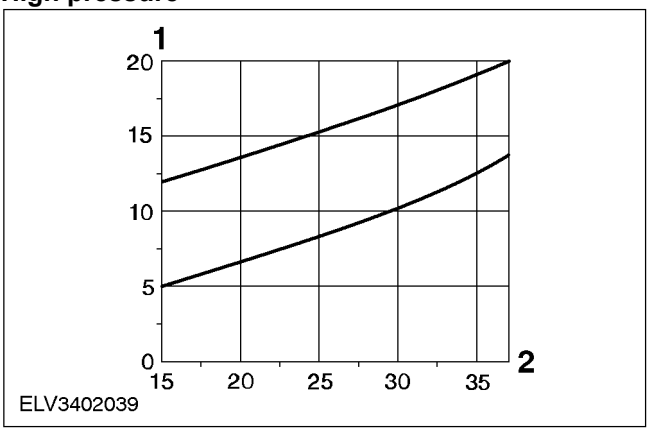
Fault cause: Refrigerant quantity insufficient.

Specified values (vehicles with 2.0L diesel engine only)

The high and low pressure values and the cycle times are dependent upon the ambient temperature. The ambient temperature should be measured at a distance of 1 m from the vehicle.

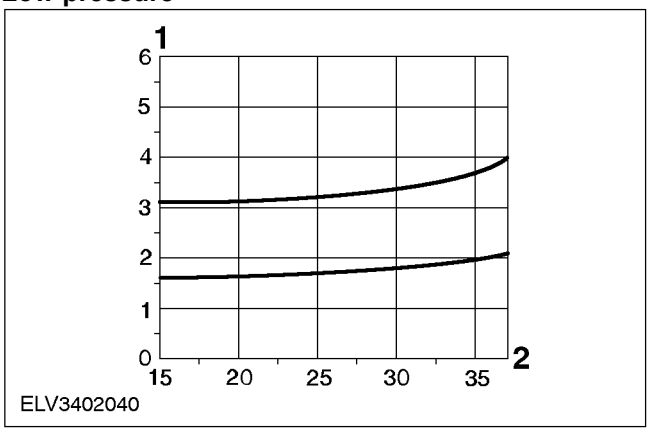
The applicable tolerance range which describes the "normal" range for a measured value, lies between the upper and lower curves.

High pressure



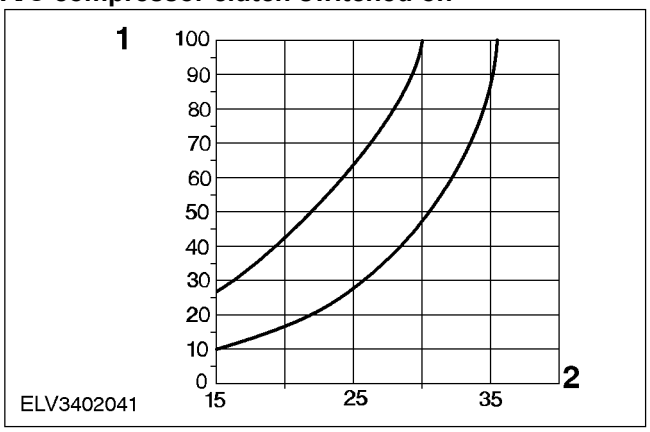
Co-ordinate axis	Description
1	High pressure (bar)
2	Ambient temperature (°C)

Low pressure



Co-ordinate axis	Description
1	Low pressure (bar)
2	Ambient temperature (°C)

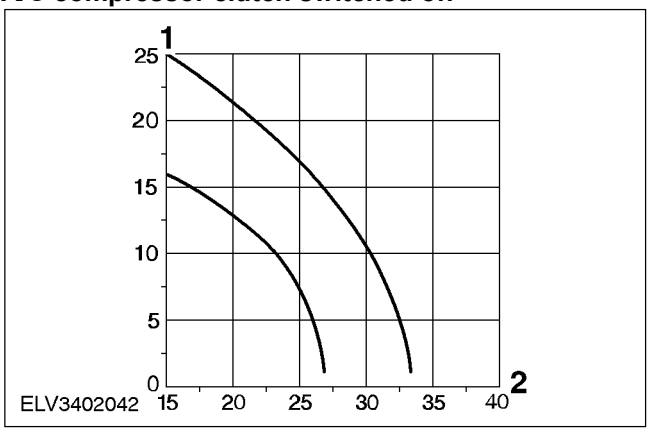
A/C compressor clutch switched on



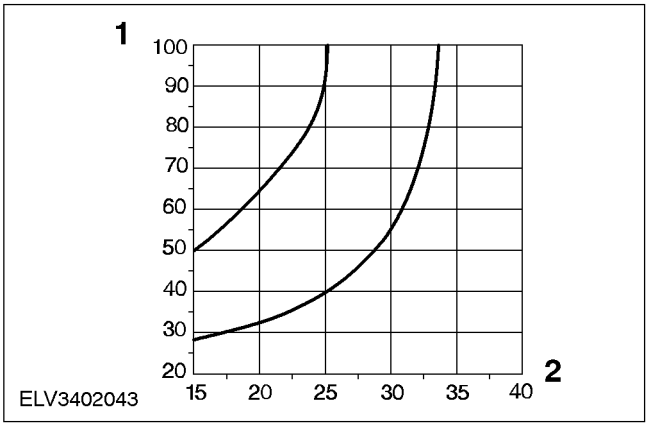
Co-ordinate axis	Description
1	A/C compressor clutch switched on (seconds)
2	Ambient temperature (°C)

DIAGNOSIS AND TESTING (Continued)

A/C compressor clutch switched off



Co-ordinate axis	Description
1	A/C compressor clutch switched off (seconds)
2	Ambient temperature (°C)



Co-ordinate axis	Description
1	Total cycle time (seconds)
2	Ambient temperature (°C)

Total cycle time

NOTE: The total cycle time is made up of the "A/C compressor clutch ON time" and the "A/C compressor clutch OFF time".

Symptom Chart: Refrigerant Circuit

High pressure	Low pressure	Total cycle time	"A/C compressor clutch ON" cycle time	"A/C compressor clutch OFF" cycle time	Fault cause
too high	too high	too long	continuously switched on	-	Inadequate heat dissipation at the condenser (e.g. cooling fan inoperative, external contamination of the condenser)
normal to too high	normal	too long	continuously switched on	-	Air, foreign material or too much refrigerant in the refrigerant circuit
normal	too high	too long	continuously switched on	-	Fixed orifice tube O-rings leaking/damaged
normal	normal	too long	too long to continuous	normal to not at all	Foreign material (e.g. moisture) or too much refrigerant oil in the refrigerant circuit
normal	too low	too long	too long	too long	Low-pressure switch faulty
normal to too low	too high	too long	continuously switched on	-	A/C compressor faulty
normal to too low	normal to too high	too long	continuously switched on	-	Low pressure line to the A/C compressor blocked
normal to too low	normal	too short	too short	normal	Evaporator blocked
normal to too low	normal	too short to normal	too short	normal to too long	Condenser, fixed orifice tube or high-pressure line blocked
normal to too low	normal	too short	too short	too short	Refrigerant quantity insufficient
normal to too low	normal	too short	too short	too long	High-pressure line to the evaporator blocked

DIAGNOSIS AND TESTING (Continued)

High pressure	Low pressure	Total cycle time	"A/C compressor clutch ON" cycle time	"A/C compressor clutch OFF" cycle time	Fault cause
normal to too low	too low	too long	continuously switched on	-	Low pressure line to the A/C compressor blocked, or a fault in the control via the low pressure switch (fails to switch off).

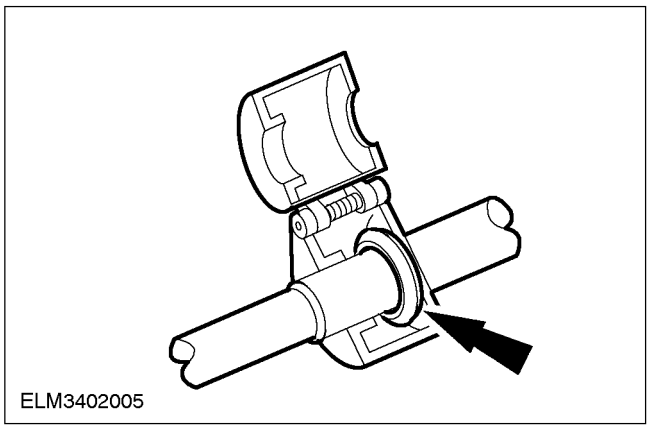
GENERAL PROCEDURES

Spring Lock Coupling

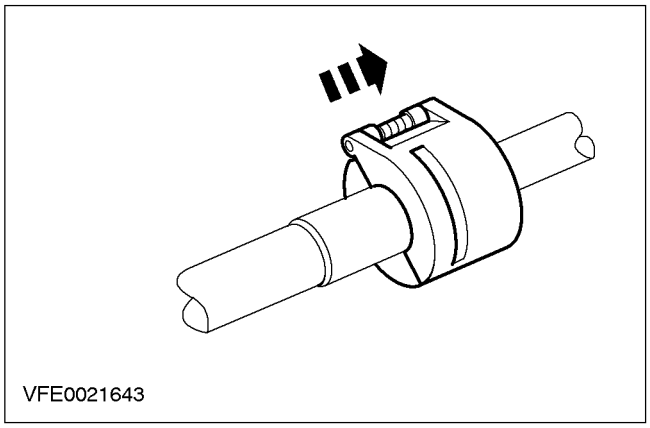
1. **NOTE:** Select special tool to suit the line diameter.

   Fit the special tool.

   - Fit the special tool so that the inner collar can be guided into the clamping spring.

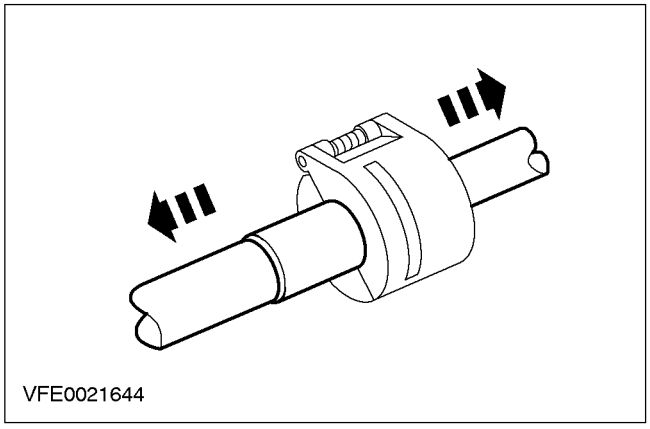


2. **Press the special tool into the clamping spring.**



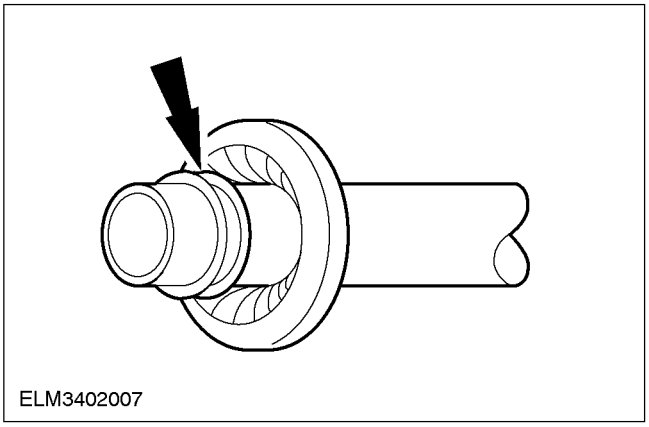
3. **Disconnect the refrigerant line.**

   - Discard the O-ring seals.



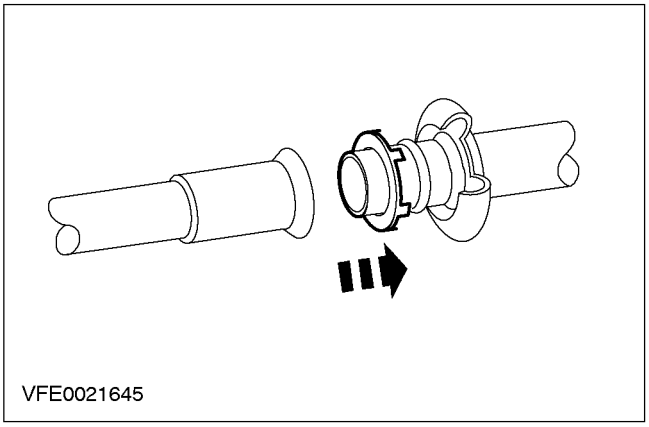
4. **Connect the refrigerant line.**

   - Check the clamping spring for damage.
   - Carefully pull out any damaged clamping springs using a thin piece of wire and install new one.



5. **NOTE:** Clean the connections using refrigerant oil and a lint-free cloth.

   Press the indicator ring into the clamping spring.



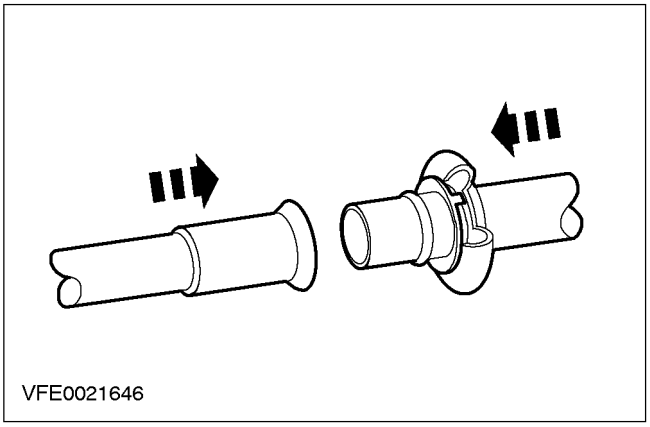
GENERAL PROCEDURES (Continued)

6. NOTE: Install new refrigerant line O-ring seals.

NOTE: Coat the refrigerant line O-ring seals in clean refrigerant oil prior to installation.

Connect the refrigerant lines.

- Check that the clamping spring engages correctly.



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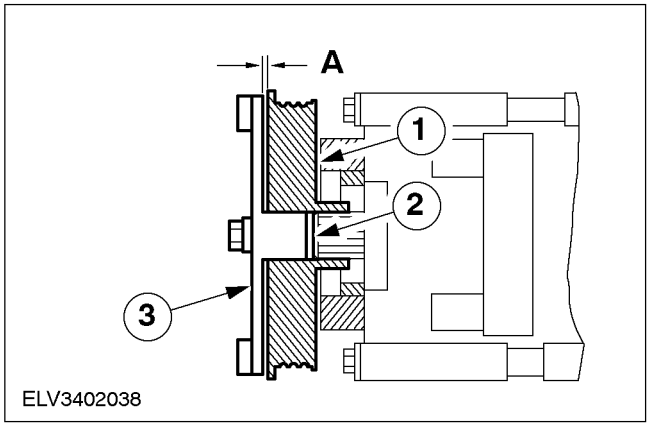
GENERAL PROCEDURES

Air Conditioning (A/C) Clutch Air Gap Adjustment (34 628 6)

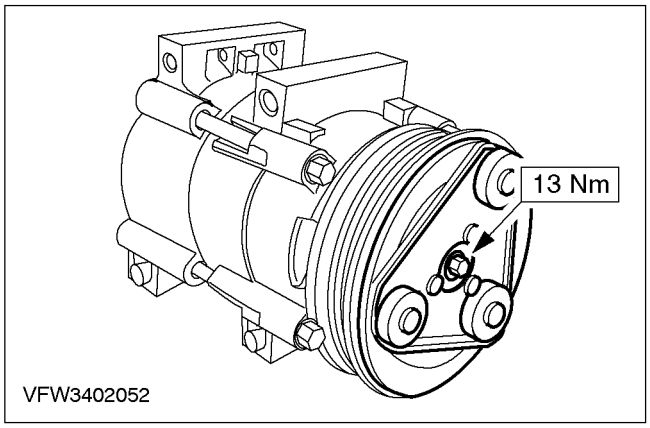
Name	Specification
Spacer washer set	

1. Check the air gap A between the drive plate and the pulley at 60 degrees intervals around the circumference. For additional information, refer to Specifications in this section.

1. Belt pulley
2. Spacer washer
3. Drive plate



2. Detach the drive plate.



3. Correct air gap A as necessary using spacer washers.

4. Attach the drive plate.

5. Check air gap A as described in step 1. Repeat steps 3-6 if necessary.

GENERAL PROCEDURES

Air Conditioning (A/C) System Recovery, Evacuation and Charging (34 620 2)

General Equipment
Service unit

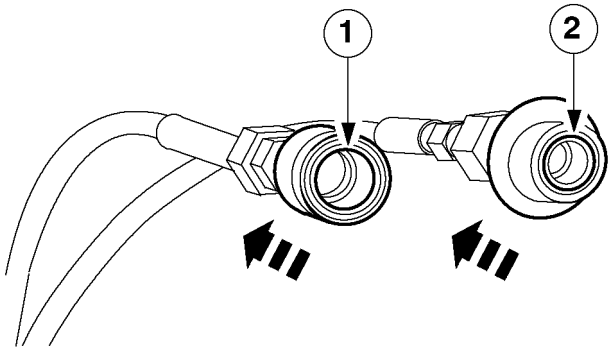
1. **WARNING: Observe "Health and Safety Rules". For additional information, refer to Section 100-00.**

CAUTION: The refrigerant detector must be used before evacuation; otherwise, the service unit may become contaminated. Contaminated refrigerant must be disposed of as hazardous waste. Always follow the manufacturer instructions when using the service units.

Remove the protective caps of the filler valves and connect the service unit leads to the filler valves.

- Pull back the lock on the quick-release connector.

1. Larger inside diameter for high-pressure side.
2. Smaller inside diameter for low-pressure side.



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2. **WARNING: Avoid releasing the refrigerant into the atmosphere at all costs.**

Drain the air conditioning system through the low-pressure port in accordance with the service unit manufacturer instructions.

3. **NOTE:** The air conditioning system has to be evacuated for approximately 30 minutes in order to make sure that the system will work perfectly again once refilled.

NOTE: If moisture has entered the open system over an extended period of time (several hours), install a new accumulator/dryer and extend the evacuation time to 2-3 hours.

Evacuate the air conditioning system in accordance with the service unit manufacturer instructions.

4. **NOTE:** If an air conditioning system is evacuated before the refrigerant has been drained, some of the refrigerant will remain in the compressor refrigerant oil. This remaining refrigerant may evaporate, causing a slight increase (maximum two marks) in the reading on the pressure gauge during the leak test. This increase in pressure does not mean the air conditioning system is leaking.

Carry out a leak test.

- To test for leaks, close the hand valves on the pressure gauge head, switch off the service unit vacuum pump and observe the low-pressure gauge.
- If the reading increases by more than 20 mbar (2 kPa, 0.29 psi), this means that the system is leaking.
- If the air conditioning system is leaking, fill it with approximately 300 g refrigerant and check using a leakage detector. For additional information, refer to Leak test in this section.

CAUTION: Always evacuate the air conditioning system before filling it.

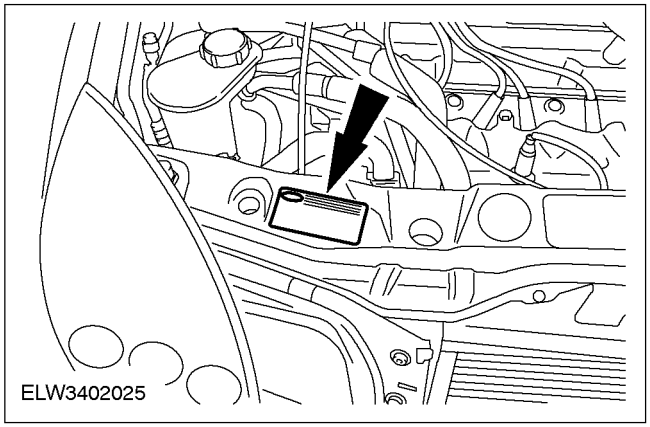
NOTE: Depending on the service unit and equipment (with or without heatable filler cylinder), the air conditioning system can be filled in liquid form through the high-pressure port or in gaseous form through the low-pressure port.

NOTE: Fill quantity indicated on sticker in engine compartment.

GENERAL PROCEDURES (Continued)

5. Filling the air conditioning system through the high-pressure port (liquid fill).

- Open the high-pressure shut-off valve on the pressure gauge head.
- Switch the service unit to "Fill" mode and fill the system with the prescribed quantity of liquid refrigerant (R134a).



6. ⚠ CAUTION: Filling the air conditioning system through the low-pressure port (gas fill only).

Filling the air conditioning system through the low-pressure port.

- Open the low-pressure shut-off valve on the pressure gauge head.
- Switch the service unit to "Fill" mode and fill the system with the prescribed quantity of gaseous refrigerant.
- Top up with the remaining refrigerant whilst the air conditioning is switched on. Let the engine run at about 1200-1500 rpm for this purpose. Switch the air conditioning to maximum cooling power and fresh air mode. Set the blower to maximum power. Allow the remainder of the prescribed amount to be drawn in.

7. NOTE: Do not detach the high-pressure hose whilst the air conditioning is switched on.

Disconnect the service unit.

- Close the shut-off valves.
- Switch off the service unit.
- Disconnect the refrigerant hoses from the air conditioning system.
- Screw the protective caps onto the filler valves.

GENERAL PROCEDURES

Refrigerant Oil Adding (34 621 1)

CAUTION: Store the refrigerant oil in a closed, sealed container to prevent the ingress of moisture.

NOTE: Collect the refrigerant oil in a clean measuring cylinder when replacing the A/C compressor, the dehydrator or refrigerant lines.

1. **NOTE:** This step only needs to be carried out when removing the A/C compressor.

   Drain the refrigerant oil from the A/C compressor.

   - Rotate the compressor shaft at least 6 to 8 turns when draining the refrigerant oil.

2. **NOTE:** This step only needs to be carried out when removing the dehydrator.

   Drain the refrigerant oil from the dehydrator.

3. **NOTE:** This step only needs to be carried out when removing refrigerant lines.

   Drain the refrigerant oil from the refrigerant lines.

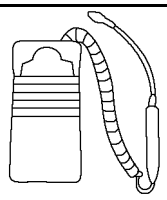
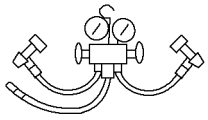
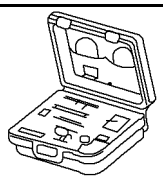
4. **NOTE:** If more than one air conditioning system component is being renewed, the oil quantity to be added is the sum of each individual quantity.

NOTE: In addition, add the same quantity of new refrigerant oil as was collected in the oil separator of the servicing unit when the air conditioning was drained.

Add the calculated quantity of new refrigerant oil. For additional information, refer to General Specifications in this section.

GENERAL PROCEDURES

Electronic Leak Detection (34 620 7)

Special Tool(s)	
 ST1245–A	Automatic Calibration Halogen Leak Detector or equivalent
 ST1460–A	R-134a Manifold Gauge Set or equivalent
 ST1457–A	Refrigerant identifier or equivalent

WARNING: Good ventilation before leak detection is necessary in the area where it is to be performed. If the surrounding air is contaminated with refrigerant gas, the leak detector will indicate this gas all the time. Odors from other chemicals such as antifreeze, diesel fuel, disc brake cleaner, or other cleaning solvents can cause the same problem. While leak detection air movement must be prevented.

1. **CAUTION: The refrigerant identification equipment must be used before the manifold gauge set is installed, otherwise the manifold gauge may become contaminated. Contaminated refrigerant must be disposed of as special waste. The manufacturer's instructions must be followed when working with the service unit.**

NOTE: Both manifold gauges should indicate 4,1-5,5 bar at 24°C with the engine off.

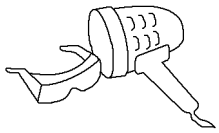
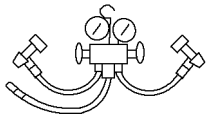
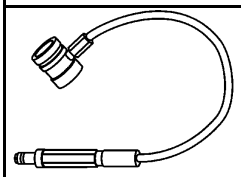
Attach the manifold gauge set to the service gauge port valves.

1. For the leak test, close the manual valves on the gauge set.
2. If little or no pressure is indicated, charge the system with approx. 300g of refrigerant.

2. **Use R-134a Automatic Calibration Halogen Leak Detector to leak test the refrigerant system. Follow the instructions included with leak detector for handling and operation techniques.**
3. **If a leak is found, recover the A/C system.**

GENERAL PROCEDURES

Flourescent Dye Leak Detection

Special Tool(s)	
 ST1261–A	120 Watt UV Spot Lamp or equivalent
 ST1460–A	R-134a Manifold Gauge Set or equivalent
 ST1705-B	R-134a Fluorescent Dye Injector

NOTE: Vehicles built 07/1999 onwards have a fluorescent tracer dye tablet inserted into the air conditioning (A/C) system. If tracer dye is present, there is a green cross on the suction accumulator.

NOTE: On vehicles built up to 07/1999 tracer dye must be added.

1. **Using the dye injector, add 7.4 ml of Fluorescent Tracer Dye.**

NOTE: Some vehicles may have signs of refrigerant oil at the spring lock couplers. This may be caused from the assembly process which applies to the fittings before installation to aid in assembly. When a spring lock coupler is suspected of leaking, always wipe the fitting clean and verify the leak with R-134a Automatic Calibration Halogen Leak Detector.

NOTE: The exact location of leaks can be pinpointed by the bright yellow - green glow of the tracer dye. Since more than one leak may exist, always inspect each component.

2. **Check for leaks using a 120 Watt UV Spot Lamp. Always scan all components, fittings and lines of the A/C system.**
3. **After the leak is found and repaired, remove any traces of dye with a general purpose oil solvent.**
4. **Verify the repair by operating the system for some minutes and inspecting with the UV lamp again.**

GENERAL PROCEDURES

Vacuum Leak Detection (34 620 3)

1. Drain the air conditioning (A/C) system.

GENERAL PROCEDURES

Contaminated Refrigerant Handling (34 620 9)

⚠CAUTION: Any R134a or R12 refrigerant which is contaminated with unsuitable refrigerant should be extracted only by means of a suitable servicing unit designed for the purpose of collecting and storing contaminated refrigerant, so that the spread to other vehicles can be prevented.

1. **Use refrigerant identification equipment to check that there is contaminated refrigerant in the air conditioning system.**
2. **Inform the customer about the additional cost to repairing the system caused by the contamination.**
3. **Extract the contaminated refrigerant.**

SECTION 412-01 Air Distribution and Filtering

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

DESCRIPTION AND OPERATION

Air Distribution and Filtering..... 412-01-2

DIAGNOSIS AND TESTING

Air Distribution and Filtering..... 412-01-3

REMOVAL AND INSTALLATION

Pollen Filter ..... (34 350 0) 412-01-4

DESCRIPTION AND OPERATION

Air Distribution and Filtering

The purpose of the air distribution system is to route air to the designated registers. This is accomplished when air enters the plenum through the fresh air inlet and is routed to the selected outlets by use of distribution doors.

The incoming fresh air is passed through a pollen filter which is standard and is located under the air cowl trim panel on the front passengers side. There are two different filter elements available:

- The standard pollen filter is capable of removing all airborne particles larger than three microns in size and cleans the air of pollen, dusts and diesel soot.
- The activated carbon combination filter is optional and has the same advantages as the pollen filter plus an effective active carbon layer, which neutralizes unpleasant adours and keeps the air free of ozone.

Air ducts route air to specific areas of the air distribution system. These areas are the floor ducts, panel registers, side window demisters and defrost nozzles.

The instrument panel registers are adjustable and used to aim the discharged air to a required area. The floor ducts, side window demisters and defrost nozzles are nonadjustable.

DIAGNOSIS AND TESTING

Air Distribution and Filtering

REFER to Section 412-00.

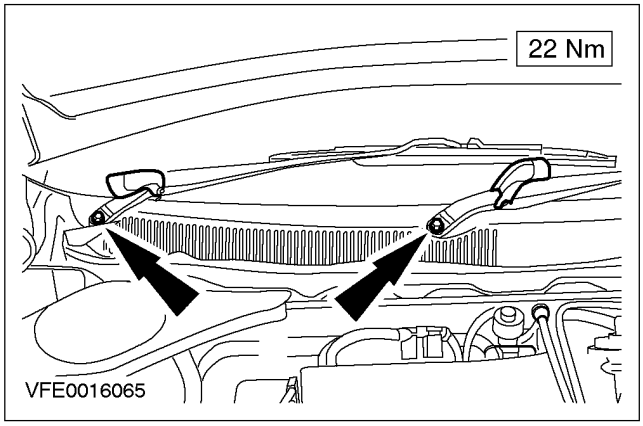
REMOVAL AND INSTALLATION

Pollen Filter (34 350 0)

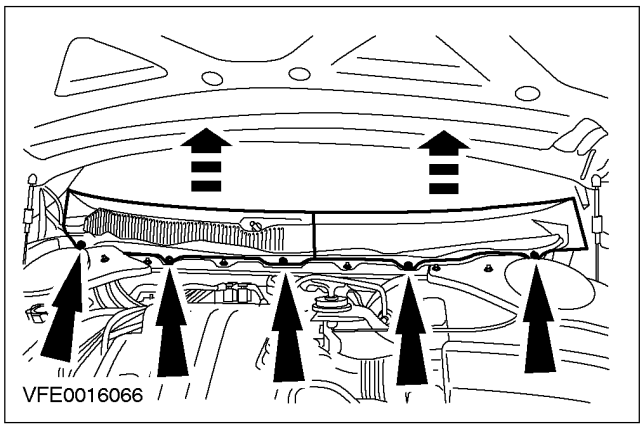
Removal

1. **NOTE:** Make sure that the windshield wiper motor is in the park position.

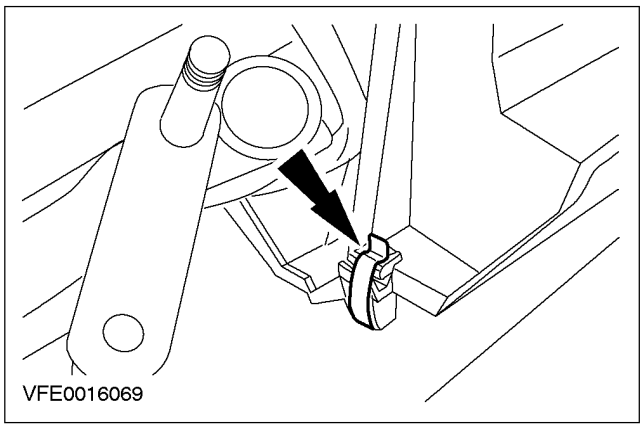
   Remove the windshield wiper arms.



2. **Remove the cowl panels.**
   - Pull the cowl panels out of the retaining groove.



3. **Remove the pollen filter housing cover.**
   - Detach the retaining straps on both sides.



4. **Remove the pollen filter.**

Installation

1. **To install, reverse the removal procedure.**

SECTION 412-02A Heating and Ventilation

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

SPECIFICATIONS

Specifications 412-02-2

DESCRIPTION AND OPERATION

Heating and Ventilation..... 412-02-3
Heater Core Housing..... 412-02-3

DIAGNOSIS AND TESTING

Heating and Ventilation..... 412-02-4

REMOVAL AND INSTALLATION

Blower Motor ..... (34 374 0) 412-02-5
Heater Core and Evaporator Core Housing 412-02-7
Heater Core..... (34 364 0) 412-02-12

DISASSEMBLY AND ASSEMBLY

Heater Core and Evaporator Core Housing 412-02-14

SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
In-vehicle crossbeam retaining bolts	20	15	-

DESCRIPTION AND OPERATION

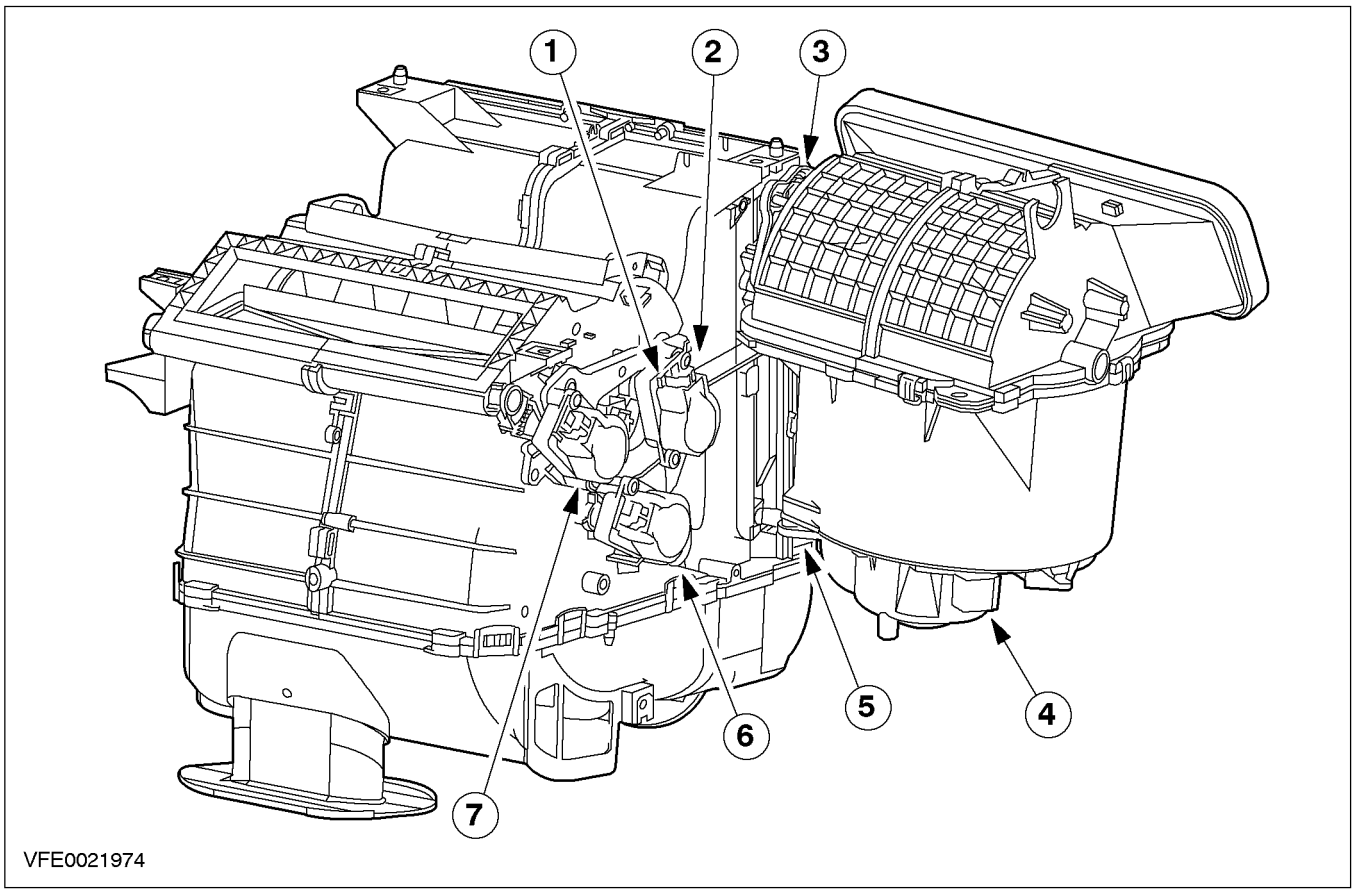
Heating and Ventilation

The heating and ventilation system is a blended air system and consists of a heater core, a blower motor, distribution doors and an evaporator core on vehicles equipped with air conditioning (A/C).

Air is directed through the heater core for heating and around for cooling, mixed and discharged through outlets in the plenum assembly to the floor, instrument panel or defrost nozzles, as required. For additional information, refer to Section 412-01.

Heater Core Housing

In the heater core housing, all blend doors are actuated electronically by means of control motors.



Item	Description
1	Defrost vent blend door actuator
2	Outlet air temperature sensor
3	Air inlet blend door actuator
4	Blower motor
5	Blower motor resistor
6	Temperature blend door actuator
7	Center vent/footwell vent blend door actuator

DIAGNOSIS AND TESTING

Heating and Ventilation

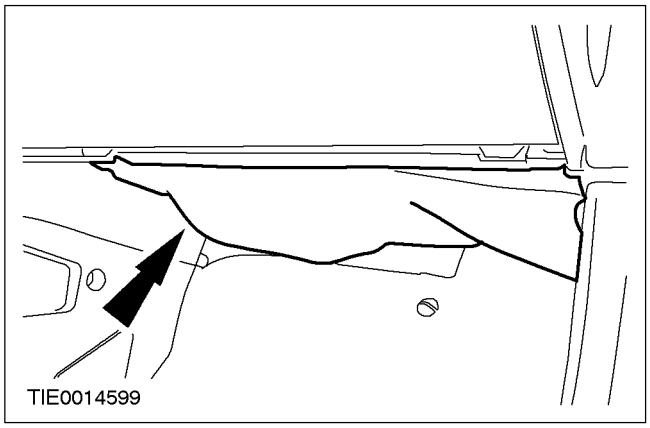
REFER to Section 412-00.

REMOVAL AND INSTALLATION

Blower Motor (34 374 0)

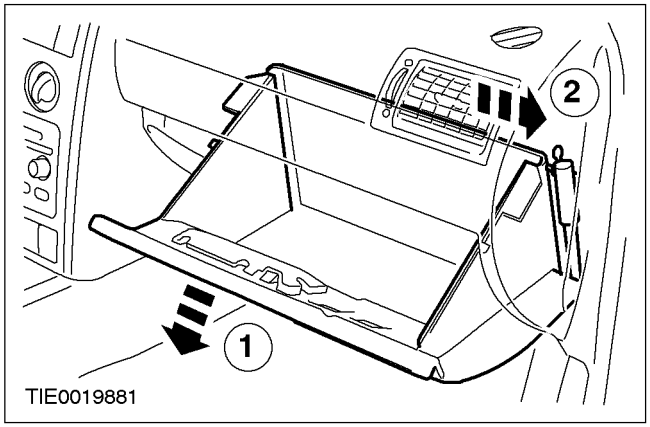
Removal

1. Remove the footwell lower trim panel (five clips).



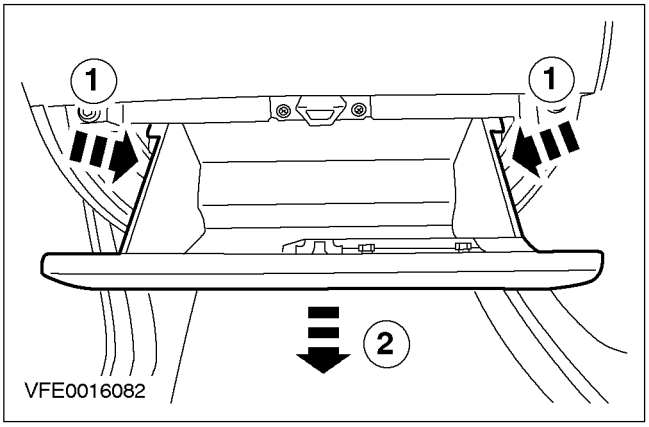
2. Detach the damper from the glove compartment.

1. Open the glove compartment to access the damper.
2. Push the top of the damper away from the glove compartment.

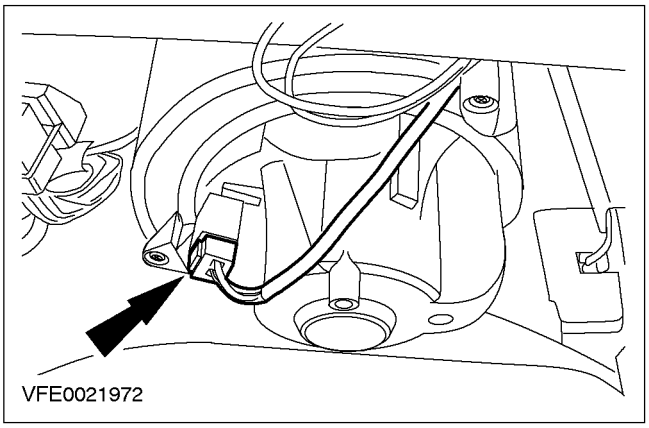


3. Remove the glove compartment.

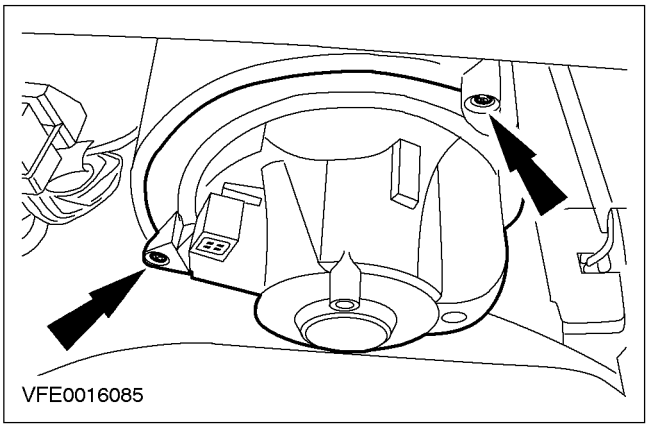
1. Press the sides towards the center to release the glove compartment.
2. Pull the glove compartment out of the hinges.



4. Disconnect the blower motor electrical connector.



5. Remove the blower motor.



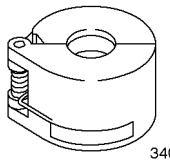
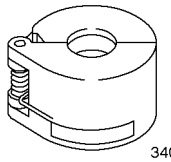
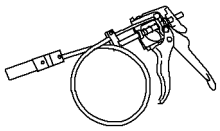
REMOVAL AND INSTALLATION (Continued)

Installation

1. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

Heater Core and Evaporator Core Housing

Special Tool(s)	
 34001	Disconnect Tool, Spring Lock Coupling 1/2 inch (blue) 412-027 (34-001)
 34003	Disconnect Tool, Spring Lock Coupling 5/8 inch (black) 412-081 (34-003)
 24003	Remover/Installer, Cooling Hose Clamp 303-397 (24-003)

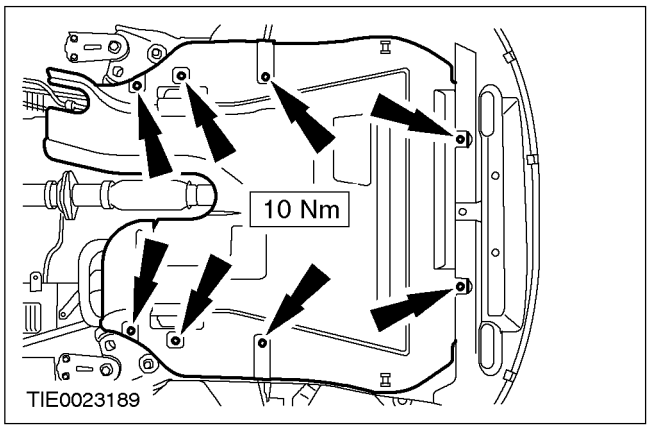
Removal

All vehicles

1. **Drain the cooling system. For additional information, refer to Section 303-03.**
2. **Drain the air conditioning system. For additional information, refer to Section 412-00.**
3. **Raise and support the vehicle. For additional information, refer to Section 100-02.**

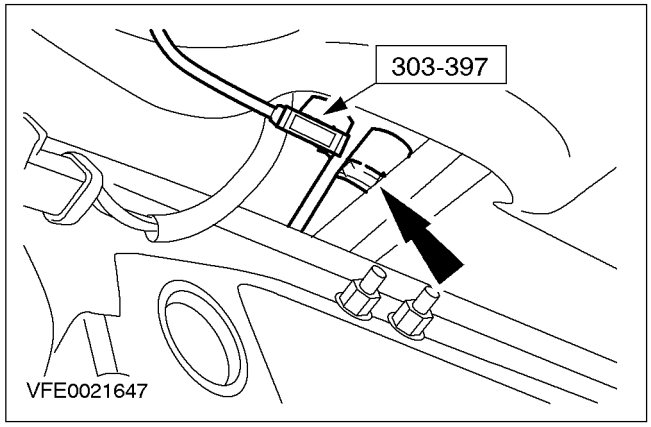
Vehicles with diesel engine

4. **Remove the engine undershield.**

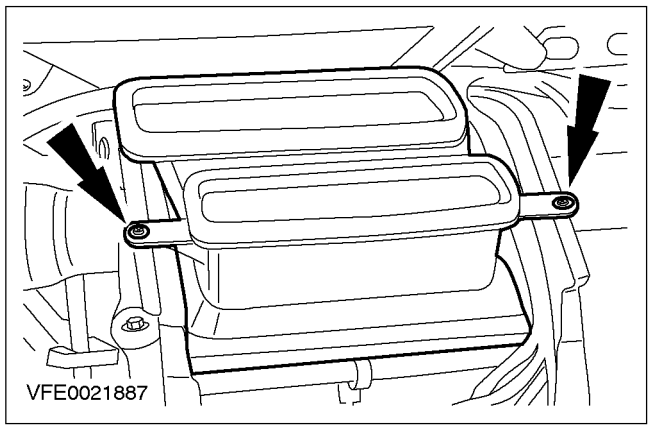


All vehicles

5. **Using the special tool, disconnect the coolant hoses from the heater core.**
   - Disconnect the water drain hose from the water drain channel.

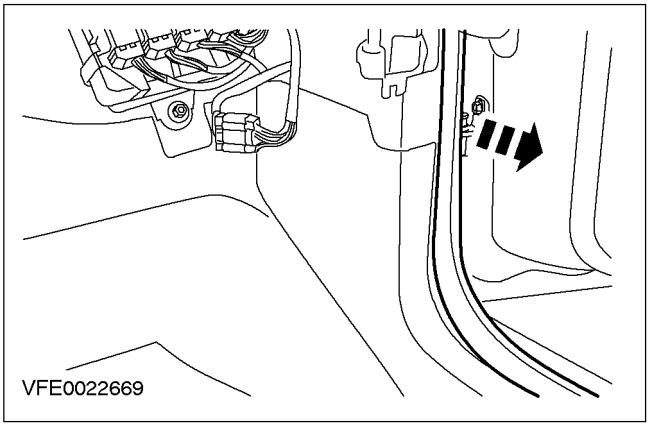


6. **Lower the vehicle.**
7. **Remove the instrument panel. For additional information, refer to Section 501-12.**
8. **Remove the duct.**

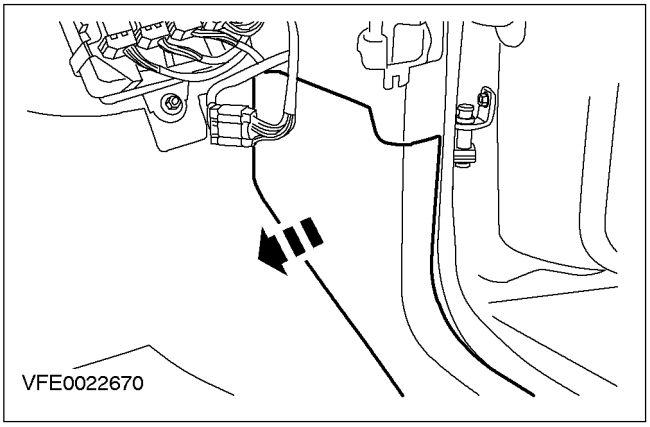


REMOVAL AND INSTALLATION (Continued)

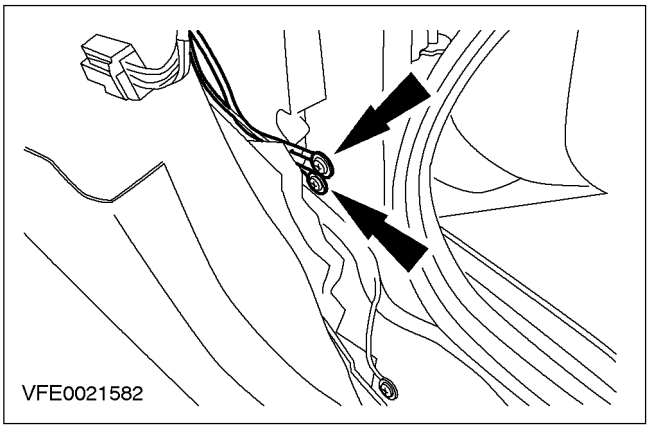
9. Detach the right-hand door opening weatherstrip from the A-pillar.



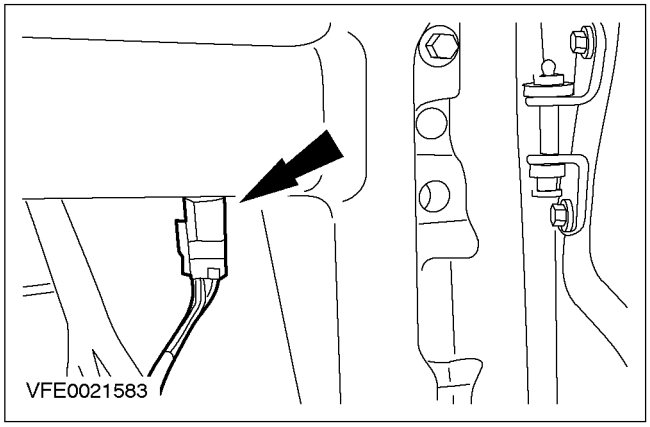
10. Remove the right-hand cowl side trim panel.



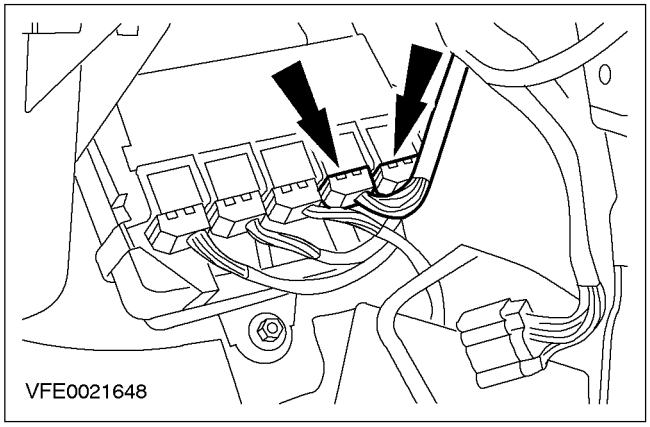
11. Remove the ground connection retaining bolts.



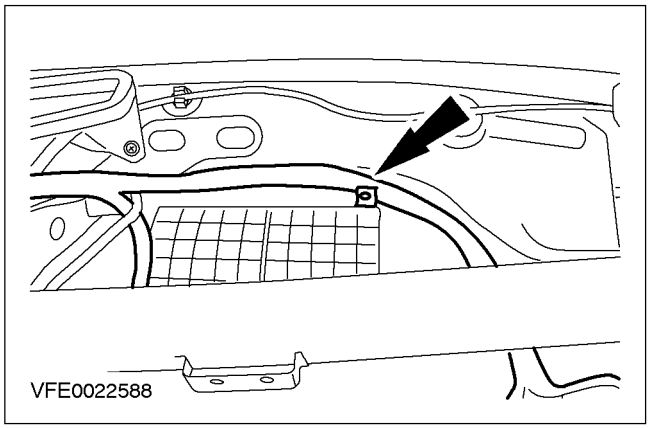
12. Disconnect the main body electrical connector.



13. Disconnect the generic electronic module (GEM) electrical connectors.

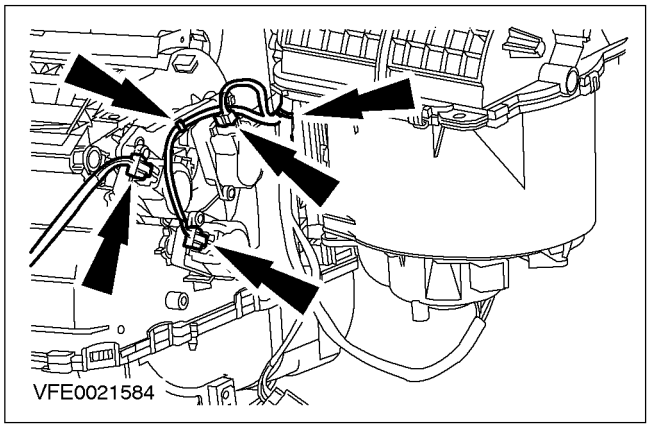


14. Detach the wiring harness from the heater core and evaporator core housing.

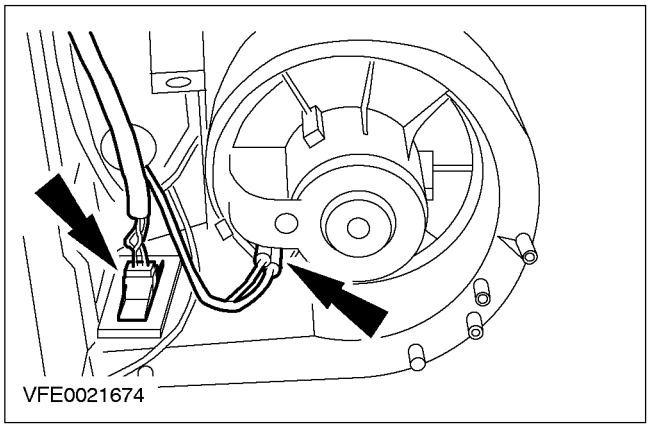


REMOVAL AND INSTALLATION (Continued)

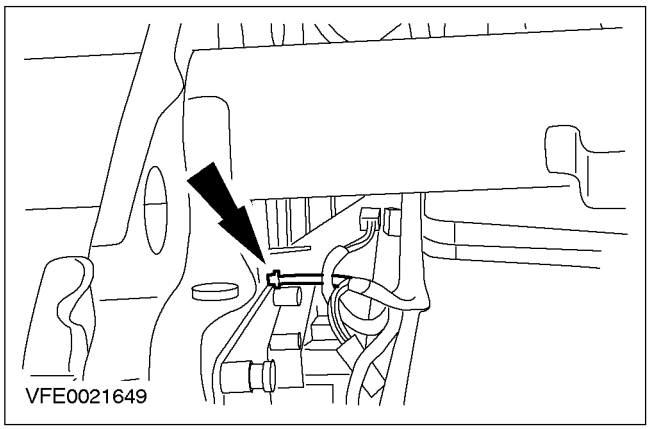
15. **Disconnect the vent actuators electrical connectors.**
    - Unclip the wiring harness.



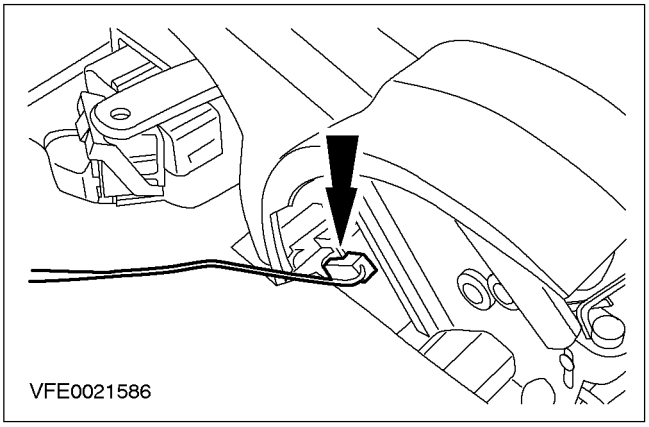
16. **Disconnect the blower motor and blower motor resistor electrical connectors.**



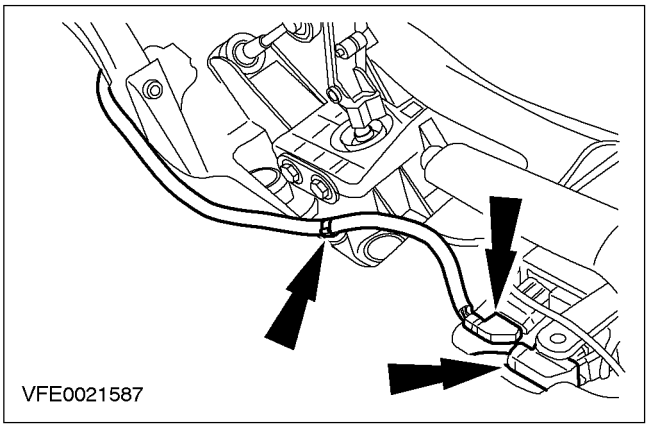
17. **Disconnect the temperature sensor electrical connector.**



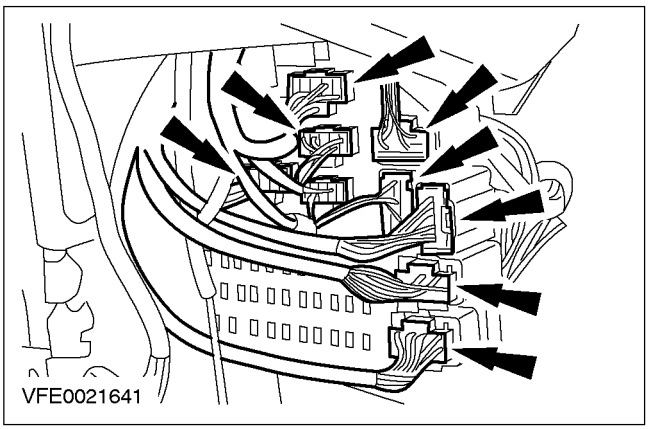
18. **Disconnect the parking brake warning light switch electrical connector.**



19. **Disconnect the adaptive restraint module electrical connectors.**
    - Unclip the wiring harness.

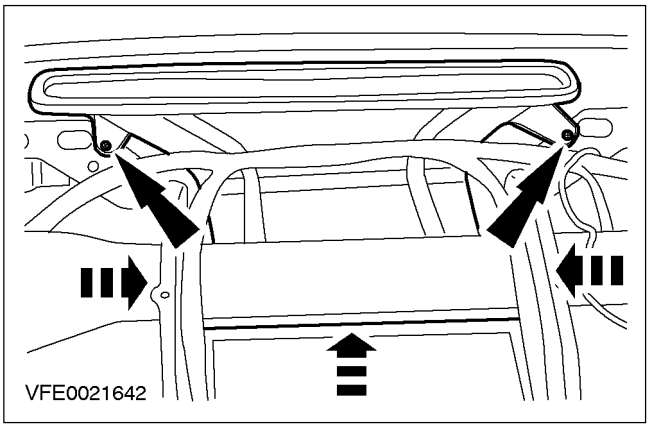


20. **Disconnect the central junction box (CJB) electrical connectors.**



REMOVAL AND INSTALLATION (Continued)

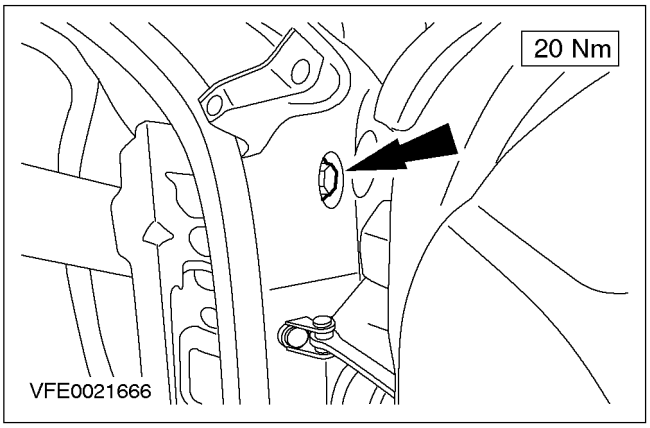
21. Remove the windshield air duct.



Vehicles built up to 05/2001

22. Remove the in-vehicle crossbeam retaining bolts (right-hand side shown).

- Remove the blanking caps.

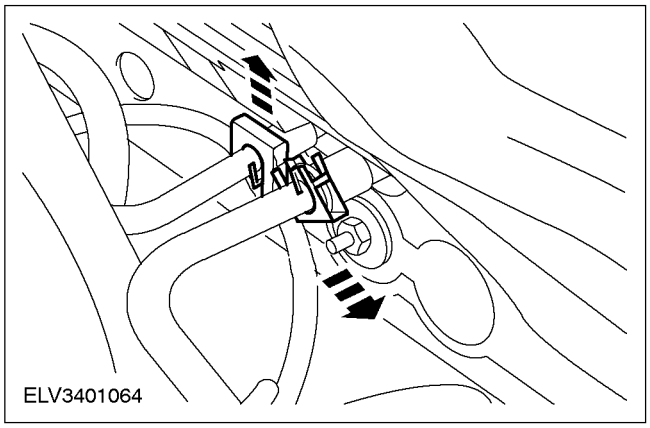


Vehicles with 2.5L engine

23. Remove the ignition coil. For additional information, refer to Section 303-07A / 303-07B.

All vehicles

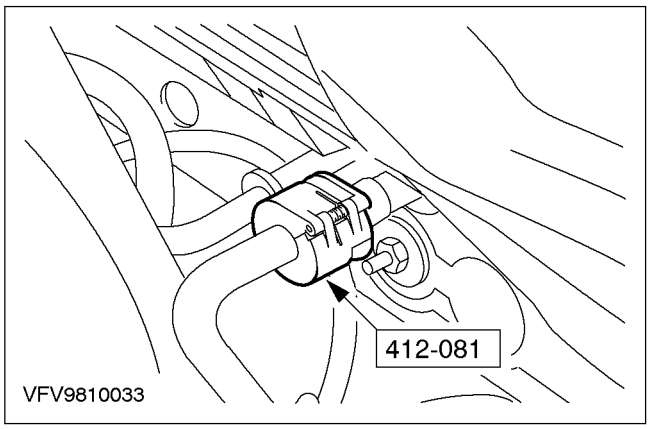
24. Remove the refrigerant line spring lock coupling locking clips.



CAUTION: Cap the refrigerant lines and the evaporator core to prevent dirt ingress.

25. Using the special tool, disconnect the left-hand refrigerant line from the evaporator core.

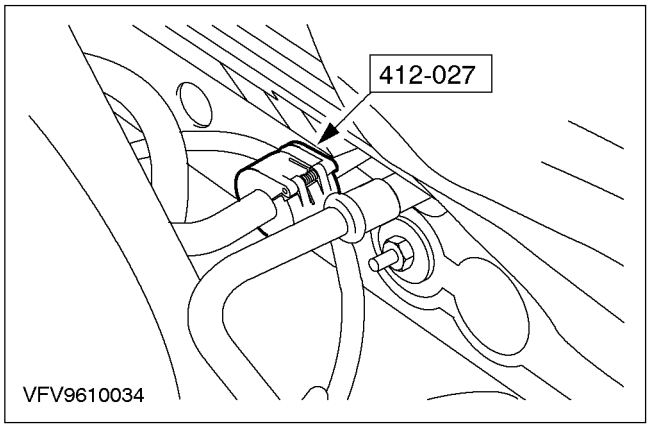
- Discard the O-ring seals.



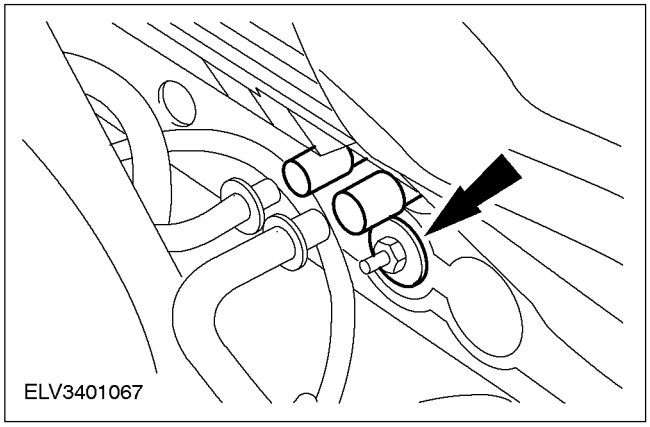
REMOVAL AND INSTALLATION (Continued)

26. Using the special tool, disconnect the right-hand refrigerant line from the evaporator core.

- Discard the O-ring seals.

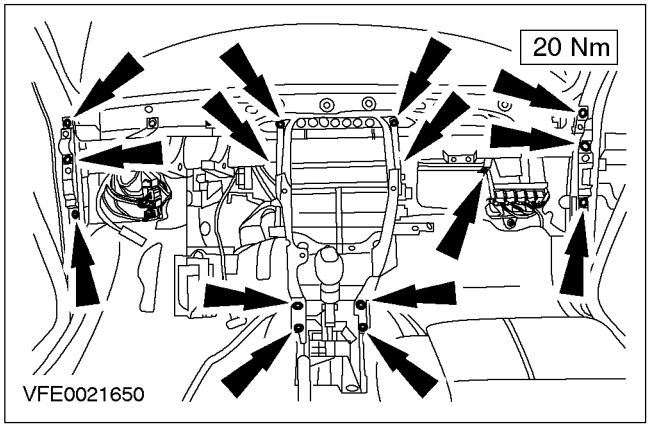


27. Remove the heater core and evaporator core housing retaining nut.

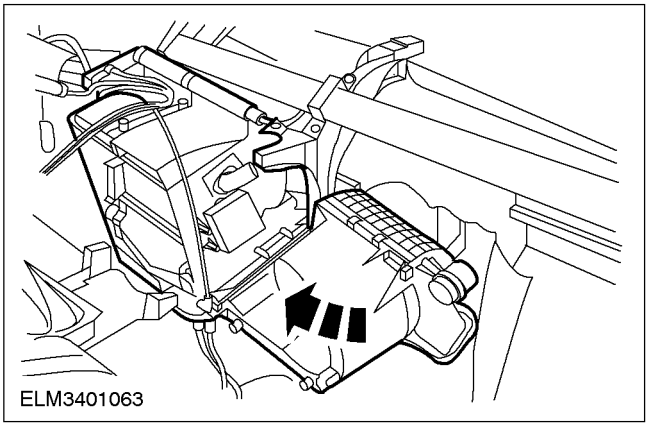


28. Remove the in-vehicle crossbeam.

- Unclip the wiring harness.



29. Remove the heater core and evaporator core housing.



Installation

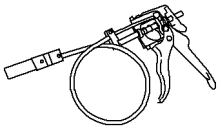
1. NOTE: Install new refrigerant line O-ring seals.

NOTE: Lubricate the refrigerant line O-ring seals with clean refrigerant oil before installation.

To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

Heater Core (34 364 0)

Special Tool(s)	
 24003	Remover/Installer, Coolant Hose Clamp 303-397 (24-003)

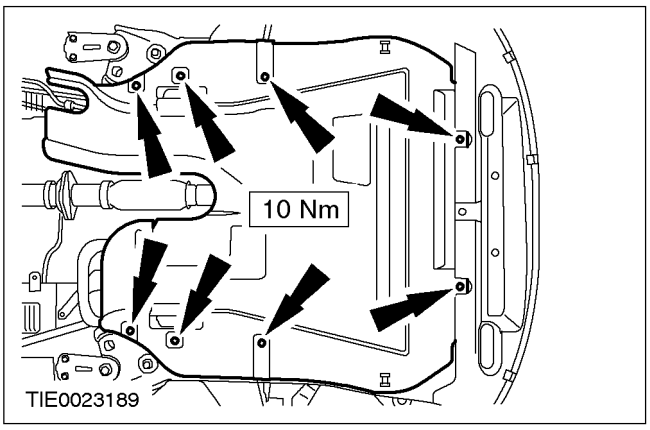
Removal

All vehicles

1. **Drain the cooling system.For additional information, refer to Section 303-03.**
2. **Raise the vehicle.For additional information, refer to Section 100-02.**

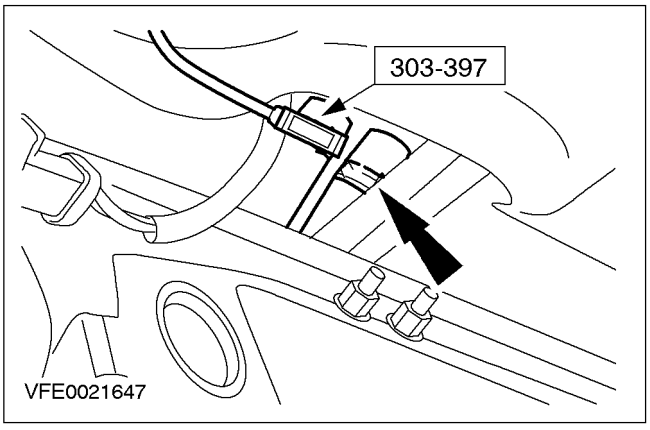
Vehicles with diesel engine

3. **Detach engine undershield.**

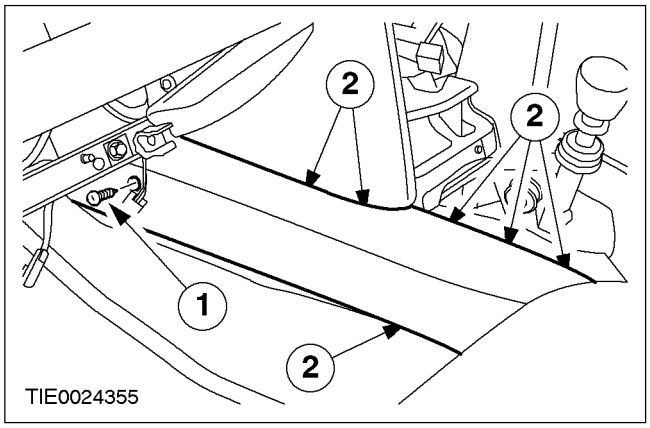


All vehicles

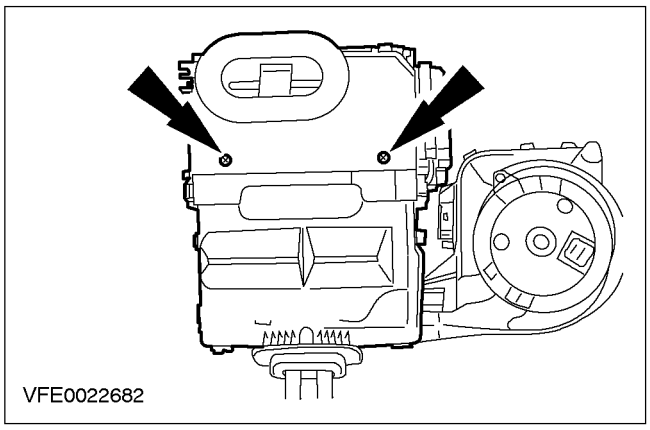
4. **Using the special tool, detach the coolant hoses from the heater core.**
   - Disconnect the water drain hose from the water drain connection.



5. **Lower the vehicle.**
6. **Remove the right and left-hand centre console side trim panel (left-hand side shown).**
   1. Remove the bolt.
   2. Release the clips and remove the centre console side trim panel.



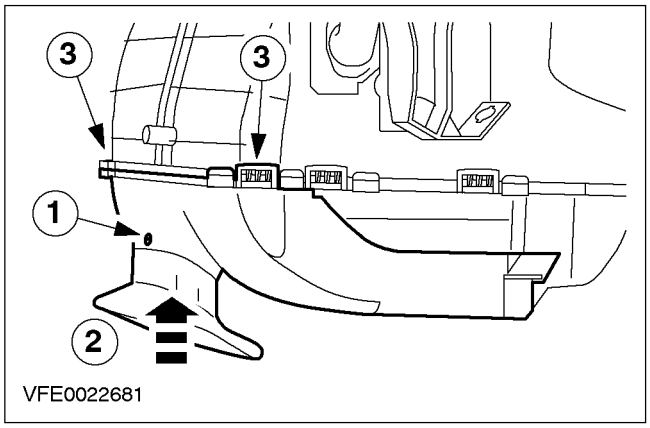
7. **Disconnect the rear footwell air guide from the heater core housing (shown with heater core / evaporator housing removed for clarity).**



REMOVAL AND INSTALLATION (Continued)

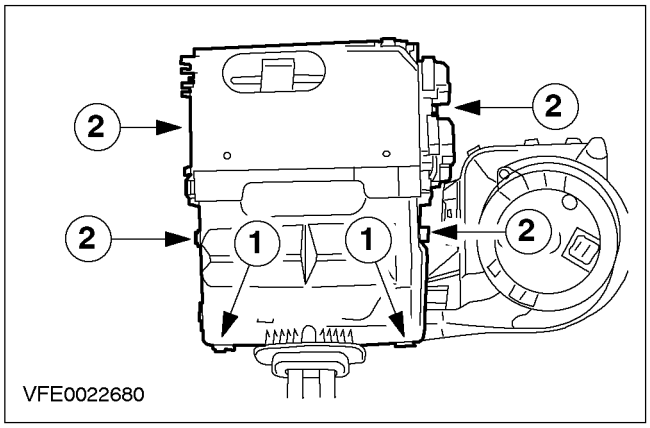
8. Remove the rear footwell air guide.

1. Remove the air guide screw.
2. Push the air guide upwards.
3. Release the retainers.

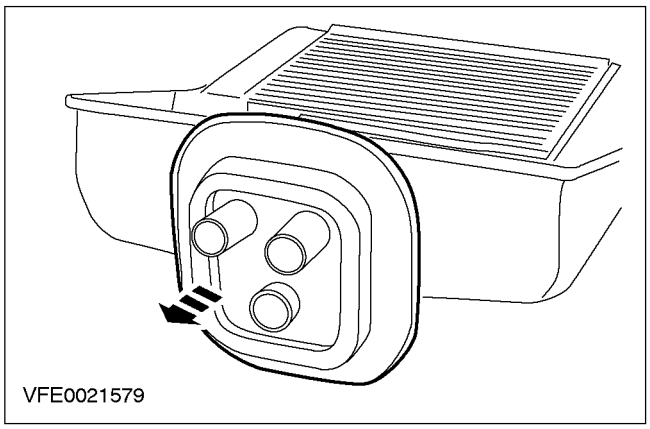


9. Remove the heater core housing (shown with heater core and evaporator housing removed for clarity).

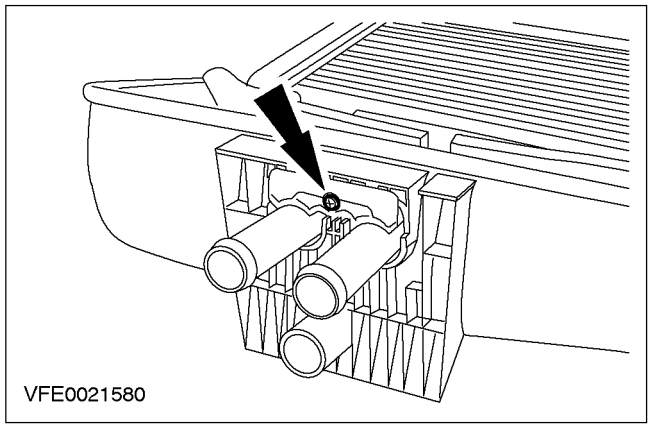
1. Remove the clips.
2. Release the retainers.



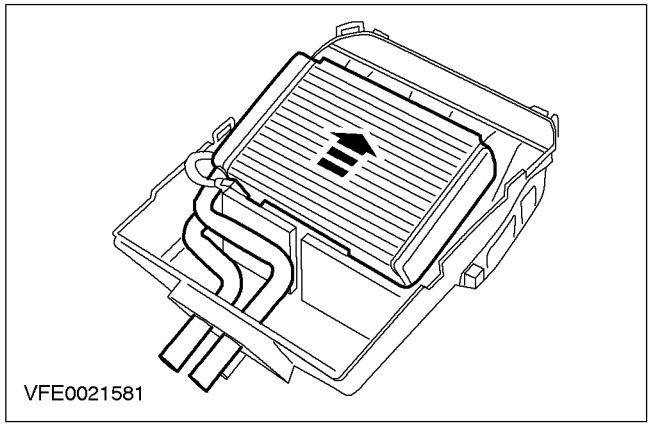
10. Remove the rubber seal.



11. Remove the heater core screw.



12. Remove the heater core.



Installation

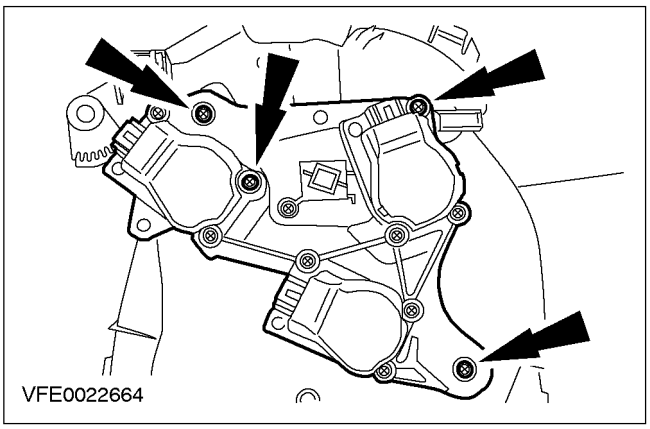
1. Install the components in the reverse order.

DISASSEMBLY AND ASSEMBLY

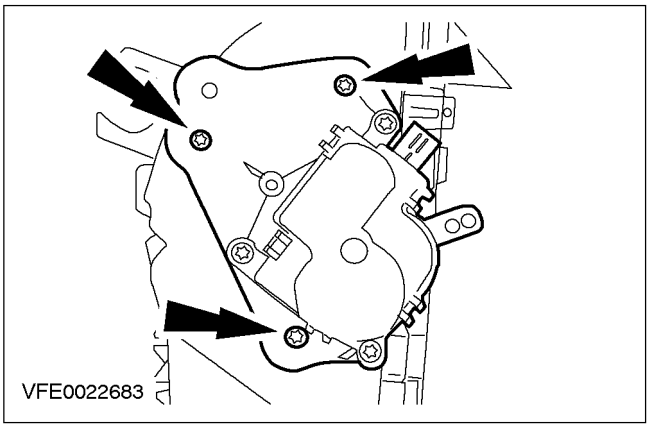
Heater Core and Evaporator Core Housing

Disassembly

1. Remove the blend door actuator assembly.

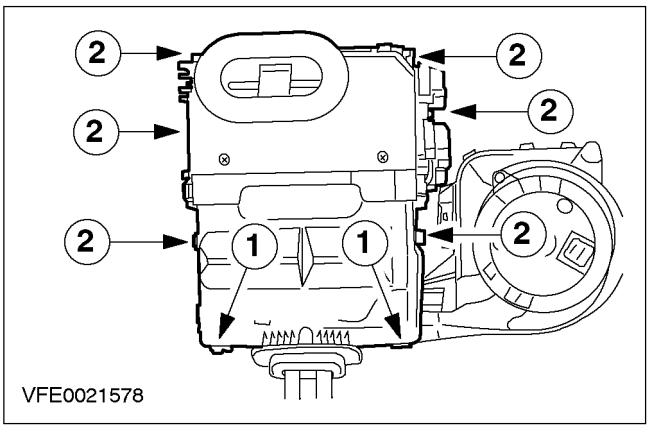


2. Remove the air inlet blend door actuator.

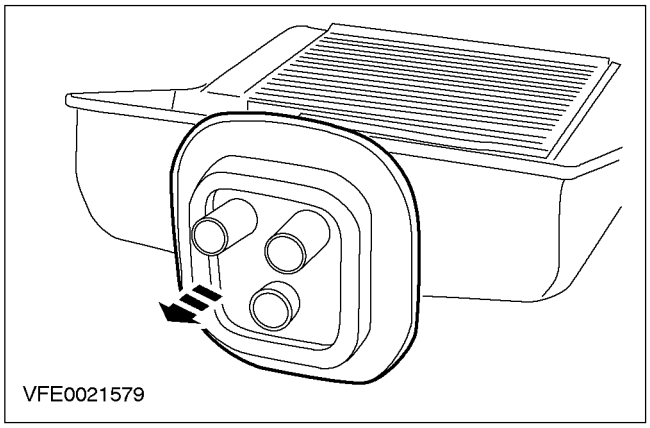


3. Remove the heater core housing.

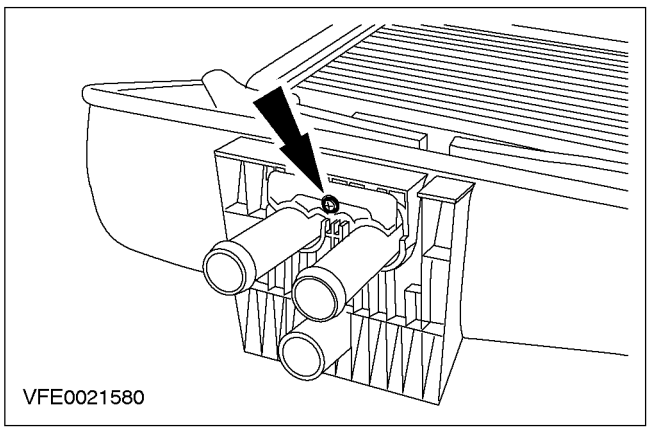
1. Remove the retaining clips.
2. Release the retaining tabs.



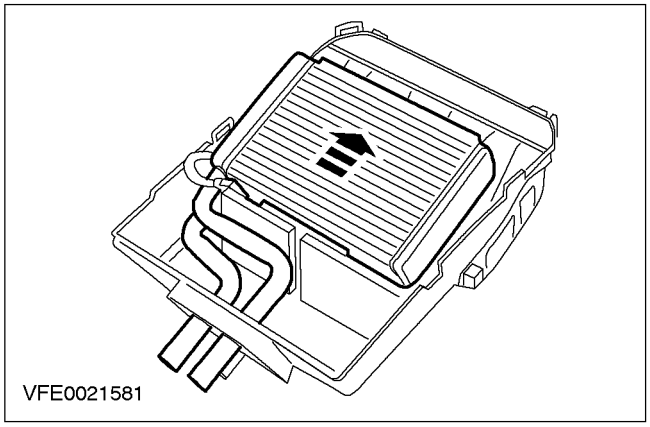
4. Remove the rubber seal.



5. Remove the heater core retaining bolt.

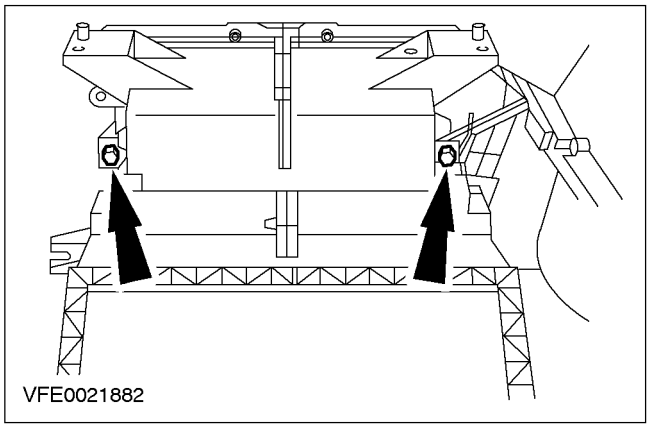


6. Remove the heater core.

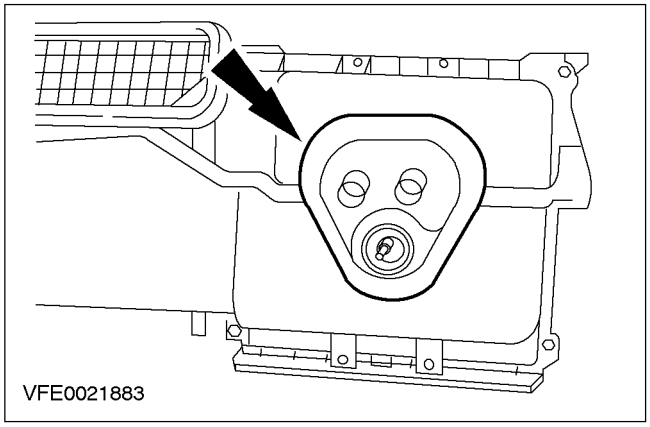


DISASSEMBLY AND ASSEMBLY (Continued)

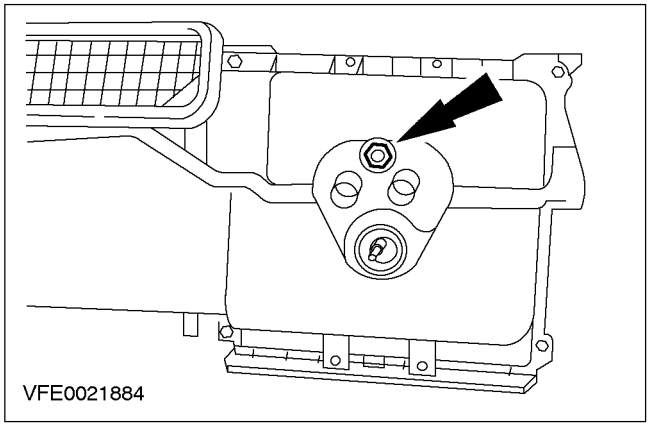
7. Detach the evaporator core upper housing.



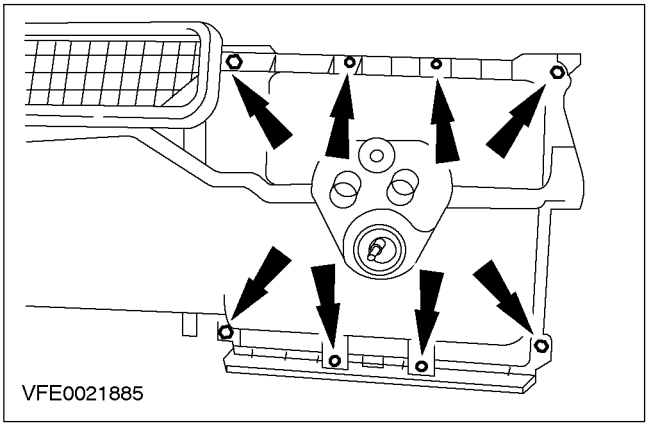
8. Remove the rubber seal.



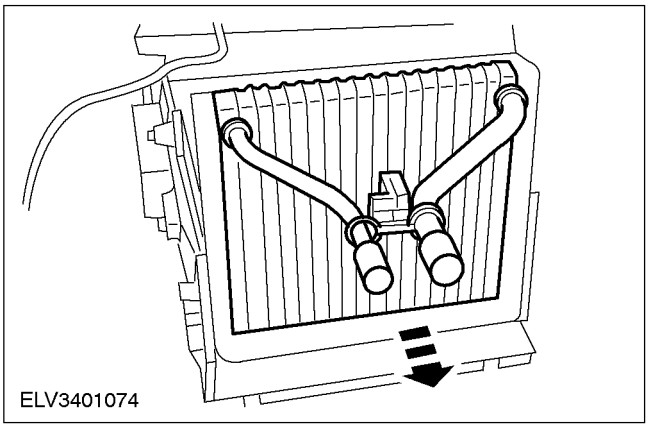
9. Remove the evaporator core retaining bolt.



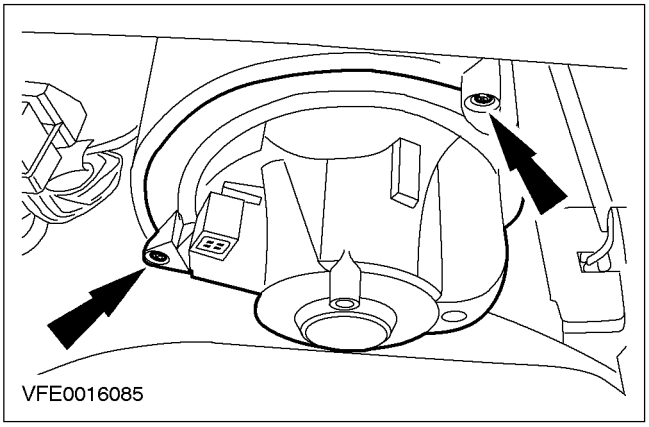
10. Remove the evaporator core uppper housing.



11. Remove the evaporator core.

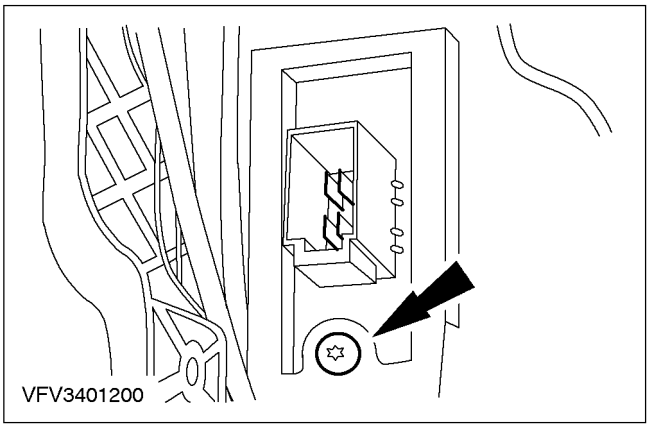


12. Remove the blower motor.



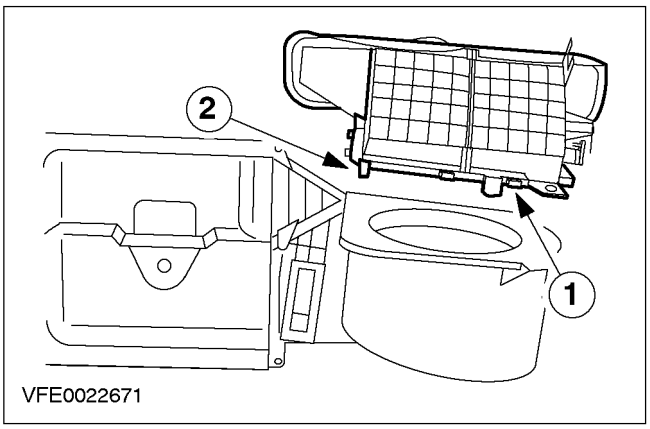
DISASSEMBLY AND ASSEMBLY (Continued)

13. Remove the blower motor resistor.



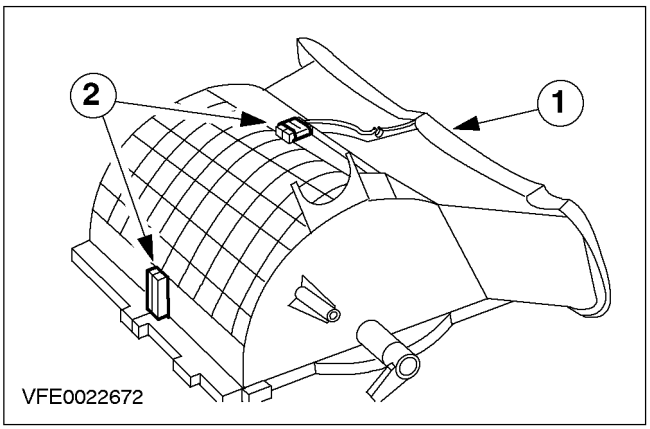
14. Remove the blower motor upper housing.

1. Remove the two retaining clips.
2. Release the eight retaining tabs.



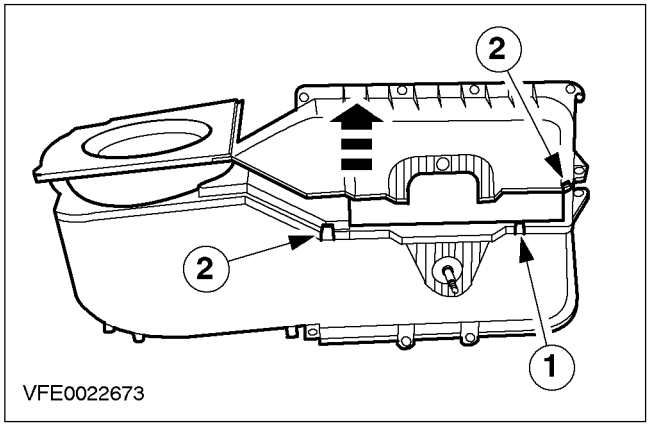
15. Separate the blower motor upper housing.

1. Remove the gasket.
2. Release the retaining tabs.



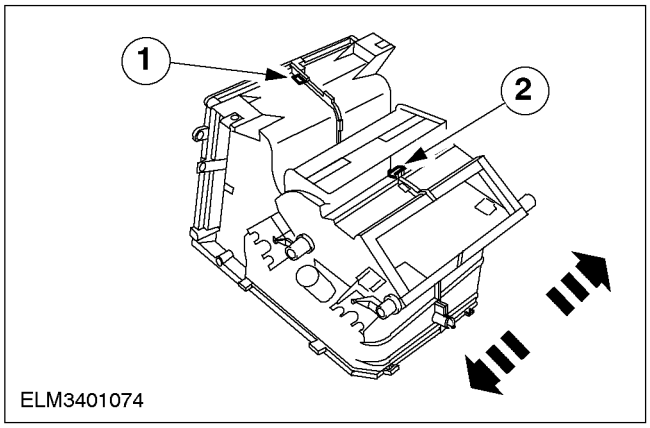
16. Separate the evaporator core housing.

1. Remove the retaining clip.
2. Release the retaining tabs.



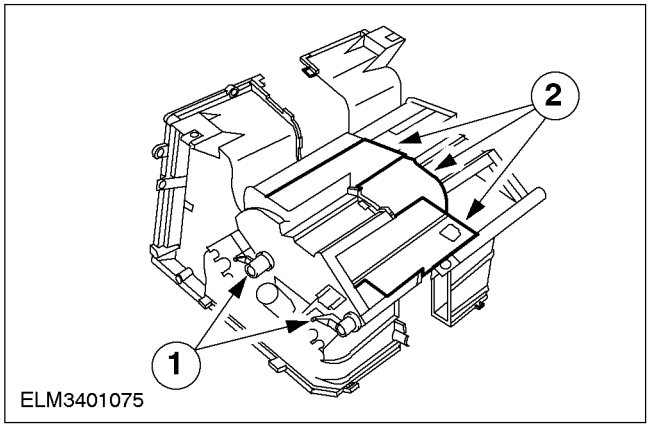
17. Separate the heater core and evaporator core housing.

1. Pull off the retaining clip.
2. Release the five retaining tabs.



18. Remove the blend doors.

1. Pull out the three blend doors.
2. Pull out the three blend door shafts.



DISASSEMBLY AND ASSEMBLY (Continued)

Assembly

1. **To assemble, reverse the disassemble procedure.**

SECTION 412-02B Auxiliary Heating

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

SPECIFICATIONS

Specifications 412-02-2

DESCRIPTION AND OPERATION

Electric Booster Heater 412-02-3

DIAGNOSIS AND TESTING

Electric Booster Heater 412-02-4
Inspection and Verification 412-02-4
Symptom chart 412-02-4
Pinpoint Test 412-02-4
Component Tests 412-02-14

SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Engine undershield retaining bolts	10	–	89
Booster heater exhaust pipe retaining bolts	10	–	89
Booster heater bracket retaining nuts	7	–	62
Booster heater retaining bolts	10	–	68
Air intake hose retaining bolt	5	–	44

DESCRIPTION AND OPERATION

Electric Booster Heater

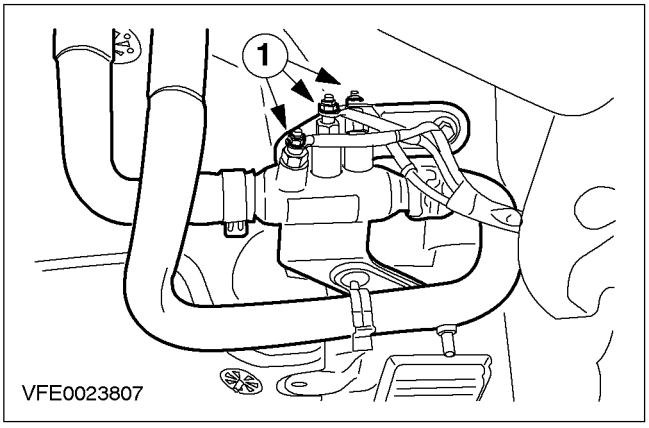
In some markets an electrically powered booster heater is installed to improve the heating output of the highly efficient diesel engines.

The booster heater is switched on by the powertrain control module (PCM) at an intake air temperature of approximately 0°C.

The cooling system is heated with three glow plugs which are actuated by the PCM when the engine is running.

NOTE: Do not change the glow plugs separately to prevent of any coolant leaks.

The glow plugs are located together in a separate housing in the coolant circuit.



The heating output of the glow plugs is 750 W.

Item	Description
1	Glow plugs

DIAGNOSIS AND TESTING

Electric Booster Heater

Refer to Wiring Diagrams Section 412-02B for schematic and connector information.

Inspection and Verification

1. Check customer concern.
2. Visually CHECK for any obvious mechanical or electrical damage.
3. RESOLVE any obvious causes for a concern found during the visual inspection before carrying out any further tests. CHECK operation of system
4. If the concern persists after the visual inspection, use WDS to PERFORM a fault diagnosis of the electronic engine management (PCM) and RESOLVE the fault(s) displayed according to the fault description. CHECK system operates correctly
5. If no fault code is stored, CONTINUE with the Symptom Chart.

Visual inspection

Mechanical	Electrical
• Coolant level • Auxiliary heater mounting	• Fuses • Wiring harness • Connector(s)

Symptom chart

Condition	Possible Sources	Action
•Coolant additional electric heater inoperative / partly inoperative	•Fuse(s) •Circuit(s) •Intake air temperature signal •Relay 1, coolant additional electric heating •Relay 2, coolant additional electric heating •Coolant additional electric heater •Powertrain control module (PCM)	• GO to Pinpoint Test A

Pinpoint Test

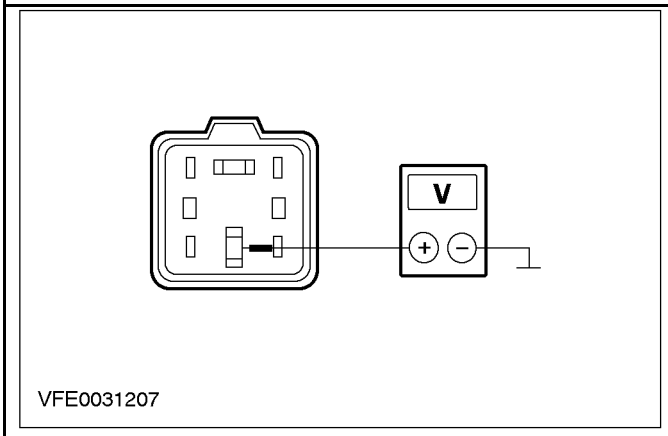
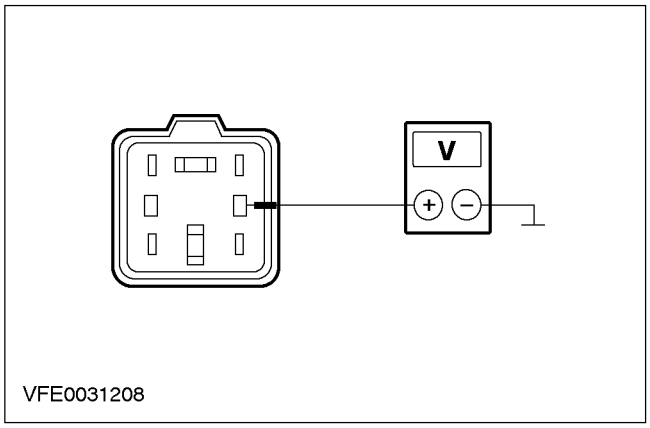
PINPOINT TEST A: COOLANT ADDITIONAL ELECTRIC HEATER INOPERATIVE / PARTLY INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: DETERMINE THE CONDITIONS UNDER WHICH THE FAULT OCCURS	
	1 Check the operation of the coolant additional electric heater. • Are levels 1 and 2 of the coolant additional electric heater inoperative? → **Yes** GO to **A2** → **No** Only level 1 is inoperative: GO to **A10** Only level 2 is inoperative: GO to **A16**
A2: CHECK FUSE F3	
	1 Key in OFF position. 2 CHECK Fuse F3 (BJB).

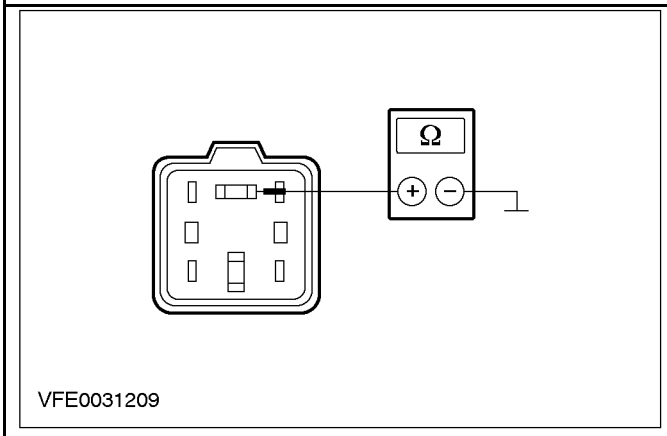
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is fuse OK? → **Yes** GO to **A3** → **No** RENEW fuse F3 (60 A). If the fuse blows again, LOCATE and REPAIR the short to ground using the wiring diagrams. CHECK the system again
A3: TEST VOLTAGE AT FUSE F3	
	1 Connect Fuse F3 (BJB). 2 Test voltage between fuse F3 (60 A) and ground. • Does the meter display battery voltage? → **Yes** GO to **A4** → **No** REPAIR the voltage supply to fuse F3 with the aid of the Wiring Diagrams. CHECK operation of system
A4: CHECK FUSE F82	
	1 CHECK Fuse F82 (CJB). • Is fuse OK? → **Yes** GO to **A5** → **No** RENEW fuse F82 (7.5 A). If the fuse blows again, LOCATE and REPAIR the short to ground using the wiring diagrams. CHECK the system again
A5: TEST VOLTAGE AT FUSE F82	
	1 Connect Fuse F82 (CJB). 2 Key in ON position. 3 Test voltage between fuse F82 (7.5 A) and ground. • Does the meter display battery voltage? → **Yes** GO to **A6** → **No** REPAIR the voltage supply to fuse F82 with the aid of the Wiring Diagrams. CHECK operation of system
A6: CHECK VOLTAGE AT RELAY 1, COOLANT ADDITIONAL ELECTRIC HEATING	
	1 Key in OFF position. 2 Disconnect Relay 1, coolant additional electric heating C125.

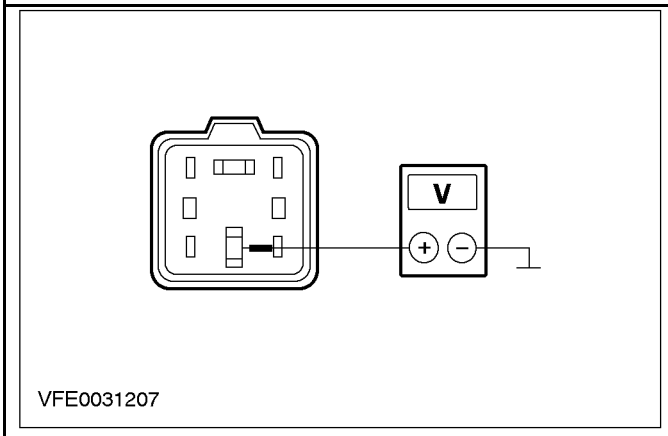
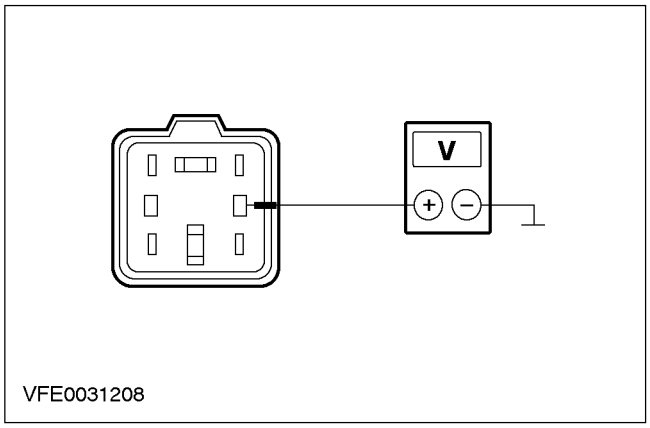
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031207	3 Measure the voltage between relay 1, coolant additional electric heating, connector C125, pin 3, circuit 30-RH24A (RD), wiring harness side and ground. • Does the meter display battery voltage? → **Yes** GO to **A7** → **No** LOCATE and REPAIR the break in the circuit between fuse F3 and splice S361 with the aid of the Wiring Diagrams. CHECK operation of system
A7: CHECK CONTROL VOLTAGE AT RELAY 1, COOLANT ADDITIONAL ELECTRIC HEATING	
 VFE0031208	1 Key in ON position. 2 Measure the voltage between relay 1, coolant additional electric heating, connector C125, pin 1, circuit 15-RH23 (GN/RD), wiring harness side and ground. • Does the meter display battery voltage? → **Yes** GO to **A8** → **No** LOCATE and REPAIR break in circuit between relay 1, coolant additional electric heating or relay 2, coolant additional electric heating and fuse F82 using the wiring diagrams. CHECK operation of system
A8: CHECK THE GROUND CONNECTION OF THE COOLANT ADDITIONAL HEATING	
	1 Key in OFF position.

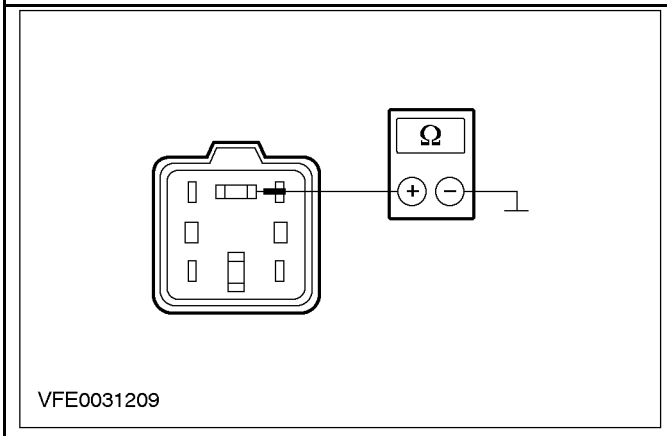
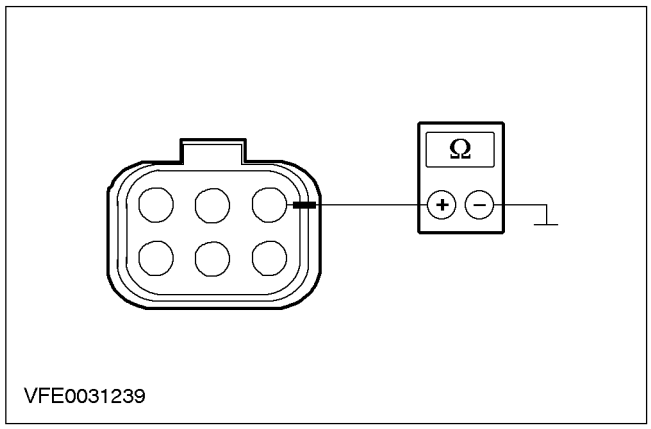
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031209	**2** Measure the resistance between relay 1, coolant additional electric heating, connector C125, pin 5, circuit 15S-RH24 (GN/OG) and ground. • Is a resistance of less than 0,9 Ohm registered? → **Yes** GO to **A9** → **No** CHECK the ground connection of the coolant additional electric heater, if necessary CLEAN the threaded connection(s) on the bulkhead. CHECK operation of system
A9: TEST THE SIGNAL FROM THE INTAKE AIR TEMPERATURE SENSOR	
NOTE: The intake air temperature sensor is integrated in the mass air flow sensor (engine management).	
	1 Connect the diagnostic tool. **2** Key in ON position. **3** Test the intake air temperature signal using the WDS. • Is the intake air temperature signal OK? (i.e. is the shown temperature plausible?) → **Yes** CHECK the powertrain control module (PCM) and RENEW as necessary. CHECK operation of system → **No** For further information, refer to REFER to Section 303-14.
A10: CHECK VOLTAGE AT RELAY 1, COOLANT ADDITIONAL ELECTRIC HEATING	
	1 Key in OFF position. **2** Disconnect Relay 1, coolant additional electric heating C125.

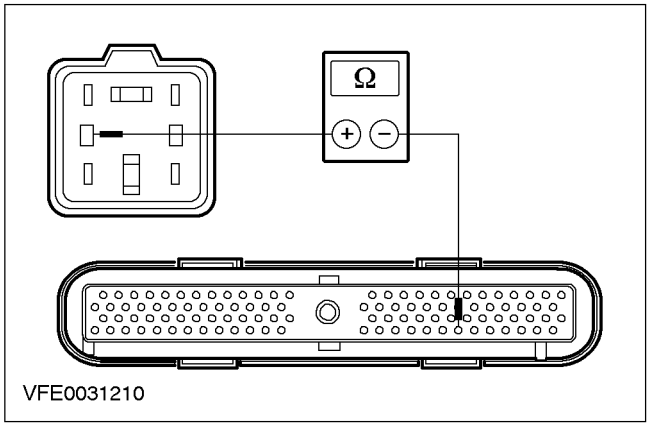
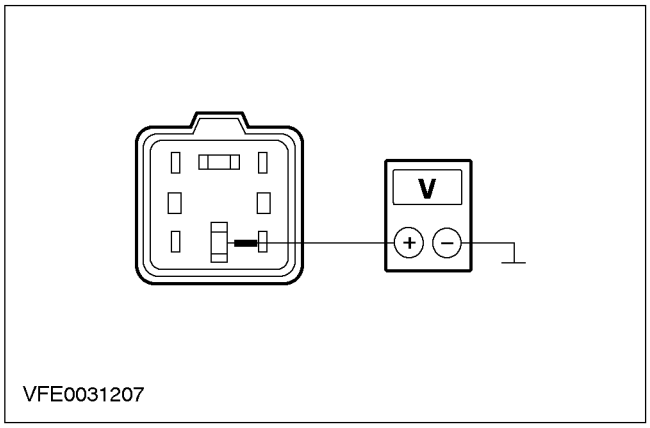
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031207	**3** Measure the voltage between relay 1, coolant additional electric heating, connector C125, pin 3, circuit 30-RH24A (RD), wiring harness side and ground. • Does the meter display battery voltage? → **Yes** GO to **A11** → **No** LOCATE and RECTIFY the break in circuit 30-RH24A (RD) between relay 1, coolant additional electric heating and solder point S361 using the Wiring Diagrams. CHECK operation of system
A11: CHECK CONTROL VOLTAGE AT RELAY 1, COOLANT ADDITIONAL ELECTRIC HEATING	
 VFE0031208	**1** Key in ON position. **2** Measure the voltage between relay 1, coolant additional electric heating, connector C125, pin 1, circuit 15-RH23 (GN/RD), wiring harness side and ground. • Does the meter display battery voltage? → **Yes** GO to **A12** → **No** LOCATE and RECTIFY the break in circuit 15-RH23 (GN/RD) between relay 1, coolant additional electric heating and fuse F82 using the Wiring Diagrams. CHECK operation of system
A12: CHECK THE CIRCUIT BETWEEN RELAY 1, COOLANT ADDITIONAL ELECTRIC HEATING AND THE COOLANT ADDITIONAL ELECTRIC HEATER FOR OPEN CIRCUIT.	
	1 Key in OFF position.

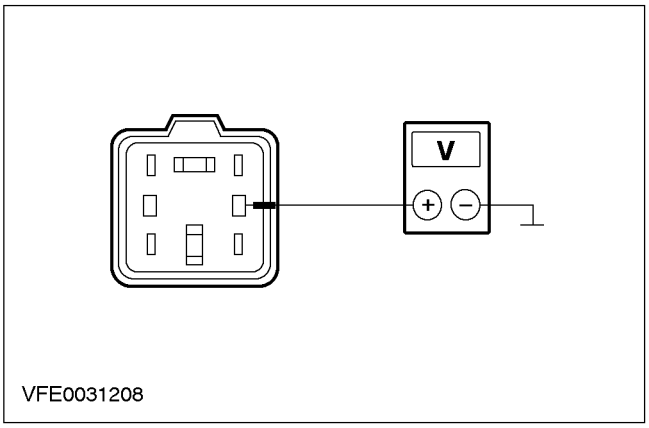
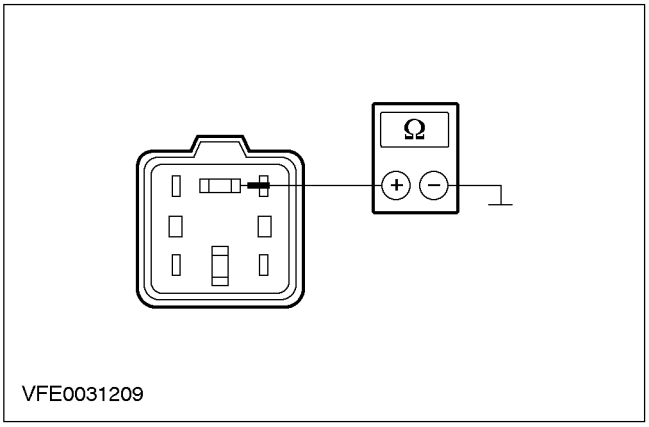
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031209	**2** Measure the resistance between relay 1, coolant additional electric heating, connector C125, pin 5, circuit 15S-RH24 (GN/OG), wiring harness side and ground. • Is a resistance of less than 0,9 Ohm registered? → **Yes** GO to **A14** → **No** GO to **A13**
A13: CHECK THE COOLANT ADDITIONAL ELECTRIC HEATER	
 VFE0031239	**1** Disconnect Coolant additional electric heating C124. **2** Measure the resistance between coolant additional electric heating, connector C124, pin 1, circuit 15S-RH24 (GN/OG), component side and ground. • Is a resistance of less than 0,9 Ohm registered? → **Yes** LOCATE and RECTIFY the break in circuit 15S-RH24 (GN/OG) between relay 1, coolant additional electric heating and the coolant additional electric heater using the Wiring Diagrams. CHECK operation of system → **No** RENEW the coolant additional electric heater. CHECK operation of system
A14: CHECK RELAY 1, COOLANT ADDITIONAL ELECTRIC HEATING	
	1 Check relay 1, coolant additional electric heating in accordance with the component test at the end of this section.

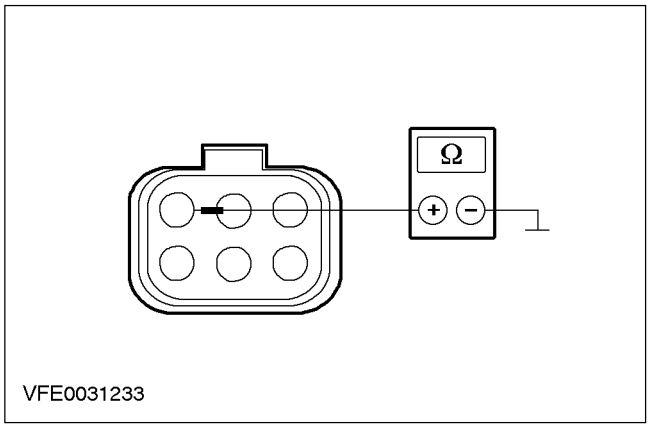
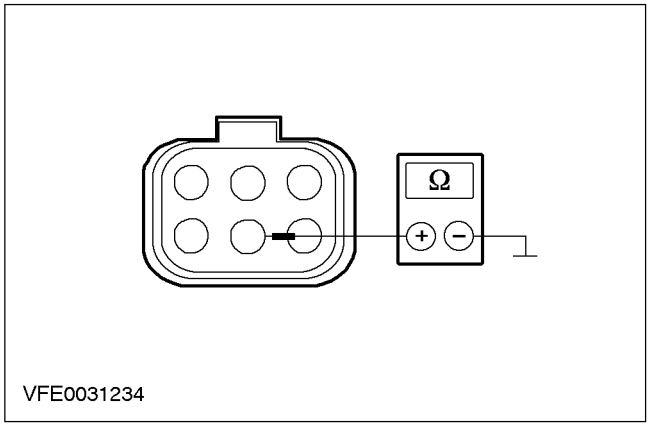
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is relay 1, coolant additional electric heating OK? → **Yes** GO to **A15** → **No** RENEW relay 1, coolant additional electric heating CHECK operation of system
A15: CHECK THE CIRCUIT BETWEEN PCM AND RELAY 1, COOLANT ADDITIONAL ELECTRIC HEATING FOR OPEN CIRCUIT	
	1 Disconnect PCM C100. 2 Measure resistance between relay 1, coolant additional electric heating, socket C125, pin 2, circuit 91S-RH23 (BK/OG), wiring harness side and PCM, connector C100, pin 98, circuit 91S-RH23 (BK/OG), wiring harness side. • Is a resistance of less than 2 Ohm registered? → **Yes** TEST the PCM and RENEW it if necessary. CHECK operation of system → **No** LOCATE and RECTIFY the break in circuit 91S-RH23 (BK/OG) between PCM and relay 1, coolant additional electric heating using the Wiring Diagrams. CHECK operation of system
A16: CHECK VOLTAGE AT RELAY 2, COOLANT ADDITIONAL ELECTRIC HEATING	
	1 Key in OFF position. 2 Disconnect Relay 2, coolant additional electric heating C126. 3 Measure the voltage between relay 2, coolant additional electric heating, connector C126, pin 3, circuit 30-RH26 (RD), wiring harness side and ground.

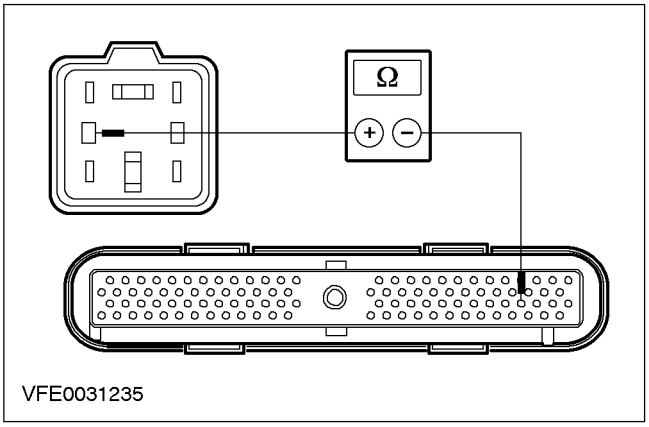
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Does the meter display battery voltage? → **Yes** GO to **A17** → **No** LOCATE and RECTIFY the break in circuit 30-RH26 (RD) between relay 2, coolant additional electric heating and solder point S361 using the Wiring Diagrams. CHECK operation of system
A17: CHECK CONTROL VOLTAGE AT RELAY 2, COOLANT ADDITIONAL ELECTRIC HEATING	
 VFE0031208	1 Key in ON position. 2 Measure the voltage between relay 2, coolant additional electric heating, connector C126, pin 1, circuit 15-RH25 (GN/BK), wiring harness side and ground. • Does the meter display battery voltage? → **Yes** GO to **A18** → **No** LOCATE and RECTIFY the break in circuit 15-RH25 (GN/BK) between relay 2, coolant additional electric heating and fuse F82 using the Wiring Diagrams. Check operation of system
A18: CHECK THE CIRCUIT BETWEEN RELAY 2, COOLANT ADDITIONAL ELECTRIC HEATING AND THE COOLANT ADDITIONAL ELECTRIC HEATER FOR OPEN CIRCUIT.	
 VFE0031209	1 Key in OFF position. 2 Measure the resistance between relay 2, coolant additional electric heating, connector C126, pin 5, circuit 15S-RH26 (GN/WH), wiring harness side and ground.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is a resistance of less than 0,7 Ohm registered? → **Yes** GO to **A21** → **No** GO to **A19**
A19: CHECK THE COOLANT ADDITIONAL ELECTRIC HEATER	
 VFE0031233	1 Disconnect Coolant additional electric heating C124. 2 Measure the resistance between coolant additional electric heating, connector C124, pin 3, circuit 15S-RH26B (GN/WH), component side and ground. • Is a resistance of less than 0,9 Ohm registered? → **Yes** GO to **A20** → **No** RENEW the coolant additional electric heater. CHECK operation of system
A20: CHECK THE COOLANT ADDITIONAL ELECTRIC HEATER	
 VFE0031234	1 Measure the resistance between coolant additional electric heating, connector C124, pin 5, circuit 15S-RH26A (GN/WH), component side and ground. • Is a resistance of less than 0,9 Ohm registered? → **Yes**

DIAGNOSIS AND TESTING (Continued)

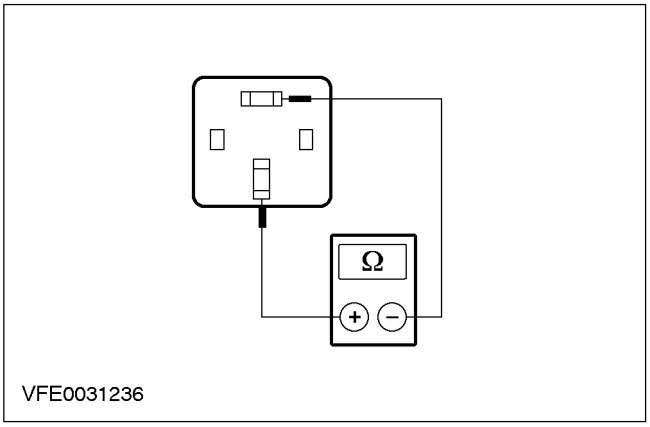
CONDITIONS	DETAILS/RESULTS/ACTIONS
	LOCATE and RECTIFY the break in circuit 15S-RH26 (GN/WH), 15S-RH26A (GN/WH) or 15S-RH26B (GN/WH) between relay 2, coolant additional electric heating and the coolant additional electric heater using the Wiring Diagrams. CHECK operation of system → **No** RENEW the coolant additional electric heater. CHECK operation of system
A21: CHECK RELAY 2, COOLANT ADDITIONAL ELECTRIC HEATING	
	1 Check relay 2, coolant additional electric heating in accordance with the component test at the end of this section. • Is relay 2, coolant additional electric heating OK? → **Yes** GO to **A22** → **No** RENEW relay 2, coolant additional electric heating CHECK operation of system
A22: CHECK THE CIRCUIT BETWEEN PCM AND RELAY 2, COOLANT ADDITIONAL ELECTRIC HEATING FOR OPEN CIRCUIT	
 VFE0031235	1 Disconnect PCM C100. 2 Measure resistance between relay 2, coolant additional electric heating, socket C126, pin 2, circuit 91S-RH25 (BK/GN), wiring harness side and PCM, connector C100, pin 75, circuit 91S-RH25 (BK/GN), wiring harness side. • Is a resistance of less than 2 Ohm registered? → **Yes** TEST the PCM and RENEW it if necessary. CHECK system operates correctly → **No** LOCATE and RECTIFY the break in circuit 91S-RH25 (BK/GN) between PCM and relay 2, coolant additional electric heating using the Wiring Diagrams. CHECK system operates correctly

DIAGNOSIS AND TESTING

Component Tests

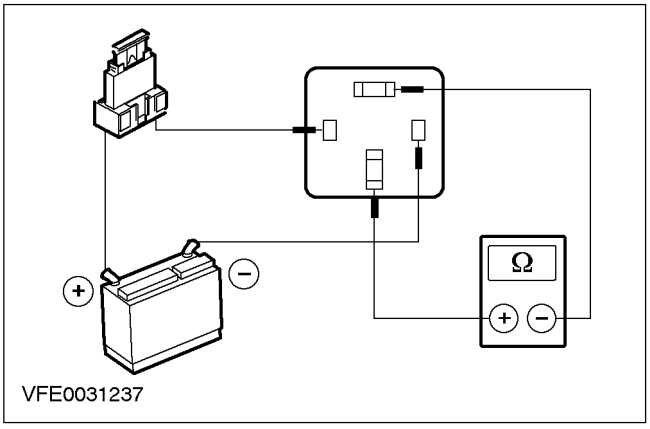
Relay, coolant additional electric heating

1. Check the normally open contact in the unswitched state.
   - Measure the resistance at the relay, between pin 3 and pin 5, component side.
   - Is a resistance of more than 10 kOhms registered? If yes, go to 2. If no, RENEW the relay.



VFE0031236

2. Check the normally open contact in the switched state.
   - Using a fused test cable (1 A), connect pin 1 of the relay, component side, with the battery positive pole.
   - Using a test cable, connect pin 2 of the relay, component side, with the battery negative pole.
   - Measure the resistance at the relay, between pin 3 and pin 5, component side.
   - Is a resistance of less than 2 Ohm registered? If yes, the relay is OK. If no, RENEW relay.



VFE0031237

SECTION 412-03 Air Conditioning

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

Specifications 412-03-2

DESCRIPTION AND OPERATION

Air Conditioning 412-03-3
Air conditioning components 412-03-4

DIAGNOSIS AND TESTING

Air Conditioning 412-03-6

REMOVAL AND INSTALLATION

Air Conditioning (A/C) Compressor — 1.8L/2.0L/2.5L	(34 626 0)	412-03-7
Clutch and Clutch Field Coil — 1.8L/2.0L/2.5L	(34 628 0)	412-03-9
Evaporator Core	(34 622 0)	412-03-12
Evaporator Core Orifice	(34 624 0)	412-03-13
Suction Accumulator	(34 630 0)	412-03-15
Low-Pressure Cutoff Switch	(34 629 0)	412-03-17
High-Pressure Cutoff Switch	(34 631 0)	412-03-19
Condenser Core	(34 632 0)	412-03-20

SPECIFICATIONS

Air Conditioning (A/C) Compressor

	Type
Air conditioning (A/C) compressor (Vehicles with diesel engine)	FS10
Air conditioning (A/C) compressor (Vehicles with petrol engine)	FVS 090

Evaporator Core Orifice

	Color
Evaporator core orifice	Orange

Torque Specifications

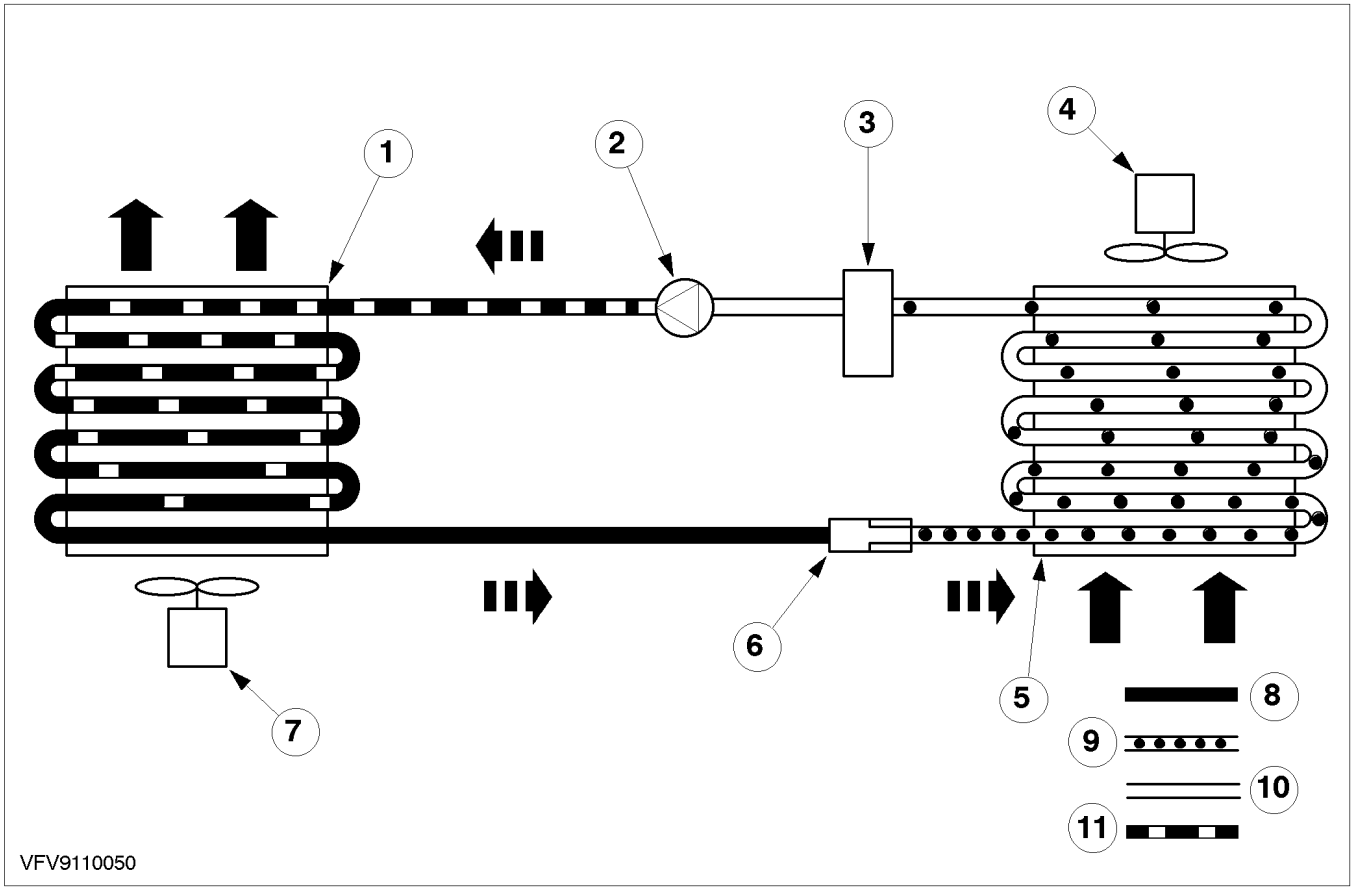
Description	Nm	lb-ft	lb-in
Air conditioning (A/C) compressor heat shield (Vehicles with 2.5L engine)	10	–	89
Refrigerant line to air conditioning (A/C) compressor union	20	15	–
Air conditioning (A/C) compressor retaining bolts	25	18	–
Air conditioning (A/C) compressor drive plate retaining bolt	13	10	–
Evaporator core orifice connection	14	10	–
High-pressure cutoff switch	8	–	71
Low-pressure cutoff switch	2.5	–	23
Refrigerant line to condenser core unions	8	–	71
Condenser core retaining bolts	9	–	80
Refrigerant line to suction accumulator unions	8	–	71
Suction accumulator	8	–	71
Strut and spring assembly reinforcement retaining bolts	20	15	–
Strut and spring assembly retaining nuts	30	22	–
Engine undershield	10	–	89

DESCRIPTION AND OPERATION

Air Conditioning

The air conditioning (A/C) system contains a evaporator core orifice and is controlled by the low-pressure cutoff switch. R134a refrigerant is used.

Refrigerant Circuit



Item	Part Number	Description
1	-	Condenser core
2	-	Air conditioning (A/C) compressor
3	-	Suction accumulator
4	-	Blower motor
5	-	Evaporator core
6	-	Evaporator core orifice
7	-	Condenser fan motor
8	-	High-pressure (liquid and warm)

Item	Part Number	Description
9	-	Low-pressure (liquid and cool)
10	-	Low-pressure (gaseous and cool)
11	-	High-pressure (gaseous and hot)

The A/C compressor (2) is driven by the engine. The A/C compressor primes the gaseous refrigerant out of the suction accumulator (3) and compresses it. The refrigerant heats up and is passed to the condenser core (1) under high-pressure.

DESCRIPTION AND OPERATION (Continued)

At this point heat is drawn from the refrigerant by the air being forced past the cooling fins. Because of this heat loss, the refrigerant liquifies and leaves the condenser core.

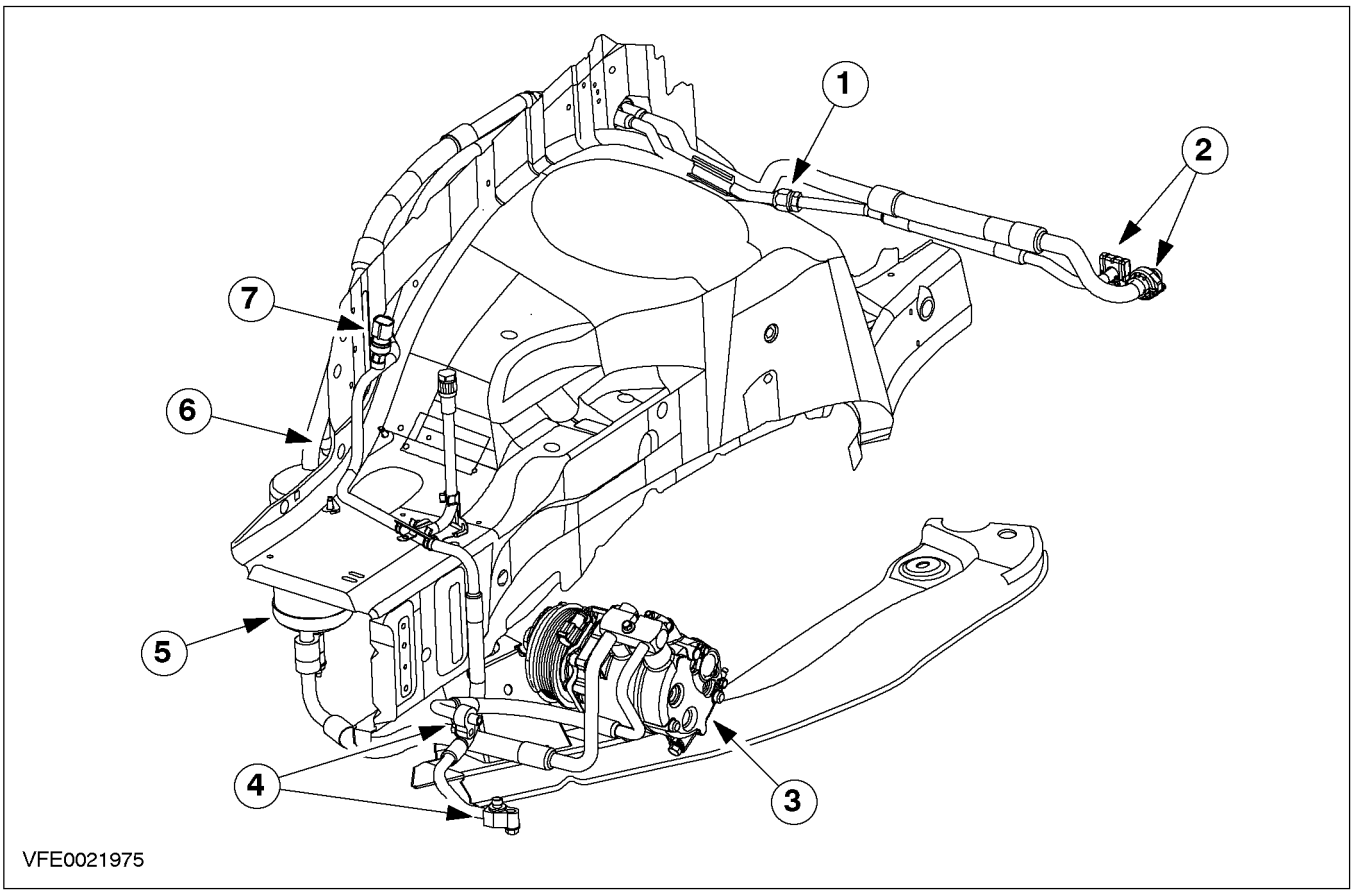
A evaporator core orifice (6), which separates the refrigerant at high-pressure from that at low-pressure, is located between the condenser core and the evaporator core (5). This evaporator core orifice slows down the flow of the refrigerant from the A/C compressor, so that pressure builds up in the condenser core.

After passing through the evaporator core orifice the liquid refrigerant expands in the circuit to the evaporator core. In the evaporator core the liquid refrigerant converts back into the gaseous state and this causes heat to be extracted from the air coming into the vehicle. The air therefore cools down and the moisture it contained is given up at the evaporator core. The refrigerant stream coming from the evaporator core enters the suction accumulator and is primed up again by the A/C compressor.

The system is protected by the high-pressure cutoff switch, in order to prevent damage by excessive pressure (example, because of overfilling). If the pressure exceeds the maximum allowed, the high-pressure cutoff switch turns off the A/C compressor.

The working cycles of the A/C compressor are controlled by the low-pressure cutoff switch depending on the low-pressure in the suction accumulator. The low-pressure cutoff switch turns the A/C compressor off permanently if the pressure falls below the approved value (example, if there is a leak).

Air conditioning components



Item	Description
1	Evaporator core orifice
2	Evaporator core connections
3	A/C compressor
4	Condenser core connections
5	Suction accumulator

DESCRIPTION AND OPERATION (Continued)

Item	Description
6	Low-pressure cutoff switch
7	High-pressure cutoff switch

DIAGNOSIS AND TESTING

Air Conditioning

REFER to Section 412-00.

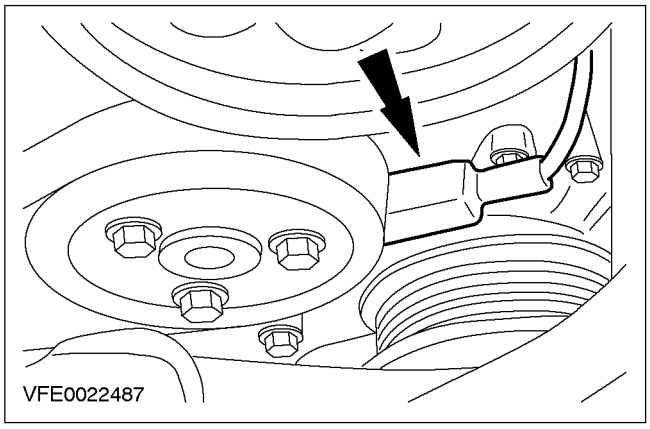
REMOVAL AND INSTALLATION

Air Conditioning (A/C) Compressor — 1.8L/2.0L/2.5L (34 626 0)

Removal

All vehicles

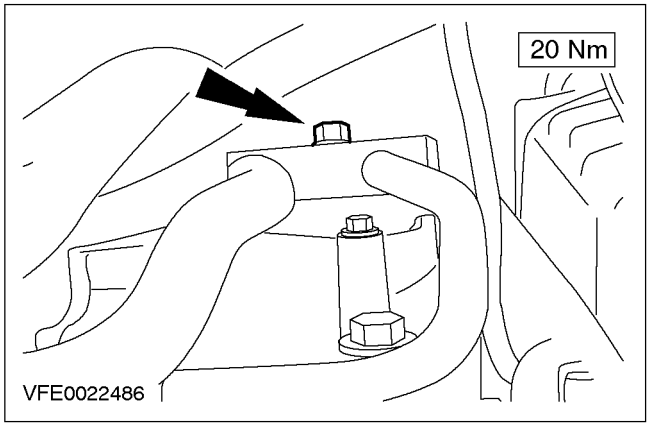
1. **Evacuate the air conditioning (A/C) system.For additional information, refer to Section 412-00.**
2. **Disconnect the A/C compressor clutch connector.**



3. **Remove the accessory drive belt.For additional information, refer to Section 303-05.**
4. **CAUTION: Cap the refrigerant lines and the A/C compressor to prevent dirt ingress.**

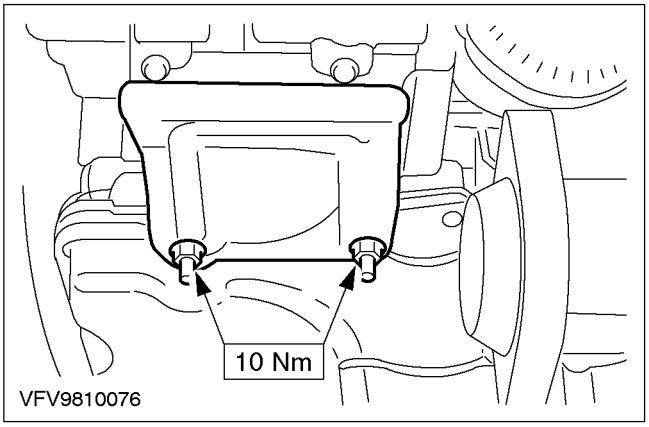
   Detach the refrigerant lines from the A/C compressor. (1.8L engine shown).

   • Discard the O-ring seals.



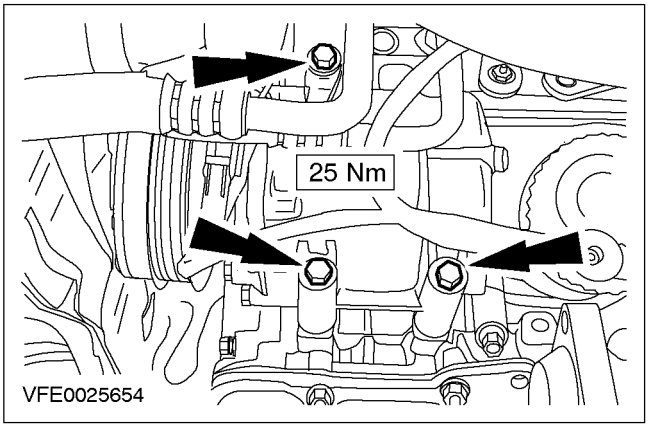
Vehicles with 2.5L Engine

5. **Remove the heat shield from the A/C compressor clutch (exhaust pipe shown removed for clarity).**



6. **CAUTION: Support the A/C compressor before removing the retaining bolts.**

   Remove the A/C compressor.

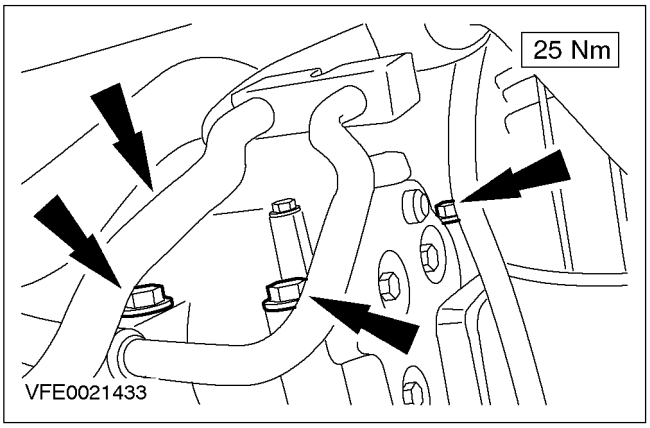


REMOVAL AND INSTALLATION (Continued)

Vehicles with 1.6L, 1.8L or 2.0L engine

7. ⚠ CAUTION: Support the A/C compressor before removing the retaining bolts.

Remove the A/C compressor.



Installation

1. NOTE: Install new refrigerant line O-ring seals.

NOTE: Coat the refrigerant line O-ring seals with clean refrigerant oil prior to installation.

Install the components in the reverse order.

REMOVAL AND INSTALLATION

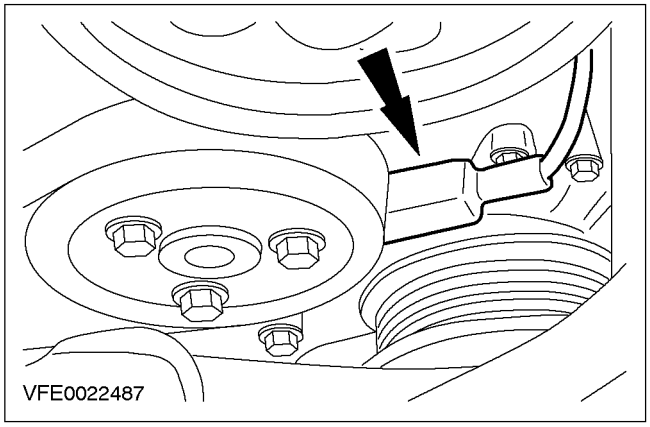
Clutch and Clutch Field Coil — 1.8L/2.0L/2.5L (34 628 0)

General Equipment
Two leg puller
M6 x 30 mm bolt
Washer

Removal

All vehicles

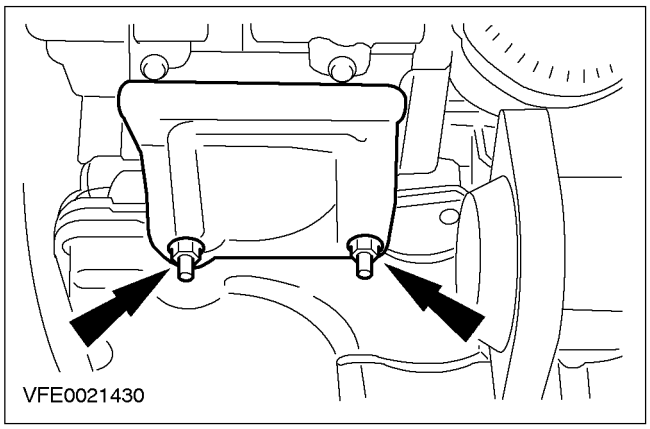
1. **Disconnect the air conditioning (A/C) compressor clutch electrical connector.**



2. **Remove the accessory drive belt. For additional information, refer to Section 303-05.**

Vehicles with the 2.5L engine

3. **Remove the A/C compressor heat shield (shown with removed exhaust pipe for clarity).**

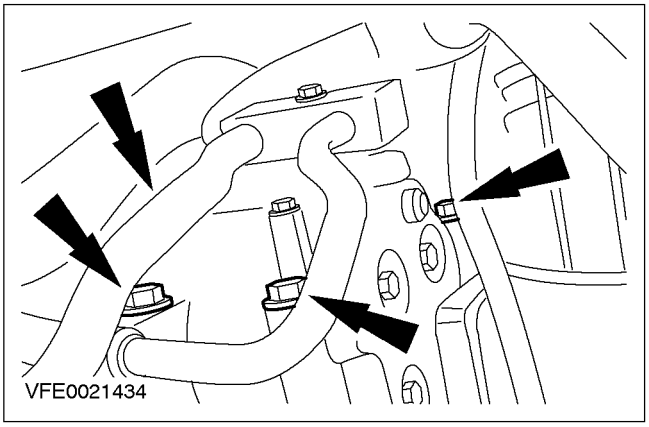


All vehicles

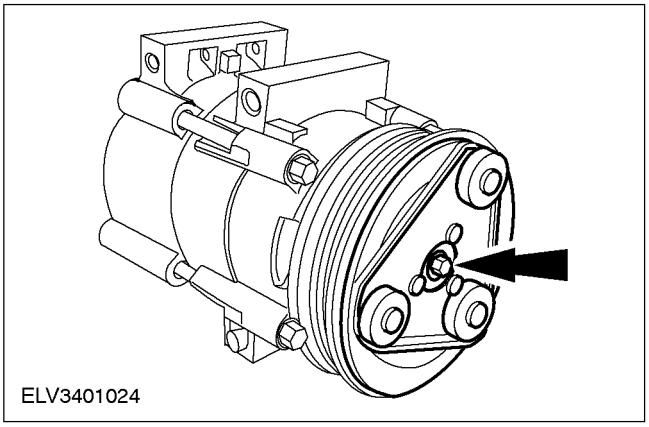
CAUTION: Support the A/C compressor before removing the retaining bolts and secure it to prevent load being placed on the refrigerant lines.

NOTE: Mark the position of the A/C compressor clutch electrical connector in relation to the compressor housing.

4. **Detach the A/C compressor from the A/C compressor bracket.**



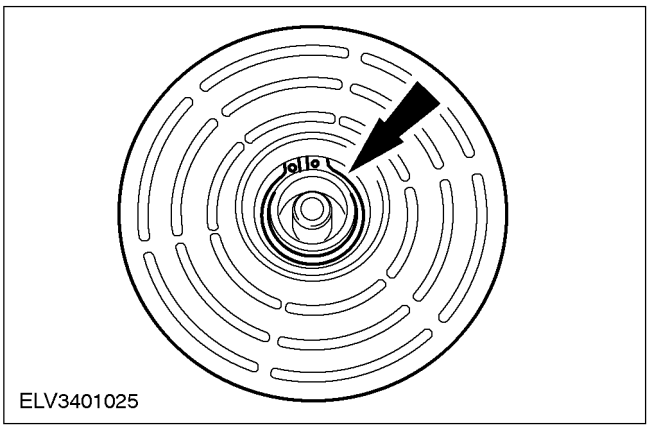
5. **Remove the A/C compressor drive plate.**



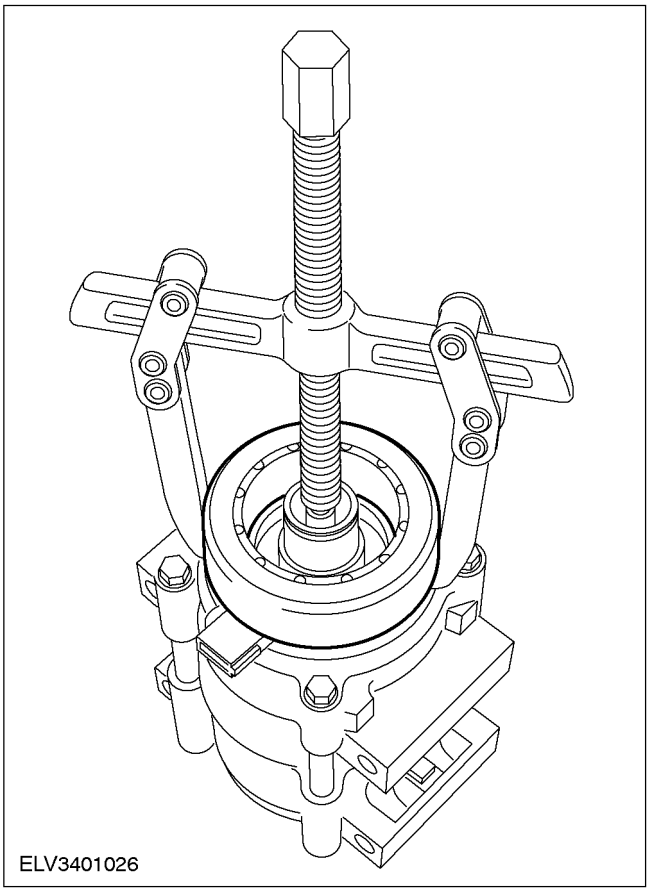
REMOVAL AND INSTALLATION (Continued)

6. Remove the A/C compressor pulley.

- Remove the spacer shims.



7. Using a suitable two leg puller, remove the clutch field coil.

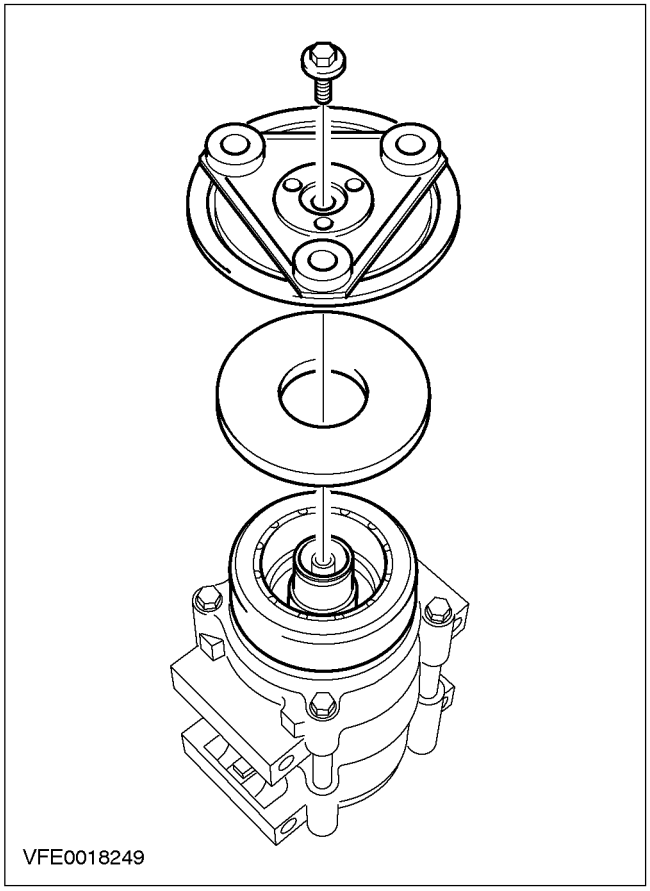


Installation

All vehicles

NOTE: Do not skew the clutch field coil when installing it to the A/C compressor seat.

1. Using a suitable M6 x 30 mm bolt, a suitable washer and the A/C compressor drive plate, install the clutch field coil.



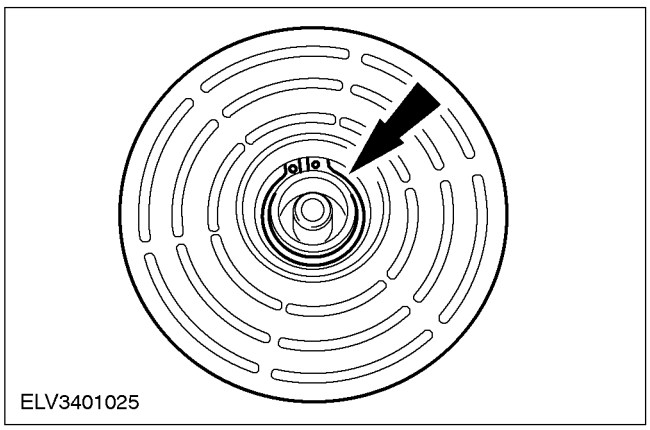
2. Remove the M6 x 30 mm bolt, washer and A/C compressor drive plate.

1. Install the spacer shims.

3. NOTE: Install a new A/C compressor pulley snap ring.

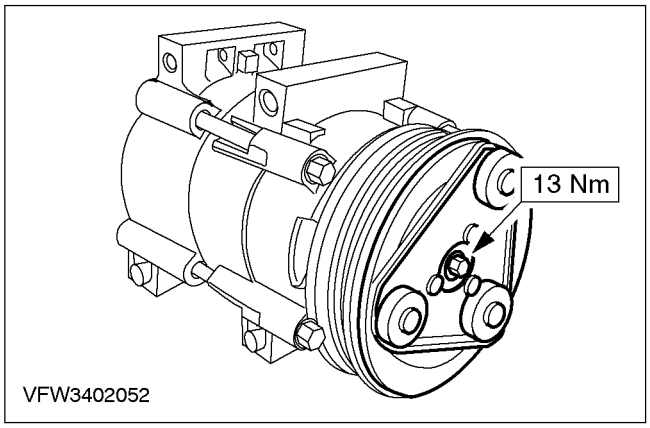
Install the A/C compressor pulley.

- Install the snap ring.

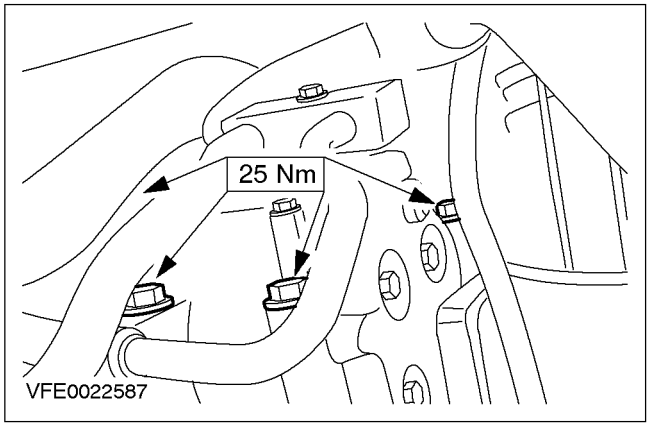


REMOVAL AND INSTALLATION (Continued)

4. **Install the A/C compressor drive plate.**

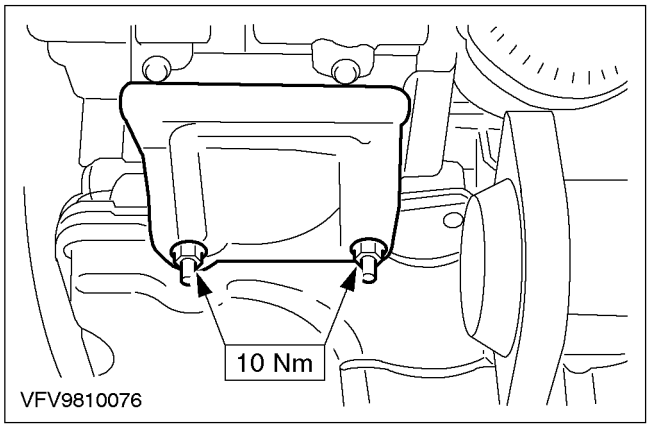


5. **Check the A/C clutch air gap. For additional information, refer to Section 412-00.**
6. **Attach the A/C compressor to the A/C compressor bracket.**



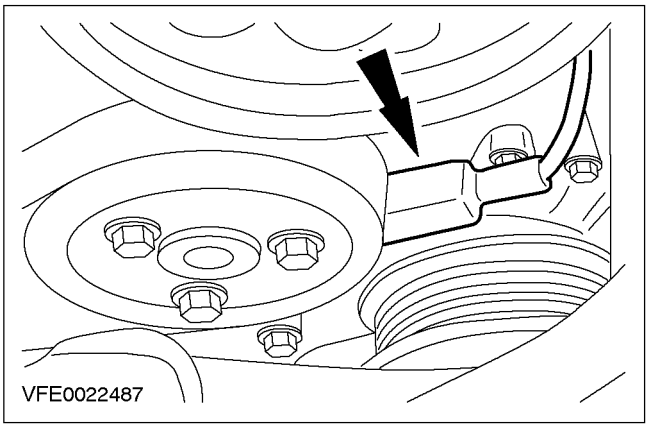
Vehicles with the 2.5L engine

7. **Install the A/C compressor heat shield (shown with removed exhaust pipe for clarity).**



All vehicles

8. **Install the accessory drive belt. For additional information, refer to Section 303-05.**
9. **Connect the A/C compressor clutch electrical connector.**

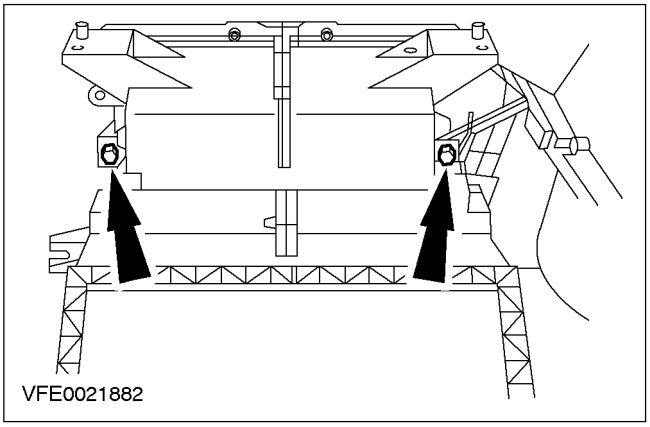


REMOVAL AND INSTALLATION

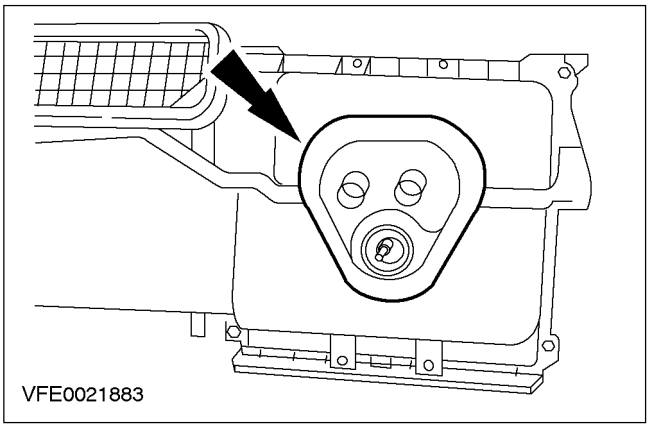
Evaporator Core (34 622 0)

Removal

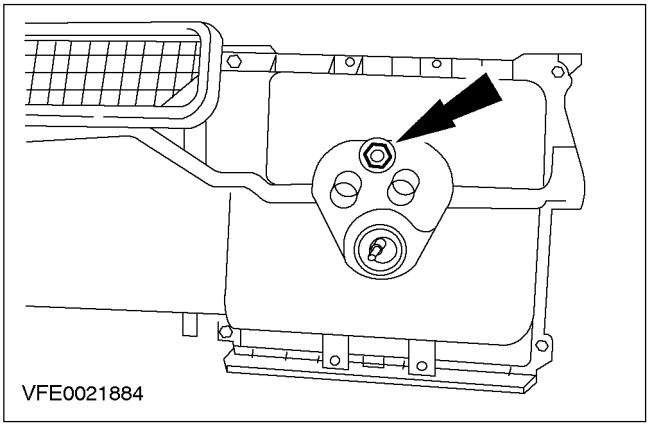
1. **Remove the heater core and evaporator core housing. For additional information, refer to Section 412-02A / 412-02B.**
2. **Remove the evaporator core upper housing.**



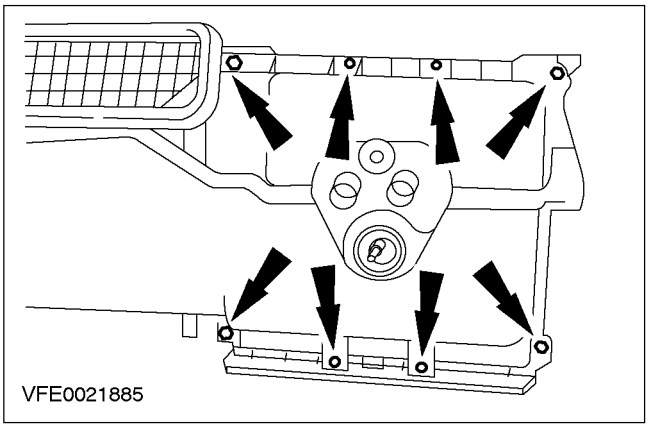
3. **Remove the rubber seal.**



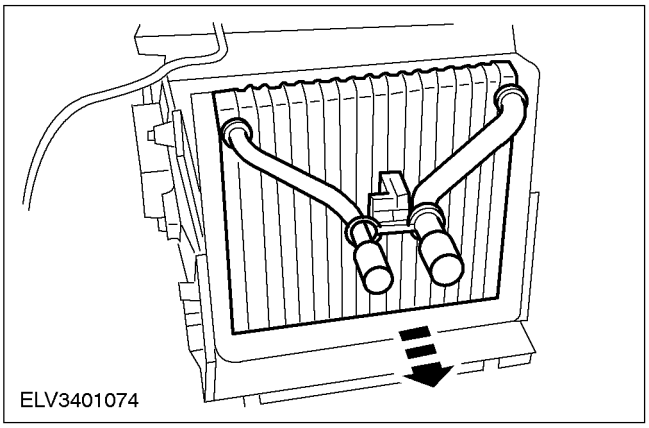
4. **Remove the evaporator core retaining bolt.**



5. **Separate the evaporator core housing.**



6. **Remove the evaporator core.**

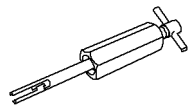


Installation

1. **To install, reverse the removal procedure.**

REMOVAL AND INSTALLATION

Evaporator Core Orifice (34 624 0)

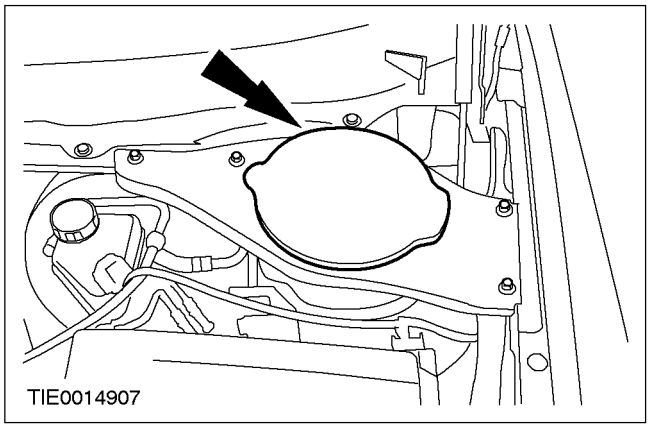
Special Tool(s)	
 34004	Remover/Installer, Evaporator Core Orifice 412-034 (34-004)
 34005	Remover, Broken Evaporator Core Orifice 412-035 (34-005)

Removal

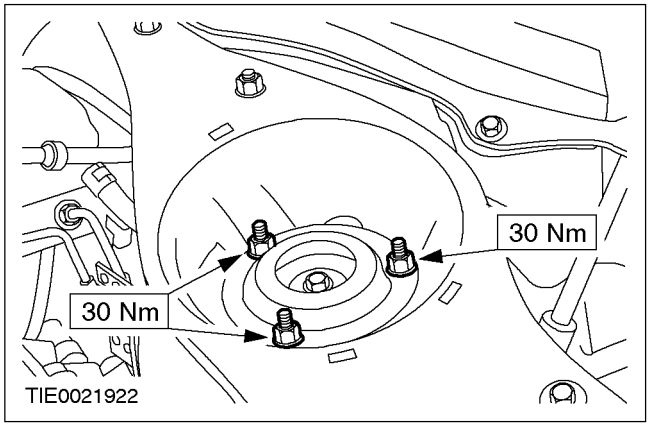
Vehicles with diesel engine

CAUTION: Do not raise the vehicle.

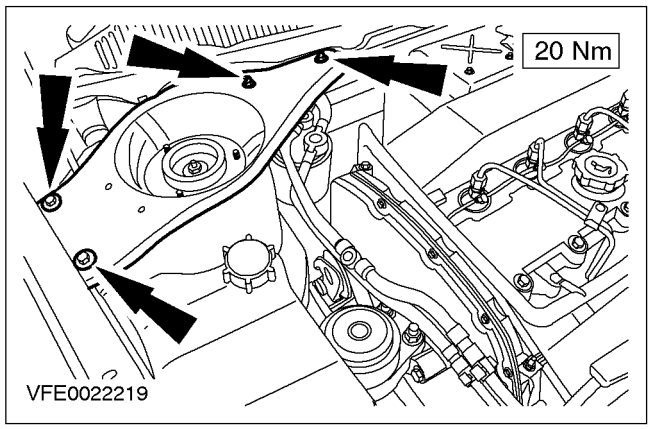
1. **Remove the right-hand suspension strut cover (left-hand side shown).**



2. **Remove the right-hand suspension strut nuts (left-hand side shown).**

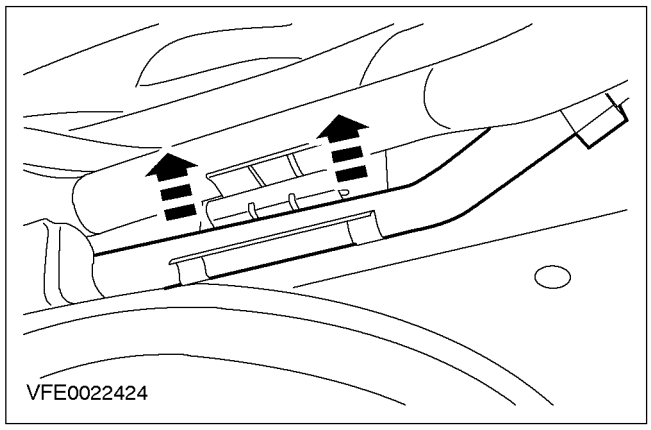


3. **Remove the right-hand suspension strut nuts.**

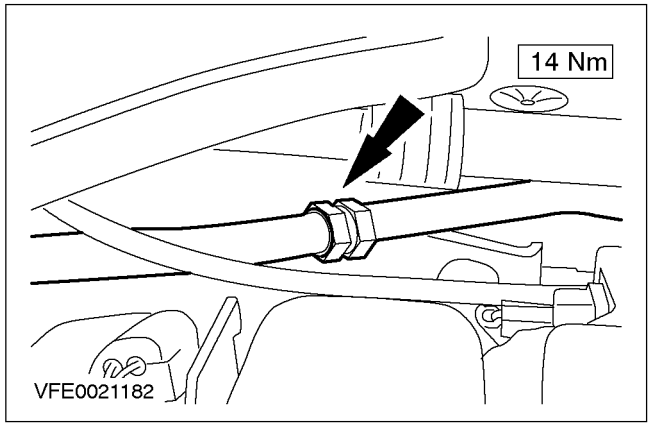


All vehicles

4. **Evacuate the air conditioning (A/C) system.For additional information, refer to Section 412-00.**
5. **Unclip the refrigerant line from the evaporator core orifice.**



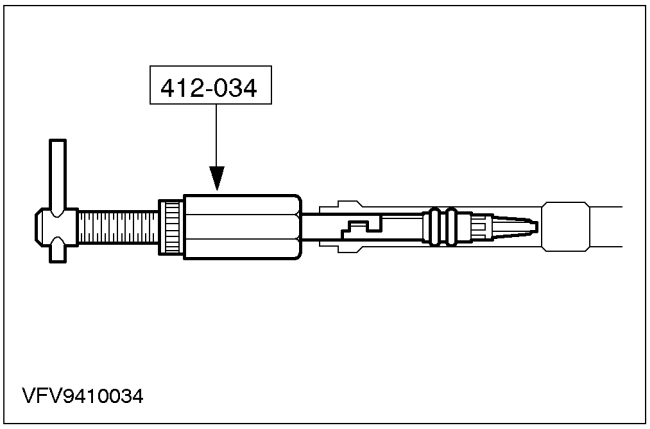
6. **Detach the refrigerant line.**
   - Discard the O-ring seals.



REMOVAL AND INSTALLATION (Continued)

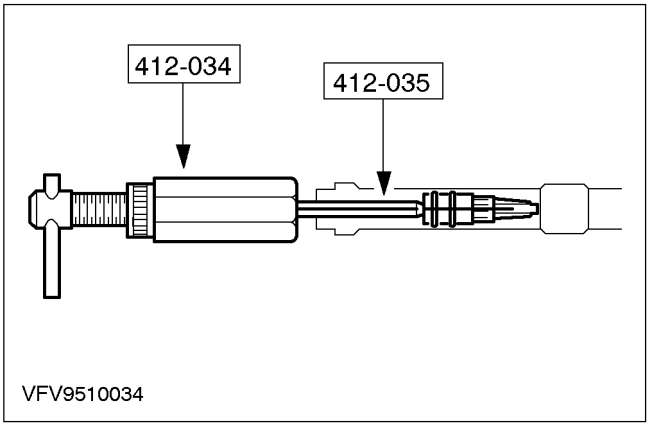
7. Using the special tool, remove the evaporator core orifice.

- Guide the tool into the tube and hook it into the evaporator core orifice.
- Turn the tool clockwise and pull out the evaporator core orifice.



8. NOTE: Only necessary if the evaporator core orifice is broken.

Using the special tools, remove the broken evaporator core orifice.



Installation

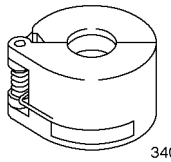
1. NOTE: Install new refrigerant line O-ring seals.

NOTE: Coat the refrigerant line O-ring seals with clean refrigerant oil prior to installation.

Install the components in the reverse order.

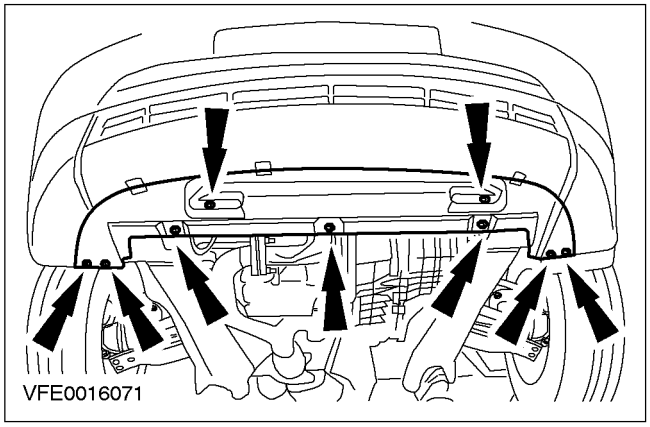
REMOVAL AND INSTALLATION

Suction Accumulator (34 630 0)

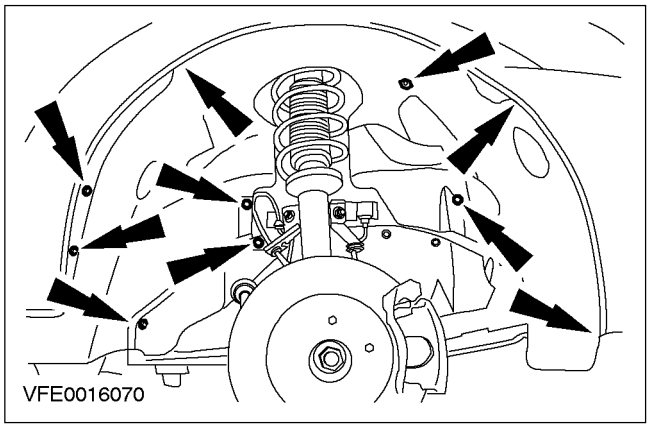
Special Tool(s)	
 34002	Disconnect Tool, Spring Lock Coupling 3/4 inch (white) 412-069 (34-002)

Removal

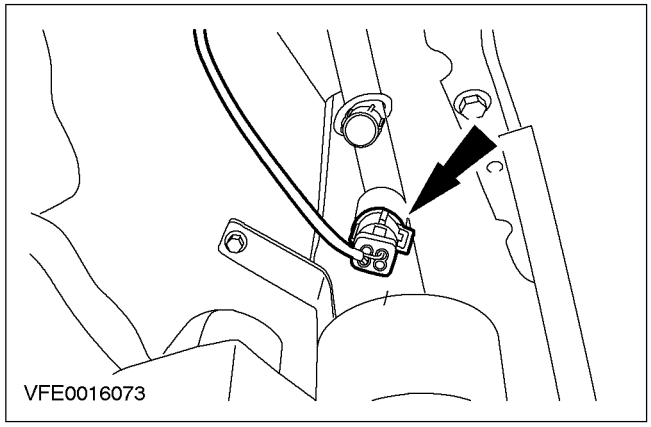
1. **Evacuate the air conditioning (A/C) system.For additional information, refer to Section 412-00.**
2. **Raise the vehicle.For additional information, refer to Section 100-02.**
3. **Remove the radiator shield.**



4. **Remove the right-hand wheel arch trim panel (shown without wheel for clarity).**

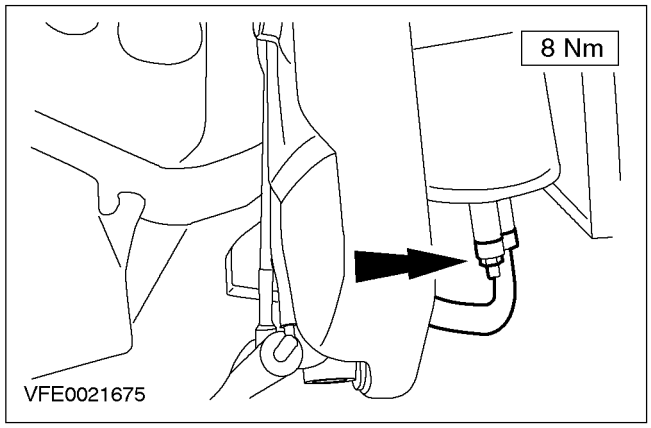


5. **Disconnect the A/C low-pressure switch connector.**

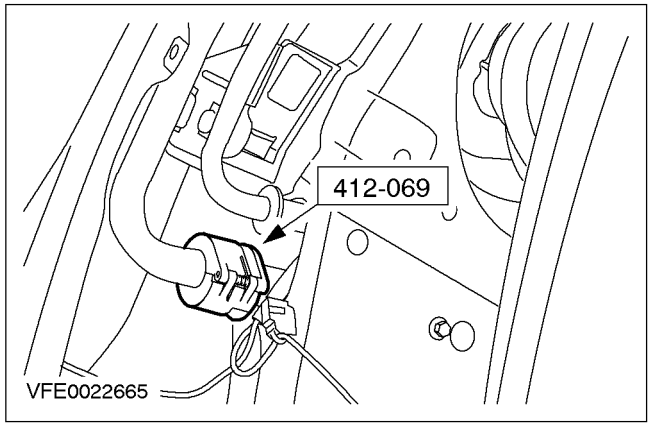


CAUTION: Cap the refrigerant lines and the suction accumulator/dryer connections to prevent dirt ingress.

6. **Detach the refrigerant line from the suction accumulator/dryer.**
   - Discard the O-ring seals.

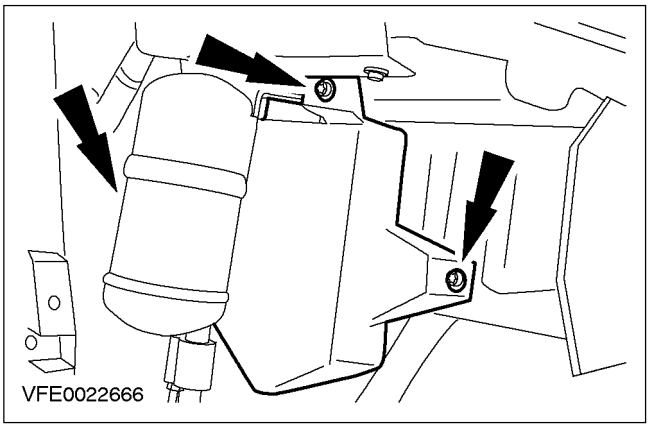


7. **Detach the refrigerant line from the suction accumulator/dryer using the special tool.**
   - Discard the O-ring seals.

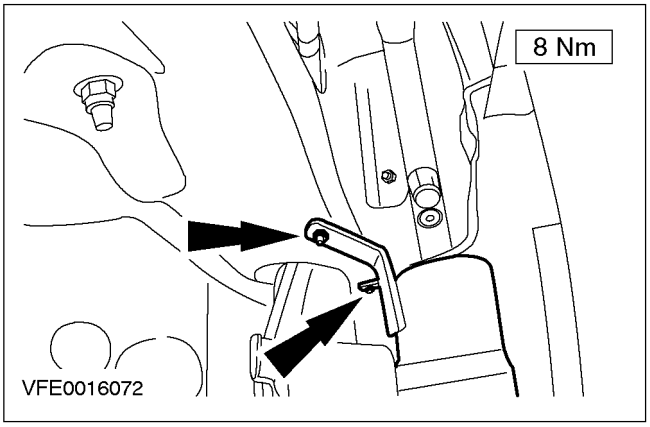


REMOVAL AND INSTALLATION (Continued)

8. Remove the windscreen wiper reservoir (front bumper cover shown removed for clarity).



9. Remove the suction accumulator/drier.



Installation

1. NOTE: Install new refrigerant line O-ring seals.

NOTE: Coat the refrigerant line O-ring seals with clean refrigerant oil prior to installation.

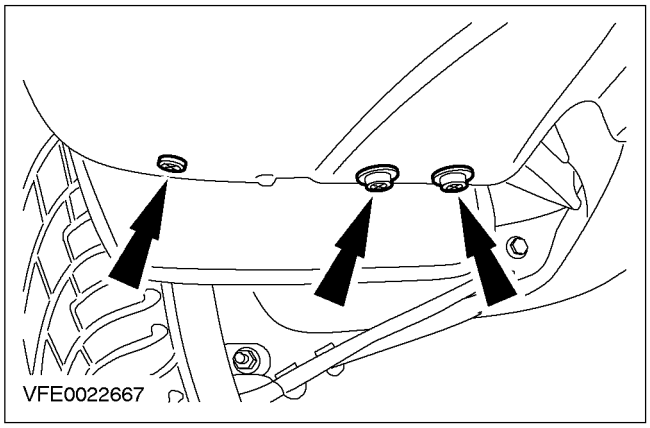
Install the components in the reverse order.

REMOVAL AND INSTALLATION

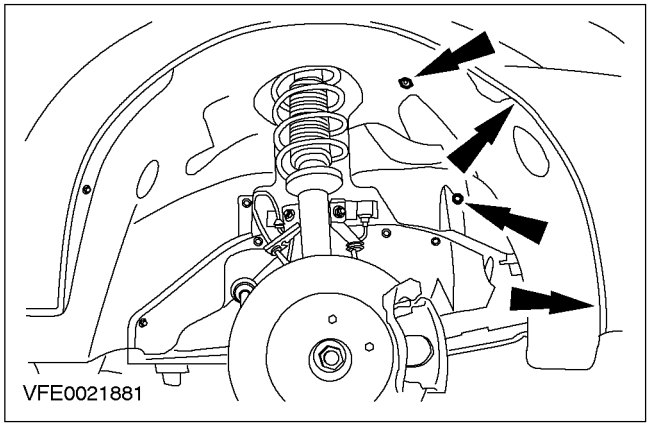
Low-Pressure Cutoff Switch (34 629 0)

Removal

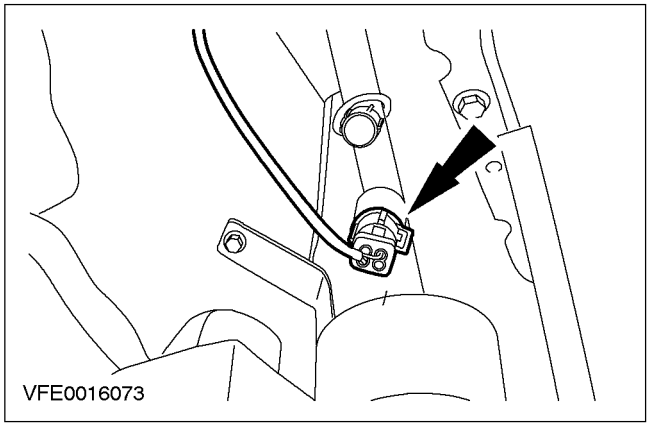
1. **Remove the right-hand fender splash shield lower retaining screws.**



2. **Detach the right-hand fender splash shield and push it to one side (wheel shown removed for clarity).**

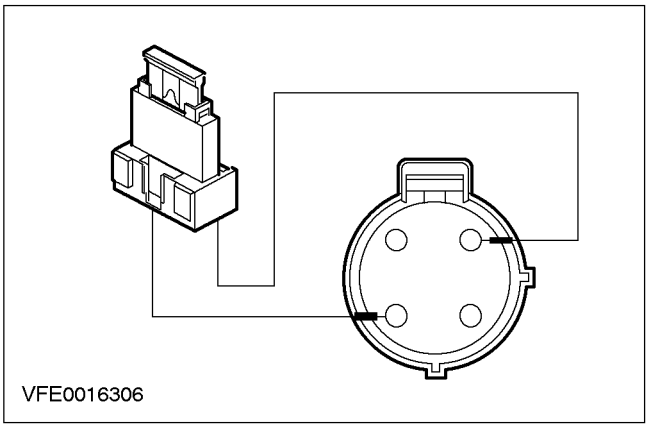


3. **Disconnect the low-pressure cutoff switch electrical connector.**



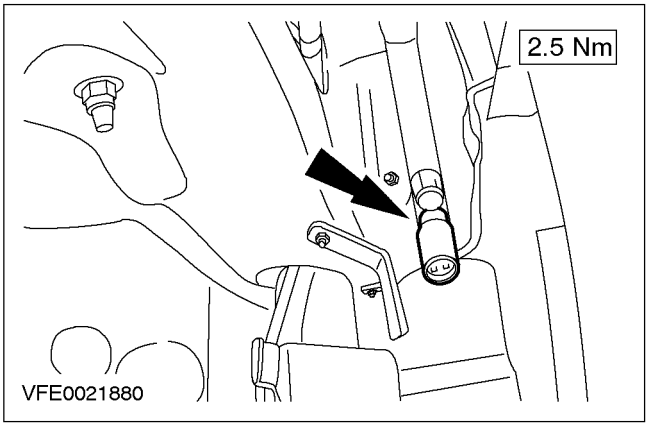
4. **Start the engine and turn the air conditioning (A/C) switch to the ON position.**
5. **NOTE:** The A/C compressor must run during low-pressure cutoff switch removal.

   Connect a 20 A fuse rated jumper wire between Pin 1 and Pin 4, harness side, of the low-pressure cutoff switch electrical connector.



6. **NOTE:** Make sure that the low-pressure cutoff switch valve closes completely after removal of the low-pressure cutoff switch to prevent loss of refrigerant.

   Remove the low-pressure cutoff switch.
   - Discard the O-ring seals.



REMOVAL AND INSTALLATION (Continued)

Installation

1. **NOTE:** Install new low-pressure cutoff switch O-ring seals.

NOTE: Coat the low-pressure cutoff switch O-ring seals in clean refrigerant oil prior to installation.

NOTE: Thighten the low-pressure cutoff switch carefully to prevent any damage.

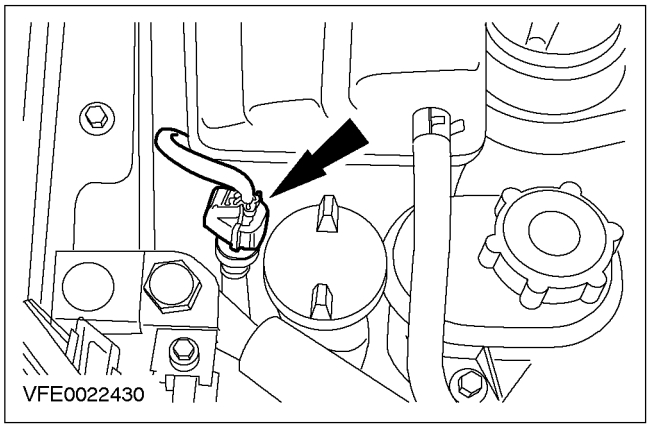
To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

High-Pressure Cutoff Switch (34 631 0)

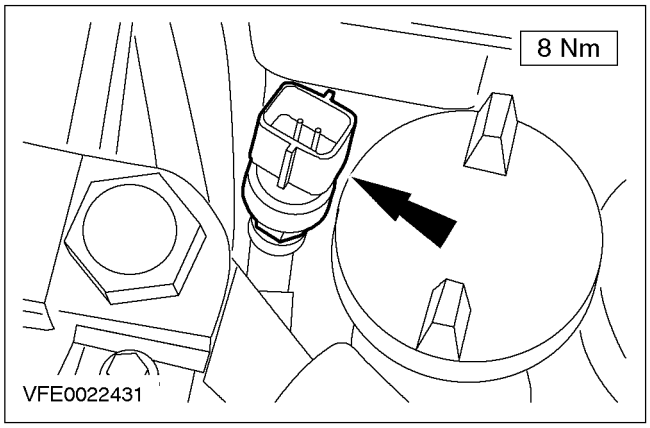
Removal

1. **Disconnect the high-pressure cutoff switch electrical connector.**



2. **NOTE:** Make sure that the high-pressure cutoff switch valve closes completely after removal of the high-pressure cutoff switch to prevent loss of refrigerant.

   Remove the high-pressure cutoff switch.
   - Discard the O-ring seals.



Installation

1. **NOTE:** Install new high-pressure cutoff switch O-ring seals.

NOTE: Coat the high-pressure cutoff switch O-ring seals in clean refrigerant oil prior to installation.

To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

Condenser Core (34 632 0)

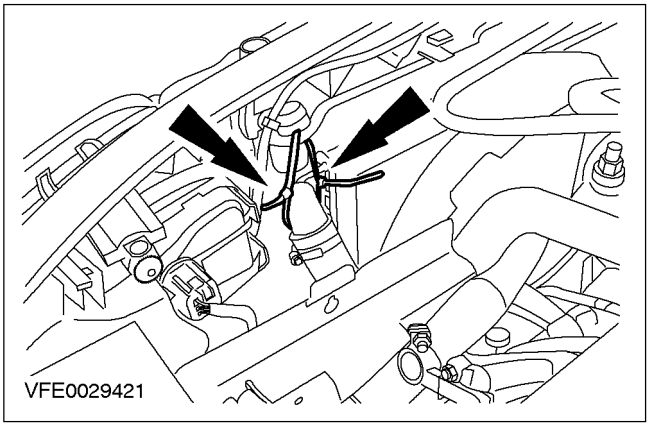
Removal

All vehicles

1. **Evacuate the air conditioning (A/C) system.For additional information, refer to Section 412-00.**

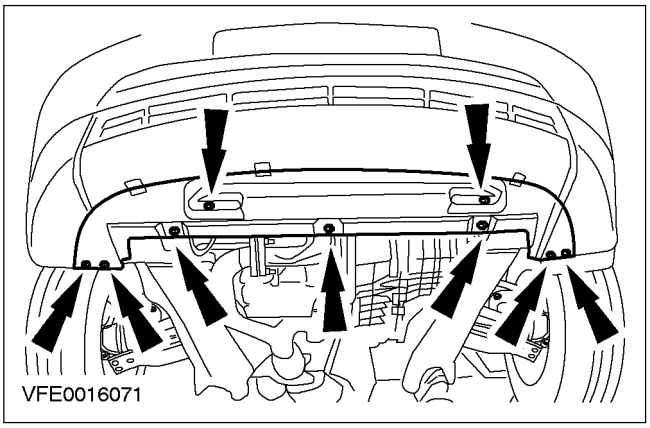
Vehicles with 2.0L diesel engine and 5-speed automatic transmission (front wheel drive)

2. **Secure the radiator at both sides using suitable cable ties.**



All vehicles

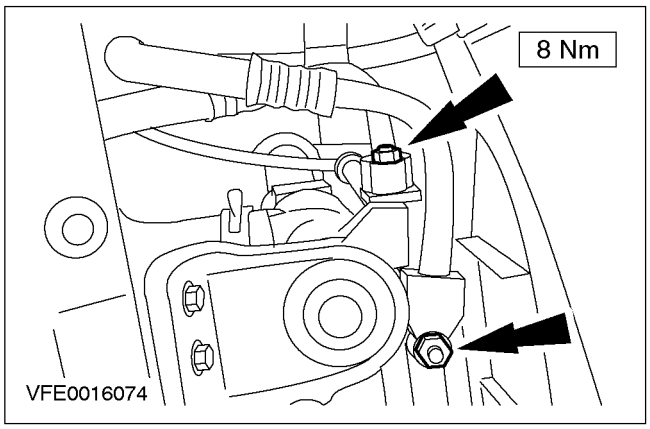
3. **Raise the vehicle.For additional information, refer to Section 100-02.**
4. **Remove the lower radiator cover.**



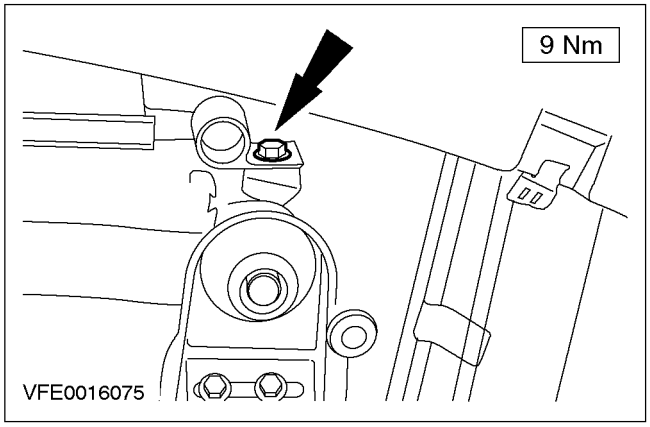
5. **CAUTION: Cap the refrigerant lines and the A/C condenser core to prevent dirt ingress.**

   Disconnect the refrigerant lines from the A/C condenser core.

   - Discard the O-ring seals.



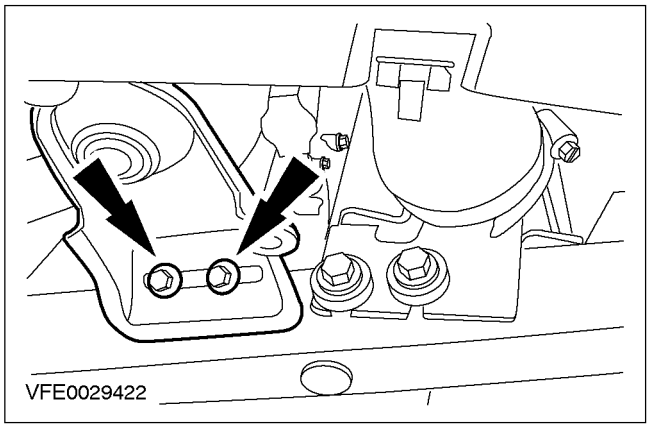
6. **Remove the A/C condenser core fastening bolts.**



REMOVAL AND INSTALLATION (Continued)

Vehicles with 2.0L diesel engine and 5-speed automatic transmission (front wheel drive)

7. Remove the radiator support bracket.

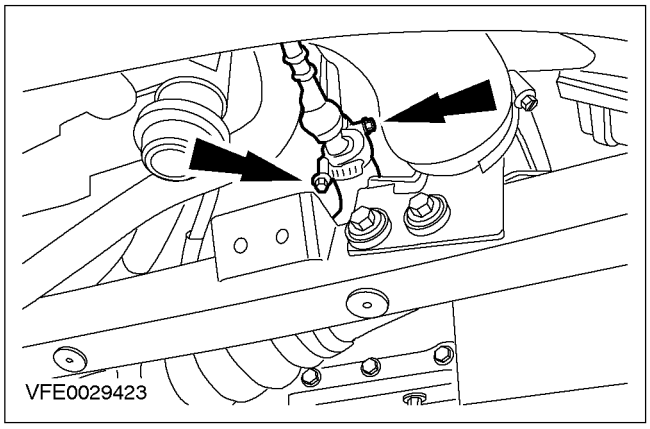


8. CAUTION: Cap the hoses and the oil cooler to prevent dirt ingress.

NOTE: Mark the installation position of the feed and return hose.

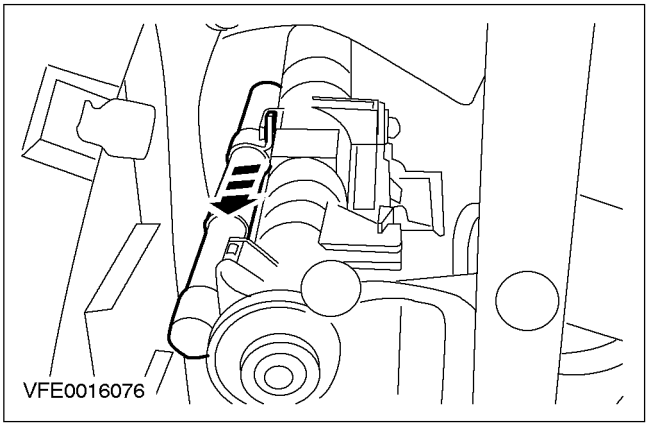
NOTE: Allow the automatic transmission fluid to drain into a suitable container.

Remove the automatic transmission oil cooler hoses.



All vehicles

9. Remove the A/C condenser core.



Installation

All vehicles

NOTE: Install new refrigerant line O-ring seals.

NOTE: Coat the refrigerant line O-ring seals with clean refrigerant oil prior to installation.

1. Install the components in the reverse order.

Vehicles with 2.0L diesel engine and 5-speed automatic transmission (front wheel drive)

2. Check the transmission fluid level.For additional information, refer to Section 307-01A / 307-01B.

SECTION 412-04 Control Components

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

DESCRIPTION AND OPERATION

Control Components 412-04-2
Climate Control Assembly - Vehicles with Manual Temperature Control 412-04-2
Climate Control Assembly - Vehicles with Automatic Temperature Control 412-04-2

DIAGNOSIS AND TESTING

Control Components 412-04-3

REMOVAL AND INSTALLATION

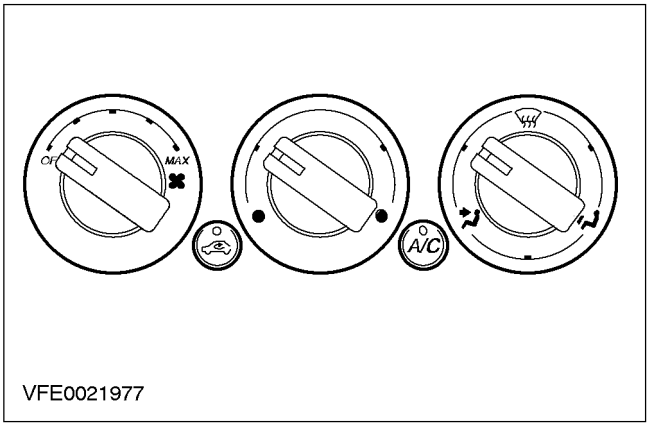
Climate Control Assembly ..... (34 300 0) 412-04-4

DESCRIPTION AND OPERATION

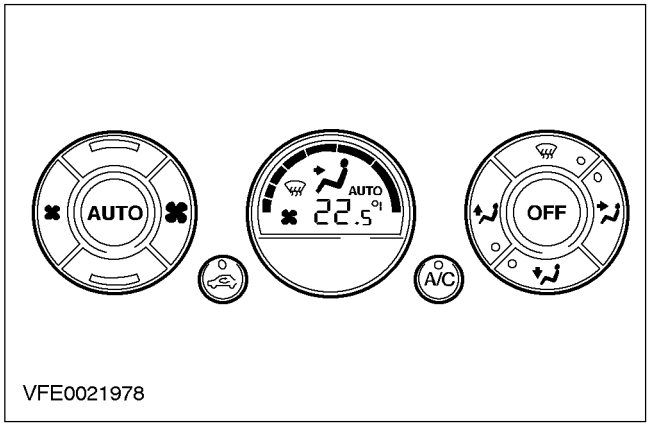
Control Components

Climate Control Assembly - Vehicles with Manual Temperature Control

Vehicles with manual temperature control have a climate control assembly with three rotary switches.The position of the temperature door, defrost vent nozzle and air distribution door are controlled by the control module incorporated in the control unit and actuated electronically by means of control motors. The air recirculation valve is controlled by an actuating switch and actuated electronically by means of a control motor. Furthermore the actuating buttons for the air conditioning and air recirculation are located on the climate control assembly.



VFE0021977



VFE0021978

Climate Control Assembly - Vehicles with Automatic Temperature Control

Vehicles with automatic temperature control have a climate control assembly with several buttons. Two buttons for the interior temperature setting, two buttons for the blower speed and four buttons for the air flow direction. Furthermore the actuating buttons for the air conditioning and air recirculation are located on the climate control assembly.

The digital display has been enlarged to the display of the previous model and displays the blower speed setting, the demist/defrost mode, the air flow direction indicator, the air conditioning automatic mode and the selected interior temperature.

DIAGNOSIS AND TESTING

Control Components

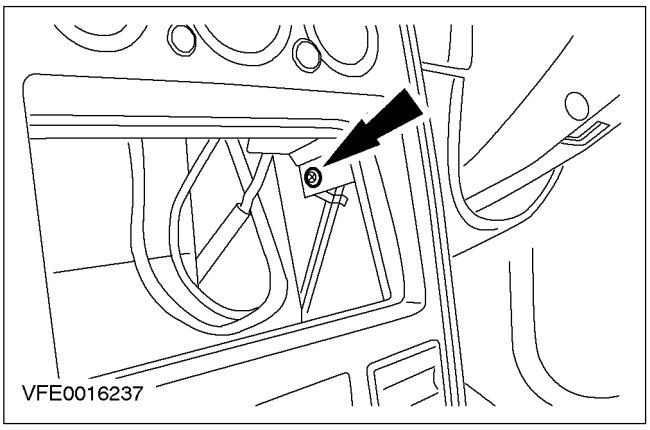
REFER to Section 412-00.

REMOVAL AND INSTALLATION

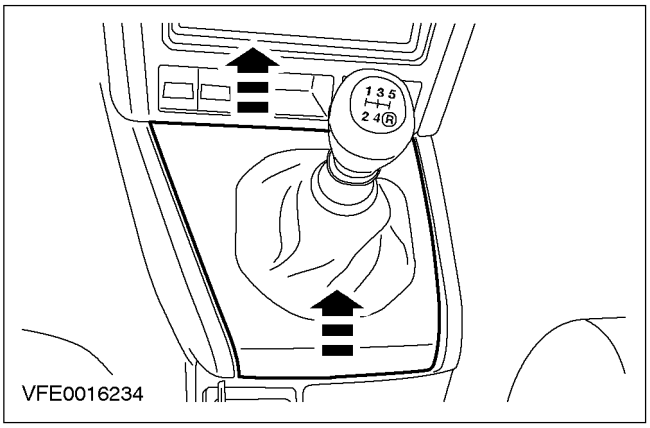
Climate Control Assembly (34 300 0)

Removal

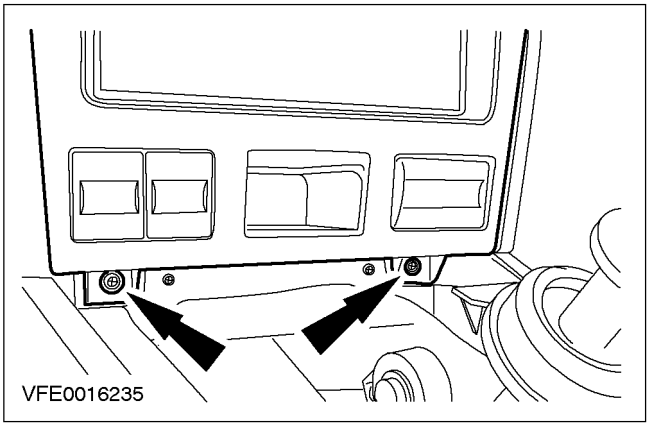
1. **Remove the audio unit. For additional information, refer to Section 415-01.**
2. **Remove the instrument panel center bezel rear retaining screws.**



3. **Detach the gearshift lever boot from the floor console.**

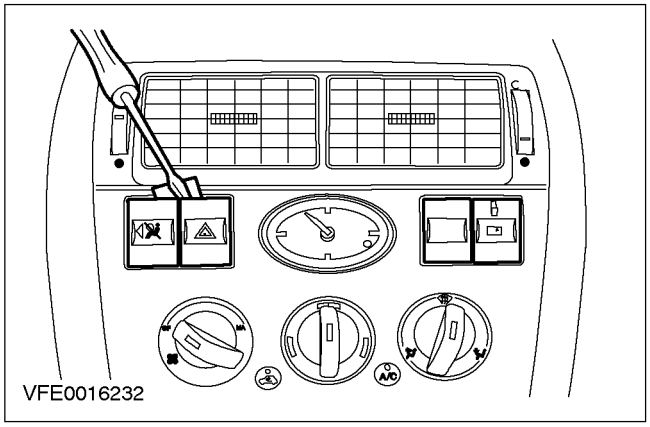


4. **Remove the instrument panel center bezel lower retaining screws.**

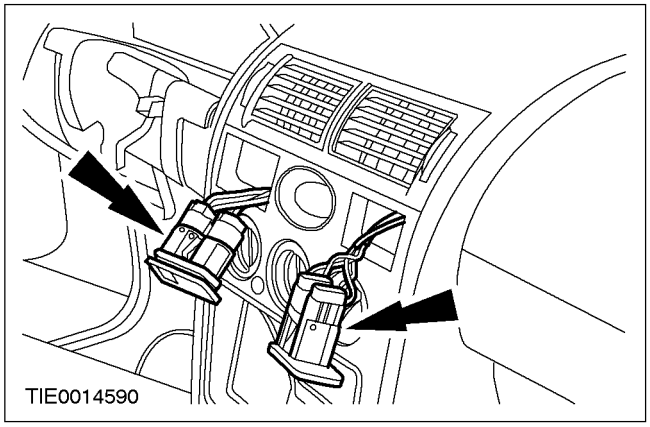


5. **NOTE:** Use a pad under the screwdriver to prevent damage to the instrument panel center bezel.

   Detach the operating switches from the instrument panel center bezel.

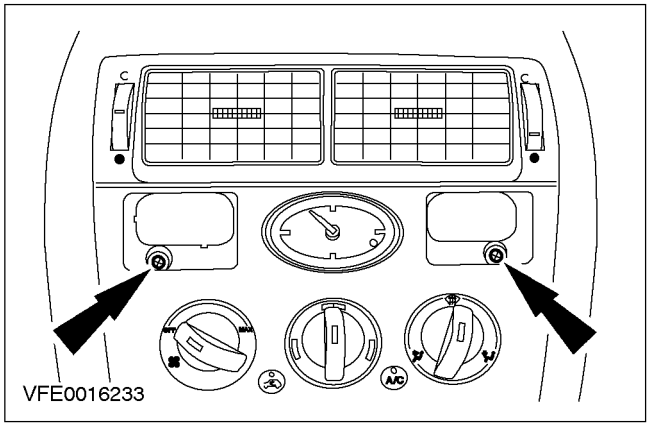


6. **Remove the operating switches.**
   - Disconnect the electrical connectors.

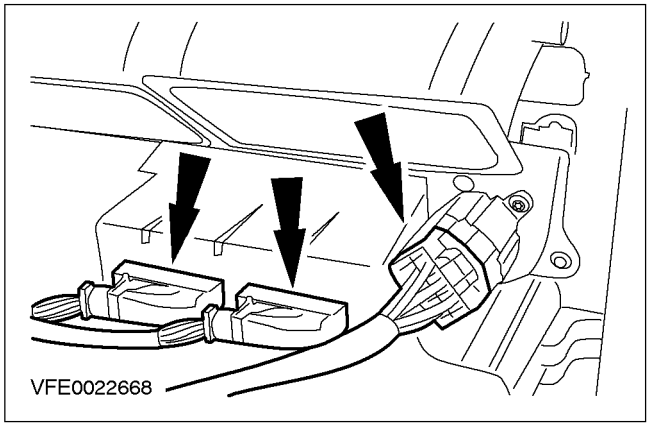


REMOVAL AND INSTALLATION (Continued)

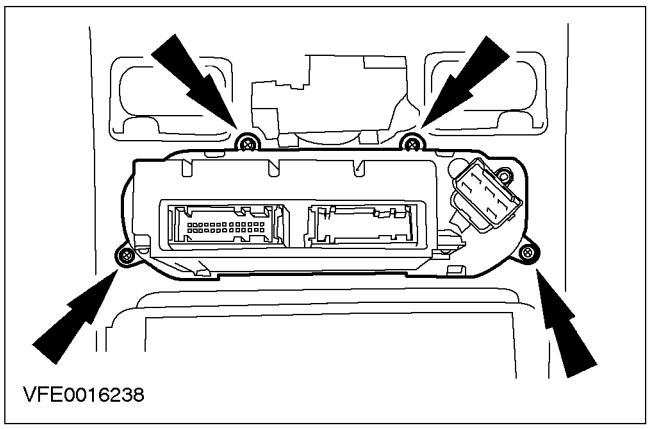
7. Remove the instrument panel center bezel upper retaining screws.



8. Disconnect the climate control assembly electrical connector.



9. Remove the climate control assembly.



Installation

1. To install, reverse the removal procedure.

SECTION 413-00 Instrument Cluster and Panel Illumination

VEHICLE APPLICATION: 2003.0 Mondeo

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DIAGNOSIS AND TESTING

Instrument Cluster and Panel Illumination

Inspection and Verification

1. Verify the customer concern .
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Fluid level(s) – Accessory installations	– Bulb(s) – Fuse(s) – Wiring harness – Electrical connector(s) – Engine/engine compartment or underbody components – Instrument cluster – Instrument cluster printed circuit

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to WDS to diagnose the system.

SECTION 413-01 Instrument Cluster

VEHICLE APPLICATION: 2003.0 Mondeo

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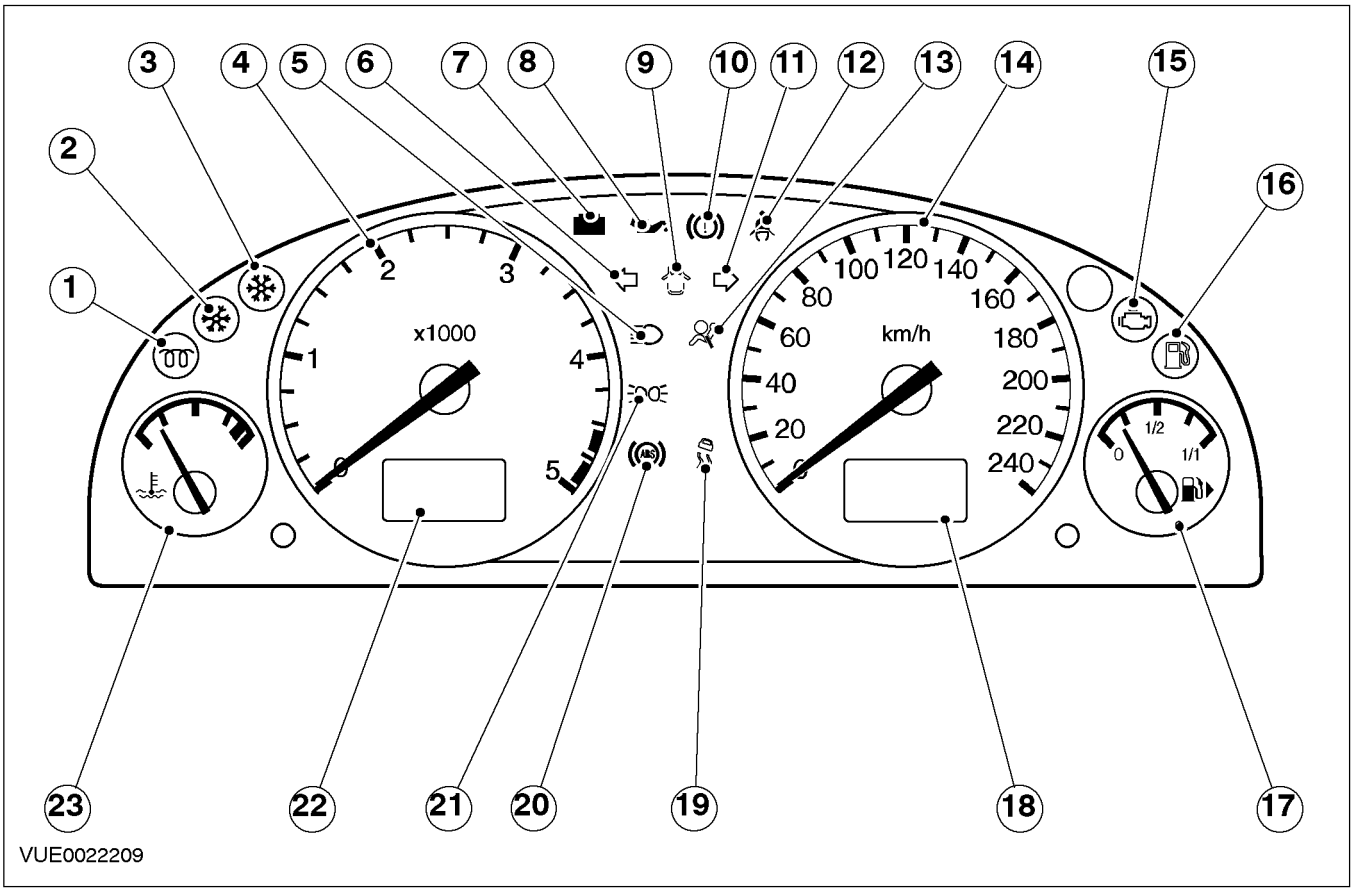
REMOVAL AND INSTALLATION

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DESCRIPTION AND OPERATION

Instrument Cluster

Instrument Cluster



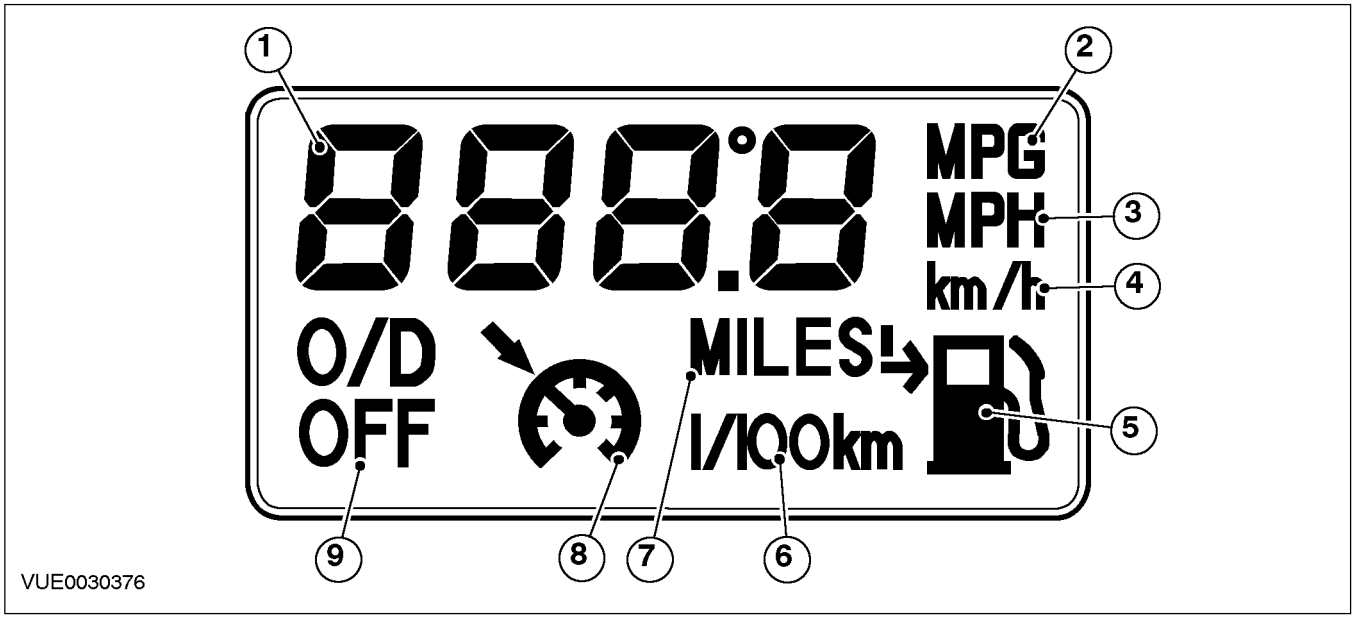
Item	Part Number	Description
1	-	Glow plug indicator (if equipped)
2	-	Ice warning indicator (red)
3	-	Frost warning indicator (orange)
4	-	Tachometer
5	-	High beam indicator
6	-	LH turn signal indicator
7	-	Charging system warning indicator
8	-	Low oil pressure warning indicator

Item	Part Number	Description
9	-	Door ajar indicator
10	-	Parking brake/brake warning indicator
11	-	RH turn signal indicator
12	-	Safety belt warning indicator
13	-	Air bag warning indicator
14	-	Speedometer
15	-	Malfunction indicator lamp (MIL)
16	-	Low fuel level indicator
17	-	Fuel gauge
18	-	Odometer

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
19	-	Stability assist indicator
20	-	Anti-lock brake system (ABS) warning indicator
21	-	Headlamp indicator
22	-	Information and message center
23	-	Temperature gauge

Information and Message Center



Item	Part Number	Description
1	-	Trip computer (average fuel economy indicator, average speed indicator, outside air temperature indicator, range to empty indicator)
2	-	Average fuel economy indicator - right-hand drive vehicles
3	-	Average speed indicator - right-hand drive vehicles
4	-	Average speed indicator/range to empty indicator - left-hand drive vehicles
5	-	Range to empty indicator - all vehicles
6	-	Average fuel economy indicator - left-hand drive vehicles
7	-	Range to empty indicator - right-hand drive vehicles
8	-	Vehicle speed control indicator (if equipped)
9	-	Overdrive indicator - vehicles with automatic transaxle

For additional information. REFER to the Owners Guide.

DIAGNOSIS AND TESTING

Instrument Cluster

Refer to Wiring Diagrams Section 413-01 for schematic and connector information.

Principles of Operation

The instrument cluster is a mix of intelligent and hardwired electrical signals and has a built-in self-test feature. The instrument cluster is connected to the powertrain control module (PCM), anti-lock brake system (ABS), traction control (TC) (if equipped) and stability assist (if equipped) by a control area network (CAN) bus. This link allows the instrument cluster and the PCM to communicate with each other. The instrument cluster consists of gauges, indicators and warning indicators. On the high series instrument cluster a trip computer is fitted to the information and message center.

When the ignition switch is turned to position II from either position 0 or position I the instrument cluster carries out a display test to verify that the warning indicators or indicator bulbs and monitored systems are functioning correctly. The warning indicators or indicator bulbs which illuminate during this test are:

- ABS
- Air bag system
- Charging system (the indicator is functional but will illuminate with the during the test)
- Brake system
- Low fuel
- Low oil pressure
- Malfunction indicator lamp (MIL)
- TC (if equipped)
- Overdrive (displayed in a liquid crystal display (LCD)) (if equipped)
- Glow plugs - Vehicles with diesel engine
- Frost (orange)
- Ice (red)
- Safety belt
- Speed control (displayed in LCD)
- Door ajar

Instrument Cluster Gauges

Engine Temperature Gauge

The engine temperature gauge uses information supplied by the engine coolant temperature (ECT) or the cylinder head temperature (CHT) sensor, through the PCM on the CAN bus. If the temperature signal is missing or invalid, the instrument cluster will move the temperature gauge pointer to below the cold position.

Fuel Gauge

The instrument cluster receives the fuel level information from the fuel level sensor (part of the fuel pump module on vehicles with a petrol engine). This is a variable resistor in the fuel gauge ground circuit. If the fuel level signal is missing or invalid, the instrument cluster will move the fuel gauge pointer to below the empty position and the low fuel warning indicator will illuminate.

The fuel gauge signal is damped to prevent pointer surge as the fuel in the fuel tank moves while the vehicle is in motion. When the ignition switch is turned to position 0 the fuel gauge pointer is moved to below the empty position.

DIAGNOSIS AND TESTING (Continued)

Speedometer

Vehicle speed information is received by the PCM from the vehicle speed sensor (VSS). The PCM calculates the vehicle speed using various factors one of these being tire size. The vehicle speed information is sent to the instrument cluster through the CAN bus, the vehicle speed information is then indicated in m.p.h.or km/h on the speedometer gauge. If this information is missing or invalid, the speedometer will default to zero.

If the tire size is changed from that originally fitted it may be necessary to change the PCM configuration. This can be done using WDS.

Odometer

Vehicle speed information is received by the PCM from the VSS. The PCM uses the configured tire size to calculate distance travelled and inputs this information to the instrument cluster through the CAN bus. The instrument cluster displays this information in an LCD. If this information is missing or invalid, the LCD will display dashes. Also incorporated in this LCD is a tripmeter.

Tachometer

Engine speed information is received by the PCM from the crankshaft position (CKP) and camshaft position (CMP) sensors. The engine speed information is sent to the instrument cluster through the CAN bus. If this information is missing or invalid, the tachometer will default to zero.

Warning Indicators

Air Bag Warning Indicator

The air bag warning indicator is controlled by the air bag module. REFER to Section 501-20A / 501-20B.

Low Fuel Warning Indicator

The instrument cluster receives the fuel level information from the fuel level sensor (part of the fuel pump module on vehicles with a petrol engine). When the fuel level in the fuel tank drops below a predetermined limit the low fuel warning indicator receives a direct signal from the fuel level sensor and illuminates the low fuel warning indicator. This information is also based on calculations from the range to empty display.

ABS Warning Indicator

The instrument cluster receives the ABS information from the ABS module. If the ABS module detects an open circuit, a short to battery, or an ABS failure the ABS warning indicator will illuminate. REFER to Section 206-09A / 206-09B. The ABS Warning indicator must be enabled when a new instrument cluster is installed. For additional information REFER to Programmable Module Installation Routine on WDS.

Brake System Warning Indicator

The brake system warning indicator has multiple functions. The warning indicator illuminates if the brake fluid level is low or if the parking brake is set or if the electronic brake distribution (EBD) fail input is high. REFER to Section 206-00.

Charging System Warning Indicator

The PCM controls the charging system warning indicator through the CAN bus. The warning indicator is illuminated if the charging system is not operating correctly, or if the ignition switch is turned to position II but the engine is not running. REFER to Section 414-00. This signal is sent to the generic electronic module (GEM) and fuel fired heater (if equipped). The signal is used by the GEM to control when the fuel fired heater can be activated.

Traction Control (TC) Warning Indicator (if equipped)

The TC indicator is controlled by the ABS/TC module. The TC indicator flashes to indicate when a concern is present. REFER to Section 206-09A / 206-09B. This information is provided to the instrument cluster through the CAN bus. The TC system can be disabled by pressing the TC OFF button which is located in the instrument panel center console.

If the TC indicator is required it must be enabled when a new instrument cluster is installed. For additional information REFER to Programmable Module Installation Routine on WDS.

DIAGNOSIS AND TESTING (Continued)

Low Oil Pressure Warning Indicator

The low oil pressure warning indicator has a direct connection to the engine oil pressure switch through the instrument cluster. With the ignition switch in position II, the low oil pressure warning indicator illuminates. After the engine is started, the oil pressure switch opens at a predetermined pressure, breaking the ground circuit continuity which extinguishes the oil pressure warning indicator.

Door Ajar Warning Indicator

The door ajar indicator is controlled by the GEM. The system operates by supplying a ground when the GEM detects a door(s) or liftgate/luggage compartment lid which is opened or not fully closed, which will illuminate the indicator. The GEM has a direct connection to the door ajar indicator through the instrument cluster.

Frost Warning Indicator or Ice Warning Indicator

The ambient temperature is provided by the ambient temperature sensor to the PCM. The PCM provides this signal to the instrument cluster through the CAN bus. When the ambient temperature falls to 4°C (40°F) there is an audible chime from the GEM and the amber frost warning indicator illuminates. When the ambient temperature falls to 0°C (32°F) or below, the red ice warning indicator illuminates and the amber frost warning indicator extinguished. This is to alert the driver to the possibility of icy roads.

Glow Plug Warning Indicator - Vehicles with Diesel Engine

The glow plug warning indicator will illuminate when the ignition is in the ON position with the engine OFF while the glow plugs are heating. The glow plug warning indicator is controlled by the PCM through the CAN bus. The glow plug warning indicator will also flash to indicate the presence of a hard DTC. REFER to Section 303-04A / 303-04B.

High Beam Indicator

The high beam indicator has a direct connection to the steering column multifunction switch through the instrument cluster.

When high beam is selected on the steering column multifunction switch power is sent by a direct connection to the high beam indicator in the instrument cluster. The high beam indicator has a permanent ground and therefore when the power is supplied the indicator illuminates.

Left and Right Turn Signal Indicators

The left and right turn signal indicators have a direct connection to the GEM. The GEM provides a permanent ground to the turn signal indicators.

When the left or right turn signals are selected on the steering column multifunction switch power is sent through the GEM and instrument cluster to illuminate the left and right turn signal indicators.

Malfunction Indicator Lamp (MIL)

The MIL illuminates where the exhaust emissions are affected and an appropriate diagnostic trouble code (DTC) is registered in the PCM.

When an emission related DTC is registered in the PCM, the PCM will send a signal through the CAN bus to the instrument cluster to illuminate the MIL. The DTC and associated concern must be rectified and cleared from the PCM memory for the MIL to extinguish.

Liftgate/Luggage Compartment Release Inhibit

The GEM uses a direct connection to the instrument cluster to ascertain the current vehicle speed. If the vehicle speed is above 3 m.p.h. (5 km/h) the GEM will inhibit the liftgate/luggage compartment lid from being opened using the remote luggage compartment release.

Ambient Temperature

The ambient temperature is provided by the ambient temperature sensor to the PCM. The PCM provides this signal to the instrument cluster through the CAN bus. The ambient temperature is displayed in the left-hand LCD in the instrument cluster. To change the ambient temperature from °C to °F press the left-hand reset button.

Warning Chimes

All warning chimes are generated by the GEM. The following warning chimes can be requested by the instrument cluster through the GEM to function on the vehicle:

DIAGNOSIS AND TESTING (Continued)

- Reverse gear selected (if equipped)
- Low fuel
- Distance to fuel tank empty
- Frost/ice warning
- Overspeed chime (configurable if equipped)
- Trip computer mode select

Information and Message Center Indicators and Warning Indicators

The information and message center is located in the left-hand LCD of a high series instrument cluster. The information and message center can supply the driver with the following information.

All the functions within the information and message center can be selected by pressing the INFO button on the directional indicator switch.

– Average speed
– Range to empty
– Average fuel economy
– Outside air temperature

Average Speed

This function indicates the average vehicle speed calculated during the last 500 miles (804 km), or since the last reset. Press the left-hand reset button in the instrument cluster for 3 seconds at any time to reset the average speed calculated.

Range to Empty

This function indicates the approximate distance the vehicle will travel using the remaining fuel in the fuel tank. Changes in driving pattern may cause this figure to vary. A short audible chime will be emitted when the remaining distance is 50 miles (80 km), 25 miles (40 km) and 10 miles (20 km).

Average Fuel Economy

This function indicates the average fuel consumption of the vehicle since the function was last reset. Press the left-hand reset button in the instrument cluster for 3 seconds at any time to reset the average fuel economy.

Gear Selection Display - Vehicles with 5-speed Automatic Transaxle

This function indicates what mode and gear the vehicle is in. If the transaxle is in automatic mode the display will show 'AUTO' and the selector lever indicator will display the gear selected. If the transaxle is in manual mode the display will show 'MAN' and the selector lever indicator will display the gear selected. The gear selection display is located in the information and message center which is located in the left-hand LCD of the instrument cluster

Control Area Network (CAN)

The CAN is an electronic link enabling the instrument cluster to communicate with the PCM, ABS/TC module and stability assist module. This creates a pathway through the data link connector (DLC) for WDS, although WDS uses the ISO link to access the instrument cluster control systems. This increases the WDS diagnostic capabilities.

Configuration of Instrument Cluster

The instrument cluster is a programmable module, which must be configured by selecting the Programmable Module Installation Routine on WDS.

The following features will need to be configured when a new instrument cluster is installed:

- Overspeed chime (if equipped)
- Speed control (if equipped)
- TC indicator (if equipped)
- Reverse warning chime (if equipped)

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

DIAGNOSIS AND TESTING (Continued)

Mechanical	Electrical
– Engine oil filter – Oil pump – Engine oil level – Oil pressure switch – Engine coolant level – Coolant thermostat – Fuel gauge – Door adjustment	– Fuse(s) – Bulb(s) – LED(s) – Wiring harness – Electrical connector(s) – Sensor(s) – Instrument cluster – Instrument cluster printed circuit

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: If all of the following systems are not operating correctly this may indicate a concern with the GEM. If one or more of the following systems operate correctly this may indicate an instrument cluster concern.

4. Verify the following systems are working correctly by operating the system.
   - Charging
   - Turn signals
   - Headlamps
5. If the concern remains after the inspection, enter the instrument cluster Self-Diagnostic Mode.

Self-Diagnostic Mode

1. To enter the instrument cluster Self-Diagnostic Mode simultaneously press and hold the tripmeter reset button and turn the ignition switch to position II.
2. When TEST is displayed in the LCD release the tripmeter reset button
3. The instrument cluster will enter the gauge sweep test.
4. To navigate through or skip any of the instrument cluster Self-Diagnostic Mode tests press the tripmeter RESET button.
5. The self-test is deactivated when the ignition switch is turned to the OFF position or when the tripmeter reset button is pressed and held for 5 seconds.
6. If Self-Diagnostic Mode cannot be accessed use WDS to diagnose instrument cluster.

NOTE: Additional tests are available after the following but are not applicable for this diagnostic.

Self - Diagnostic Mode

Test	Message Displayed	Gauge/Indicator/Display/Inputs/System Tested	Description
1. Gauge sweep	GAGE	Tachometer, speedometer, temperature and fuel	All gauges go through a full up and down pointer sweep smoothness check, which takes approximately 5 seconds
2.All LCD are illuminated	8888	LCD displays built into Speedometer and Tachometer	Fills in all segments of LCD display therefore seeing if display functioning correctly

DIAGNOSIS AND TESTING (Continued)

Test	Message Displayed	Gauge/Indicator/Display/Inputs/System Tested	Description
3. Indicator bulbs	bulb	Instrument cluster illuminates indicators and warning indicators	Illuminates the following warning indicators that are controlled by the instrument cluster • ABS • Brake warning • Glow plugs (if equipped) • Frost warning (orange) • Ice warning (red) • Low fuel • MIL • TC (if equipped)
4. ROM level	rXXXX	Instrument cluster read only memory (ROM)	Displays the instrument cluster ROM revision level
5. NVM (ROM) level	ErXXXX	Instrument cluster non volatile memory (NVM)	Displays the instrument cluster NVM revision
6. EEPROM level	E XX	Instrument cluster EEPROM level	Displays the instrument cluster EEPROM revision
7. DTC	DTC or NONE	DTCs	The DTCs stored will be displayed. The DTC codes will scroll through if there is more than one
8. Road speed m.p.h.	SPXXXX	Speedometer	Displays the current vehicle speed input in m.p.h.
9. Road speed Km/h	SPXXXX	Speedometer	Displays the current vehicle speed signal input in Km/h
10. Engine speed	tAXXXX	Tachometer	Displays the current engine speed tachometer input signal (RPM)
11. Fuel volume	FXXX	Fuel level sensor	Displays the fuel volume signal input (0 = empty, 255 = full)
12.ECT/CHT	XXXC	ECT/CHT	Displays the temperature signal input in degrees C
13. Battery voltage	btXXX	Battery voltage	Displays battery voltage input

7. REFER to WDS to continue diagnostics.
8. On vehicles with 5-speed automatic transaxle, if two dashes are shown on the information and message center in place of the selector lever indicator. GO to Symptom Chart for further diagnosis.

Symptom Chart

Condition	Possible Sources	Action
•The information and message center selector lever indicator displays two dashes	•Transmission range (TR) sensor.	•CHECK the TR sensor. REFER to Section 307-01A / 307-01B.
	•Circuit.	•CARRY out wiring checks between theTR sensor and the instrument cluster. REFER to wiring diagrams.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
	•Instrument cluster.	•REFER to WDS.

REMOVAL AND INSTALLATION

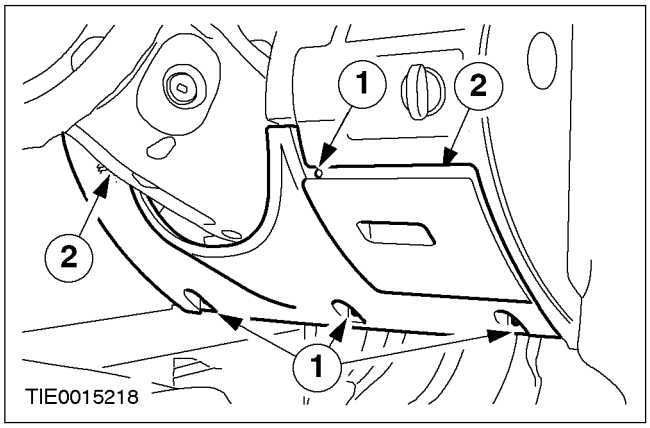
Instrument Cluster (33 214 0)

Removal

NOTE: If a new instrument cluster is being installed connect WDS. Upload the instrument cluster configuration information using the programmable modules installation routine prior to commencing the removal of the instrument cluster.

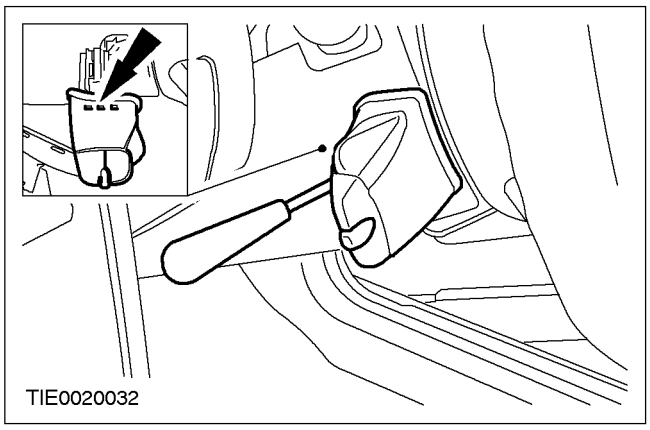
1. Remove the instrument panel lower panel.

1. Remove the retaining screws.
2. Release the retaining clips.



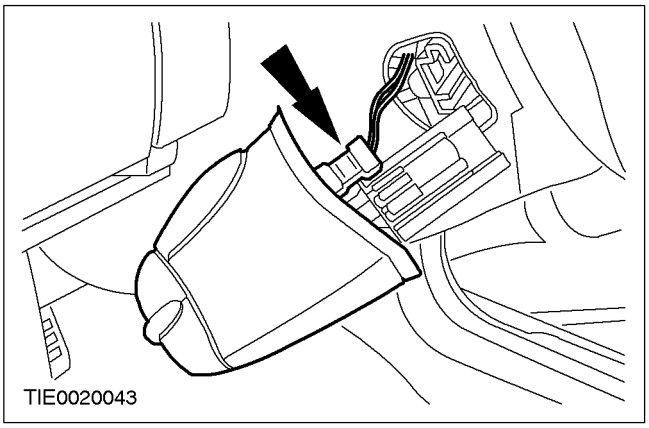
2. Detach the audio control switch from the steering column lower shroud (if equipped).

- Using a thin bladed screwdriver, release the locking tang.



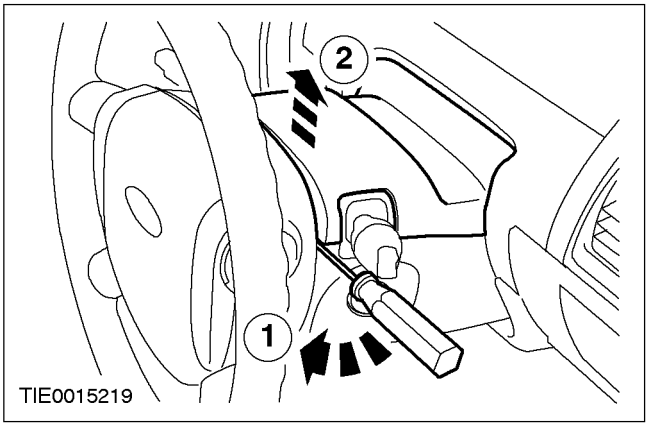
3. Remove the audio control switch (if equipped).

- Disconnect the electrical connector.

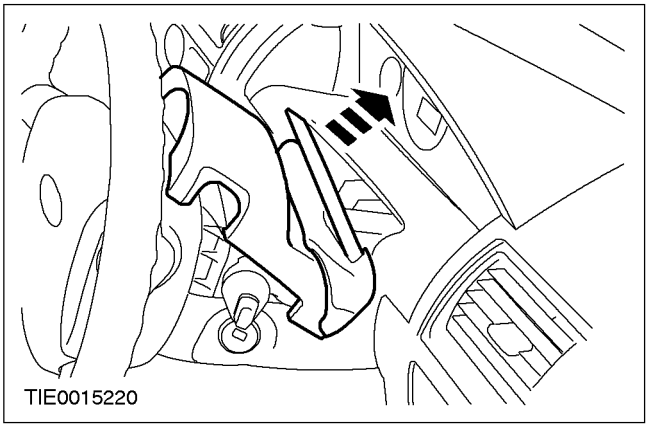


4. Detach the steering column upper shroud.

1. Using a thin bladed screw driver, release the two clips (one each side).
2. Detach the shroud.

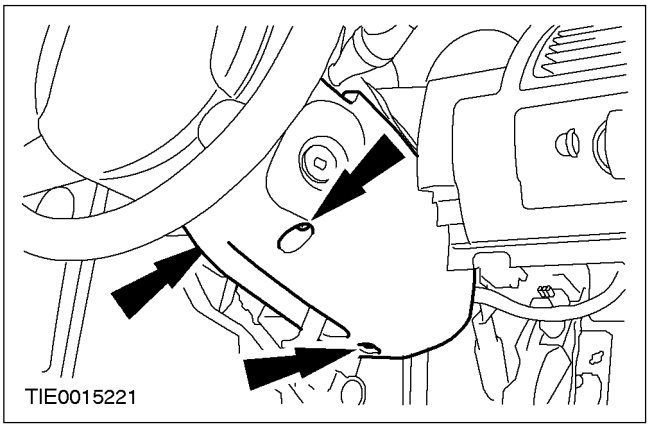


5. Remove the steering column upper shroud.

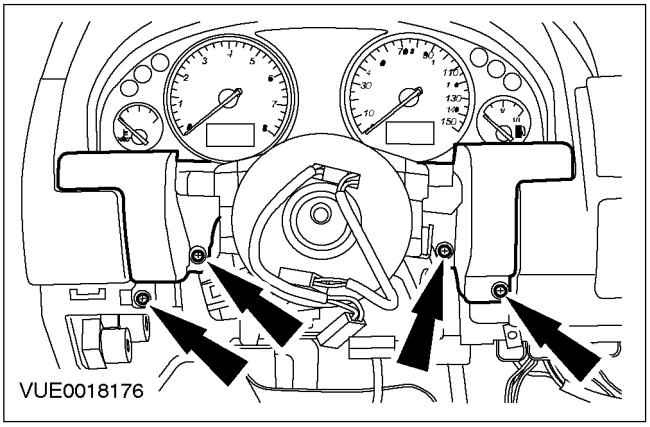


REMOVAL AND INSTALLATION (Continued)

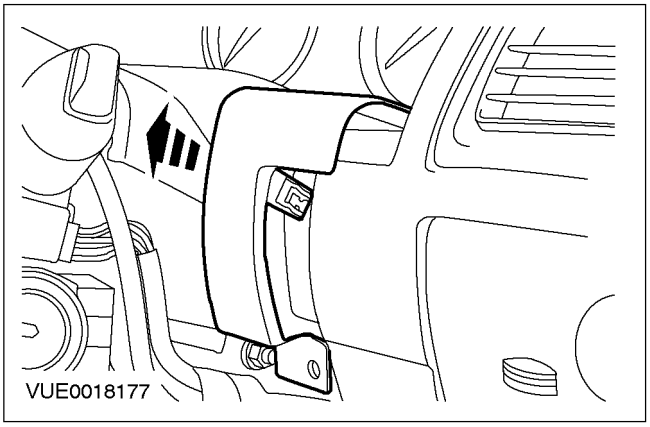
6. Remove the steering column lower shroud.



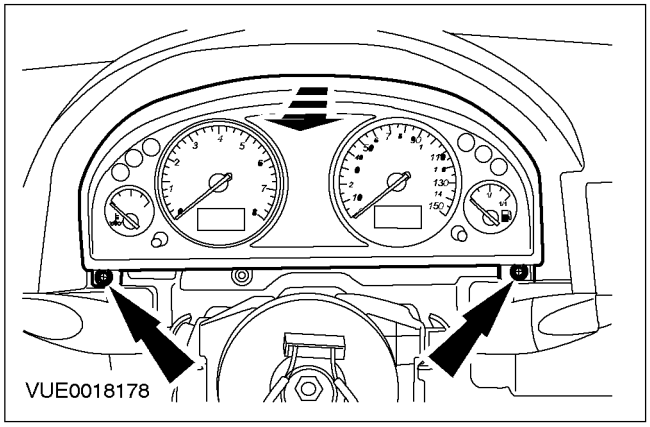
7. Remove the instrument cluster finish panel retaining screws. (Steering wheel shown removed for clarity).



8. Remove the instrument cluster finish panel.



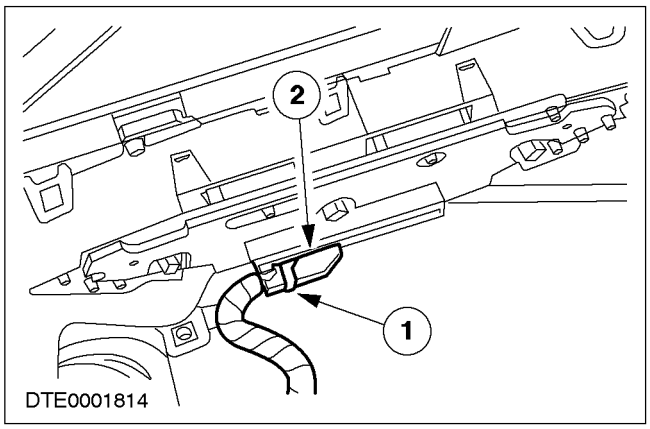
9. Remove the instrument cluster retaining screws and detach the instrument cluster.



10. ⚠ CAUTION: The instrument cluster must be kept upright to avoid silicone liquid leaking from the gauges.

Remove the instrument cluster.

1. Release the locking tang.
2. Disconnect the instrument cluster electrical connector.



Installation

NOTE: If a new instrument cluster is being installed connect WDS. Download the instrument cluster configuration information using the programmable modules installation routine after the installation of the instrument cluster.

1. To install, reverse the removal procedure.

SECTION 413-06 Horn

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

Specifications 413-06-2

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Horn 413-06-3
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Symptom Chart 413-06-3
Pinpoint Tests 413-06-3

REMOVAL AND INSTALLATION

Horn Switch ..... (33 523 0) 413-06-11

SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Horn switch retaining bolts	4	-	35

DIAGNOSIS AND TESTING

Horn

Refer to Wiring Diagrams Section 413-06 for schematic and connector information.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
– Fuse(s) – Wiring harness – Electrical connector(s) – Horn(s) – Relay – Horn switch – Clock spring

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Condition	Possible Sources	Action
•The horn does not sound	•Fuse(s). •Circuit(s). •Horn(s). •Horn switch. •Clock spring. •Horn relay.	• GO to Pinpoint Test A
•The horn sounds continuously	•Circuit(s). •Horn switch. •Clock spring. •Horn relay.	• GO to Pinpoint Test B

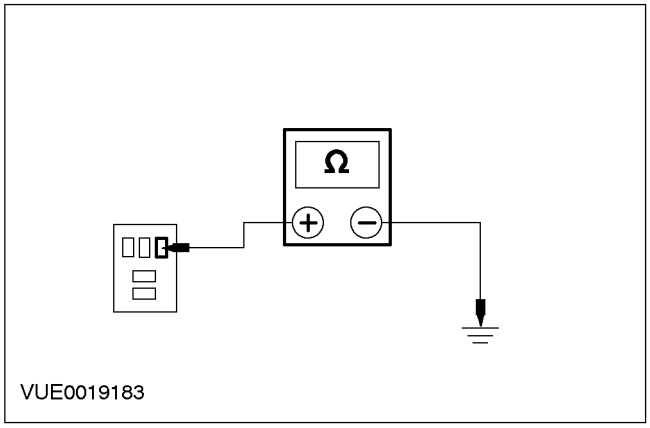
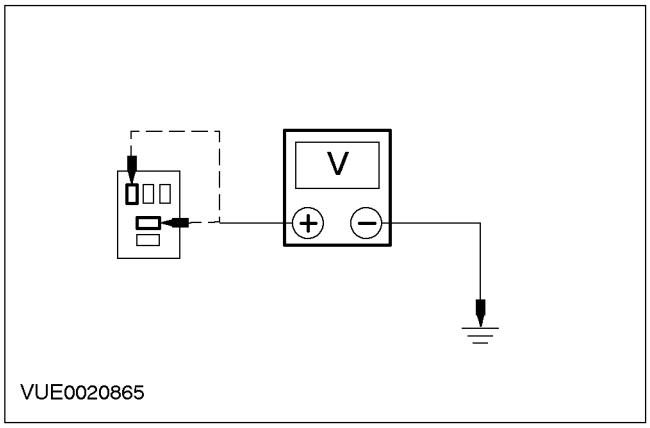
Pinpoint Tests

NOTE: Use a digital multimeter for all electrical measurements.

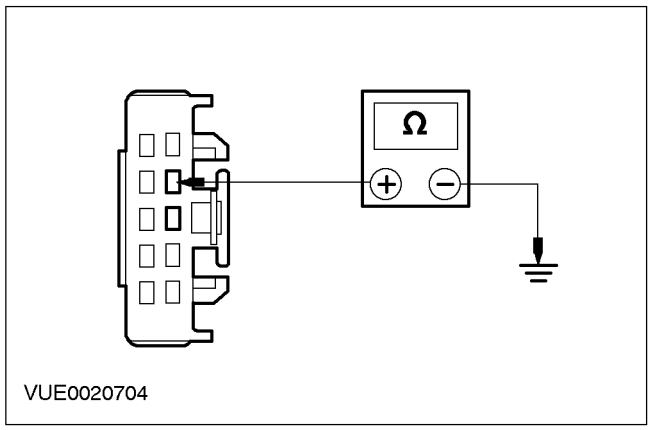
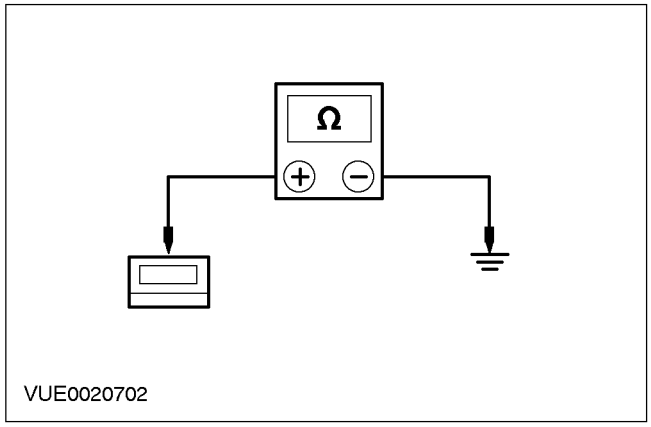
PINPOINT TEST A: THE HORN DOES NOT SOUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK THE OPERATION OF THE HORN RELAY	
	1 Press the horn switch and listen for the horn relay clicking. • Does the horn relay click when the horn switch is pressed? → **Yes** GO to **A8** → **No** GO to **A2**
A2: CHECK THE HORN SWITCH OPERATION	
	1 Disconnect Horn Relay C903.

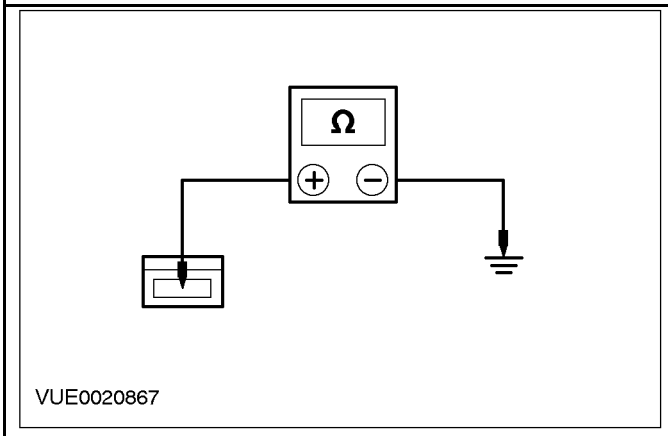
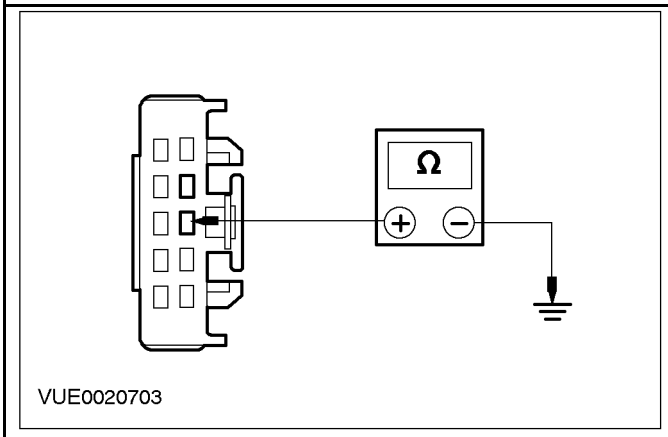
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	2 Press and hold the horn switch. 3 Measure the resistance between horn relay C903 pin 1, circuit 31S-GJ7 (BK), harness side and ground. 4 Release the horn switch. • Is the resistance less than 5 ohms? → **Yes** GO to **A3** → **No** GO to **A4**
A3: CHECK FOR VOLTAGE AT HORN RELAY	
	1 Measure the voltage between horn relay C903 pin 2, circuit 30-GJ7 (RD), harness side and ground; and between the horn relay C903 pin 5, circuit 30-GJ8 (RD), harness side and ground. • Are the voltages greater than 10 volts? → **Yes** CARRY OUT the relay Component Test. REFER to the wiring diagrams. INSTALL a new horn relay as necessary. TEST the system for normal operation. → **No** INSTALL a new battery junction box (BJB). TEST the system for normal operation.
A4: CHECK CIRCUIT 31S-GJ7 (BK/BU) FOR SHORT TO GROUND	
WARNING: To deactivate the air bag module, refer to the procedure in Section 501-20B for the correct air bag module deactivation procedure. Failure to follow this instruction may result in personal injury.	
	1 Remove the driver air bag module. REFER to Section 501-20A / 501-20B.

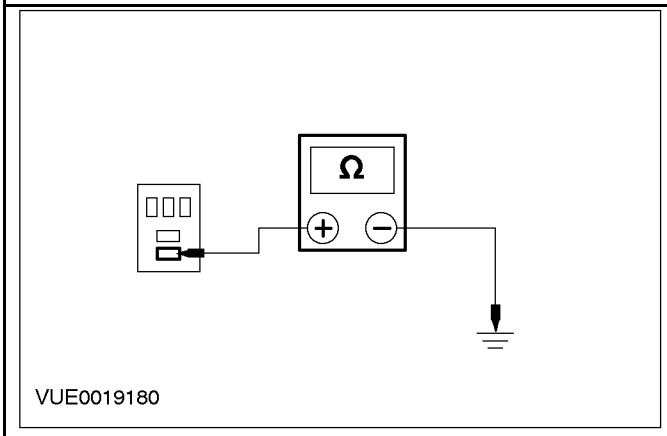
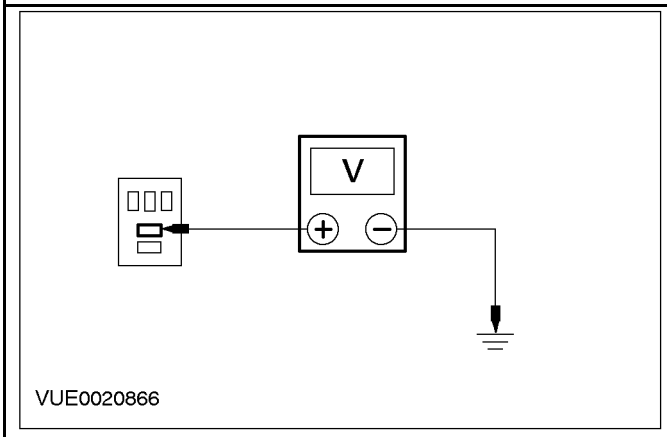
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VUE0020704	2 Disconnect Clock Spring C413. 3 Measure the resistance between clock spring C413 pin 4, circuit 31S-GJ7 (BK/BU), harness side and ground. • Is the resistance less than 5 ohms? → **Yes** REPAIR the circuit. TEST the system for normal operation. → **No** GO to **A5**
A5: CHECK THE CLOCK SPRING	
 VUE0020702	1 Disconnect Horn Switch C4. 2 Measure the resistance between horn switch C4 pin 1, harness side and ground. • Is the resistance greater than 10,000 ohms? → **Yes** GO to **A6** → **No** INSTALL a new clock spring. REFER to Section 501-20A / 501-20B. TEST the system for normal operation.
A6: CHECK THE HORN SWITCH	
	1 Disconnect Horn Switch C5.

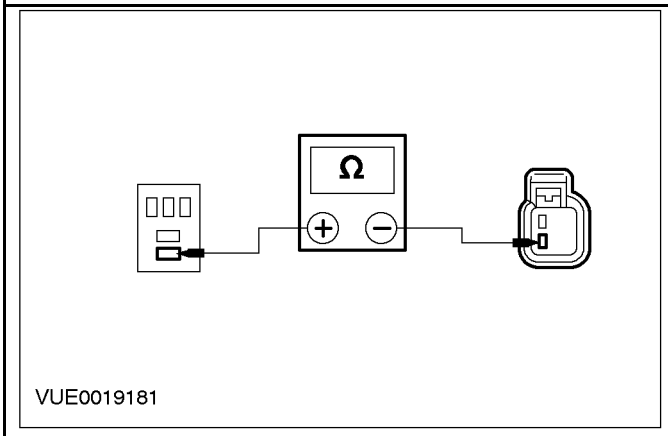
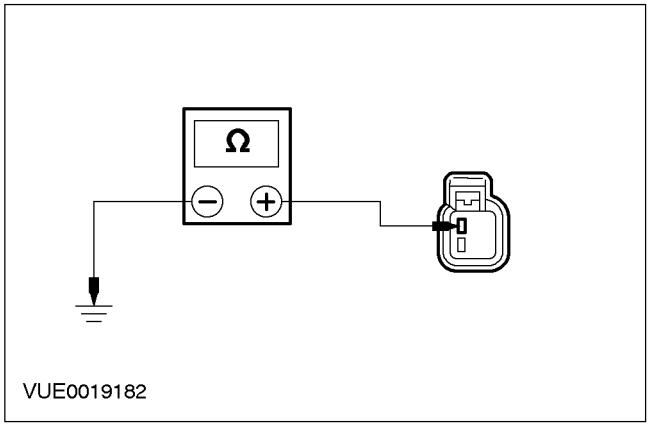
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VUE0020867	**2** Measure the resistance between horn switch C5 pin 1, component side and ground. • Is the resistance greater than 10,000 ohms? → **Yes** INSTALL a new horn switch. REFER to Horn Switch in this section. TEST the system for normal operation. → **No** GO to **A7**
A7: CHECK GROUND CIRCUIT 31-GJ9 (BK)	
 VUE0020703	**1** Measure the resistance between clock spring C413 pin 3, circuit 31-GJ9 (BK), harness side and ground. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new clock spring. REFER to Section 501-20A / 501-20B. TEST the system for normal operation. → **No** REPAIR the circuit. TEST the system for normal operation.
A8: CHECK THE HORN GROUND CIRCUIT	
	1 Disconnect Horn Relay C903.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**2** Measure the resistance between horn relay C903 pin 3, circuit 29S-GJ6 (OG/YE), harness side and ground. • Is the resistance between 0.5 and 4 ohms? → **Yes** GO to **A9** → **No** GO to **A10**
A9: CHECK VOLTAGE AT HORN RELAY	
	**1** Measure the voltage between horn relay C903 pin 5, circuit 30-GJ8 (RD), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** CARRY OUT the relay Component Test. REFER to the wiring diagrams. INSTALL a new horn relay as necessary. TEST the system for normal operation. → **No** INSTALL a new battery junction box (BJB). TEST the system for normal operation.
A10: CHECK CIRCUIT 29S-GJ6 (OG/YE) FOR OPEN	
	1 Disconnect Horn C151.

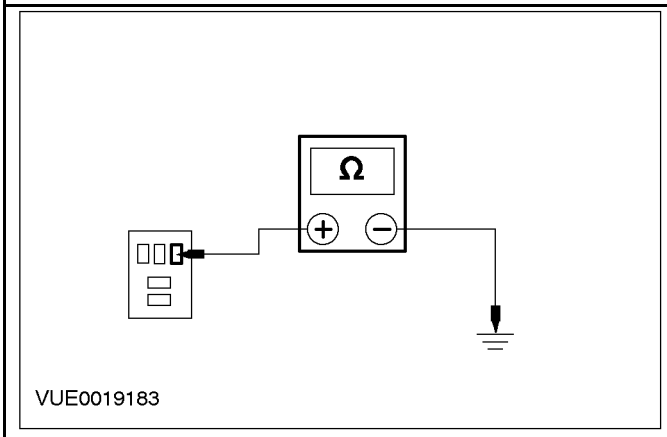
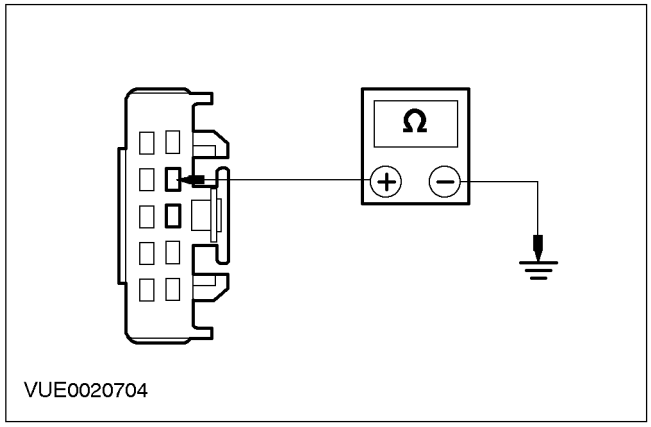
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	2 Measure the resistance between horn relay C903 pin 3, circuit 29S-GJ6 (OG/YE), harness side and the horn C151 pin 2, harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **A11** → **No** REPAIR the circuit. TEST the system for normal operation.
A11: CHECK THE HORN GROUND CIRCUIT	
	1 Measure the resistance between horn C151 pin 1, circuit 31-GJ6 (BK), harness side and ground. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new horn. TEST the system for normal operation. → **No** REPAIR circuit 31-GJ6 (BK). TEST the system for normal operation.

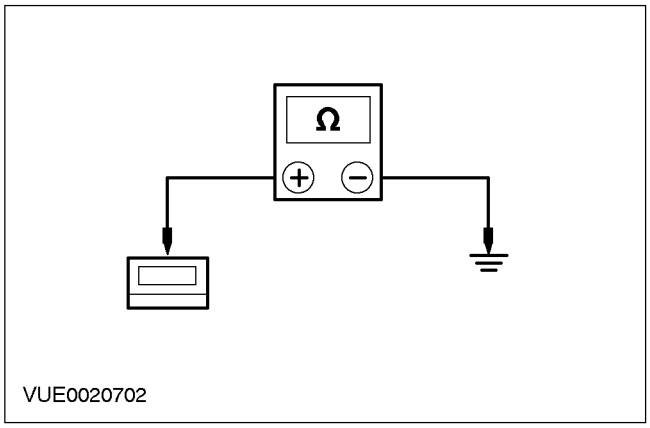
PINPOINT TEST B: THE HORN SOUNDS CONTINUOUSLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK CIRCUIT 29S-GJ6 (OG/YE) FOR SHORT TO (B+)	
	1 Disconnect Horn Relay C903. • Does the horn stop when the relay is disconnected? → **Yes** GO to **B2**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **No** REPAIR the circuit. TEST the system for normal operation.
B2: CHECK CIRCUIT 31S-GJ7 (BK)	
	1 Measure the resistance between horn relay C903 pin 1, circuit 31S-GJ7 (BK), harness side and ground. • Is the resistance greater than 10,000 ohms? → **Yes** CARRY OUT the relay Component Test. REFER to the wiring diagrams. INSTALL a new horn relay as necessary. TEST the system for normal operation. → **No** GO to **B3**
B3: CHECK CIRCUIT 31S-GJ7 (BK/BU) FOR SHORT TO GROUND	
WARNING: To deactivate the air bag module, refer to the procedure in Section 501-20B for the correct air bag module deactivation procedure. Failure to follow this instruction may result in personal injury.	
	1 Remove the driver air bag module. REFER to Section 501-20A / 501-20B. 2 Disconnect Clock Spring C413. 3 Measure the resistance between horn switch C413 pin 4, circuit 31S-GJ7 (BK/BU), harness side and ground. • Is the resistance greater than 10,000 ohms? → **Yes** GO to **B4** → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR the circuit. TEST the system for normal operation.
B4: CHECK THE CLOCK SPRING	
	1 Disconnect Horn Switch C4. 2 Measure the resistance between horn switch C4 pin 1, circuit 31S-GJ9 (BK), component side and ground. • Is the resistance greater than 10,000 ohms? → **Yes** INSTALL a new clock spring. REFER to Section 501-20A / 501-20B. TEST the system for normal operation. → **No** INSTALL a new horn switch. REFER to Horn Switch in this section. TEST the system for normal operation.

REMOVAL AND INSTALLATION

Horn Switch (33 523 0)

Removal

1. **Remove the driver air bag module. For additional information, refer to Section 501-20A / 501-20B.**

Installation

1. **To install, reverse the removal procedure.**

SECTION 413-07 Clock

VEHICLE APPLICATION: 2003.0 Mondeo

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Symptom Chart 413-07-2
Pinpoint Tests 413-07-2

REMOVAL AND INSTALLATION

Clock ..... (33 374 0) 413-07-4

DIAGNOSIS AND TESTING

Clock

Refer to Wiring Diagrams Section 413-06 for schematic and connector information.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
– Fuse(s) – Wiring harness – Electrical connector(s) – Clock

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

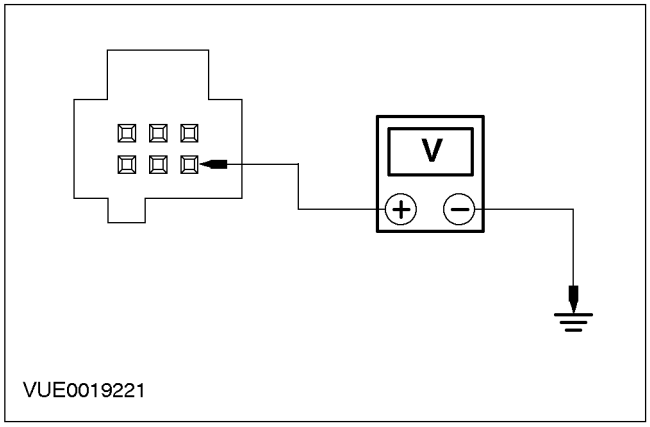
Symptom Chart

Condition	Possible Sources	Action
•The clock operation is erratic/inoperative	•Fuse(s). •Circuit. •Clock.	• GO to Pinpoint Test A

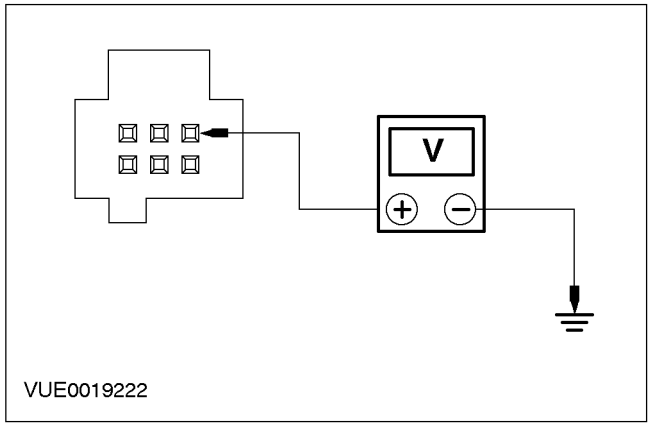
Pinpoint Tests

NOTE: Use a digital multimeter for all electrical measurements

PINPOINT TEST A: THE CLOCK OPERATION IS ERRATIC/INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK CIRCUIT 29-GB6 (OG/YE) FOR VOLTAGE	
	1 Key in OFF position. 2 Disconnect Clock C412. 3 Measure the voltage between clock C412 pin 6, circuit 29-GB6 (OG/YE), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **A2** → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	CHECK fuse F75 (7.5A). INSTALL a new fuse as required. If the fuse fails again check for short to ground. REPAIR the circuit. TEST the system for normal operation.
A2: CHECK CIRCUIT 31-GB6 (BK) FOR OPEN	
	1 Measure the resistance between C412 pin 3, circuit 31-GB6 (BK), harness side and ground. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new clock. REFER to Clock in this section. TEST the system for normal operation. → **No** REPAIR the circuit. TEST the system for normal operation.

REMOVAL AND INSTALLATION

Clock (33 374 0)

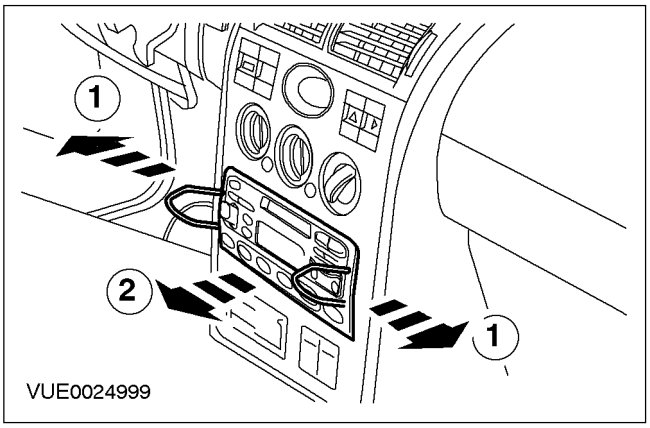
Removal

Vehicles with automatic transaxle

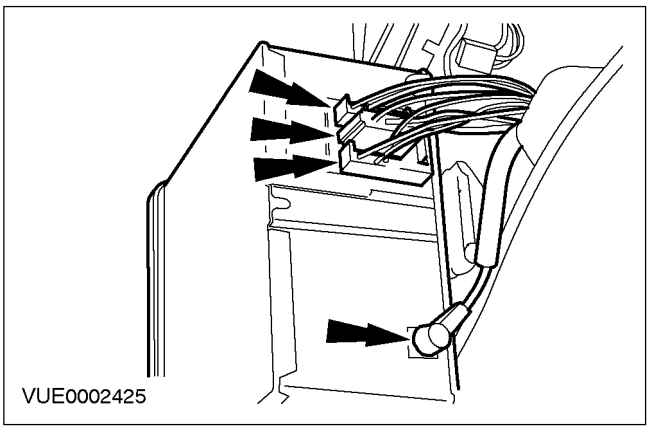
1. **Move the automatic transaxle selector lever to the ""N" position.**

All vehicles

2. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
3. **Detach the audio unit from the heater control trim panel.**
   1. Using audio unit removal tools, gently pull the removal tools to the left and right of the audio unit to release the locking tangs.
   2. Slide the audio unit out of the heater control trim panel.

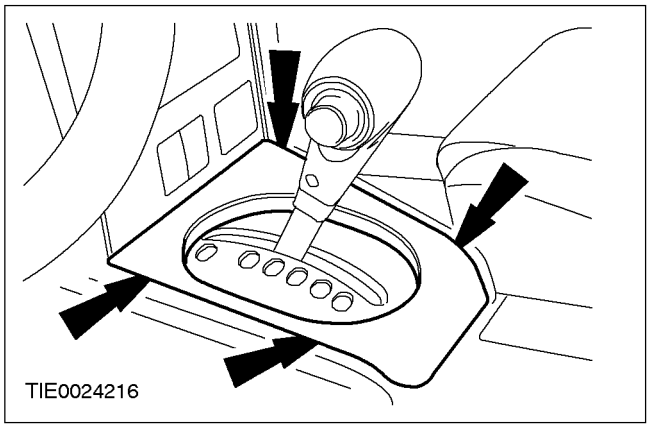


4. **Remove the audio unit.**
   - Disconnect the antenna cable and the audio unit electrical connectors.



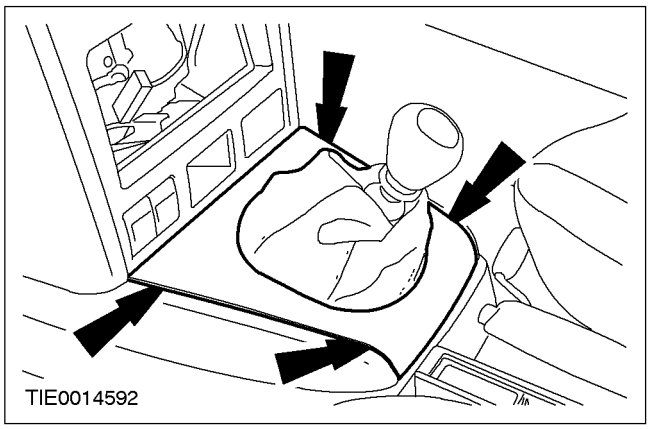
Vehicles with automatic transaxle

5. **Remove the automatic transaxle selector lever trim.**



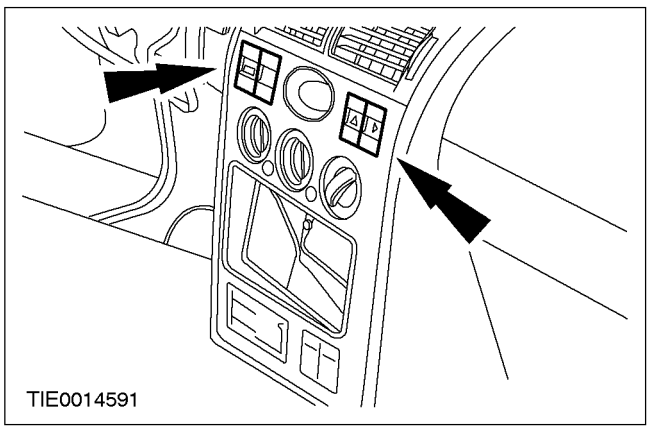
Vehicles with manual transaxle

6. **Remove the gearshift lever boot.**



All vehicles

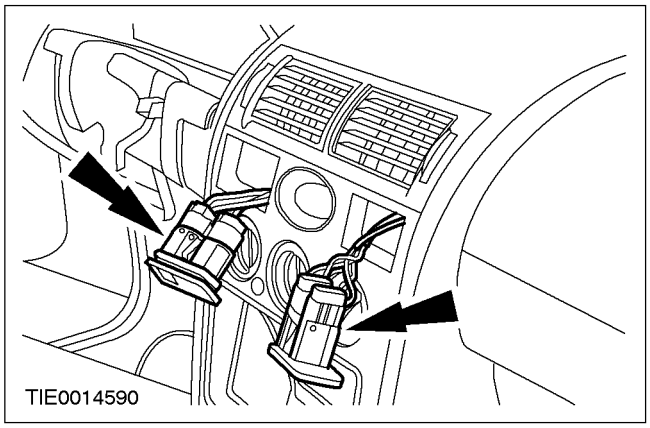
7. **Detach the accessory switches from the heater control trim panel.**



REMOVAL AND INSTALLATION (Continued)

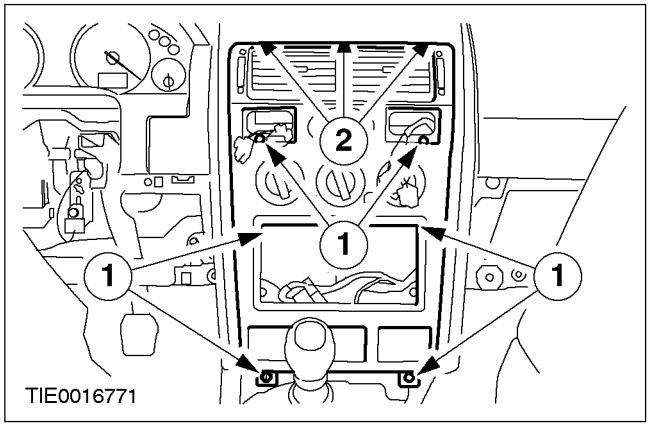
8. Remove the heater control trim panel accessory switches.

- Disconnect the electrical connectors.

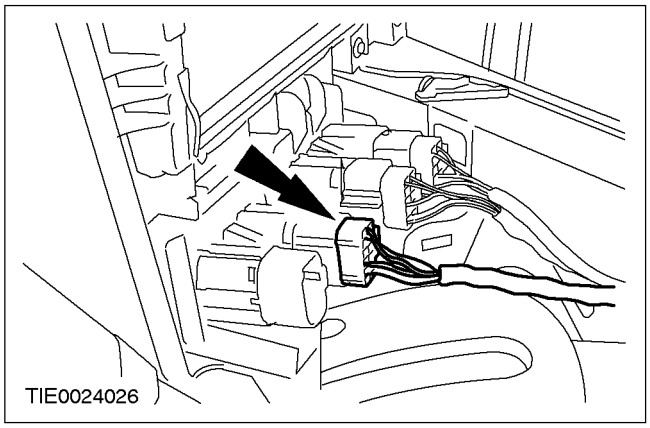


9. Detach the heater control trim panel from the instrument panel.

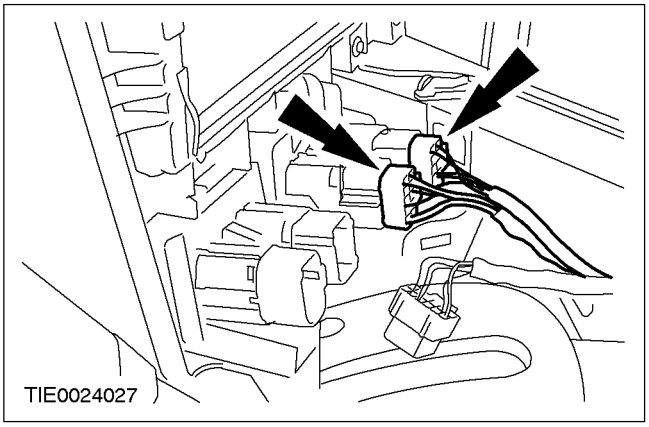
1. Remove the retaining screws.
2. Detach the retaining clips.



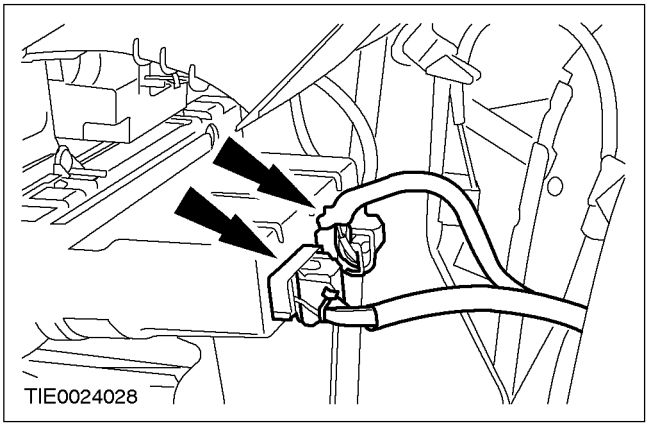
10. Disconnect the liftgate release switch electrical connector.



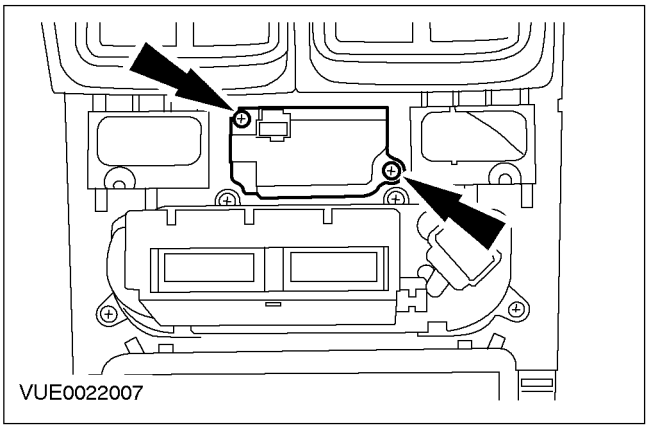
11. Disconnect the heated front seats electrical connectors.



12. Disconnect the auxiliary climate control electrical connectors.



13. Remove the clock from the heater control trim panel.



Installation

1. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION (Continued)

2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

SECTION 413-08 Information and Message Center

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DESCRIPTION AND OPERATION

Information and Message Center

For additional information, refer to Section 413-01.

DIAGNOSIS AND TESTING

Information and Message Center

1. REFER to Section 413-01.

SECTION 413-09 Warning Devices

VEHICLE APPLICATION: 2003.0 Mondeo

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Warning Devices 413-09-2
Principles of Operation 413-09-2
Inspection and Verification 413-09-2
Symptom Chart 413-09-2
Pinpoint Tests 413-09-2

GENERAL PROCEDURES

Belt Minder Deactivating/Activating 413-09-5
Preparation 413-09-5
Deactivating/Activating 413-09-5

DIAGNOSIS AND TESTING

Warning Devices

Refer to Wiring Diagrams Section 413-09 for schematic and connector information.

Principles of Operation

Belt Minder

The belt minder feature is a supplemental warning that augments the current safety belt warning function. This feature continually reminds the driver that their safety belt is unbuckled by intermittently sounding a chime and illuminating the safety belt warning indicator in the instrument cluster once the vehicle speed has exceeded 5 mph (7 km/h).

Immediately after ignition is turned to position II the belt minder is activated. The belt minder alternates from on for six seconds and off for 30 seconds until deactivated.

The belt minder will be deactivated under the following conditions:

- ignition switch is turned to position O
- ignition switch is turned to position I
- five minutes has elapsed with the belt minder activated

If the customer buckles their safety belt prior to belt minder becoming active, belt minder will remain inactive, i.e. will not provide a reminder, until the proper conditions are met as described above on the NEXT ignition cycle from OFF or position I to position II.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Door ajar switch(es) – Safety belt buckle and pretensioner – Headlamp switch – Fuel gauge	– Fuse(s) – Wiring harness(es) – Electrical connector(s) – Switch(es) – Sensor(s) – Generic electronic module (GEM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to WDS to diagnose the system.
5. If the vehicle is fitted with a belt minder, REFER to the Symptom Chart.

Symptom Chart

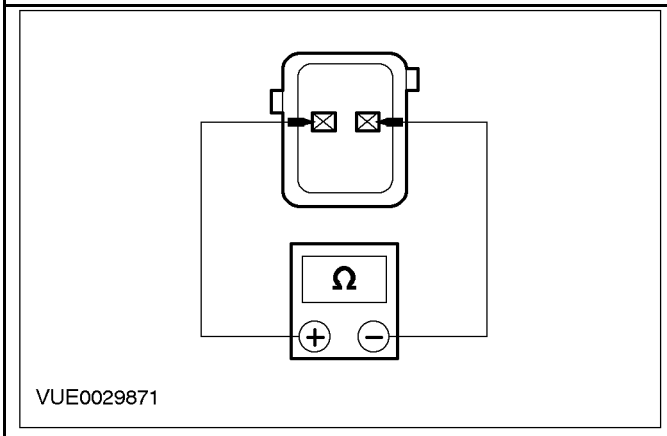
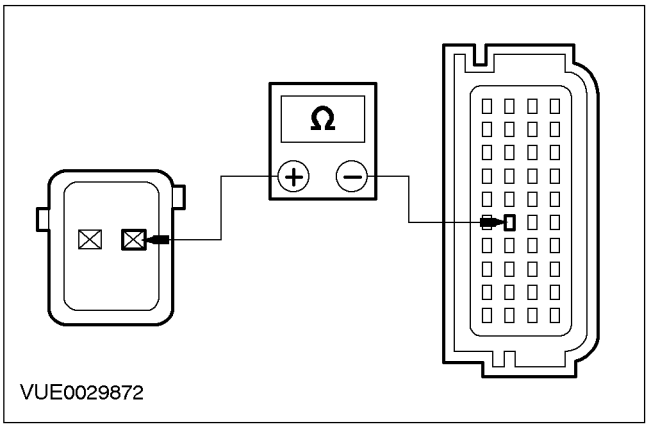
Condition	Possible Sources	Action
•The belt minder feature does not operate correctly	•Safety belt warning indicator switch. •Circuit(s). •Restraints control module (RCM).	• GO to Pinpoint Test A.

Pinpoint Tests

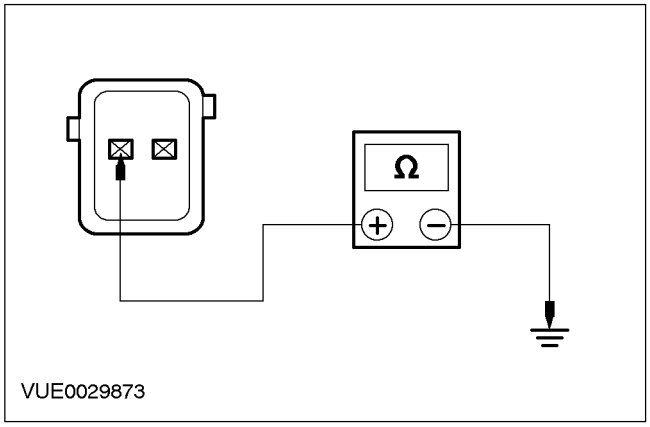
PINPOINT TEST A: THE BELT MINDER FEATURE DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK SAFETY BELT BUCKLE SWITCH FOR CORRECT OPERATION	
	1 Key in OFF position. 2 Disconnect Safety Belt Buckle Switch C60f.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VUE0029871	**3** Measure the resistance between the safety belt buckle switch C60f, pin 1 and pin 2, component side. **4** Connect the safety belt buckle in to the seat belt pretensioner. **5** Measure the resistance between the safety belt buckle switch C60f pin 1 and pin 2, component side. • Does the resistance change from 5 ohms to 10,000 ohms when the safety belt is connected? → **Yes** GO to **A2**. → **No** INSTALL a new safety belt buckle and pretensioner. REFER to Section 501-20A / 501-20B. TEST the system for normal operation.
A2: CHECK CIRCUIT 91S-GE52A (BK/RD) FOR OPEN	
 VUE0029872	**1** Disconnect RCM C491. **2** Measure the resistance between the RCM C491 circuit 91S-GE52A, pin 25 (BK/RD), harness side and the safety belt buckle switch C60f, pin 2, harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **A3**. → **No** REPAIR the circuit. TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A3: CHECK CIRCUIT 91-GE52A (BK/RD) FOR GROUND	
 VUE0029873	**1** Measure the resistance between the safety belt buckle switch C60f, circuit 91-GE52A, pin 1 (BK/RD), harness side and ground. • Is the resistance less than 5 ohms? → **Yes** REFER to Section 501-20A / 501-20B. → **No** REPAIR the circuit. TEST the system for normal operation.

GENERAL PROCEDURES

Belt Minder Deactivating/Activating

Preparation

1. **Apply the parking brake.**
2. **Place gearshift in P (Park) - vehicles with automatic transmission or the neutral position - vehicles with manual transmission.**
3. **Turn the ignition switch to the O position.**
4. **Close all the vehicle doors.**
5. **Unbuckle the drivers safety belt.**
6. **Place the parking lamps/headlamps switch in the OFF position (If vehicle is equipped with Autolamps, this will not affect the procedure).**

Deactivating/Activating

1. **Turn the ignition switch to position II. (Do not start the engine).**
2. **Wait until the safety belt warning indicator turns off. (Approximately one to two minutes).**
3. **NOTE:** Steps 3 through 5 must be completed within 60 seconds or the procedure must be repeated.

   Buckle then unbuckle the safety belt three times, ending with the safety belt unbuckled.
4. **Turn the headlamps ON then OFF.**
5. **Buckle then unbuckle the safety belt three times ending with the safety belt unbuckled. After this step the safety belt warning indicator will be illuminated for three seconds.**
6. **Within seven seconds of the safety belt warning indicator turning off, buckle then unbuckle the safety belt. This will enable the belt minder if disabled or disable belt minder if enabled.**
7. **The following sequence will confirm the belt minder is enabled:**
   - the safety belt warning indicator flashes four times per second for three seconds.
   - three seconds with the safety belt warning indicator off.
   - the safety belt warning indicator flashes four times per second for three seconds again.
8. **The safety belt warning indicator flashing four times per second for three seconds provides confirmation of belt minder disabled.**
9. **After confirmation, the deactivation/activation procedure is complete.**

SECTION 414-00 Charging System - General Information

VEHICLE APPLICATION: 2003.0 Mondeo

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DIAGNOSIS AND TESTING

Charging System 414-00-2
Inspection and Verification 414-00-2

GENERAL PROCEDURES

Battery Charging..... (31 003 0) 414-00-3

DIAGNOSIS AND TESTING

Charging System

Inspection and Verification

WARNING: Batteries contain sulphuric acid. Avoid contact with skin, eyes, or clothing. Also, shield your eyes when working near batteries to protect against possible splashing of the acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in personal injury.

WARNING: Batteries normally produce explosive gases which can cause personal injury. Therefore, do not allow flames, sparks or lighted substances to come near the battery. When charging or working near a battery, always shield your face and protect your eyes. Always provide ventilation. Failure to follow these instructions may result in personal injury.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Accessory drive belt – Generator	– Fuse(s) – Wiring harness – Electrical connector(s) – Battery junction box (BJB) – Battery – Battery cables – Charging system warning indicator

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to WDS to diagnose the system.

GENERAL PROCEDURES

Battery Charging (31 003 0)

GENERAL PROCEDURES

1. **WARNING: Keep batteries out of reach of children. Batteries contain sulphuric acid, avoid contact with skin, eyes or clothing. Shield your eyes when working near the battery to protect against possible splashing of the acid solution. In case of acid contact with the skin or the eyes, flush immediately with water for a minimum of 15 minutes and seek prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in personal injury.**

WARNING: Batteries normally produce explosive gases which can cause personal injury, therefore do not allow flames, sparks or lighted substances to come near the battery. When charging or working near the battery always shield your face and protect your eyes. Always provide adequate ventilation. Failure to follow these instructions may result in personal injury.

WARNING: Always observe all manufacturers instructions when using any charging equipment. Failure to follow this instruction may result in personal injury.

WARNING: Connect the charger to the battery before switching the charger on. Failure to follow this instruction may result in personal injury.

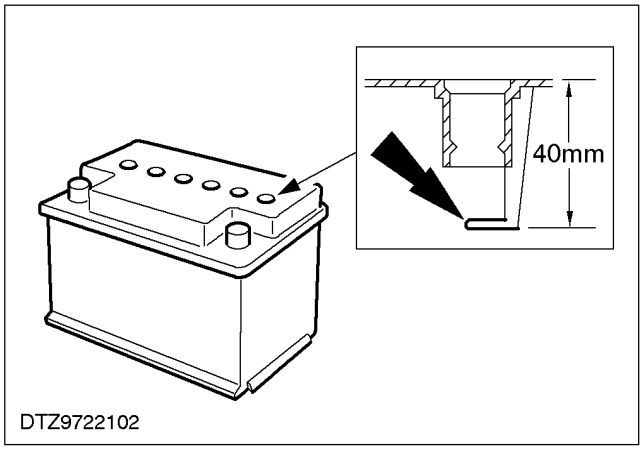
WARNING: Switch the charger off before disconnecting the charger from the battery. Failure to follow this instruction may result in personal injury.

CAUTION: Batteries should not be charged in the vehicle.

CAUTION: Do not rely on the generator to recharge a discharged battery as it would take in excess of eight hours of continuous driving with no additional loads placed on the charging system.

NOTE: The maximum level mark is approximately 40mm below the top of the battery.

Place the battery on a level surface and check the electrolyte level through the casing, reaches the indicated maximum mark.



WARNING: It is important not to overfill a battery, as this can cause acid leakage and corrosion damage to the vehicle. Failure to follow this instruction may result in personal injury.

2. **If the level is below the maximum mark, remove the vent covers and top up the cell(s) to the correct level.**
3. **Cold batteries will not readily accept a charge. Therefore batteries should be allowed to warm up to approximately 5°C. (41°F.) before charging. This may require four to eight hours at room temperature depending on the initial temperature and the battery size.**
4. **A battery which has been completely discharged may be slow to accept a charge initially, and in some cases may not accept a charge at the normal charger setting. When batteries are in this condition, charging can be started by use of the dead battery switch on chargers that have this facility equipped.**
5. **To determine whether a battery is accepting a charge, follow the manufacturer's instructions for the charger, for use of the dead battery switch. If the switch is the spring-loaded type, it should be held in the ON position for up to three minutes.**
6. **After releasing the dead battery switch and with the charger still on, measure the battery voltage. If it shows 12 volts or higher, the battery is accepting a charge and is capable of being recharged. However, it may require up to two hour of charging with batteries colder than 5°C (41°F) before the charge rate is high enough to show a charge on an ammeter. It has been found that all non-damaged**

GENERAL PROCEDURES (Continued)

batteries can be charged by this procedure. If a battery cannot be charged by this procedure, a new one should be installed.

7. **A rapid recharger procedure has been developed for recharging batteries that have passed the Load Test and only need a recharge. This can be due to in-service no-start battery failures (vehicle will not crank due to low battery state of charge) or battery discharged in vehicle due to key-off loads.**
8. **With the cables then disconnected, the battery can be rapidly recharged by using either of the following methods:**
   - Carry out a two hour charge using 20A constant current (manual setting on charger).
   - Carry out a two hour charge using a constant potential (automatic setting on charger).

SECTION 414-01 Battery, Mounting and Cables

VEHICLE APPLICATION: 2003.0 Mondeo

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Inspection and Verification 414-01-3
Symptom Chart 414-01-3

GENERAL PROCEDURES

Battery Disconnect 414-01-4

SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Battery hold down clamp retaining nuts	6	-	53
Battery terminal clamp retaining nut	6	-	53
Battery junction box (BJB) electrical connector retaining nut	7	-	62
Generator electrical connector retaining nut	8	-	71
Ignition switch to starter motor cable retaining nut	8	-	71
Starter motor positive cable retaining nut	12	9	-

DIAGNOSIS AND TESTING

Battery

General Equipment
Battery Tester

Inspection and Verification

WARNING: Batteries contain sulphuric acid. Avoid contact with skin, eyes, or clothing. Also, shield your eyes when working near batteries to protect against possible splashing of the acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in personal injury.

WARNING: Batteries normally produce explosive gases which can cause personal injury. Therefore, do not allow flames, sparks or lighted substances to come near the battery. When charging or working near a battery, always shield your face and protect your eyes. Always provide adequate ventilation. Failure to follow these instructions may result in personal injury.

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

Inspection and Verification

Electrical
• Electrical connector(s) • Battery terminal clamps • Battery cable(s) • Battery

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Condition	Possible Sources	Action
•Vehicle electrical systems inoperative	•Battery.	•CARRY OUT a battery condition test, using the battery tester.
•The engine cranks slowly	•Battery.	•CARRY OUT a battery condition test, using the battery tester.
	•Battery cable(s). •Starter motor.	•REFER to Section 303-06.

GENERAL PROCEDURES

Battery Disconnect

Disconnect

WARNING: Batteries normally produce explosive gases which may cause personal injury, therefore do not allow flames, sparks or lighted substances to come near the battery. When charging or working near the battery always shield your face and protect your eyes. Always provide adequate ventilation. Failure to follow these instructions may result in personal injury.

WARNING: Batteries contain sulphuric acid, avoid contact with skin eyes or clothing. Shield your eyes when working near the battery to protect against possible splashing of the acid solution. In case of acid contact with the skin or eyes, flush immediately for a minimum of 15 minutes and seek prompt medical attention. If swallowed, call a physician immediately. Failure to follow these instructions may result in personal injury.

WARNING: Audio unit key code saving devices must not be used when working on supplemental restraint or fuel systems. When using these devices the vehicle electrical system is still live but with a reduced current flow. Failure to follow this instruction may result in personal injury.

CAUTION: Make sure the engine is not running before disconnecting the battery ground cable to avoid damage to the vehicle electrical system.

NOTE: Before disconnecting the battery make sure that no data is required from the powertrain control module (PCM), as battery cable disconnection will erase any fault codes and idle/drive values held in the keep alive memory (KAM). It is not necessary to disconnect or remove electronic control modules.

NOTE: This procedure should be used to disconnect the battery while carrying out repairs that refer to the battery being disconnected.

1. **Obtain and record the audio unit keycode and preset radio frequencies.**
2. **Disconnect the battery ground cable.**

Connect

WARNING: Batteries normally produce explosive gases which may cause personal injury, therefore do not allow flames, sparks or lighted substances to come near the battery. When charging or working near the battery always shield your face and protect your eyes. Always provide adequate ventilation. Failure to follow these instructions may result in personal injury.

WARNING: Batteries contain sulphuric acid, avoid contact with skin eyes or clothing. Shield your eyes when working near the battery to protect against possible splashing of the acid solution. In case of acid contact with the skin or eyes, flush immediately for a minimum of 15 minutes and seek prompt medical attention. If swallowed, call a physician immediately. Failure to follow these instructions may result in personal injury.

CAUTION: Make sure all electrical systems are switched OFF before connecting the battery ground cable to avoid damage to the vehicle electrical system.

1. **Connect the battery ground cable.**
2. **Enter the audio unit keycode and preset radio frequencies.**
3. **Reset the clock to the correct time.**
4. **NOTE:** When the battery has been disconnected and connected, the stored idle and drive values contained within the powertrain control module (PCM) will have been erased. The following steps must be carried out to allow the PCM to relearn its idle and drive values.

   Start and run the engine at idle for three minutes.
5. **When the engine reaches normal operating temperature, increase the engine speed to 1200 rpm and maintain for approximately two minutes.**

GENERAL PROCEDURES (Continued)

6. **Drive the vehicle for approximately five miles/eight kilometers of varied driving.**

SECTION 414-02 Generator and Regulator

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

Specifications 414-02-2

DESCRIPTION AND OPERATION

Generator 414-02-3

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REMOVAL AND INSTALLATION

Generator — 1.8L/2.0L ..... (31 414 0) 414-02-6
Generator — 2.5L/3.0L ..... (31 414 0) 414-02-11

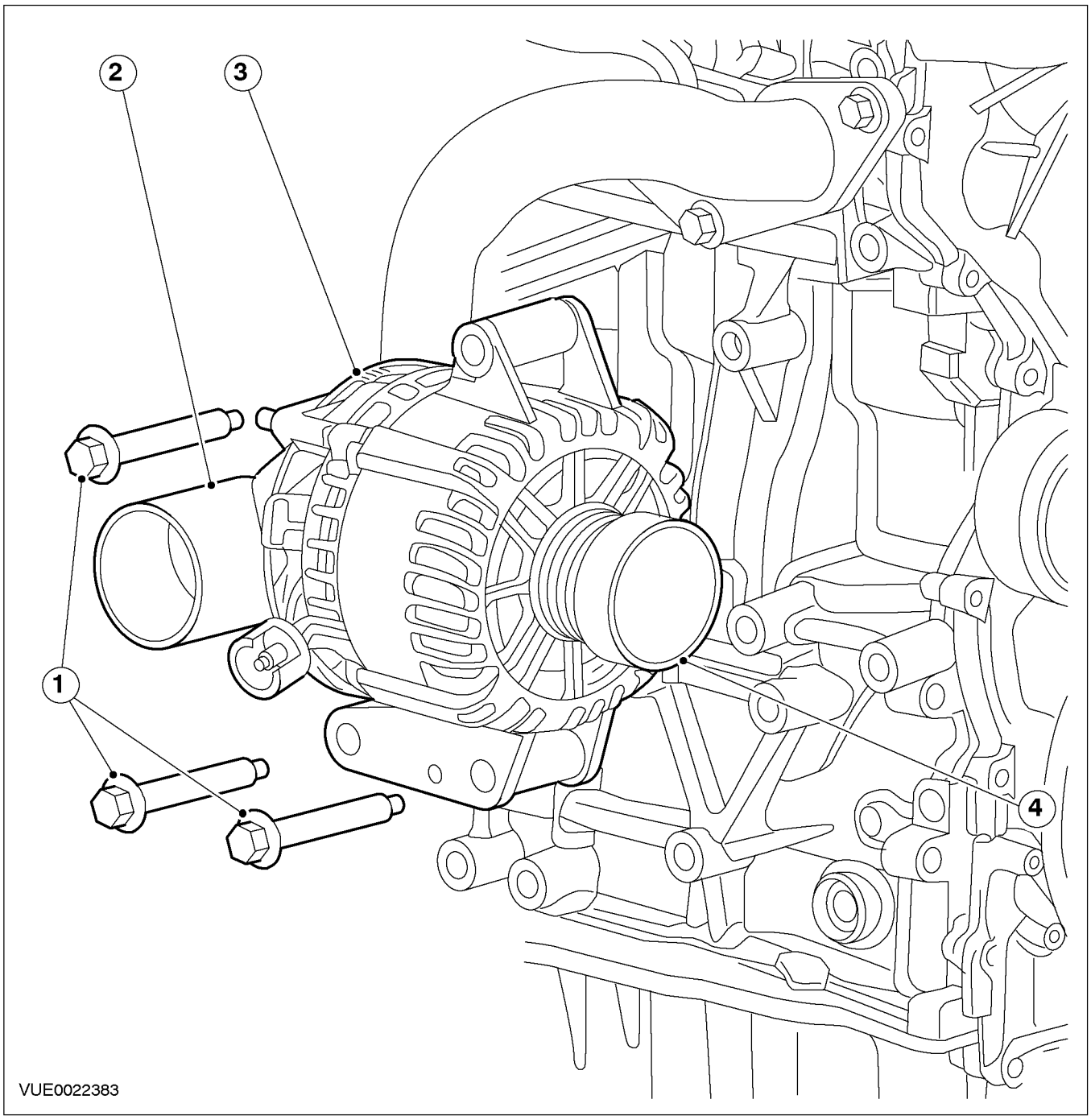
SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Generator retaining bolts	47	35	-
Generator electrical connector retaining nut	8	-	71
Tie-rod end retaining nut	40	30	-
Generator mounting studs - vehicles with 2.0L diesel engine	15	11	-
Generator retaining nuts - vehicles with 2.0L diesel engine	47	35	-
Generator cooling duct retaining nuts	4	-	35

DESCRIPTION AND OPERATION

Generator



Item	Part Number	Description
1	-	Generator retaining bolts

Item	Part Number	Description
2	-	Generator cooling duct - vehicles with 1.8L or 2.0L engine shown, vehicles with 2.0L diesel engine or 2.5L engine similar

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
3	-	Generator - vehicles with 1.8L or 2.0L engine shown, vehicles with 2.0L diesel engine or 2.5L engine similar
4	-	Generator Decoupler - vehicles with 1.8L or 2.0L engine with manual transaxle

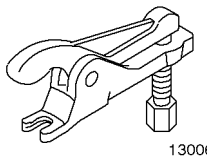
DIAGNOSIS AND TESTING

Generator

REFER to Section 414-00.

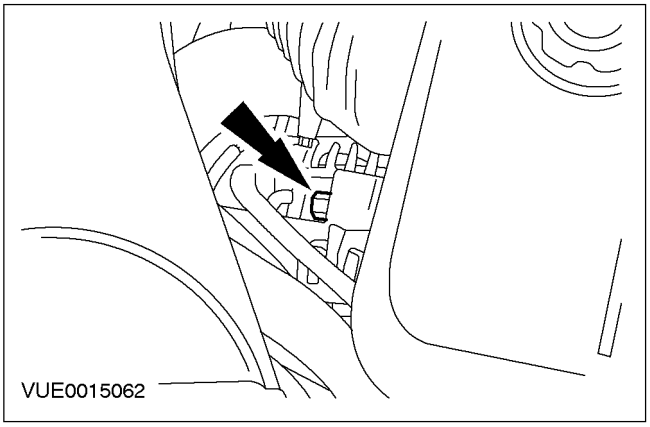
REMOVAL AND INSTALLATION

Generator — 1.8L/2.0L (31 414 0)

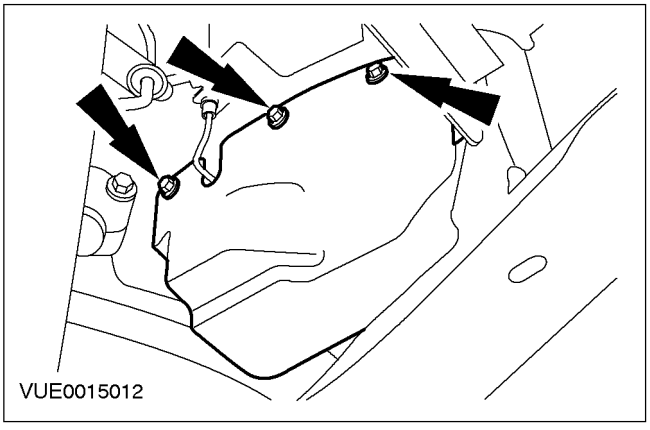
Special Tool(s)	
 13006	Separator, Ball Joint 211-020 (13-006)

Removal

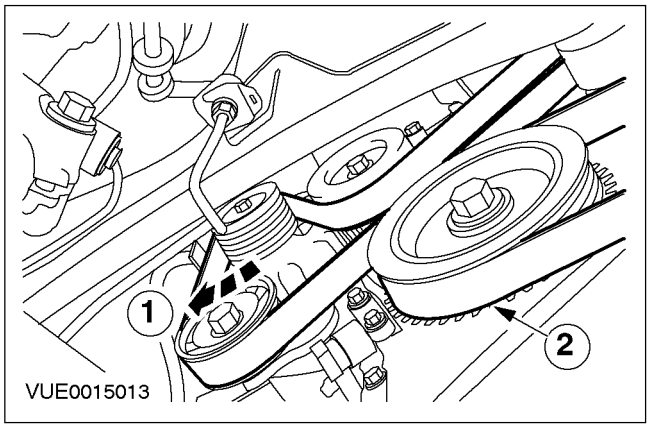
1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Remove the generator upper retaining bolt.**
   - Remove the wiring harness support bracket from the generator upper retaining bolt.



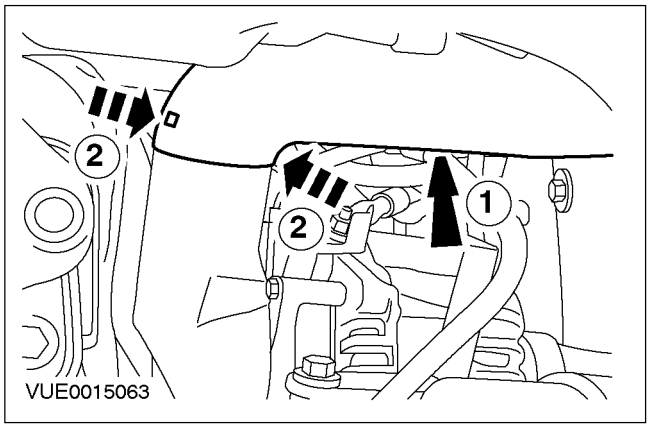
3. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
4. **Remove the splash shield.**



5. **Detach the accessory drive belt.**
   1. Rotate the accessory drive belt tensioner clockwise.
   2. Detach the accessory drive belt from the generator pulley.

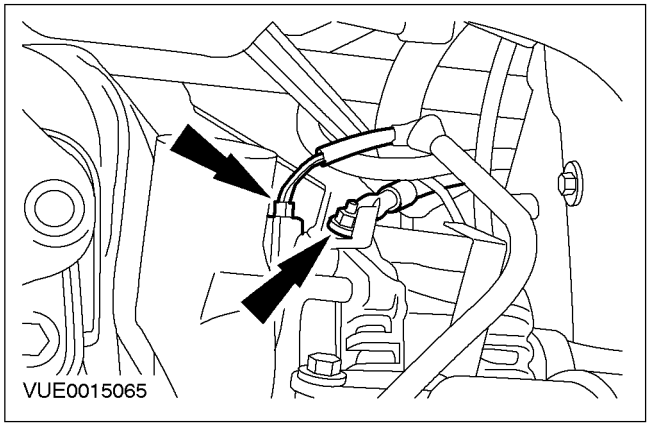


6. **Remove the generator cooling duct intake pipe.**
   1. Detach the generator cooling duct intake pipe retaining clip.
   2. Release the clips and remove the generator cooling duct intake pipe.
   - Remove and discard the generator cooling duct intake pipe retaining clip.



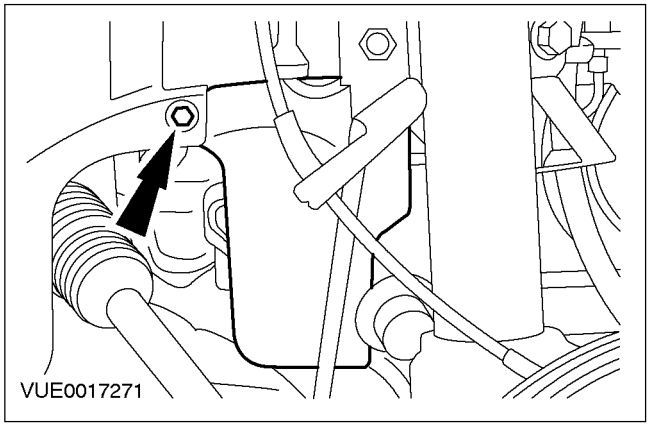
REMOVAL AND INSTALLATION (Continued)

7. Disconnect the generator electrical connectors.



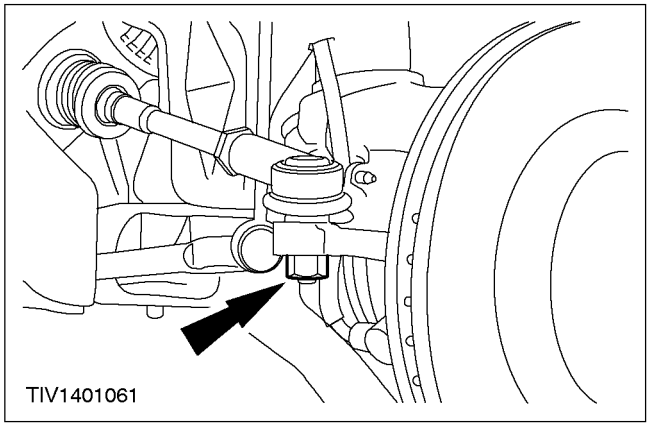
8. Remove the right-hand front wheel and tire. For additional information, refer to Section 204-04.

9. Remove the steering gear gaiter shield.



10. CAUTION: Leave the tie-rod end retaining nut in place to protect the ball joint stud.

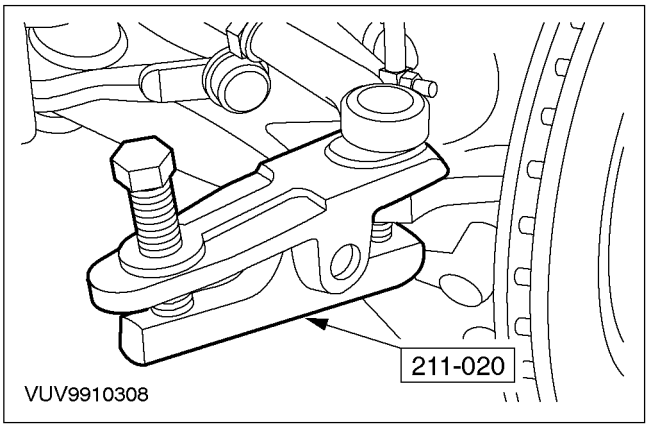
Loosen the tie-rod end retaining nut.



11. CAUTION: Protect the ball joint seal using a soft cloth to prevent damage.

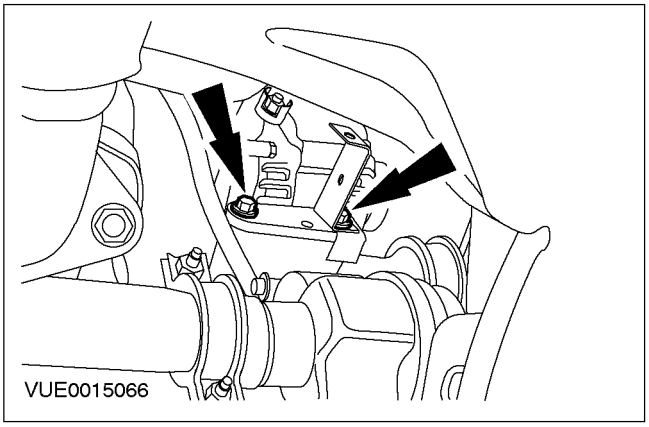
Using the special tool, detach the tie-rod end from the wheel knuckle.

- Remove and discard the tie-rod end retaining nut.



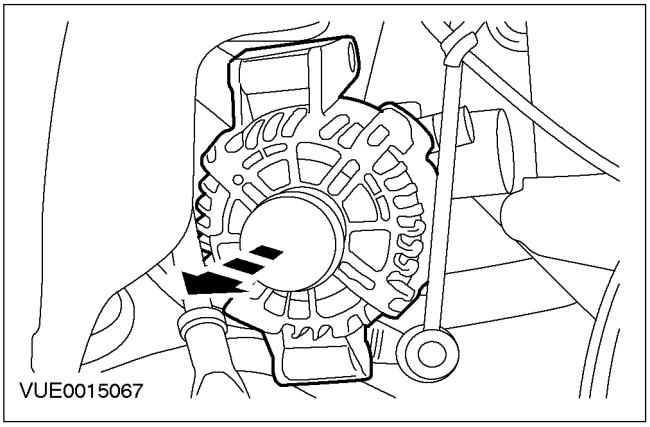
12. Remove the generator lower retaining bolts.

- Remove the wiring harness support bracket from the generator lower retaining bolt.

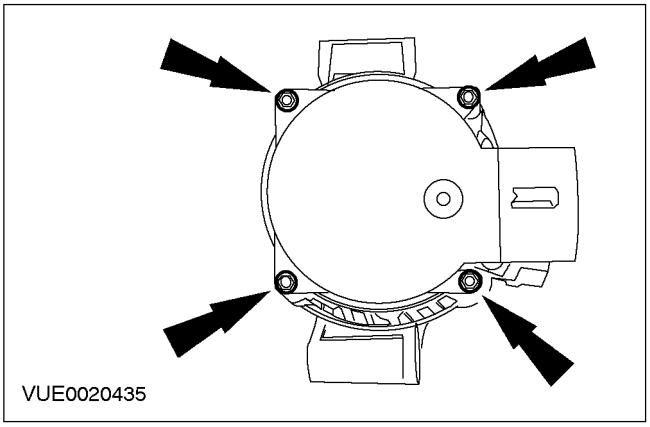


REMOVAL AND INSTALLATION (Continued)

13. Remove the generator through the wheelhousing.

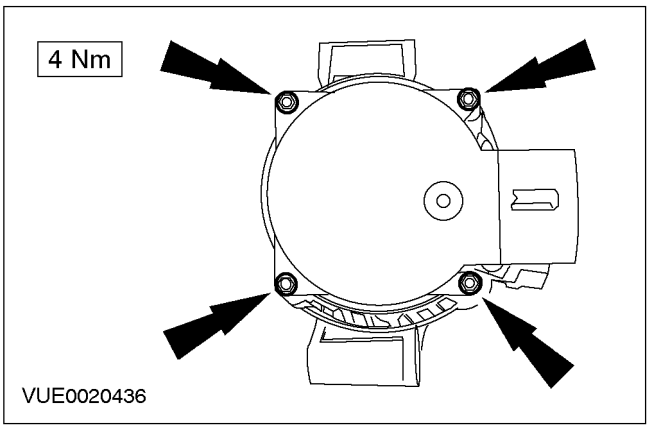


14. Remove the generator cooling duct from the generator.

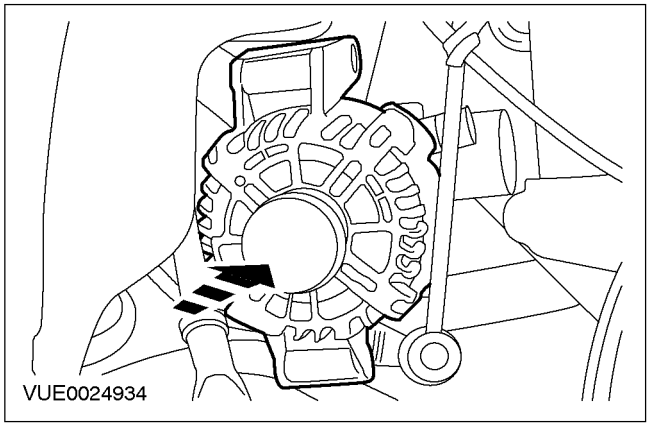


Installation

1. Install the generator cooling duct to the generator.



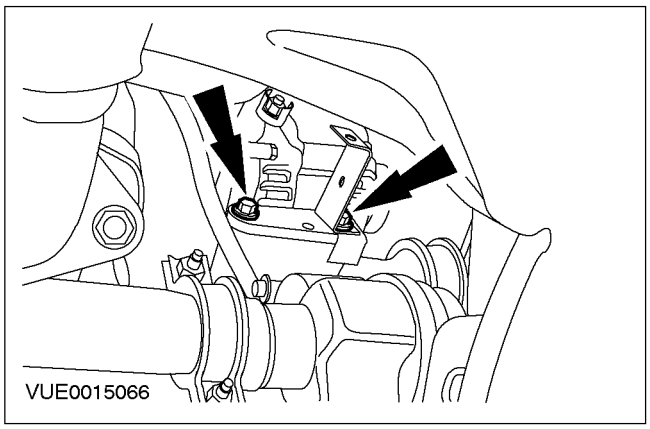
2. Install the generator through the wheelhousing.



3. NOTE: Make sure the wiring harness support bracket is installed.

NOTE: Do not tighten the generator lower retaining bolts at this stage.

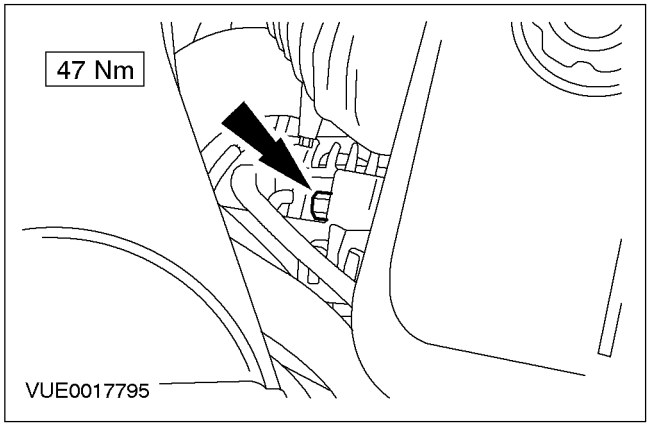
Install the generator lower retaining bolts.



4. Lower the vehicle.

5. NOTE: Make sure the wiring harness support bracket is installed.

Install the generator upper retaining bolt.

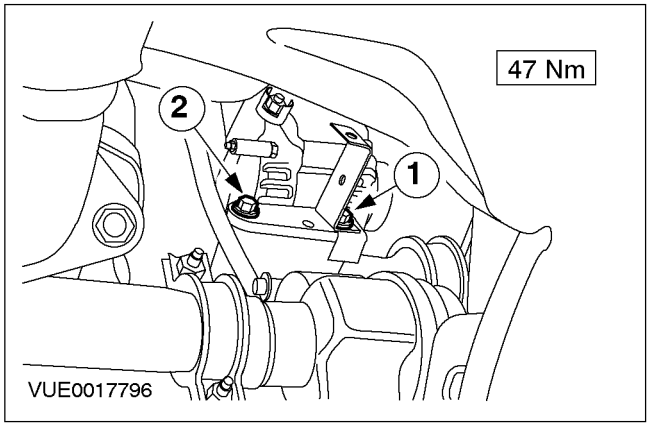


REMOVAL AND INSTALLATION (Continued)

6. Raise the vehicle.

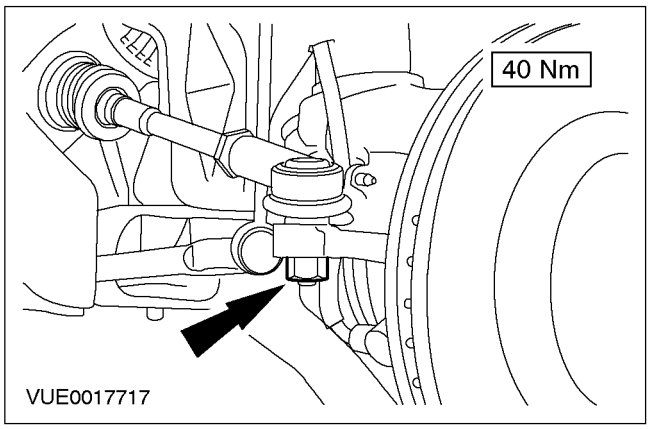
7. Tighten the generator lower retaining bolts.

1. Tighten the right-hand lower retaining bolt.
2. Tighten the left-hand lower retaining bolt.

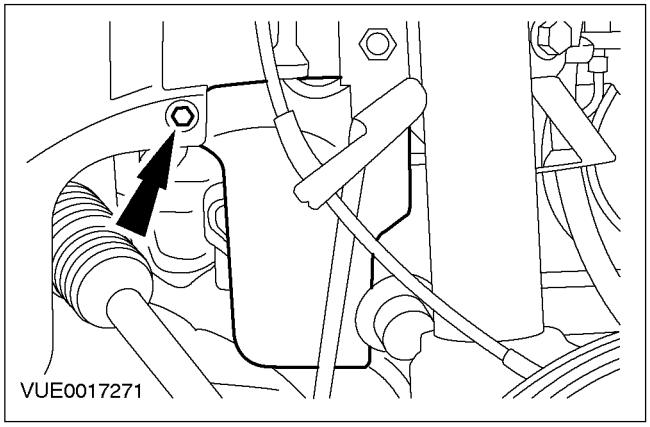


8. WARNING: Install a new tie-rod end retaining nut. Failure to follow this instruction may result in personal injury.

Attach the tie-rod end to the wheel knuckle and install the tie-rod end retaining nut.

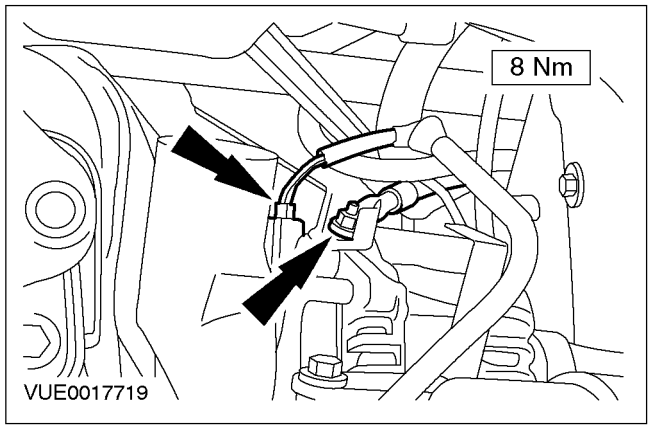


9. Install the steering gear gaiter shield.



10. Install the right-hand front wheel and tire. For additional information, refer to Section 204-04.

11. Connect the generator electrical connectors.

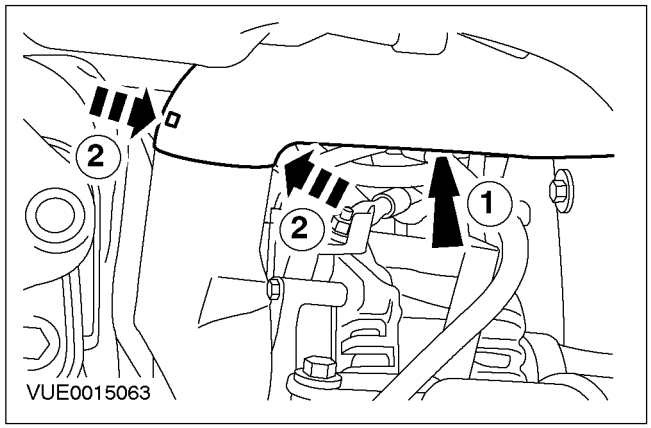


12. NOTE: Install a new generator cooling duct intake pipe retaining clip.

Install the generator cooling duct intake pipe.

1. Install the generator cooling duct intake pipe retaining clip.
2. Connect the generator cooling duct intake pipe to the generator cooling duct.

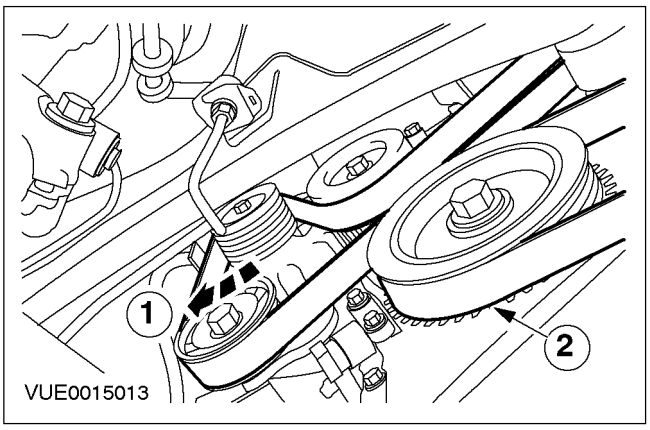
- Attach the generator cooling duct intake pipe retaining clip.



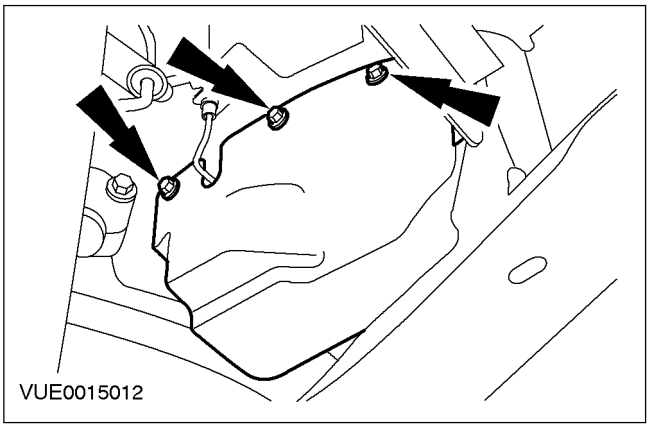
REMOVAL AND INSTALLATION (Continued)

13. Install the accessory drive belt.

1. Rotate the accessory drive belt tensioner clockwise.
2. Install the accessory drive belt to the generator pulley.



14. Install the splash shield.



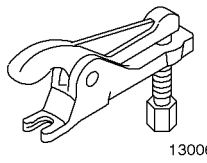
15. Lower the vehicle.

16. Connect the battery ground cable. For additional information, refer to Section 414-01.

17. Initialize the door window motors. For additional information, refer to Section 501-11.

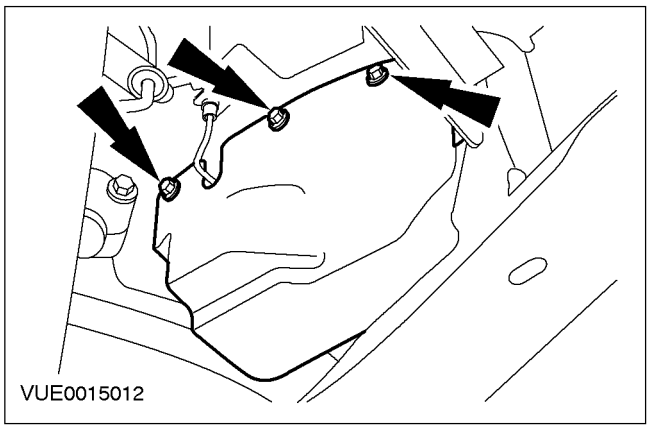
REMOVAL AND INSTALLATION

Generator — 2.5L/3.0L (31 414 0)

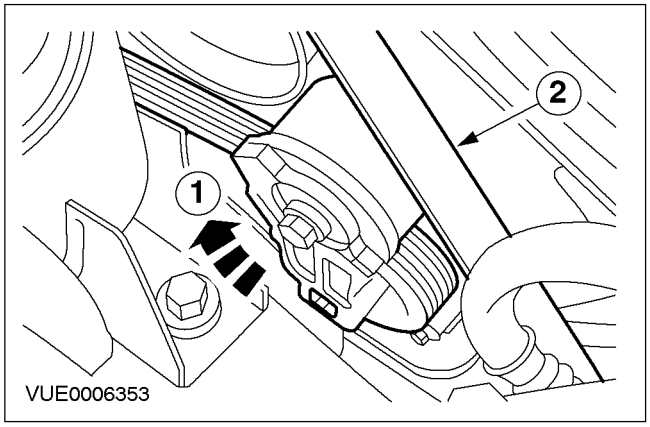
Special Tool(s)	
 13006	Separator, Ball Joint 211-020 (13-006)

Removal

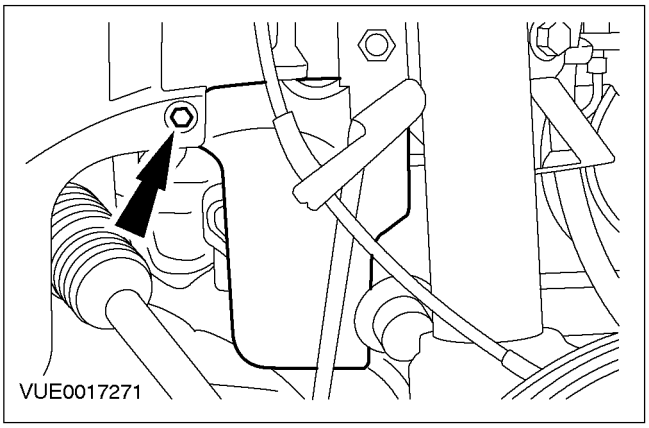
1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Remove the right-hand front wheel and tire. For additional information, refer to Section 204-04.**
3. **Remove the splash shield.**



4. **Detach the accessory drive belt.**
   1. Rotate the accessory drive belt tensioner clockwise.
   2. Detach the accessory drive belt from the generator pulley.

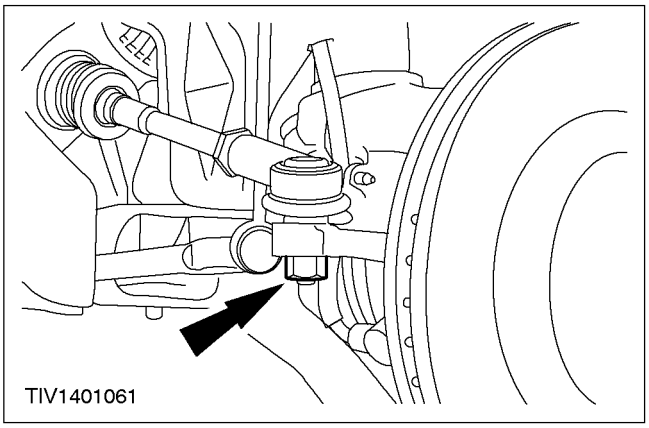


5. **Remove the steering gear gaiter shield.**



6. **CAUTION: Leave the tie-rod end retaining nut in place to protect the ball joint stud.**

   Loosen the tie-rod end retaining nut.

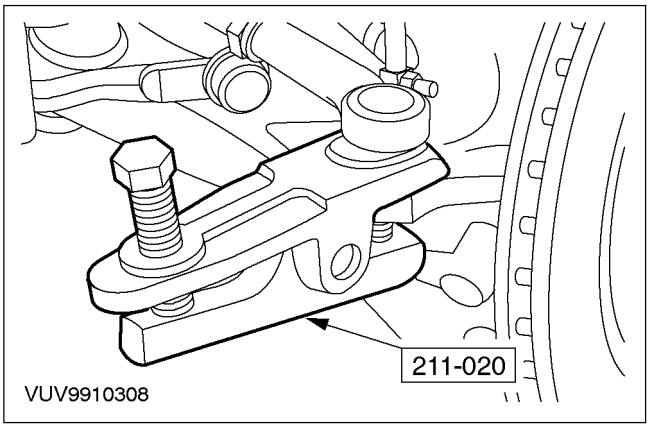


REMOVAL AND INSTALLATION (Continued)

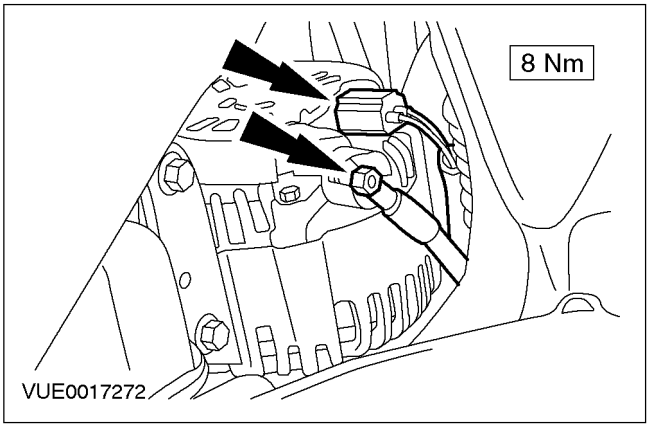
7. **CAUTION: Protect the ball joint seal using a soft cloth to prevent damage.**

   Using the special tool, detach the tie-rod end from the wheel knuckle.

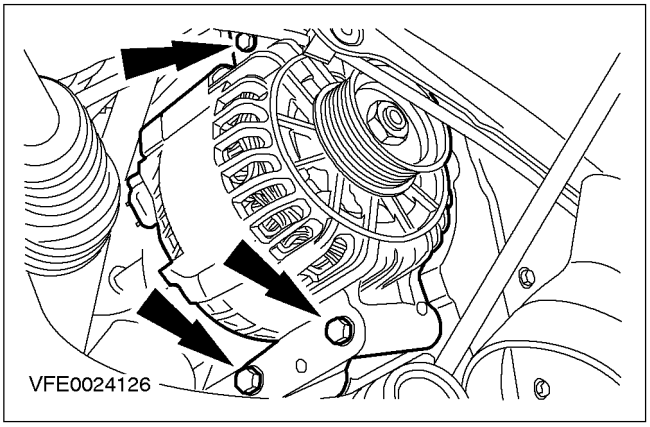
   - Remove and discard the tie-rod end retaining nut.



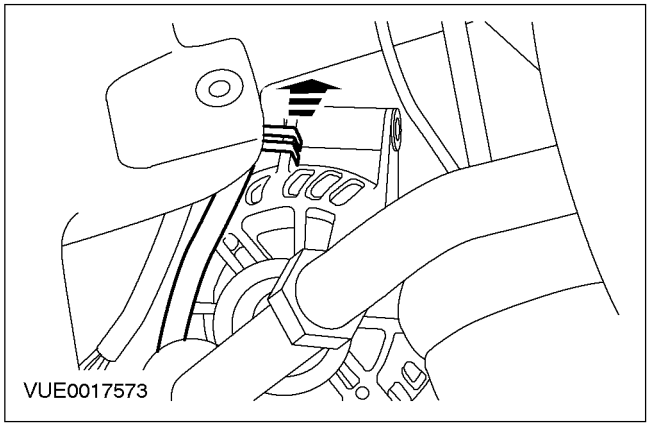
8. **Disconnect the generator electrical connectors.**



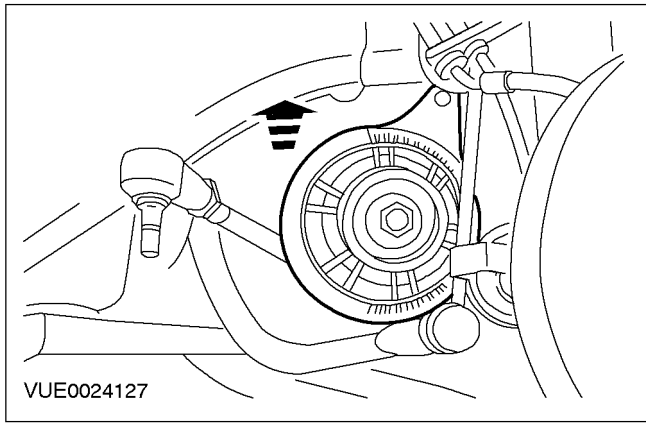
9. **Detach the generator from the engine.**



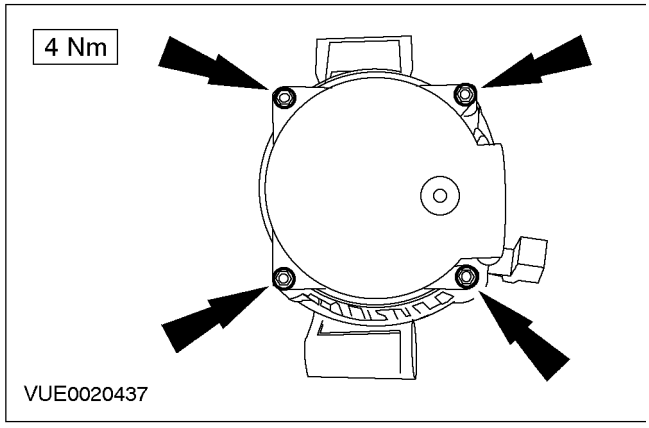
10. **Detach the generator wiring harness from the top of the generator.**



11. **Remove the generator through the wheelhousing.**



12. **Remove the generator cooling duct from the generator.**



REMOVAL AND INSTALLATION (Continued)

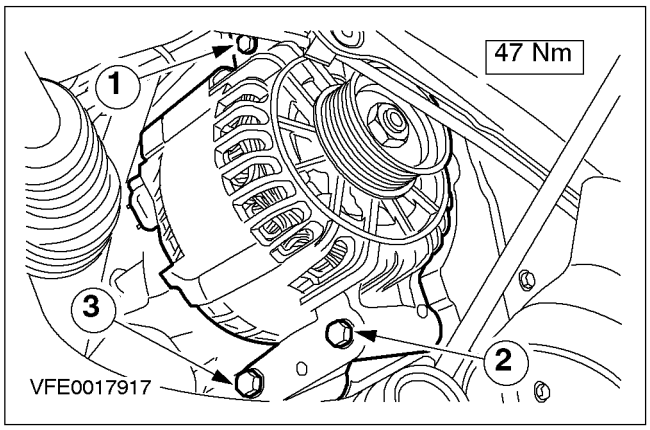
Installation

1. **WARNING: Install a new tie-rod end retaining nut. Failure to follow this instruction may result in personal injury.**

CAUTION: Loosely install the generator retaining bolts before tightening them.

To install, reverse the removal procedure.

- Tighten the generator retaining bolts in the sequence shown.



2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

SECTION 415-00 Entertainment System - General Information

VEHICLE APPLICATION: 2003.0 Mondeo

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Inspection and Verification 415-00-2
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Component Tests 415-00-36

DIAGNOSIS AND TESTING

Audio System

Refer to Wiring Diagrams Section 415-01 for schematic and connector information.

General Equipment
Worldwide Diagnostic System (WDS) (418-F224).

Principles of Operation

Diversity Antenna

The audio unit has the facility to receive the input of two antennae. Sensors within the audio unit calculate which of the antenna signals is the strongest and uses this signal to improve the reception for the listener. The first antenna is the original vehicle antenna fitted on the roof at the front of the vehicle.

The second antenna is integrated into the rear window glass on all vehicles except wagon. On the wagon the second antenna is integrated into the right-hand rear quarter window glass. It is connected to the audio unit by a cable.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Audio unit – Antenna(s) – Cassette player – Compact disc (CD) player jammed, not loading – Foreign objects contacting speaker – Trim poorly fitted/resonance – Steering wheel audio controls (if equipped) – Video cassette player jammed, not loading – Contaminated video cassette player heads – Diversity antenna grid wires	– Fuse(s) – Wiring harness – Electrical connector(s) – Audio unit – CD player – Steering wheel audio controls (if equipped) – Antenna(s) – Remote control battery(s) – Remote control – Video display – Video cassette player – Video system module – Passenger entertainment control panel – External game/media source (games console/video camera etc)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If an obvious cause is not found, codes may be shown in the audio unit display (vehicles with 6000, 6006E or 9006 audio unit only). Check the audio unit display for the following Error Codes:

- for vehicles with 6006E or 9006 audio unit refer to the CD Error Codes - vehicles with Vehicles with 6006E or 9006 Audio Unit
- for vehicles with 6000 audio unit refer to the CD Error Codes - vehicles with 6000 Audio Unit
- for vehicles with CD changer refer to the CD Error Codes - vehicles with CD Changer

5. If no error codes are displayed on the audio unit refer to the Self-Diagnostic Mode.

CD Error Codes - vehicles with 6006E or 9006 Audio Unit

DIAGNOSIS AND TESTING

Error Codes

Error Code	Error Description	Error Rectification
E1	Communications Error	Install a new audio unit. TEST the system for normal operation.
E2	Overtemp Error	The Audio unit is too hot, unit will not work until it has cooled down. Check the heater duct(s) are not bleeding hot air on to the radio. If the concern persists, INSTALL a new audio unit. TEST the system for normal operation.
E3	Mechanical Error	Install a new audio unit. TEST the system for normal operation.
E4	Focus Error	CD is upside down or dirty. Clean the CD and try it again, if the error code is still displayed, INSERT a different CD. If the error code is still displayed. INSTALL a new audio unit. TEST the system for normal operation.
E5	Overcurrent Error	Install a new audio unit. TEST the system for normal operation.

CD Error Codes - vehicles with 6000 Audio Unit

Error Codes

Error Code	Error Description	Error Rectification
E11	SPI Bus Failure	CHECK and REPAIR the wiring harness. If the wiring harness is OK, INSTALL a new audio unit. TEST the system for normal operation.
E12	Communications Error	Install a new audio unit. TEST the system for normal operation.
E14	Overtemp Error	The Audio unit is too hot, unit will not work until it has cooled down. Check the heater duct(s) are not bleeding hot air on to the radio. If the concern persists, INSTALL a new audio unit. TEST the system for normal operation.
E15	Mechanical Error	Install a new audio unit. TEST the system for normal operation.
E16	CD Eject Failure	Install a new audio unit. TEST the system for normal operation.

CD Error Codes - vehicles with CD Changer

Error Codes

Error Code	Error Description	Error Rectification
E2	Communications Error	Install a new CD changer. TEST the system for normal operation.
E3	Focus Error	CD is upside down or dirty. Clean the CD and try it again, if the error code is still displayed, INSERT a different CD. If the error code is still displayed. INSTALL a new CD changer. TEST the system for normal operation.
E4	Overtemp Error	The CD changer is too hot, unit will not work until it has cooled down. Check the heater duct(s) are not bleeding hot air on to the CD changer. If the concern persists, INSTALL a new CD changer. TEST the system for normal operation.
E5	Mechanical Error	Install a new CD changer. TEST the system for normal operation.

preset buttons 3 and 6 together until the audio unit enters the Self-Diagnostic Mode.

Self-Diagnostic Mode

1. To enter the audio unit Self-Diagnostic Mode, switch the audio unit ON. Press and hold the

DIAGNOSIS AND TESTING

Self-Diagnostic Mode

Test	Message Displayed	Circuit Tested	Description
1. FM waveband check.	FM frequency received.	Antenna signal.	Tests signal from the antenna cable.
2. Traffic Announcement.	TP.	Traffic announcement volume level.	Tests the volume of TA.
3.Test speaker circuit left hand front speaker.	4CH LF for four channel system 2CH LF for two channel system.	Left hand front speaker circuit.	Test speaker circuit.
4.Test speaker circuit right hand front speaker.	4CH RF for four channel system 2CH RF for two channel system.	Right hand front speaker circuit.	Test speaker circuit.
5.Test speaker circuit left hand rear speaker.	4CH LR for four channel system.	Left hand rear speaker circuit.	Test speaker circuit.
6.Test speaker circuit right hand rear speaker.	4CH RR for four channel system.	Right hand rear speaker circuit.	Test speaker circuit.
7. Test communications with compact disc autochanger (if equipped) or internal CD changer.	CDDJ OK/CD OK if communications are achieved and NO CDDJ/NO CD if no communications are achieved.	Compact disc communications circuit.	Test compact disc circuit.

2. If the cause is not visually evident, verify the symptom and refer to the following Symptom Chart.

Symptom Chart

Condition	Possible Sources	Action
•The audio unit is inoperative/does not operate correctly	•Fuse(s). •Circuit. •Audio unit.	• GO to Pinpoint Test A.
•The display is blank - radio and cassette player operate	•Audio unit.	•INSTALL a new audio unit.
•Poor reception	•Antenna. •Antenna cable. •Audio unit.	• GO to Pinpoint Test B.
	•Diversity antenna. •Diversity antenna cable. •Audio unit.	• GO to Pinpoint Test B.
•Poor quality/distorted sound from one or more speakers (not all speakers)	•Speaker(s). •Circuit. •Audio unit.	• GO to Pinpoint Test C.
•No sound from all speakers	•Speaker(s). •Circuit. •Audio unit.	• GO to Pinpoint Test D.
•No sound from one or more of the speakers (not all speakers)	•Speaker(s). •Circuit. •Audio unit.	• GO to Pinpoint Test E.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
•The auxiliary audio control is inoperative/does not operate correctly.	•Circuit. •Audio control switch. •Audio unit.	• GO to Pinpoint Test F.
•The video system is inoperative/does not operate correctly	•Remote control. •Remote control batteries.	•CHECK the remote control batteries for correct voltage. If the remote control batteries are not to correct specification. Install new batteries to the remote control. TEST the system for normal operation.
	•Circuit(s). •Video system module. •Audio unit.	• GO to Pinpoint Test G.
	•Video cassette player.	• GO to Pinpoint Test J.
•No auxiliary headphone audio	•Contaminated video cassette player heads.	•CLEAN the video cassette player heads using a cleaning cassette.
	•Headphone(s). •Circuit(s). •Passenger entertainment control panel. •Video system module.	• GO to Pinpoint Test H.
	•Video cassette player.	• GO to Pinpoint Test J.
	•External game/media source (games console/video camera etc).	•Not Ford responsibility. REFER the customer to the game/media source supplier.
•The video display is inoperative/does not operate correctly	•Contaminated video cassette player heads.	•CLEAN the video cassette player heads using a cleaning cassette.
	•Circuit(s). •Video display. •Video system module.	• GO to Pinpoint Test I.
	•Video cassette player.	• GO to Pinpoint Test J.
	•External game/media source (games console/video camera etc).	•Not Ford responsibility. REFER the customer to the game/media source supplier.
•The video cassette player is inoperative/does not operate correctly	•Contaminated video cassette player heads.	•CLEAN the video cassette player heads using a cleaning cassette.
	•Circuit(s). •Video cassette player. •Audio unit.	• GO to Pinpoint Test J.
•The remote control is inoperative/does not operate correctly	•Remote control. •Circuit(s). •Video display infrared sensor. •Video system module.	• GO to Pinpoint Test K.

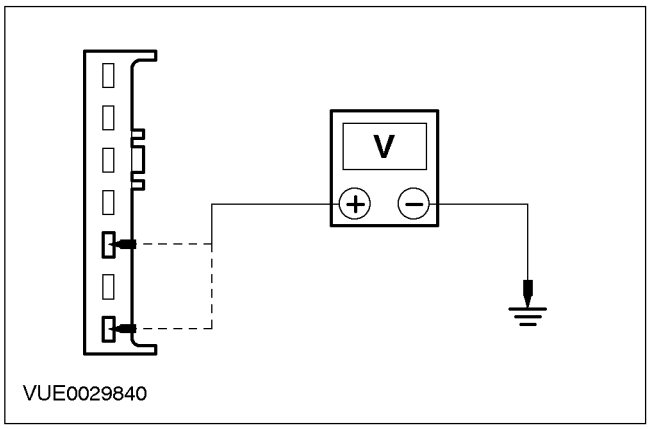
DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
•External game console/media source is inoperative/does not operate correctly	•External game/media source (games console/video camera etc).	•Not Ford responsibility. REFER the customer to the game/media source supplier.
	•Inverter cable.	•Not Ford responsibility. REFER the customer to the inverter cable supplier.
	•Circuit(s). •Passenger entertainment control panel. •Video system module.	• GO to Pinpoint Test L.
•No video cassette player on-screen menu options display	•Video cassette player.	•INSTALL a new video cassette player.
•CD changer is inoperative/does not operate correctly	•Circuit(s). •Fuse. •CD changer. •Audio unit.	• GO to Pinpoint Test M.

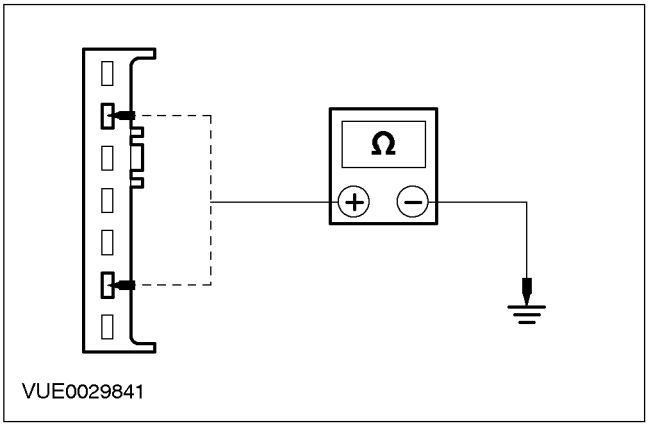
Pinpoint Tests

NOTE: Use a digital multimeter for all electrical measurements.

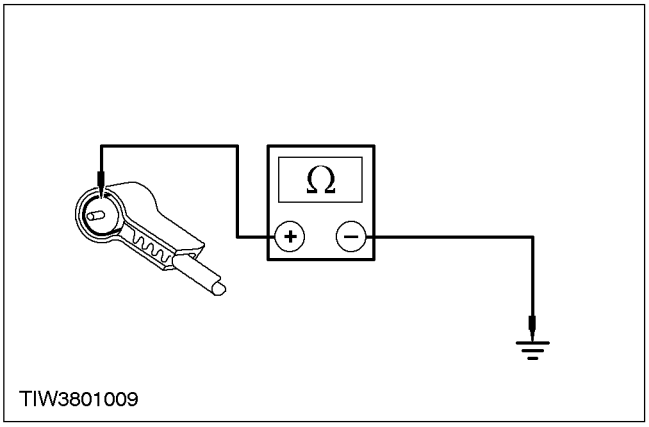
PINPOINT TEST A: THE AUDIO UNIT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK FOR VOLTAGE TO AUDIO UNIT	
 VUE0029840	**1** Disconnect Audio Unit C483. **2** Key in ACCESSORY position. **3** Measure the voltage between the audio unit C483 pin 1, circuit 29-MD15 (OG/BK), harness side and ground, and between the audio unit C483 pin 3, circuit 75-MD15 (YE/GN), harness side and ground. • Are the voltages greater than 10 volts? → **Yes** GO to **A2**. → **No** REPAIR circuit 29-MD15 (OG/BK) or circuit 75-MD15 (YE/GN). TEST the system for normal operation.

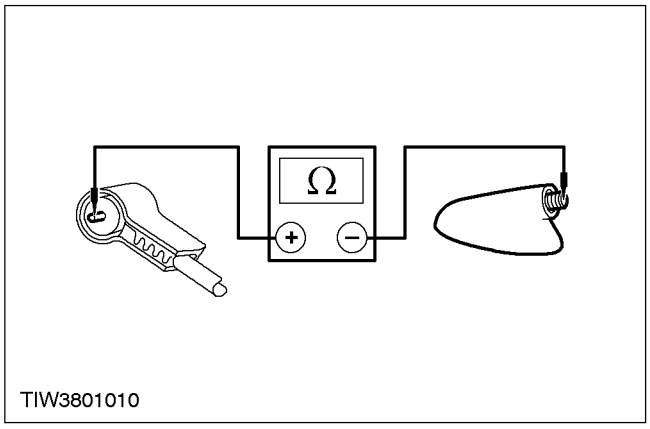
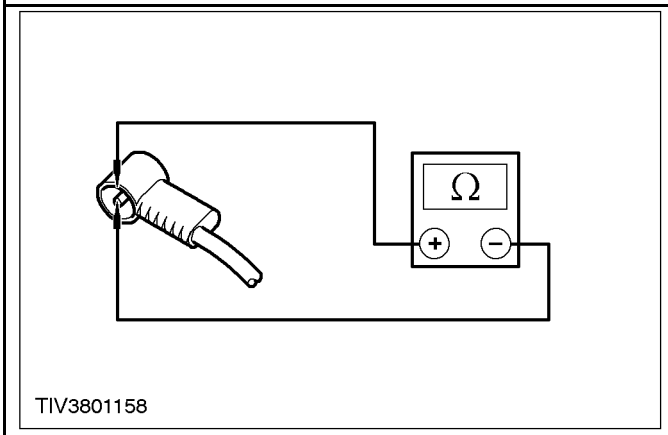
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A2: CHECK THE AUDIO UNIT GROUND CIRCUITS FOR OPEN	
 VUE0029841	1 Key in OFF position. 2 Measure the resistance between the audio unit C483 pin 6, circuit 91-MD15 (BK/GN), harness side and ground, and between the audio unit C483 pin 2, circuit 91-MD34 (BK/YE), harness side and ground. • Are the resistances less than 5 ohms? → **Yes** INSTALL a new audio unit. TEST the system for normal operation. → **No** REPAIR circuit 91-MD15 (BK/GN) or 91-MD34 (BK/YE). TEST the system for normal operation.

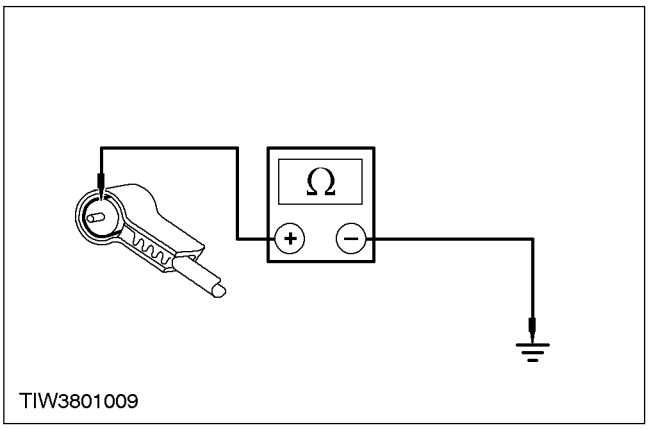
PINPOINT TEST B: POOR RECEPTION

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK THE ANTENNA CABLE SHIELD	
 TIW3801009	1 Key in OFF position. 2 Disconnect the antenna cable from the audio unit. 3 Measure the resistance between the antenna cable ground connector (shield), and ground. • Is the resistance less than 0.1 ohm? → **Yes** GO to **B2**. → **No**

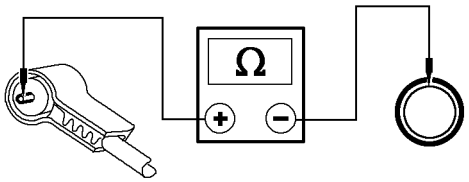
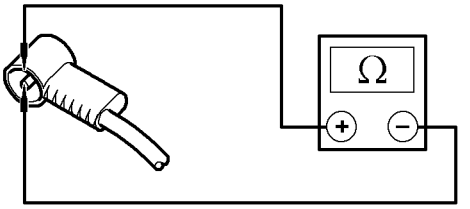
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	CLEAN and TIGHTEN the antenna base connection to the body. If the concern persists, INSTALL a new antenna cable. TEST the system for normal operation.
B2: CHECK THE ANTENNA CENTER CONDUCTOR FOR OPEN	
 TIW3801010	**1** Remove the antenna mast. **2** Measure the resistance of the center conductor between the ends of the antenna cable. • Is the resistance less than 0.1 ohm? → **Yes** GO to **B3**. → **No** INSTALL a new antenna cable. TEST the system for normal operation.
B3: CHECK ANTENNA CABLE FOR SHORT	
 TIV3801158	**1** Measure the resistance between the antenna center conductor and the antenna ground (shield). • Is the resistance greater than 10,000 ohms? → **Yes** If a diversity antenna is fitted to the vehicle. GO to **B4**. CLEAN and TIGHTEN the ground connections at the base of the antenna and battery negative cable to the body. If concern the persists, INSTALL a new audio unit. TEST the system for normal operation. → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	INSTALL a new antenna cable. TEST the system for normal operation.
B4: CHECK THE DIVERSITY ANTENNA GRID WIRES ON THE REAR WINDOW GLASS OR RIGHT-HAND REAR QUARTER WINDOW GLASS	
	1 Check the diversity antenna grid wires on the rear window glass or right-hand rear quarter window glass for damage. • Are the diversity antenna grid wires on the rear window glass or right-hand rear window glass damaged? → **Yes** On all vehicles except wagon. INSTALL a new rear window glass. REFER to Rear Window Glass - 4-Door / Rear Window Glass - 5-Door in this section. TEST the system for normal operation. Wagon. INSTALL a new right-hand rear quarter window glass. REFER to Rear Quarter Wnidow Glass - Wagon in this section. TEST the system for normal operation. → **No** GO to **B5**.
B5: CHECK THE DIVERSITY ANTENNA CABLE SHIELD	
 TIW3801009	1 Key in OFF position. 2 Disconnect the diversity antenna cable from the audio unit. 3 Measure the resistance between the diversity antenna cable ground connector (shield), and ground. • Is the resistance less than 0.1 ohm? → **Yes** GO to **B6**. → **No** INSTALL a new diversity antenna cable. TEST the system for normal operation.
B6: CHECK THE DIVERSITY ANTENNA FOR OPEN	
	1 Remove the diversity antenna mast.

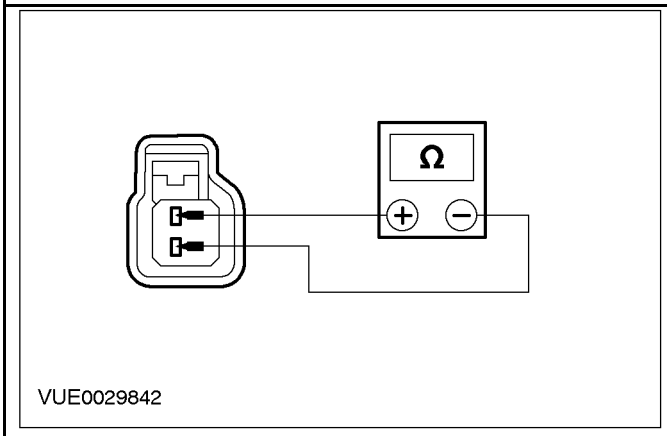
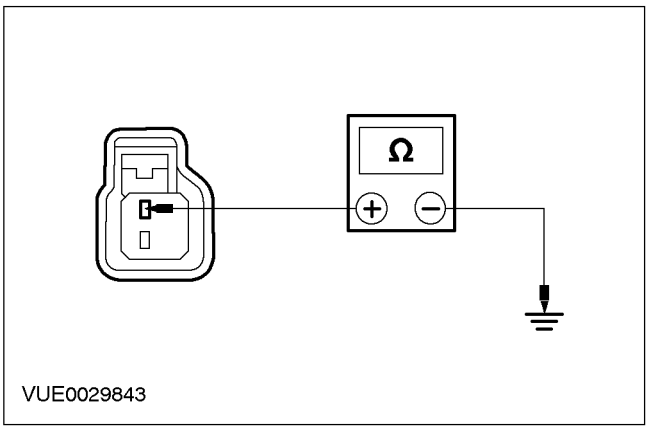
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VUE0030378	2 Measure the resistance of the diversity antenna rear window glass connector and the diversity antenna cable audio unit connector. • Is the resistance less than 0.1 ohm? → **Yes** GO to **B7**. → **No** INSTALL a new diversity antenna cable. TEST the system for normal operation.
B7: CHECK DIVERSITY ANTENNA CABLE FOR SHORT	
 TIV3801158	1 Measure the resistance between the diversity antenna center conductor and the diversity antenna ground (shield). • Is the resistance greater than 10,000 ohms? → **Yes** INSTALL a new audio unit. TEST the system for normal operation. → **No** INSTALL a new diversity antenna cable. TEST the system for normal operation.

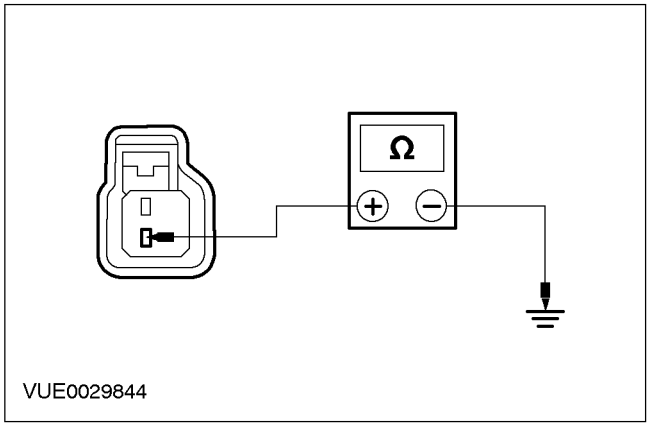
PINPOINT TEST C: POOR QUALITY/DISTORTED SOUND FROM ONE OR MORE SPEAKERS (NOT ALL SPEAKERS)

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK THE SPEAKER RESISTANCE	
	1 Disconnect Inoperative Speaker.

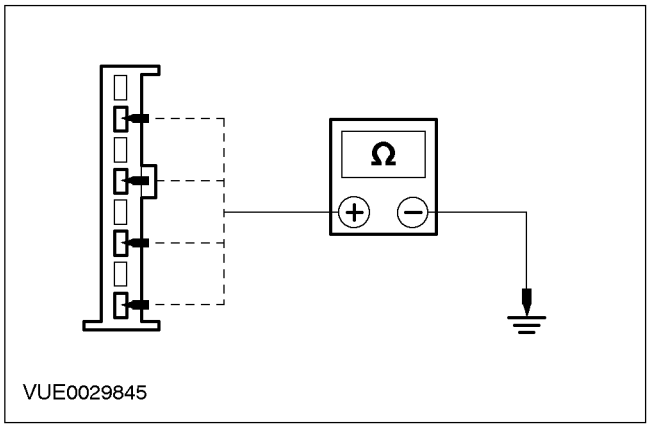
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VUE0029842	**2** Measure the resistance between the inoperative speaker pin 1 and pin 2, component side. • Is the resistance approximately 4.0 ohms? → **Yes** GO to **C2**. → **No** INSTALL a new speaker. TEST the system for normal operation.
C2: CHECK SPEAKER INPUT FOR SHORT TO GROUND	
 VUE0029843	**1** Disconnect Audio Unit C484. **2** Measure the resistance between the inoperative speaker connector pin 1, harness side and ground. • Is the resistance greater than 10,000 ohms? → **Yes** GO to **C3**. → **No** REPAIR speaker input circuit. TEST the system for normal operation.

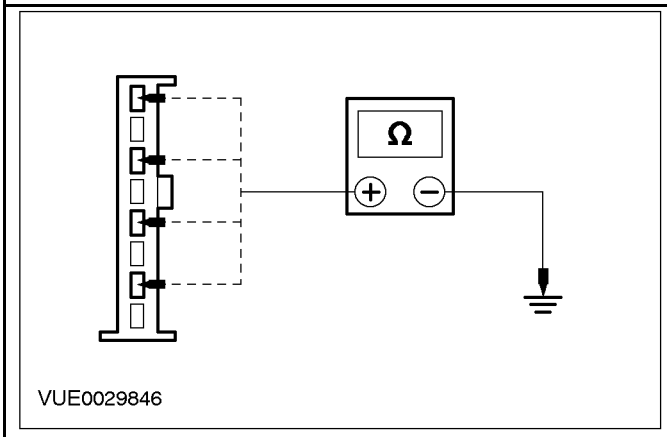
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
C3: CHECK SPEAKER RETURN FOR SHORT TO GROUND	
	1 Measure the resistance between the inoperative speaker connector pin 2, harness side and ground. • Is the resistance greater than 10,000 ohms? → **Yes** INSTALL a new speaker. TEST the system for normal operation. If the concern persists, INSTALL a new audio unit. TEST the system for normal operation. → **No** REPAIR speaker return circuit. TEST the system for normal operation.

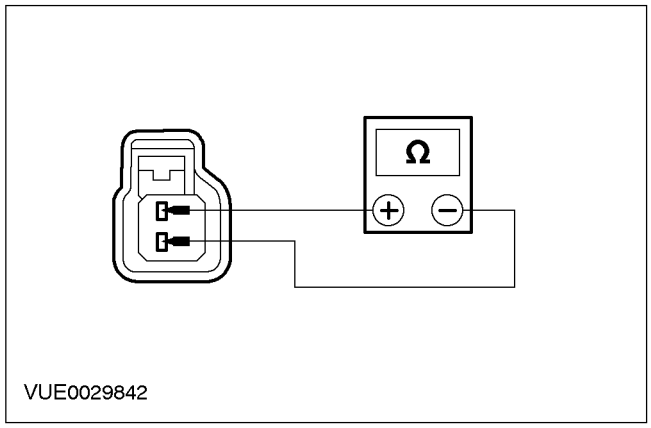
PINPOINT TEST D: NO SOUND FROM ALL SPEAKERS

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: CHECK SPEAKER INPUT CIRCUIT FOR SHORT TO GROUND	
	1 Key in OFF position. 2 Disconnect Audio Unit C484. 3 Measure the resistance between the following audio unit connector pins and ground: - (Front left speaker) C484 pin 1, circuit 8-MD10 (WH/BK), harness side and ground. - (Rear left speaker) C484 pin 3, circuit 8-MD11 (WH/VT), harness side and ground. - (Front right speaker) C484 pin 5, circuit 8-MD17 (WH/RD), harness side and ground. - (Rear right speaker) C484 pin 7, circuit 8-MD18 (WH), harness side and ground. • Are the resistances greater than 10,000 ohms? → **Yes** GO to **D2**. → **No** REPAIR the circuit in question. TEST the system for normal operation.

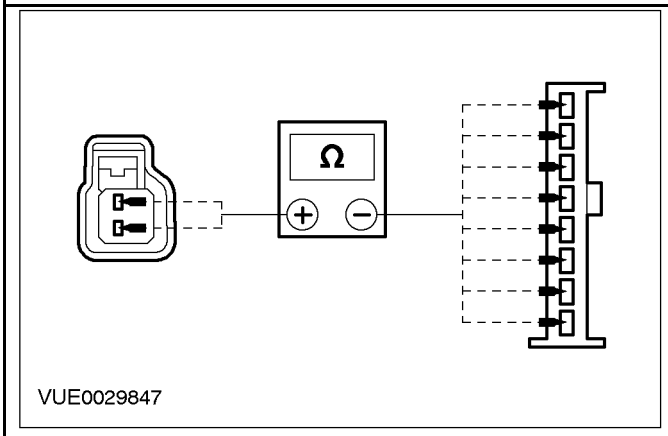
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
D2: CHECK SPEAKER RETURN CIRCUIT FOR SHORT TO GROUND	
	1 Measure the resistance between the following audio unit connector pins and ground: - (Front left speaker) C484 pin 2, circuit 10-MD10 (GY/BK), harness side and ground. - (Rear left speaker) C484 pin 4, circuit 10-MD11 (GY/WH), harness side and ground. - (Front right speaker) C484 pin 6, circuit 10-MD17 (GY/RD), harness side and ground. - (Rear right speaker) C484 pin 8, circuit 10-MD18 (GY), harness side and ground. • Are the resistances greater than 10,000 ohms? → **Yes** INSTALL a new audio unit. TEST the system for normal operation. → **No** REPAIR the circuit in question. TEST the system for normal operation.

PINPOINT TEST E: NO SOUND FROM ONE OR MORE OF THE SPEAKERS (NOT ALL SPEAKERS)

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: CHECK THE SPEAKER RESISTANCE	
	1 Disconnect Inoperative Speaker. 2 Measure the resistance between the inoperative speaker pin 1 and pin 2, component side. • Is the resistance approximately 4.0 ohms? → **Yes** GO to **E2**. → **No** INSTALL a new speaker(s). TEST the system for normal operation.
E2: CHECK SPEAKER CIRCUIT RESISTANCE - SPEAKER DISCONNECTED	
	1 Disconnect Audio Unit C484.

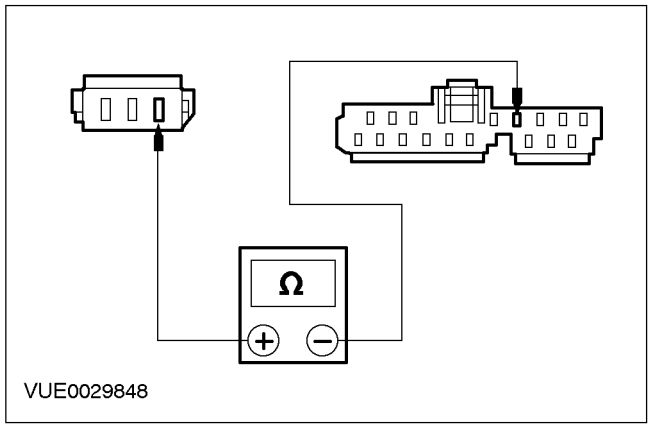
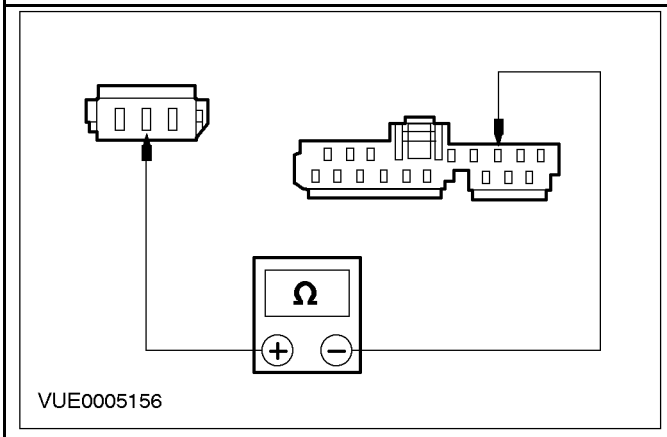
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	2 Measure the resistance between the audio unit C484 and the speaker connector pins for the inoperative speaker(s). - (Front left speaker) C484 pin 1, circuit 8-MD10 (WH/BK), harness side and C720 pin 2, circuit 8-MD28 (WH), harness side. - (Front left speaker) C484 pin 2, circuit 10-MD10 (GY/BK), harness side and C720 pin 1, circuit 10-MD28 (GY), harness side. - (Front right speaker) C484 pin 5, circuit 8-MD17 (WH/RD), harness side and C723 pin 2, circuit 8-MD28 (WH), harness side. - (Front right speaker) C484 pin 6, circuit 10-MD17 (GY/RD), harness side and C723 pin 1, circuit 10-MD28 (GY), harness side. - (Rear left speaker) C484 pin 3, circuit 8-MD11 (WH/VT), harness side and C722 pin 2, circuit 8-MD29 (WH/VT), harness side. - (Rear left speaker) C484 pin 4, circuit 10-MD11 (GY/WH), harness side and C722 pin 1, circuit 10-MD29 (GY/WH), harness side. - (Rear right speaker) C484 pin 7, circuit 8-MD18 (WH), harness side and C724 pin 2, circuit 8-MD29 (WH/VT), harness side. - (Rear right speaker) C484 pin 8, circuit 10-MD18 (GY), harness side and C724 pin 1, circuit 10-MD29 (GY/WH), harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new speaker. TEST the system for normal operation. If concern persists, INSTALL a new audio unit. TEST the system for normal operation → **No** REPAIR the circuit in question. TEST the system for normal operation.

PINPOINT TEST F: THE AUXILIARY AUDIO CONTROL SWITCH IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1: CHECK THE AUDIO UNIT OPERATES CORRECTLY WITHOUT USING THE AUDIO CONTROL SWITCH	
	1 Operate the audio unit without the audio control switch. • Does the audio unit operate correctly without using the remote control? → **Yes** GO to **F2**. → **No** INSTALL a new audio unit. TEST the system for normal operation.

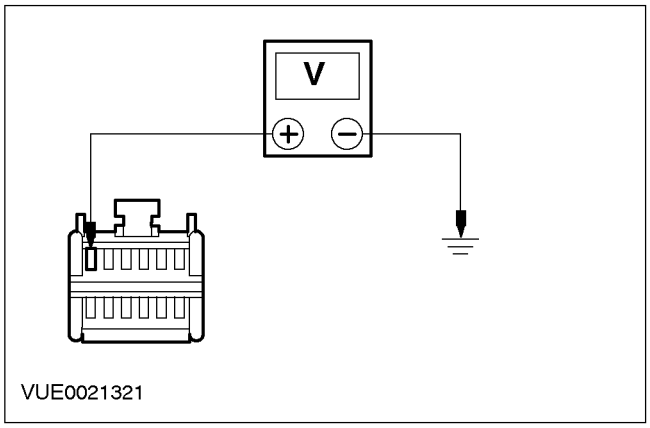
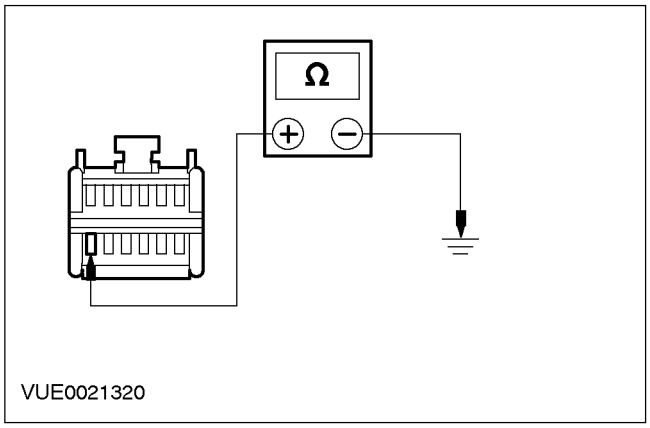
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
F2: CHECK THE CIRCUIT 8-MD26 FOR OPEN	
 VUE0029848	1 Disconnect Audio Unit C485. 2 Disconnect Audio Control Switch C487. 3 Measure the resistance between the audio unit C485 pin 11, circuit 8-MD26 (WH/BK) harness side and the audio control switch C487 pin 1, circuit 8-MD26 (WH/BK) harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **F3**. → **No** REPAIR the circuit. TEST the system for normal operation.
F3: CHECK CIRCUIT 9-MD26 FOR OPEN	
 VUE0005156	1 Measure the resistance between the audio unit C485 pin 12, circuit 9-MD26 (BN/YE) harness side and the audio control switch C487 pin 2, circuit 9-MD26 (BN/YE) harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new audio control switch. TEST the system for normal operation. → **No** REPAIR the circuit. TEST the system for normal operation.

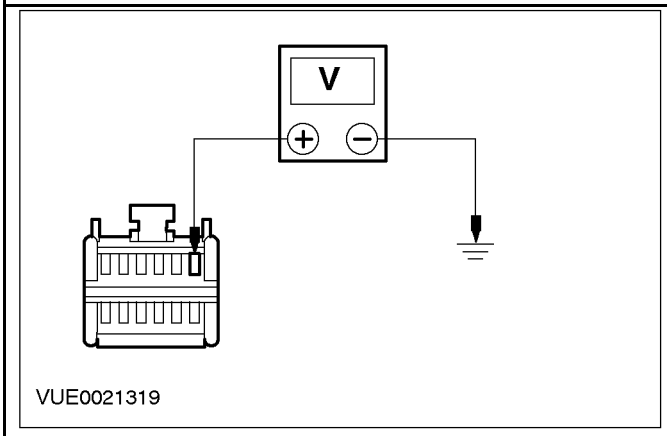
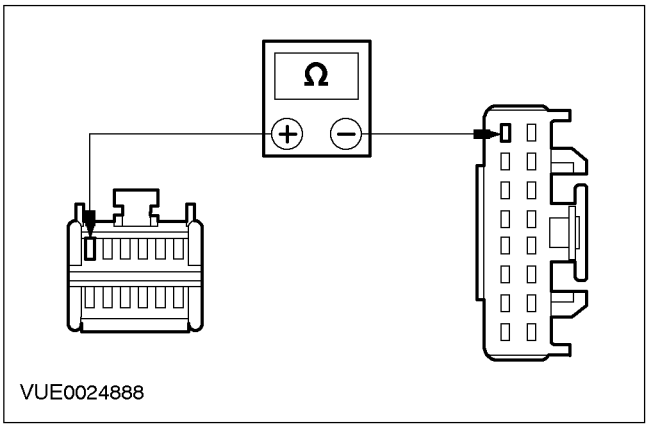
NOTE: The video system will only operate when the audio unit is switched on.

DIAGNOSIS AND TESTING

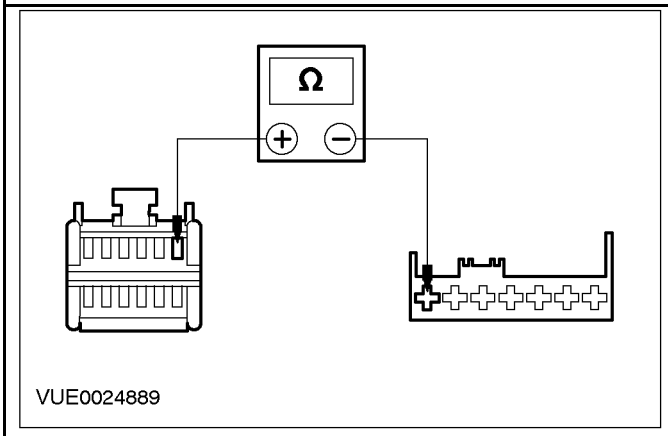
PINPOINT TEST G: THE VIDEO SYSTEM IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1: CHECK VIDEO SYSTEM MODULE C552 CIRCUIT 29-MD16A (OG/GN) FOR VOLTAGE	
 VUE0021321	1 Disconnect Video System Module C552. 2 Switch the audio unit ON. 3 Measure the voltage between the video system module C552 pin 6, circuit 29-MD16A (OG/GN), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **G2**. → **No** GO to **G4**.
G2: CHECK THE VIDEO SYSTEM MODULE C552 91-MD16A (BK) FOR GROUND	
 VUE0021320	1 Measure the resistance between the video system module C552 pin 12, circuit 91-MD16A (BK), harness side and ground. • Is the resistance less than 0.5 ohms? → **Yes** GO to **G3**. → **No** REPAIR the circuit. TEST the system for normal operation.
G3: CHECK SWITCHED POWER TO VIDEO SYSTEM MODULE CIRCUIT 29S-MD16 (OG/GN) WITH THE AUDIO UNIT SWITCHED ON	
	1 Switch the audio unit ON.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VUE0021319	**2** Measure the voltage between the video system module C552 pin 1, circuit 29S-MD16 (OG/GN), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** INSTALL a new video system module. TEST the system for normal operation. → **No** REPAIR the circuit. TEST the system for normal operation.
G4: CHECK POWER CIRCUIT BETWEEN VIDEO SYSTEM MODULE C552 CIRCUIT 29-MD16A (OG/GN) AND CENTRAL JUNCTION BOX (CJB) C501 CIRCUIT 29-MD15 (OG/BK) FOR OPEN	
 VUE0024888	**1** Disconnect Central Junction Box (CJB) C501. **2** Measure the resistance between the video system module C552 pin 6, circuit 29-MD16A (OG/GN), harness side and the CJB C501 pin 14, circuit 29-MD15 (OG/BK), harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **G5**. → **No** REPAIR the circuit. TEST the system for normal operation.
G5: CHECK SWITCHED POWER CIRCUIT BETWEEN VIDEO SYSTEM MODULE C552 CIRCUIT 29S-MD16 (OG/GN) AND AUDIO UNIT C489 (OG/GN) FOR OPEN	
	1 Disconnect Audio Unit C489.

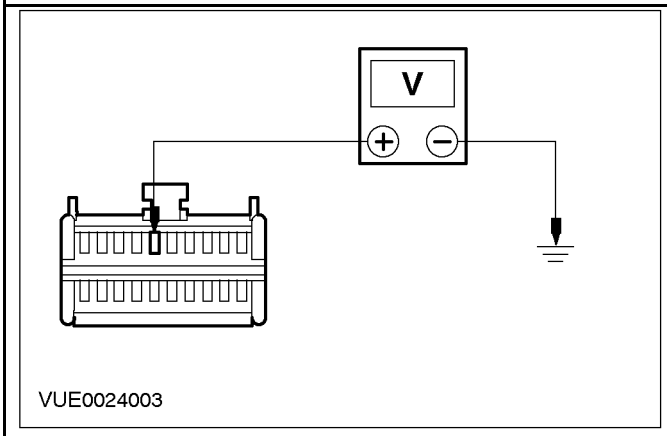
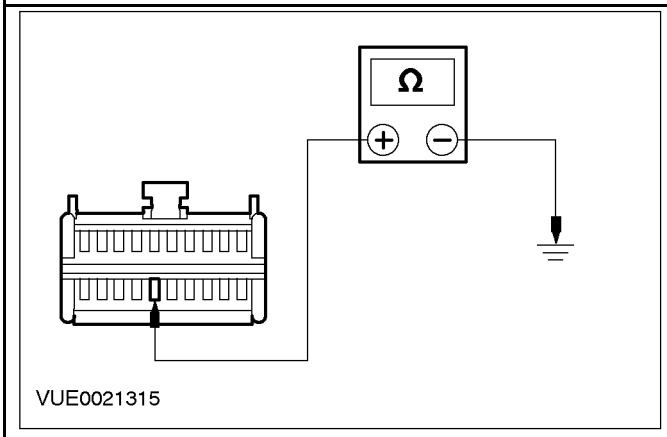
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	2 Measure the resistance between the video system module C552 pin 1, circuit 29S-MD16 (OG/GN), harness side and the audio unit C489 pin 7, circuit 29S-MD16 (OG/GN), harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new audio unit. TEST the system for normal operation. → **No** REPAIR the circuit. TEST the system for normal operation.

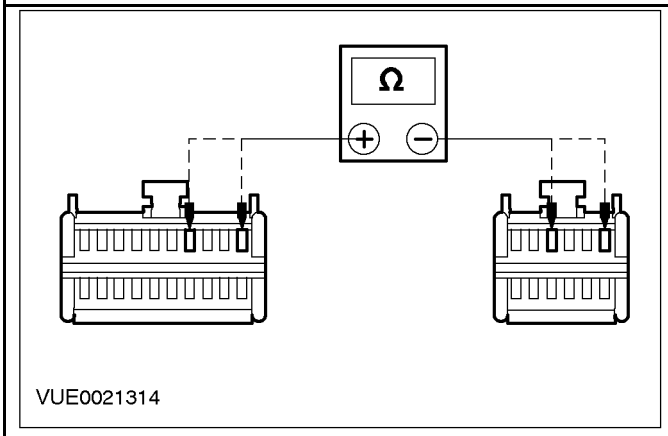
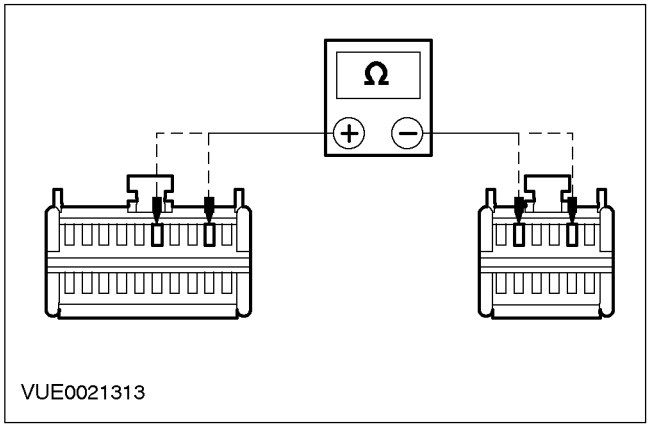
PINPOINT TEST H: NO AUXILIARY HEADPHONE AUDIO

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1: CHECK THE HEADPHONE AND HEADPHONE SOCKETS	
	1 Using a known good headphone, check the headphone in the right-hand and left-hand sockets. • Does the substitute headphone operate correctly? → **Yes** INSTALL a new headphone. TEST the system for normal operation. → **No** No output from either channel, GO to **H2**. No output from the right-hand channel, GO to **H4**. No output from the left-hand channel, GO to **H5**.
H2: CHECK THE PASSENGER ENTERTAINMENT CONTROL PANEL C521 (RD) FOR VOLTAGE	
	1 Disconnect Passenger Entertainment Control Panel C521.

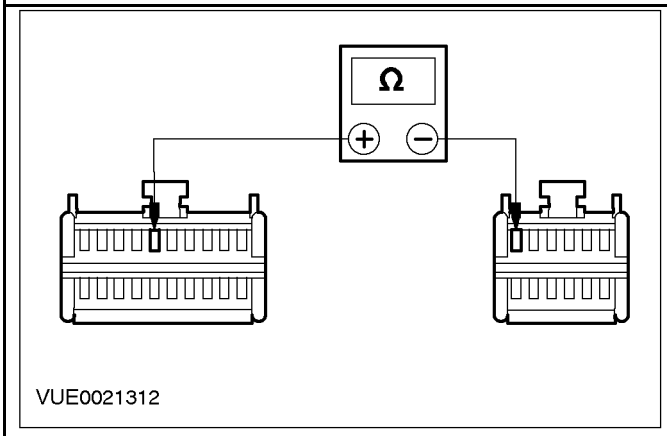
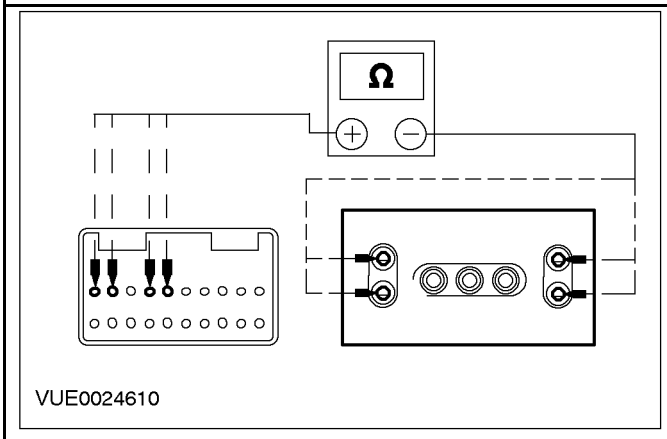
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VUE0024003	**2** Measure the voltage between the passenger entertainment control panel C521 pin 6, (RD), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **H3**. → **No** GO to **H6**
H3: CHECK THE PASSENGER ENTERTAINMENT CONTROL PANEL C521 (BK) FOR GROUND	
 VUE0021315	**1** Measure the resistance between the passenger entertainment control panel C521 pin 16, (BK), harness side and ground. • Is the resistance less than 0.5 ohms? → **Yes** INSTALL a new video system module. TEST the system for normal operation. → **No** REPAIR the circuit (BK). TEST the system for normal operation.
H4: CHECK RIGHT-HAND HEADPHONE CIRCUIT (NO) FOR OPEN	
	1 Disconnect Video System Module C520. **2** Disconnect Passenger Entertainment Control Panel C521.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	3 Measure the resistances between the video system module C520 pin 1, (NO), harness side and the passenger entertainment control panel C521 pin 1, (NO), harness side; and between the video system module C520 pin 4, (NO), harness side and the passenger entertainment control panel C521 pin 4, (NO), harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **H7**. → **No** REPAIR the circuit(s) (NO). TEST the system for normal operation
H5: CHECK LEFT-HAND HEADPHONE CIRCUIT (NO) FOR OPEN	
	1 Disconnect Video System Module C520. 2 Disconnect Passenger Entertainment Control Panel C521. 3 Measure the resistances between the video system module C520 pin 2, (NO), harness side and the passenger entertainment control panel C521 pin 2, (NO), harness side; and between the video system module C520 pin 5, (NO), harness side and the passenger entertainment control panel C521 pin 5, (NO), harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **I7**. → **No** REPAIR the circuit(s) (NO). TEST the system for normal operation.
H6: CHECK POWER CIRCUIT BETWEEN VIDEO SYSTEM MODULE C520 (RD) AND PASSENGER ENTERTAINMENT CONTROL PANEL C521 (RD) FOR OPEN	
	1 Disconnect Video System Module C520.

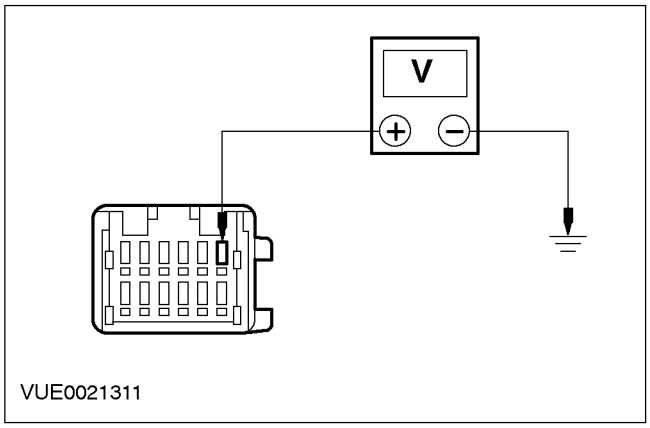
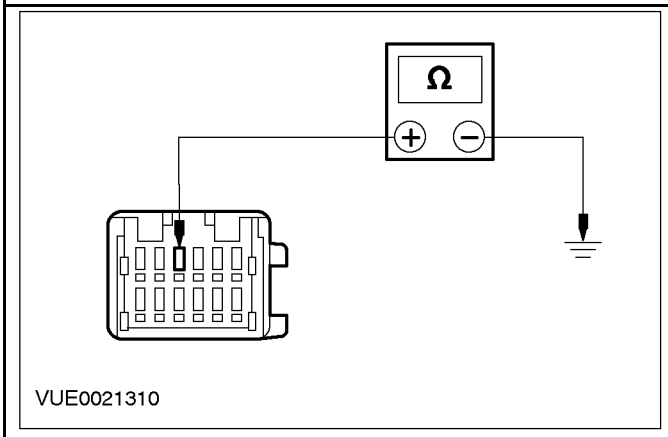
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**2** Measure the resistance between the video system module C520 pin 6, (RD), harness side and the passenger entertainment control panel C521 pin 6, (RD), harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **H7**. → **No** REPAIR the circuit (RD). TEST the system for normal operation.
H7: CHECK THE PASSENGER ENTERTAINMENT CONTROL PANEL FOR CONTINUITY	
	**1** Measure the resistance between the passenger entertainment control panel C96, component side and the headphone sockets: - pins 4 and 5 and the left-hand headphone sockets - pins 1 and 2 and the right-hand headphone sockets • Are the resistances less than 0.5 ohms? → **Yes** INSTALL a new video system module. TEST the system for normal operation. → **No** INSTALL a new passenger entertainment control panel. TEST the system for normal operation.

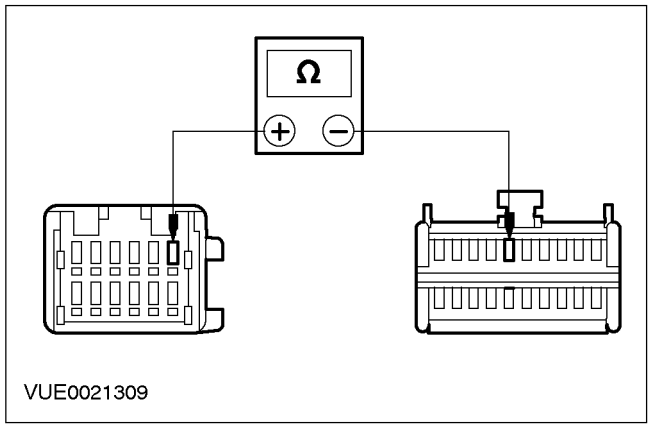
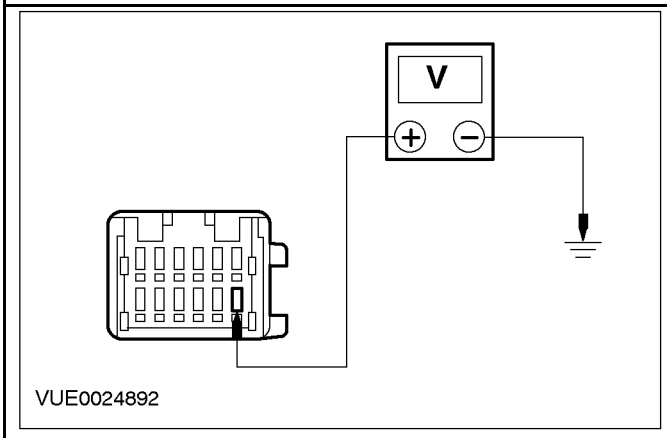
PINPOINT TEST I: THE VIDEO DISPLAY IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
⚠ WARNING: Do not attempt to open or repair a video display as there are internal voltages in excess of 2000 volts. Failure to follow this instruction may result in personal injury.	
I1: CHECK OPERATION OF THE VIDEO DISPLAY	
	1 Change the head restraints/video displays between the two front seats.

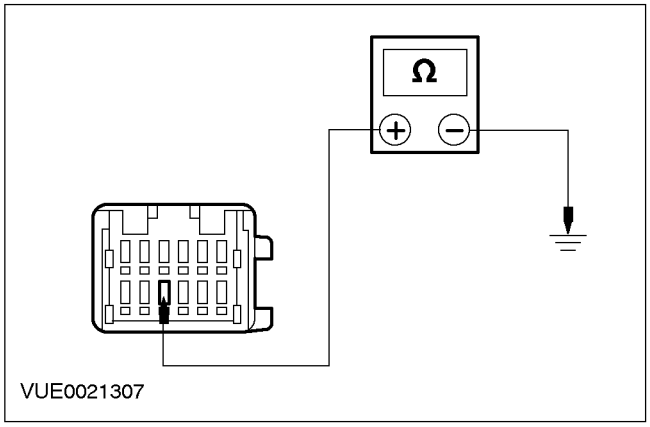
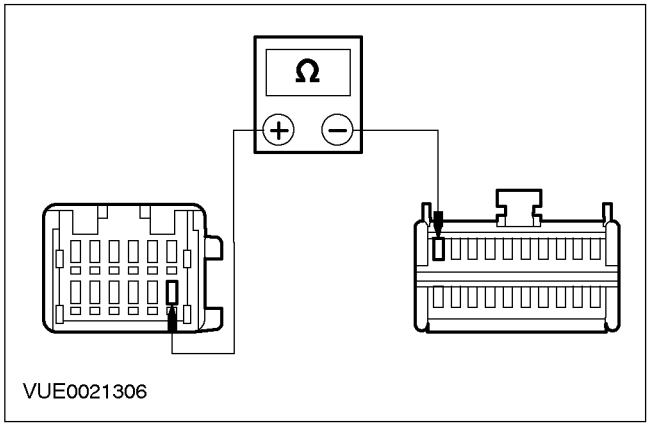
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Has the concern moved with the video display? → **Yes** INSTALL a new head restraint/video display. TEST the system for normal operation. → **No** For concern with right-hand video display, GO to **I2**. For concern with left-hand video display, GO to **I8**.
I2: CHECK RIGHT-HAND FRONT SEAT BACKREST UPPER VIDEO SYSTEM C529 CIRCUIT 15-MD16A (OG) FOR VOLTAGE	
 VUE0021311	1 Disconnect Right-Hand Front Seat Backrest Upper Video System C557. 2 Measure the voltage between the right-hand front seat backrest upper video system C557 pin 6, circuit 15-MD16A (OG), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **I3**. → **No** GO to **I4**.
I3: CHECK RIGHT-HAND FRONT SEAT BACKREST UPPER VIDEO SYSTEM C557 CIRCUIT 48-MD16A (NO) FOR GROUND	
 VUE0021310	1 Measure the resistance between the right-hand front seat backrest upper video system C557 pin 3, circuit 48-MD16A (NO), harness side and ground. • Is the resistance less than 0.5 ohms? → **Yes** GO to **I5**.

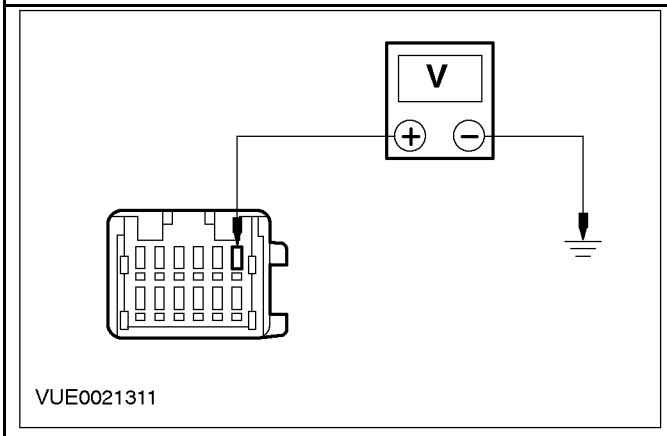
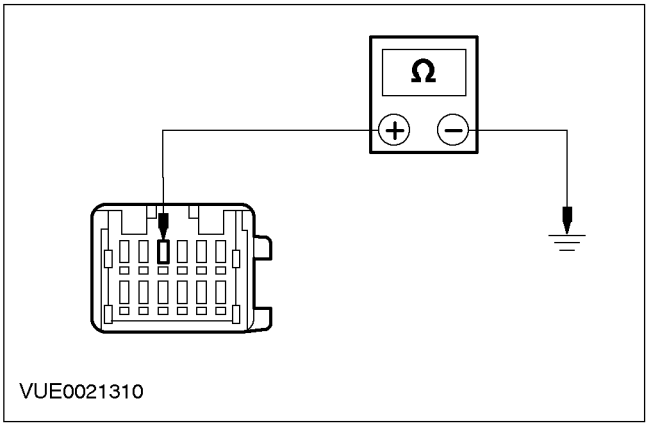
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **No** REPAIR the circuit. TEST the system for normal operation.
I4: CHECK POWER CIRCUIT BETWEEN RIGHT-HAND FRONT SEAT BACKREST UPPER VIDEO C557 (OG) AND VIDEO SYSTEM MODULE C553 CIRCUIT 15-MD16A (OG) FOR OPEN	
	1 Disconnect Video System Module C553. 2 Measure the resistance between the right-hand front seat backrest upper video system C557 pin 6, (OG), harness side and the video system module C553 pin 6, circuit 15-MD16A (OG), harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **I5**. → **No** REPAIR the circuit (OG). TEST the system for normal operation
I5: CHECK RIGHT-HAND FRONT SEAT BACKREST UPPER VIDEO SYSTEM C557 CIRCUIT 15-XL21A (RD) FOR ILLUMINATION VOLTAGE	
	1 Measure the voltage between the right-hand front seat backrest upper video system C557 pin 16, circuit 15-XL21A (RD), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **I6**. → **No** GO to **I7**.

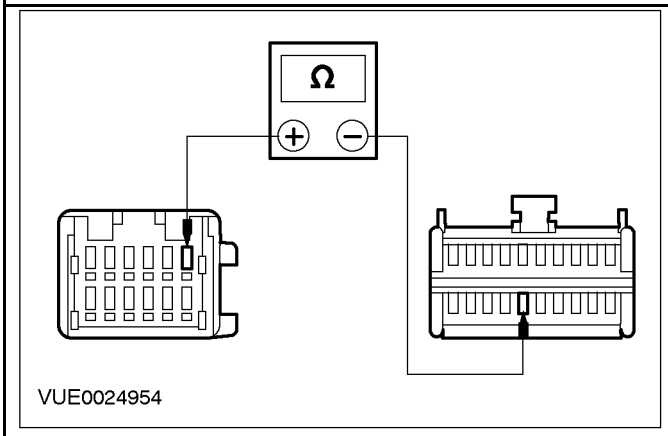
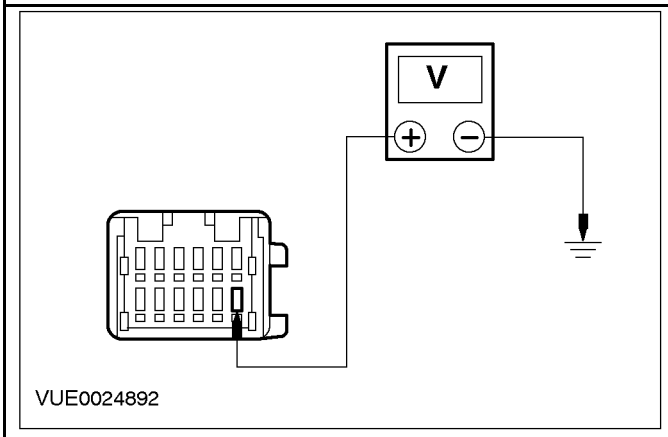
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
I6: CHECK RIGHT-HAND FRONT SEAT BACKREST UPPER VIDEO SYSTEM C557 CIRCUIT 91-XL21A (BK) FOR ILLUMINATION GROUND	
	1 Measure the resistance between the right-hand front seat backrest upper video system C557 pin 13, circuit 91-XL21A (BK), harness side and ground. • Is the resistance less than 0.5 ohms? → **Yes** GO to **I7**. → **No** REPAIR the circuit. TEST the system for normal operation.
I7: CHECK CIRCUIT BETWEEN RIGHT-HAND FRONT SEAT BACKREST UPPER VIDEO SYSTEM C557 (RD) AND VIDEO SYSTEM MODULE C553 CIRCUIT 15-XL21A (RD) FOR OPEN	
	1 Disconnect Video System Module C553. 2 Measure the resistance between the right-hand front seat backrest upper videosystem C557 pin 16, (RD), harness side and the video system module C553 pin 10, circuit 15-XL21A (RD), harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new video system module. TEST the system for normal operation. → **No** REPAIR the circuit. TEST the system for normal operation.
I8: CHECK LEFT-HAND FRONT SEAT BACKREST UPPER VIDEO SYSTEM C554 CIRCUIT 15-MD16 (GN/OG) FOR VOLTAGE	
	1 Disconnect Front Seat Backrest Upper Video System C554.

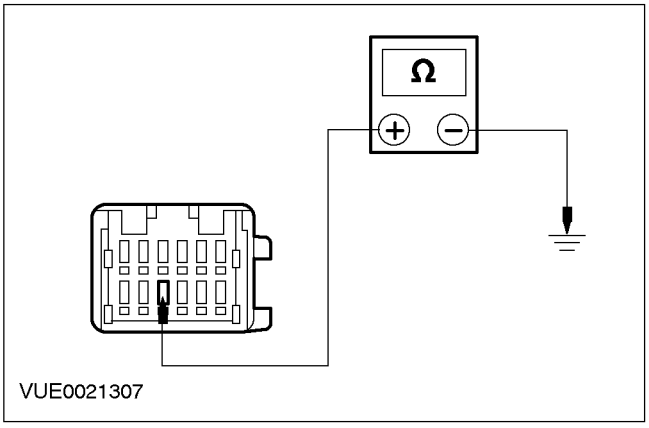
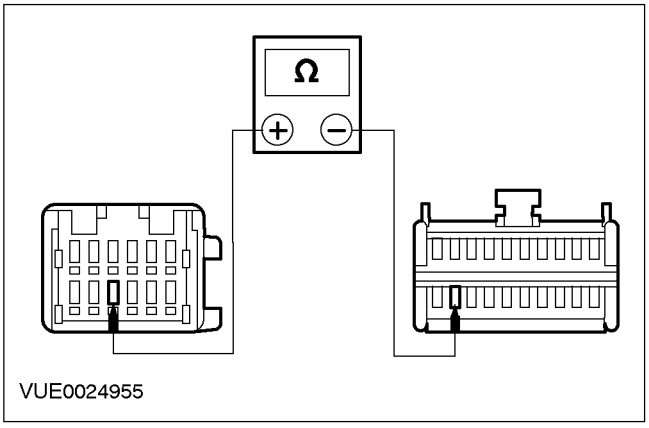
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VUE0021311	**2** Measure the voltage between the left-hand front seat backrest upper video system C554 pin 6, circuit 15-MD16 (GN/OG), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **I9**. → **No** GO to **I10**.
I9: CHECK LEFT-HAND FRONT SEAT BACKREST UPPER VIDEO SYSTEM C554 CIRCUIT 48-MD16 (NO) FOR GROUND	
 VUE0021310	**1** Measure the resistance between the left-hand front seat backrest upper video system C554 pin 3, circuit 48-MD16 (NO), harness side and ground. • Is the resistance less than 0.5 ohms? → **Yes** GO to **I11**. → **No** REPAIR the circuit. TEST the system for normal operation.
I10: CHECK POWER CIRCUIT BETWEEN LEFT-HAND FRONT SEAT BACKREST UPPER VIDEO C554 (GN/OG) AND VIDEO SYSTEM MODULE C553 CIRCUIT 15-MD16 (GN/OG) FOR OPEN	
	1 Disconnect Video System Module C553.

DIAGNOSIS AND TESTING (Continued)

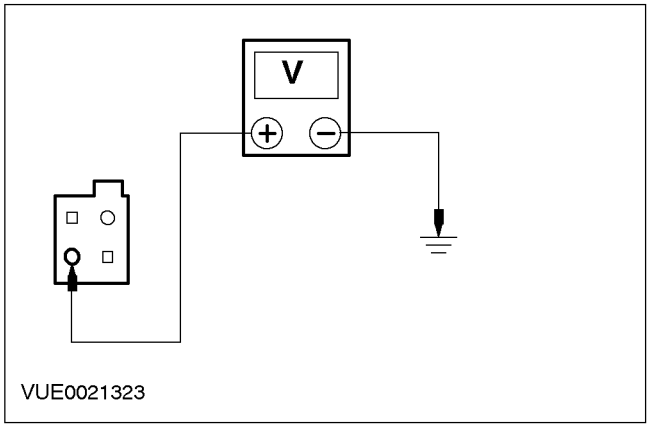
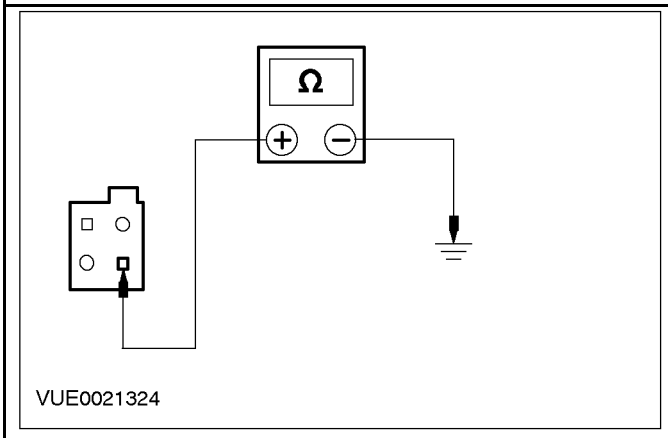
CONDITIONS	DETAILS/RESULTS/ACTIONS
	**2** Measure the resistance between the left-hand front seat backrest upper video system C554 pin 6, (GN/OG), harness side and the video system module C553 pin 16, circuit 15-MD16 (GN/OG), harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **I11**. → **No** REPAIR the circuit. TEST the system for normal operation.
I11: CHECK LEFT-HAND FRONT SEAT BACKREST UPPER VIDEO SYSTEM C554 CIRCUIT 15-XL1 (GN/BU) FOR ILLUMINATION VOLTAGE	
	**1** Measure the voltage between the left-hand front seat backrest upper video system C528 pin 16, circuit 15-XL1 (GN/BU), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **I12**. → **No** GO to **I13**.

DIAGNOSIS AND TESTING (Continued)

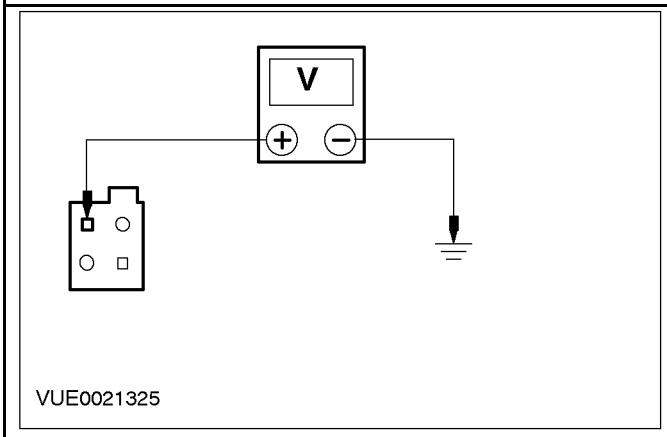
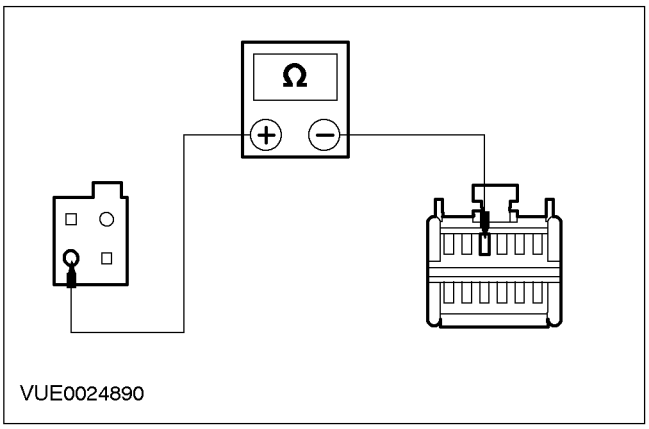
CONDITIONS	DETAILS/RESULTS/ACTIONS
I12: CHECK LEFT-HAND FRONT SEAT BACKREST UPPER VIDEO SYSTEM C528 CIRCUIT 91-XL21 (BK) FOR ILLUMINATION GROUND	
	**1** Measure the resistance between the left-hand front seat backrest upper video system C554 pin 13, circuit 1-XL1 (WH/RD), harness side and ground. • Is the resistance less than 0.5 ohms? → **Yes** GO to **I13**. → **No** REPAIR the circuit. TEST the system for normal operation.
I13: CHECK CIRCUIT BETWEEN LEFT-HAND FRONT SEAT BACKREST UPPER VIDEO SYSTEM C554 (RD) AND VIDEO SYSTEM MODULE C553 CIRCUIT 91-XL21 (RD) FOR OPEN	
	**1** Disconnect Video System Module C553. **2** Measure the resistance between the left-hand front seat backrest upper video system C554 pin 9, (WH/RD), harness side and the video system module C553 pin 19, circuit 1-XL21 (WH/RD), harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new video system module. TEST the system for normal operation. → **No** REPAIR the circuit. TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

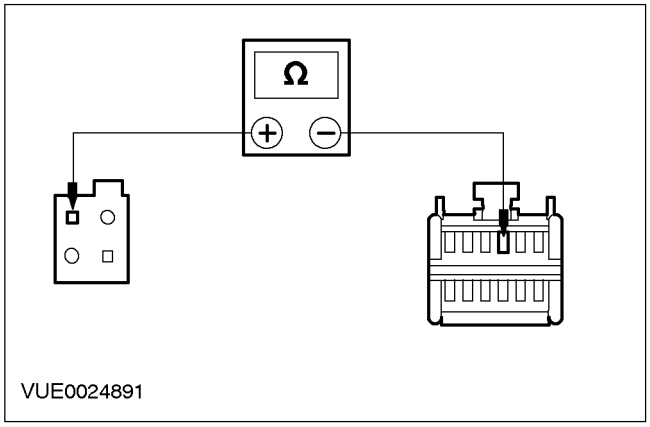
PINPOINT TEST J: THE VIDEO CASSETTE PLAYER IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
J1: CHECK VIDEO CASSETTE PLAYER C556 (RD) FOR VOLTAGE	
 VUE0021323	1 Disconnect Video Cassette Player C556. 2 Switch the audio unit ON. 3 Measure the voltage between the video cassette player C556 pin 4, (RD), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **J2**. → **No** GO to **J3**.
J2: CHECK VIDEO CASSETTE PLAYER C556 (BK) FOR GROUND	
 VUE0021324	1 Measure the resistance between the video cassette player C556 pin 2, (BK), harness side and ground. • Is the resistance less than 0.5 ohms? → **Yes** GO to **J5**. → **No** REPAIR the circuit. TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
J3: CHECK SWITCHED POWER CIRCUIT TO THE VIDEO CASSETTE PLAYER C556 (GN/BU)	
 VUE0021325	1 Measure the voltage between the video cassette player C556 pin 3, (GN/BU), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** INSTALL a new video cassette player. TEST the system for normal operation. → **No** GO to **J4**.
J4: CHECK POWER CIRCUIT BETWEEN VIDEO SYSTEM MODULE C552 CIRCUIT 15-XL2 (GN/BU) AND VIDEO CASSETTE PLAYER C556 (GN/BU) FOR OPEN	
 VUE0024890	1 Disconnect Video System Module C552. 2 Measure the resistance between the video system module C552 pin 4, circuit 15-XL2 (GN/BU), harness side and the video cassette player C556 pin 4, (GN/BU), harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **J5**. → **No** REPAIR the circuit. TEST the system for normal operation.

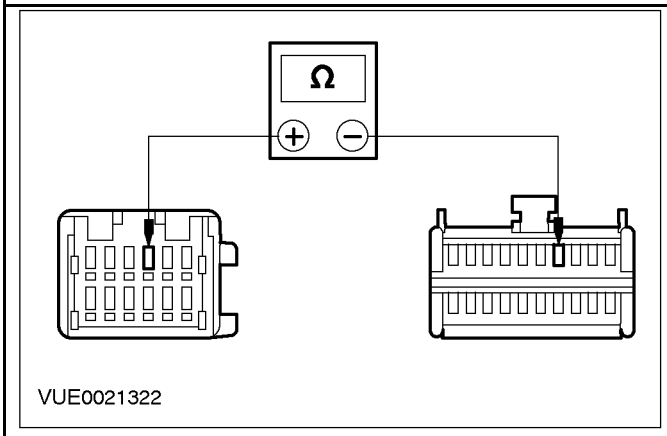
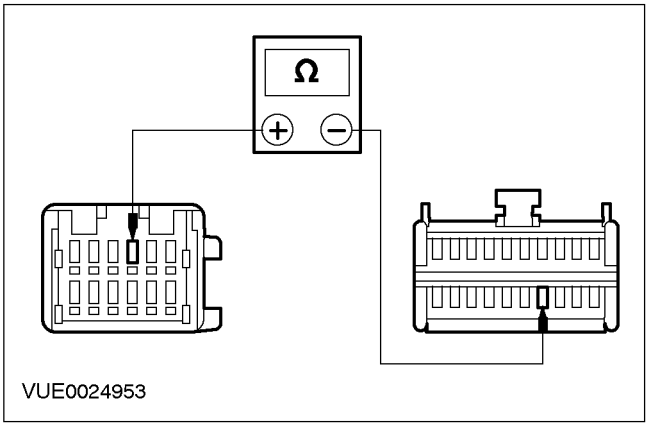
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
J5: CHECK SWITCHED POWER CIRCUIT BETWEEN THE VIDEO SYSTEM MODULE C552 CIRCUIT 15S-XL24 (OG) AND THE VIDEO CASSETTE PLAYER C519 (OG) FOR OPEN	
	1 Measure the resistance between the video system module C552 pin 3, circuit 15S-XL2 (GN/BU), harness side and the video cassette player C519 pin 3, (GN/BU), harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new video system module. TEST the system for normal operation. → **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST K: REMOTE CONTROL IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
K1: CHECK OPERATION OF THE INFRARED SENSORS USING THE REMOTE CONTROL	
NOTE: Refer to the Multimedia System Operating Guide for full operating instructions.	
	1 Operate the remote control while pointing it at the infrared sensor of each video display in turn. 2 Change the head restraints/video displays between the two front seats. • Has the concern moved with the video display? → **Yes** INSTALL a new head restraint/video display. TEST the system for normal operation. → **No** For concern with right-hand video display, GO to **K2**. For concern with left-hand video display, GO to **K3**.
K2: CHECK CIRCUIT BETWEEN RIGHT-HAND FRONT SEAT BACKREST UPPER VIDEO SYSTEM C557 (WH) AND VIDEO SYSTEM MODULE C553 CIRCUIT 4-MD16A (WH) FOR OPEN	
	1 Disconnect Right-Hand Front Seat Backrest Upper Video System C557. 2 Disconnect Video System Module C553.

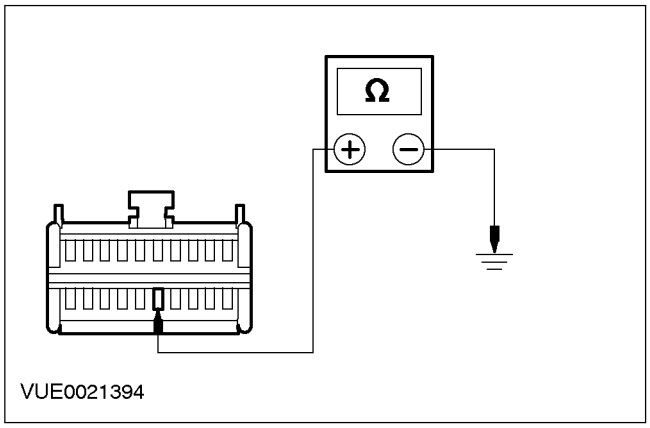
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	3 Measure the resistance between the right-hand front seat backrest upper video system C557 pin 4, (WH), harness side and the video system module C553 pin 4, circuit 4-MD16A (WH), harness side. • Is the resistance less than 0.5 ohms? → **Yes** GO to **K4**. → **No** REPAIR the circuit. TEST the system for normal operation.
K3: CHECK CIRCUIT BETWEEN LEFT-HAND FRONT SEAT BACKREST UPPER VIDEO SYSTEM C554 (WH) AND VIDEO SYSTEM MODULE C553 CIRCUIT 4-MD16 (WH) FOR OPEN	
	1 Disconnect Front Seat Backrest Upper Video System C554. 2 Disconnect Video System Module C553. 3 Measure the resistance between the left-hand front seat backrest upper video system C554 pin 4, (WH), harness side and the video system module C553 pin 14, circuit 4-MD16 (WH), harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **K4**. → **No** REPAIR the circuit. TEST the system for normal operation.
K4: CHECK THE VIDEO CASSETTE PLAYER OPERATION USING THE CONTROLS ON THE VIDEO CASSETTE PLAYER	
	1 Operate the video cassette player using the controls on the video cassette player. • Does the video cassette player operate correctly?

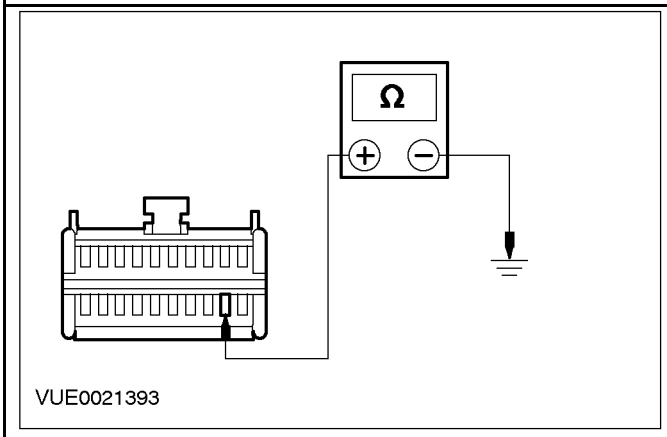
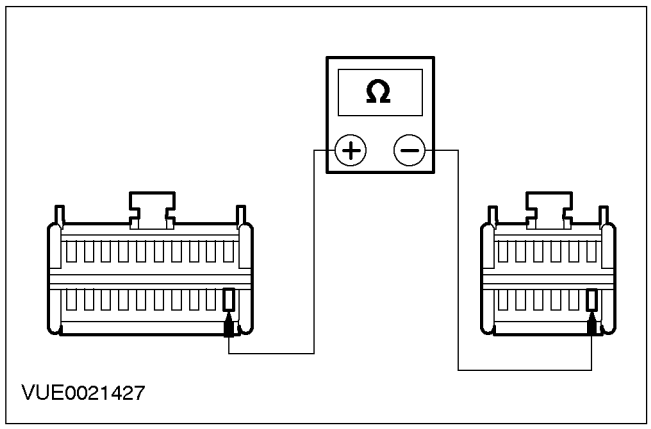
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** INSTALL a new remote control. TEST the system for normal operation. → **No** INSTALL a new video system module. TEST the system for normal operation.

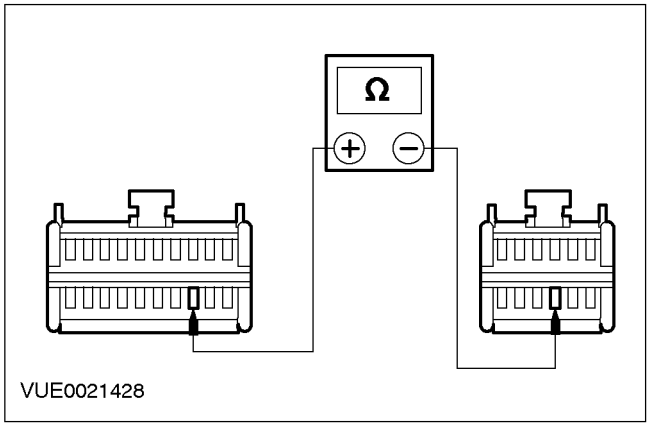
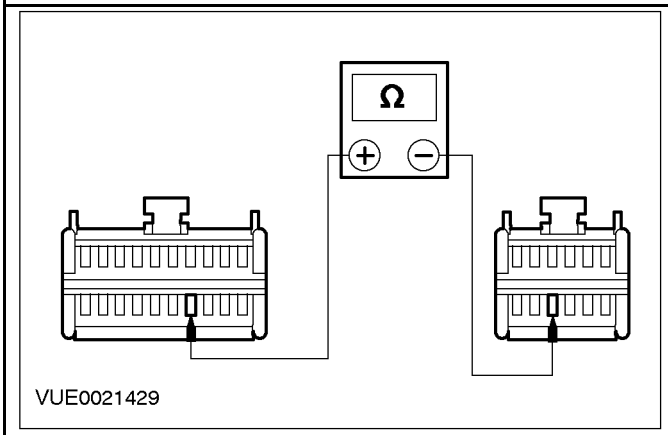
PINPOINT TEST L: EXTERNAL GAME CONSOLE/MEDIA SOURCE IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: An inverter is required (not supplied by Ford) to convert the vehicle battery voltage to mains voltage to power external games consoles etc. Make sure the inverter cable has not become broken, split or damaged. Failure to follow this instruction may result in personal injury.	
NOTE: Make sure that the external game console/media source device operates correctly out of the vehicle before commencing diagnostics.	
L1: CHECK PASSENGER ENTERTAINMENT CONTROL PANEL C521 (VT) FOR AUDIO GROUND	
	**1** Disconnect Passenger Entertainment Control Panel C521. **2** Measure the resistance between the passenger entertainment control panel C521 pin 15, (VT), harness side and ground. • Is the resistance less than 0.5 ohms? → **Yes** GO to **L2**. → **No** REPAIR the circuit (VT). TEST the system for normal operation.

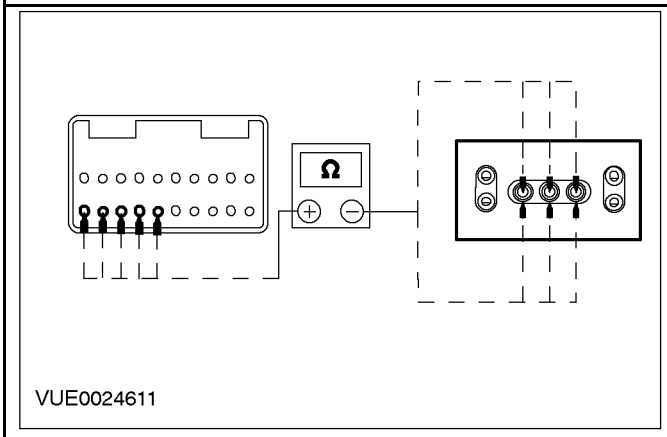
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
L2: CHECK PASSENGER ENTERTAINMENT CONTROL PANEL C521 (BN) FOR VIDEO GROUND	
	1 Measure the resistance between the passenger entertainment control panel C521 pin 12, (BN), harness side and ground. • Is the resistance less than 0.5 ohms? → **Yes** GO to **L3**. → **No** REPAIR the circuit (BN). TEST the system for normal operation.
L3: CHECK VIDEO CIRCUIT BETWEEN PASSENGER ENTERTAINMENT CONTROL PANEL C521 (YE) AND VIDEO SYSTEM MODULE C520 (YE)	
	1 Disconnect Video System Module C520. 2 Measure the resistance between the passenger entertainment control panel C521 pin 1,1 (YE), harness side and the video system module C520 pin 7, (YE), harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **L4**. → **No** REPAIR the circuit (YE). TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
L4: CHECK RIGHT-HAND AUDIO CIRCUIT BETWEEN PASSENGER ENTERTAINMENT CONTROL PANEL C521 (BU) AND VIDEO SYSTEM MODULE C520 (BU)	
	**1** Measure the resistance between the passenger entertainment control panel C521 pin 13, (BU), harness side and the video system module C520 pin 9, (BU), harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **L5**. → **No** REPAIR the circuit (BU). TEST the system for normal operation.
L5: CHECK LEFT-HAND AUDIO CIRCUIT BETWEEN PASSENGER ENTERTAINMENT CONTROL PANEL C521 (GN) AND VIDEO SYSTEM MODULE C520 (GN)	
	**1** Measure the resistance between the passenger entertainment control panel C521 pin 14, (GN), harness side and the video system module C520 pin 10, (GN), harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **L6**. → **No** REPAIR the circuit (GN). TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
L6: CHECK THE PASSENGER ENTERTAINMENT CONTROL PANEL FOR CONTINUITY	
 VUE0024611	1 Measure the resistances between the passenger entertainment control panel C521, component side and the auxiliary input sockets: - pin 11 and the yellow video input socket center pin - pin 12 and the yellow video input socket outer shield - pin 13 and the red audio input socket center pin - pin 14 and the white audio input socket center pin - pin 15 and the red audio input socket outer shield - pin 15 and the white audio input socket outer shield • Are the resistances less than 0.5 ohms? → **Yes** INSTALL a new video system module. TEST the system for normal operation. → **No** INSTALL a new passenger entertainment control panel. TEST the system for normal operation.

PINPOINT TEST M: CD CHANGER IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
M1: CHECK IN-LINE FUSE	
	1 CHECK Fuse F101 (3A). 2 Check in-line fuse F101 (3A) for the CD changer. • Is the fuse OK? → **Yes** GO to **M2**. → **No** INSTALL a new fuse. TEST the system for normal operation.
M2: TEST THE AUDIO UNIT TO CD CHANGER WIRING HARNESS	
	1 Disconnect CD Changer C465. 2 Disconnect Audio Unit C464 (Standard Audio Unit or Travel Pilot Navigation) or C1464 (9000 Vehicle Navigation Radio (VNR)). 3 Carry out the CD changer wiring harness component test, REFER to the Component Test in this Section. • Is the audio unit to CD changer wiring harness OK? → **Yes** GO to **M3**.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **No** REPAIR the CD changer wiring harness. TEST the system for normal operation.
M3: CHECK FOR CORRECT OPERATION OF CD CHANGER	
	1 Substitute a known good CD changer. 2 Verify correct operation of the substitute CD changer. • Do all CD changer functions operate correctly? → **Yes** INSTALL a new CD changer. REFER to Section 415-01. TEST the system for normal operation. → **No** REMOVE the substitute CD changer and INSTALL the original CD changer. INSTALL a new audio unit. TEST the system for normal operation.

Component Tests

CD Changer Wiring Harness

NOTE: Refer to the Wiring Diagram, Section 415-00 or Section 419-07 for Schematic and Connector information.

1. Test the CD changer wiring harness using the following table as a guide to meter lead placement as well as expected values.

Vehicles With Standard Audio Unit or Travel Pilot Navigation

CD Changer C465	Audio Unit C464	Expected Value
Pin 1	Pin 10	Less than 5 ohms
Pin 3	Pin 15	Less than 5 ohms
Pin 5	Pin 19	Less than 5 ohms
Pin 6	Pin 20	Less than 5 ohms
Pin 7	Pin 11	Less than 5 ohms
Pin 8	Pin 13	Less than 5 ohms
Pin 9	Pin 14	Less than 5 ohms
Pin 10	Pin 18	Less than 5 ohms
Pin 11	Pin 16	Less than 5 ohms
Pin 12	Pin 17	Less than 5 ohms

CD Changer C465	Ground	Expected Value
Pin 1	Ground	Greater than 10,000 ohms
Pin 3	Ground	Greater than 10,000 ohms
Pin 5	Ground	Greater than 10,000 ohms
Pin 6	Ground	Greater than 10,000 ohms
Pin 7	Ground	Greater than 10,000 ohms
Pin 8	Ground	Greater than 10,000 ohms
Pin 9	Ground	Greater than 10,000 ohms
Pin 10	Ground	Greater than 10,000 ohms
Pin 11	Ground	Greater than 10,000 ohms
Pin 12	Ground	Greater than 10,000 ohms

Vehicles With 9000 Vehicle Navigation Radio (VNR)

DIAGNOSIS AND TESTING

CD Changer C465	Audio Unit C1464	Expected Value
Pin 1	Pin 1	Less than 5 ohms
Pin 3	Pin 3	Less than 5 ohms
Pin 5	Pin 5	Less than 5 ohms
Pin 6	Pin 6	Less than 5 ohms
Pin 7	Pin 7	Less than 5 ohms
Pin 8	Pin 8	Less than 5 ohms
Pin 9	Pin 9	Less than 5 ohms
Pin 10	Pin 10	Less than 5 ohms
Pin 11	Pin 11	Less than 5 ohms
Pin 12	Pin 12	Less than 5 ohms

CD Changer C465	Ground	Expected Value
Pin 1	Ground	Greater than 10,000 ohms
Pin 3	Ground	Greater than 10,000 ohms
Pin 5	Ground	Greater than 10,000 ohms
Pin 6	Ground	Greater than 10,000 ohms
Pin 7	Ground	Greater than 10,000 ohms
Pin 8	Ground	Greater than 10,000 ohms
Pin 9	Ground	Greater than 10,000 ohms
Pin 10	Ground	Greater than 10,000 ohms
Pin 11	Ground	Greater than 10,000 ohms
Pin 12	Ground	Greater than 10,000 ohms

2. If routed here from a Pinpoint Test, return to the Pinpoint Test.

SECTION 415-01 Audio Unit

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

DIAGNOSIS AND TESTING

Audio System 415-01-2

REMOVAL AND INSTALLATION

Compact Disc (CD) Changer 415-01-3

DIAGNOSIS AND TESTING

Audio System

REFER to Section 415-00.

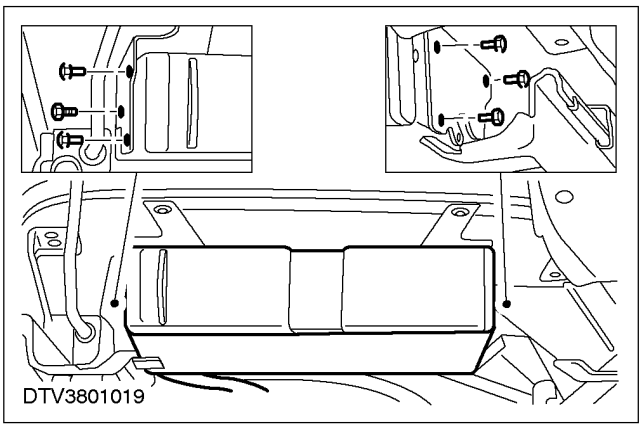
REMOVAL AND INSTALLATION

Compact Disc (CD) Changer

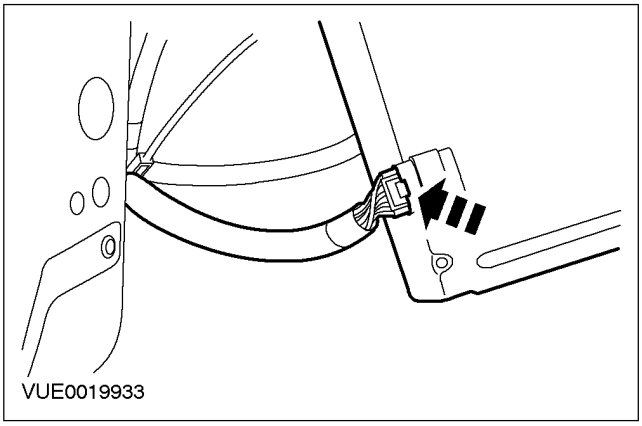
Removal

1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Remove the passenger seat assembly. For additional information, refer to Section 501-10.**
3. **NOTE:** Lay the seat onto its back to allow access to the CD autochanger.

   Remove the retaining screws from either side and detach the CD autochanger from its mounting bracket.



4. **Disconnect the electrical connector and remove the CD autochanger.**



Installation

1. **To install, reverse the removal procedure.**
2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

SECTION 415-02 Antenna

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

DESCRIPTION AND OPERATION

Antenna 415-02-2

DIAGNOSIS AND TESTING

Antenna 415-02-4

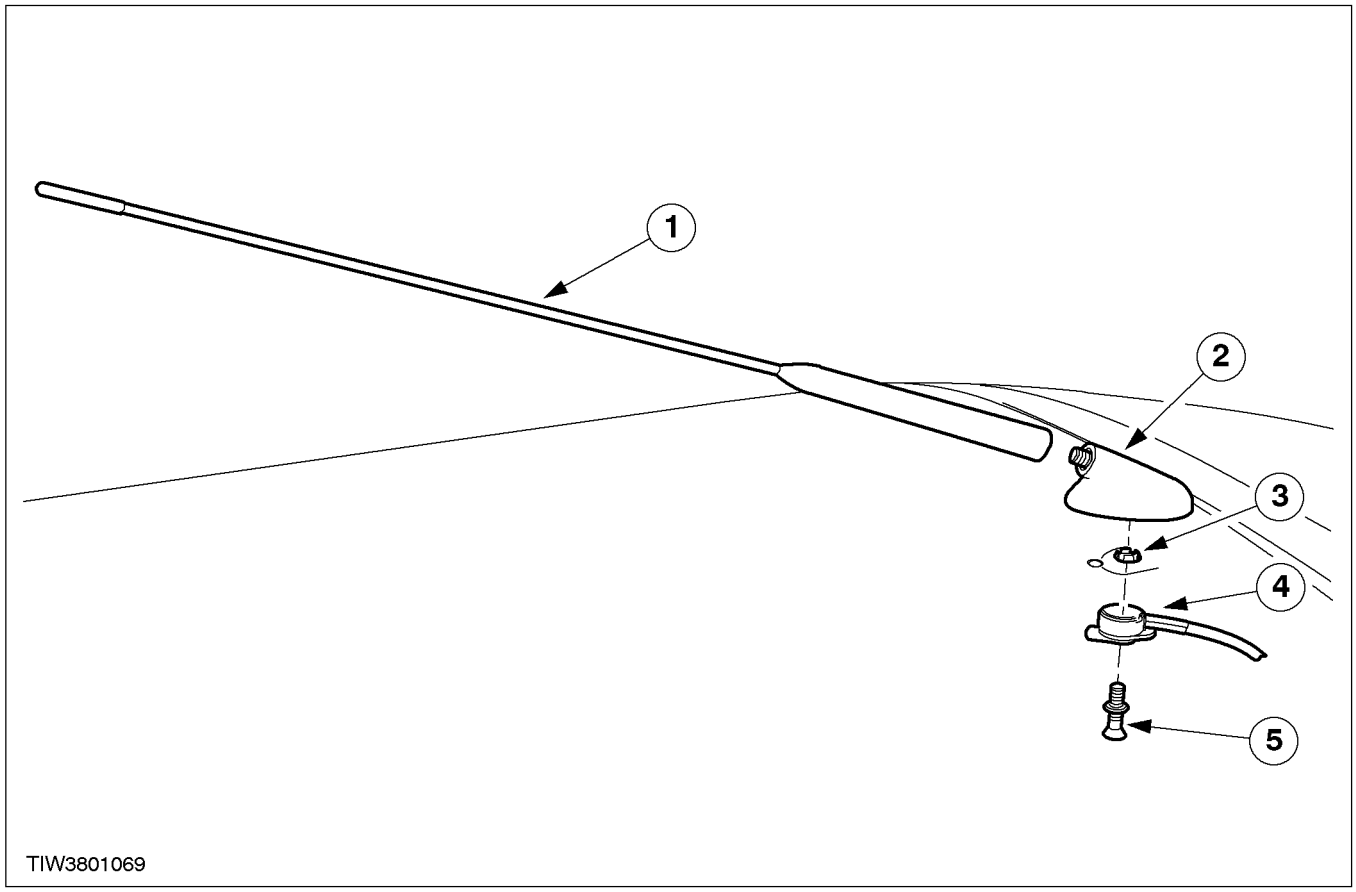
REMOVAL AND INSTALLATION

Antenna Cable 415-02-5

DESCRIPTION AND OPERATION

Antenna

Antenna

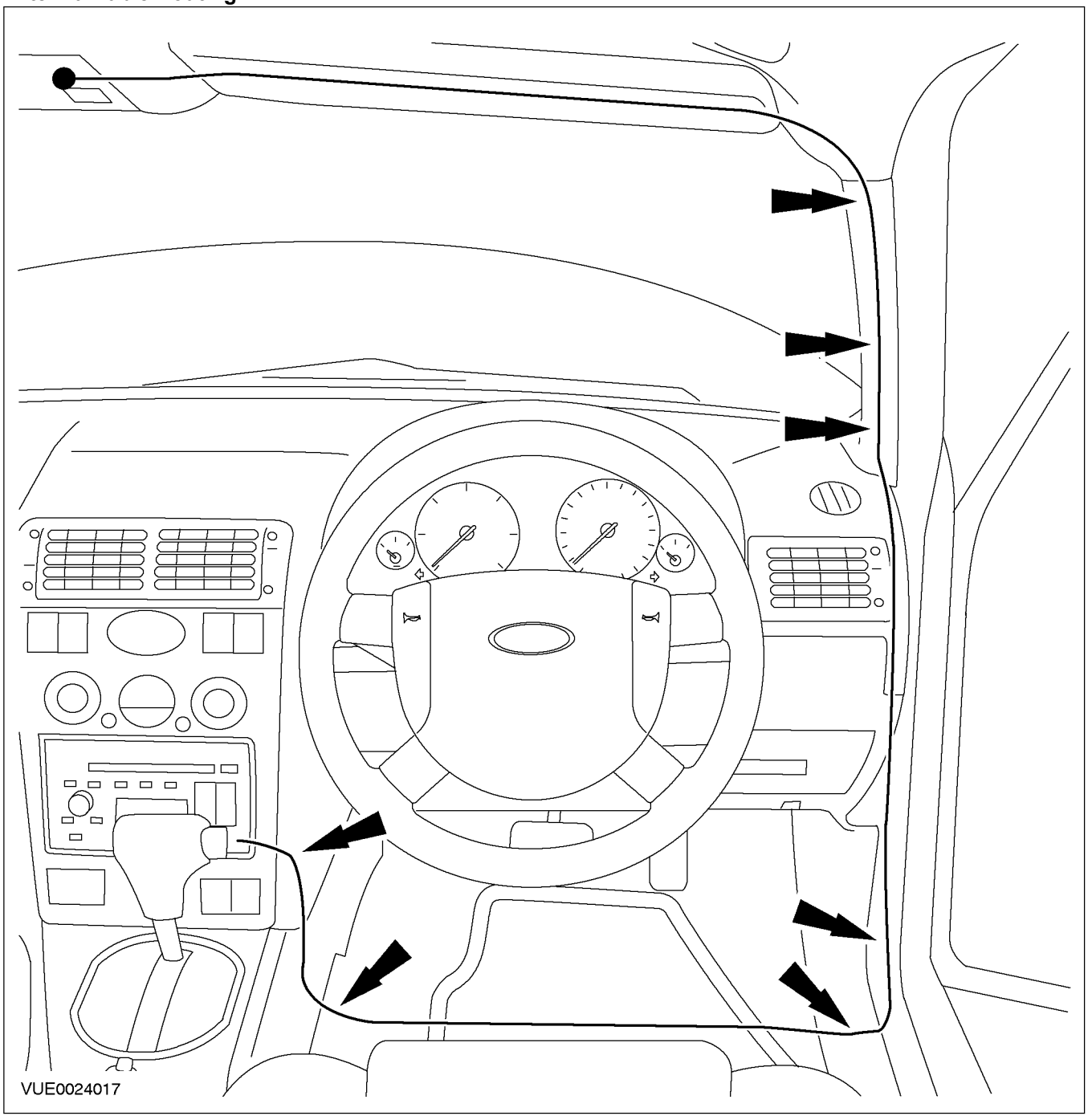


Item	Part Number	Description
1		Antenna mast
2		Antenna base

Item	Part Number	Description
3		Insulator clip
4		Antenna cable
5		Retaining screw

DESCRIPTION AND OPERATION

Antenna Cable Routing



DIAGNOSIS AND TESTING

Antenna

REFER to Section 415-00.

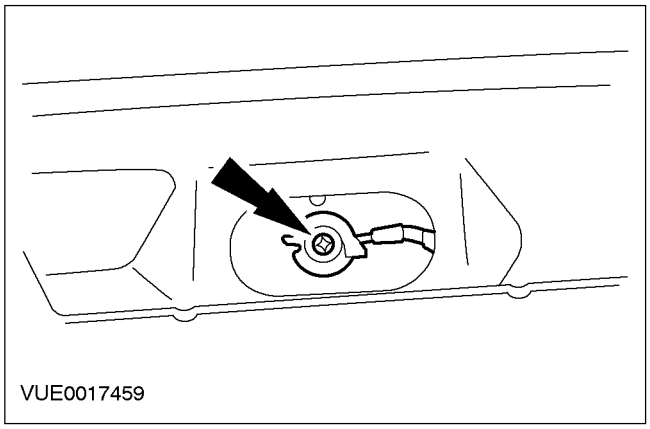
REMOVAL AND INSTALLATION

Antenna Cable

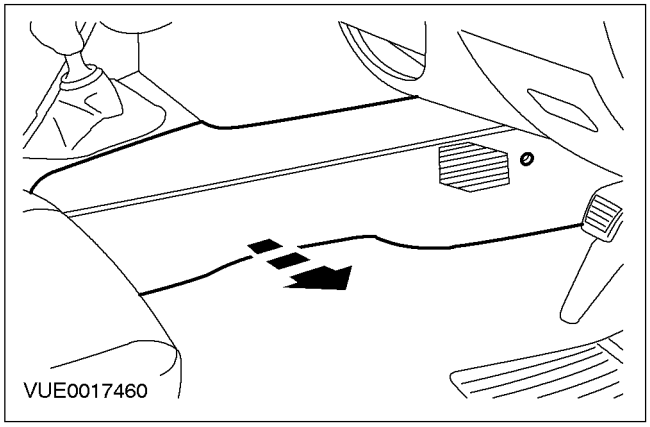
General Equipment
Suitable draw cord with a minimum length of three meters

Removal

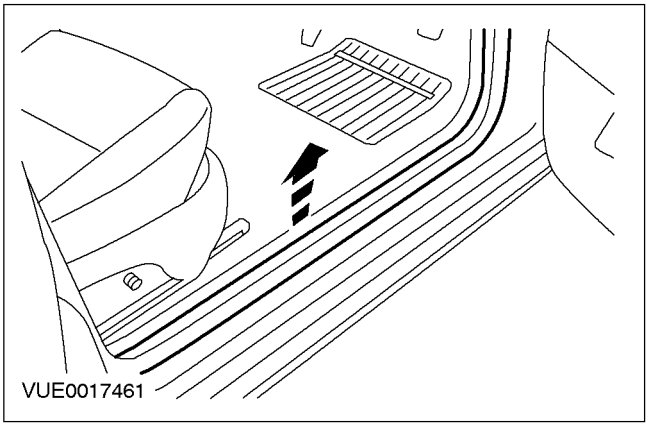
1. **Remove the audio unit. For additional information, refer to Section 415-01.**
2. **Remove the overhead console. For additional information, refer to Section 501-12.**
3. **Disconnect the antenna cable from the antenna base.**


VUE0017459

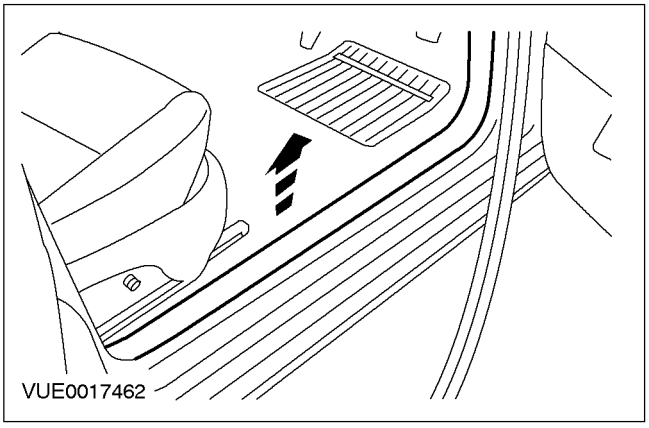
4. **Remove the right-hand A-pillar trim panel. For additional information, refer to Section 501-05.**
5. **Remove the right-hand trim panel from the floor console.**


VUE0017460

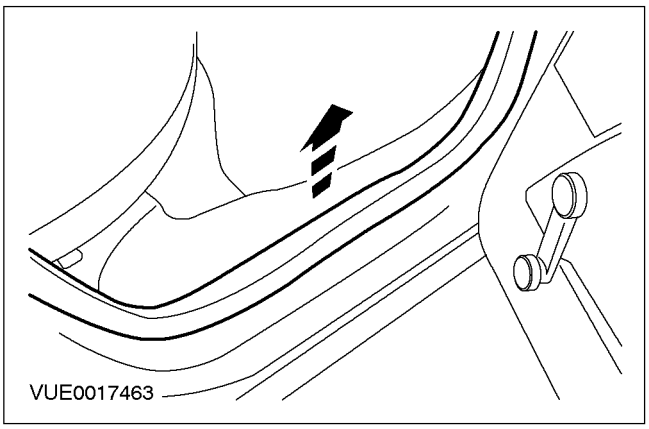
6. **Detach the right-hand front door weather strip.**


VUE0017461

7. **Detach the right-hand cowl trim panel.**

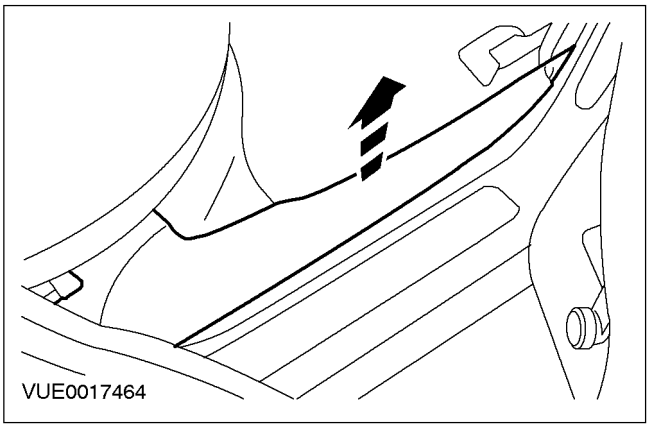

VUE0017462

8. **Detach the right-hand rear door weather strip.**

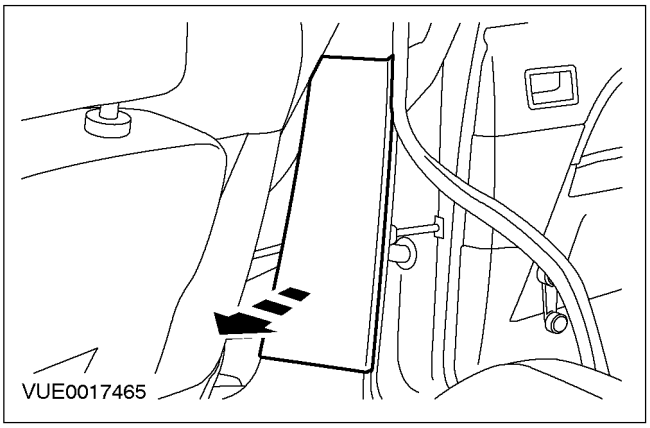

VUE0017463

REMOVAL AND INSTALLATION (Continued)

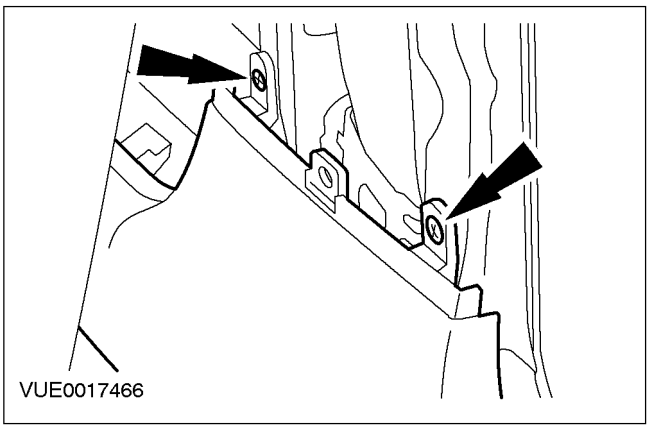
9. Detach the right-hand cowl trim panel.



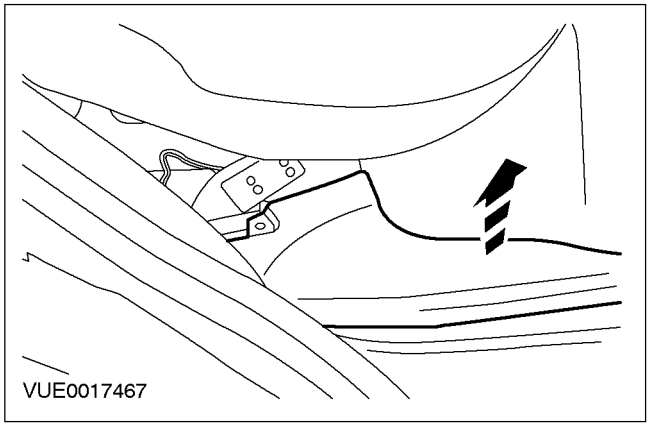
10. Detach the right-hand lower B-pillar trim panel.



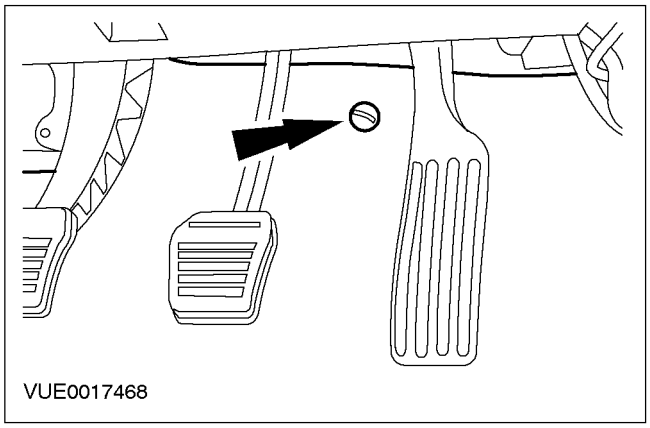
11. Detach the right-hand cowl trim panel.



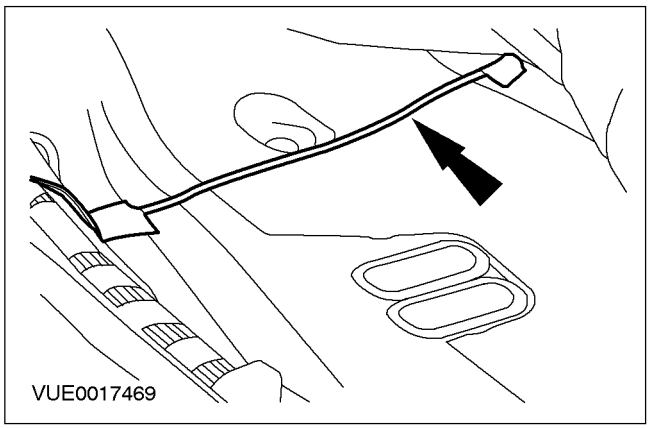
12. Remove the right-hand cowl trim panel (to aid removal lift the rear seat cushion).



13. Detach the floor covering.

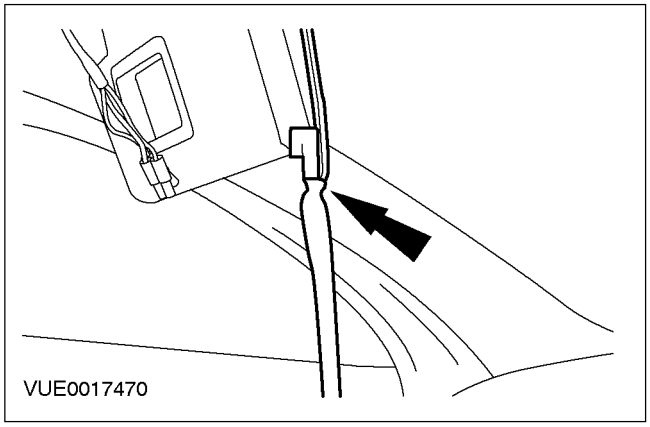


14. Detach the antenna cable from the floor.



REMOVAL AND INSTALLATION (Continued)

15. **Attach a suitable draw cord to the antenna cable.**



16. **Pull the antenna cable down the A-pillar to expose the suitable draw cord.**
17. **Detach the suitable draw cord and remove the antenna cable.**

Installation

1. **To install, reverse the removal procedure.**

SECTION 415-03 Speakers

VEHICLE APPLICATION: 2003.0 Mondeo

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Speakers 415-03-2

DIAGNOSIS AND TESTING

Speakers

REFER to Section 415-00.

SECTION 417-01 Exterior Lighting

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

Exterior Lighting

Component	Type
Conventional headlamps	Complex reflector system, alignment achieved by adjusting the reflector
Xenon headlamps	Complex reflector system, alignment achieved by adjusting the reflector
Fog lamps	Reflector system, alignment achieved by adjusting the reflector

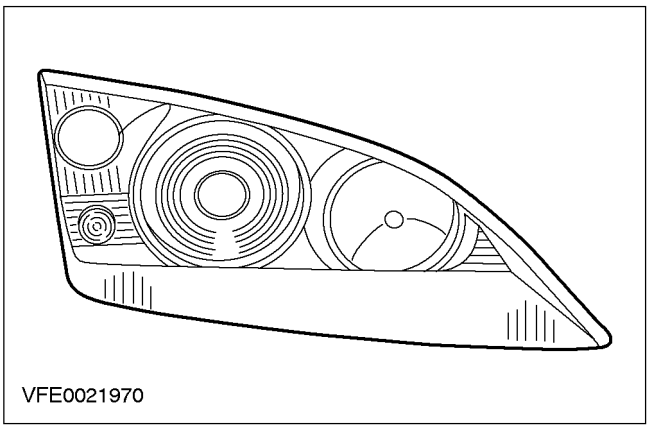
Headlamp Adjustment

Component	X value
Headlamps	X = 10 cm/10 m = 0 degrees 34 minutes = 1.0%
Front fog lamps	X = 22 cm/10 m = 1 degree 16 minutes = 2.2%

DESCRIPTION AND OPERATION

Exterior Lighting

Xenon Headlamps


VFE0021970

Xenon headlamps are optional, which produce the low beam by a 35 Watt Xenon bulb. The Xenon bulb produces three times the light of the conventional H7 bulb.

The headlamp assembly consists of the following components:

- Headlamp housing
- Headlamp housing cover
- Xenon bulb for low beam
- Halogen bulb for high beam and headlamp flash
- Turn signal bulb
- Parking lamp bulb
- Headlamp levelling motor
- Starter module
- Control module

Function

WARNING: Voltages of up to 30 kV are possible.

Like sunlight, the light produced has very high levels of green and blue fraction.

The special design of the bezel and the diffuser produce a significantly increased range and a much broader short range spread. This allows better illumination of the side of the road without exceeding the statutory limits for causing dazzle.

Another advantage of the chosen light distribution is softening of the light and dark boundary. Excessive contrast between the light and dark zones could cause disturbing changes in the road surface illumination when the vehicle is moving. In all, the Xenon headlamps produce a significant improvement in active safety.

With Xenon headlamps the full brightness is only achieved after about one minute of switching on. Therefore, usage in motor vehicles require special electronics to ensure full brightness in the first second.

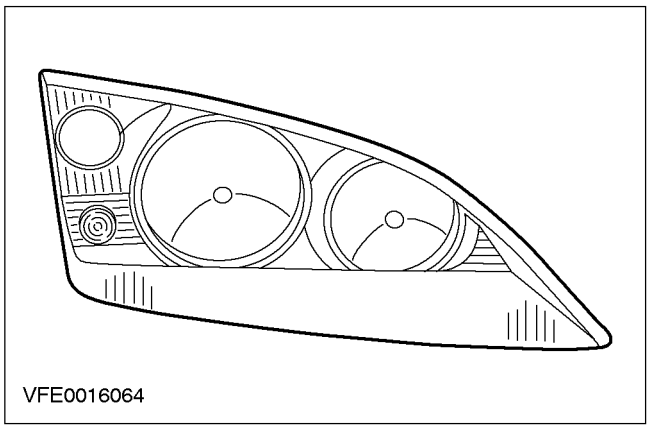
The arc chamber of the Xenon bulb is filled with Xenon gas and a mixture of metal halide salts.

A high voltage of 20 kV surge ignites the arc between the two electrodes. After a brief excess current phase in which the arc stabilizes, the lamp output is regulated to 35 watts by the electronics.

The bulb wear is so low that the Xenon bulb lasts the life of the vehicle.

The front side lamps and turn signal lamps are integrated into the headlamp housing.

Conventional Headlamps


VFE0016064

NOTE: When changing bulbs, make sure that bulbs with a special coating are used in place of conventional H1 or H7 bulbs so as to avoid yellowing of the plastic lenses from the inside.

The front side lamps and turn signal lamps are integrated into the headlamp housing. The headlamp assembly is fitted with a H7 bulb for the low beam and a H1 bulb for the high beam and the headlamp flash.

DESCRIPTION AND OPERATION (Continued)

Headlamp Levelling System – Xenon Headlamps

An automatic headlamp levelling system is required for vehicles with Xenon headlamps to comply with national legislation.

The system consists of the following components:

- Vehicle level sensors on the front and rear axles
- Master control module on the left-hand headlamp housing
- Slave control module on the right-hand headlamp housing
- Headlamp levelling motors in both headlamp housings

The system automatically adjusts to the laden state of the vehicle when the ignition is switched on to avoid dazzling of oncoming traffic.

No adjustment of the range take place during dynamic processes (braking, accelerating, initial drive).

NOTE: After removing a headlamp level sensor or disconnecting of the electrical circuit, a new calibration of the headlamp levelling system is required and must be initialized with WDS.

A vehicle level sensor on the front and rear axle sends the master control module a voltage signal according to the suspension compression. This master control module calculates the inclination of the headlamps according to the difference between the two signals and sends the required position to the slave control module. Both modules generate the control signal for the headlamp levelling motors in comparison of the present reflector position to the required reflector position.

When the low beam is switched on, the system compares actual conditions with original adjustment. This prevents a reduction in road surface illumination and avoids dazzling of oncoming traffic.

Headlamp Levelling System – Conventional Headlamps

NOTE: Basic adjustment of the headlamps must always be carried out with the headlamp levelling switch set to position ""0".

Each headlamp unit incorporates a levelling motor, which is activated electrically and controlled by the switch. The motor moves the pivoting reflector by means of an adjustment spindle until it reaches the required setting.

The headlamp levelling control switch has two stops. The switch clicks in position ""0", which corresponds to the basic setting. The headlamps are inclined upwards at their maximum angle when the switch is set to position ""4".

The headlamp levelling system is operated by means of voltage controlled direct current (DC) motors. A potentiometer inside the headlamp levelling switch is used to adjust a voltage (required value). Following the same principle, the actuator in the motor produces a voltage that depends on the position of the adjustment spindle (actual value).

The electronics built into these systems compares the required value (setting of the switch) with the actual value (adjustment spindle setting). Depending on the voltage difference the reflectors are swivelled up or down until the two voltages are the same.

In case of a signal failure the system adjusts to a safety position (low beam) to comply with national legislation.

Headlamp Cleaning System

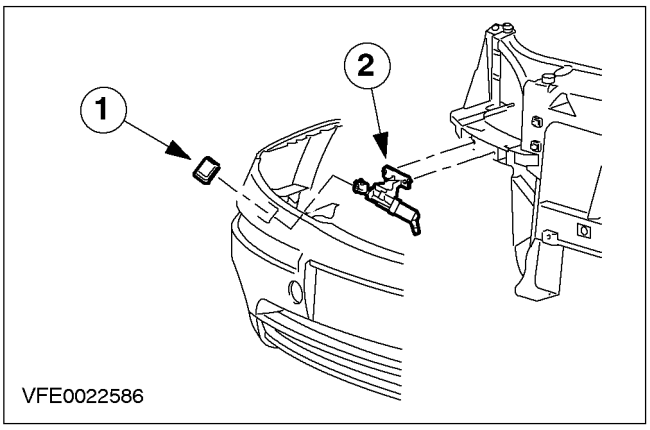
A headlamp cleaning system is required for vehicles with Xenon headlamps to comply with national legislation. This takes the form of a high-pressure washer system.

When inactive, the telescopic nozzle holder is concealed in the bumper.

As soon as the windshield washer system is operated with the headlamps switched on, the telescopic nozzle holder extends and cleans the external surface of the headlamp (plastic cover) with a high-pressure jet of water.

An additional high-pressure pump is mounted on the washer fluid reservoir for the high-pressure washer system.

DESCRIPTION AND OPERATION (Continued)

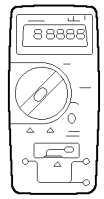
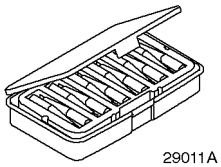


Item	Description
1	Cover
2	Nozzle holder

DIAGNOSIS AND TESTING

Headlamps

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Special Tool(s)	
 ST1137-A	Digital multimeter 105-R0051 or a comparable device
 29011A	Terminal probe kit 29-011 A

Diagnosis and Testing

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual inspection

Electrical
• Fuse(s). • Bulb(s). • Electrical connector(s). • Switch(es). • Wiring harness.

3. If an obvious cause for an observed or reported concern is found,correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Condition	Possible Sources	Action
•Dipped beam and main beam are completely inoperative	•Fuse(s). •Circuit(s). •Ignition switch •Light switch •Central junction box (CJB).	• GO to Pinpoint Test A
•Dipped beam is completely inoperative	•Fuse(s). •Circuit(s). •Dipped beam relay (conventional headlamps) •Gas discharge headlamp relay. •Central junction box (CJB).	• GO to Pinpoint Test B
•One dipped beam inoperative	•Fuse(s). •Circuit(s). •Headlamps	• GO to Pinpoint Test C
•Main beam is completely inoperative	•Circuit(s). •Main beam relay. •Turn signal switch •Central junction box (CJB).	• GO to Pinpoint Test D
•One main beam inoperative	•Fuse(s). •Circuit(s). •Headlamp assembly. •Central junction box (CJB).	• GO to Pinpoint Test E

DIAGNOSIS AND TESTING (Continued)

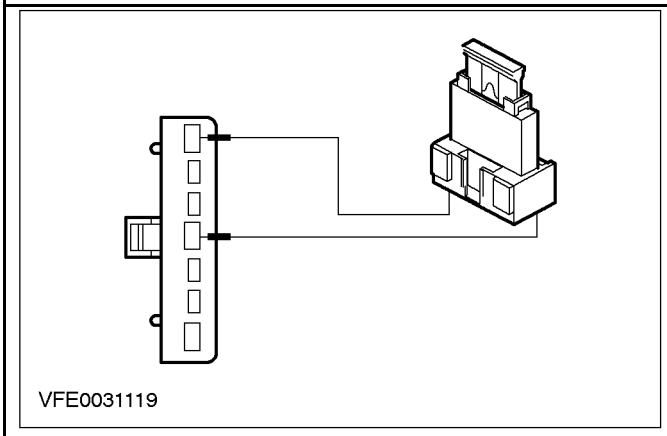
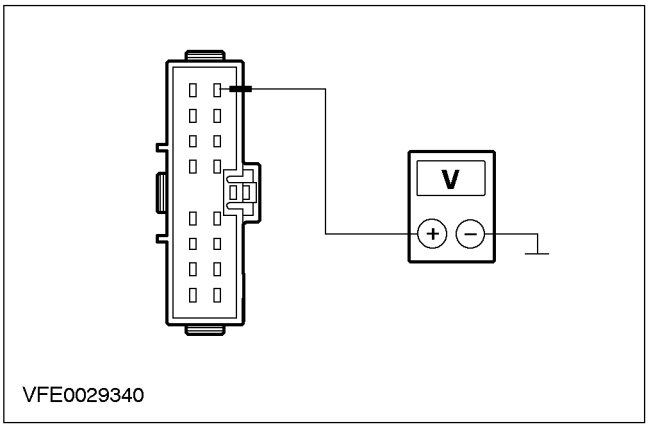
Condition	Possible Sources	Action
•The headlamp are on continuously	•Circuit(s). •Light switch •Turn signal switch •Main beam relay. •Dipped beam relay (conventional headlamps) •Gas discharge headlamp relay. •Central junction box (CJB).	• GO to Pinpoint Test F

Pinpoint Tests

PINPOINT TEST A: DIPPED BEAM AND MAIN BEAM ARE COMPLETELY INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK FUSE F88 (CJB)	
	1 Key in OFF position. 2 CHECK Fuse F88 (CJB). 3 Check fuse F88 (15 A). • Is the fuse OK? → **Yes** GO to **A2** → **No** INSTALL a new fuse F88 (15 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short to groundof the circuit(s) by using the wiring diagrams.
A2: CHECK THE VOLTAGE AT FUSE F88 (CJB)	
	1 Connect Fuse F88 (CJB). 2 Key in ON position. 3 Measure the voltage between fuse F88 (CJB) and ground. • Is battery voltage indicated? → **Yes** GO to **A4** → **No** GO to **A3**
A3: CHECK CIRCUIT 15-DA2 (GN/BU) BETWEEN THE IGNITION SWITCH AND FUSE F88 (CJB)	
	1 Key in OFF position. 2 Disconnect Ignition switch C400.

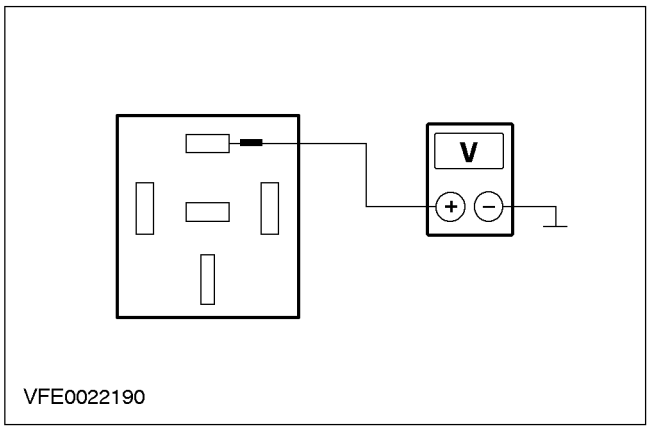
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031119	**3** Use a fused test cable (15 A) to bridge the ignition switch, connector C400, pin 1, circuit 15-DA2 (GN/BU) and pin 4, circuit 30-BB9 (RD), wiring harness side. **4** Switch on the dipped beam. **5** Check the dipped beams. • Does the dipped beam illuminate? → **Yes** RENEW the ignition switch. CHECK the operation of the system. → **No** REPAIR the open circuit between the ignition switch and fuse F88 (CJB) with the aid of the Wiring Diagrams, if necessary RENEW the central junction box (CJB). CHECK the operation of the system.
A4: CHECK THE VOLTAGE AT THE LIGHT SWITCH	
 VFE0029340	**1** Key in OFF position. **2** Disconnect Light switch (C478). **3** Key in ON position. **4** Measure the voltage between the light switch, connector C478, pin 8, circuit 15-LE21 (GN/BK), wiring harness side and ground. • Is battery voltage indicated? → **Yes** Renew the light switch. CHECK the operation of the system. → **No**

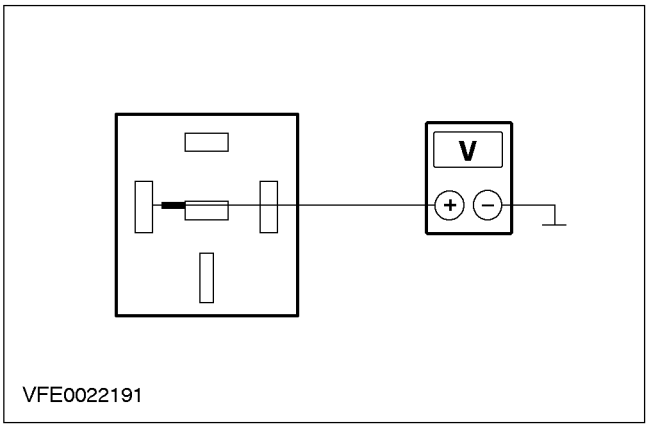
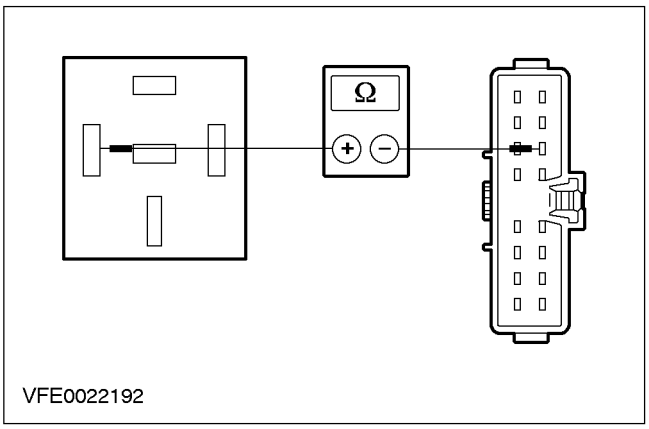
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR the open circuit between fuse F88 (CJB) and the light switch with the aid of the Wiring Diagrams, if necessary RENEW the central junction box (CJB). CHECK the operation of the system.

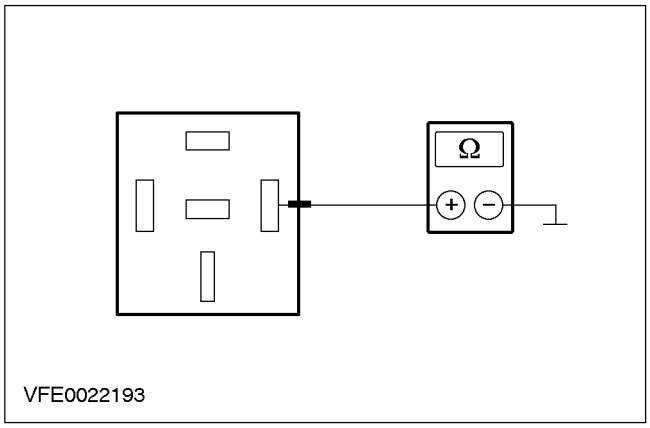
PINPOINT TEST B: DIPPED BEAM IS COMPLETELY INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: DETERMINE THE MODEL	
	1 Determine the model variant. • Is the vehicle equipped with gas discharge headlamps? → **Yes** GO to **B7** → **No** GO to **B2**
B2: CHECK FUSE F95 (CJB)	
	1 Key in OFF position. 2 CHECK Fuse F95 (CJB). 3 Check fuse F95 (7,5 A). • Is the fuse OK? → **Yes** GO to **B3** → **No** INSTALL a new fuse F95 (7,5 A). If the fuse blows again, LOCATE and RECTIFY the short to ground using the wiring diagrams. CHECK the operation of the system.
B3: CHECK THE VOLTAGE AT THE WORKING CIRCUIT OF THE DIPPED BEAM RELAY	
 VFE0022190	1 Disconnect Dipped beam relay C901. 2 Key in ON position. 3 Measure the voltage between dipped beam relay, connector C901, pin 5, circuit15-LE19 (GN/BU), BJB side and ground. • Is battery voltage indicated? → **Yes** GO to **B4** → **No**

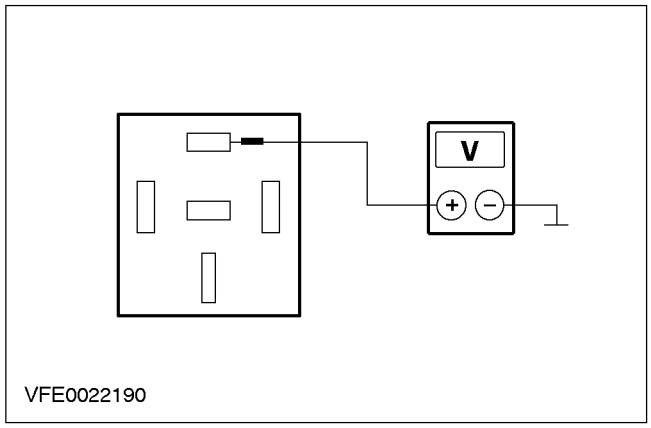
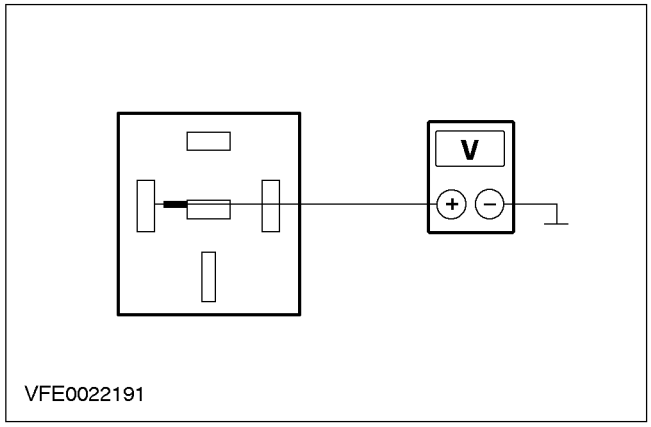
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR the break in circuit 15-LE19 (GN/BU) with the aid of the Wiring Diagrams. CHECK the operation of the system.
B4: CHECK THE VOLTAGE AT THE CONTROL CIRCUIT OF THE DIPPED BEAM RELAY	
 VFE0022191	1 Key in OFF position. 2 Connect Fuse F95 (CJB). 3 Key in ON position. 4 Switch on the dipped beam. 5 Measure the voltage between dipped beam relay, connector C901, pin 2, circuit15S-LE19 (GN/BU), BJB side and ground. • Is battery voltage indicated? → **Yes** GO to **B6** → **No** GO to **B5**
B5: CHECK THE CIRCUIT 15S-LE19	
 VFE0022192	1 Key in OFF position. 2 Disconnect Light switch (C478). 3 Measure the resistance between the dipped beam relay, connector C901, pin 2, circuit 15S-LE19 (GN/BU), BJB side and the light switch C478, pin 6, circuit 15S-LE19 (GN/BU), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** GO to **B6** → **No**

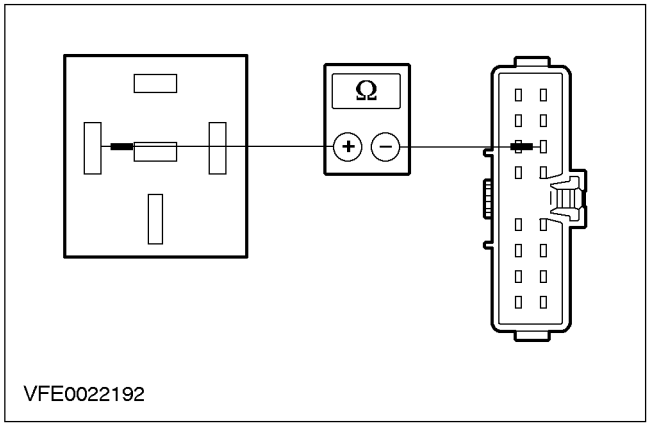
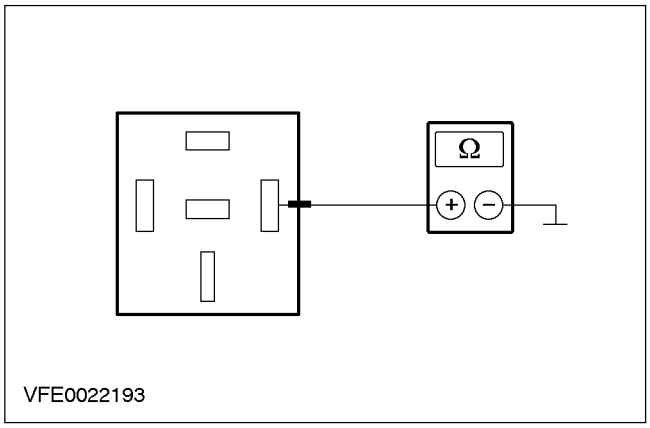
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR the open circuit between the light switch and the dipped beam relay with the aid of the Wiring Diagrams, if necessary RENEW the central junction box (CJB). CHECK the operation of the system.
B6: CHECK THE GROUND CONNECTION OF THE DIPPED BEAM RELAY	
	1 Key in OFF position. 2 Measure the resistance between dipped beam relay, connector C901, pin 1,circuit 31-LE19 (BK), BJB side and ground. • Is the resistance less than 2 ohms? → **Yes** INSTALL a new dipped beam relay. CHECK the operation of the system. → **No** REPAIR the break in circuit 31-LE19 (BK) with the aid of the Wiring Diagrams. CHECK the operation of the system.
B7: CHECK FUSE F95 (CJB)	
	1 Key in OFF position. 2 CHECK Fuse F95 (CJB). 3 Check fuse F95 (7,5 A). • Is the fuse OK? → **Yes** GO to **B8** → **No** INSTALL a new fuse F95 (7,5 A). If the fuse blows again, LOCATE and RECTIFY the short to ground using the wiring diagrams. CHECK the operation of the system.
B8: READ OUT THE FAULT MEMORY	
	1 Connect the diagnostic tool. 2 Check the system using WDS. • Are any trouble codes (DTCs) displayed? → **Yes** RESOLVE the faults according to the WDS instructions. CLEAR the fault memory and CHECK the operation of the system.

DIAGNOSIS AND TESTING (Continued)

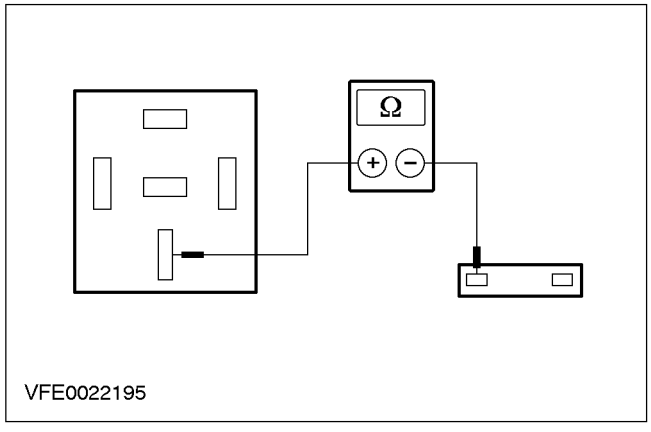
CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **No** GO to **B9**
B9: CHECK THE VOLTAGE AT THE WORKING CIRCUIT OF THE GAS DISCHARGE HEADLAMP RELAY	
 VFE0022190	1 Disconnect Gas discharge headlamp relay C901. 2 Measure the voltage between gas discharge headlamp relay, connector C901, pin5, circuit 30-LE19 (RD), BJB side and ground. • Is battery voltage indicated? → **Yes** GO to **B10** → **No** REPAIR the break in circuit 30-LE19 (RD) with the aid of the Wiring Diagrams. CHECK the operation of the system.
B10: CHECK THE VOLTAGE AT THE CONTROL CIRCUIT OF THE GAS DISCHARGE HEADLAMP RELAY	
 VFE0022191	1 Connect Fuse F95 (CJB). 2 Key in ON position. 3 Switch on the dipped beam. 4 Measure the voltage between gas discharge headlamp relay, connector C901, pin2, circuit 15S-LE19 (GN/BU), BJB side and ground. • Is battery voltage indicated? → **Yes** GO to **B12** → **No** GO to **B11**

DIAGNOSIS AND TESTING (Continued)

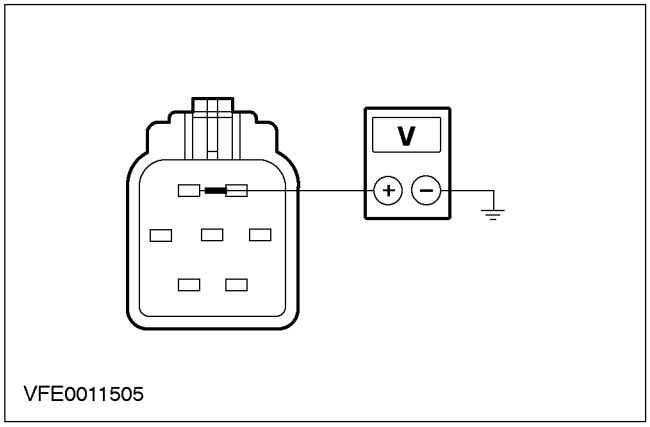
CONDITIONS	DETAILS/RESULTS/ACTIONS
B11: CHECK CIRCUIT 15S-LE19 (GN/BU) BETWEEN THE LIGHT SWITCH AND THE GAS DISCHARGE HEADLAMP RELAY	
	1 Key in OFF position. 2 Disconnect Light switch (C478). 3 Measure the resistance between the gas discharge headlamp relay, connector C901, pin 2, circuit 15S-LE19 (GN/BU), BJB side and the light switch C478, pin 6, circuit 15S-LE19 (GN/BU), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** GO to **B12** → **No** REPAIR the break in circuit 15S-LE19 (GN/BU) between the light switch and the gas discharge headlamp relay with the aid of the Wiring Diagrams, if necessary RENEW the central junction box (CJB). CHECK the operation of the system.
B12: CHECK THE GROUND CONNECTION OF THE GAS DISCHARGE HEADLAMP RELAY	
	1 Key in OFF position. 2 Measure the resistance between gas discharge headlamp relay, connector C901, pin 1, circuit 31-LE19 (BK), BJB side and ground. • Is the resistance less than 2 ohms? → **Yes** INSTALL a new gas discharge headlamp relay. CHECK the operation of the system. → **No** REPAIR the break in circuit 31-LE19 (BK) with the aid of the Wiring Diagrams. CHECK the operation of the system.

DIAGNOSIS AND TESTING (Continued)

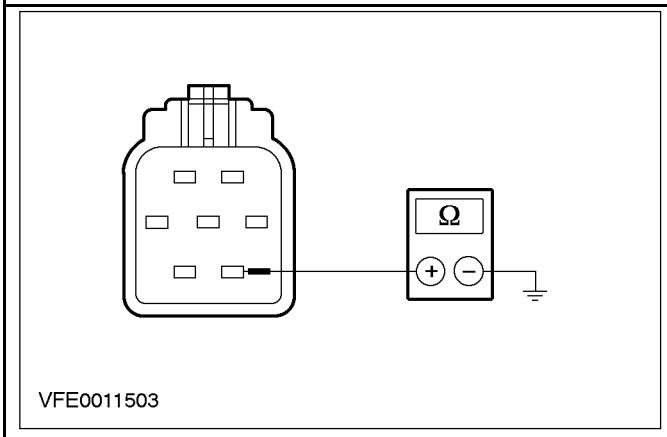
PINPOINT TEST C: ONE DIPPED BEAM INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: DETERMINE THE MODEL	
	1 Determine the model variant. • Is the vehicle equipped with gas discharge headlamps? → **Yes** GO to **C11** → **No** GO to **C2**
C2: DETERMINE THE INOPERATIVE LAMP	
	1 Key in ON position. 2 Switch on the dipped beam. 3 Check the dipped beams. • Is the left-hand dipped beam inoperative? → **Yes** GO to **C3** → **No** The right-hand dipped beam is inoperative: GO to **C7**
C3: CHECK FUSE F16 (BJB)	
	1 Key in OFF position. 2 CHECK Fuse F16 (BJB). 3 Check fuse F16 (7,5 A). • Is the fuse OK? → **Yes** GO to **C4** → **No** INSTALL a new fuse F16 (7,5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short to groundof the circuit(s) by using the wiring diagrams.
C4: CHECK THE CIRCUIT BETWEEN THE DIPPED BEAM RELAY AND FUSE F16 (BJB)	
	1 Disconnect Dipped beam relay C901. 2 Measure the resistance between the dipped beam relay, connector C901, pin 3, circuit 15S-LE16A (GN/OG), BJB side and fuse F16 (BJB).

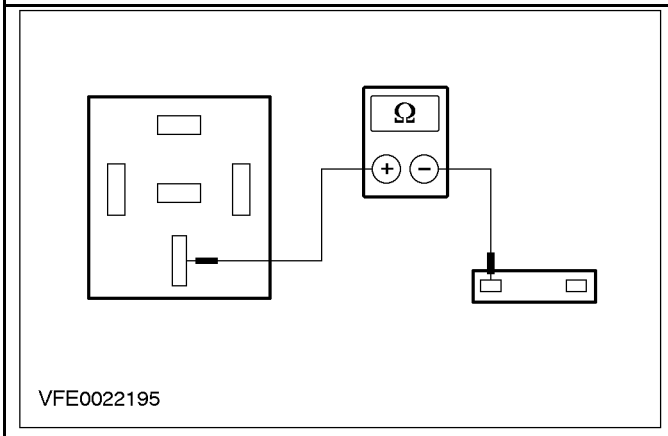
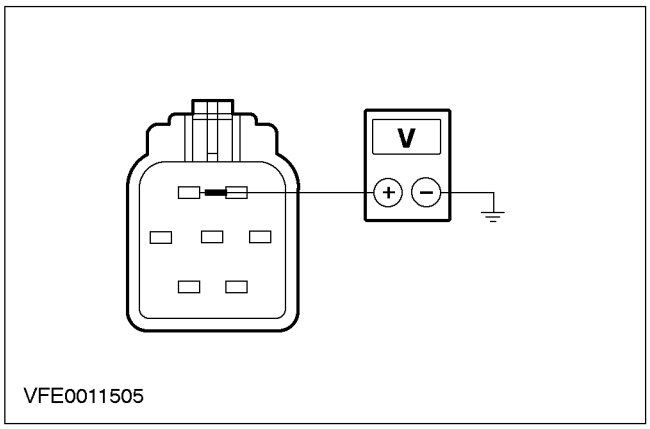
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is the resistance less than 2 ohms? → **Yes** GO to **C5** → **No** REPAIR the break in circuit 15S-LE16A (GN/OG) between the dipped beam relay and fuse F16 (BJB) with the aid of the Wiring Diagrams. CHECK the operation of the system.
C5: CHECK THE CIRCUIT TO FUSE F16 (BJB)	
 VFE0011505	1 Connect Fuse F16 (BJB). 2 Connect Dipped beam relay C901. 3 Disconnect Left-hand headlamp C146. 4 Key in ON position. 5 Switch on the dipped beam. 6 Measure the voltage between left-hand headlamp, connector C146, pin 1, circuit 15S-LE16 (GN/OG), harness side and ground. • Is battery voltage indicated? → **Yes** GO to **C6** → **No** REPAIR the break in circuit 15S-LE16 (GN/OG) between fuse F16 (BJB) and the headlamp with the aid of the Wiring Diagrams. CHECK the operation of the system.

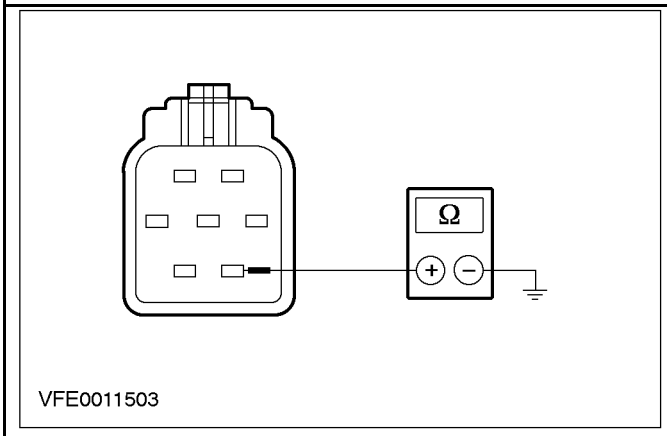
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
C6: CHECK THE GROUND CONNECTION OF THE LEFT-HAND HEADLAMP	
 VFE0011503	1 Measure the resistance between left-hand headlamp, connector C146, pin 7, circuit 31-LE31 (BK), harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the headlamp. CHECK the operation of the system. → **No** REPAIR the break in circuit 31-LE31 (BK) with the aid of the Wiring Diagrams. CHECK the operation of the system.
C7: CHECK FUSE F18 (BJB)	
	1 Key in OFF position. 2 CHECK Fuse F18 (BJB). 3 Check fuse F18 (7,5 A). • Is the fuse OK? → **Yes** GO to **C8** → **No** INSTALL a new fuse F18 (7,5 A). If the fuse blows again, LOCATE and RECTIFY the short to ground using the wiring diagrams. CHECK the operation of the system.
C8: CHECK THE CIRCUIT BETWEEN THE GAS DISCHARGE HEADLAMP RELAY AND FUSE F18 (BJB)	
	1 Connect Fuse F18 (BJB).

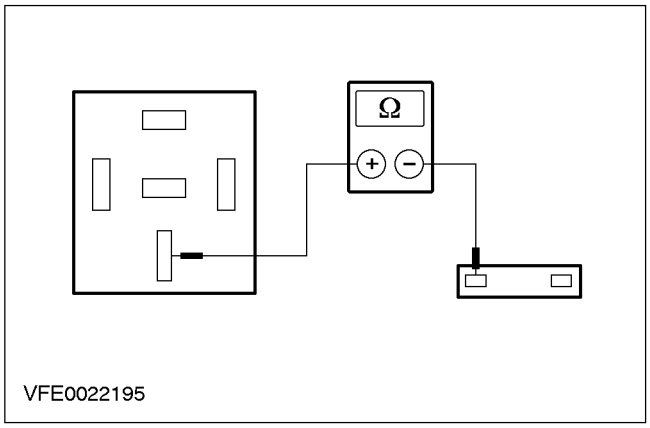
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022195	**2** Measure the resistance between the dipped beam relay, connector C901, pin 3, BJB side and fuse F18 (BJB). • Is the resistance less than 2 ohms? → **Yes** GO to **C9** → **No** REPAIR the break in circuit 15S-LE23A (GN/WH) between the dipped beam relay and fuse F18 (BJB) with the aid of the Wiring Diagrams. CHECK the operation of the system.
C9: CHECK THE CIRCUIT TO FUSE F18 (BJB)	
 VFE0011505	**1** Disconnect Right-hand headlamp C147. **2** Key in ON position. **3** Switch on the dipped beam. **4** Measure the voltage between the right-hand headlamp, connector C147, pin 1, circuit 15S-LE23 (GN/WH), BJB side and ground. • Is battery voltage indicated? → **Yes** GO to **C10** → **No** REPAIR the break in circuit 15S-LE23 (GN/WH) between fuse F18 (BJB) and the headlamp with the aid of the Wiring Diagrams. CHECK the operation of the system.
C10: CHECK THE GROUND CONNECTION OF THE RIGHT-HAND HEADLAMP	
	1 Key in OFF position.

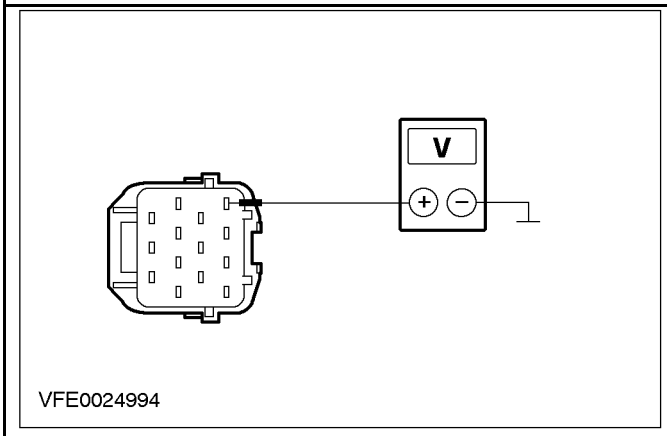
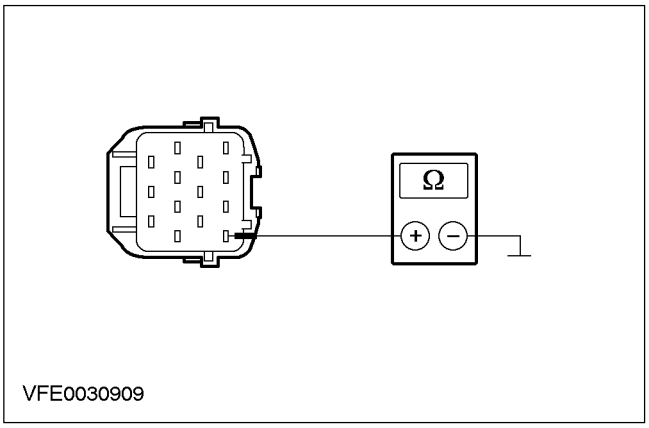
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0011503	**2** Measure the resistance between right-hand headlamp, connector C147, pin 7, circuit 31-LE30 (BK), harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the headlamp. CHECK the operation of the system. → **No** REPAIR the break in circuit 31-LE30 (BK) with the aid of the Wiring Diagrams. CHECK the operation of the system.
C11: DETERMINE THE INOPERATIVE LAMP	
	1 Key in ON position. **2** Switch on the dipped beam. **3** Check the dipped beams. • Is the left-hand dipped beam inoperative? → **Yes** GO to **C12** → **No** The right-hand dipped beam is inoperative: GO to **C17**
C12: CHECK FUSE F16	
	1 Key in OFF position. **2** CHECK Fuse F16 (BJB). **3** Check fuse F16 (20 A). • Is the fuse OK? → **Yes** GO to **C13** → **No** INSTALL a new fuse F16 (20 A). If the fuse blows again, LOCATEand REPAIR the short to ground of the circuit(s) by using the wiring diagrams.CHECK the operation of the system.
C13: READ OUT THE FAULT MEMORY	
	1 Connect the diagnostic tool. **2** Check the system using WDS. • Are any trouble codes (DTCs) displayed?

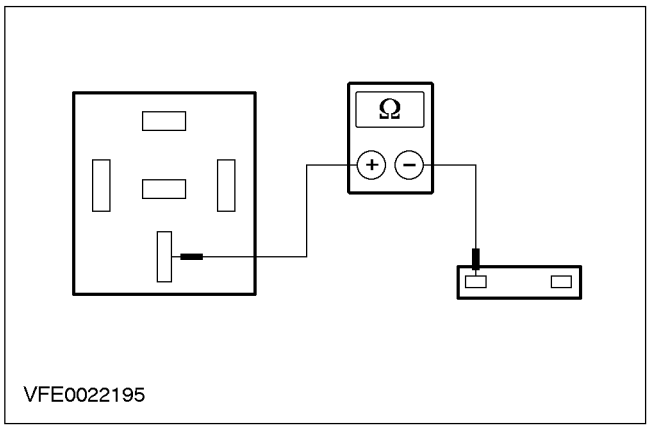
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** RESOLVE the faults according to the WDS instructions. CLEAR the fault memory and CHECK the operation of the system. → **No** GO to **C14**
C14: CHECK THE CIRCUIT BETWEEN THE GAS DISCHARGE HEADLAMP RELAY AND FUSE F16 (BJB)	
	1 Key in OFF position. 2 Disconnect Gas discharge headlamp relay C901. 3 Connect Fuse F16 (BJB). 4 Measure the resistance between the gas discharge headlamp relay, connector C901, pin 3, circuit 15S-LE16A (GN/OG), BJB side and fuse F16 (BJB). • Is the resistance less than 2 ohms? → **Yes** GO to **C15** → **No** REPAIR the break in circuit 15S-LE16A (GN/OG) between the gas discharge headlamp relay and fuse F16 (BJB) with the aid of the Wiring Diagrams. CHECK the operation of the system.
C15: CHECK THE CIRCUIT TO FUSE F16 (BJB)	
	1 Connect Gas discharge headlamp relay C901. 2 Disconnect Left-hand headlamp C146. 3 Key in ON position. 4 Switch on the dipped beam.

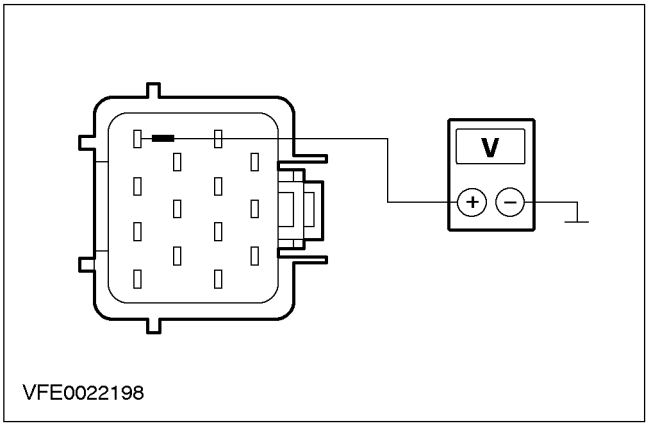
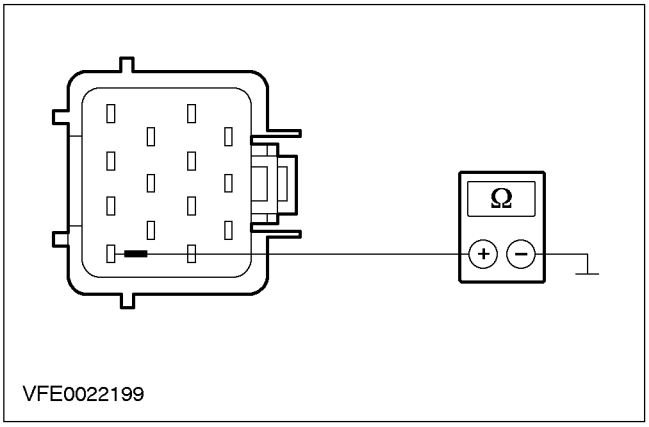
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0024994	**5** Measure the voltage between left-hand headlamp, connector C1146, pin 14, circuit 15S-LE16 (GN/OG), harness side and ground. • Is battery voltage indicated? → **Yes** GO to **C16** → **No** REPAIR the break in circuit 15S-LE16 (GN/OG) between fuse F16 (BJB) and the headlamp with the aid of the Wiring Diagrams. CHECK the operation of the system.
C16: CHECK THE GROUND CONNECTION OF THE HEADLAMP	
 VFE0030909	**1** Key in OFF position. **2** Measure the resistance between left-hand headlamp, connector C1146 11, circuit 31-LE31 (BK), harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the headlamp. CHECK the operation of the system. → **No** REPAIR the break in circuit 31-LE31 (BK) with the aid of the Wiring Diagrams. CHECK the operation of the system.
C17: CHECK FUSE F18 (BJB)	
	1 Key in OFF position. **2** CHECK Fuse F18 (BJB). **3** Check fuse F18 (20 A).

DIAGNOSIS AND TESTING (Continued)

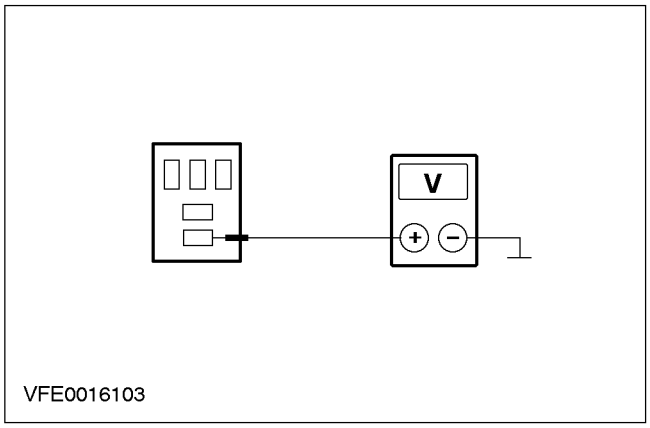
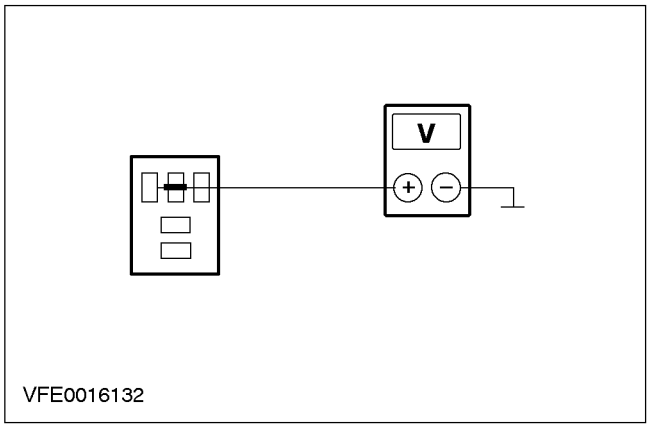
CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is the fuse OK? → **Yes** GO to **C18** → **No** INSTALL a new fuse F18 (20 A). If the fuse blows again, LOCATEand REPAIR the short to ground of the circuit(s) by using the wiring diagrams.CHECK the operation of the system.
C18: READ OUT THE FAULT MEMORY	
	1 Connect the diagnostic tool. 2 Check the system using WDS. • Are any trouble codes (DTCs) displayed? → **Yes** RESOLVE the faults according to the WDS instructions. CLEAR the fault memory and CHECK the operation of the system. → **No** GO to **C19**
C19: CHECK THE CIRCUIT BETWEEN THE GAS DISCHARGE HEADLAMP RELAY AND FUSE F18 (BJB)	
 VFE0022195	1 Key in OFF position. 2 Connect Fuse F18 (BJB). 3 Disconnect Gas discharge headlamp relay C901. 4 Measure the resistance between the gas discharge headlamp relay, connector C901, pin 3, circuit 15S-LE23A (GN/WH), BJB side and fuse F18 (BJB). • Is the resistance less than 2 ohms? → **Yes** GO to **C20** → **No** REPAIR the break in circuit 15S-LE23A (GN/OG) between the gas discharge headlamp relay and fuse F18 (BJB) with the aid of the Wiring Diagrams. CHECK the operation of the system.
C20: CHECK THE CIRCUIT TO FUSE F18 (BJB)	
	1 Disconnect Right-hand headlamp C1147.

DIAGNOSIS AND TESTING (Continued)

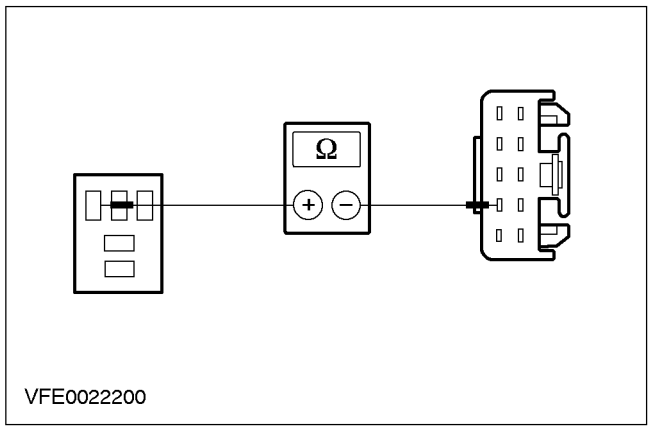
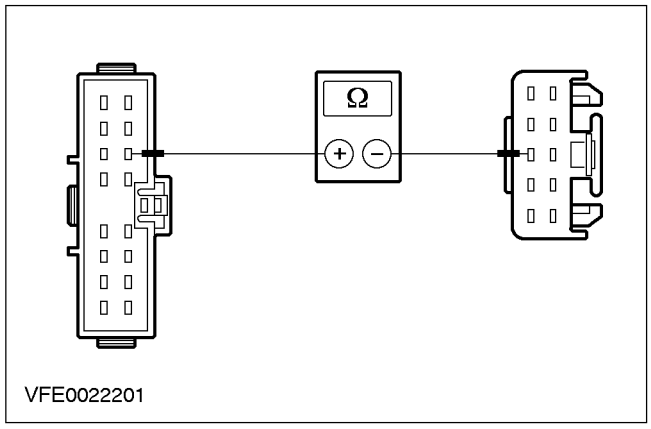
CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022198	**2** Key in ON position. **3** Switch on the dipped beam. **4** Measure the voltage between the right-hand headlamp, connector C1147, pin 14, circuit 15S-LE23 (GN/WH), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **C21** → **No** REPAIR the break in circuit 15S-LE23 (GN/WH) between fuse F18 (BJB) and the headlamp with the aid of the Wiring Diagrams. CHECK the operation of the system.
C21: CHECK THE GROUND CONNECTION OF THE HEADLAMP	
 VFE0022199	**1** Key in OFF position. **2** Measure the resistance between right-hand headlamp, connector C1147, pin 11, circuit 31-LE30 (BK), harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the headlamp. CHECK the operation of the system. → **No** REPAIR the break in circuit 31-LE30 (BK) with the aid of the Wiring Diagrams. CHECK the operation of the system.

DIAGNOSIS AND TESTING (Continued)

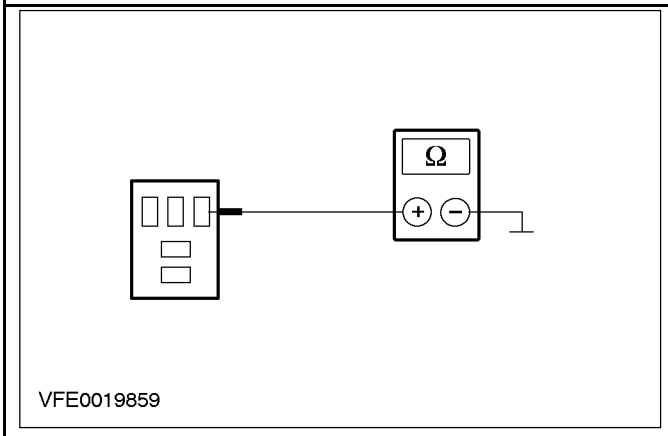
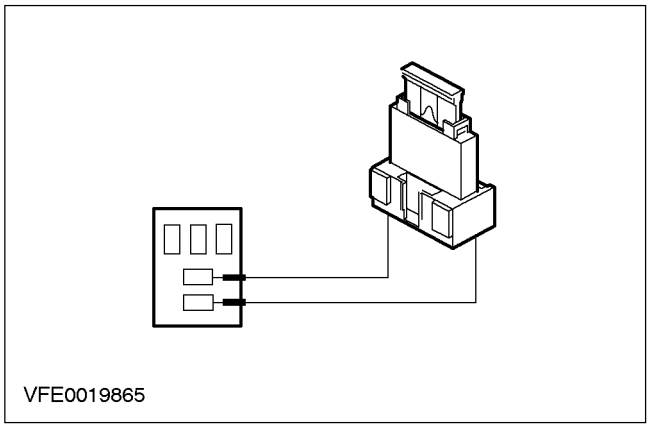
PINPOINT TEST D: MAIN BEAM IS COMPLETELY INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: CHECK THE VOLTAGE AT THE WORKING CIRCUIT OF THE MAIN BEAM RELAY	
	1 Key in OFF position. 2 Disconnect Main beam relay C915. 3 Measure the voltage between the main beam relay, connector C915, pin 3, CJB side and ground. • Is battery voltage indicated? → **Yes** GO to **D2** → **No** REPAIR the open circuit between fuse F7 (CJB) and the main beam relay (BJB) with the aid of the Wiring Diagrams, if necessary RENEW the central junction box (CJB). CHECK the operation of the system.
D2: CHECK THE VOLTAGE AT THE CONTROL CIRCUIT OF THE MAIN BEAM RELAY	
	1 Key in ON position. 2 Switch on the dipped beam and main beam. 3 Measure the voltage between the main beam relay, connector C915, pin 2, CJB side and ground. • Is battery voltage indicated? → **Yes** GO to **D5** → **No** GO to **D3**
D3: CHECK THE CONTROL CIRCUIT OF THE MAIN BEAM RELAY	
	1 Key in OFF position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022200	**2** Disconnect Turn signal switch C529. **3** Measure the resistance between the main beam relay, connector C915, pin 2, CJB side and the turn signal switch, connector C529, pin 7, circuit 15S-LE12A (GN/YE), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** GO to **D4** → **No** REPAIR the open circuit between the turn signal switch and the main beam relay with the aid of the Wiring Diagrams, if necessary RENEW the central junction box (CJB). CHECK the operation of the system.
D4: CHECK THE CIRCUIT BETWEEN THE LIGHT SWITCH AND THE TURN SIGNAL SWITCH	
 VFE0022201	**1** Disconnect Light switch (C478). **2** Measure the resistance between the light switch, connector C478, pin 6, circuit 15S-LE10 (GN/OG), wiring harness side and the turn signal switch, connector C529, pin 8, circuit 15S-LE10 (GN/OG), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** RENEW the turn signal switch. CHECK the operation of the system. → **No** REPAIR the break in circuit 15S-LE10 (GN/OG) between the light switch and the turn signal switch with the aid of the Wiring Diagrams. CHECK the operation of the system.
D5: CHECK THE MAIN BEAM RELAY GROUND CONNECTION	
	1 Key in OFF position.

DIAGNOSIS AND TESTING (Continued)

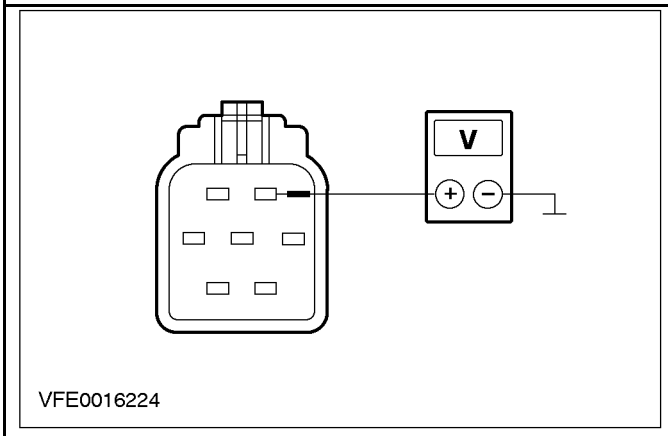
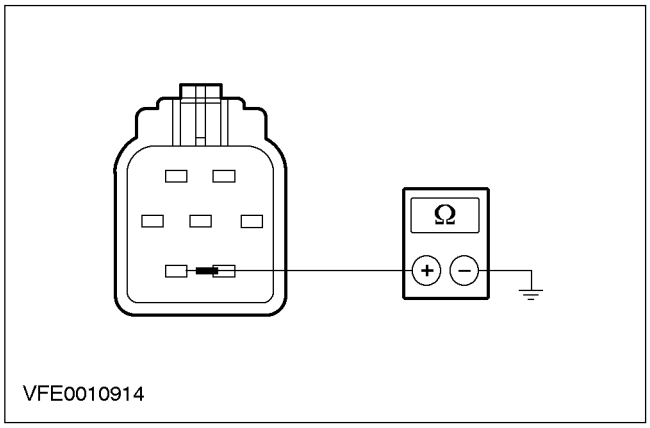
CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0019859	**2** Measure the resistance between the main beam relay, connector C915, pin 1, CJB side and ground. • Is the resistance less than 2 ohms? → **Yes** GO to **D6** → **No** REPAIR the open circuit between the main beam relay and ground connection G200 with the aid of the Wiring Diagrams, if necessary RENEW the central junction box (CJB). CHECK the operation of the system.
D6: CHECK THE MAIN BEAM RELAY	
 VFE0019865	**1** Switch on the dipped beam and main beam. **2** Connect a bridging cable to the main beam relay (CJB), connector C915, between pin 3 and pin 5, CJB side. **3** Key in ON position. **4** Check the main beams. • Are the main beams illuminated? → **Yes** INSTALL a new main beam relay. CHECK the operation of the system. → **No** RENEW the central junction box (CJB). CHECK the operation of the system.

DIAGNOSIS AND TESTING (Continued)

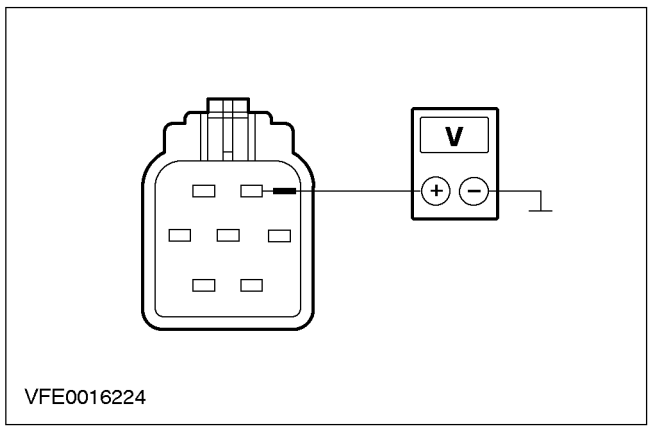
PINPOINT TEST E: ONE MAIN BEAM INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: DETERMINE THE INOPERATIVE LAMP	
	1 Key in ON position. 2 Switch on the dipped beam and main beam. 3 Check main beams. • Is the left-hand main beam inoperative? → **Yes** GO to **E2** → **No** Right-hand main beam inoperative: GO to **E6**
E2: CHECK FUSE F85 (CJB)	
	1 Key in OFF position. 2 CHECK Fuse F85 (CJB). 3 Check fuse F85 (7,5 A). • Is the fuse OK? → **Yes** GO to **E3** → **No** INSTALL a new fuse F85 (7,5 A). If the fuse blows again, LOCATE and RECTIFY the short to ground using the wiring diagrams. CHECK the operation of the system.
E3: CHECK THE CENTRAL JUNCTION BOX (CJB).	
	1 Connect Fuse F85 (CJB). 2 Key in ON position. 3 Switch on the dipped beam and main beam. 4 Measure the voltage between fuse F85 (7.5 A) and ground. • Is battery voltage indicated? → **Yes** Vehicles with conventional headlamps: GO to **E4** Vehicles with gas discharge headlamps: GO to **E10** → **No** REPAIR and if necessary RENEW the central junction box (CJB). CHECK the operation of the system.
E4: CHECK THE CIRCUIT TO FUSE F85 (CJB)	
	1 Key in OFF position. 2 Disconnect Left-hand headlamp C146. 3 Key in ON position. 4 Switch on the dipped beam and main beam.

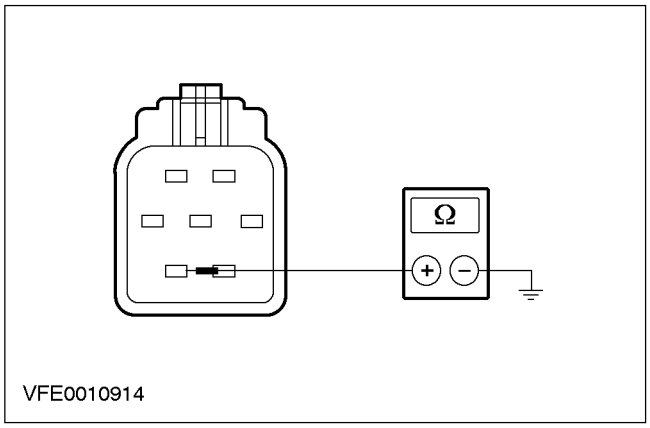
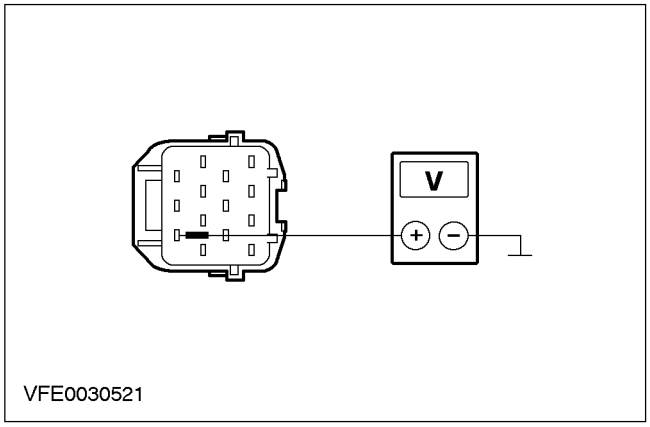
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0016224	**5** Measure the voltage between left-hand headlamp, connector C146, pin 2, circuit 15S-LE15 (GN/BK), harness side and ground. • Is battery voltage indicated? → **Yes** GO to **E5** → **No** REPAIR the open circuit between fuse F85 (CJB) and the left-hand headlamp with the aid of the Wiring Diagrams, if necessary RENEW the central junction box (CJB). CHECK the operation of the system.
E5: CHECK THE GROUND CIRCUIT OF THE LEFT-HAND HEADLAMP	
 VFE0010914	**1** Key in OFF position. **2** Measure the resistance between left-hand headlamp, connector C146, pin 6, circuit 31-LE31A (BK), harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the headlamp. CHECK the operation of the system. → **No** REPAIR the break in circuit 31-LE31A (BK) with the aid of the Wiring Diagrams. CHECK the operation of the system.
E6: CHECK FUSE F86 (CJB)	
	1 Key in OFF position. **2** CHECK Fuse F86 (CJB). **3** Check fuse F86 (7,5 A).

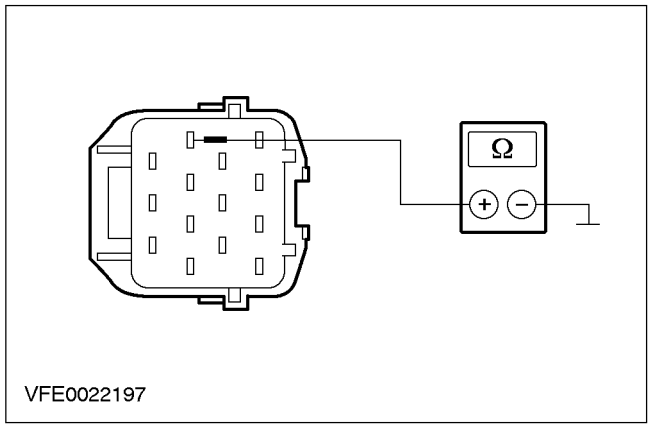
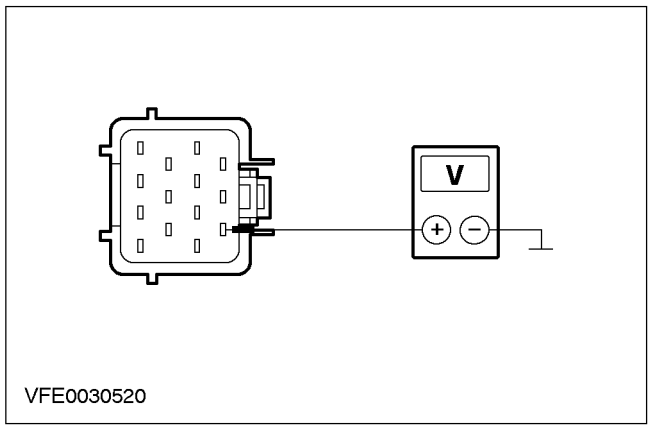
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is the fuse OK? → **Yes** GO to **E7** → **No** INSTALL a new fuse F86 (7,5 A). If the fuse blows again, LOCATE and RECTIFY the short to ground using the wiring diagrams. CHECK the operation of the system.
E7: CHECK THE CENTRAL JUNCTION BOX (CJB)	
	1 Connect Fuse F86 (CJB). 2 Key in ON position. 3 Switch on the dipped beam and main beam. 4 Measure the voltage between fuse F86 (7.5 A) and ground. • Is battery voltage indicated? → **Yes** Vehicles with conventional headlamps: GO to **E8** Vehicles with gas discharge headlamps: GO to **E12** → **No** REPAIR and if necessary RENEW the central junction box (CJB). CHECK the operation of the system.
E8: CHECK THE CIRCUIT TO FUSE F86 (CJB)	
 VFE0016224	1 Key in OFF position. 2 Disconnect Right-hand headlamp C147. 3 Key in ON position. 4 Switch on the dipped beam and main beam. 5 Measure the voltage between right-hand headlamp, connector C147, pin 2, circuit 15S-LE22 (GN/OG), harness side and ground. • Is battery voltage indicated? → **Yes** GO to **E9** → **No**

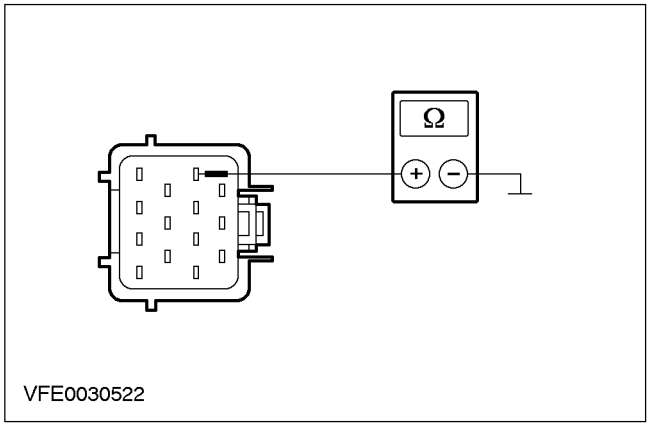
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR the open circuit between fuse F86 (CJB) and the right-hand headlamp with the aid of the Wiring Diagrams, if necessary RENEW the central junction box (CJB). CHECK the operation of the system.
E9: CHECK THE GROUND CIRCUIT OF THE RIGHT-HAND HEADLAMP	
 VFE0010914	1 Key in OFF position. 2 Measure the resistance between right-hand headlamp, connector C147, pin 6, circuit 31-LE30A (BK), harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the headlamp. CHECK the operation of the system. → **No** REPAIR the break in circuit 31-LE31A (BK) with the aid of the Wiring Diagrams. CHECK the operation of the system.
E10: CHECK THE CIRCUIT TO FUSE F85 (CJB)	
 VFE0030521	1 Disconnect Left-hand headlamp C1146. 2 Key in ON position. 3 Switch on the dipped beam and main beam. 4 Measure the voltage between left-hand headlamp, connector C1146 1, circuit 15S-LE15 (GN/BK), harness side and ground. • Is battery voltage indicated? → **Yes** GO to **E11** → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR the open circuit between fuse F85 (CJB) and the left-hand headlamp with the aid of the Wiring Diagrams, if necessary RENEW the central junction box (CJB). CHECK the operation of the system.
E11: CHECK THE GROUND CIRCUIT OF THE LEFT-HAND HEADLAMP	
 VFE0022197	1 Key in OFF position. 2 Measure the resistance between left-hand headlamp, connector C1146, pin 7, circuit 31-LE31A (BK), harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the left-hand headlamp. CHECK the operation of the system. → **No** REPAIR the break in circuit 31-LE31A (BK) with the aid of the Wiring Diagrams. CHECK the operation of the system.
E12: CHECK THE CIRCUIT TO FUSE F86 (CJB)	
 VFE0030520	1 Key in OFF position. 2 Disconnect Right-hand headlamp C1147. 3 Key in ON position. 4 Switch on the dipped beam and main beam. 5 Measure the voltage between right-hand headlamp, connector C1147 1, circuit 15S-LE22 (GN/OG), harness side and ground. • Is battery voltage indicated? → **Yes**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	GO to **E13** → **No** REPAIR the open circuit between fuse F86 (CJB) and the right-hand headlamp with the aid of the Wiring Diagrams, if necessary RENEW the central junction box (CJB). CHECK the operation of the system.
E13: CHECK THE GROUND CIRCUIT OF THE RIGHT-HAND HEADLAMP	
	1 Key in OFF position. 2 Measure the resistance between right-hand headlamp, connector C1147 7, circuit 31-LE30A (BK), harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the head-lamp. CHECK the operation of the system. → **No** REPAIR the break in circuit 31-LE31A (BK) with the aid of the Wiring Diagrams. CHECK the operation of the system.

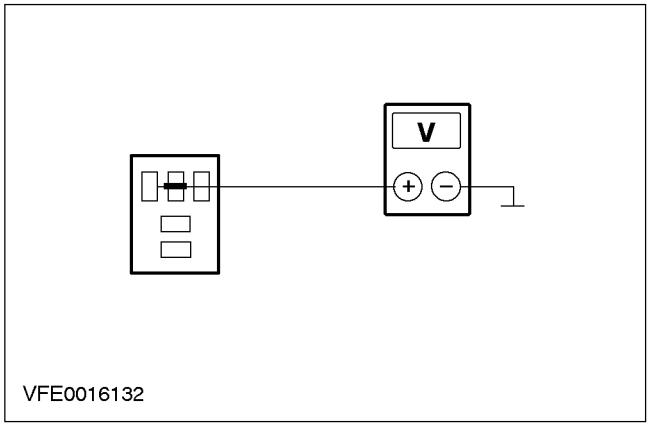
PINPOINT TEST F: HEADLAMPS ON CONTINUOUSLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1: CHECK WHETHER THE MAIN OR DIPPED BEAMS ARE ON CONTINUOUSLY	
	1 Switch off the DIPPED BEAM and the TURN SIGNAL LAMPS. 2 Check the main beams. • Are the main beams illuminated? → **Yes** GO to **F2** → **No** Vehicles with conventional headlamps: GO to **F7** Vehicles with gas discharge headlamps: GO to **F13**
F2: CHECK THE TURN SIGNAL SWITCH	
	1 Key in OFF position. 2 Disconnect Turn signal switch C529. 3 Check the main beams.

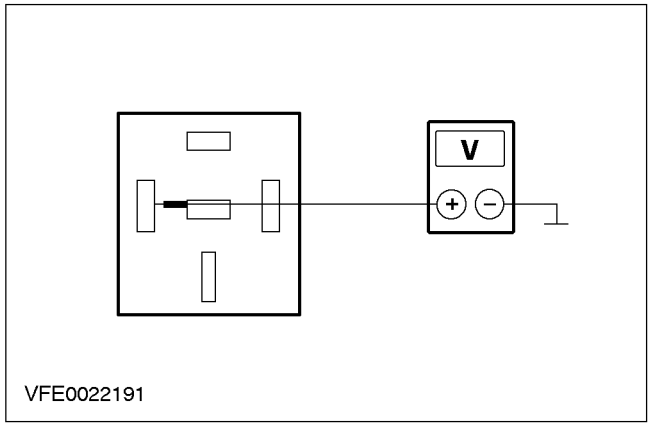
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Are the main beams illuminated? → **Yes** GO to **F3** → **No** RENEW the turn signal switch. CHECK the operation of the system.
F3: CHECK THE MAIN BEAM RELAY	
	1 Disconnect Main beam relay C915. 2 Check main beams. • Are the main beams illuminated? → **Yes** GO to **F4** → **No** GO to **F6**
F4: CHECK THE CIRCUIT TO FUSE F86 (CJB)	
	1 Disconnect Fuse F86 (CJB). 2 Check the main beam at the right-hand side. • Is the main beam at the right-hand side illuminated? → **Yes** LOCATE and RECTIFY the short to battery voltage in the circuit between fuse F86 (CJB) and the right-hand headlamp with the aid of the Wiring Diagrams, and if necessary RENEW the central junction box (CJB). CHECK the operation of the system. → **No** GO to **F5**
F5: CHECK THE CIRCUIT TO FUSE F85 (CJB)	
	1 Disconnect Fuse F85 (CJB). 2 Check the main beam at the left-hand side. • Is the main beam at the left-hand side illuminated? → **Yes** LOCATE and RECTIFY the short to battery voltage in the circuit between fuse F85 (CJB) and the left-hand headlamp with the aid of the Wiring Diagrams, and if necessary RENEW the central junction box (CJB). CHECK the operation of the system. → **No** LOCATE and RECTIFY the short to battery voltage in the circuit between the main beam relay and fuses F85, F86 (CJB) with the aid of the Wiring Diagrams, and if necessary RENEW the central junction box (CJB). CHECK the operation of the system.

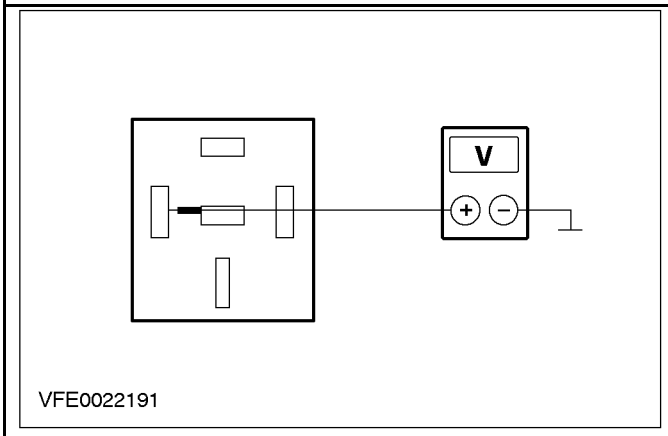
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
F6: CHECK THE CONTROL CIRCUIT OF THE MAIN BEAM RELAY FOR A SHORT TO BATTERY VOLTAGE	
 VFE0016132	1 Measure the voltage between the main beam relay, connector C915, pin 2, CJB side and ground. • Is battery voltage indicated? → **Yes** LOCATE and RECTIFY the short to battery voltage in the circuits connected to soldered connection S132 with the aid of the Wiring Diagrams, and if necessary renew the central junction box (CJB). CHECK the operation of the system. → **No** INSTALL a new main beam relay. CHECK the operation of the system.
F7: CHECK THE LIGHT SWITCH.	
	1 Disconnect Light switch (C478). 2 Check the dipped beams. • Are the dipped beams illuminated? → **Yes** GO to **F8** → **No** Renew the light switch. CHECK the operation of the system.
F8: CHECK THE DIPPED BEAM RELAY	
	1 Disconnect Dipped beam relay C901. 2 Check the dipped beams. • Are the dipped beams illuminated? → **Yes** GO to **F9** → **No** GO to **F11**
F9: CHECK THE CIRCUIT TO FUSE F18 (BJB)	
	1 Disconnect Fuse F18 (BJB). 2 Check the dipped beam at the right-hand side. • Is the dipped beam at the right-hand side illuminated?

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** LOCATE and RECTIFY the short to battery voltage in the circuit 15S-LE23 (GN/WH) between fuse F18 (BJB) and the right-hand headlamp with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** GO to **F10**
F10: CHECK THE CIRCUIT TO FUSE F16 (CJB)	
	1 Disconnect Fuse F16 (BJB). 2 Check the dipped beam at the left-hand side. • Is the dipped beam at the left-hand side illuminated? → **Yes** LOCATE and RECTIFY the short to battery voltage in the circuit 15S-LE16 (GN/OG) between fuse F16 (BJB) and the left-hand headlamp with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** GO to **F11**
F11: CHECK THE CONTROL CIRCUIT OF THE DIPPED BEAM RELAY FOR A SHORT TO BATTERY VOLTAGE	
 VFE0022191	1 Measure the voltage between dipped beam relay, connector C901, pin 2, circuit15S-LE19 (GN/BU), BJB side and ground. • Is battery voltage indicated? → **Yes** GO to **F12** → **No** INSTALL a new dipped beam relay. CHECK the operation of the system.
F12: NARROW DOWN THE LOCATION OF THE SHORT TO BATTERY VOLTAGE BETWEEN THE LIGHT SWITCH AND THE DIPPED BEAM RELAY	
	1 Disconnect Fuse F95 (CJB).

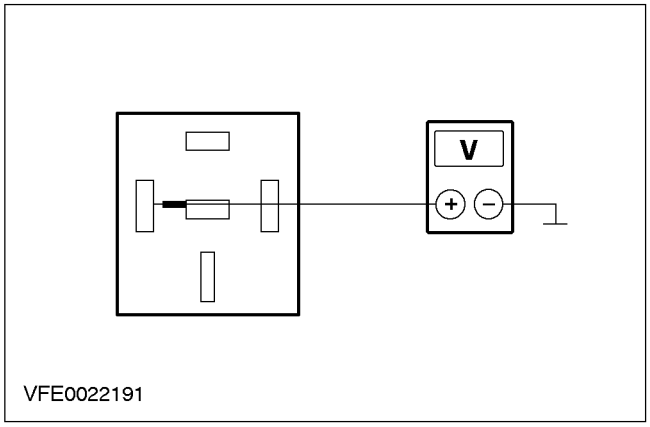
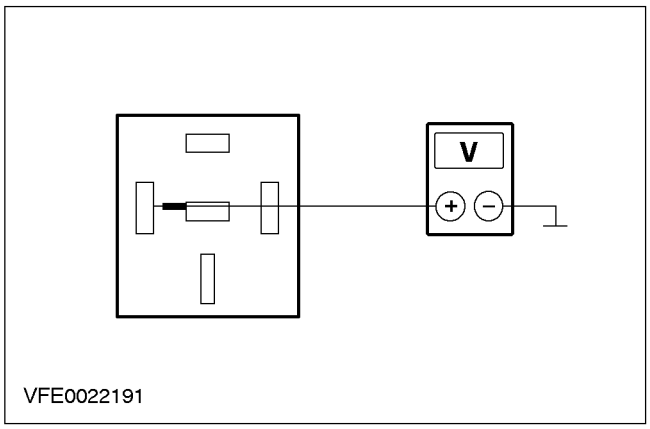
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022191	2 Measure the voltage between dipped beam relay, connector C901, pin 2, circuit15S-LE19 (GN/BU), BJB side and ground. • Is battery voltage indicated? → **Yes** LOCATE and RECTIFY the short to battery voltage in the circuits connected to the output of fuse F95 (CJB) with the aid of the Wiring Diagrams, and if necessary renew the central junction box (CJB). CHECK the operation of the system. → **No** LOCATE and RECTIFY the short to battery voltage in the circuits connected to the input of fuse F95 (CJB) with the aid of the Wiring Diagrams, and if necessary renew the central junction box (CJB). CHECK the operation of the system.
F13: READ OUT THE FAULT MEMORY	
	1 Connect the diagnostic tool. 2 Check the system using WDS. • Are any trouble codes (DTCs) displayed? → **Yes** RESOLVE the faults according to the WDS instructions. CLEAR the fault memory and CHECK the operation of the system. → **No** GO to **F14**
F14: CHECK THE LIGHT SWITCH	
	1 Key in OFF position. 2 Disconnect Light switch (C478). 3 Check the dipped beams. • Are the dipped beams illuminated? → **Yes** GO to **F15** → **No** Renew the light switch. CHECK the operation of the system.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
F15: CHECK THE GAS DISCHARGE HEADLAMP RELAY	
	1 Disconnect Gas discharge headlamp relay C901. 2 Check the dipped beams. • Are the dipped beams illuminated? → **Yes** GO to **F16** → **No** GO to **F18**
F16: CHECK THE CIRCUIT TO FUSE F18 (BJB)	
	1 Disconnect Fuse F18 (BJB). 2 Check the dipped beam at the right-hand side. • Is the dipped beam at the right-hand side illuminated? → **Yes** LOCATE and RECTIFY the short to battery voltage in the circuit 15S-LE23 (GN/WH) between fuse F18 (BJB) and the right-hand headlamp with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** GO to **F17**
F17: CHECK THE CIRCUIT TO FUSE F16 (BJB)	
	1 Disconnect Fuse F16 (BJB). 2 Check the dipped beam at the left-hand side. • Is the dipped beam at the left-hand side illuminated? → **Yes** LOCATE and RECTIFY the short to battery voltage in the circuit 15S-LE16 (GN/OG) between fuse F16 (BJB) and the left-hand headlamp with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** LOCATE and RECTIFY the short to battery voltage in the circuit 15S-LE16A (GN/OG) or 15S-LE23A (GN/WH) between the gas discharge headlamp relay and fuses F16, F18 (BJB) with the aid of the Wiring Diagrams. CHECK the operation of the system.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
F18: CHECK THE CONTROL CIRCUIT OF THE GAS DISCHARGE HEADLAMP RELAY	
 VFE0022191	1 Measure the voltage between gas discharge headlamp relay, connector C901, pin 2, circuit 15S-LE19 (GN/BU), BJB side and ground. • Is battery voltage indicated? → **Yes** GO to **F19** → **No** INSTALL a new gas discharge headlamp relay. CHECK the operation of the system.
F19: NARROW DOWN THE LOCATION OF THE SHORT TO BATTERY VOLTAGE BETWEEN THE LIGHT SWITCH AND THE GAS DISCHARGE HEADLAMP RELAY	
 VFE0022191	1 Disconnect Fuse F95 (CJB). 2 Measure the voltage between gas discharge headlamp relay, connector C901, pin2, circuit 15S-LE19 (GN/BU), BJB side and ground. • Is battery voltage indicated? → **Yes** LOCATE and RECTIFY the short to battery voltage in the circuits connected to the output of fuse F95 (CJB) with the aid of the Wiring Diagrams, and if necessary renew the central junction box (CJB). CHECK the operation of the system. → **No**

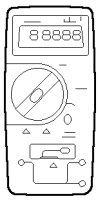
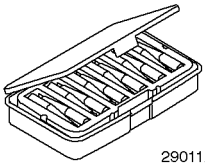
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	LOCATE and RECTIFY the short to battery voltage in the circuits connected to the input of fuse F95 (CJB) with the aid of the Wiring Diagrams, and if necessary renew the central junction box (CJB). CHECK the operation of the system.

DIAGNOSIS AND TESTING

Stoplamps

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Special Tool(s)	
 ST1137-A	Digital multimeter 105-R0051 or a comparable device
 29011A	Terminal probe kit 29-011 A

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Check

Electrical
• Fuse(s). • Bulb(s). • Rear lamp assembly. • Electrical connector(s). • Switch(es). • Wiring harness.

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

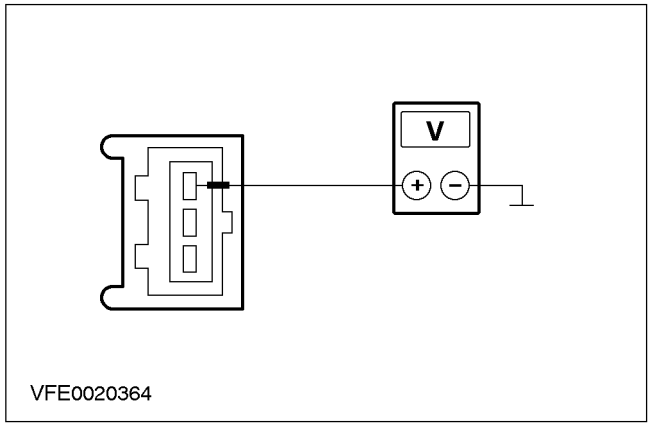
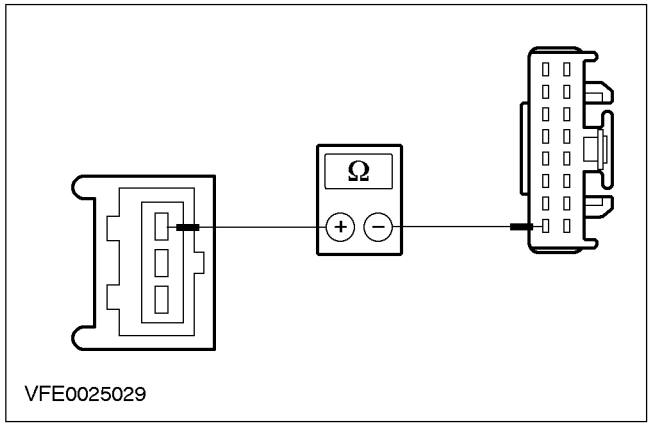
Condition	Possible Sources	Action
•All stop lamps inoperative	•Fuse(s). •Circuit(s). •Stop lamp switch. •Central junction box (CJB).	• GO to Pinpoint Test G
•One or more stop lamps are in-operative	•Circuit(s). •Rear lamp assembly(s). •High mounted stop lamp.	• GO to Pinpoint Test H
•Stop lamps continuously lit	•Circuit(s). •Stop lamp switch. •Powertrain control module (PCM). •ABS module •Cruise control module. •Transmission selector lever assembly •Trailer interface (TI) module •Central junction box (CJB)	• GO to Pinpoint Test I

Pinpoint Tests

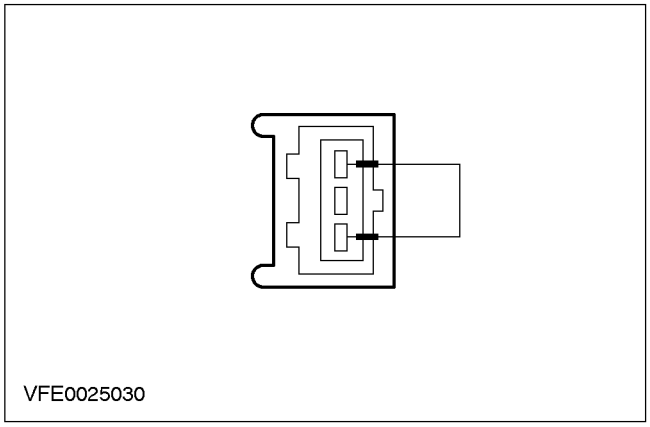
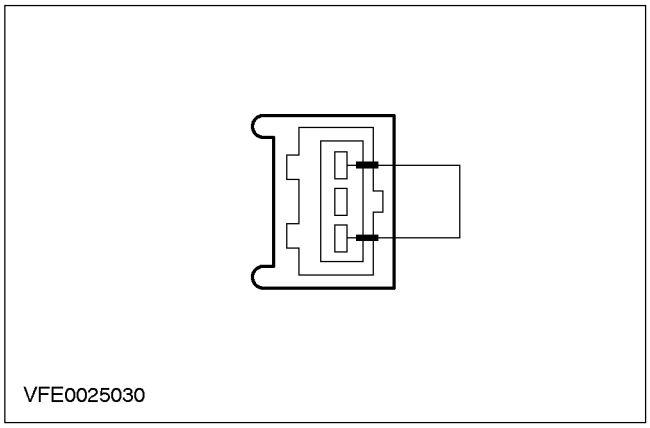
PINPOINT TEST G: ALL STOP LAMPS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1: TEST THE VOLTAGE SUPPLY AT THE STOP LAMP SWITCH	
	1 Key in OFF position.

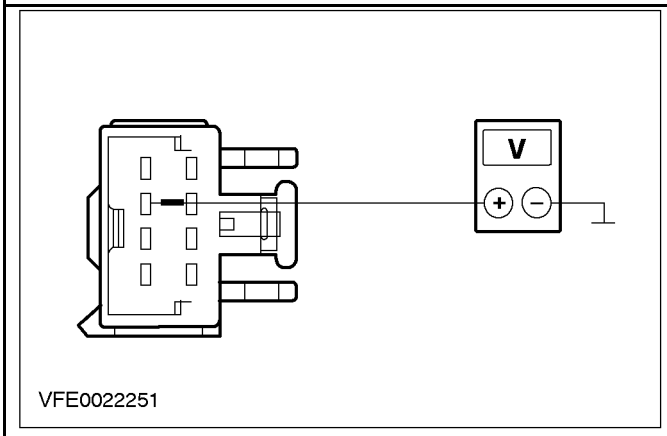
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0020364	2 Disconnect Stop lamp switch C523. 3 Key in ON position. 4 Check the voltage between the stoplamp switch, connector C523, pin 3, circuit 15-LG23 (GN/WH), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **G4** → **No** GO to **G2**
G2: CHECK POWER SUPPLY TO FUSE F93 (CJB)	
	1 Key in ON position. 2 Test voltage between fuse F93 (10 A) and ground. • Is battery voltage indicated? → **Yes** GO to **G3** → **No** REPAIR the power supply to fuse F93 using the wiring diagrams, RENEW the central junction box (CJB) if necessary. TEST the system for normal operation.
G3: CHECK CIRCUIT 15-LG23 (GN/WH)	
 VFE0025029	1 Key in OFF position. 2 Disconnect CJB C509. 3 Measure resistance between CJB, connector C509, pin 9, circuit 15-LG23 (GN/WH) or 15-LE2 (GN/BU) (vehicles with gas discharge lamps from 10/2001), wiring harness side and stop lamp switch, connector C523, pin 3, circuit 15-LG23 (GN/WH), wiring harness side. • Is the resistance less than 2 ohms?

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** CHECK and if necessary RENEW the central junction box (CJB). TEST the system for normal operation. → **No** REPAIR open circuit 15-LG23 (GN/WH) or 15-LE2 (GN/BU) between fuse F93 and stop lamp switch using the wiring diagrams. TEST the system for normal operation.
G4: CHECK THE STOP LAMP SWITCH	
 VFE0025030	1 Key in OFF position. 2 Using a test cable at the stop lamp switch, bridge connector C523, pin 1, circuit 15(S)-LG23 (GN/WH) and pin 3, circuit 15-LG23 (GN/WH), wiring harness side. 3 Key in ON position. • Are the stop lamps illuminated? → **Yes** CHECK and if necessary RENEW the stop lamp switch. TEST the system for normal operation. → **No** GO to **G5**
G5: CHECK THE VOLTAGE SUPPLY CIRCUIT OF THE CENTRAL JUNCTION BOX (CJB).	
 VFE0025030	1 Key in OFF position. 2 Disconnect C505. 3 Using a test cable at the stop lamp switch, bridge connector C523, pin 1, circuit 15(S)-LG23 (GN/WH) and pin 3, circuit 15-LG23 (GN/WH), wiring harness side. 4 Key in ON position.

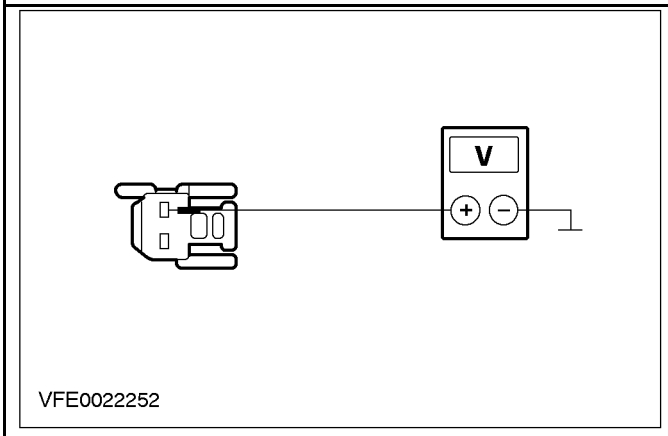
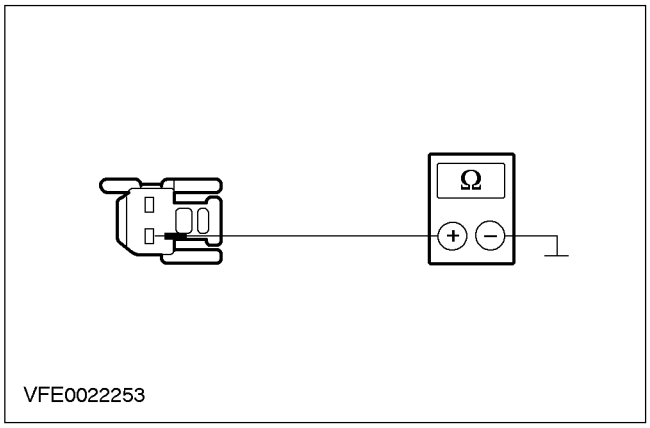
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022251	5 Check the voltage between the CJB, connector C505, pin 7, circuit 15S-LG23 (GN/WH), wiring harness side and ground. • Is battery voltage indicated? → **Yes** CHECK and if necessary RENEW the central junction box (CJB). TEST the system for normal operation. → **No** REPAIR open circuit 15S-LG23 (GN/WH) between stop lamp switch and CJB using the wiring diagrams. TEST the system for normal operation.

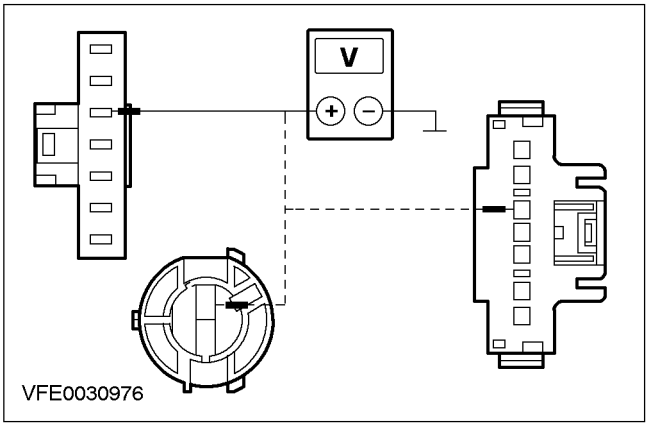
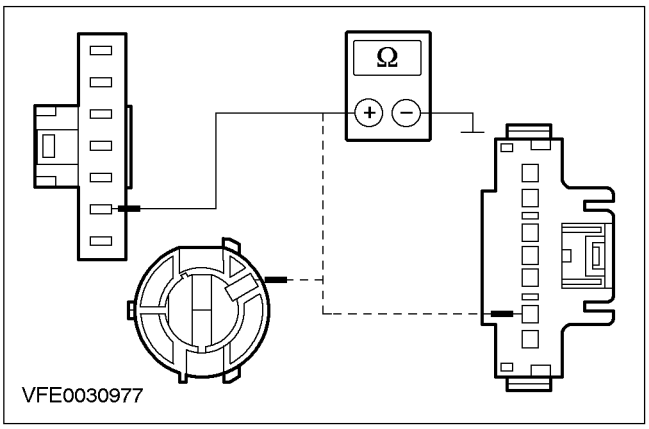
PINPOINT TEST H: ONE OR MORE STOP LAMPS ARE INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1: DETERMINE THE INOPERATIVE LAMP	
	1 Key in ON position. 2 Depress the brake pedal. 3 Check the stop lamps. • Is the high mounted stop lamp inoperative? → **Yes** GO to **H2** → **No** Stop lamps inoperative, wagon: GO to **H4** Left-hand stop lamp inoperative, 4-/5-door without trailer socket: GO to **H5** Left- and right-hand stop lamps inoperative, 4-/5-door: GO to **H4** Left-hand stop lamp inoperative, 4-/5-door with trailer socket: GO to **H4** Stop lamp right-hand side is inoperative: GO to **H6**
H2: CHECK THE VOLTAGE SUPPLY AT THE ADDITIONAL HIGH-MOUNTED STOP LAMP	
	1 Key in OFF position. 2 Disconnect High mounted stop lamp C700. 3 Key in ON position. 4 Depress the BRAKE PEDAL and keep it depressed.

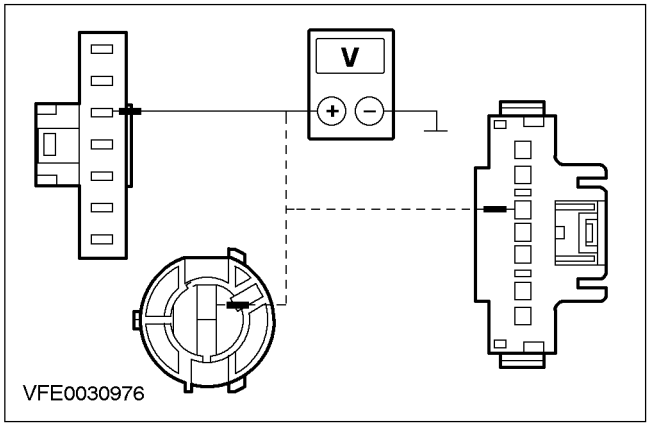
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022252	**5** Measure the voltage between the additional high-mounted stop lamp, connector C700, pin 2, circuit 15S-LG6 (GN/YE), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **H3** → **No** REPAIR break in circuit 15S-LG6(A) (GN/YE), between CJB and high mounted stop lamp, using the wiring diagrams, if necessary RENEW the central junction box (CJB). TEST the system for normal operation.
H3: CHECK GROUND CONNECTION OF CIRCUIT 31-LG6 (BK)	
 VFE0022253	**1** Key in OFF position. **2** Measure the resistance between the high mounted stop lamp, connector C700, pin 1, circuit 31-LG6 (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the additional high-mounted stop lamp. TEST the system for normal operation. → **No** REPAIR break in circuit 31-LG6 (BK) between high-mounted stop lamp and ground G300 or G200 (4-/5-door) using the wiring diagrams. TEST the system for normal operation.

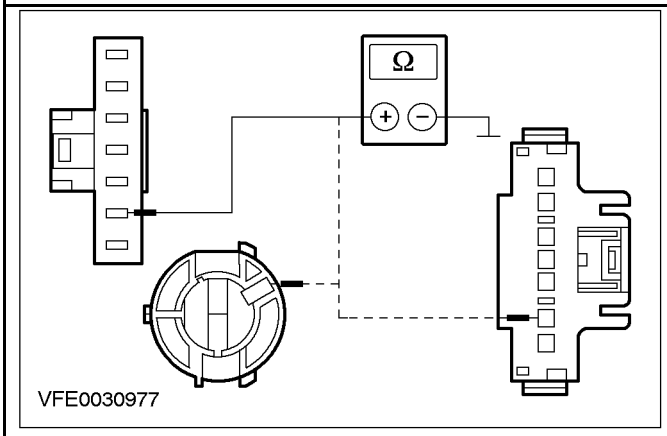
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
H4: CHECK THE VOLTAGE SUPPLY AT THE LEFT-HAND STOP LAMP.	
	**1** Key in OFF position. **2** Disconnect Left-hand stop lamp. - C540 (4-/5-door without trailer socket) - C2005 (4-/5-door with trailer socket) - C540a Wagon **3** Key in ON position. **4** Depress the BRAKE PEDAL and keep it depressed. **5** Test the voltage between the left-hand rear lamp assembly: - 4-/5-door without trailer socket: Connector C540, pin 3, circuit 15S-LG14 (GN/RD), wiring harness side and ground. - 4-/5-door with trailer socket: Connector C2005, pin 3, circuit (BK/RD), wiring harness side and ground. - Wagon: Connector C540a, pin 2, circuit 15S-LG14 (GN/RD), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **H5** → **No** REPAIR break in circuit 15S-LG14 (GN/RD) or (BK/RD), between CJB and rear lamp assembly using the wiring diagrams, if necessary RENEW the central junction box (CJB). TEST the system for normal operation.
H5: CHECK THE GROUND CONNECTION OF THE LEFT-HAND STOP LAMP	
	**1** Key in OFF position. **2** Measure the resistance between the left-hand rear lamp assembly: - 4-/5-door without trailer socket: Connector C540, pin 6, circuit 31-LF11 (BK), wiring harness side and ground. - 4-/5-door with trailer socket: Connector C2005, pin 6, circuit (BN), wiring harness side and ground. - Wagon: Connector C540a, pin 1, circuit 31-LG14 (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	CHECK and if necessary RENEW the rear lamp assembly. TEST the system for normal operation. → **No** REPAIR open circuit 31-LF11 (BK) or 31-LG14 (BK), between rear lamp assembly and ground G300, using the wiring diagrams. TEST the system for normal operation.
H6: CHECK THE VOLTAGE SUPPLY OF THE RIGHT-HAND REAR LAMP ASSEMBLY	
	**1** Key in OFF position. **2** Disconnect Right-hand rear lamp assembly. - C541 (4-/5-door without trailer socket) - C2007 (4-/5-door with trailer socket) - C541a Wagon **3** Key in ON position. **4** Depress the BRAKE PEDAL and keep it depressed. **5** Test the voltage between the right-hand rear lamp assembly: - 4-/5-door without trailer socket: Connector C541, pin 3, circuit 15S-LG21 (GN/BK), wiring harness side and ground. - 4-/5-door with trailer socket: Connector C2007, pin 3, circuit (GN), wiring harness side and ground. - Wagon: Connector C541a, pin 2, circuit 15S-LG14 (GN/RD), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **H7** → **No** REPAIR break in circuit 15S-LG21 (GN/BK), 15S-LG14 (GN/RD) or (GN), between CJB and rear lamp assembly using the wiring diagrams, if necessary RENEW the central junction box (CJB). TEST the system for normal operation.
H7: CHECK THE GROUND CONNECTION OF THE RIGHT-HAND REAR LAMP ASSEMBLY	
	1 Key in OFF position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	2 Measure the resistance between the right-hand rear lamp assembly: - 4-/5-door without trailer socket: Connector C541, pin 6, circuit 31-LF20 (BK), wiring harness side and ground. - 4-/5-door with trailer socket: Connector C2007, pin 6, circuit (GN), wiring harness side and ground. - Wagon: Connector C541a, pin 1, circuit 31-LG14 (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the rear lamp assembly. TEST the system for normal operation. → **No** REPAIR open circuit 31-LF20 (BK) or 31-LG14 (BK), between rear lamp assembly and ground G300 (4-/5-door) or G205 (wagon), using the wiring diagrams. TEST the system for normal operation.

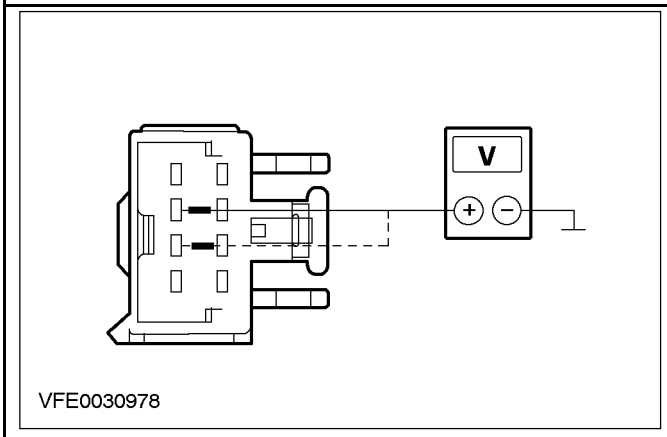
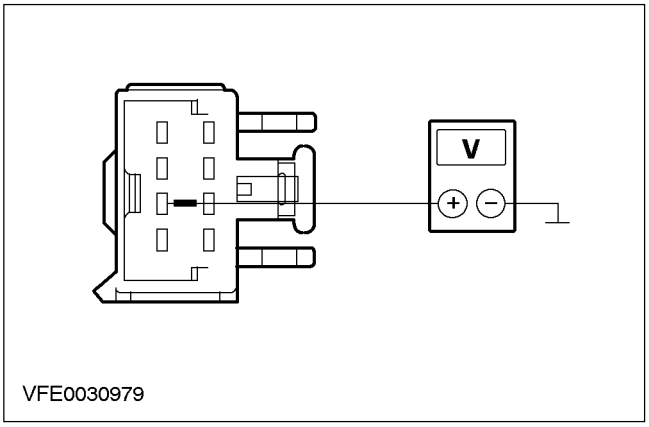
PINPOINT TEST I: STOP LAMPS CONTINUOUSLY LIT

CONDITIONS	DETAILS/RESULTS/ACTIONS
I1: CHECK THE STOP LAMP SWITCH	
	1 Key in OFF position. 2 Disconnect Stop lamp switch C523. 3 Key in ON position. 4 Check the stop lamps. • Are the stop lamps illuminated? → **Yes** GO to **I2** → **No** INSTALL a new stop lamp switch. TEST the system for normal operation.
I2: NARROW DOWN THE LOCATION OF THE SHORT TO BATTERY VOLTAGE	
	1 Key in OFF position. 2 Disconnect CJB (C506). 3 Key in ON position. 4 Check the stop lamps. • Does only the high-mounted stop lamp illuminate? → **Yes**

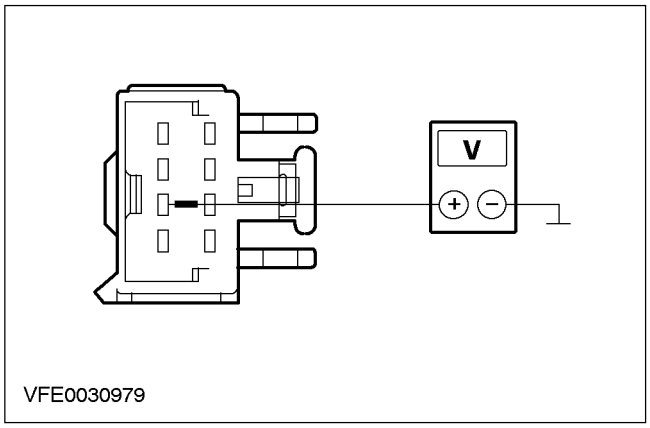
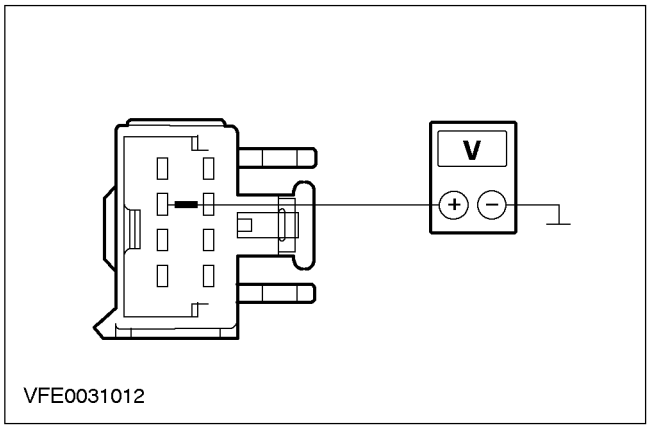
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	With manual transmission: REPAIR circuit 15S-LG6(A) (GN/YE), shorted to battery positive, using the wiring diagrams. TEST the system for normal operation. With automatic transmission: REPAIR circuit 15S-LG6 (GN/YE) or 15S-TA33 (GN/WH), shorted to battery positive, using the wiring diagrams. If necessary, CHECK the transmission selector lever assembly, RENEW it if required. TEST the system for normal operation. → **No** Wagon without trailer socket, left- or right-hand stop lamp lit continuously: REPAIR circuit 15S-LG21 (GN/BK) or 15S-LG14 (GN/RD), shorted to battery positive, between CJB and rear lamp assembly, using the wiring diagrams. TEST the system for normal operation. 4-/5-door without trailer, right- and left-hand stop lamps lit continuously: REPAIR circuit 15S-LG14 (GN/RD) or 15S-LG21 (GN/BK), shorted to battery positive, between CJB and rear lamp assembly, using the wiring diagrams. TEST the system for normal operation. Vehicles with trailer socket, right- and left-hand stop lamps lit continuously: GO to **I8** Stop lamps do not illuminate: GO to **I3**
I3: CHECK THE CENTRAL JUNCTION BOX (CJB)	
	1 Key in OFF position. **2** Disconnect C505. **3** Connect C506. **4** Key in ON position. **5** Check the stop lamps. • Are the stop lamps illuminated? → **Yes** CHECK and if necessary RENEW the central junction box (CJB). TEST the system for normal operation. → **No** GO to **I4**

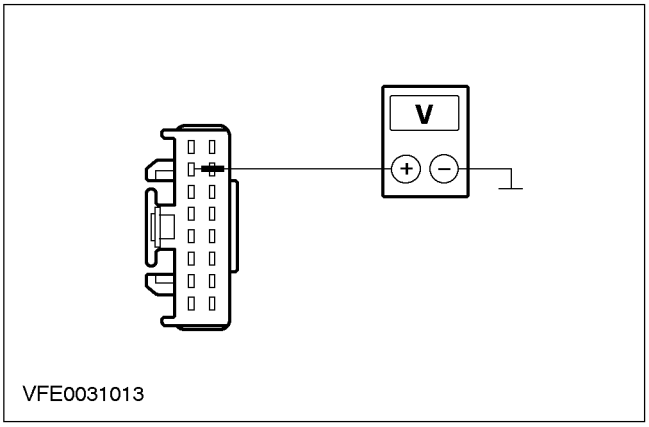
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
I4: CHECK CIRCUITS FOR SHORT TO BATTERY POSITIVE	
 VFE0030978	1 Check the voltage between the CJB, connector C505, pin 6, circuit 15S-RE13 (GN/RD), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **I5** → **No** Vehicles with cruise control system: GO to **I7** Vehicles without cruise control system: REPAIR circuit 15S-LG23 (GN/WH), shorted to battery positive, using the wiring diagrams. TEST the system for normal operation.
I5: CHECK CIRCUITS FOR SHORT TO BATTERY POSITIVE	
 VFE0030979	1 Key in OFF position. 2 Disconnect PCM C100. 3 Disconnect ABS module C103. 4 Key in ON position. 5 Check the voltage between the CJB, connector C505, pin 6, circuit 15S-RE13 (GN/RD), wiring harness side and ground. • Is battery voltage indicated? → **Yes** REPAIR circuit 15S-CF58 (GN/OG) or 15S-RE13 (GN/RD), shorted to battery positive, using the wiring diagrams. TEST the system for normal operation. → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	GO to **I6**
I6: CHECK ABS MODULE	
 VFE0030979	**1** Key in OFF position. **2** Connect ABS module C103. **3** Key in ON position. **4** Check the voltage between the CJB, connector C505, pin 6, circuit 15S-CF58 (GN/OG), wiring harness side and ground. • Is battery voltage indicated? → **Yes** CHECK ABS module, RENEW it if necessary. TEST the system for normal operation. → **No** CHECK PCM module, RENEW it if necessary. TEST the system for normal operation.
I7: CHECK CIRCUITS FOR SHORT TO BATTERY POSITIVE	
 VFE0031012	**1** Key in OFF position. **2** Disconnect PCM C100 (diesel). **3** Disconnect Cruise control system C175 (vehicles with a petrol engine). **4** Key in ON position. **5** Check the voltage between the CJB, connector C505, pin 7, circuit 15S-LG23 (GN/WH), wiring harness side and ground. • Is battery voltage indicated? → **Yes**

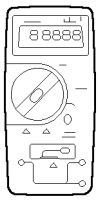
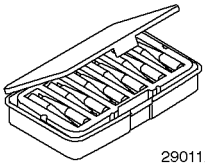
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR circuit 15S-LG23 (GN/WH), 15S-PG7 (GN/BU) or 15S-PG17 (GN/BU) shorted to battery positive, using the wiring diagrams. TEST the system for normal operation. → **No** Diesel: CHECK PCM module, RENEW it if necessary. TEST the system for normal operation. Petrol engine: CHECK and if necessary RENEW cruise control system. TEST the system for normal operation.
I8: CHECK THE TRAILER INTERFACE (TI) MODULE	
 VFE0031013	**1** Key in OFF position. **2** Connect Trailer interface (TI) module C2000. **3** Key in ON position. **4** Check the voltage between the CJB, connector C506, pin 2, circuit 15S-LG14 (GN/RD), wiring harness side and ground. • Is battery voltage indicated? → **Yes** REPAIR circuit 15S-LG14 (GN/RD), 15S-LG21 (GN/BK), (BK/RD) or (GN) shorted to battery positive, between CJB and rear lamp assembly, using the wiring diagrams. TEST the system for normal operation. → **No** CHECK the trailer interface (TI), RENEW it if necessary. TEST the system for normal operation.

DIAGNOSIS AND TESTING

Turn Signal and Hazard Lamps

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Special Tool(s)	
 ST1137-A	Digital multimeter 105-R0051 or a comparable device
 29011A	Terminal probe kit 29-011 A

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Check

Electrical
• Fuse(s). • Bulb(s). • Electrical connector(s). • Switch(es). • Wiring harness.

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

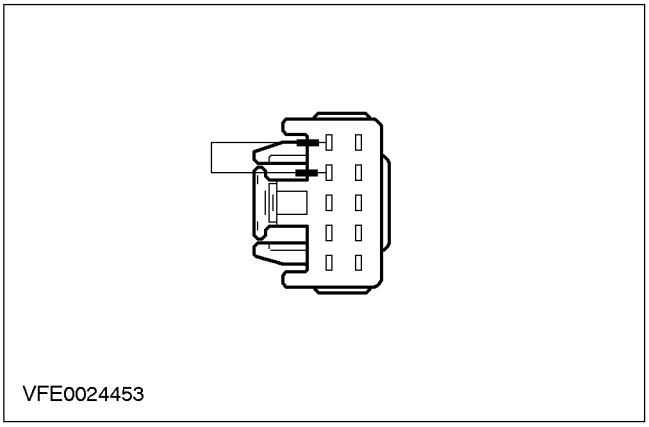
Condition	Possible Sources	Action
•Acoustic turn signal is inoperative	•Circuit(s). •Turn signal switch •Generic electronic module (GEM).	• GO to Pinpoint Test J
•Hazard warning lights are completely inoperative	•Fuse(s). •Circuit(s). •Hazard warning lamp switch •Generic electronic module (GEM).	• GO to Pinpoint Test K
•Turn signal lamps are inoperative	•Circuit(s). •Turn signal switch •Generic electronic module (GEM).	• GO to Pinpoint Test L
•The left- or right-hand turn signals are inoperative.	•Circuit(s). •Turn signal switch •Generic electronic module (GEM).	• GO to Pinpoint Test M

DIAGNOSIS AND TESTING (Continued)

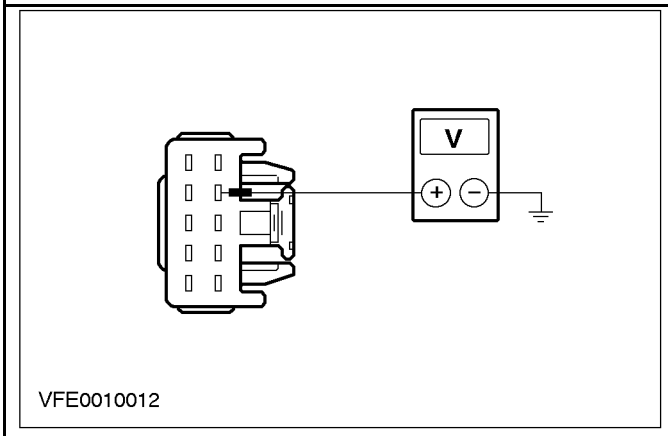
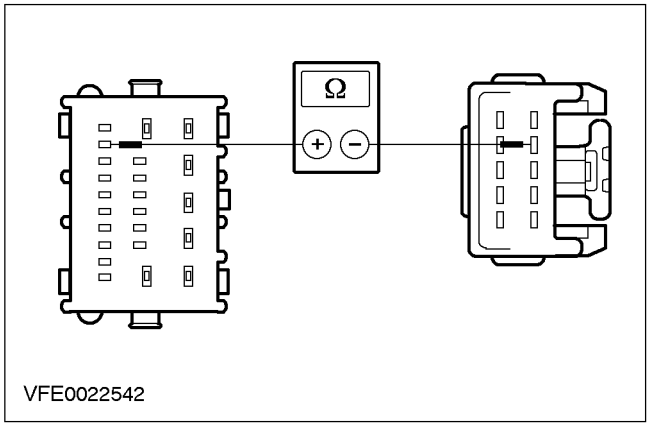
Condition	Possible Sources	Action
•One or more turn signal lamps are inoperative	•Circuit(s). •Bulb •Turn signal switch •Generic electronic module (GEM). •Front turn signal lamp •Headlamps •Tail Lamp Assembly •Trailer switch interface (SI) module	• GO to Pinpoint Test N
•One or more turn signal lamps illuminate/flash continually	•Circuit(s). •Turn signal lamp switch •Generic electronic module (GEM). •Instrument cluster. •Trailer switch interface (SI) module	• GO to Pinpoint Test O

Pinpoint Tests

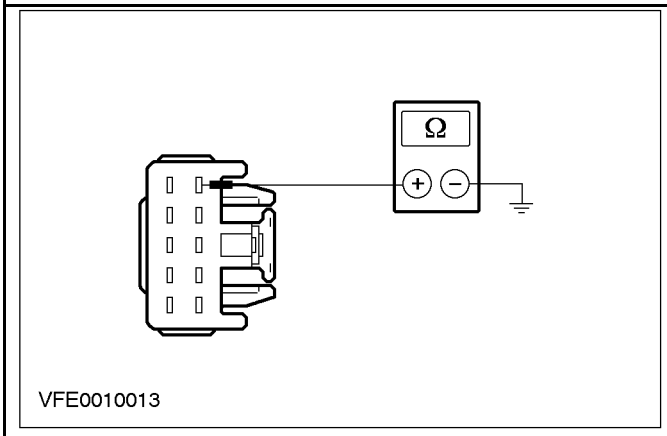
PINPOINT TEST J: ACOUSTIC TURN SIGNAL IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
J1: CHECK SIGNAL FROM TURN SIGNAL LAMP SWITCH	
 VFE0024453	1 Key in OFF position. 2 Disconnect Turn signal lamp switch C529. 3 Connect a bridging cable between turn signal lamp switch, connector C529, pin 1, circuit 91S-LG27B (BK/GN), wiring harness side and pin 2, circuit 91-LG27 (BK/GN), wiring harness side. 4 Key in ON position.

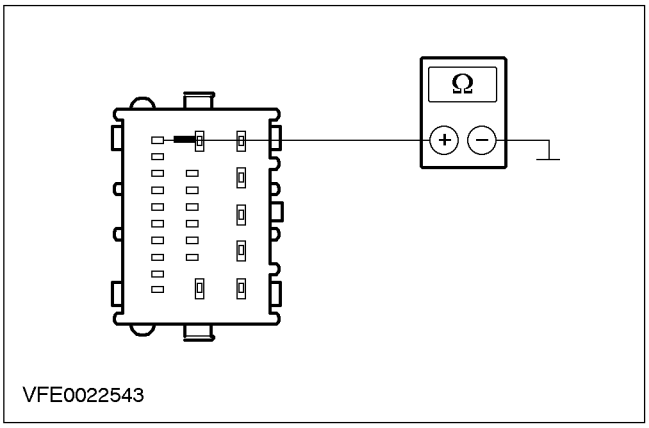
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0010012	**5** Measure the voltage between turn signal lamp switch, connector C529, pin 4, circuit 29S-LG43 (OG/WH), wiring harness side and ground. • Does the voltage alternate between 0 volt and battery voltage? → **Yes** GO to **J3** → **No** GO to **J2**
J2: CHECK CIRCUIT 29S-LG43 (OG/WH)	
 VFE0022542	**1** Key in OFF position. **2** Disconnect GEM C430. **3** Measure resistance between GEM, connector C430, pin 22, circuit 29S-LG43 (OG/WH), wiring harness side and turn signal lamp switch, connector C529, pin 4, circuit 29S-LG43 (OG/WH), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** CHECK system using WDS, if necessary RENEW the generic electronic module (GEM). TEST the system for normal operation. → **No** REPAIR circuit 29S-LG43 (OG/WH), between GEM and turn signal lamp switch, using the wiring diagrams. TEST the system for normal operation.
J3: CHECK CIRCUIT 31-LG43 (BK)	
	1 Key in OFF position.

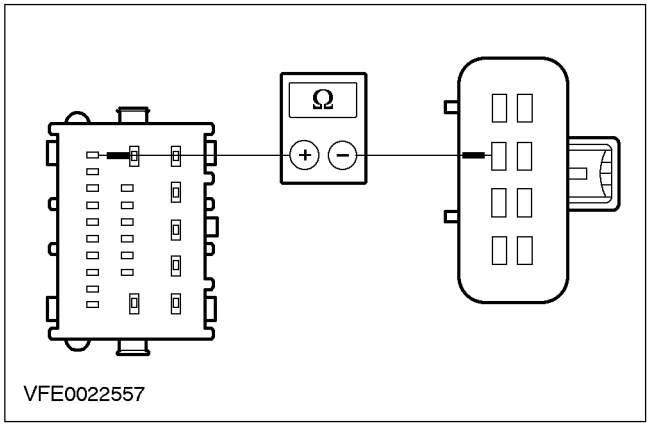
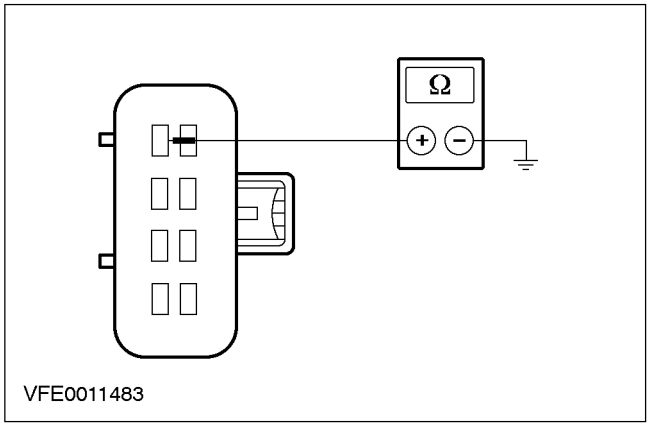
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0010013	**2** Measure the resistance between the turn signal lamp switch, connector C529, pin 5, circuit 31-LG43 (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the turn signal lamp switch. TEST the system for normal operation → **No** REPAIR circuit 31-LG43 (BK), between turn signal lamp switch and ground G204, using the wiring diagrams. TEST the system for normal operation.

PINPOINT TEST K: HAZARD WARNING LIGHTS ARE COMPLETELY INOPERATIVE

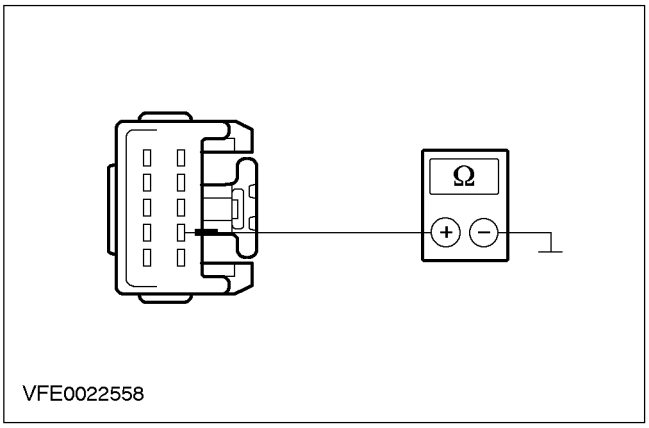
CONDITIONS	DETAILS/RESULTS/ACTIONS
K1: CHECK GROUND CONNECTION OF THE HAZARD WARNING SWITCH	
 VFE0022543	**1** Key in OFF position. **2** Disconnect GEM C429. **3** Switch on the hazard warning lights. **4** Measure the resistance between GEM, connector C429, pin 23, circuit 91S-LG8 (BK/OG), harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK system using WDS, if necessary RENEW the generic electronic module (GEM). TEST the system for normal operation. → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	GO to **K2**
K2: CHECK CIRCUIT 91S-LG8 (BK/OG)	
 VFE0022557	**1** Disconnect Hazard warning lamp switch C438. **2** Measure resistance between GEM, connector C429, pin 23, circuit 91S-LG8 (BK/OG), wiring harness side and hazard warning switch, connector C438, pin 2, circuit 91S-LG8 (BK/OG), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** GO to **K3** → **No** REPAIR circuit 91S-LG8 (BK/OG), between hazard warning switch and GEM, using the wiring diagrams. TEST the system for normal operation.
K3: CHECK CIRCUIT 91-LG8 (BK/OG)	
 VFE0011483	**1** Measure the resistance between the hazard warning lights switch, connector C438, pin 1, circuit 91-LG8 (BK/OG), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** TEST the hazard warning lamp switch, RENEW it if necessary. TEST the system for normal operation. → **No** REPAIR circuit 91-LG8 (BK/OG), between hazard warning switch and ground G203. TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

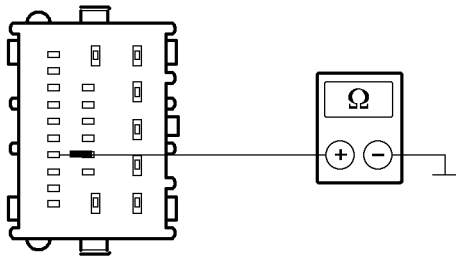
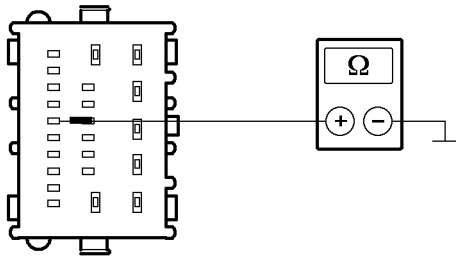
PINPOINT TEST L: TURN SIGNAL LAMPS ARE INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
L1: CHECK GROUND CONNECTION OF TURN SIGNAL LAMP SWITCH	
 VFE0022558	1 Key in OFF position. 2 Disconnect Turn signal lamp switch C529. 3 Measure the resistance between the turn signal lamp switch, connector C529, pin 2, circuit 91-LG27 (BK/GN), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK turn signal lamp switch according to the component tests in the wiring diagrams, RENEW it if necessary. TEST the system for normal operation. If the concern persists, CHECK system using WDS, if necessary RENEW the generic electronic module (GEM). TEST the system for normal operation. → **No** REPAIR circuit 91-LG27 (BK/GN), between turn signal lamp switch and ground G203, using the wiring diagrams. TEST the system for normal operation.

PINPOINT TEST M: THE LEFT- OR RIGHT-HAND TURN SIGNAL LAMPS ARE INOPERATIVE.

CONDITIONS	DETAILS/RESULTS/ACTIONS
M1: DETERMINE THE FAULT CONDITION	
	1 Key in ON position. 2 Switch on the LEFT-HAND TURN SIGNAL. • Are the left-hand turn signals inoperative? → **Yes** GO to **M2** → **No** GO to **M3**
M2: CHECK CIRCUIT 91S-LG27B (BK/GN)	
	1 Key in OFF position. 2 Disconnect GEM C429. 3 Switch on the RIGHT-HAND TURN SIGNAL.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022559	**4** Measure the resistance between GEM, connector C429, pin 17, circuit 91S-LG27B (BK/GN), harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK system using WDS, if necessary RENEW the generic electronic module (GEM). TEST the system for normal operation. → **No** CHECK turn signal lamp switch according to the component tests in the wiring diagrams, RENEW it if necessary. TEST the system for normal operation. If the concern persists, REPAIR circuit 91S-LG27 (BK/GN), between turn signal lamp switch and GEM, using the wiring diagrams. TEST the system for normal operation.
M3: CHECK CIRCUIT 91S-LG27A (BK/GN)	
 VFE0022561	**1** Key in OFF position. **2** Disconnect GEM C429. **3** Switch on the RIGHT-HAND TURN SIGNAL. **4** Measure the resistance between GEM, connector C429, pin 19, circuit 91S-LG27A (BK/GN), harness side and ground. • Is the resistance less than 2 ohms? → **Yes**

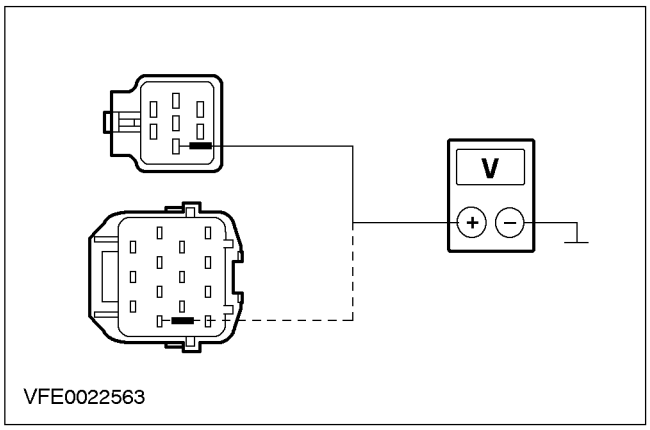
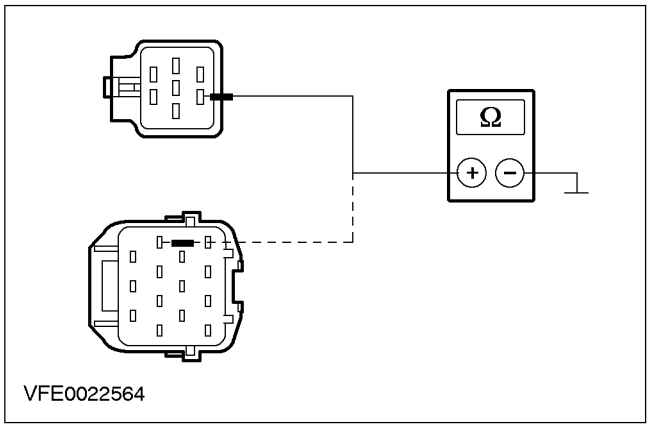
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	CHECK system using WDS, if necessary RENEW the generic electronic module (GEM). TEST the system for normal operation. → **No** CHECK turn signal lamp switch according to the component tests in the wiring diagrams, RENEW it if necessary. TEST the system for normal operation. If the concern persists, REPAIR circuit 91S-LG27A (BK/GN), between turn signal lamp switch and GEM, using the wiring diagrams. TEST the system for normal operation.

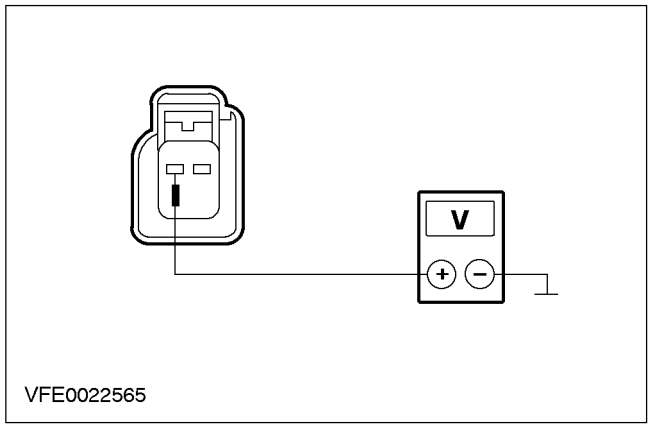
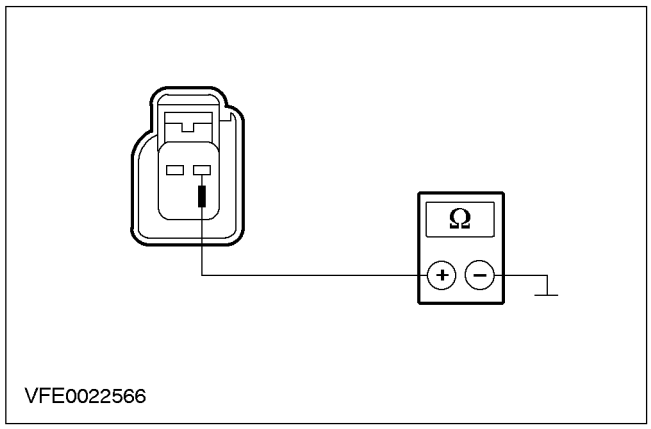
PINPOINT TEST N: ONE OR MORE TURN SIGNAL LAMPS ARE INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
N1: DETERMINE THE FAULT CONDITION	
	1 Determine the fault condition. • Is one of the left-hand turn signal lamps inoperative? → **Yes** GO to **N2** → **No** One right-hand turn signal lamp is inoperative: GO to **N18**
N2: DETERMINE THE FAULT CONDITION	
	1 Key in ON position. 2 Switch on the LEFT-HAND TURN SIGNAL. 3 Check front left-hand turn signal lamp. • Is the front left-hand turn signal lamp inoperative? → **Yes** GO to **N3** → **No** The left-hand turn signal side repeater lamp is inoperative: GO to **N5** The left-hand turn front signal lamp and side repeater lamp are inoperative: GO to **N7** The rear left-hand turn signal lamp is inoperative: GO to **N8** (without trailer interface socket) or GO to **N11** (with trailer interface socket) The left-hand warning lamp in the instrument cluster is inoperative: GO to **N16**
N3: CHECK VOLTAGE SUPPLY TO LEFT-HAND HEADLAMP	
	1 Key in OFF position. 2 Disconnect Left-hand headlamp C146 (conventional headlamp) or C1146 (gas discharge headlamp). 3 Key in ON position.

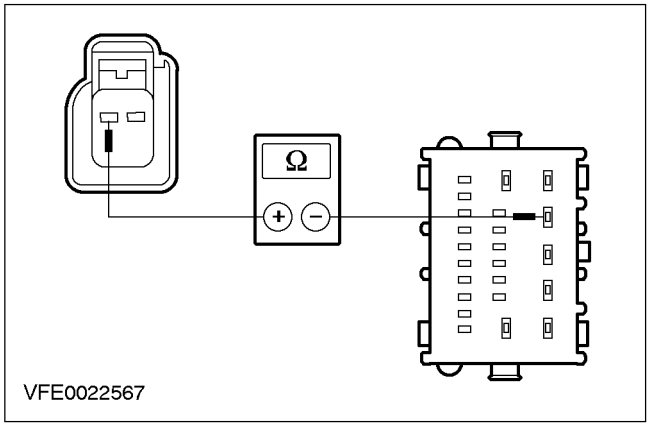
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022563	**4** Switch on the LEFT-HAND TURN SIGNAL. **5** Measure the voltage between the left-hand headlamp, connector C146, pin 3 (conventional headlamp), or connector C1146, pin 4 (gas discharge headlamp), circuit 49-LG11 (BU/OG), wiring harness side and ground. • Does the voltage alternate between 0 volt and battery voltage? → **Yes** GO to **N4** → **No** REPAIR circuit 49-LG11 (OG/BU), between solder point S371 and headlamp, using the wiring diagrams. TEST the system for normal operation.
N4: CHECK CIRCUIT 31-LE31A (BK)	
 VFE0022564	**1** Key in OFF position. **2** Measure the resistance between the left-hand headlamp, connector C146, pin 6 (conventional headlamp), or connector C1146, pin 7 (gas discharge headlamp), circuit 31-LE31A (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the left-hand headlamp. TEST the system for normal operation. → **No** REPAIR circuit 31-LG31A (BK), between headlamp and ground G104, using the wiring diagrams. TEST the system for normal operation.
N5: CHECK THE POWER SUPPLY OF THE SIDE DIRECTION INDICATOR LAMP LH SIDE	
	1 Key in OFF position.

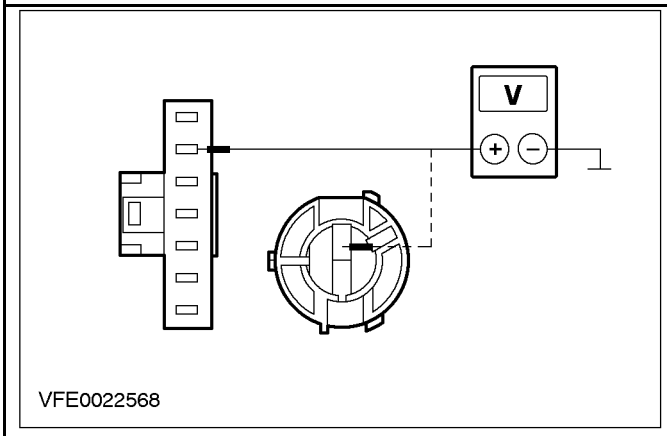
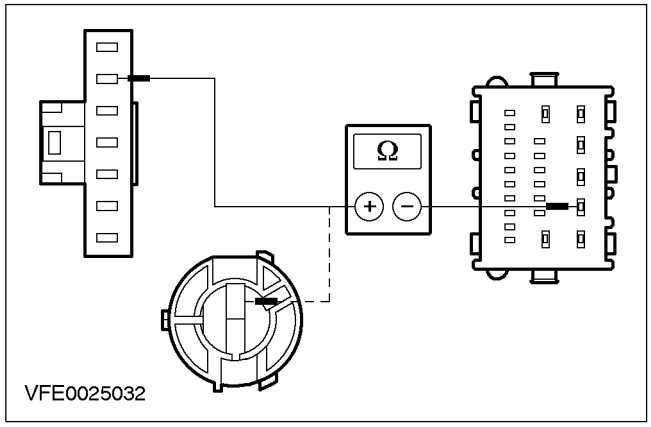
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022565	**2** Disconnect Side direction indicator lamp LH C163. **3** Key in ON position. **4** Switch on the LEFT-HAND TURN SIGNAL. **5** Measure the voltage between the left-hand side turn repeater lamp, connector C163, pin 2, circuit 49-LG13 (BU/RD), wiring harness side and ground. • Does the voltage alternate between 0 volt and battery voltage? → **Yes** GO to **N6** → **No** REPAIR circuit 49-LG13 (BU/RD), between solder point S371 and side repeater lamp, using the wiring diagrams. TEST the system for normal operation.
N6: CHECK CIRCUIT 31-LG13 (BK)	
 VFE0022566	**1** Key in OFF position. **2** Measure the resistance between side direction indicator lamp LH side, connector C163, pin 1, circuit 31-LG13 (BK), harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the left-hand side repeater lamp. TEST the system for normal operation. → **No**

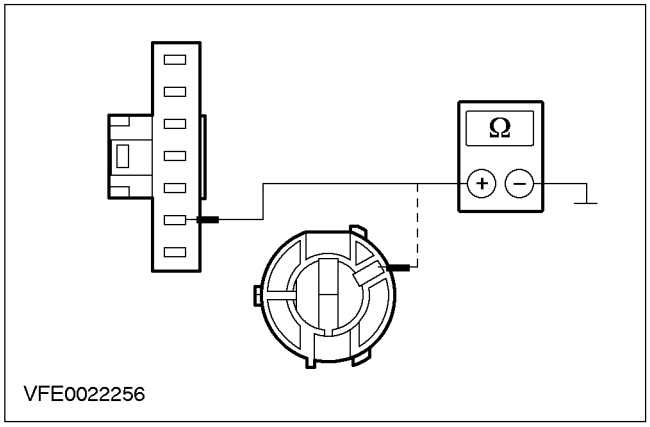
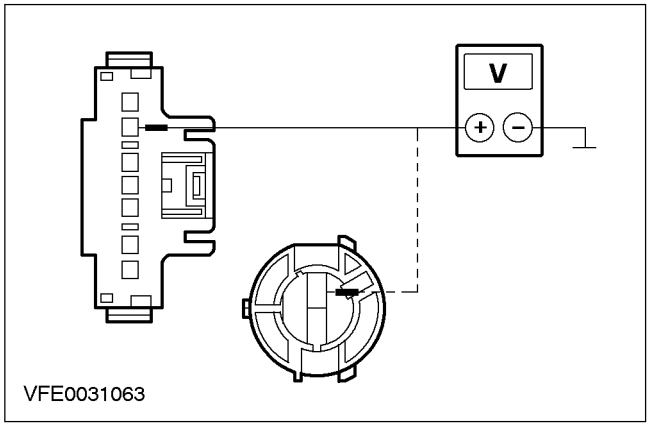
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR circuit 31-LG13 (BK), between left-hand side repeater lamp and ground G104, using the wiring diagrams. TEST the system for normal operation.
N7: CHECK CIRCUIT 49-LG1 (BU)	
	1 Key in OFF position. 2 Disconnect Side direction indicator lamp LH C163. 3 Disconnect GEM C426. 4 Measure the resistance between side direction indicator lamp LH side, connector C163, pin 2, circuit 49-LG13 (BU/RD), harness side and GEM, connectorC426, pin 4, circuit 49-LG1 (BU), harness side. • Is the resistance less than 2 ohms? → **Yes** CHECK system using WDS, if necessary RENEW the generic electronic module (GEM). TEST the system for normal operation. → **No** REPAIR circuit 49-LG1 (BU), between left-hand side repeater lamp and GEM, using the wiring diagrams. TEST the system for normal operation.
N8: CHECK THE POWER SUPPLY OF THE REAR LAMP ASSEMBLY LH SIDE	
	1 Key in OFF position. 2 Disconnect Left-hand rear lamp assembly C540 (4-/5-door) or C540b (wagon). 3 Key in ON position. 4 Switch on the LEFT-HAND TURN SIGNAL.

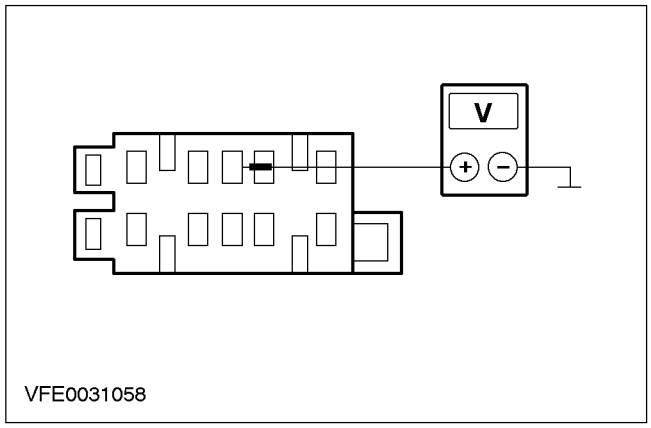
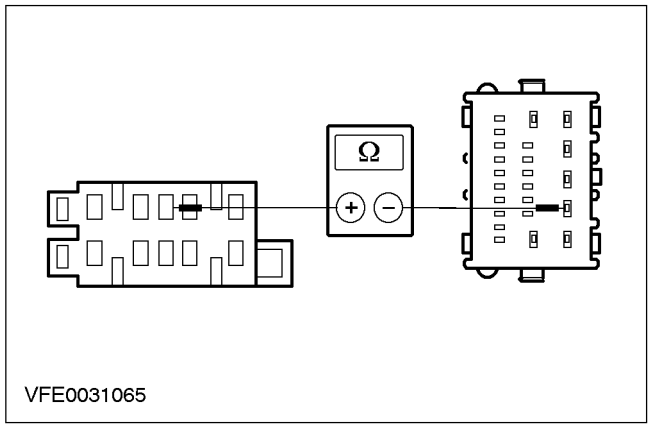
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022568	**5** Measure voltage between left-hand rear lamp assembly, connector C540, pin 2, circuit 49-LG12 (BU) (4-/5-door) or connector C540b, pin 2, circuit 15S-LG12 (GN/YE) (wagon), wiring harness side and ground. • Does the voltage alternate between 0 volt and battery voltage? → **Yes** GO to **N10** → **No** GO to **N9**
N9: CHECK CIRCUIT 49-LG12 (BU) OR 15S-LG12 (GN/YE)	
 VFE0025032	**1** Key in OFF position. **2** Disconnect GEM C427. **3** Disconnect Left-hand rear lamp assembly C540 (4-/5-door) or C540b (wagon). **4** Measure resistance between left-hand rear lamp assembly, connector C540, pin 2, circuit 49-LG12 (BU) (4-/5-door) or connector C540b, pin 2, circuit 15S-LG12 (GN/YE) (wagon), wiring harness side and GEM, connector C427, pin 2, circuit 49-LG12 (BU), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** CHECK system using WDS, if necessary RENEW the generic electronic module (GEM). TEST the system for normal operation. → **No** REPAIR circuit 49-LG12 (BU) or 15S-LG12 (GN/YE), between left-hand rear lamp assembly and GEM, using the wiring diagrams. TEST the system for normal operation.

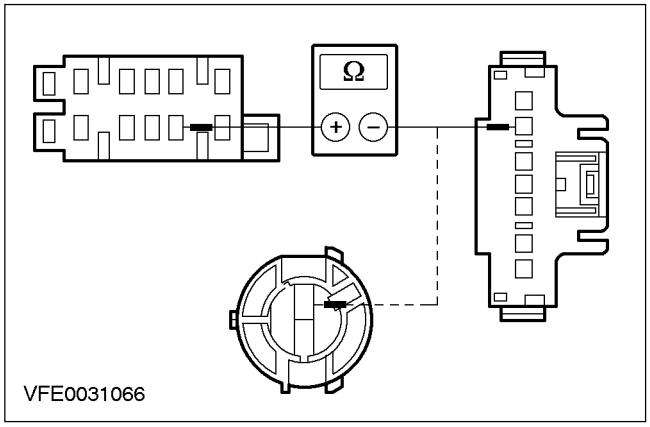
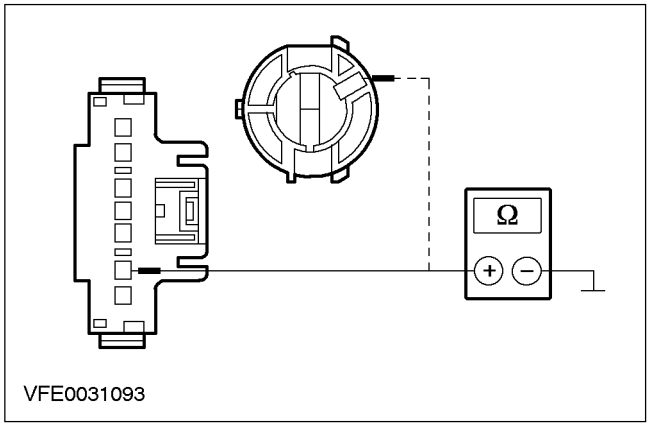
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
N10: CHECK CIRCUIT 31-LF11 (BK) OR 31-LG12 (BK)	
	1 Key in OFF position. 2 Disconnect Left-hand rear lamp assembly C540 (4-/5-door) or C540b (wagon). 3 Measure resistance between left-hand rear lamp assembly, connector C540, pin 6, circuit 31-LF11 (BK) (4-/5-door) or connector C540b, pin 1, circuit 31-LG12 (BK) (wagon), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the left-hand rear lamp assembly. TEST the system for normal operation. → **No** REPAIR circuit 31-LF11 (BK) or 31-LG12 (BK), between left-hand rear lamp assembly and ground G300, using the wiring diagrams. TEST the system for normal operation.
N11: CHECK THE POWER SUPPLY OF THE REAR LAMP ASSEMBLY LH SIDE	
	1 Key in OFF position. 2 Disconnect Left-hand rear lamp assembly C2005 (4-/5-door) or C540b (wagon). 3 Key in ON position. 4 Switch on the LEFT-HAND TURN SIGNAL. 5 Measure voltage between left-hand rear lamp assembly, connector C2005, pin 2, circuit 31-LF11 (GN/WH) (4-/5-door) or connector C540b, pin 2, circuit 15S-LG12 (GN/YE) (wagon), wiring harness side and ground. • Does the voltage alternate between 0 volt and battery voltage?

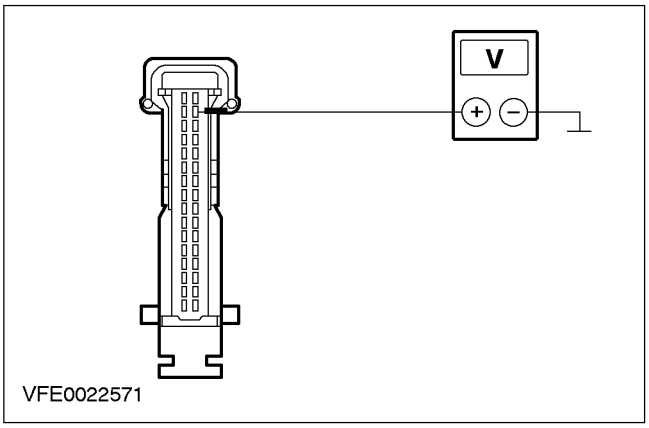
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** GO to **N15** → **No** GO to **N12**
N12: CHECK CIRCUIT 49-LG12 (BU) OR (WH)	
 VFE0031058	**1** Key in OFF position. **2** Disconnect Trailer switch interface (SI) module C2002. **3** Key in ON position. **4** Switch on the LEFT-HAND TURN SIGNAL. **5** Measure voltage between trailer switch interface (SI) module, connector C2002, pin 5, circuit (WH), wiring harness side and ground. • Does the voltage alternate between 0 volt and battery voltage? → **Yes** GO to **N14** → **No** GO to **N13**
N13: CHECK CIRCUIT 49-LG12 (BU) OR (WH)	
 VFE0031065	**1** Key in OFF position. **2** Disconnect GEM C427. **3** Measure resistance between trailer switch interface (SI) module, connector C2002, pin 5, circuit (WH), wiring harness side and GEM, connector C427, pin 2, circuit 49-LG12 (BU), wiring harness side. • Is the resistance less than 2 ohms? → **Yes**

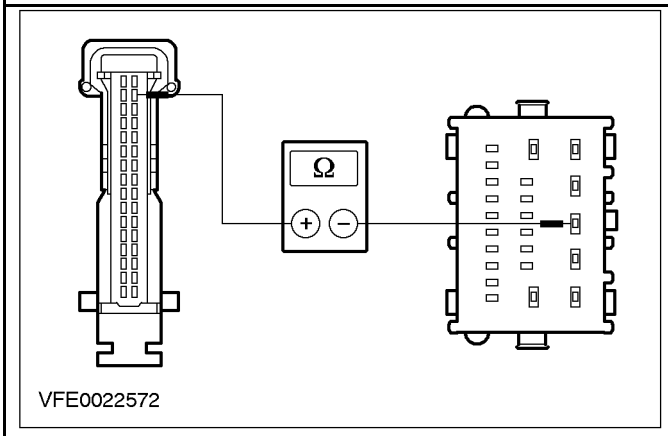
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	CHECK system using WDS, if necessary RENEW the generic electronic module (GEM). TEST the system for normal operation. → **No** REPAIR circuit (WH) or 49-LG12 (BU), between trailer switch interface (SI) module and GEM, using the wiring diagrams. TEST the system for normal operation.
N14: CHECK CIRCUIT (GY/WH), 15S-LG12 (GN/YE) OR (GN/WH)	
	**1** Key in OFF position. **2** Measure resistance between trailer switch interface (SI) module, connector C2002, pin 8, circuit (GN/WH) (4-/5-door) or (GY/WH) (wagon), wiring harness side and left-hand rear lamp assembly, connector C2005, pin 2, circuit (GN/WH) (4-/5-door) or connector C540b, pin 2, circuit 15S-LG12 (GN/YE) (wagon), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** CHECK the trailer switch interface (SI) module, if necessary RENEW it. TEST the system for normal operation. → **No** REPAIR break in circuit (GY/WH), (GN/WH). or 15S-LG12 (GN/YE), between trailer switch interface (SI) module and rear lamp assembly, using the wiring diagrams. TEST the system for normal operation.
N15: CHECK CIRCUIT (BN) OR 31-LG12 (BK)	
	**1** Key in OFF position. **2** Measure resistance between left-hand rear lamp assembly, connector C2005, pin 6, circuit (BN) (4-/5-door) or connector C540b, pin 1, circuit 31-LG12 (BK) (wagon), wiring harness side and ground.

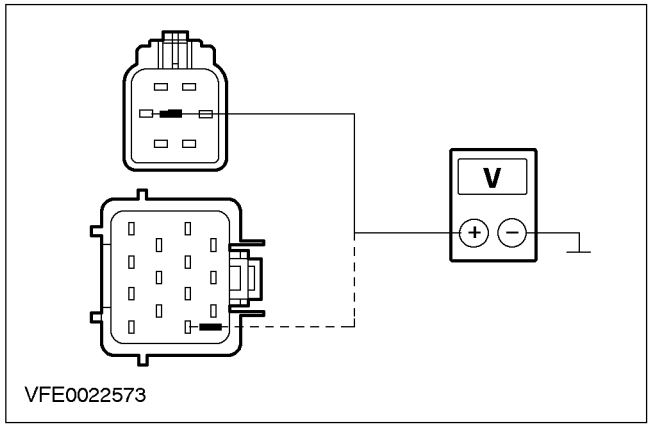
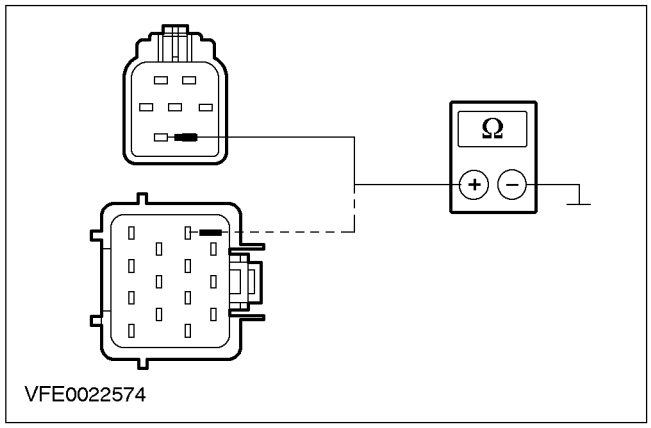
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the left-hand rear lamp assembly. TEST the system for normal operation. → **No** REPAIR circuit (BN) or 31-LG12 (BK), between left-hand rear lamp assembly and ground G300, using the wiring diagrams. TEST the system for normal operation.
N16: CHECK THE POWER SUPPLY OF THE INSTRUMENT CLUSTER	
	**1** Key in OFF position. **2** Disconnect Instrument cluster C449. **3** Key in ON position. **4** Switch on the LEFT-HAND TURN SIGNAL. **5** Measure the voltage between instrument cluster, connector C449, pin18, circuit 49-LG15 (BU/BK), harness side and ground. • Is battery voltage indicated? → **Yes** CHECK and if necessary RENEW the instrument cluster. TEST the system for normal operation. → **No** GO to **N17**
N17: CHECK CIRCUIT 49-LG15 (BU/BK)	
	1 Key in OFF position. **2** Disconnect GEM C429.

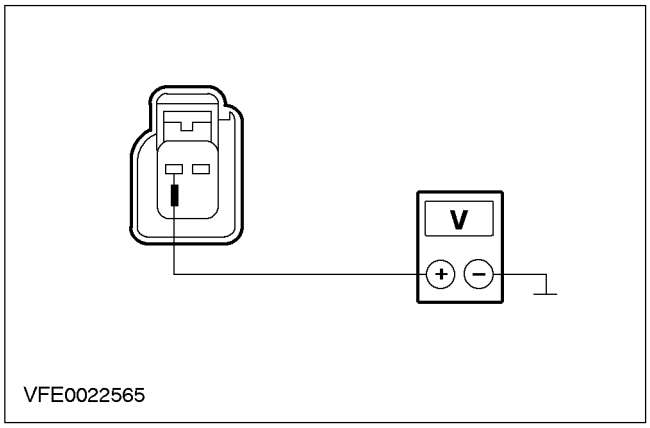
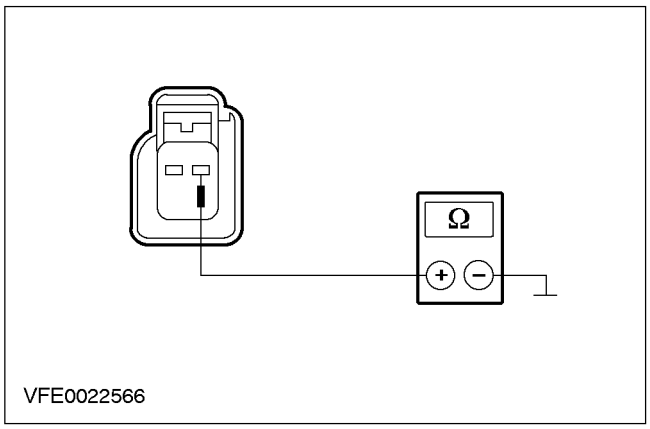
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022572	3 Measure the resistance between instrument cluster, connector C449, pin18, circuit 49-LG15 (BU/BK), harness side and GEM, connector C429, pin 3,circuit 49-LG15 (BU/BK), harness side. • Is the resistance less than 2 ohms? → **Yes** CHECK system using WDS, if necessary RENEW the generic electronic module (GEM). TEST the system for normal operation. → **No** REPAIR circuit 49-LG15 (BU/BK), between instrument cluster and GEM, using the wiring diagrams. TEST the system for normal operation.
N18: DETERMINE THE FAULT CONDITION	
	1 Key in ON position. 2 Switch on the RIGHT-HAND TURN SIGNAL. 3 Check front right-hand turn signal lamp. • Is the front right-hand turn signal lamp inoperative? → **Yes** GO to **N19** → **No** The right-hand turn signal side repeater lamp is inoperative: GO to **N21** The right-hand turn front signal lamp and side repeater lamp are inoperative: GO to **N23** The rear right-hand turn signal lamp is inoperative: GO to **N24** (without trailer interface socket) or GO to **N27** (with trailer interface socket) The right-hand warning lamp in the instrument cluster is inoperative: GO to **N32**
N19: CHECK THE POWER SUPPLY OF THE HEADLAMP	
	1 Key in OFF position. 2 Disconnect Right-hand headlamp C147 (conventional headlamp) or C1147 (gas discharge headlamp). 3 Key in ON position.

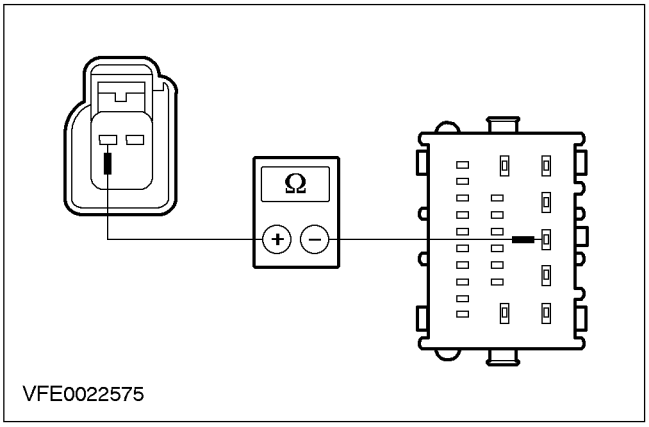
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022573	**4** Switch on the RIGHT-HAND TURN SIGNAL. **5** Measure the voltage between the right-hand headlamp, connector C147, pin 3 (conventional headlamp), or connector C1147, pin 4 (gas discharge headlamp), circuit 49-LG18 (BU), wiring harness side and ground. • Does the voltage alternate between 0 volt and battery voltage? → **Yes** GO to **N20** → **No** REPAIR circuit 49-LG18 (BU), between solder point S373 and right-hand headlamp, using the wiring diagrams. TEST the system for normal operation.
N20: CHECK CIRCUIT 31-LE30A (BK)	
 VFE0022574	**1** Key in OFF position. **2** Measure the resistance between the right-hand headlamp, connector C147, pin 6 (conventional headlamp), or connector C1147, pin 7 (gas discharge headlamp), circuit 31-LE30A (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the right-hand headlamp. TEST the system for normal operation. → **No** REPAIR circuit 31-LG30A (BK), between right-hand headlamp and ground G105, using the wiring diagrams. TEST the system for normal operation.
N21: CHECK THE POWER SUPPLY OF THE SIDE DIRECTION INDICATOR LAMP	
	1 Key in OFF position.

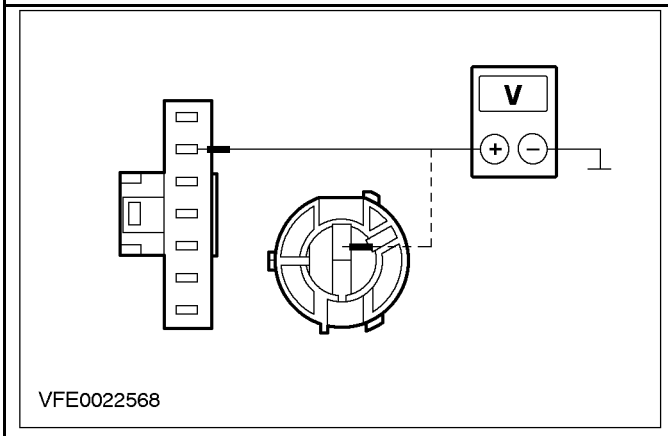
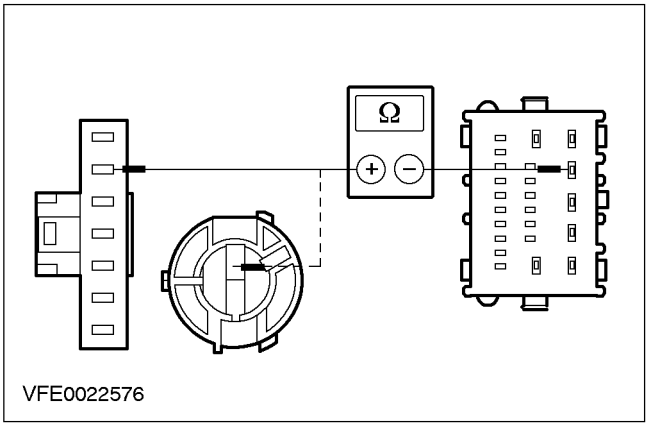
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022565	2 Disconnect Side direction indicator lamp RH side C164. 3 Key in ON position. 4 Switch on the RIGHT-HAND TURN SIGNAL. 5 Measure the voltage between side direction indicator lamp RH side, connector C164, pin 2, circuit 49-LG20 (BU/WH), harness side and ground. • Does the voltage alternate between 0 volt and battery voltage? → **Yes** GO to **N22** → **No** REPAIR circuit 49-LG20 (BU/WH), between solder point S373 and right-hand side repeater lamp, using the wiring diagrams. TEST the system for normal operation.
N22: CHECK CIRCUIT 31-LG20 (BK)	
 VFE0022566	1 Key in OFF position. 2 Measure the resistance between side direction indicator lamp RH side, connector C164, pin 1, circuit 31-LG20 (BK), harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the right-hand side repeater lamp. TEST the system for normal operation. → **No**

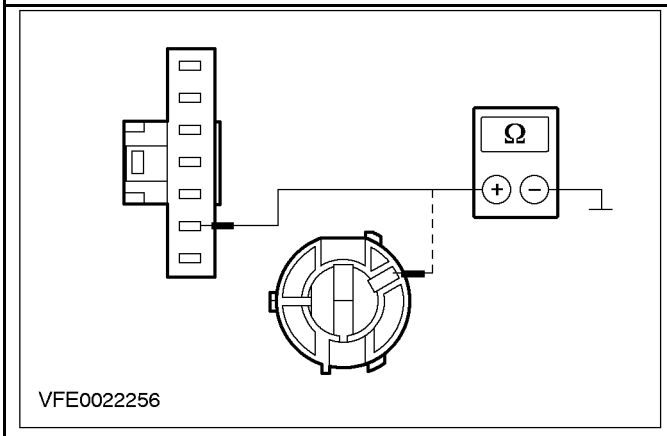
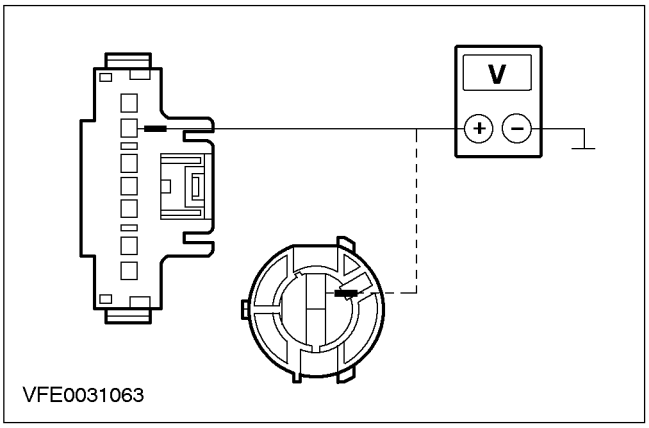
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR circuit 31-LG20 (BK), between right-hand side repeater lamp and ground G105, using the wiring diagrams. TEST the system for normal operation.
N23: CHECK CIRCUIT 49-LG2 (BU/RD)	
	**1** Key in OFF position. **2** Disconnect Side direction indicator lamp RH side C164. **3** Disconnect GEM C426. **4** Measure the resistance between side direction indicator lamp RH side, connector C164, pin 2, circuit 49-LG20 (BU/WH), harness side and GEM, connector C426, pin 3, circuit 49-LG2 (BU/RD), harness side. • Is the resistance less than 2 ohms? → **Yes** CHECK system using WDS, if necessary RENEW the generic electronic module (GEM). TEST the system for normal operation. → **No** REPAIR circuit 49-LG2 (BU/RD), between GEM and solder point S373, using the wiring diagrams. TEST the system for normal operation.
N24: CHECK THE POWER SUPPLY OF THE REAR LAMP ASSEMBLY RH SIDE	
	1 Key in OFF position. **2** Disconnect Right-hand rear lamp assembly C541 (4-/5-door) or C541b (wagon). **3** Key in ON position. **4** Switch on the RIGHT-HAND TURN SIGNAL.

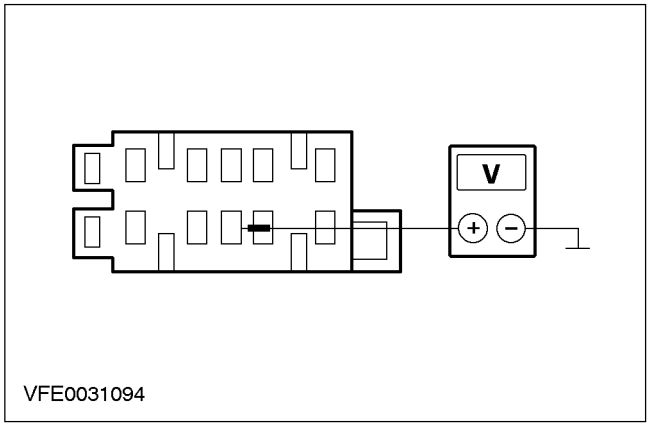
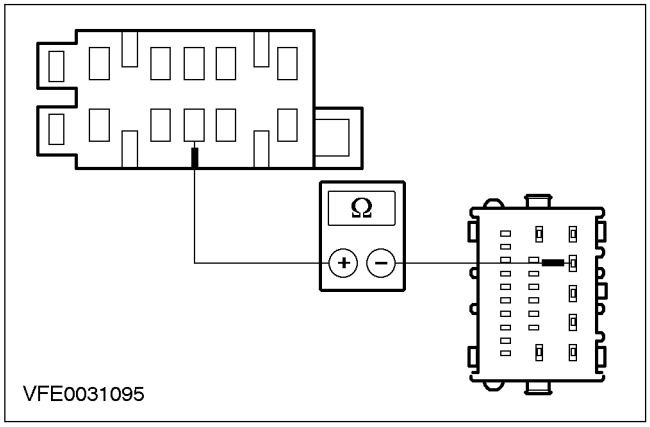
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022568	**5** Measure voltage between right-hand rear lamp assembly, connector C541, pin 2, circuit 49-LG19 (BU/RD) (4-/5-door) or connector C541b, pin 2, circuit 15S-LG12 (GN/YE) (wagon), wiring harness side and ground. • Does the voltage alternate between 0 volt and battery voltage? → **Yes** GO to **N26** → **No** GO to **N25**
N25: CHECK CIRCUIT 49-LG19 (BU/RD) OR 15S-LG12 (GN/YE)	
 VFE0022576	**1** Key in OFF position. **2** Disconnect GEM C428. **3** Measure resistance between right-hand rear lamp assembly, connector C541, pin 4, circuit 49-LG19 (BU/RD) (4-/5-door) or connector C541b, pin 2, circuit 15S-LG12 (GN/YE) (wagon), wiring harness side and GEM, connector C428, pin 2, circuit 49-LG19 (BU/RD), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** CHECK system using WDS, if necessary RENEW the generic electronic module (GEM). TEST the system for normal operation. → **No** REPAIR circuit 49-LG19 (BU/RD) or 15S-LG12 (GN/YE), between rear lamp assembly and GEM, using the wiring diagrams. TEST the system for normal operation.
N26: CHECK CIRCUIT 31-LF20 (BK) OR 31-LG12 (BK)	
	1 Key in OFF position.

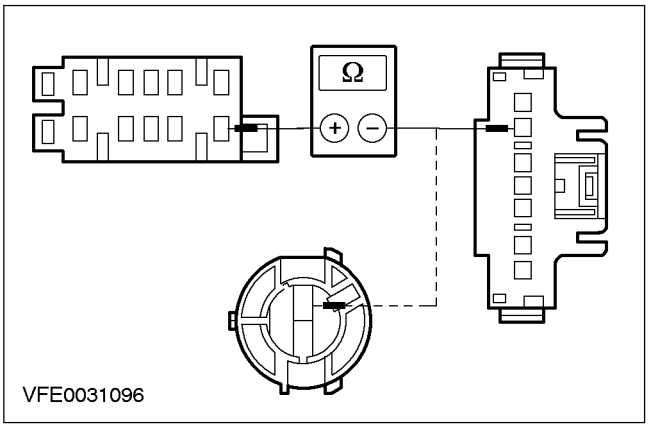
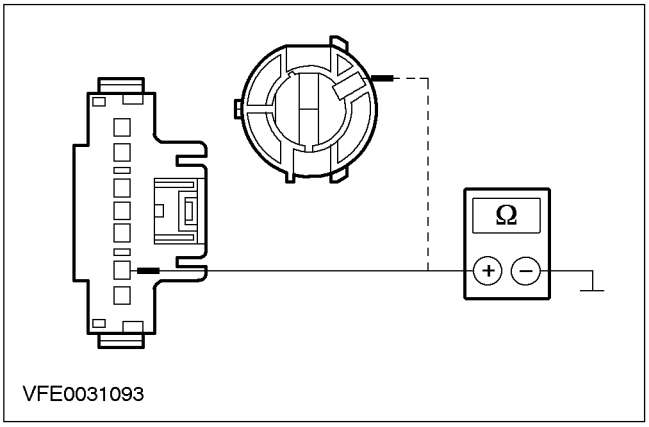
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022256	**2** Measure resistance between right-hand rear lamp assembly, connector C541, pin 6, circuit 31-LF20 (BK) (4-/5-door) or connector C541b, pin 1, circuit 31-LG12 (BK) (wagon), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the right-hand rear lamp assembly. TEST the system for normal operation. → **No** REPAIR circuit 31-LF20 (BK) or 31-LG12 (BK), between right-hand rear lamp assembly and ground G300 (4-/5-door) or G205 (wagon), using the wiring diagrams. TEST the system for normal operation.
N27: CHECK THE POWER SUPPLY OF THE REAR LAMP ASSEMBLY RH SIDE	
 VFE0031063	**1** Key in OFF position. **2** Disconnect Right-hand rear lamp assembly C2007 (4-/5-door) or C541b (wagon). **3** Key in ON position. **4** Switch on the RIGHT-HAND TURN SIGNAL. **5** Measure voltage between right-hand rear lamp assembly, connector C2007, pin 2, circuit (GN/YE) (4-/5-door) or connector C541b, pin 2, circuit 15S-LG12 (GN/YE) (wagon), wiring harness side and ground. • Does the voltage alternate between 0 volt and battery voltage? → **Yes** GO to **N31** → **No** GO to **N28**

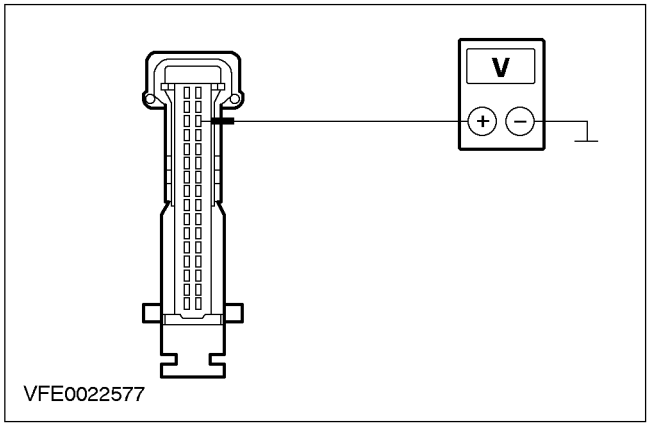
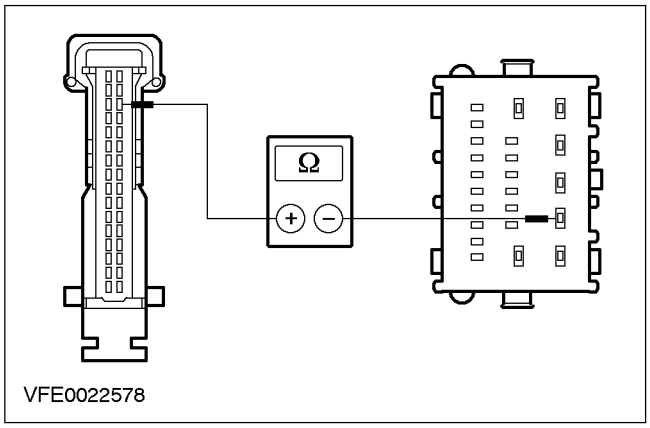
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
N28: CHECK CIRCUIT 49-LG19 (BU/RD) OR (GN/RD)	
 VFE0031094	1 Key in OFF position. 2 Disconnect Trailer switch interface (SI) module C2002. 3 Key in ON position. 4 Switch on the RIGHT-HAND TURN SIGNAL. 5 Measure voltage between trailer switch interface (SI) module, connector C2002, pin 6, circuit (GN/RD), wiring harness side and ground. • Does the voltage alternate between 0 volt and battery voltage? → **Yes** GO to **N30** → **No** GO to **N29**
N29: CHECK CIRCUIT 49-LG19 (BU/RD) OR (GN/RD)	
 VFE0031095	1 Key in OFF position. 2 Disconnect GEM C428. 3 Measure resistance between trailer switch interface (SI) module, connector C2002, pin 6, circuit (GN/RD), wiring harness side and GEM, connector C428, pin 4, circuit 49-LG19 (BU/RD), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** CHECK system using WDS, if necessary RENEW the generic electronic module (GEM). TEST the system for normal operation. → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR circuit (GN/RD) or 49-LG19 (BU/RD), between trailer switch interface (SI) module and GEM, using the wiring diagrams. TEST the system for normal operation.
N30: CHECK CIRCUIT (GN/YE), OR 15S-LG12 (GN/YE)	
	1 Measure resistance between trailer switch interface (SI) module, connector C2002, pin 10, circuit (GN/YE), wiring harness side and right-hand rear lamp assembly, connector C2007, pin 2, circuit (GN/YE) (4-/5-door) or connector C541b, pin 2, circuit 15S-LG12 (GN/YE) (wagon), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** CHECK the trailer switch interface (SI) module, if necessary RENEW it. TEST the system for normal operation. → **No** REPAIR circuit (GN/YE) or 15S-LG12 (GN/YE), between trailer switch interface (SI) module and rear lamp assembly, using the wiring diagrams. TEST the system for normal operation.
N31: CHECK CIRCUIT (GN) OR 31-LG12 (BK)	
	1 Key in OFF position. 2 Measure resistance between right-hand rear lamp assembly, connector C2007, pin 6, circuit (GN) (4-/5-door) or connector C541b, pin 1, circuit 31-LG12 (BK) (wagon), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the rear lamp assembly. TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **No** REPAIR circuit (GN) or 31-LG12 (BK), between rear lamp assembly and ground G300 (4-/5-door) or G205 (wagon), using the wiring diagrams. TEST the system for normal operation.
N32: CHECK THE POWER SUPPLY OF THE INSTRUMENT CLUSTER	
	1 Key in OFF position. 2 Disconnect Instrument cluster C449. 3 Key in ON position. 4 Switch on the RIGHT-HAND TURN SIGNAL. 5 Measure the voltage between instrument cluster, connector C449, pin19, circuit 49-LG22 (BU/YE), harness side and ground. • Is battery voltage indicated? → **Yes** CHECK and if necessary RENEW the instrument cluster. TEST the system for normal operation. → **No** GO to **N33**
N33: CHECK CIRCUIT 49-LG22 (BU/YE)	
	1 Key in OFF position. 2 Disconnect GEM C429. 3 Measure the resistance between instrument cluster, connector C449, pin19, circuit 49-LG22 (BU/YE), harness side and GEM, connector C429, pin 2,circuit 49-LG22 (BU/YE), harness side. • Is the resistance less than 2 ohms? → **Yes**

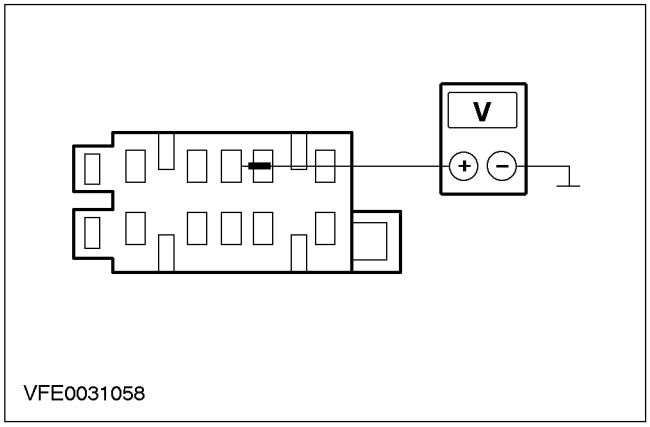
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	CHECK system using WDS, if necessary RENEW the generic electronic module (GEM). TEST the system for normal operation. → **No** REPAIR circuit 49-LG22 (BU/YE), between instrument cluster and GEM, using the wiring diagrams. TEST the system for normal operation.

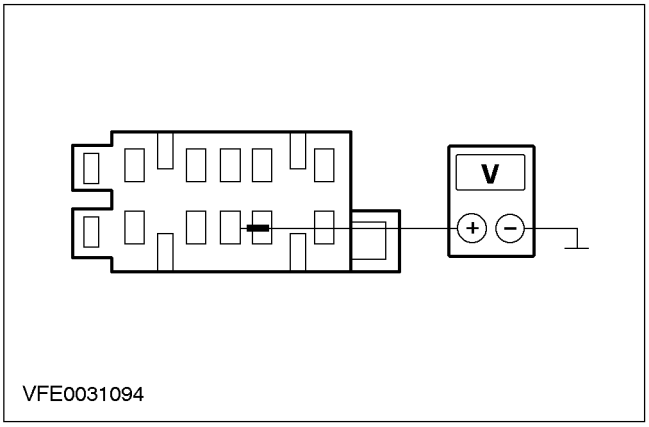
PINPOINT TEST O: ONE OR MORE TURN SIGNAL LAMPS ILLUMINATE/FLASH CONTINUALLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
O1: READ OUT THE FAULT MEMORY	
	1 Key in OFF position. 2 Connect the diagnostic tool. 3 Check the system using WDS. • Are any trouble codes (DTCs) displayed? → **Yes** RESOLVE the faults according to the WDS instructions. CLEAR fault memory. TEST the system for normal operation. → **No** Turn signal lamps flashing continuously: GO to **O10** Turn signal lamps permanently lit: GO to **O2**
O2: CHECK THE GENERIC ELECTRONIC MODULE (GEM)	
	1 Key in OFF position. 2 Disconnect GEM C426, C427, C428 and C429. 3 Key in ON position. 4 Determine the fault condition. • Is one or more turn signal lamp constantly on? → **Yes** GO to **O3** → **No** INSTALL a new GEM. TEST the system for normal operation.
O3: DETERMINE THE FAULT CONDITION	
	1 Determine the fault condition. • Are the front and side turn signal lamps on the left or right lit permanently? → **Yes** LOCATE and RECTIFY the short to battery voltage in the circuits connected to soldered connection S371 (left) or S373 (right) with the aid of the Wiring Diagrams. TEST the system for normal operation. → **No**

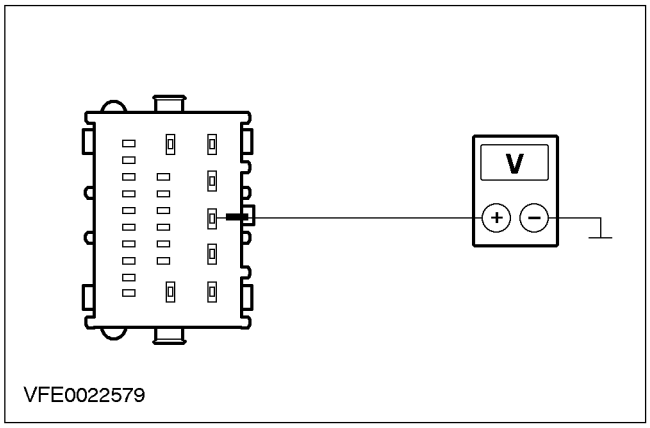
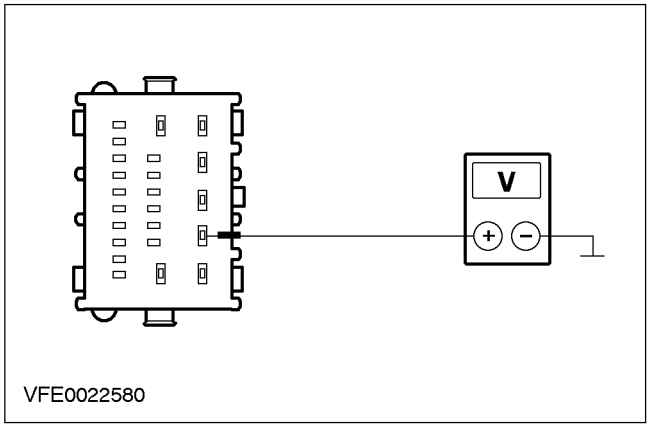
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	One rear turn signal lamp lit permanently, vehicle without trailer socket: LOCATE and RECTIFY the short to battery voltage in the circuits connected to the rear left or rear right turn signal lamp with the aid of the Wiring Diagrams. TEST the system for normal operation. Both rear turn signal lamps lit permanently, vehicles with trailer socket: CHECK the trailer switch interface (SI) module, if necessary RENEW it. TEST the system for normal operation. One rear turn signal lamp is permanently lit, vehicles with trailer socket: GO to **O4** (left) or GO to **O6** (right). The left- or right-hand warning lamp in the instrument cluster is permanently lit: GO to **O8** (left) or GO to **O9** (right).
O4: CHECK TRAILER SWITCH INTERFACE (SI) MODULE	
	1 Key in OFF position. 2 Disconnect Trailer switch interface (SI) module C2002. 3 Key in ON position. 4 Determine the fault condition. • Is the turn signal lamp permanently switched on? → **Yes** LOCATE and REPAIR short to battery voltage in circuit (GN/WH), 49-LG12 (BU) or 15S-LG12 (GN/YE), between trailer switch interface (SI) module and rear lamp assembly, using the wiring diagrams. TEST the system for normal operation. → **No** GO to **O5**
O5: CHECK TRAILER SWITCH INTERFACE (SI) MODULE	
	1 Measure voltage between trailer switch interface (SI) module, connector C2002, pin 5, circuit (WH) or 49-LG12 (BU), wiring harness side and ground. • Is battery voltage indicated? → **Yes**

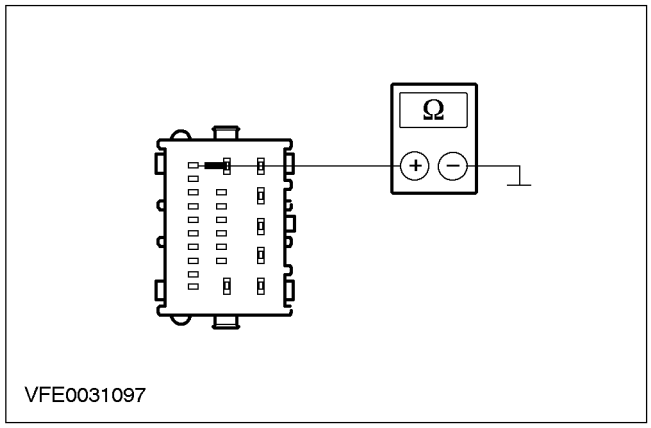
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR short to battery supply in circuit (WH) or 49-LG12 (BU), connected to trailer switch interface (SI) module, using the wiring diagrams. TEST the system for normal operation. → **No** CHECK the trailer switch interface (SI) module, if necessary RENEW it. TEST the system for normal operation.
O6: CHECK TRAILER SWITCH INTERFACE (SI) MODULE	
	1 Key in OFF position. 2 Disconnect Trailer switch interface (SI) module C2002. 3 Key in ON position. 4 Determine the fault condition. • Is the turn signal lamp permanently switched on? → **Yes** REPAIR short to battery supply in circuit (GN/YE) or 15S-LG12 (GN/YE), connected to rear lamp assembly, using the wiring diagrams. TEST the system for normal operation. → **No** GO to **O7**
O7: CHECK TRAILER SWITCH INTERFACE (SI) MODULE	
 VFE0031094	1 Measure voltage between trailer switch interface (SI) module, connector C2002, pin 6, circuit (GN/RD) or 49-LG19 (BU/RD), wiring harness side and ground. • Is battery voltage indicated? → **Yes** REPAIR short to battery supply in circuit (GN/RD) or 49-LG19 (BU/RD), connected to trailer switch interface (SI) module, using the wiring diagrams. TEST the system for normal operation. → **No** CHECK the trailer switch interface (SI) module, if necessary RENEW it. TEST the system for normal operation.

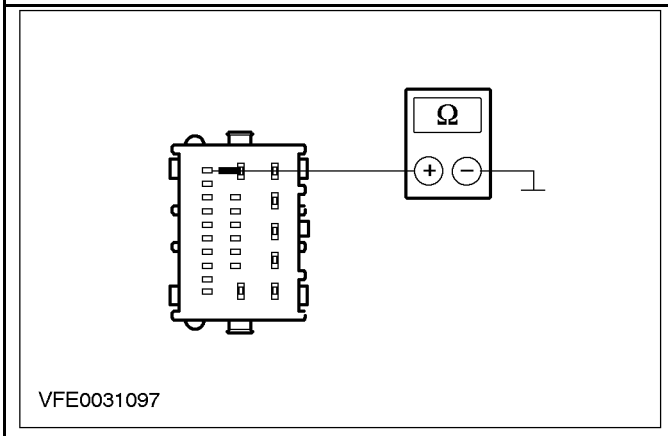
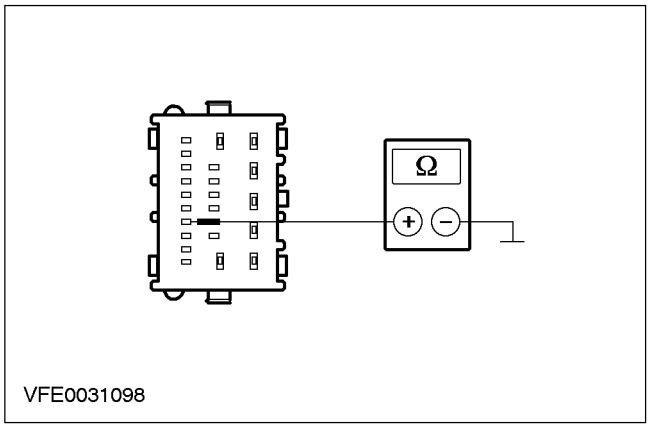
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
O8: CHECK CIRCUIT 49-LG15 (BU/BK)	
 VFE0022579	1 Key in OFF position. 2 Disconnect Instrument cluster C449. 3 Measure the voltage between GEM, connector C429, pin 3, circuit 49-LG15(BU/BK), harness side and ground. • Is battery voltage indicated? → **Yes** REPAIR short to battery supply in circuit 49-LG15 (BU/BK), connected to the instrument cluster, using the wiring diagrams. TEST the system for normal operation. → **No** CHECK and if necessary RENEW the instrument cluster. TEST the system for normal operation.
O9: CHECK CIRCUIT 49-LG22 (BU/YE)	
 VFE0022580	1 Key in OFF position. 2 Disconnect Instrument cluster C449. 3 Measure the voltage between GEM, connector C429, pin 2, circuit 49-LG22(BU/YE), harness side and ground. • Is battery voltage indicated? → **Yes** REPAIR short to battery voltage in circuit 49-LG22 (BU/YE), connected to the instrument cluster, using the wiring diagrams. TEST the system for normal operation. → **No**

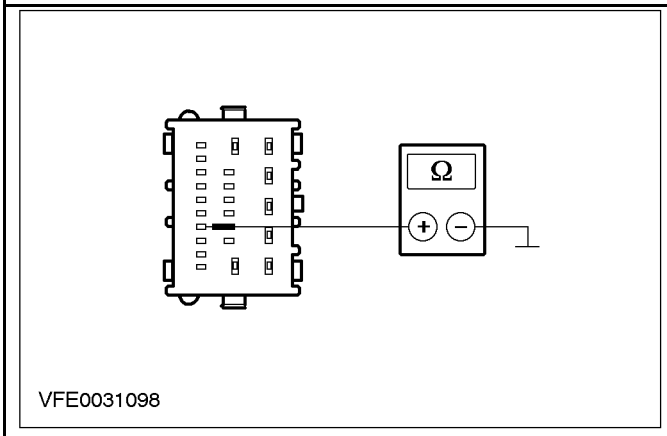
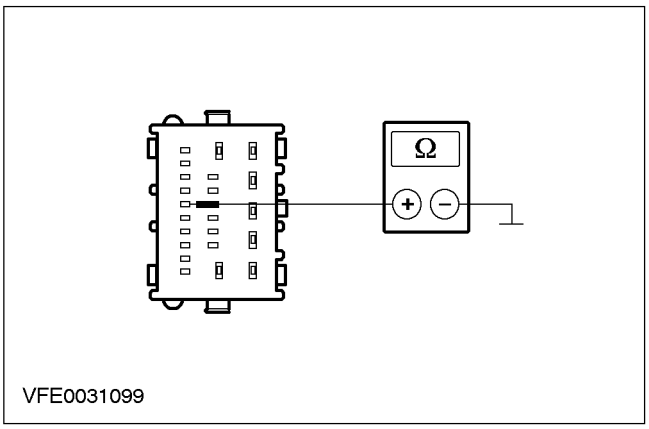
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	CHECK and if necessary RENEW the instrument cluster. TEST the system for normal operation.
O10: DETERMINE THE FAULT CONDITION	
	1 Determine the fault condition. • Do all turn signal lamps flash continuously? → **Yes** GO to **O11** → **No** The turn signal lamps on the left-hand side flash continuously: GO to **O13** The turn signal lamps on the right-hand side flash continuously: GO to **O15** The front and side left or right turn signal lamps, or the rear left or right turn signal lamps flash continually. RENEW the generic electronic module (GEM) TEST the system for normal operation. Left- or right-hand warning lamp in the instrument cluster flashes continuously: GO to **O17**
O11: CHECK CIRCUIT 91S-LG8 (BK/OG)	
	1 Key in OFF position. 2 Disconnect GEM C429. 3 Measure the resistance between GEM, connector C429, pin 23, circuit 91S-LG8 (BK/OG), harness side and ground. • Is the resistance greater than 10 kOhms? → **Yes** INSTALL a new GEM. TEST the system for normal operation. → **No** GO to **O12**
O12: CHECK THE HAZARD WARNING LAMP SWITCH	
	1 Key in OFF position. 2 Disconnect Hazard warning lamp switch C438.

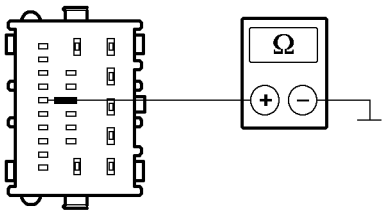
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031097	**3** Measure the resistance between GEM, connector C429, pin 23, circuit 91S-LG8 (BK/OG), harness side and ground. • Is the resistance greater than 10 kOhms? → **Yes** RENEW the hazard warning lamp switch. TEST the system for normal operation. → **No** REPAIR short to ground in circuit 91S-LG8 (BK/OG), connected to the instrument cluster, using the wiring diagrams. TEST the system for normal operation.
O13: CHECK CIRCUIT 91S-LG27B (BK/GN)	
 VFE0031098	**1** Key in OFF position. **2** Disconnect GEM C429. **3** Measure the resistance between GEM, connector C429, pin 17, circuit 91S-LG27B (BK/GN), harness side and ground. • Is the resistance greater than 10 kOhms? → **Yes** INSTALL a new GEM. TEST the system for normal operation. → **No** GO to **O14**
O14: CHECK THE TURN SIGNAL SWITCH	
	1 Key in OFF position. **2** Disconnect Turn signal switch C529.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031098	**3** Measure the resistance between GEM, connector C429, pin 17, circuit 91S-LG27B (BK/GN), harness side and ground. • Is the resistance greater than 10 kOhms? → **Yes** RENEW the turn signal switch. TEST the system for normal operation. → **No** REPAIR short to ground in circuit 91S-LG27B (BK/GN), using the wiring diagrams. TEST the system for normal operation.
O15: CHECK CIRCUIT 91S-LG27A (BK/GN)	
 VFE0031099	**1** Key in OFF position. **2** Disconnect GEM C429. **3** Measure the resistance between GEM, connector C429, pin 19, circuit 91S-LG27A (BK/GN), harness side and ground. • Is the resistance greater than 10 kOhms? → **Yes** INSTALL a new GEM. TEST the system for normal operation. → **No** GO to **O16**
O16: CHECK THE TURN SIGNAL SWITCH	
	1 Key in OFF position. **2** Disconnect Turn signal switch C529.

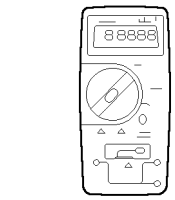
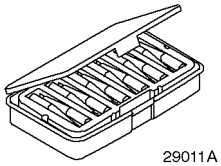
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031099	**3** Measure the resistance between GEM, connector C429, pin 19, circuit 91S-LG27A (BK/GN), harness side and ground. • Is the resistance greater than 10 kOhms? → **Yes** RENEW the turn signal switch. TEST the system for normal operation. → **No** REPAIR short to ground in circuit 91S-LG27A (BK/GN), using the wiring diagrams. TEST the system for normal operation.
O17: CHECK THE INSTRUMENT CLUSTER	
	1 Key in OFF position. **2** Disconnect GEM C429. **3** Check warning lamp in instrument cluster. • Does the left-or right-hand warning lamp flash continually? → **Yes** INSTALL a new instrument cluster. TEST the system for normal operation. → **No** INSTALL a new GEM. TEST the system for normal operation.

DIAGNOSIS AND TESTING

Parking, Rear and License Lamps

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Special Tool(s)	
 ST1137-A	Digital multimeter 105-R0051 or a comparable device
 29011A	Terminal probe kit 29-011 A

Inspection and Verification

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Check

Electrical
• Fuse(s). • Bulb(s). • Wiring harness. • Electrical connector(s). • Switch(es).

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Condition	Possible Sources	Action
•Parking lamps, rear lamps and license lamps are inoperative	•Fuse(s). •Circuit(s). •Headlamp switch. •Battery junction box (BJB)	• GO to Pinpoint Test P
•One or more parking lights, rear lamps or license plate lamps not operating	•Fuse(s). •Circuit(s). •Headlamp switch. •Ignition switch •Headlamp. •Tail Lamp Assembly •License plate lamp. •Instrument cluster. •Central Junction Box (CJB).	• GO to Pinpoint Test Q
•Parking lamps, rear lamps and/or license plate lamp lit continuously	•Circuit(s). •Headlamp switch. •Instrument cluster. •Trailer interface (TI) module •Generic electronic module (GEM) •Central Junction Box (CJB)	• GO to Pinpoint Test R

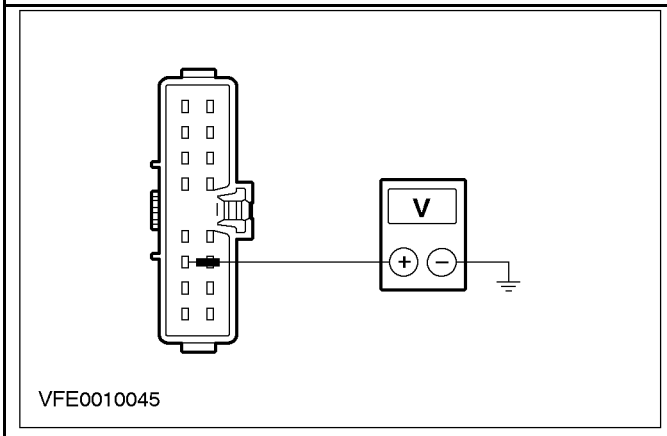
DIAGNOSIS AND TESTING (Continued)

Pinpoint Tests

PINPOINT TEST P: PARKING LAMPS, REAR LAMPS AND LICENSE LAMPS ARE INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
P1: TEST PARKING LAMPS WITH PARKING LIGHTS SWITCHED ON, AND WITH DIPPED BEAM SWITCHED ON	
	1 Switch on side light. 2 Test the parking lamps. • Do the parking lamps, rear lamps and license plate lamps illuminate? → **Yes** Parking lamps inoperative when dipped beam switched on: RENEW the light switch. TEST the system for normal operation. → **No** All lamps inoperative: GO to **P2** Parking lamps inoperative, license plate lamps OK: GO to **Q1**
P2: CHECK FUSE F21 (BJB)	
	1 Key in OFF position. 2 CHECK Fuse F21 (BJB). 3 Check fuse F21 (15 A). • Is the fuse OK? → **Yes** GO to **P3** → **No** RENEW fuse F21 (15 A) and CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the wiring diagrams. TEST the system for normal operation.
P3: CHECK THE VOLTAGE AT FUSE F21 (BJB)	
	1 Connect Fuse F21 (BJB). 2 Key in ON position. 3 Measure the voltage between fuse F21 (BJB) and ground. • Is battery voltage indicated? → **Yes** GO to **P4** → **No** TEST the battery junction box (BJB), RENEW it if necessary. TEST the system for normal operation.
P4: CHECK THE VOLTAGE SUPPLY AT THE LIGHT SWITCH	
	1 Key in OFF position. 2 Disconnect Headlamp switch C478.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0010045	3 Measure the voltage between the light switch, connector C478, pin 11, circuit 30-LE21 (RD), wiring harness side, and ground. • Is battery voltage indicated → **Yes** INSTALL a new headlamp switch. TEST the system for normal operation. → **No** REPAIR break in circuit 30-LE21 (RD), between fuse F21 and light switch using the wiring diagrams. TEST the system for normal operation.

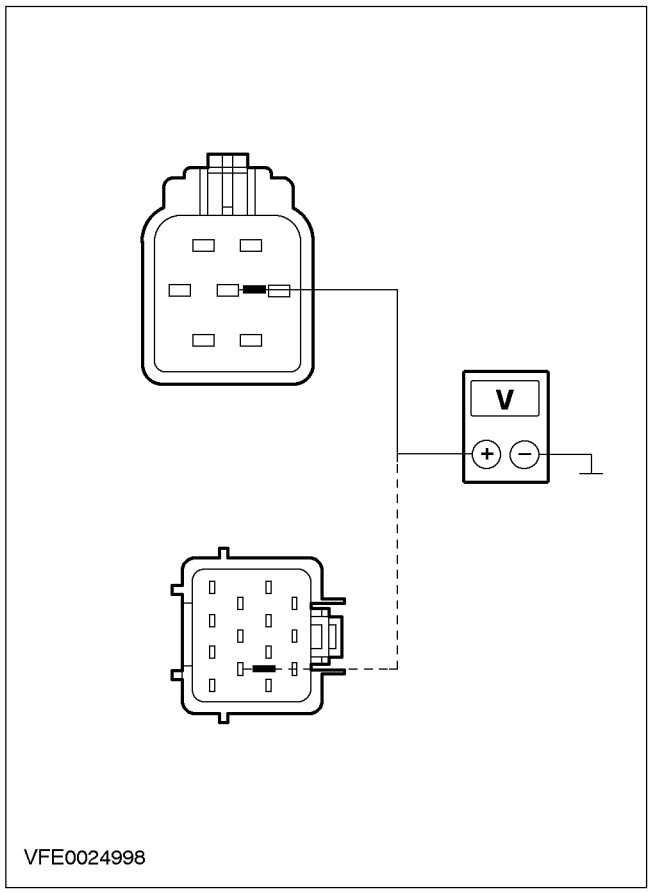
PINPOINT TEST Q: ONE OR MORE PARKING LIGHTS, REAR LAMPS OR LICENSE PLATE LAMPS NOT WORKING

CONDITIONS	DETAILS/RESULTS/ACTIONS
Q1: DETERMINE THE CONDITIONS UNDER WHICH THE FAULT OCCURS	
	1 Switch on the PARKING LIGHTS and the SIDE LIGHTS one after the other. 2 Test the parking lamps. • Are all parking lamps inoperative in both light switch positions (license plate lamps OK in SIDELIGHT position)? → **Yes** GO to **Q23** → **No** Individual parking lamp(s) is/are inoperative: GO to **Q2** Parking lamps inoperative when PARKING LIGHTS switched on, OK when SIDELIGHTS switched on:.: GO to **Q19** (without daytime running lamps) or GO to **Q22** (with daytime running lamps)
Q2: DETERMINE THE CONDITIONS UNDER WHICH THE FAULT OCCURS	
	1 Switch on side lights. 2 Test the parking lamps. • Is/are the parking lamp(s) on the right-hand side inoperative? → **Yes** All right-hand parking lamps: GO to **Q3**

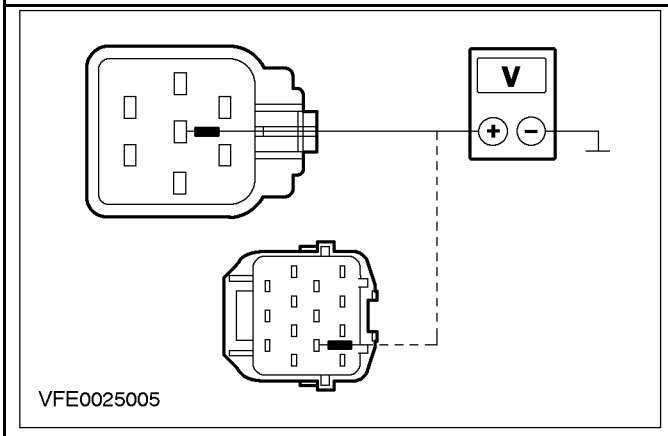
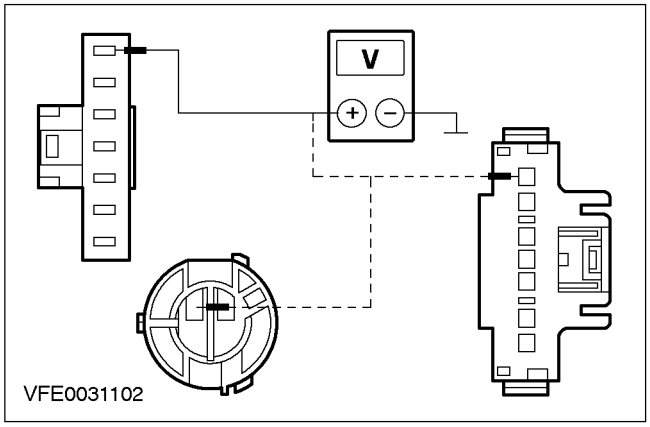
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	Front right-hand parking lamps: GO to **Q5** Rear right-hand parking lamps: GO to **Q7** The license plate lamp(s) is/are inoperative: GO to **Q11** → **No** All left-hand parking lamps: GO to **Q4** Front left-hand parking lamp: GO to **Q6** Rear left-hand parking lamps: GO to **Q9** The license plate lamp(s) is/are inoperative: GO to **Q11** The LIGHTS ON display is inoperative: GO to **Q18**
Q3: CHECK FUSE F63 (CJB)	
	1 Key in OFF position. 2 CHECK Fuse F63 (CJB). 3 Check fuse F63 (7.5 A). • Is the fuse OK? → **Yes** CHECK and if necessary RENEW the central junction box (CJB). TEST the system for normal operation. → **No** INSTALL a new fuse F63 (7.5 A). If the fuse blows again, LOCATE and REPAIR the short using the wiring diagrams. TEST the system for normal operation.
Q4: CHECK FUSE F64 (CJB)	
	1 Key in OFF position. 2 CHECK Fuse F64 (CJB). 3 Check fuse F64 (7.5 A). • Is the fuse OK? → **Yes** CHECK and if necessary RENEW the central junction box (CJB). TEST the system for normal operation. → **No** INSTALL a new fuse F64 (7.5 A). If the fuse blows again, LOCATE and REPAIR the short using the wiring diagrams. TEST the system for normal operation.
Q5: CHECK VOLTAGE SUPPLY AT RIGHT-HAND HEADLAMP	
	1 Disconnect Right-hand headlamp C147 (conventional headlamp) or C1147 (gas discharge headlamp). 2 Switch on the PARKING LAMPS.

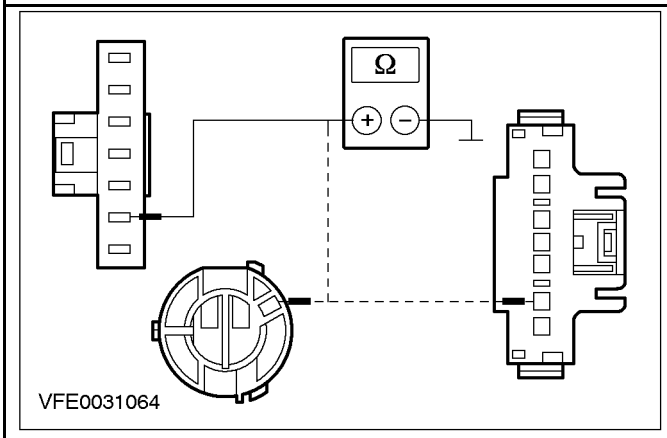
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0024998	**3** Measure the voltage between the right-hand headlamp, connector C147, pin 4 (conventional headlamp), or connector C1147, pin 8 (gas discharge headlamp), circuit 29S-LF16 (OG/GN), wiring harness side and ground. • Is battery voltage indicated? → **Yes** REPAIR the ground connection of the headlamp with the aid of the Wiring Diagrams, if necessary RENEW the headlamp. TEST the system for normal operation. → **No** REPAIR the break in circuit between fuse F63 (CJB) and the right-hand headlamp using the wiring diagrams, RENEW the central junction box (CJB) if necessary. TEST the system for normal operation.
Q6: CHECK VOLTAGE SUPPLY AT LEFT-HAND HEADLAMP	
	1 Disconnect Left-hand headlamp C146 (conventional headlamp) or C1146 (gas discharge headlamp). **2** Switch on the PARKING LAMPS.

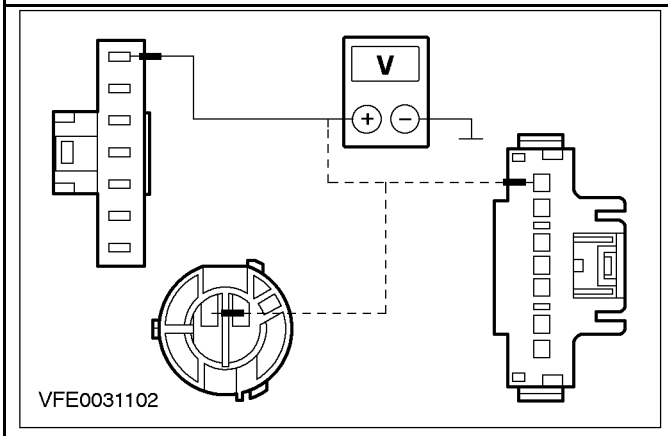
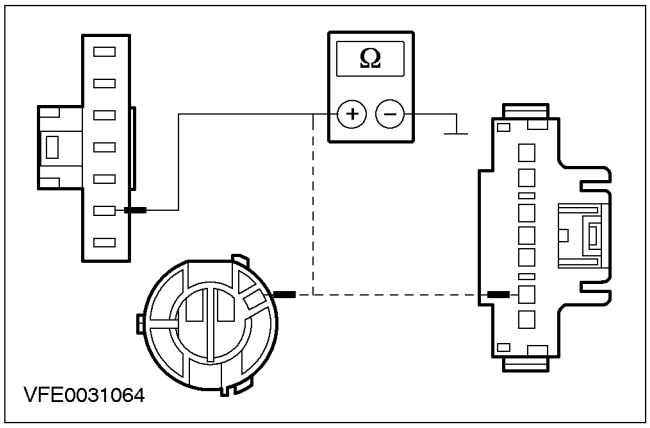
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**3** Measure the voltage between the left-hand headlamp, connector C146, pin 4 (conventional headlamp), or connector C1146, pin 8 (gas discharge headlamp), circuit 29S-LF7 (OG/BU), wiring harness side and ground. • Is battery voltage indicated? → **Yes** REPAIR the ground connection of the headlamp with the aid of the Wiring Diagrams, if necessary RENEW the headlamp. TEST the system for normal operation. → **No** REPAIR the break in circuit between fuse F64 (CJB) and the left-hand headlamp using the wiring diagrams, RENEW the central junction box (CJB) if necessary. TEST the system for normal operation.
Q7: CHECK THE VOLTAGE SUPPLY AT THE RIGHT-HAND REAR LAMP ASSEMBLY	
	**1** Disconnect Right-hand rear lamp assembly. - C541 (4-/5-door, without trailer socket) - C2007 (4-/5-door, with trailer socket) - C541d Wagon **2** Switch on the PARKING LAMPS. **3** Measure the voltage between the right-hand rear lamp assembly. … - 4/5 doors: connector C541, pin 1, circuit 29S-LF20 (OG) (without trailer socket) or connector C2007, pin 1, circuit (GY/RD) (with trailer socket), wiring harness side and ground. - Wagon: connector C541d, pin 2, circuit 29S-LF11 (OG/WH), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **Q8** → **No**

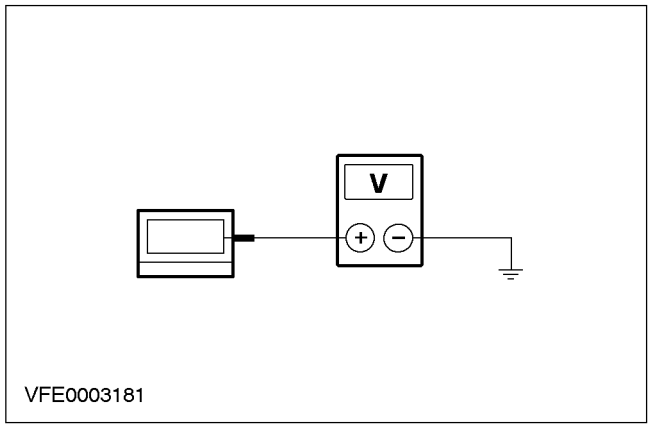
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	The LIGHTS ON display is OK: REPAIR break in circuit (GY/RD), 29S-LF20 (OG) or 29S-LF11 (OG/WH), between CJB and right-hand rear lamp assembly, using the wiring diagrams. TEST the system for normal operation. The LIGHTS ON display is inoperative: CHECK and if necessary RENEW the central junction box (CJB). TEST the system for normal operation.
Q8: CHECK GROUND CONNECTION OF RIGHT-HAND REAR LAMP ASSEMBLY	
	**1** Measure the resistance between the right-hand rear lamp assembly, … - 4/5 doors: connector C541, pin 6, circuit 31-LF20 (BK) (without trailer socket) or connector C2007, pin 6, circuit (GN) (with trailer socket), wiring harness side and ground. - Wagon: Connector C541d, pin 1, circuit 31-LF11 (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the rear lamp assembly. TEST the system for normal operation. → **No** REPAIR break in circuit (GN), 31-LF20 (BK) or 31-LF11 (BK), between rear lamp assembly and ground G300 or G205 (wagon), using the wiring diagrams. TEST the system for normal operation.
Q9: CHECK THE VOLTAGE SUPPLY AT THE LEFT-HAND REAR LAMP ASSEMBLY	
	1 Disconnect Left-hand rear lamp assembly. - C540 (4-/5-door, without trailer socket) - C2005 (4-/5-door, with trailer socket) - C540d Wagon **2** Switch on the PARKING LAMPS.

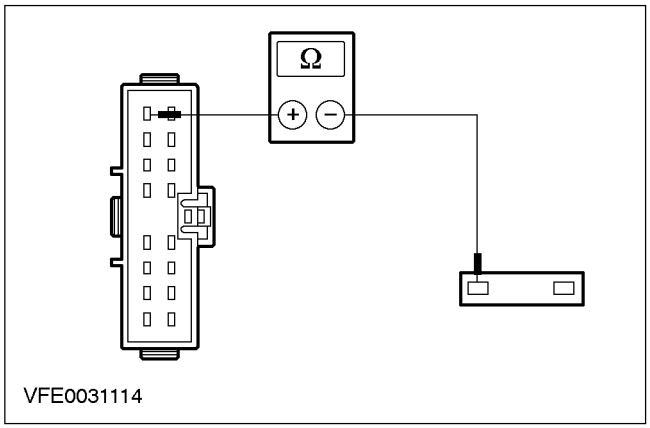
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**3** Measure the voltage between the left-hand rear lamp assembly, … - 4/5 doors: connector C540, pin 1, circuit 29S-LF11 (OG/WH) (without trailer socket) or connector C2005, pin 1, circuit (GY/BK) (with trailer socket), wiring harness side and ground. - Wagon: connector C540d, pin 2, circuit 29S-LF11 (OG/WH), wiring harness side and ground. • Is battery voltage indicated → **Yes** GO to **Q10** → **No** REPAIR the break in circuit between fuse F64 (CJB) and the left-hand rear lamp assembly using the wiring diagrams, RENEW the central junction box (CJB) if necessary. TEST the system for normal operation.
Q10: CHECK GROUND CONNECTION OF LEFT-HAND REAR LAMP ASSEMBLY	
	**1** Measure the resistance between the left-hand rear lamp assembly, … - 4/5 doors: connector C540, pin 6, circuit 31-LF11 (BK) (without trailer socket) or connector C2005, pin 6, circuit (BN) (with trailer socket), wiring harness side and ground. - Wagon: Connector C540d, pin 1, circuit 31-LF11 (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the rear lamp assembly. TEST the system for normal operation. → **No** REPAIR break in circuit (BN) or 31-LF11 (BK), between rear lamp assembly and ground G300, using the wiring diagrams. TEST the system for normal operation.
Q11: CHECK LICENSE PLATE LAMPS	
	1 Switch on side lights. **2** Check the license plate lamps.

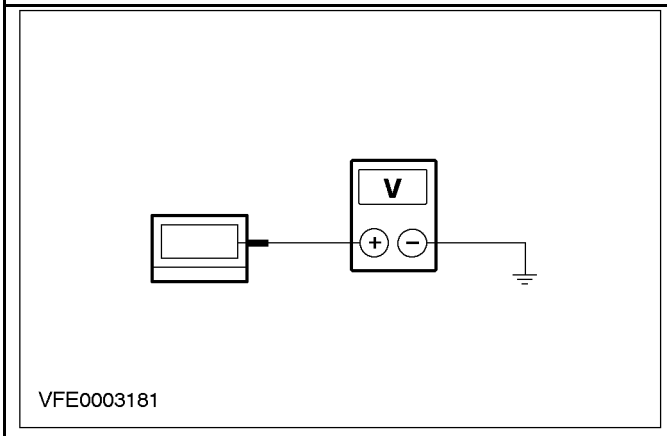
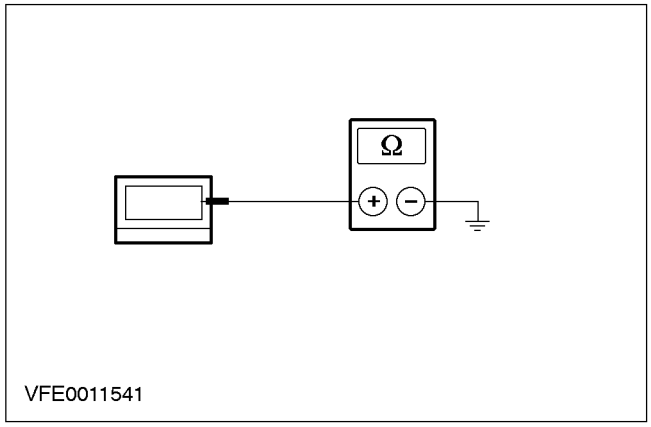
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Are both license plate lamps inoperative? → **Yes** GO to **Q12** → **No** Left-hand license plate lamp inoperative: GO to **Q16** Right-hand license plate lamp inoperative: GO to **Q17**
Q12: CHECK FUSE F97 (CJB)	
	1 Key in OFF position. 2 CHECK Fuse F97 (CJB). 3 Check fuse F97 (7.5 A). • Is the fuse OK? → **Yes** GO to **Q13** → **No** INSTALL a new fuse F97 (7.5 A). If the fuse blows again, LOCATE and REPAIR the short to ground using the wiring diagrams. TEST the system for normal operation.
Q13: CHECK POWER SUPPLY TO FUSE F97 (CJB)	
	1 Connect Fuse F97 (CJB). 2 Switch on the PARKING LAMPS. 3 Test voltage between fuse F97 (7.5 A) and ground. • Is battery voltage indicated? → **Yes** GO to **Q14** → **No** GO to **Q15**
Q14: CHECK THE VOLTAGE SUPPLY AT THE RIGHT-HAND LICENSE PLATE LAMP	
	1 Disconnect License plate lamp RH side C735a. 2 Switch on side light. 3 Measure the voltage between right-hand license lamp, connector C735a, circuit 29S-LF21 (OG/BK), wiring harness side and ground. • Is battery voltage indicated? → **Yes**

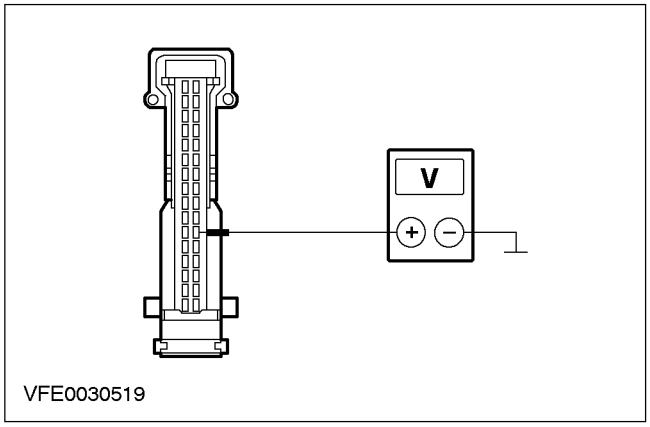
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	RECTIFY the break in circuit 31-LF21 (BK) between the left-hand license plate lamp and ground connection G300 with the aid of the Wiring Diagrams. TEST the system for normal operation. → **No** REPAIR the break in circuit between fuse F97 (CJB) and the right-hand license plate lamp using the wiring diagrams, RENEW the central junction box if necessary. TEST the system for normal operation.
Q15: CHECK THE CIRCUIT BETWEEN THE LIGHT SWITCH AND FUSE F97 (CJB)	
	1 Disconnect Headlamp switch C478. 2 Measure resistance between fuse F97 (CJB) and light switch, connector C478, pin 16, circuit 30S-LF12 (RD/GN), wiring harness side. • Is the resistance less than 2 ohms → **Yes** CHECK and if necessary RENEW the light switch. TEST the system for normal operation. → **No** REPAIR the break in circuit between light switch and fuse F97 (CJB) using the wiring diagrams, RENEW the central junction box (CJB) if necessary. TEST the system for normal operation.
Q16: CHECK VOLTAGE SUPPLY TO LEFT-HAND LICENSE PLATE LAMP	
	1 Disconnect License plate lamp LH side C736a. 2 Switch on side light.

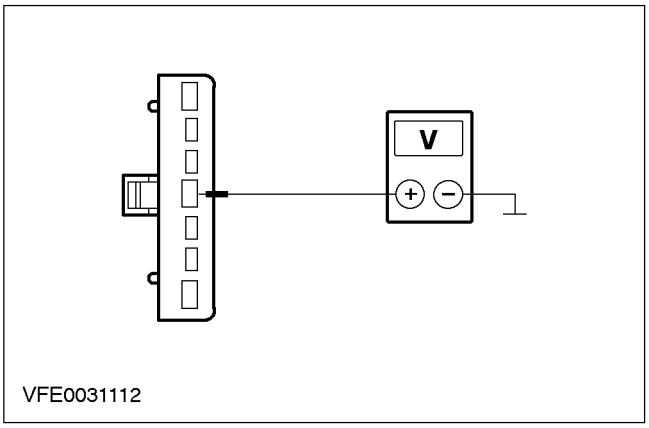
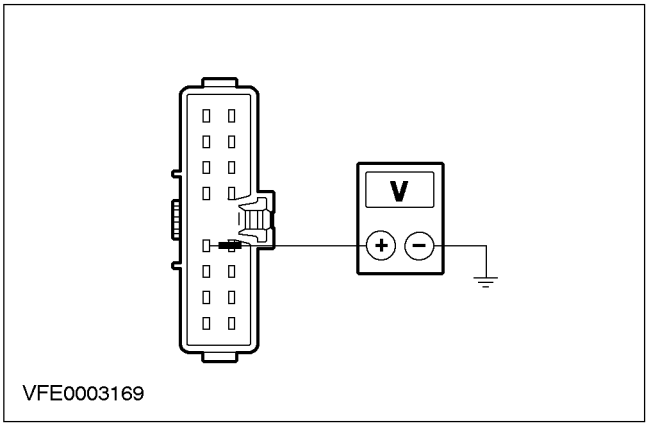
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0003181	**3** Measure the voltage between left-hand license plate lamp, connector C736a, circuit 29S-LF22 (OG/BK), wiring harness side and ground. • Is battery voltage indicated? → **Yes** CHECK and if necessary RENEW the left-hand license plate lamp. TEST the system for normal operation. → **No** REPAIR break in circuit 29S-LF22 (OG/BK), between left-hand license plate lamp and right-hand license plate lamp using the wiring diagrams. TEST the system for normal operation.
Q17: CHECK GROUND CONNECTION OF RIGHT-HAND LICENSE PLATE LAMP	
 VFE0011541	**1** Disconnect License plate lamp RH side C735b. **2** Measure the resistance between right-hand license plate lamp, connector C735b, circuit 31-LF22 (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the right-hand license plate lamp. TEST the system for normal operation. → **No** REPAIR break in circuit 31-LF22 (BK), between left-hand license plate lamp and right-hand license plate lamp using the wiring diagrams. TEST the system for normal operation.

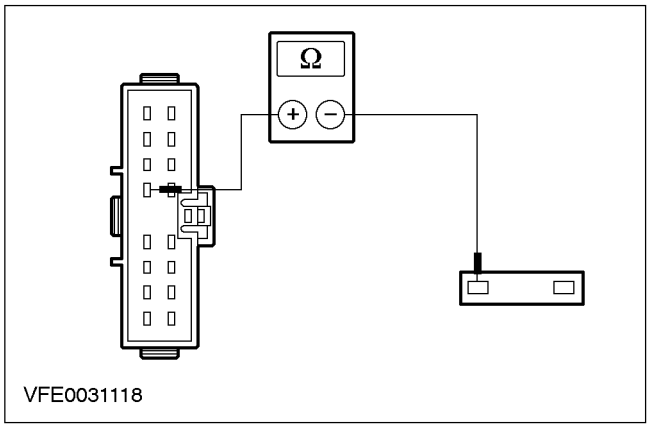
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
Q18: CHECK CIRCUIT 29S-GM12 (OG/BK) BETWEEN FUSE F63 (CJB) AND INSTRUMENT CLUSTER	
 VFE0030519	1 Disconnect Instrument cluster C449. 2 Measure the voltage between instrument cluster, connector C449, pin 27, circuit 29S-GM12 (OG/BK), wiring harness side and ground. • Is battery voltage indicated? → **Yes** CHECK and if necessary RENEW the instrument cluster. TEST the system for normal operation. → **No** REPAIR break in circuit 29S-GM12 (OG/BK), between fuse F63 (CJB) and instrument cluster using the wiring diagrams. TEST the system for normal operation.
Q19: CHECK FUSE F28 (BJB)	
	1 Key in OFF position. 2 CHECK Fuse F28 (BJB). 3 Check fuse F28 (20 A). • Is the fuse OK? → **Yes** GO to **Q20** → **No** RENEW fuse F28 (20 A) and CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short to ground using the wiring diagrams. TEST the system for normal operation.
Q20: CHECK THE VOLTAGE AT FUSE F28 (BJB)	
	1 Connect Fuse F28 (BJB). 2 Key in ON position. 3 Measure the voltage between fuse F28 (BJB) and ground. • Is battery voltage indicated? → **Yes** GO to **Q21** → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	CHECK and if necessary RENEW the central junction box (CJB). TEST the system for normal operation.
Q21: TEST THE VOLTAGE AT THE IGNITION SWITCH	
 VFE0031112	1 Key in OFF position. 2 Disconnect Ignition switch C400. 3 Key in ON position. 4 Measure the voltage between the ignition switch, connector C400, pin 4, circuit 30-BB9 (RD), wiring harness side, and ground. • Is battery voltage indicated? → **Yes** CHECK the ignition switch according to the component checks in the wiring diagrams and RENEW it if necessary. TEST the system for normal operation. If the concern persists: GO to **Q22** → **No** REPAIR break in circuit 30-BB9 (RD), between fuse F28 and ignition switch using the wiring diagrams. TEST the system for normal operation.
Q22: TEST VOLTAGE ON LIGHT SWITCH	
 VFE0003169	1 Key in OFF position. 2 Connect Ignition switch C400 (vehicles without daytime running lights). 3 Disconnect Headlamp switch C478. 4 Measure the voltage between the light switch, connector C478, pin 12, circuit 30S-LF14 (RD/OG), wiring harness side and ground.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is battery voltage indicated? → **Yes** CHECK and if necessary RENEW the light switch. TEST the system for normal operation. → **No** REPAIR break in circuit 30S-LF14 (RD/OG) using the wiring diagrams. TEST the system for normal operation.
Q23: CHECK THE CIRCUIT BETWEEN THE LIGHT SWITCH AND FUSE F63 (CJB)	
	1 Disconnect Headlamp switch C478. 2 Measure resistance between fuse F63 (CJB) and light switch, connector C478, pin 13, 30S-LF2 (RD/BU), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the light switch. TEST the system for normal operation. → **No** REPAIR the break in circuit between light switch and fuses F63, F64 (CJB) using the wiring diagrams, RENEW the central junction box (CJB) if necessary. TEST the system for normal operation.

PINPOINT TEST R: PARKING LAMPS, REAR LAMPS AND/OR LICENSE PLATE LAMP LIT CONTINUOUSLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
R1: DETERMINE THE CONDITIONS UNDER WHICH THE FAULT OCCURS	
	1 Key in OFF position. 2 Disconnect Headlamp switch C478. 3 Key in ON position. 4 Test the parking lamps • Are the parking lamps and the license plate lamps lit continuously? → **Yes** CHECK and if necessary RENEW the light switch. TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **No** The parking lamps are on continuously: GO to **R2** The license plate lamps stay on continuously: GO to **R6**
R2: CHECK THE VOLTAGE SUPPLY TO FUSES F63, F64 (CJB) FOR A SHORT TO BATTERY VOLTAGE	
	1 Key in OFF position. **2** Disconnect Fuse F63 (CJB). **3** Disconnect Fuse F64 (CJB). **4** Key in ON position. **5** Test the parking lamps • Are the parking lamps lit continuously on one side? → **Yes** Right-hand parking lamps lit continuously: GO to **R3** Left-hand parking lamps lit continuously: GO to **R4** → **No** LOCATE and REPAIR the short to battery voltage in circuit, between light switch and fuses F63, F64 (CJB) using the wiring diagrams, RENEW the central junction box (CJB) if necessary. TEST the system for normal operation.
R3: CHECK THE INSTRUMENT CLUSTER	
	1 Key in OFF position. **2** Disconnect Instrument cluster C449. **3** Key in ON position. **4** Test the right-hand parking lamps. • Are the right-hand parking lamps lit continuously? → **Yes** GO to **R4** → **No** CHECK and if necessary RENEW the instrument cluster. TEST the system for normal operation.
R4: DETERMINE VEHICLE EQUIPMENT LEVEL	
	1 Determine vehicle equipment level. • Is the vehicle equipped with a trailer socket? → **Yes** GO to **R5** → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	LOCATE and RECTIFY short to battery voltage in the circuits which are connected to output of fuse F64 (left side lit all time) or output of fuse F63 (right side lit all time) using the wiring diagrams, RENEW the central junction box (CJB) if necessary. TEST the system for normal operation.
R5: CHECK THE TRAILER INTERFACE (TI) MODULE	
	1 Key in OFF position. 2 Disconnect Trailer interface (TI) module C2000. 3 Key in ON position. 4 Test the parking lamps • Are the parking lamps lit continuously on one side? → **Yes** LOCATE and RECTIFY short to battery voltage in the circuits which are connected to output of fuse F64 (left side lit all time) or output of fuse F63 (right side lit all time) using the wiring diagrams, RENEW the central junction box (CJB) if necessary. TEST the system for normal operation. → **No** RENEW trailer interface (TI) module. TEST the system for normal operation.
R6: CHECK THE VOLTAGE SUPPLY TO FUSE F97 (CJB) FOR A SHORT TO BATTERY VOLTAGE	
	1 Key in OFF position. 2 Disconnect Fuse F97 (CJB). 3 Key in ON position. 4 Check the license plate lamps. • Does the license plate lamps stay on continuously? → **Yes** GO to **R7** → **No** LOCATE and REPAIR the short to battery voltage in circuit, between light switch and fuse F97, (CJB) using the wiring diagrams, RENEW the central junction box (CJB) if necessary. TEST the system for normal operation.
R7: CHECK GEM	
	1 Key in OFF position. 2 Disconnect Generic electronic module (GEM) C429. 3 Key in ON position. 4 Check the license plate lamps.

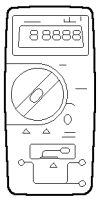
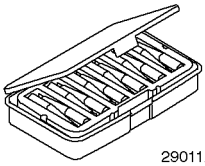
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Does the license plate lamps stay on continuously? → **Yes** GO to **R8** → **No** CHECK and if necessary RENEW the generic electronic module (GEM). TEST the system for normal operation.
R8: CHECK CIRCUIT 29S-GG17 (OG)	
	1 Key in OFF position. 2 Disconnect Central Junction Box (CJB) C502. 3 Key in ON position. 4 Check the license plate lamps. • Do the license plate lamps stay on continuously? → **Yes** GO to **R9** → **No** LOCATE and RECTIFY the short to battery voltage in circuit 29S-GG17 (OG), between the CJB and the GEM using the Wiring Diagrams. TEST the system for normal operation.
R9: CHECK CIRCUITS 29S-LF21 (OG/BK), 29S-LF22 (OG/BK) TO THE LICENSE PLATE LAMPS	
	1 Key in OFF position. 2 Disconnect Central Junction Box (CJB) C508. 3 Key in ON position. 4 Check the license plate lamps. • Do the license plate lamps stay on continuously? → **Yes** LOCATE and REPAIR short to battery voltage in circuit 29S-LF21 (OG/BK) or 29S-LF22 (OG/BK), between CJB and license plate lamps using the wiring diagrams. TEST the system for normal operation. → **No** CHECK and if necessary RENEW the central junction box (CJB). TEST the system for normal operation.

DIAGNOSIS AND TESTING

Fog Lamps

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Special Tool(s)	
 ST1137-A	Digital multimeter 105-R0051 or a comparable device
 29011A	Terminal probe kit 29-011 A

Diagnosis and Testing

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Check

Electrical
• Fuse(s). • Bulb(s). • Fog lamps. • Electrical connector(s). • Switch(es). • Wiring harness.

3. If an obvious cause for an observed or reported concern is found,correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and referto the Symptom Chart.

Symptom Chart

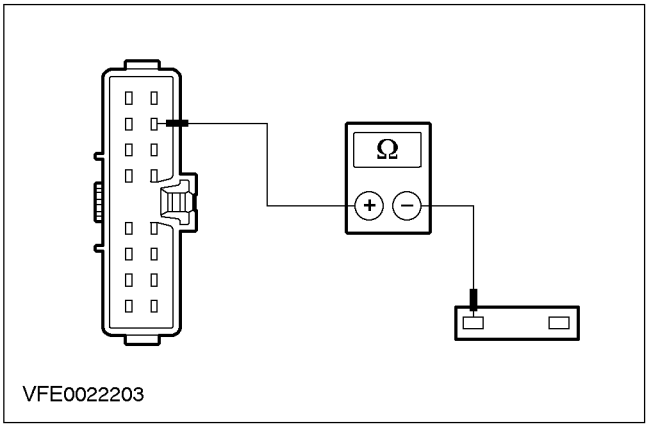
Condition	Possible Sources	Action
•The fog lamps are inoperative	•Fuse(s). •Circuit(s). •Light switch •Rear fog lamp shut-off relay	• GO to Pinpoint Test S
•Individual fog lamp inoperative	•Circuit(s). •Front fog lamp •Rear fog lamp	• GO to Pinpoint Test T
•The fog lamps are on continu-ously	•Circuit(s). •Light switch •Rear fog lamp shut-off relay	• GO to Pinpoint Test U

Pinpoint Tests

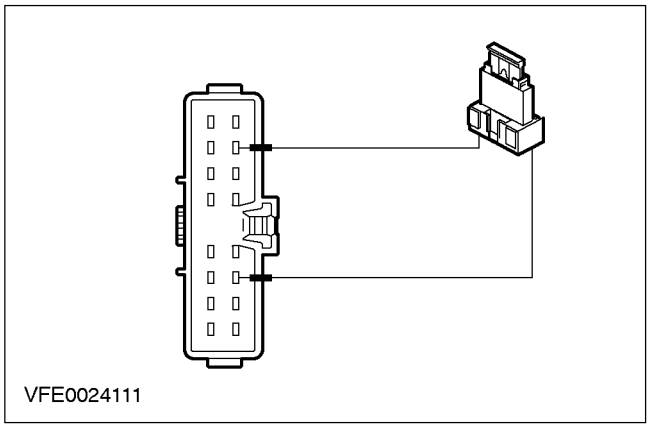
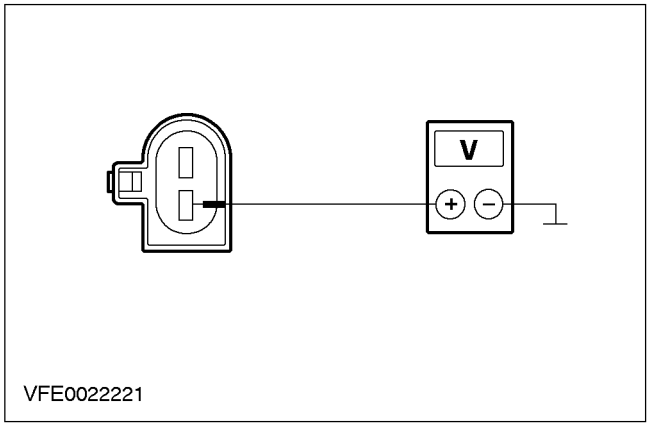
PINPOINT TEST S: THE FOG LAMPS ARE INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
S1: CHECK THE CAUSE OF THE FAULT	
	1 Key in ON position. 2 Switch on the FRONT and REAR FOG LAMPS. 3 Check the fog lamps. • Are all of the fog lamps not working? → **Yes**

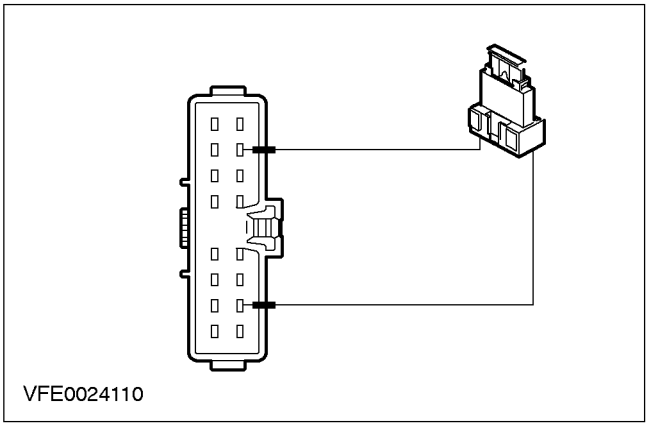
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	GO to **S2** → **No** Front fog lamps inoperative: GO to **S5** Rear fog lamps inoperative: GO to **S7**
S2: CHECK FUSE F62	
	1 Key in OFF position. 2 CHECK Fuse F62 (CJB). 3 Check the fuse F62 (15 A). • Is the fuse OK? → **Yes** GO to **S3** → **No** INSTALL a new fuse F62 (15 A). Check the operation of the system. If the fuse blows again, LOCATEand REPAIR the short circuit to ground by using the wiring diagrams. CHECK the operation of the system.
S3: TEST VOLTAGE AT FUSE F62	
	1 Connect Fuse F62 (CJB). 2 Key in ON position. 3 Measure the voltage between fuse F62 (CJB) and ground. • Is battery voltage indicated? → **Yes** GO to **S4** → **No** LOCATE and RECTIFY the break in the voltage supply to fuse F62 with the aid of the Wiring Diagrams. CHECK the operation of the system.
S4: CHECK CIRCUIT 15-LD10 (GN/OG)	
 VFE0022203	1 Key in OFF position. 2 Disconnect Light switch (C478). 3 Measure the resistance between the light switch, connector C478, pin 7, circuit 15-LD10 (GN/OG), wiring harness side and fuse F62 (CJB). • Is the resistance less than 2 ohms? → **Yes**

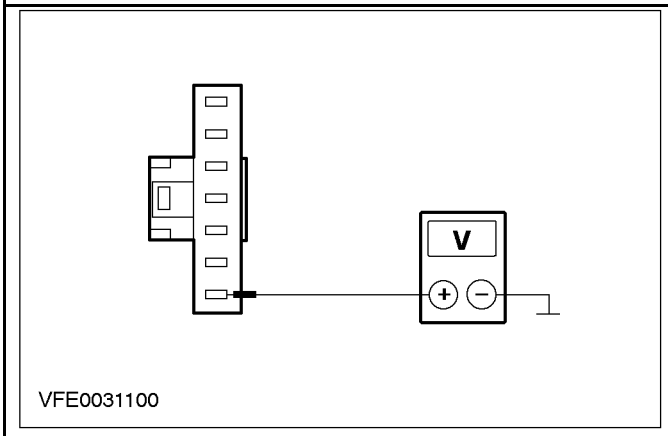
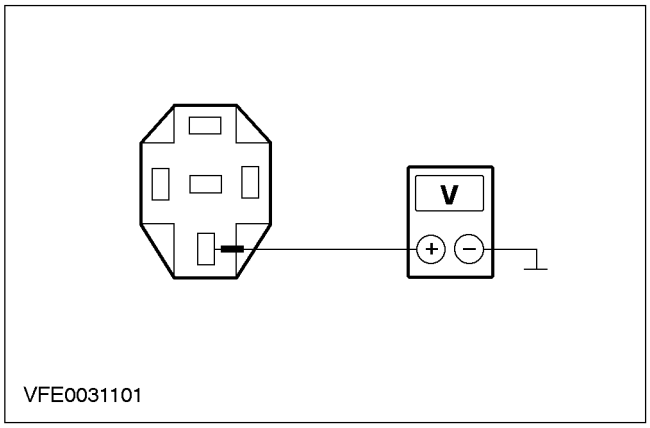
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	Renew the light switch. CHECK the operation of the system. → **No** REPAIR circuit 15-LD10 (GN/OG) between fuse F62 and the light switch with the aid of the Wiring Diagrams. CHECK the operation of the system.
S5: CHECK THE LIGHT SWITCH	
 VFE0024111	1 Key in OFF position. 2 Disconnect Light switch (C478). 3 Using a fused test cable (15 A) at the light switch, bridge between connector C478, pin 7, circuit 15-LD10 (GN/OG) and pin 3, circuit 15S-LD10 (GN/OG), wiring harness side. 4 Key in ON position. 5 Check the front fog lamps. • Are the front fog lamps illuminated? → **Yes** Renew the light switch. CHECK the operation of the system. → **No** GO to **S6**
S6: CHECK CIRCUITS 15S-LD10 (GN/OG) AND 15S-LD9 (GN/BK)	
 VFE0022221	1 Key in OFF position. 2 Connect Light switch (C478). 3 Disconnect Front fog lamp left-hand side C207. 4 Key in ON position. 5 Switch on the front fog lamps. 6 Measure the voltage between front fog lamp left-hand side, connector C207, pin 1, circuit 15S-LD11 (GN/WH), harness side and ground.

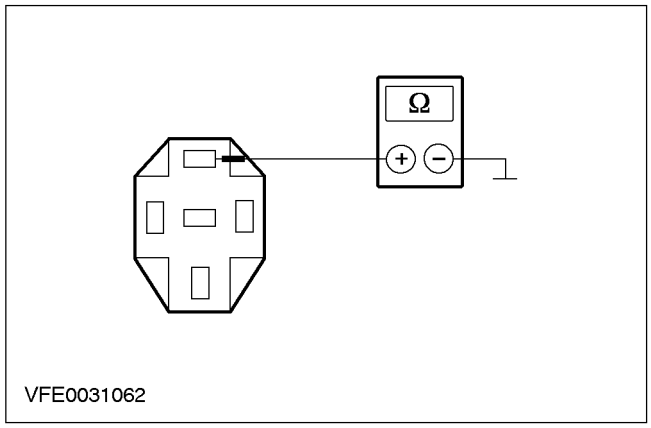
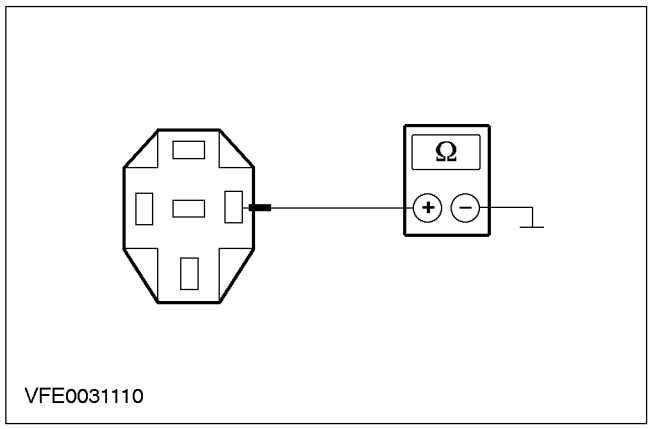
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is battery voltage indicated? → **Yes** REPAIR the circuit between soldered connection S734 and ground connection G104 with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** REPAIR circuit 15S-LD10 (GN/OG) or 15S-LD9 (GN/BK) with the aid of the wiring diagrams. CHECK the operation of the system.
S7: CHECK THE LIGHT SWITCH.	
 VFE0024110	1 Key in OFF position. 2 Disconnect Light switch (C478). 3 Using a fused test cable (15 A) at the light switch, bridge between connector C478, pin 7, circuit 15-LD10 (GN/OG) and pin 2, circuit 15S-LD16 (GN/RD), wiring harness side. 4 Key in ON position. 5 If the rear fog lamps are still inoperative, remove the bridging cable (estate versions without a trailer socket only). 6 Check the rear fog lamps. • Are the rear fog lamps illuminated? → **Yes** Renew the light switch. CHECK the operation of the system. → **No** 4/5-door versions without a trailer socket: GO to **S8** Estate versions without a trailer socket: REPAIR circuit 15S-LD16 (GN/RD) or 15S-LD6 (GN/YE) between the light switch and the rear lamp cluster with the aid of the Wiring Diagrams. CHECK the operation of the system. Vehicles with a trailer socket: GO to **S9**
S8: CHECK CIRCUITS 15S-LD16 (GN/RD) AND 15S-LD6 (GN/YE)	
	1 Key in OFF position. 2 Disconnect Rear fog lamp C540. 3 Key in ON position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031100	4 Measure the voltage between the left-hand rear fog lamp, connector C540, pin 7, circuit 15S-LD6 (GN/YE), wiring harness side and ground. • Is battery voltage indicated? → **Yes** REPAIR circuit 31-DA7 (BK) between soldered connection S211 and ground connection G300 with the aid of the wiring diagrams. CHECK the operation of the system. → **No** REPAIR circuit 15S-LD16 (GN/RD) or 15S-LD6 (GN/YE) between the light switch and the left-hand rear fog lamp with the aid of the Wiring Diagrams. CHECK the operation of the system.
S9: CHECK CIRCUITS 15S-LD16 (GN/RD) AND 15S-LD6 (GN/YE)	
 VFE0031101	1 Key in OFF position. 2 Disconnect Rear fog lamp shut-off relay C2008. 3 Key in ON position. 4 Measure the voltage between the rear fog lamp shut-off relay, connector C2008, circuit (RD/WH), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **S10** → **No**

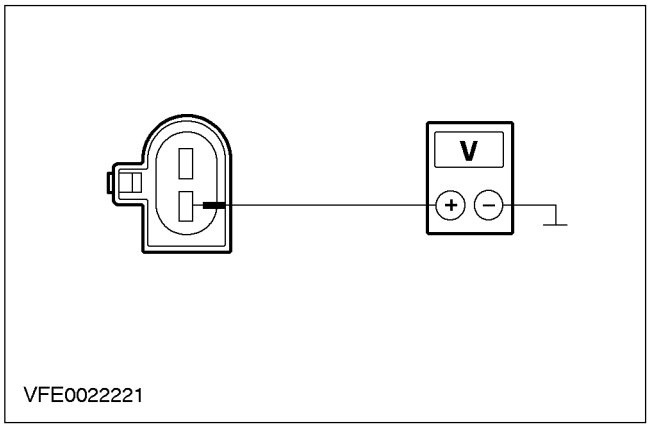
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR circuit 15S-LD16 (GN/RD) or 15S-LD6 (GN/YE) between the light switch and the rear fog lamp shut-off relay with the aid of the Wiring Diagrams. CHECK the operation of the system.
S10: CHECK CIRCUIT (BN)	
 VFE0031062	**1** Key in OFF position. **2** Measure the resistance between the rear fog lamp shut-off relay, connector C2008, circuit (BN), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** GO to **S11** → **No** REPAIR circuit (BN) or 31-DA7 (BK) between the rear fog lamp shut-off relay and ground connection G300 with the aid of the Wiring Diagrams. CHECK the operation of the system.
S11: CHECK CIRCUIT (RD/YE)	
NOTE: Check that no adapters or consumers are connected to the trailer socket.	
 VFE0031110	**1** Key in OFF position. **2** Measure the resistance between the rear fog lamp shut-off relay, connector C2008, circuit (RD/YE), wiring harness side and ground. • Is the resistance greater than 10 kOhms? → **Yes** CHECK and if necessary RENEW the rear fog lamp shut-off relay. CHECK the operation of the system.

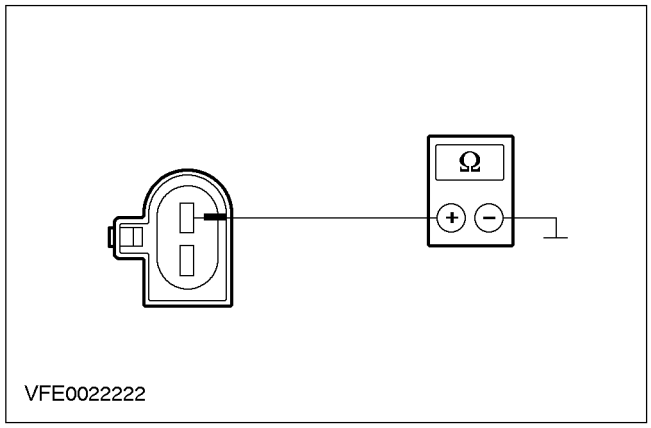
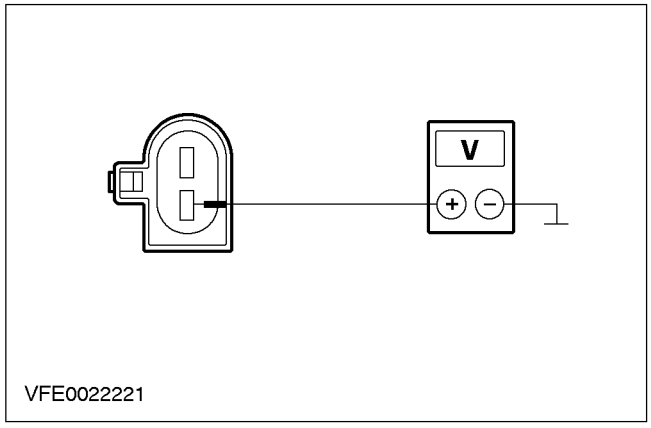
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **No** LOCATE and RECTIFY the short to ground in circuit (RD/YE) between the rear fog lamp shut-off relay and the trailer socket with the aid of the Wiring Diagrams. CHECK the operation of the system.

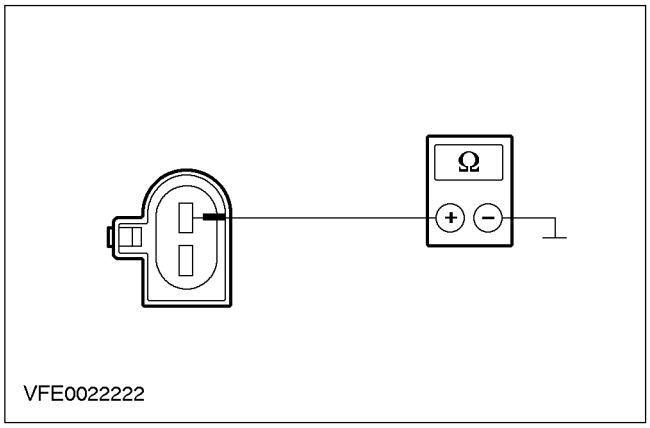
PINPOINT TEST T: INDIVIDUAL FOG LAMP INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
T1: DETERMINE THE INOPERATIVE LAMP(S)	
	1 Key in ON position. 2 Switch on the FRONT and REAR FOG LAMPS. 3 Check the fog lamps. • Is a single fog lamp inoperative? → **Yes** Left-hand side: GO to **T2** Right-hand side: GO to **T4** → **No** Right-hand rear fog lamp: GO to **T6** Left-hand rear fog lamp, estate and 4/5-door versions with a trailer socket: GO to **T8** Left-hand rear fog lamp, 4/5-door versions without a trailer socket: GO to **T9**
T2: CHECK CIRCUIT 15S-LD11 (GN/WH)	
	1 Key in OFF position. 2 Disconnect Front fog lamp left-hand side C207. 3 Key in ON position. 4 Switch on the front fog lamps. 5 Measure the voltage between front fog lamp left-hand side, connector C207, pin 1, circuit 15S-LD11 (GN/WH), harness side and ground. • Is battery voltage indicated? → **Yes** GO to **T3** → **No**

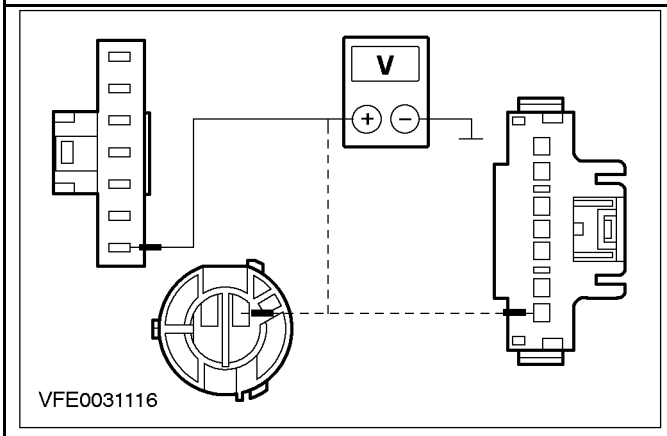
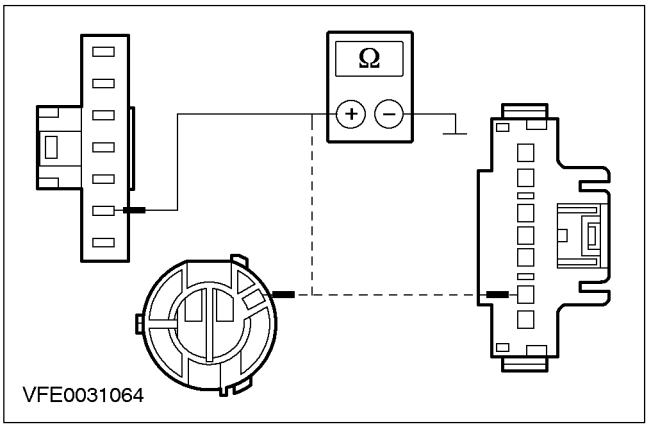
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR the circuit 15S-LD11 (GN/WH) between soldered connection S733 and the front fog lamp with the aid of the Wiring Diagrams. CHECK the operation of the system.
T3: CHECK CIRCUIT 31-LD11 (BK)	
 VFE0022222	**1** Key in OFF position. **2** Measure the resistance between front fog lamp left-hand side, connector C207, pin 2, circuit 31-LD11 (BK), harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the left-hand front fog lamp. CHECK the operation of the system. → **No** REPAIR the circuit 31-LD11 (BK) between the front fog lamp and soldered connection S734 with the aid of the Wiring Diagrams. Check the operation of the system.
T4: CHECK CIRCUIT 15S-LD17 (GN/WH)	
 VFE0022221	**1** Key in OFF position. **2** Disconnect Front fog lamp right-hand side C208. **3** Key in ON position. **4** Switch on the front fog lamps. **5** Measure the voltage between front fog lamp right-hand side, connector C208, pin 1, circuit 15S-LD17 (GN/WH), harness side and ground.

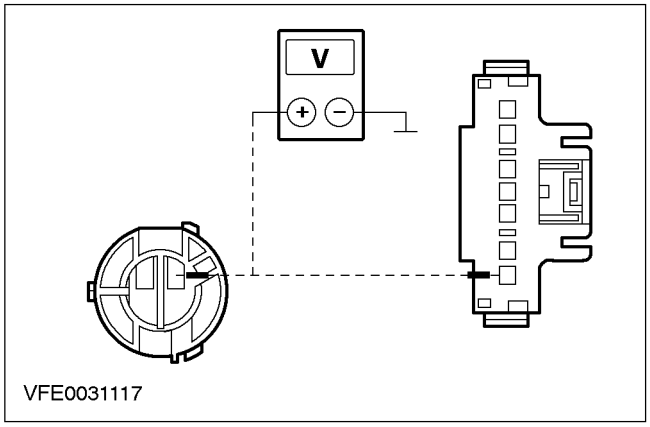
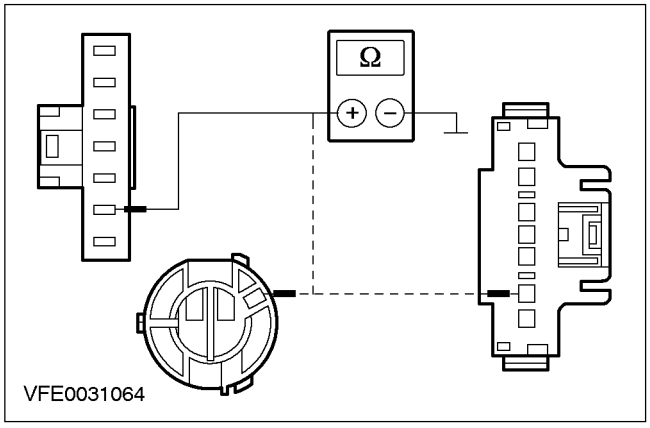
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is battery voltage indicated? → **Yes** GO to **T5** → **No** REPAIR the circuit 15S-LD17 (GN/WH) between soldered connection S733 and the front fog lamp with the aid of the Wiring Diagrams. CHECK the operation of the system.
T5: CHECK CIRCUIT 31-LD17 (BK)	
	1 Key in OFF position. 2 Measure the resistance between the right-hand front fog lamp, connector C208, pin 2, circuit 31-LD17 (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the right-hand front fog lamp. CHECK the operation of the system. → **No** REPAIR the circuit 31-LD17 (BK) between the front fog lamp and soldered connection S734 with the aid of the Wiring Diagrams. CHECK the operation of the system.
T6: CHECK CIRCUIT 15S-LD12 (GN/YE) OR 15S-LD6 (GN/YE)	
	1 Key in OFF position. 2 Disconnect Right-hand rear lamp cluster. - C541 (4/5-door versions without a trailer socket) - C2007 (4/5-door versions with a trailer socket) - C541 estate 3 Key in ON position. 4 Switch on the REAR FOG LAMPS.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**5** Measure the voltage between the right-hand rear lamp cluster, … - 4/5-door versions: connector C541, pin 7, circuit 15S-LD12 (GN/YE) (without a trailer socket) or connector C2007, pin 7, circuit (VT/YE) (with a trailer socket), wiring harness side and ground. - Estate: connector C541d, pin 3, circuit 15S-LD6 (GN/YE), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **T7** → **No** REPAIR circuit (VT/YE), 15S-LD6 (GN/YE) or 15S-LD12 (GN/YE) with the aid of the Wiring Diagrams. CHECK the operation of the system.
T7: CHECK THE GROUND CONNECTION OF THE RIGHT-HAND REAR LAMP CLUSTER	
	**1** Key in OFF position. **2** Measure the resistance between the right-hand rear lamp cluster, … - 4/5-door versions: connector C541, pin 6, circuit 31-LF20 (BK) (without a trailer socket) or connector C2007, pin 6, circuit (GN) (with a trailer socket) wiring harness side and ground. - Estate: connector C541d, pin 1, circuit 31-LF11 (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the right-hand rear lamp cluster. CHECK the operation of the system. → **No** REPAIR circuit (GN), 31-LF11 (BK) or 31-LF20 (BK) between the rear lamp cluster and ground connection G300 or G205 with the aid of the Wiring Diagrams. CHECK the operation of the system.
T8: CHECK CIRCUIT 15S-LD6 (GN/YE)	
	1 Key in OFF position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031117	**2** Disconnect Left-hand rear lamp cluster. - C540d estate - C2005 (4/5-door versions with a trailer socket) **3** Key in ON position. **4** Switch on the REAR FOG LAMPS. **5** Measure the voltage between the left-hand rear lamp cluster, connector C540d, pin 3, circuit 15S-LD6 (GN/YE) (estate) or connector C2005, pin 7, circuit (VT/YE) (4/5-door versions), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **T9** → **No** REPAIR circuit (VT/YE) or 15S-LD6 (GN/YE) with the aid of the Wiring Diagrams. CHECK the operation of the system.
T9: CHECK CIRCUIT 31-LF11 (BK)	
 VFE0031064	**1** Key in OFF position. **2** Disconnect Left-hand rear lamp cluster C540 (4/5-door versions without a trailer socket). **3** Measure the resistance between the left-hand rear lamp cluster, … - 4/5-door versions: connector C540, pin 6, circuit 31-LF11 (BK) (without a trailer socket) or connector C2005, pin 6, circuit (BN) (with a trailer socket) wiring harness side and ground. - Estate: connector C541d, pin 1, circuit 31-LF11 (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK and if necessary RENEW the left-hand rear lamp cluster. CHECK the operation of the system. → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR circuit (BN) or 31-LF11 (BK) between the rear lamp cluster and ground with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST U: FOG LAMPS ON CONTINUOUSLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
U1: CHECK THE LIGHT SWITCH.	
	1 Key in OFF position. 2 Disconnect Light switch (C478). 3 Key in ON position. 4 Check the fog lamps. • Are the fog lamps illuminated? → **Yes** Rear fog lamps on continuously, vehicles without a trailer socket: LOCATE and RECTIFY the short circuit to voltage supply in circuit 15S-LD16 (GN/RD), 15S-LD6 (GN/YE) or 15S-LD12 (GN/YE) between the light switch and the rear fog lamp with the aid of the Wiring Diagrams. CHECK the operation of the system. Rear fog lamps on continuously, vehicles with a trailer socket: GO to **U2** Front fog lamps on continuously: LOCATE and RECTIFY the short to voltage supply in circuit 15S-LD10 (GN/OG), 15S-LD9 (GN/BK), 15S-LD11 (GN/WH) or 15S-LD17 (GN/WH) between the light switch and the front fog lamps with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** CHECK and if necessary RENEW the light switch. CHECK the operation of the system.
U2: CHECK THE REAR FOG LAMP SHUT-OFF RELAY	
	1 Key in OFF position. 2 Disconnect Rear fog lamp shut-off relay C2008. 3 Key in ON position. 4 Check the fog lamps. • Are the rear fog lamps illuminated? → **Yes** LOCATE and RECTIFY the short to voltage supply in circuit (VT/YE) or 15S-LD6 (GN/YE) (estate) between the rear fog lamp shut-off relay and the rear fog lamp with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No**

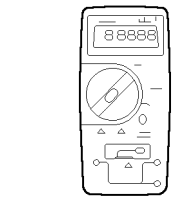
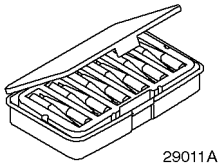
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	LOCATE and RECTIFY the short to voltage supply in circuit 15S-LD16 (GN/RD), 15S-LD6 (GN/YE), 15S-LD12 (GN/YE) or (RD/WH) between the light switch and the rear fog lamp shut-off relay with the aid of the Wiring Diagrams. CHECK the operation of the system. If the concern persists, CHECK and if necessary RENEW the rear fog lamp shut-off relay. CHECK the operation of the system.

DIAGNOSIS AND TESTING

Reversing Lamps

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Special Tool(s)	
 ST1137-A	Digital multimeter 105-R0051 or a comparable device
 29011A	Terminal probe kit 29-011 A

Diagnosis and Testing

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electricaldamage.

Visual Check

Electrical
• Fuse(s). • Bulb(s). • Rear lamp cluster. • Electrical connector(s). • Switch(es). • Wiring harness.

3. If an obvious cause for an observed or reported concern is found,correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and referto the Symptom Chart.

Symptom Chart

Condition	Possible Sources	Action
•Backup lamps are inoperative	•Fuse(s). •Circuit(s). •Central junction box (CJB). •Transmission switch (MTX75). •Transmission range sensor (CD4E).	• GO to Pinpoint Test V
•The individual backup lamp is inoperative	•Circuit(s). •Bulb. •Trailer interface (TI) module	• GO to Pinpoint Test W
•Backup lamps are on continu-ously	•Circuit(s). •Generic electronic module (GEM). •Transmission switch (MTX75). •Transmission range sensor (CD4E). •Audio/navigation control unit. •Trailer interface (TI) module	• GO to Pinpoint Test X

Pinpoint Tests

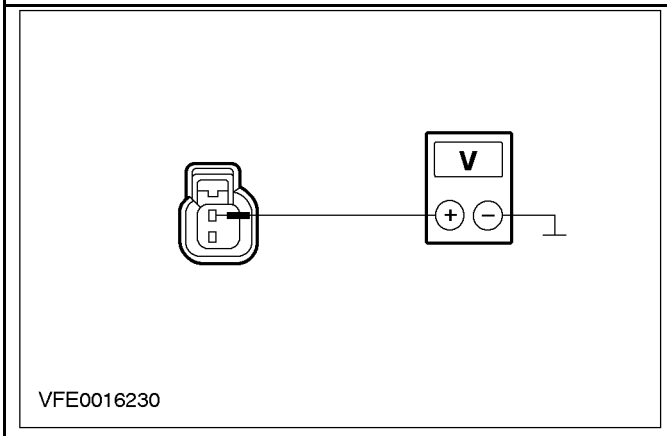
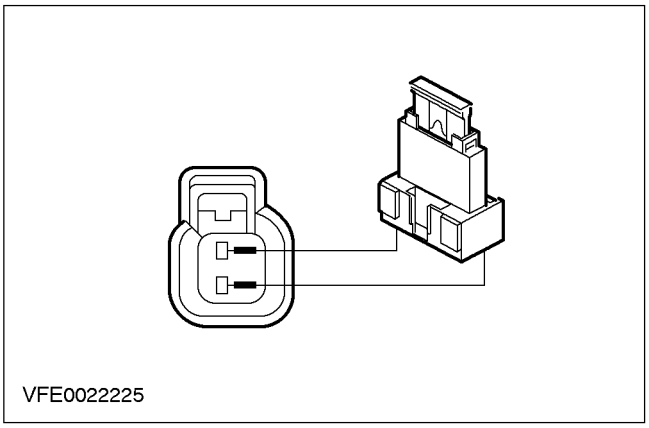
NOTE: Use a digital multimeter for all electrical measurements.

DIAGNOSIS AND TESTING

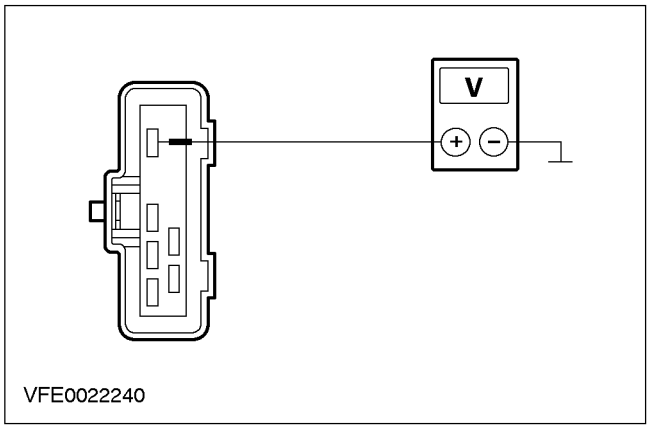
PINPOINT TEST V: BACKUP LAMPS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
V1: CHECK FUSE F80 (CJB)	
	1 Key in OFF position. 2 CHECK Fuse F80 (CJB). 3 Check the fuse F80 (7,5 A). • Is the fuse OK? → **Yes** GO to **V2** → **No** Install a new fuse F80 (7,5 A). If the fuse blows again, REPAIR the short circuit with the aid of the wiring diagrams. CHECK the operation of the system.
V2: MEASURE THE VOLTAGE AT FUSE F80	
	1 Connect Fuse F80 (CJB). 2 Key in ON position. 3 Measure the voltage between fuse F80 (CJB) and ground. • Is battery voltage indicated? → **Yes** GO to **V3** → **No** LOCATE and RECTIFY the break in the voltage supply to fuse F80 with the aid of the Wiring Diagrams. CHECK the operation of the system.
V3: DETERMINE MODEL VARIANT	
	1 Determine the model variant. • Is the vehicle equipped with an automatic transmission? → **Yes** GO to **V7** → **No** GO to **V4**
V4: CHECK CIRCUIT 15-LG28 (GN/WH)	
	1 Key in OFF position. 2 Disconnect Transmission switch C181. 3 Key in ON position.

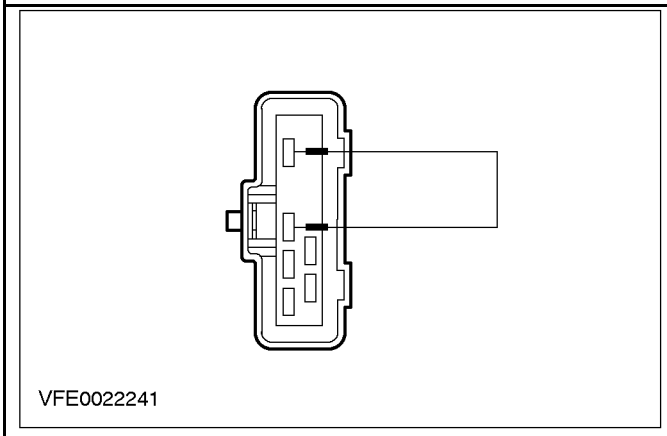
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0016230	4 Measure the voltage between the transmission switch, connector C181, pin 1, circuit 15-LG28 (GN/WH), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **V5** → **No** REPAIR circuit 15-LG28 (GN/WH) between fuse F80 and the transmission switch with the aid of the Wiring Diagrams. CHECK the operation of the system.
V5: CHECK THE TRANSMISSION SWITCH	
 VFE0022225	1 Key in OFF position. 2 Use a test cable to bridge the transmission switch, connector C181, pin 1, circuit 15-LG28 (GN/WH) and pin 2, circuit 15S-LG9 (GN/BK), wiring harness side. 3 Key in ON position. 4 If the concern persists, do not remove the bridging cable on 4/5-door versions. 5 Check the backup lamps. • Are the backup lamps lit up? → **Yes** RENEW the transmission switch. Check the operation of the system. → **No** Estate: REPAIR circuit 15S-LG9 (GN/BK) or 15S-LG9A (GN/BK) between the transmission switch and soldered connection S232 with the aid of the Wiring Diagrams. CHECK the operation of the system.

DIAGNOSIS AND TESTING (Continued)

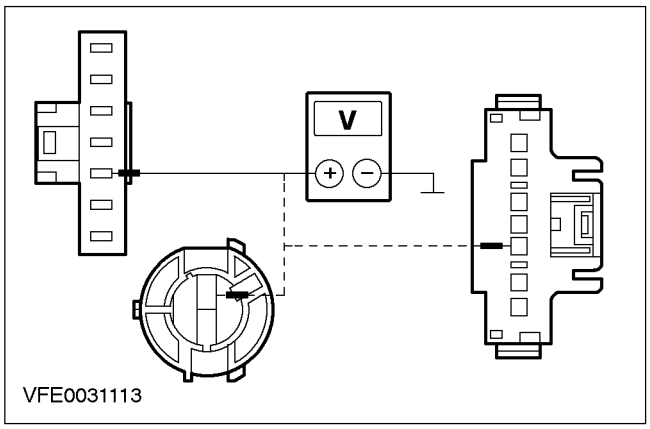
CONDITIONS	DETAILS/RESULTS/ACTIONS
	4/5-door versions: GO to **V6**
V6: CHECK CIRCUITS 15S-LG9 (GN/BK) AND 15S-LG9A (GN/BK)	
	1 Depress the BRAKE. 2 Check the stoplamps. • Do the stoplamps light up? → **Yes** REPAIR circuit 15S-LG9 (GN/BK) and 15S-LG9A (GN/BK) between the transmission switch and the rear lamp cluster with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** REPAIR circuit 31-DA7 (BK) between soldered connection S211 and ground connection G300 with the aid of the wiring diagrams. CHECK the operation of the system.
V7: CHECK THE CIRCUIT 15-LG28	
 VFE0022240	1 Key in OFF position. 2 Disconnect Transmission range sensor C187. 3 Key in ON position. 4 Measure the voltage between connector C187, pin 1, circuit 15-LG28 (GN/WH), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **V8** → **No** REPAIR circuit 15-LG28 (GN/WH) between fuse F80 and the transmission range sensor with the aid of the Wiring Diagrams. CHECK the operation of the system.
V8: CHECK THE TRANSMISSION RANGE SENSOR	
	1 Key in OFF position.

DIAGNOSIS AND TESTING (Continued)

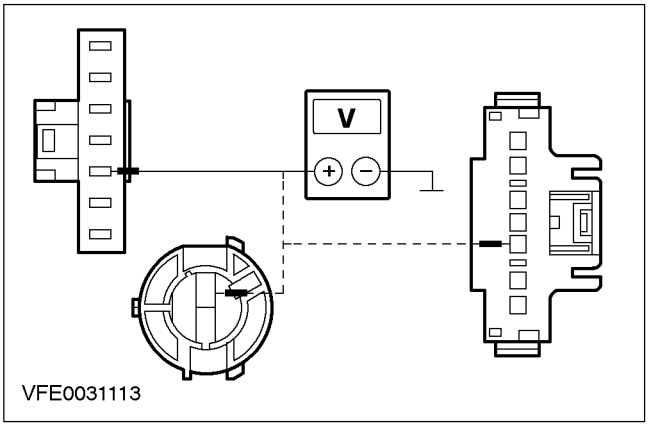
CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022241	**2** Use a test cable to bridge the transmission range sensor, connector C187, pin 1, circuit 15-LG28 (GN/WH) and pin 3, circuit 15S-LG9 (GN/BK), wiring harness side. **3** Key in ON position. **4** If the concern persists, do not remove the bridging cable on 4/5-door versions. **5** Check the backup lamps. • Are the backup lamps lit up? → **Yes** RENEW the transmission range sensor. CHECK the operation of the system. → **No** Estate: REPAIR circuit 15S-LG9 (GN/BK) and 15S-LG9A (GN/BK) between the transmission range sensor and soldered connection S232 with the aid of the Wiring Diagrams. CHECK the operation of the system. 4/5-door versions: GO to **V9**
V9: CHECK CIRCUITS 15S-LG9 (GN/BK), 15S-LG9A (GN/BK) AND (BK)	
	1 Key in ON position. **2** Depress the BRAKE. **3** Check the stoplamps. • Do the stoplamps light up? → **Yes** REPAIR circuits 15S-LG9 (GN/BK), 15S-LG9A (GN/BK) and (BK) between the transmission range sensor and the rear lamp cluster with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** REPAIR circuit 31-DA7 (BK) between soldered connection S211 and ground connection G300 with the aid of the wiring diagrams. CHECK the operation of the system.

DIAGNOSIS AND TESTING (Continued)

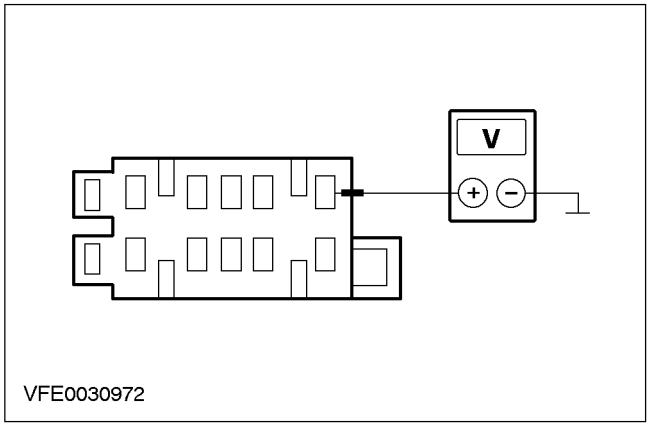
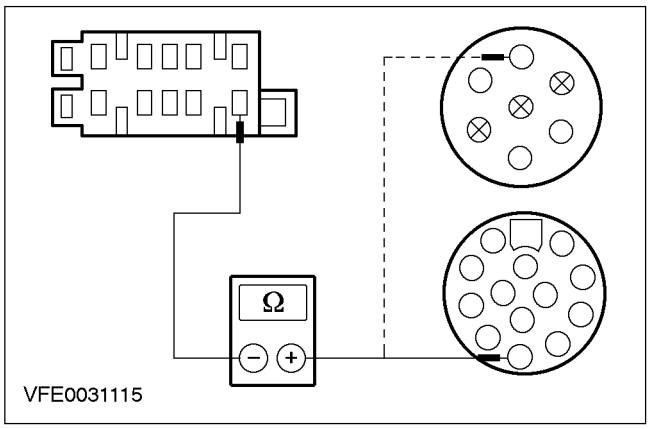
PINPOINT TEST W: INDIVIDUAL BACKUP LAMP INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
W1: DETERMINE THE INOPERATIVE LAMP	
	1 Key in ON position. 2 Shift the transmission into "Reverse". 3 Determine which backup lamp is inoperative. • Is the left-hand backup lamp on the vehicle inoperative? → **Yes** Left-hand backup lamp, on the vehicle: GO to **W2** Left-hand backup lamp on the vehicle and backup lamp on the trailer inoperative: REPAIR circuit 15S-LG9 (GN/BK) between soldered connection S232 and the rear lamp cluster with the aid of the Wiring Diagrams. Check the operation of the system. → **No** Right-hand backup lamp on the vehicle inoperative: GO to **W3** Backup lamp on the trailer inoperative: GO to **W4**
W2: CHECK CIRCUITS 15S-LG9 (GN/BK) AND (BK)	
 VFE0031113	1 Key in OFF position. 2 Disconnect Left-hand rear lamp cluster. - C540 (4/5-door versions without a trailer socket) - C2005 (4/5-door versions with a trailer socket) - C540c estate 3 Key in ON position. 4 Shift the transmission into "Reverse". 5 Measure the voltage between the left-hand rear lamp cluster, connector C540 (4/5-door versions without a trailer socket), pin 5, connector C540c (estates), pin 2, circuit 15S-LG9 (GN/BK) or C2005 (4/5-door versions with a trailer socket), pin 5, circuit (BK) wiring harness side and ground. • Is battery voltage indicated? → **Yes**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	CHECK and if necessary RENEW the rear lamp cluster. CHECK the operation of the system. If the concern persists, REPAIR circuit 31-LF11 (BK) (4/5-door versions) or 31-LG9 (BK) (estates), between the rear lamp cluster and ground connection G300 with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** REPAIR circuit 15S-LG9 (GN/BK) between soldered connection S232 and the rear lamp cluster with the aid of the Wiring Diagrams. CHECK the operation of the system.
W3: CHECK CIRCUIT 15S-LG16 (GN/OG), 15S-LG9 (GN/BK) OR (GN)	
	**1** Key in OFF position. **2** Disconnect Left-hand rear lamp cluster. - C541 (4/5-door versions without a trailer socket) - C2007 (4/5-door versions with a trailer socket) - C541c estate **3** Key in ON position. **4** Shift the transmission into "Reverse". **5** Measure the voltage between the right-hand rear lamp cluster, connector C541 (4/5-door versions without a trailer socket), pin 5, connector C540c (estates), pin 2, circuit 15S-LG9 (GN/BK) or C2007 (4/5-door versions with a trailer socket), pin 5, circuit (GN) wiring harness side and ground. • Is battery voltage indicated? → **Yes** CHECK and if necessary RENEW the rear lamp cluster. CHECK the operation of the system. REPAIR circuit 31-LF20 (BK) (4/5-door versions) or 31-LG9 (BK) (estates) between the rear lamp cluster and ground connection G300 (4/5-door versions) or G205 (estates) with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR circuit 15S-LG16 (GN/OG), 15S-LG9 (GN/BK) or (GN) between soldered connection S232 and the rear lamp cluster with the aid of the Wiring Diagrams. CHECK the operation of the system.
W4: CHECK THE TRAILER INTERFACE (TI) MODULE	
	1 Key in OFF position. 2 Disconnect Trailer interface (TI) module C2000. 3 Key in ON position. 4 Shift the transmission into "Reverse". 5 Measure the voltage between the trailer interface (TI) module, connector C2000, pin 9, circuit (BK), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **W5** → **No** REPAIR the circuit (BK) between connector C2004 (4/5-door versions) or C2005 (estates) and the trailer interface (TI) module with the aid of the Wiring Diagrams. CHECK the operation of the system.
W5: CHECK CIRCUIT (VT/OG)	
	1 Key in OFF position. 2 Shift the transmission into "Reverse". 3 Measure the resistance between the trailer interface (TI) module, connector C2000, pin 10, circuit (VT/OG), wiring harness side and the trailer socket, connector C2012, pin 8, circuit (VT/OG), wiring harness side or the auxiliary trailer socket, connector C2013, pin 1, circuit (VT/OG), wiring harness side.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is the resistance less than 2 Ohm? → **Yes** CHECK and if necessary RENEW the trailer interface (TI) module. Check the operation of the system. → **No** REPAIR circuit (VT/OG) between the trailer interface (TI) module and the auxiliary trailer socket with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST X: BACKUP LAMPS ARE ON CONTINUOUSLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
X1: CHECK THE TRANSMISSION SWITCH/TRANSMISSION RANGE SENSOR	
	1 Key in OFF position. 2 Disconnect Transmission switch C181 or transmission range sensor C187. 3 Key in ON position. 4 Check if the lamps are still on continuously. • Are the backup lamps on continuously? → **Yes** GO to **X2** → **No** Vehicles with manual transmission RENEW the transmission switch. CHECK the operation of the system. Vehicles with automatic transmission: RENEW the transmission range sensor. CHECK the operation of the system.
X2: ELIMINATE MODULES/COMPONENTS AS THE POSSIBLE CAUSE FOR A SHORT CIRCUIT TO BATTERY VOLTAGE	
	1 Key in OFF position. 2 Disconnect Start with the first module, then proceed with the next test step (3 and 4).. - (2.0 l diesel, 130 HP only): Powertrain control module (PCM) C100 - Interior mirror with automatic glare adjustment C473 - Parking aid module C2100a - GEM module C428 - Audio/navigation control unit C485 - Trailer interface (TI) module 3 Key in ON position. 4 Check the backup lamps • Are the backup lamps on? → **Yes**

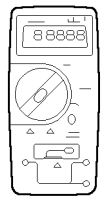
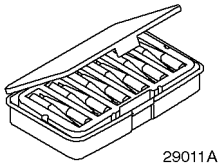
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	Not all of the listed modules have been disconnected: Switch off the ignition. Disconnect the next module, then proceed with test step 2. All of the listed modules have been disconnected: LOCATE and RECTIFY the short to voltage supply in the circuits connected to soldered connection S232 with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** RENEW the last component that was disconnected. CHECK the operation of the system.

DIAGNOSIS AND TESTING

Trailer Lamps

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Special Tool(s)	
 ST1137-A	Digital multimeter 105-R0051 or a comparable device
 29011A	Terminal probe kit 29-011 A

Diagnosis and Testing

1. Check the customer concern.
2. Visually check for any obvious mechanical or electrical damage.

Visual Inspection

Electrical
• Fuse(s) • Bulb(s) • Connector(s) • Trailer socket • Trailer lamps • Wiring harness

3. Resolve any obvious causes for a concern found during the visual inspection before carrying out any further tests.
4. If the concern persists, check the symptoms and continue with the Symptom Chart.

Symptom Chart

Condition	Possible Sources	Action
•Trailer lamps inoperative	•Fuse(s) •Circuit(s) in the vehicle •Circuit(s) in the trailer •Trailer socket •Trailer interface (TI) module •Trailer switch interface (SI) module •Rear fog lamp shut-off relay •Central junction box (CJB)	• GO to Pinpoint Test Y
•One individual trailer lamp inoperative	•Circuit(s) in the vehicle •Circuit(s) in the trailer •Trailer interface (TI) module •Trailer switch interface (SI) module	• GO to Pinpoint Test Z
•Trailer lamps permanently on	•Circuit(s) in the vehicle •Circuit(s) in the trailer •Trailer socket •Trailer interface (TI) module •Trailer switch interface (SI) module	• GO to Pinpoint Test AA

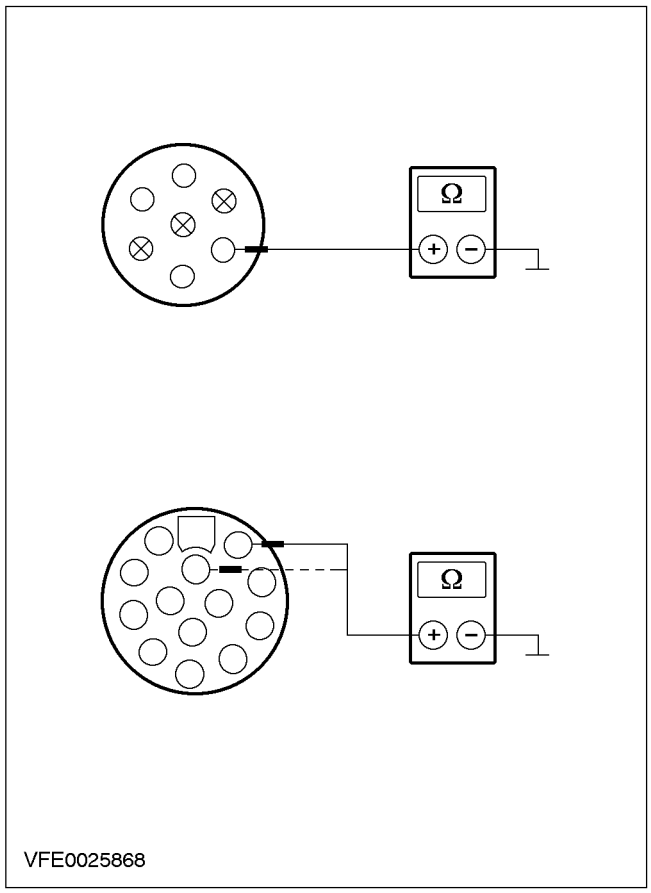
DIAGNOSIS AND TESTING (Continued)

Pinpoint Tests

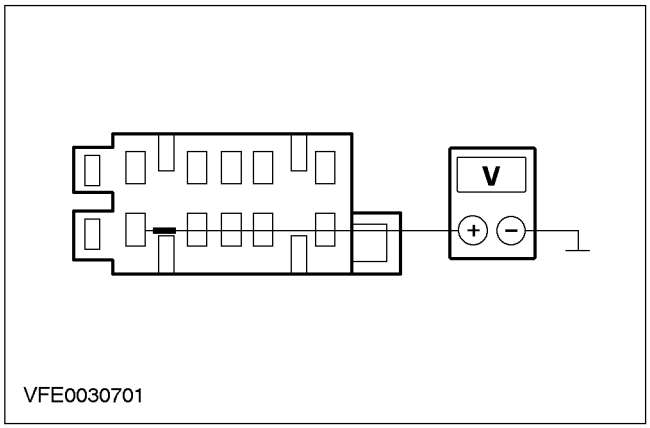
PINPOINT TEST Y: TRAILER LAMPS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
Y1: DETERMINE WHICH LAMPS ON THE TRAILER ARE INOPERATIVE	
	1 Key in ON position. 2 Switch on the SIDE LIGHTS, STOPLAMPS, REAR FOG LAMPS and LEFT and RIGHT-HAND TURN SIGNAL LAMPS in turn. Engage reverse gear. 3 Check the trailer lamps. • Are all of the lamps on the trailer inoperative? → **Yes** GO to **Y2** → **No** Only the rear lamps inoperative: RENEW the trailer interface (TI) module. CHECK the operation of the system. Stoplamps and turn signal lamps inoperative: GO to **Y7** Only the stoplamps inoperative: GO to **Y9** Only the backup lamp(s) inoperative: GO to **Y14** Only the rear fog lamp(s) inoperative: GO to **Y17** Only the turn signal lamps inoperative (both sides): RENEW the trailer switch interface (SI) module. CHECK the operation of the system.
Y2: CHECK THE GROUND CONNECTION AT THE TRAILER SOCKET	
	1 Key in OFF position.

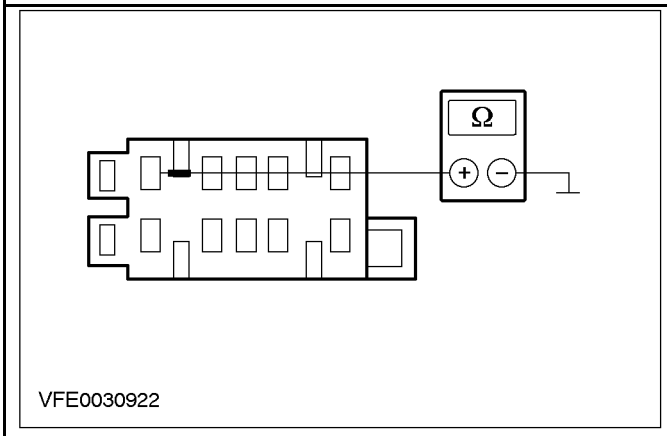
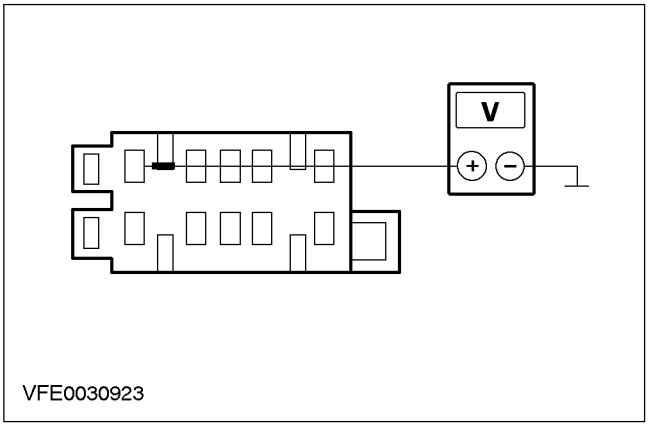
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0025868	**2** Measure the resistance between: - 7-pin trailer socket, C2010, pin 3, circuit (BN) and ground. - 13-pin trailer socket, C2012, pin 3, circuit (BN/WH) and ground and between pin 13, circuit (BN) and ground. • Is the resistance less than 2 Ohms? → **Yes** GO to **Y3** → **No** RECTIFY the open circuit in the circuit (BN) or (BN/WH) between the trailer socket and ground connection G302, G303 or G300 with the aid of the Wiring Diagrams. CHECK the operation of the system.
Y3: CHECK FUSE F74 (CJB)	
	1 CHECK Fuse F74 (CJB). **2** Check fuse F74 (20 A) • Is the fuse OK? → **Yes** GO to **Y4** → **No** RENEW fuse F74 (20 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short to ground with the aid of the Wiring Diagrams.
Y4: CHECK THE VOLTAGE AT FUSE F74 (CJB)	
	1 Connect Fuse F74 (CJB). **2** Key in ON position.

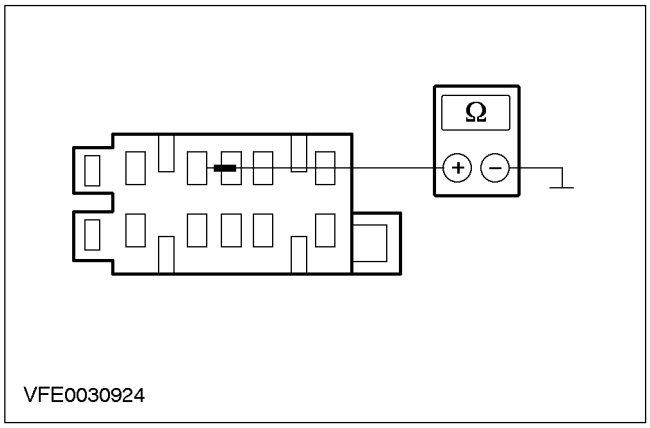
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	3 Measure the voltage between fuse F74 (20 A) and ground. • Is battery voltage displayed? → **Yes** GO to **Y5** → **No** CHECK and if necessary RENEW the central junction box (CJB). CHECK the operation of the system.
Y5: CHECK THE POWER SUPPLY TO THE TRAILER INTERFACE (TI) MODULE	
	1 Key in OFF position. 2 Disconnect Trailer interface (TI) module C2000. 3 Key in ON position. 4 Measure the voltage between the trailer interface (TI) module, connector C2000, pin 2, circuit (RD), wiring harness side and ground. • Is battery voltage displayed? → **Yes** GO to **Y6** → **No** REPAIR the open circuit between fuse F74 (CJB) and the trailer interface (TI) module with the aid of the Wiring Diagrams, and if necessary RENEW the central junction box (CJB). CHECK the operation of the system.
Y6: CHECK THE GROUND CONNECTION OF THE TRAILER INTERFACE (TI) MODULE	
	1 Key in OFF position.

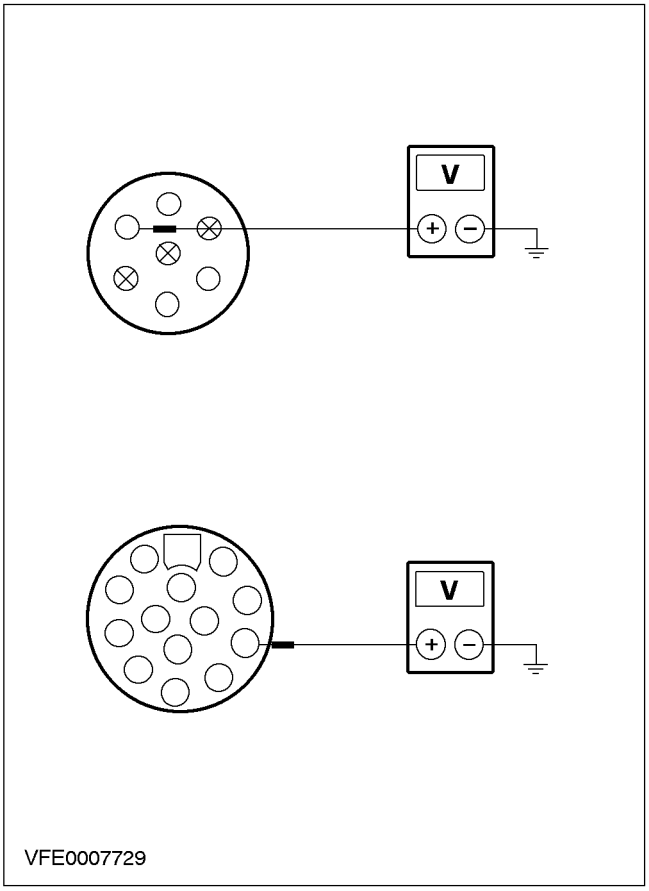
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0030922	**2** Measure the resistance between the trailer interface (TI) module, connector C2000, pin 1, circuit (BN), wiring harness side and ground. • Is the resistance less than 2 ohm? → **Yes** Continue troubleshooting on the trailer. If the electrical system on the trailer is OK, RENEW the trailer interface (TI) module. CHECK that the system operates correctly. → **No** REPAIR the open circuit between the trailer interface (TI) module and soldered connection S811 (ground connection G300) with the aid of the Wiring Diagrams. CHECK the operation of the system.
Y7: CHECK THE POWER SUPPLY TO THE TRAILER SWITCH INTERFACE (SI) MODULE	
 VFE0030923	**1** Key in OFF position. **2** Disconnect Trailer switch interface (SI) module C2002. **3** Key in ON position. **4** Measure the voltage between the trailer switch interface (SI) module, connector C2002, pin 1, circuit (RD), wiring harness side and ground. • Is battery voltage displayed? → **Yes** GO to **Y8** → **No**

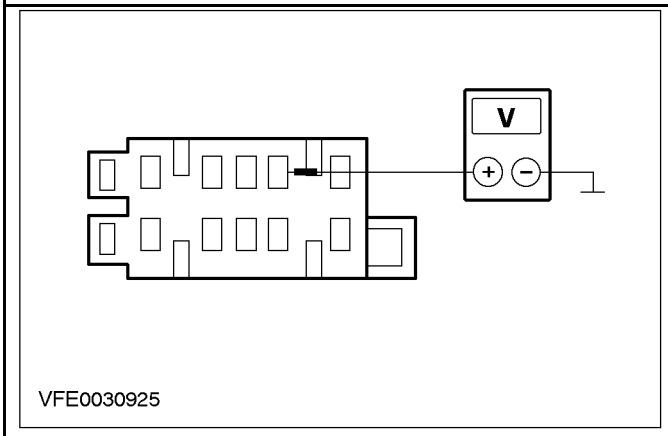
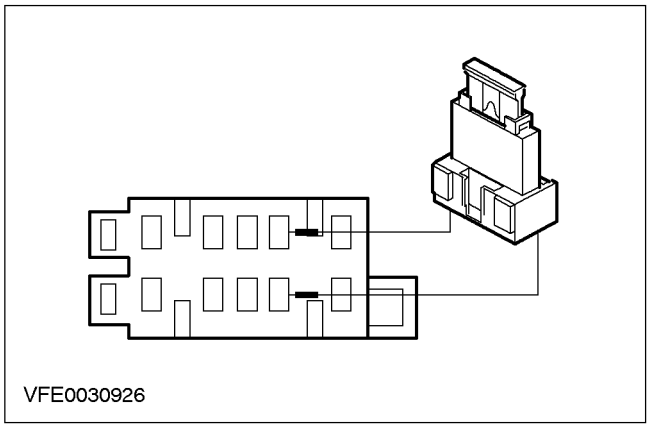
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR the open circuit between soldered connection S810 (fuse F74 (CJB)) and the trailer switch interface (SI) module with the aid of the Wiring Diagrams. CHECK that the system operates correctly.
Y8: CHECK THE GROUND CONNECTION OF THE TRAILER SWITCH INTERFACE (SI) MODULE	
 VFE0030924	1 Key in OFF position. 2 Measure the resistance between the trailer switch interface (SI) module, connector C2002, pin 3, circuit (BN), wiring harness side and ground. • Is the resistance less than 2 ohm? → **Yes** RENEW the trailer switch interface (SI) module. CHECK the operation of the system. → **No** REPAIR the open circuit between the trailer switch interface (SI) module and soldered connection S811 (ground connection G300) with the aid of the Wiring Diagrams. CHECK the operation of the system.
Y9: CHECK THE VOLTAGE AT THE TRAILER SOCKET WITH THE STOPLAMPS SWITCHED ON	
	1 Key in ON position. 2 Depress the BRAKE.

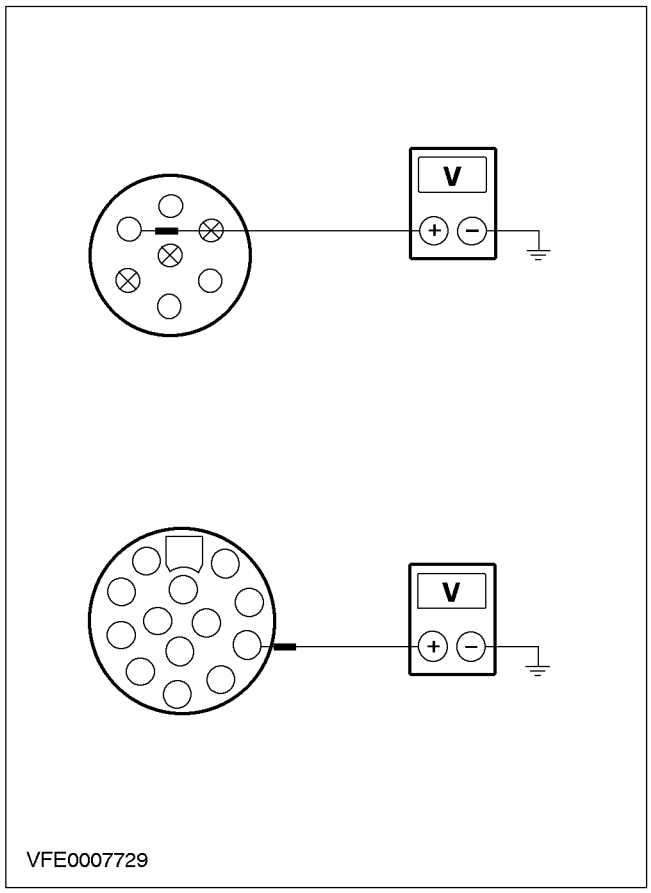
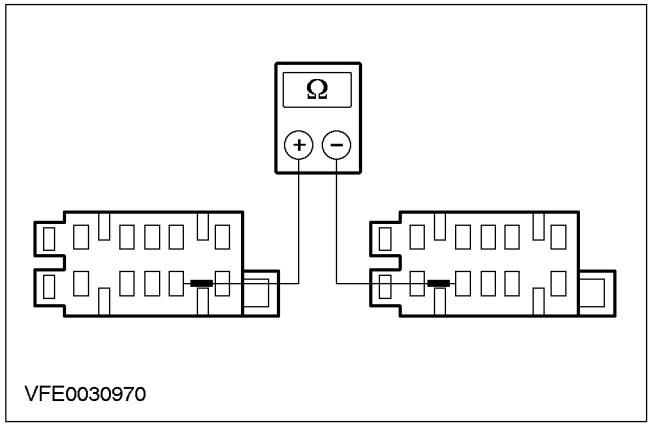
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0007729	**3** Measure the voltage between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 6, circuit (VT) and ground. • Is battery voltage displayed? → **Yes** Continue troubleshooting on the trailer. → **No** GO to **Y10**
Y10: CHECK THE VOLTAGE AT THE TRAILER INTERFACE (TI) MODULE WITH THE STOPLAMPS SWITCHED ON	
	1 Key in OFF position. **2** Disconnect Trailer interface (TI) module C2000. **3** Key in ON position. **4** Depress the BRAKE.

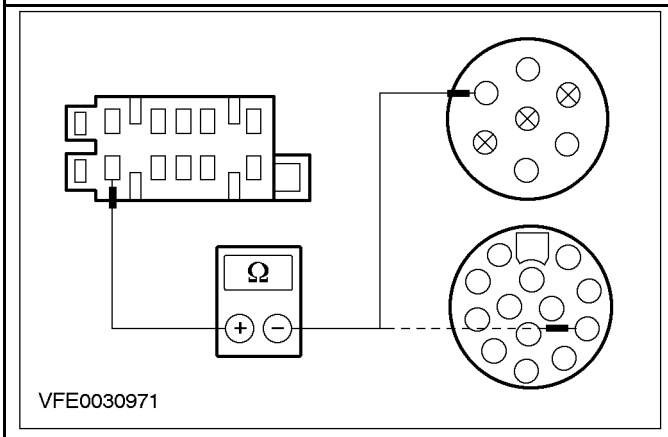
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0030925	**5** Measure the voltage between the trailer interface (TI) module, connector C2000, pin 7, circuit (BK/RD), wiring harness side and ground. • Is battery voltage displayed ? → **Yes** GO to **Y11** → **No** REPAIR the break in circuit (BK/RD) between connector C2004 and the trailer interface (TI) module with the aid of the Wiring Diagrams. CHECK that the system operates correctly.
Y11: CHECK THE TRAILER INTERFACE (TI) MODULE	
 VFE0030926	**1** Key in OFF position. **2** Use a fused test cable (10 A) to bridge the trailer interface (TI) module, connector C2000, pin 7, circuit (BK/RD) and pin 8, circuit (BK/YE), wiring harness side. **3** Key in ON position. **4** Depress the BRAKE.

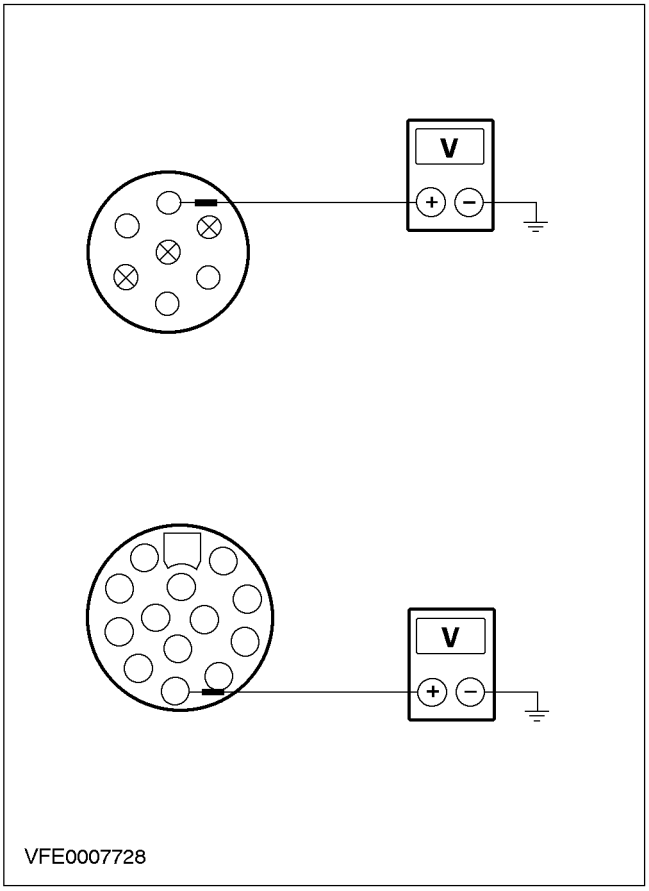
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0007729	**5** Measure the voltage between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 6, circuit (VT) and ground. • Is battery voltage displayed? → **Yes** RENEW the trailer interface (TI) module. CHECK the operation of the system. → **No** GO to **Y12**
Y12: CHECK THE CIRCUIT BETWEEN THE TRAILER INTERFACE (TI) MODULE AND THE TRAILER SWITCH INTERFACE (SI) MODULE	
 VFE0030970	**1** Key in OFF position. **2** Disconnect Trailer switch interface (SI) module C2002. **3** Measure the resistance between the trailer interface (TI) module, connector C2000, pin 8, circuit (BK/YE), wiring harness side and the trailer switch interface (SI) module, connector C2002, pin 4, circuit (BK/YE), wiring harness side.

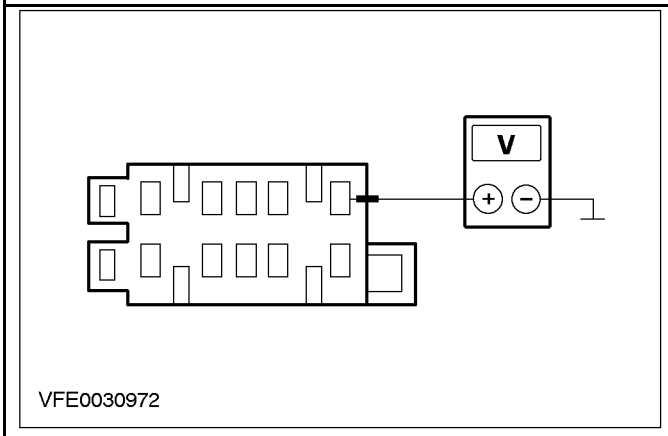
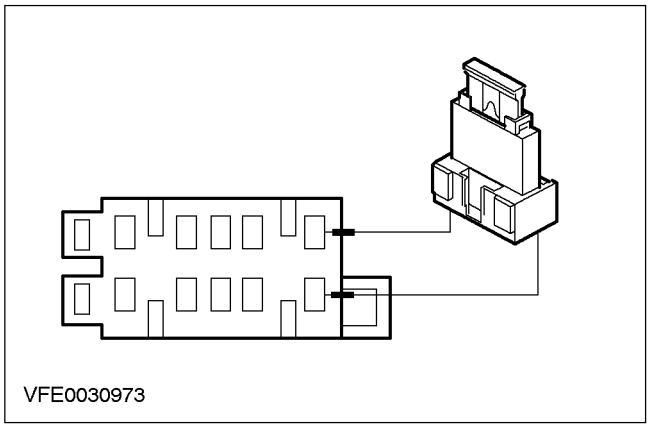
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is the resistance less than 2 ohm? → **Yes** GO to **Y13** → **No** REPAIR the break in circuit (BK/YE) between the trailer interface (TI) module and the trailer switch interface module (SI) with the aid of the Wiring Diagrams. CHECK the operation of the system.
Y13: CHECK THE CIRCUIT BETWEEN THE TRAILER SWITCH INTERFACE (SI) MODULE AND THE TRAILER SOCKET	
 VFE0030971	1 Measure the resistance between the trailer switch interface (SI) module, connector C2002, pin 2, circuit (VT), wiring harness side and the trailer socket C2010 or C2012, pin 6, circuit (VT). • Is the resistance less than 2 ohm? → **Yes** RENEW the trailer switch interface (SI) module. CHECK that the system operates correctly. → **No** REPAIR the break in circuit (VT) between the trailer switch interface (SI) module and the trailer socket with the aid of the Wiring Diagrams. CHECK the operation of the system.
Y14: CHECK THE VOLTAGE AT THE TRAILER SOCKET WITH THE BACKUP LAMPS SWITCHED ON	
	1 Key in ON position. 2 Engage reverse gear.

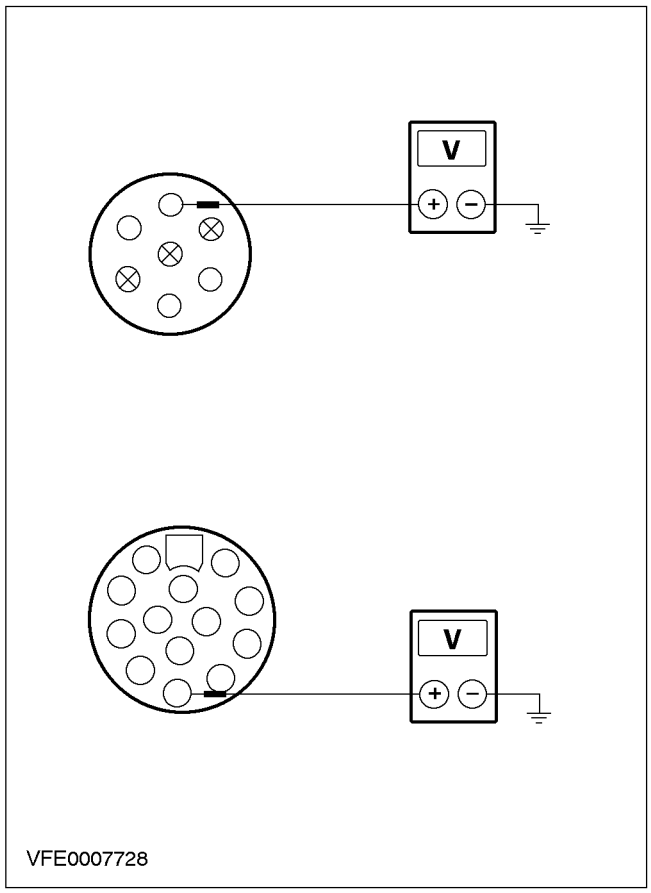
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0007728	**3** Measure the voltage between - 7-pin auxiliary trailer socket C2013, pin 1, circuit (VT/OG) and ground. - 13-pin trailer socket C2012, pin 8, circuit (VT/OG) and ground. • Is battery voltage displayed? → **Yes** Continue troubleshooting on the trailer. → **No** GO to **Y15**
Y15: CHECK THE VOLTAGE AT THE TRAILER INTERFACE (TI) MODULE WITH THE BACKUP LAMPS SWITCHED ON	
	1 Key in OFF position. **2** Disconnect Trailer interface (TI) module C2000. **3** Key in ON position. **4** Engage reverse gear.

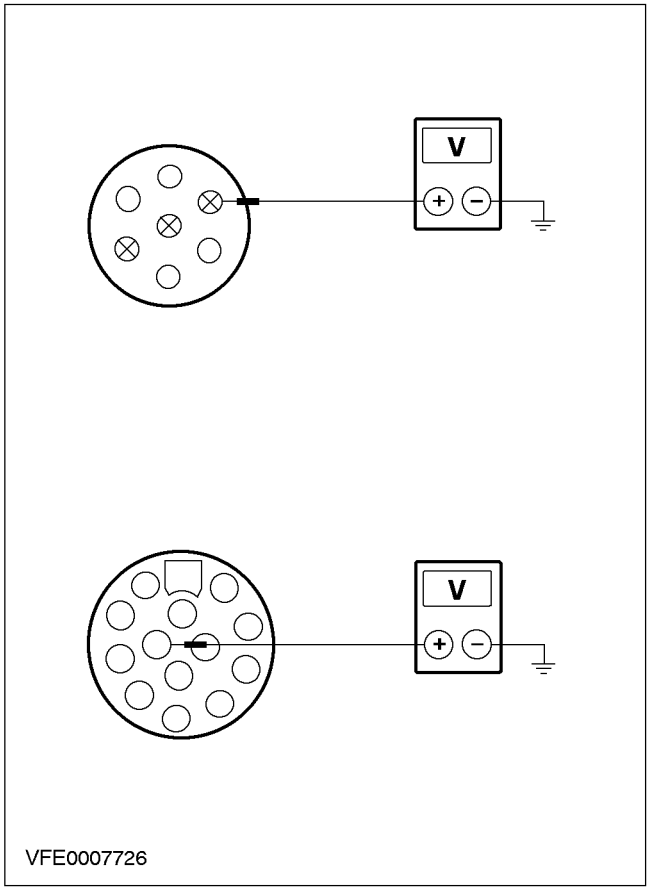
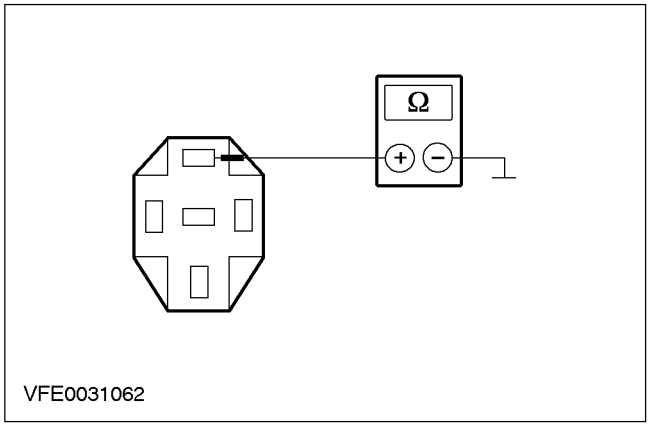
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0030972	**5** Measure the voltage between the trailer interface (TI) module, connector C2000, pin 9, circuit (BK), wiring harness side and ground. • Is battery voltage displayed? → **Yes** GO to **Y16** → **No** REPAIR the break in circuit (BK) between connector C2004 and the trailer interface (TI) module with the aid of the Wiring Diagrams. CHECK the operation of the system.
Y16: CHECK THE TRAILER INTERFACE (TI) MODULE	
 VFE0030973	**1** Key in OFF position. **2** Use a fused test cable (7.5 A) to bridge the trailer interface (TI) module, connector C2000, pin 9, circuit (BK) and pin 10, circuit (VT/OG), wiring harness side. **3** Key in ON position. **4** Engage reverse gear.

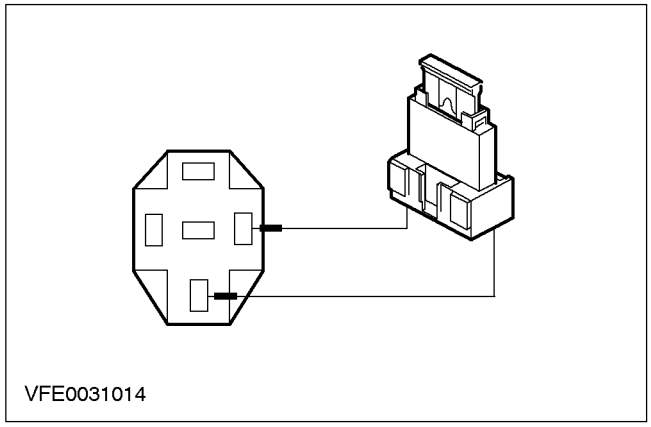
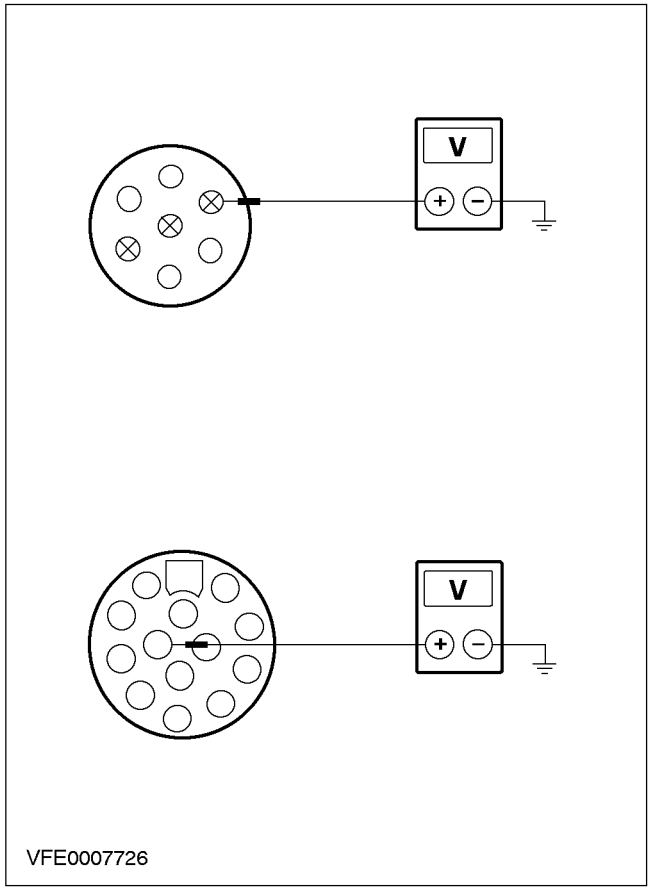
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0007728	**5** Measure the voltage between - 7-pin auxiliary trailer socket C2013, pin 1, circuit (VT/OG) and ground. - 13-pin trailer socket C2012, pin 8, circuit (VT/OG) and ground. • Is battery voltage displayed? → **Yes** RENEW the trailer interface (TI) module. CHECK that the system operates correctly. → **No** REPAIR the break in circuit (VT/OG) between the trailer interface (TI) module and the trailer socket with the aid of the Wiring Diagrams. CHECK that the system operates correctly.
Y17: CHECK THE VOLTAGE AT THE TRAILER SOCKET WITH THE REAR FOGLAMPS SWITCHED ON	
	1 Key in ON position. **2** Switch on the REAR FOG LAMPS.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0007726	**3** Measure the voltage between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 2, circuit (RD/YE) and ground. • Is battery voltage displayed? → **Yes** Continue troubleshooting on the trailer. → **No** GO to **Y18**
Y18: CHECK THE GROUND CONNECTION OF THE REAR FOG LAMP SHUT-OFF RELAY	
 VFE0031062	**1** Key in OFF position. **2** Disconnect Rear fog lamp shut-off relay C2008. **3** Measure the resistance between the rear fog lamp shut-off relay, connector C2008, circuit (BN), wiring harness side and ground. • Is the resistance less than 2 ohm? → **Yes**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	GO to **Y19** → **No** REPAIR the break in circuit (BN) between the rear fog lamp shut-off relay and soldered connection S811 (ground connection G300) with the aid of the Wiring Diagrams. CHECK the operation of the system.
Y19: CHECK THE REAR FOG LAMP SHUT-OFF RELAY	
 VFE0031014	**1** Use a fused test cable (15 A) to bridge the rear fog lamp shut-off relay, connector C2008, circuit (RD/WH) and circuit (RD/YE), wiring harness side.
 VFE0007726	**2** Key in ON position. **3** Switch on the REAR FOG LAMPS. **4** Measure the voltage between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 2, circuit (RD/YE) and ground. • Is battery voltage displayed?

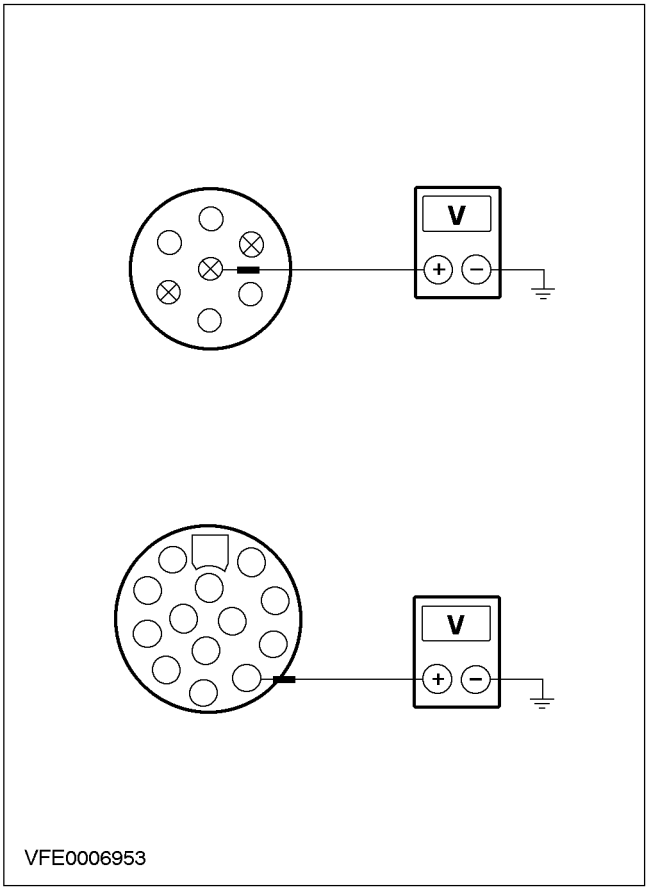
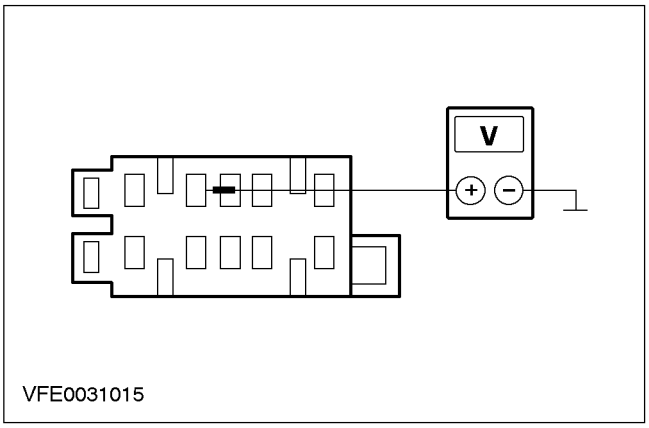
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** RENEW the rear fog lamp shut-off relay CHECK the operation of the system. → **No** REPAIR the break in circuit (RD/YE) between the rear fog lamp shut-off relay and the trailer socket with the aid of the Wiring Diagrams. CHECK the operation of the system.

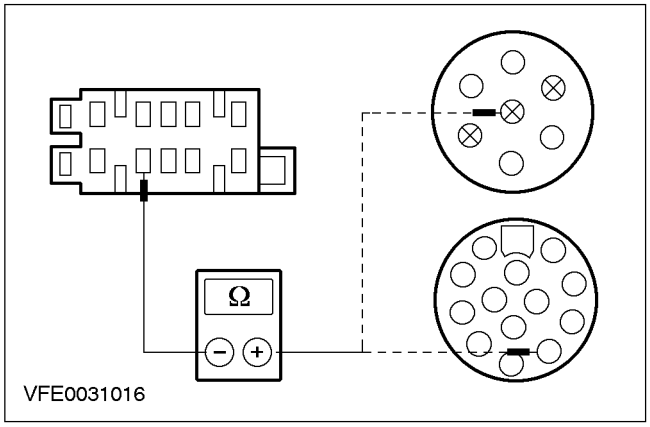
PINPOINT TEST Z: ONE INDIVIDUAL TRAILER LAMP INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
Z1: DETERMINE WHICH LAMP IS INOPERATIVE	
	1 Key in ON position. 2 Check the trailer lamps. • Is one of the rear lamps on the trailer inoperative? → **Yes** Left-hand rear trailer lamp inoperative: GO to **Z2** Right-hand rear trailer lamp inoperative: GO to **Z5** → **No** Trailer stoplamps inoperative: GO to **Y9** Trailer backup lamp(s) inoperative: GO to **Y14** Trailer rear fog lamp(s) inoperative: GO to **Y17** Left-hand trailer turn signal lamp inoperative: GO to **Z8** Right-hand trailer turn signal lamp inoperative: GO to **Z10**
Z2: CHECK THE VOLTAGE AT THE TRAILER SOCKET WITH THE SIDE LIGHTS SWITCHED ON	
	1 Switch on the side lights.

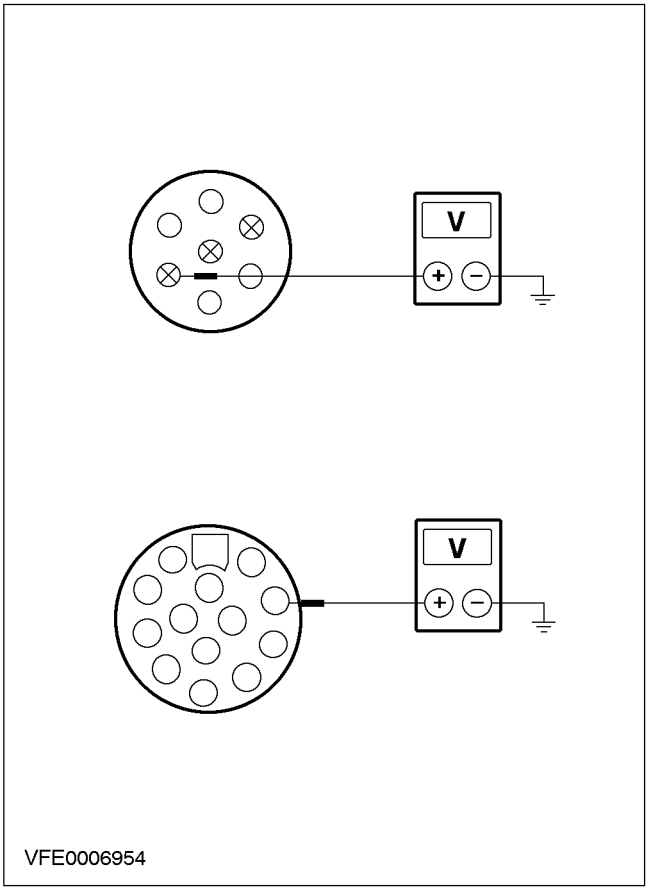
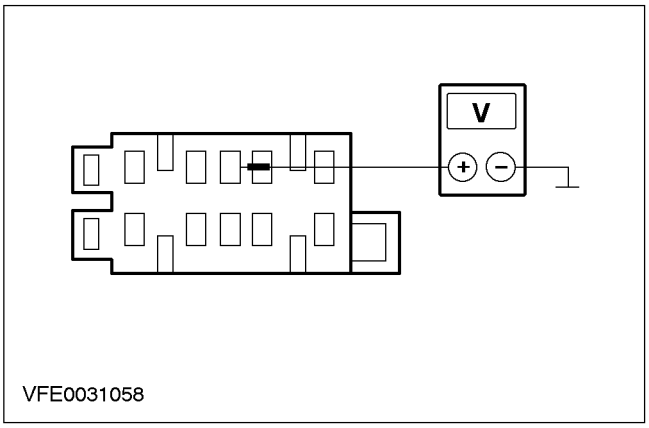
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0006953	**2** Measure the voltage between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 7, circuit (OG/WH) and ground. • Is battery voltage displayed? → **Yes** Continue troubleshooting on the trailer. → **No** GO to **Z3**
Z3: CHECK THE VOLTAGE AT THE TRAILER INTERFACE (TI) MODULE WITH THE SIDE LIGHTS SWITCHED ON	
 VFE0031015	**1** Key in OFF position. **2** Disconnect Trailer interface (TI) module C2000. **3** Key in ON position. **4** Measure the voltage between the trailer interface (TI) module, connector C2000, pin 3, circuit (GY/BK), wiring harness side and ground.

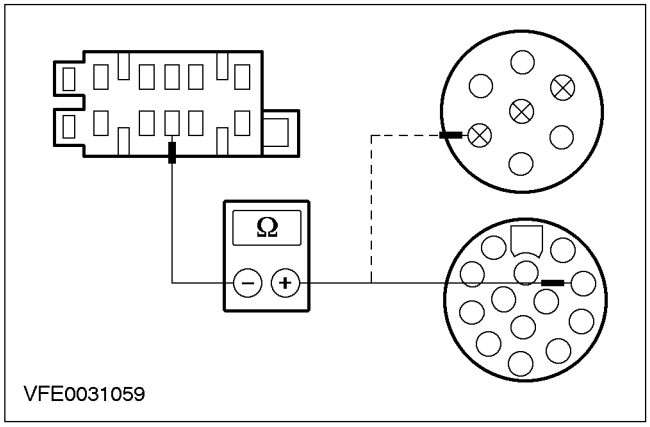
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is battery voltage displayed? → **Yes** GO to **Z4** → **No** REPAIR the break in circuit (GY/BK) between connector C2004 and the trailer interface (TI) module with the aid of the Wiring Diagrams. CHECK the operation of the system.
Z4: CHECK THE CIRCUIT BETWEEN THE TRAILER INTERFACE (TI) MODULE AND THE TRAILER SOCKET	
	1 Key in OFF position. 2 Measure the resistance between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 7, circuit (OG/WH) and the trailer interface (TI) module, connector C2000, pin 4, circuit (OG/WH), wiring harness side. • Is the resistance less than 2 ohm? → **Yes** RENEW the trailer interface (TI) module. CHECK the operation of the system. → **No** REPAIR the break in circuit (OG/WH) between the trailer interface (TI) module and the trailer socket with the aid of the Wiring Diagrams. CHECK the operation of the system.
Z5: CHECK THE VOLTAGE AT THE TRAILER SOCKET WITH THE SIDE LIGHTS SWITCHED ON	
	1 Switch on the side lights.

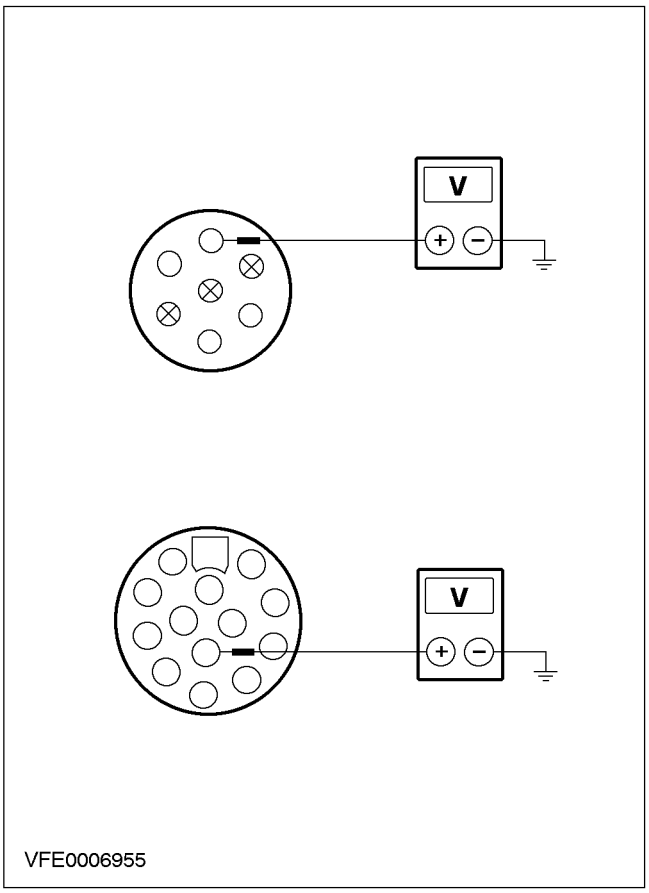
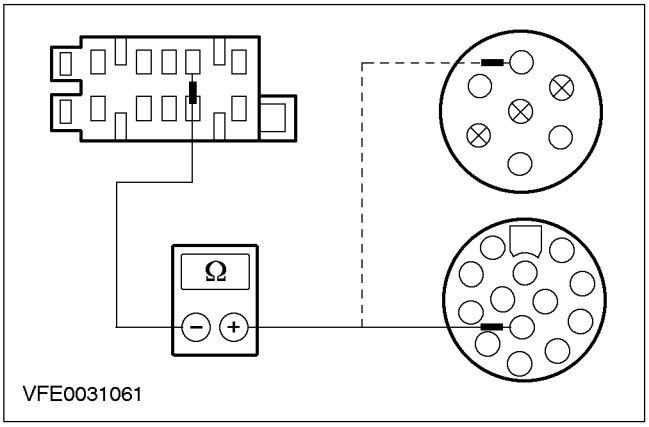
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0006954	**2** Measure the voltage between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 5, circuit (OG) and ground. • Is battery voltage displayed? → **Yes** Continue troubleshooting on the trailer. → **No** GO to **Z6**
Z6: CHECK THE VOLTAGE AT THE TRAILER INTERFACE (TI) MODULE WITH THE SIDE LIGHTS SWITCHED ON	
 VFE0031058	**1** Key in OFF position. **2** Disconnect Trailer interface (TI) module C2000. **3** Key in ON position. **4** Measure the voltage between the trailer interface (TI) module, connector C2000, pin 5, circuit (GY/RD), wiring harness side and ground.

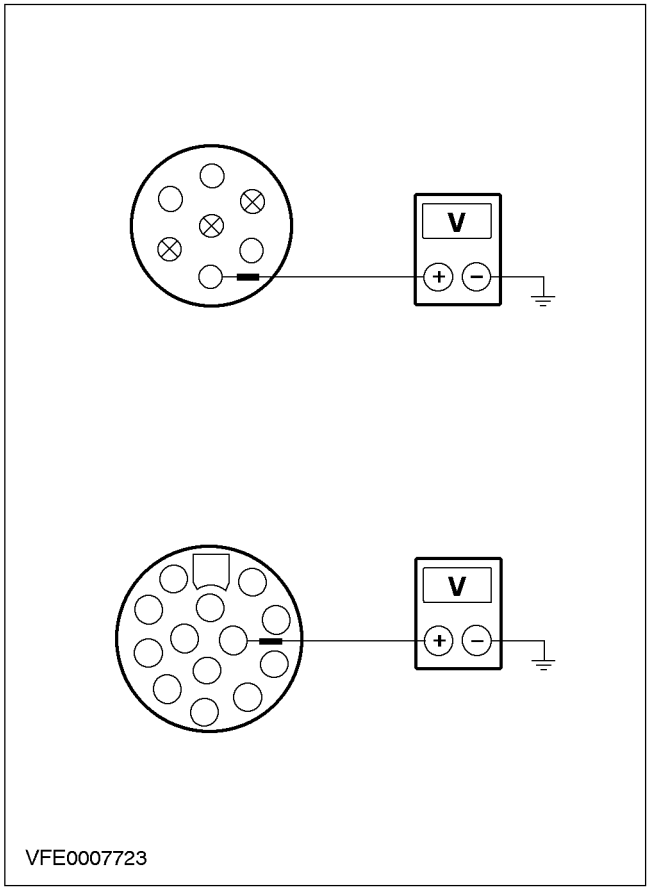
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is battery voltage displayed? → **Yes** GO to **Z7** → **No** REPAIR the break in circuit (GY/RD) between connector C2004 and the trailer interface (TI) module with the aid of the Wiring Diagrams. CHECK the operation of the system.
Z7: CHECK THE CIRCUIT BETWEEN THE TRAILER INTERFACE (TI) MODULE AND THE TRAILER SOCKET	
	**1** Key in OFF position. **2** Measure the resistance between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 5, circuit (OG) and the trailer interface (TI) module, connector C2000, pin 6, circuit (OG), wiring harness side. • Is the resistance less than 2 ohm? → **Yes** RENEW the trailer interface (TI) module. CHECK the operation of the system. → **No** REPAIR the break in circuit (OG) between the trailer interface (TI) module and the trailer socket with the aid of the Wiring Diagrams. CHECK the operation of the system.
Z8: CHECK THE VOLTAGE AT THE TRAILER SOCKET WITH THE LEFT-HAND TURN SIGNAL SWITCHED ON	
	1 Key in ON position. **2** Switch on the LEFT-HAND TURN SIGNAL.

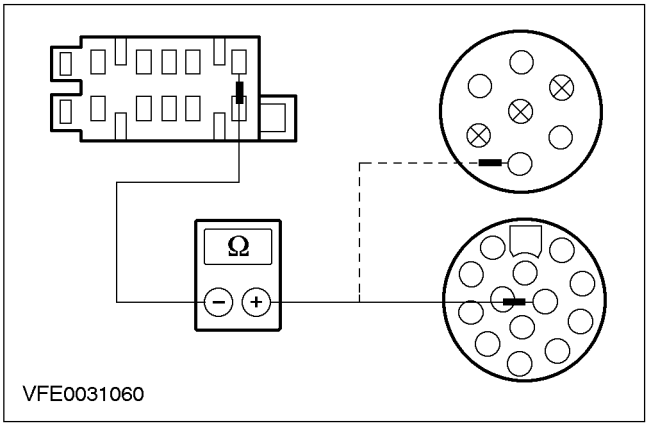
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0006955	**3** Measure the voltage between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 1, circuit (BU) and ground. • Does the voltage alternate between 0 V and battery voltage? → **Yes** Continue troubleshooting on the trailer. → **No** GO to **Z9**
Z9: CHECK THE CIRCUIT BETWEEN THE TRAILER SWITCH INTERFACE (SI) MODULE AND THE TRAILER SOCKET	
 VFE0031061	**1** Key in OFF position. **2** Disconnect Trailer switch interface (SI) module C2002. **3** Measure the resistance between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 1, circuit (BU) and the trailer switch interface (SI) module, connector C2002, pin 7, circuit (BU), wiring harness side.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is the resistance less than 2 ohm? → **Yes** RENEW the trailer switch interface (SI) module. CHECK the operation of the system. → **No** REPAIR the break in circuit (BU) between the trailer switch interface (SI) module and the trailer socket with the aid of the Wiring Diagrams. CHECK the operation of the system.
Z10: CHECK THE VOLTAGE AT THE TRAILER SOCKET WITH THE RIGHT-HAND TURN SIGNAL SWITCHED ON	
	1 Key in ON position. 2 Switch on the RIGHT-HAND TURN SIGNAL. 3 Measure the voltage between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 4, circuit (BU/RD) and ground. • Does the voltage alternate between 0 V and battery voltage? → **Yes** Continue troubleshooting on the trailer. → **No** GO to **Z11**
Z11: CHECK THE CIRCUIT BETWEEN THE TRAILER SWITCH INTERFACE (SI) MODULE AND THE TRAILER SOCKET	
	1 Key in OFF position.

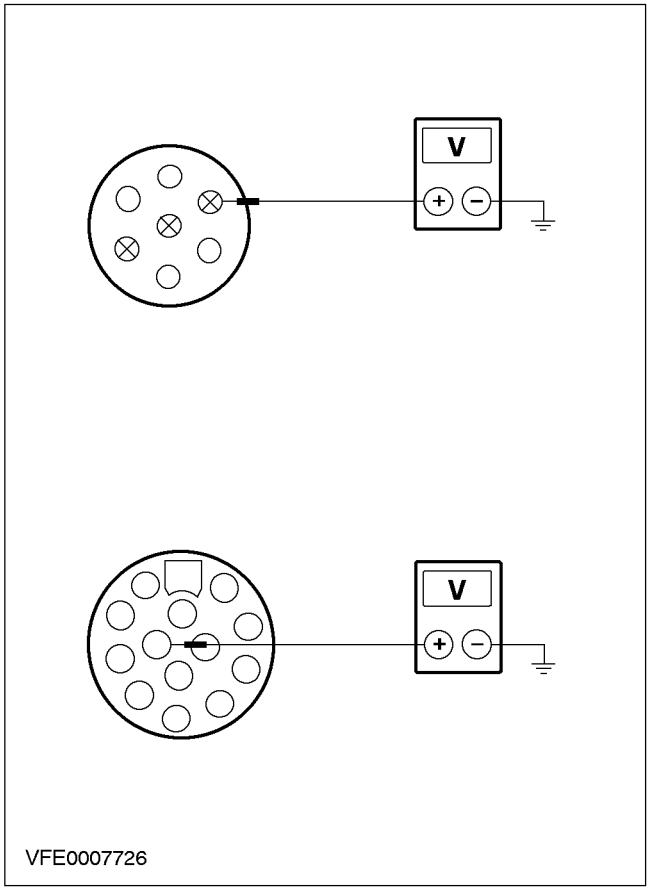
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	2 Disconnect Trailer switch interface (SI) module C2002. 3 Measure the resistance between the trailer socket C2010 (9-pin socket) or C2012 (13-pin socket), pin 4, circuit (BU/RD) and the trailer switch interface (SI) module, connector C2002, pin 9, circuit (BU/RD), wiring harness side. • Is the resistance less than 2 ohm? → **Yes** RENEW the trailer switch interface (SI) module. CHECK the operation of the system. → **No** REPAIR the break in circuit (BU/RD) between the trailer switch interface (SI) module and the trailer socket with the aid of the Wiring Diagrams. CHECK the operation of the system.

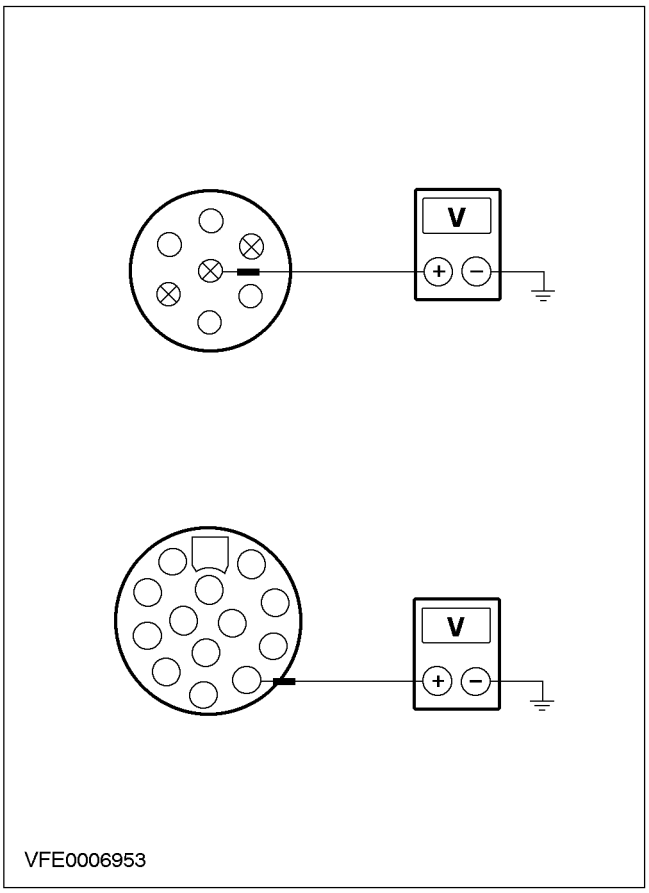
PINPOINT TEST AA: TRAILER LAMPS PERMANENTLY ON

CONDITIONS	DETAILS/RESULTS/ACTIONS
AA1: CHECK THE FAULT SYMPTOMS	
	1 Key in ON position. 2 Check the trailer lamps. • Is/are the rear fog lamp(s) on the trailer permanently on? → **Yes** GO to **AA2** → **No** Rear trailer lamp(s) permanently on: GO to **AA3** Trailer stoplamps permanently on: GO to **AA7** Trailer backup lamps permanently on: GO to **AA11** Trailer turn signal lamp(s) permanently on: GO to **AA13**

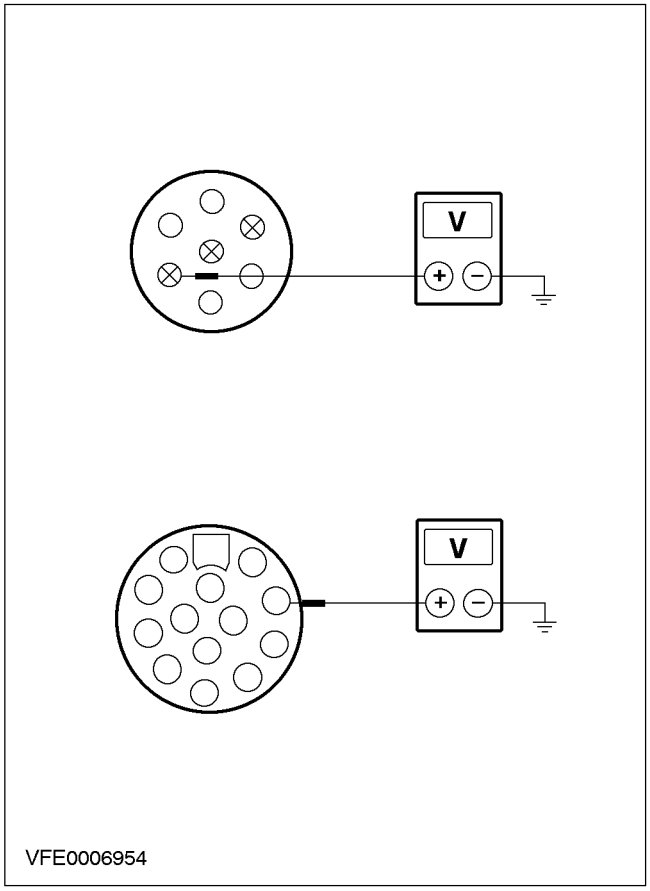
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
AA2: CHECK FOR SHORT TO BATTERY VOLTAGE AT THE TRAILER SOCKET (REAR FOG LAMP)	
 VFE0007726	**1** Measure the voltage between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 2, circuit (RD/YE) and ground. • Is battery voltage displayed? → **Yes** LOCATE and RECTIFY the short to battery voltage in the circuit (RD/YE) between the rear fog lamp shut-off relay and the trailer socket with the aid of the Wiring Diagrams, and RENEW the trailer socket as required. CHECK the operation of the system. → **No** Continue troubleshooting on the trailer.

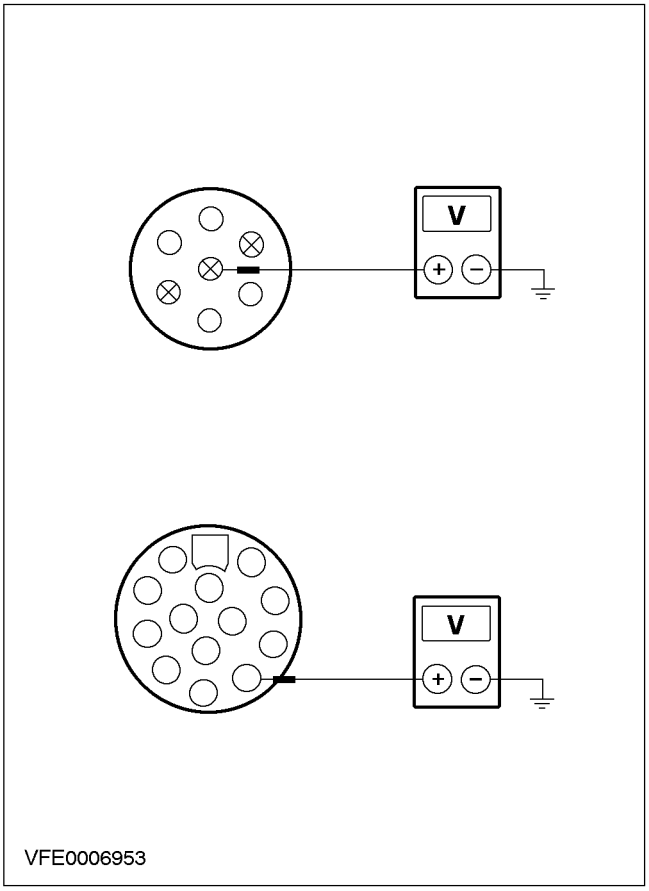
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
AA3: CHECK FOR A SHORT TO BATTERY VOLTAGE ON THE VEHICLE (LEFT-HAND REAR LAMP)	
 VFE0006953	**1** Measure the voltage between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 7, circuit (OG/WH) and ground. • Is battery voltage displayed? → **Yes** GO to **AA5** → **No** GO to **AA4**

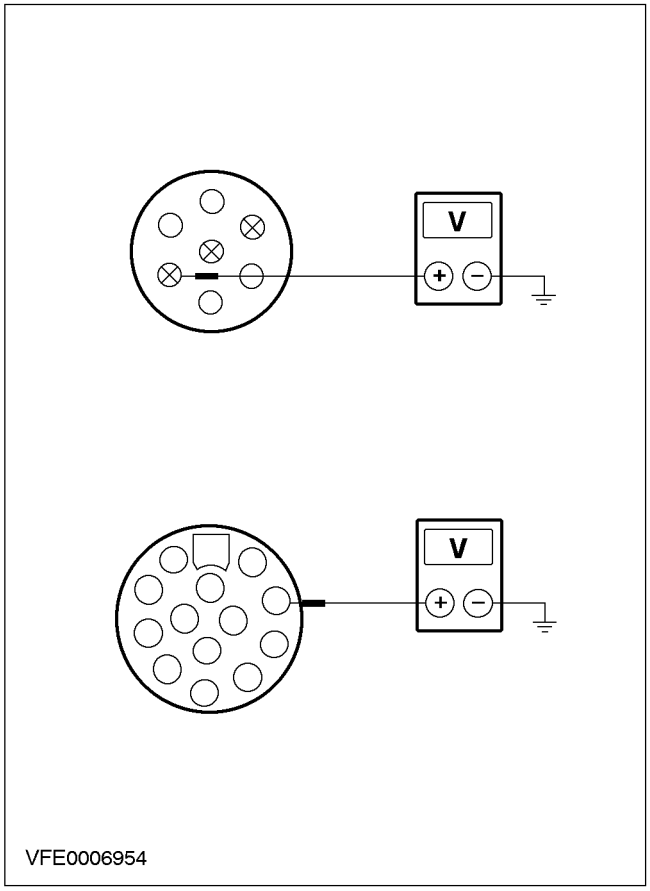
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
AA4: CHECK FOR A SHORT TO BATTERY VOLTAGE ON THE VEHICLE (RIGHT-HAND REAR LAMP)	
 VFE0006954	1 Measure the voltage between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 5, circuit (OG) and ground. • Is battery voltage displayed? → **Yes** GO to **AA6** → **No** Continue troubleshooting on the trailer.
AA5: CHECK THE TRAILER INTERFACE (TI) MODULE	
	1 Key in OFF position. 2 Disconnect Fuse F74 (CJB). 3 Key in ON position.

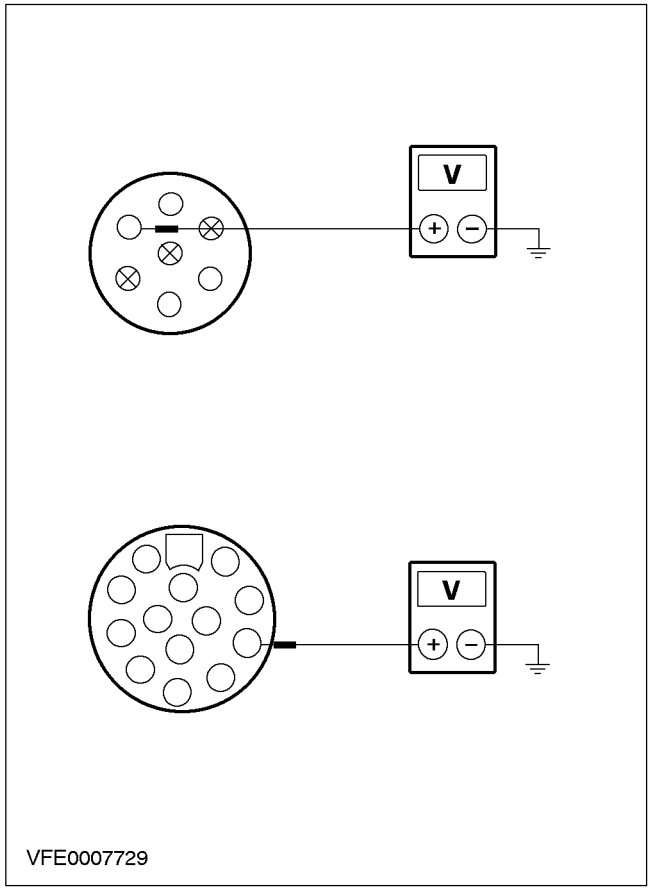
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0006953	**4** Measure the voltage between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 7, circuit (OG/WH) and ground. • Is battery voltage displayed in one of the measurements? → **Yes** LOCATE and RECTIFY the short to battery voltage in the circuit (OG/WH) between the trailer interface (TI) module and the trailer socket with the aid of the Wiring Diagrams, and RENEW the trailer socket as required. CHECK the operation of the system. → **No** RENEW the trailer interface (TI) module. CHECK the operation of the system.
AA6: CHECK THE TRAILER INTERFACE (TI) MODULE	
	1 Key in OFF position. **2** Disconnect Fuse F74 (CJB). **3** Key in ON position.

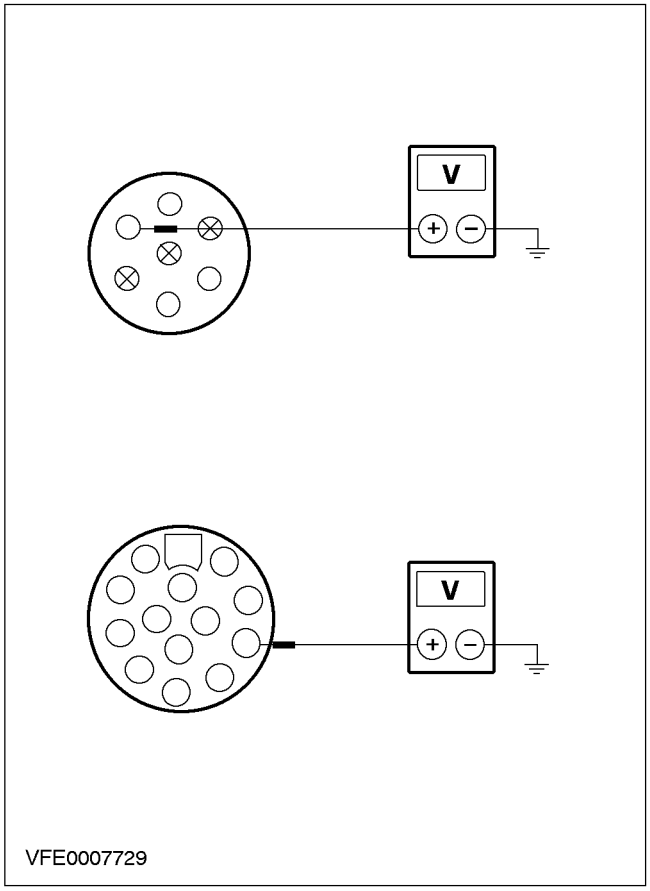
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0006954	**4** Measure the voltage between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 5, circuit (OG) and ground. • Is battery voltage displayed in one of the measurements? → **Yes** LOCATE and RECTIFY the short to battery voltage in the circuit (OG) between the trailer interface (TI) module and the trailer socket with the aid of the Wiring Diagrams, and RENEW the trailer socket as required. CHECK the operation of the system. → **No** RENEW the trailer interface (TI) module. CHECK the operation of the system.

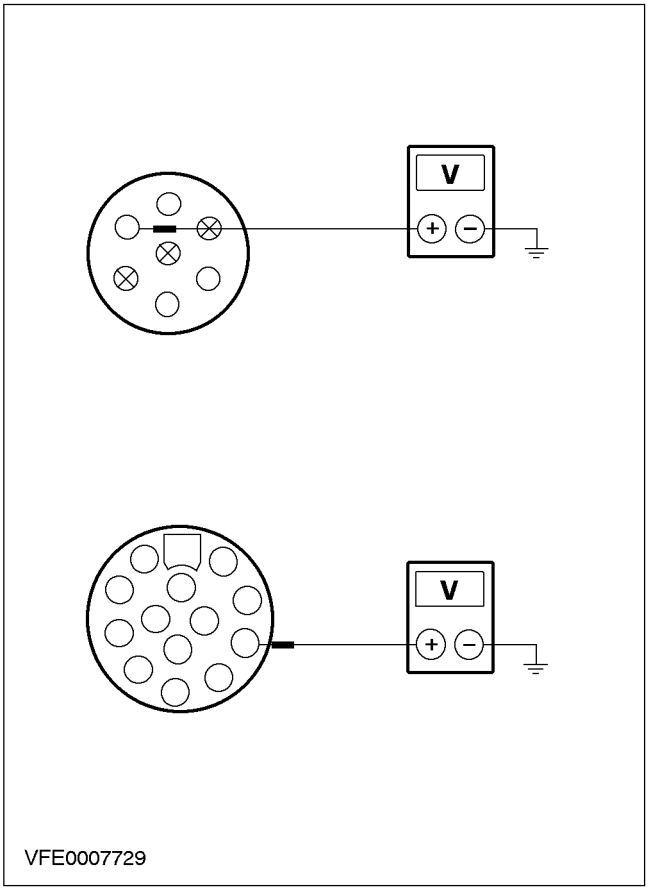
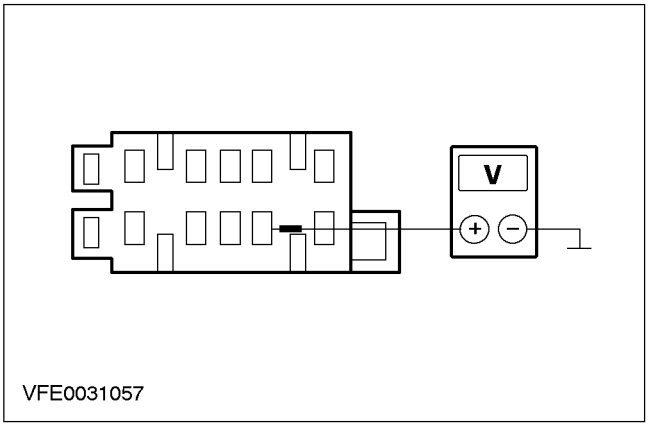
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
AA7: CHECK FOR A SHORT TO BATTERY VOLTAGE ON THE VEHICLE (STOPLAMPS)	
 VFE0007729	1 Measure the voltage between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 6, circuit (VT) and ground. • Is battery voltage displayed? → **Yes** GO to **AA8** → **No** Continue troubleshooting on the trailer.
AA8: NARROW DOWN THE LOCATION OF THE SHORT TO BATTERY VOLTAGE	
	1 Key in OFF position. 2 Disconnect Fuse F74 (CJB). 3 Key in ON position.

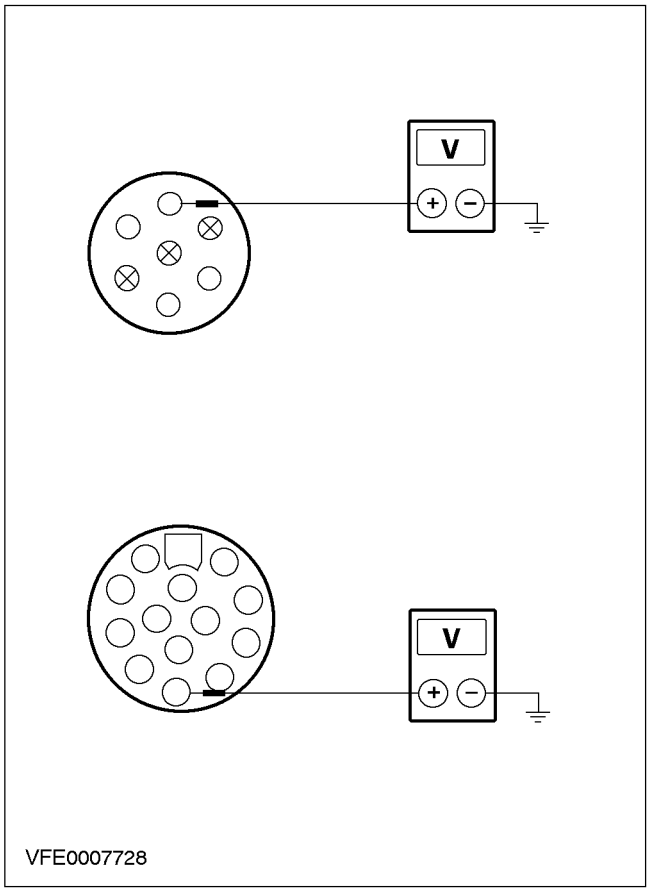
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**4** Measure the voltage between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 6, circuit (VT) and ground. • Is battery voltage displayed? → **Yes** LOCATE and RECTIFY the short to battery voltage in the circuit (VT) between the trailer switch interface (SI) module and the trailer socket with the aid of the Wiring Diagrams, and RENEW the trailer socket as required. CHECK the operation of the system. → **No** GO to **AA9**
AA9: CHECK THE TRAILER INTERFACE (TI) MODULE	
	1 Key in OFF position. **2** Disconnect Trailer interface (TI) module C2000. **3** Connect Fuse F74 (CJB). **4** Key in ON position.

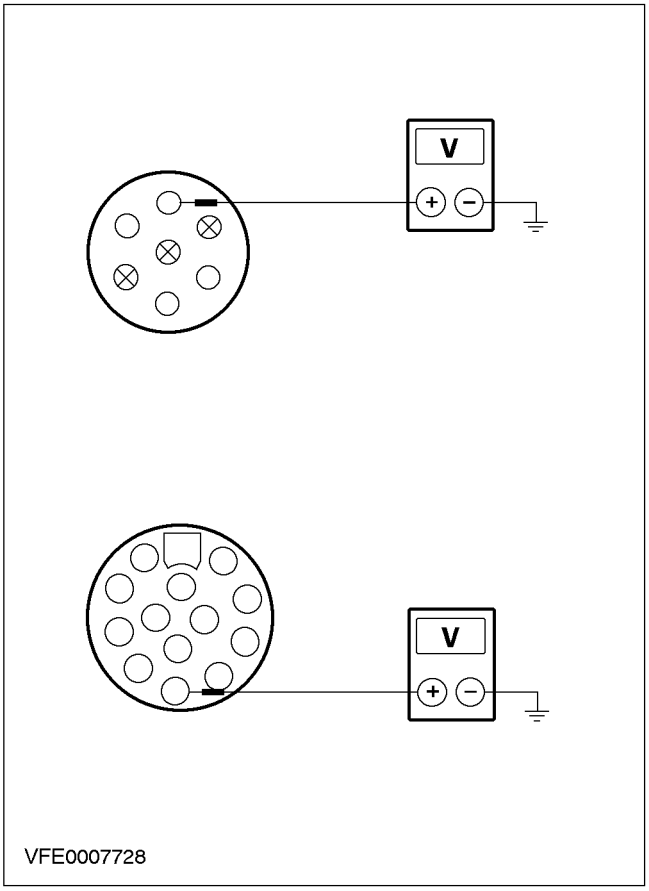
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0007729	**5** Measure the voltage between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 6, circuit (VT) and ground. • Is battery voltage displayed? → **Yes** GO to **AA10** → **No** RENEW the trailer interface (TI) module. CHECK the operation of the system.
AA10: CHECK THE CIRCUIT BETWEEN THE TRAILER INTERFACE (TI) MODULE AND THE TRAILER SWITCH INTERFACE (SI) MODULE	
 VFE0031057	**1** Measure the voltage between the trailer interface (TI) module, connector C2000, pin 8, circuit (BK/YE), wiring harness side and ground. • Is battery voltage displayed? → **Yes**

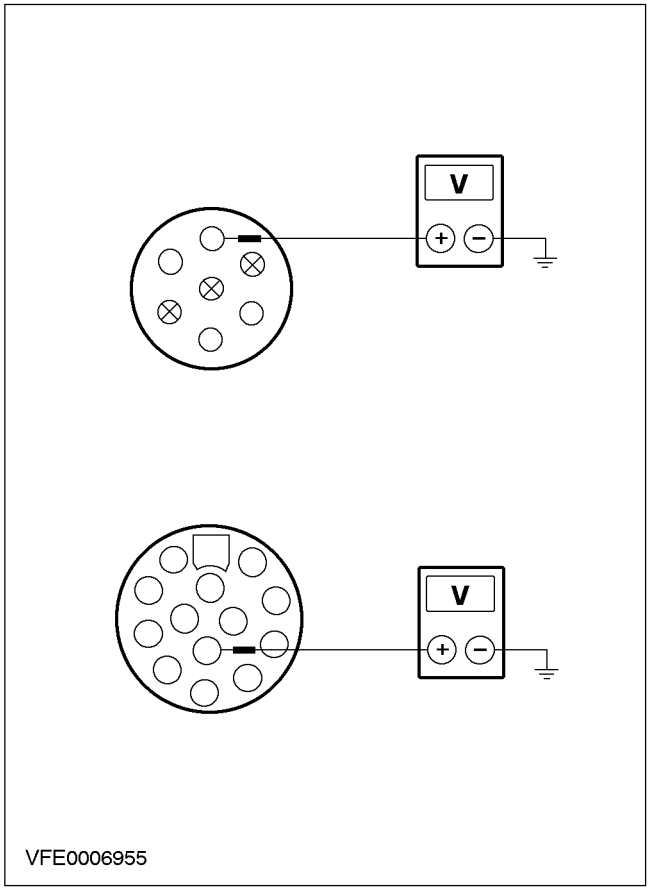
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	LOCATE and RECTIFY the short to battery voltage in circuit (BK/YE) between the trailer interface (TI) module and the trailer switch interface module (SI) with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** RENEW the trailer switch interface (SI) module. CHECK the operation of the system.
AA11: CHECK FOR A SHORT TO BATTERY VOLTAGE ON THE VEHICLE (BACKUP LAMP(S))	
	**1** Measure the voltage between - 7-pin auxiliary trailer socket C2013, pin 1, circuit (VT/OG) and ground. - 13-pin trailer socket C2012, pin 8, circuit (VT/OG) and ground. • Is battery voltage displayed? → **Yes** GO to **AA12** → **No** Continue troubleshooting on the trailer.
AA12: CHECK THE TRAILER INTERFACE (TI) MODULE	
	1 Key in OFF position. **2** Disconnect Fuse F74 (CJB). **3** Key in ON position.

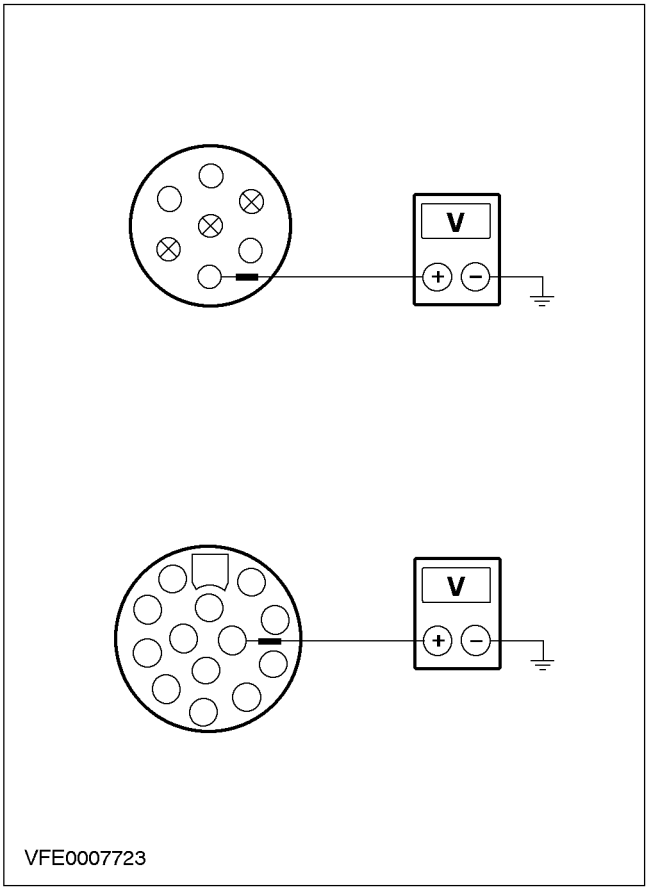
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0007728	**4** Measure the voltage between - 7-pin auxiliary trailer socket C2013, pin 1, circuit (VT/OG) and ground. - 13-pin trailer socket C2012, pin 8, circuit (VT/OG) and ground. • Is battery voltage displayed? → **Yes** LOCATE and RECTIFY the short to battery voltage in the circuit (VT/OG) between the trailer interface (TI) module and the trailer socket with the aid of the Wiring Diagrams, and RENEW the trailer socket as required. CHECK that the system operates correctly. → **No** RENEW the trailer interface (TI) module. CHECK the operation of the system.

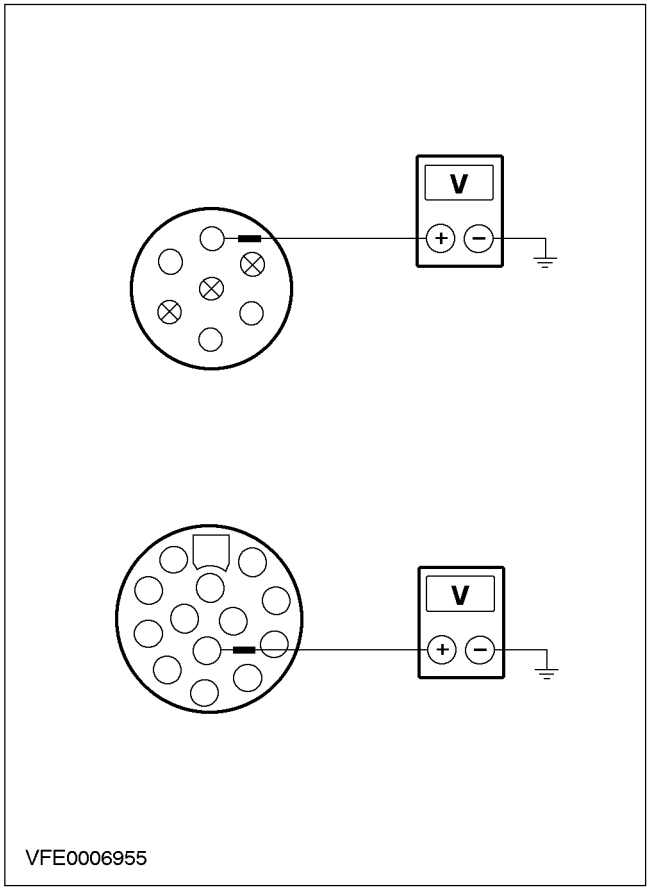
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
AA13: CHECK FOR A SHORT TO BATTERY VOLTAGE ON THE VEHICLE (LEFT-HAND TURN SIGNAL LAMP)	
 VFE0006955	**1** Measure the voltage between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 1, circuit (BU) and ground. • Is battery voltage displayed ? → **Yes** GO to **AA15** → **No** GO to **AA14**

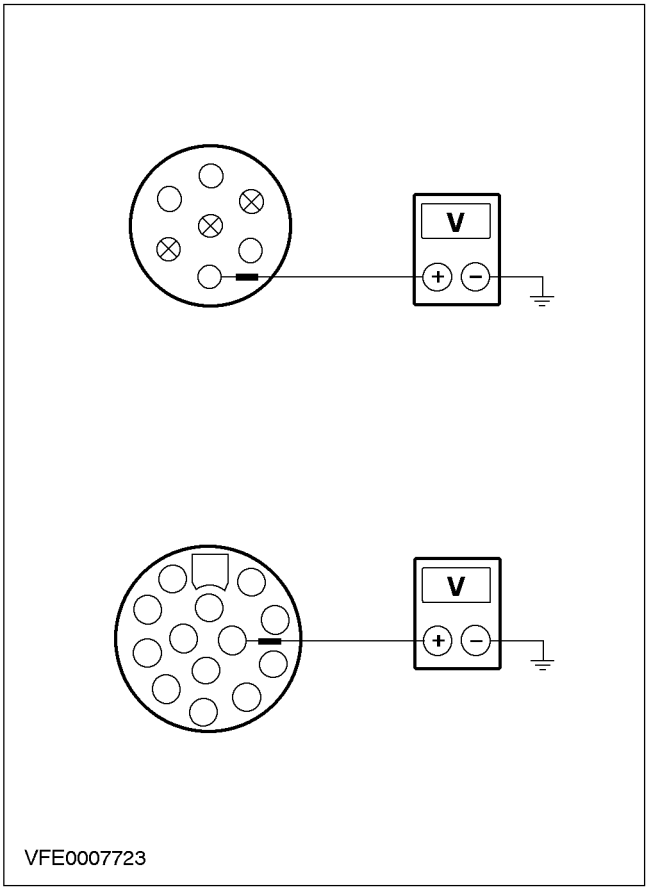
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
AA14: CHECK FOR A SHORT TO BATTERY VOLTAGE ON THE VEHICLE (RIGHT-HAND TURN SIGNAL LAMP)	
 VFE0007723	**1** Measure the voltage between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 4, circuit (BU/RD) and ground. • Is battery voltage displayed? → **Yes** GO to **AA16** → **No** Continue troubleshooting on the trailer.
AA15: CHECK THE TRAILER SWITCH INTERFACE (SI) MODULE	
	1 Key in OFF position. **2** Disconnect Fuse F74 (CJB). **3** Key in ON position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0006955	**4** Measure the voltage between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 1, circuit (BU) and ground. • Is battery voltage displayed? → **Yes** LOCATE and RECTIFY the short to battery voltage in the circuit (BU) between the trailer switch interface (SI) module and the trailer socket with the aid of the Wiring Diagrams, and RENEW the trailer socket as required. CHECK the operation of the system. → **No** RENEW the trailer switch interface (SI) module. CHECK the operation of the system.
AA16: CHECK THE TRAILER SWITCH INTERFACE (SI) MODULE	
	1 Key in OFF position. **2** Disconnect Fuse F74 (CJB). **3** Key in ON position.

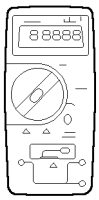
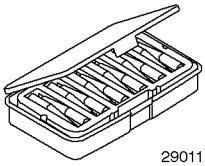
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0007723	**4** Measure the voltage between the trailer socket C2010 (7-pin socket) or C2012 (13-pin socket), pin 4, circuit (BU/RD) and ground. • Is battery voltage displayed? → **Yes** LOCATE and RECTIFY the short to battery voltage in the circuit (BU/RD) between the trailer switch interface (SI) module and the trailer socket with the aid of the Wiring Diagrams, and RENEW the trailer socket as required. CHECK the operation of the system. → **No** RENEW the trailer switch interface (SI) module. CHECK the operation of the system.

DIAGNOSIS AND TESTING

Headlamp Leveling

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Special Tool(s)	
 ST1137-A	Digital multimeter 105-R0051 or a comparable device
 29011A	Terminal probe kit 29-011 A

Diagnosis and testing

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electricaldamage.

Visual inspection

Electrical
• Fuse(s). • Wiring harness. • Electrical connector(s). • Switch(es). • Sensors • Headlamps

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

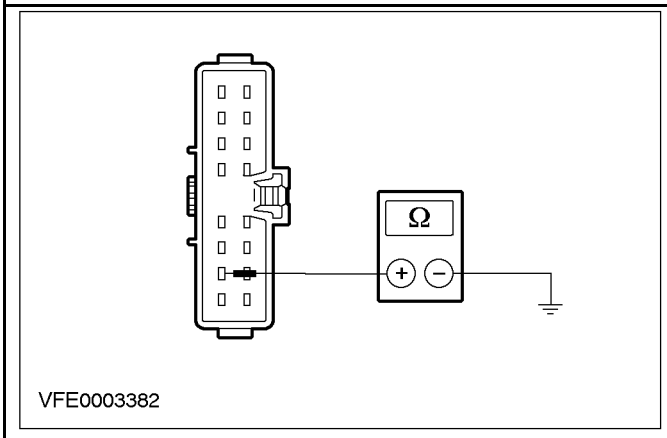
Condition	Possible Sources	Action
•Headlamp levelling system inoperative / not functioning properly, conventional headlamps	•Fuse(s). •Circuit(s). •Light switch •Headlamp levelling switch. •Headlamp levelling motor.	• GO to Pinpoint Test AB
•Headlamp levelling system inoperative / not functioning properly, Xenon headlamps	•Fuse(s). •Circuit(s). •Headlamp levelling motor. •Headlamp levelling sensor •Headlamps	• GO to Pinpoint Test AC

Pinpoint Tests

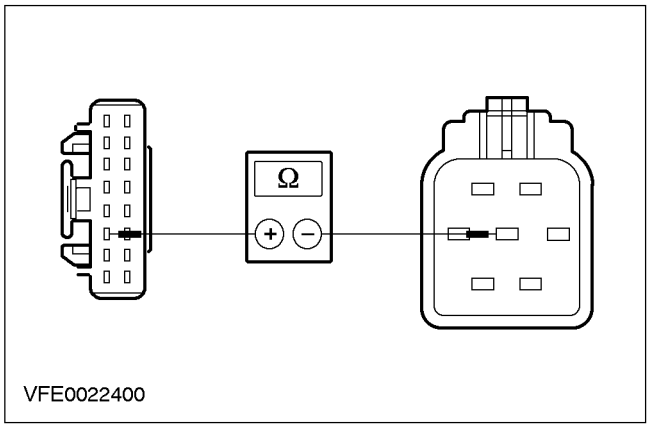
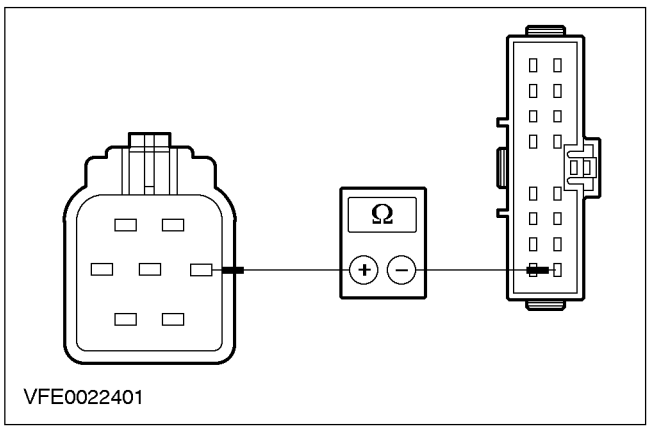
PINPOINT TEST AB: HEADLAMP LEVELLING SYSTEM INOPERATIVE / NOT FUNCTIONING PROPERLY, CONVENTIONAL HEADLAMPS

CONDITIONS	DETAILS/RESULTS/ACTIONS
AB1: CHECK THE HEADLAMP LEVELLING SWITCH	
	1 Key in ON position. 2 Switch on the dipped beam. 3 Move the headlamp levelling switch from position "4" to "1". 4 Check the adjustment of the headlamps.

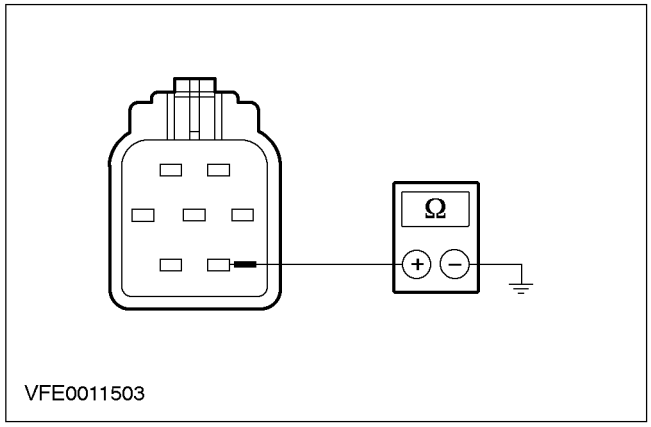
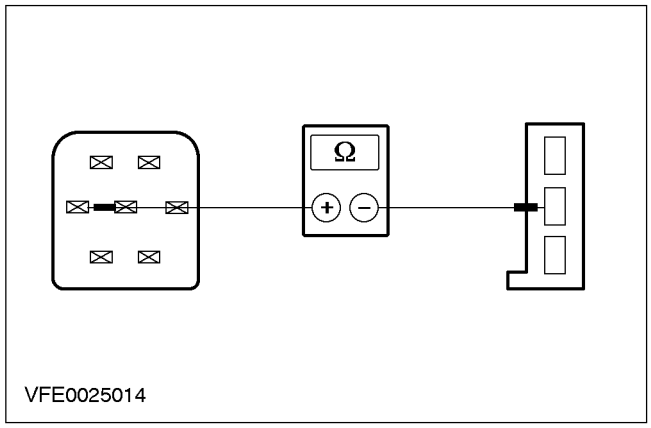
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is the headlamp levelling system inoperative on both headlamps? → **Yes** GO to **AB2** → **No** Left-hand side is inoperative: GO to **AB4** Right-hand side is inoperative: GO to **AB9**
AB2: CHECK THE LIGHT SWITCH.	
	1 Key in OFF position. 2 Disconnect Light switch (C478). 3 Check the light switch in accordance with the Component Checks in the Wiring Diagrams. • Is the light switch OK? → **Yes** GO to **AB3** → **No** RENEW the light switch. CHECK the operation of the system.
AB3: CHECK CIRCUIT 31-LE29 (BK)	
 VFE0003382	1 Measure the resistance between the light switch, connector C478, pin 10, circuit 31-LE29 (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** REPAIR circuit 64-LE45 (BU) between the light switch and the headlamp with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** REPAIR circuit 31-LE29 (BK) between the light switch and ground connection G204 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AB4: CHECK FUSE F64 (CJB)	
	1 Key in OFF position. 2 CHECK Fuse F64 (CJB). 3 Check fuse F64 (7.5 A) • Is the fuse OK?

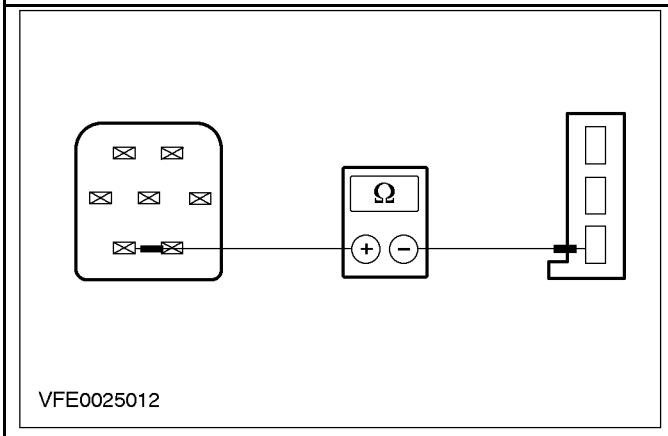
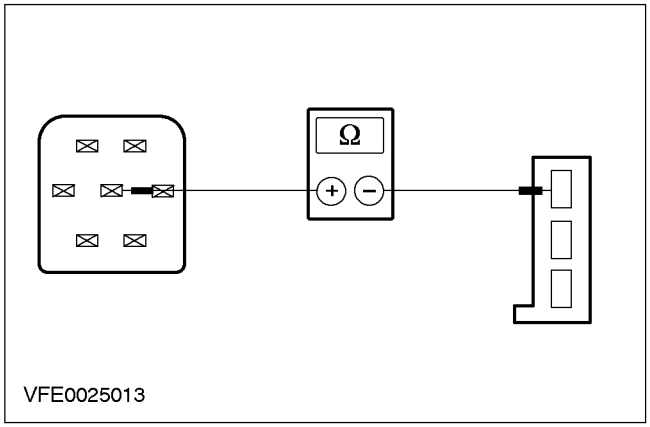
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** GO to **AB5** → **No** INSTALL a new fuse F64 (7.5 A). If the fuse blows again, LOCATE and RECTIFY the short circuit with the aid of the Wiring Diagrams. CHECK the operation of the system.
AB5: CHECK CIRCUIT 29S-LF7 (OG/BU)	
 VFE0022400	1 Connect Fuse F64 (CJB). 2 Disconnect Left-hand headlamp C146. 3 Disconnect CJB C509. 4 Measure the resistance between CJB, connector C509, pin 6, circuit 29S-LF7(OG/BU), harness side and left-hand headlamp, connector C146, pin 4, circuit 29S-LF7(OG/BU), harness side. • Is the resistance less than 2 ohms? → **Yes** GO to **AB6** → **No** REPAIR circuit 29S-LF7 (OG/BU) between fuse F64 and the left-hand headlamp with the aid of the Wiring Diagrams. CHECK the operation of the system.
AB6: CHECK CIRCUIT 64-LE45 (BU)	
 VFE0022401	1 Disconnect Light switch (C478). 2 Measure the resistance between the left-hand headlamp, connector C146, pin 5, circuit 64-LE45 (BU), wiring harness side and the light switch, connector C478, pin 1, circuit 64-LE45 (BU), wiring harness side. • Is the resistance less than 2 ohms? → **Yes**

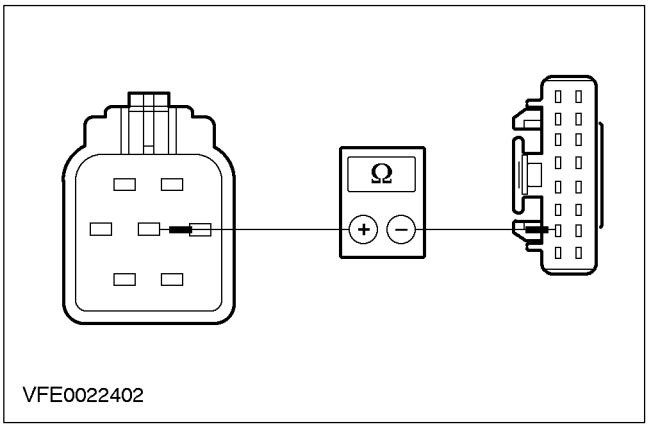
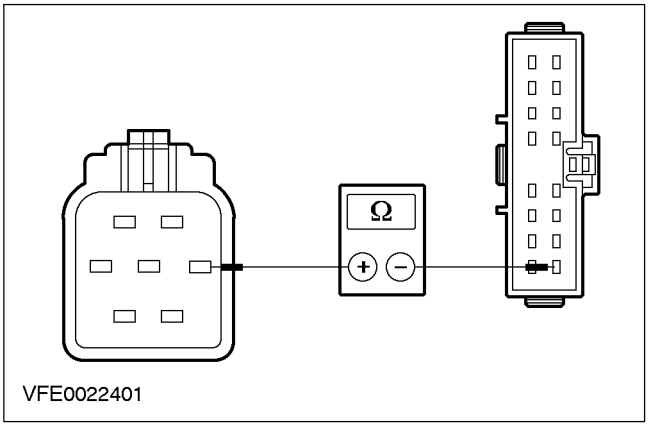
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	GO to **AB7** → **No** REPAIR circuit 64-LE45 (BU) between the headlamp and the light switch with the aid of the Wiring Diagrams. CHECK the operation of the system.
AB7: CHECK CIRCUIT 31-LE31 (BK)	
 VFE0011503	**1** Measure the resistance between the left-hand headlamp, connector C146, pin 7, circuit 31-LE31 (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** GO to **AB8** → **No** REPAIR circuit 31-LE31 (BK) between the headlamp and ground connection G104 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AB8: CHECK THE LEFT-HAND HEADLAMP LEVELLING MOTOR	
 VFE0025014	**1** Remove the left-hand headlamp. **2** Disconnect Left-hand headlamp levelling motor. **3** Measure the resistance at the left-hand headlamp between connector C146, pin 5, circuit (BU), component side and the headlamp levelling motor, circuit (BU), wiring harness side.

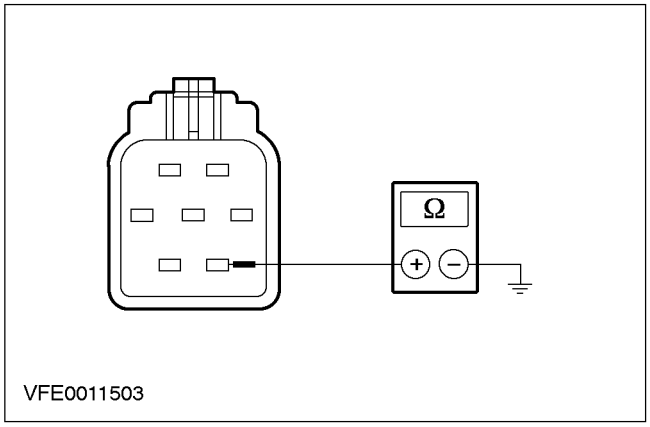
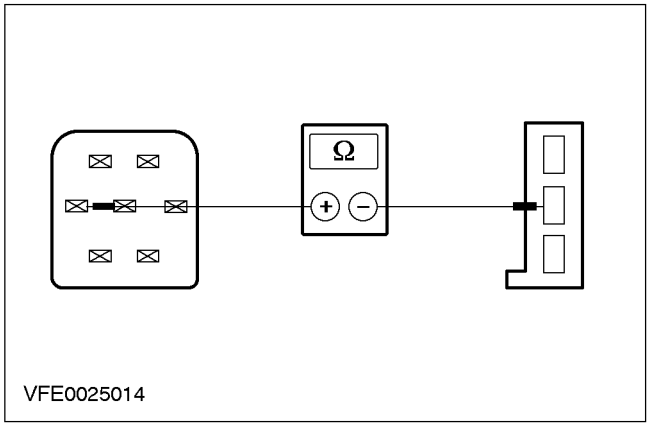
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0025012	**4** Measure the resistance between the left-hand headlamp, connector C146, pin 7, circuit (BK), component side and the left-hand headlamp levelling motor, circuit (BK), wiring harness side.
 VFE0025013	**5** Measure the resistance at the left-hand headlamp between connector C146, pin 4, circuit (VT/YE), component side and the headlamp levelling motor, circuit (VT/YE), wiring harness side. • Is the resistance in all three measurements less than 2 ohms? → **Yes** CHECK and if necessary RENEW the left-hand headlamp levelling motor. CHECK the operation of the system. → **No** REPAIR the affected circuit between the headlamp levelling motor and the headlamp with the aid of the Wiring Diagrams. CHECK the operation of the system.
AB9: CHECK FUSE F63 (CJB)	
	1 Key in OFF position. **2** CHECK Fuse F63 (CJB). **3** Check the fuse F63 (7.5 A) (CJB). • Is the fuse OK? → **Yes** GO to **AB10** → **No** INSTALL a new fuse F63 (7.5 A). If the fuse blows again, LOCATE and RECTIFY the short circuit with the aid of the Wiring Diagrams. CHECK the operation of the system.

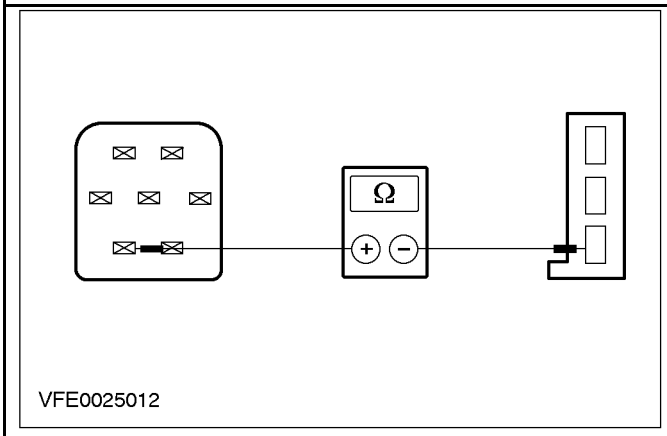
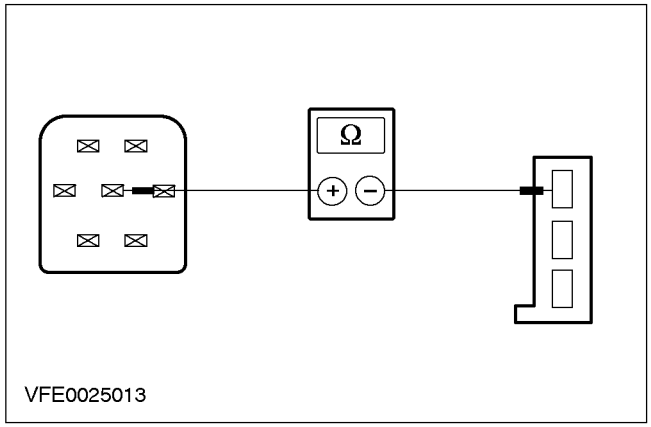
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
AB10: CHECK CIRCUIT 29S-LF16 (OG/GN)	
 VFE0022402	1 Disconnect Right-hand headlamp C147. 2 Disconnect CJB C509. 3 Measure the resistance between the CJB, connector C509, pin 7, circuit 29S-LF16 (OG/GN), wiring harness side and the right-hand headlamp, connector C147, pin 4, circuit 29S-LF16 (OG/GN), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** GO to **AB11** → **No** REPAIR circuit 29S-LF16 (OG/GN) between fuse F63 and the headlamp with the aid of the Wiring Diagrams. CHECK the operation of the system.
AB11: CHECK CIRCUIT 64-LE46 (BU/RD)	
 VFE0022401	1 Disconnect Light switch (C478). 2 Measure the resistance between the right-hand headlamp, connector C147, pin 5, circuit 64-LE46 (BU/RD), wiring harness side and the light switch, connector C478, pin 1, circuit 64-LE45 (BU), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** GO to **AB12** → **No** REPAIR circuit 64-LE46 (BU/RD) between the light switch and the headlamp with the aid of the Wiring Diagrams. CHECK the operation of the system.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
AB12: CHECK CIRCUIT 31-LE30 (BK)	
 VFE0011503	1 Measure the resistance between Right-hand headlamp, connector C147, pin 7, circuit31-LE30 (BK), harness side and ground. • Is the resistance less than 2 ohms? → **Yes** GO to **AB13** → **No** REPAIR circuit 31-LE30 (BK) between the headlamp and ground connection G105 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AB13: CHECK RIGHT-HAND HEADLAMP LEVELLING MOTOR	
 VFE0025014	1 Remove the right-hand headlamp. 2 Disconnect Right-hand headlamp levelling motor. 3 Measure the resistance at the right-hand headlamp between connector C147, pin 5, circuit (BU), component side and the headlamp levelling motor, circuit (BU), wiring harness side.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0025012	**4** Measure the resistance at the right-hand headlamp between connector C147, pin 7, circuit (BK), component side and the headlamp levelling motor, circuit (BK), wiring harness side.
 VFE0025013	**5** Measure the resistance at the right-hand headlamp between connector C147, pin 4, circuit (VT/YE), component side and the headlamp levelling motor, circuit (VT/YE), wiring harness side.
	• Is the resistance in all three measurements less than 2 ohms? → **Yes** CHECK and if necessary RENEW the right-hand headlamp levelling motor. CHECK the operation of the system. → **No** REPAIR the affected circuit between the headlamp levelling motor and the headlamp with the aid of the Wiring Diagrams. CHECK the operation of the system.

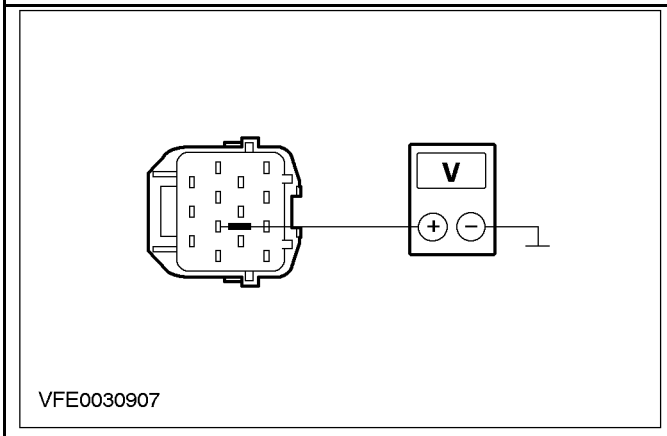
PINPOINT TEST AC: HEADLAMP LEVELLING SYSTEM INOPERATIVE / NOT FUNCTIONING PROPERLY, XENON HEADLAMPS

CONDITIONS	DETAILS/RESULTS/ACTIONS
AC1: READ OUT THE FAULT MEMORY	
	1 Key in OFF position. **2** Connect the diagnostic tool. **3** Check the system using WDS. • Are any trouble codes (DTCs) displayed? → **Yes** RESOLVE the faults according to the WDS instructions. CLEAR the fault memory and CHECK the operation of the system.

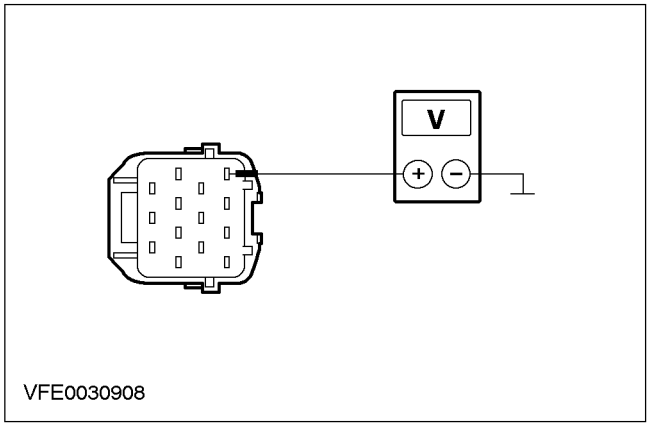
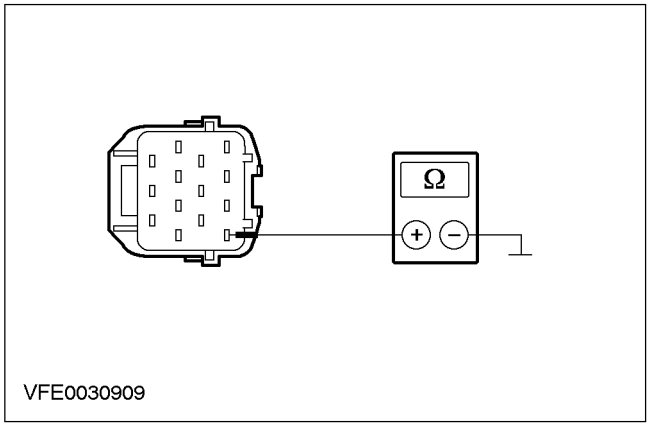
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **No** GO to **AC2**
AC2: DETERMINE THE FAULT CONDITION	
NOTE: On vehicles with Xenon headlamps the headlamp levelling takes place automatically according to the loading of the vehicle. The basic settings should be performed once on an unladen vehicle with the aid of WDS.	
	1 Key in ON position. 2 Switch on the dipped beam. 3 Simulation of a laden/unladen vehicle. 4 Check the operation of the headlamp levelling system. • Is the headlamp levelling system inoperative on both sides? → **Yes** GO to **AC3** → **No** Headlamp levelling system inoperative on the left-hand side: GO to **AC19** Headlamp levelling system inoperative on the right-hand side: GO to **AC22**
AC3: CHECK FUSE F93 (CJB)	
	1 Key in OFF position. 2 CHECK Fuse F93 (CJB). 3 Check fuse F93 (10 A) • Is the fuse OK? → **Yes** GO to **AC4** → **No** INSTALL a new fuse F93 (10 A). If the fuse blows again, LOCATE and RECTIFY the short circuit with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC4: CHECK CIRCUIT 15-LE2 (GN/BU)	
	1 Key in OFF position. 2 Connect Fuse F93. 3 Disconnect Left-hand headlamp C1146. 4 Key in ON position. 5 Switch on the dipped beam.

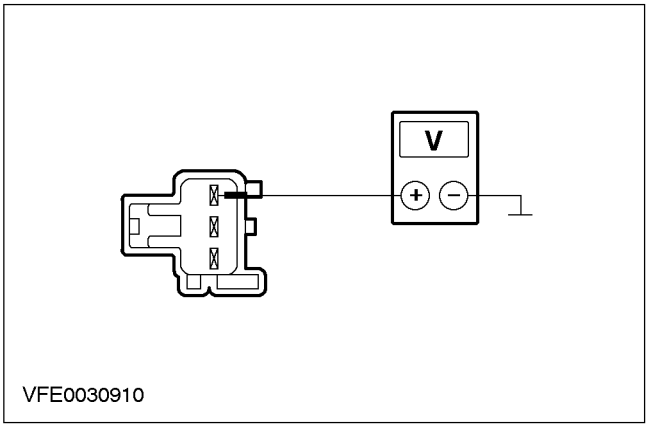
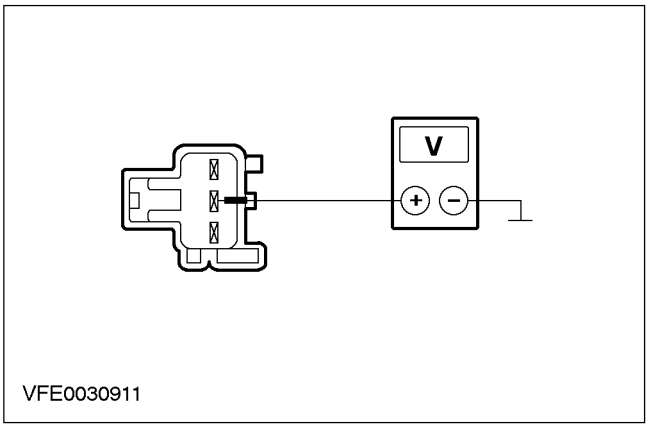
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0030907	**6** Measure the voltage between the left-hand headlamp, connector C1146, pin 5, circuit 15-LE2A (GN/BU), wiring harness side and ground. • Is battery voltage displayed? → **Yes** GO to **AC5** → **No** REPAIR circuit 15-LE2 (GN/BU) between fuse F93 and soldered connection S335 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC5: CHECK FUSE F16 (BJB)	
	1 Key in OFF position. **2** CHECK Fuse F16 (BJB). **3** Check fuse F16 (20 A) • Is the fuse OK? → **Yes** GO to **AC6** → **No** INSTALL a new fuse F16 (20 A). If the fuse blows again, LOCATE and RECTIFY the short circuit with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC6: CHECK THE VOLTAGE SUPPLY TO FUSE F16	
	1 Connect Fuse F16 (BJB). **2** Key in ON position. **3** Measure the voltage between fuse F16 (20 A) and ground. • Is battery voltage displayed? → **Yes** GO to **AC7** → **No** REPAIR circuit 15S-LE16A (GN/OG) between the headlamp relay and fuse F16 (BJB) with the aid of the Wiring Diagrams. CHECK the operation of the system.

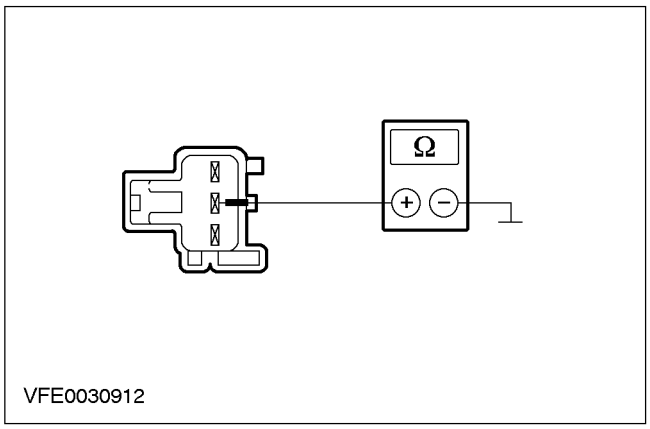
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
AC7: CHECK CIRCUIT 15S-LE16 (GN/OG)	
 VFE0030908	1 Measure the voltage between the left-hand headlamp, connector C1146, pin 14, circuit 15S-LE16 (GN/OG), wiring harness side and ground. • Is battery voltage displayed? → **Yes** GO to **AC8** → **No** REPAIR circuit 15S-LE16 (GN/OG) between fuse F16 and the headlamp with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC8: CHECK CIRCUIT 31-LE31 (BK)	
 VFE0030909	1 Key in OFF position. 2 Measure the resistance between the left-hand headlamp, connector C1146, pin 11, circuit 31-LE31 (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** GO to **AC9** → **No** REPAIR circuit 31-LE31 (BK) between the headlamp and soldered connection S315 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC9: CHECK CIRCUIT 7-XL9 (YE/VT) (PRIOR TO 10/2001) OR 7-LE54 (YE/BK) (FROM 10/2001)	
	1 Connect Left-hand headlamp C1146. 2 Connect CJB C509.

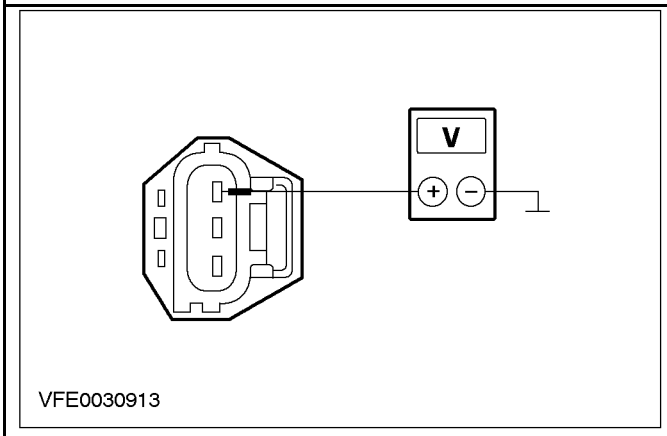
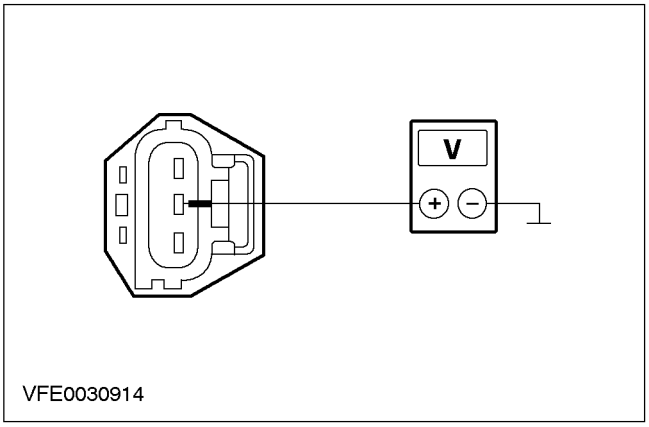
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0030910	3 Disconnect Rear headlamp levelling sensor C94. 4 Key in ON position. 5 Measure the voltage between the rear headlamp levelling sensor, connector C94, pin 3, circuit 7-XL9 (YE/VT) (prior to 10/2001) or 7-LE54 (YE/BK) (from 10/2001), wiring harness side and ground. • Is a voltage of 5 V displayed? → **Yes** GO to **AC10** → **No** REPAIR circuit 7-XL9 (YE/VT) (prior to 10/2001) or 7-LE54 (YE/BK) (from 10/2001) between the headlamp and the headlamp levelling sensor with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC10: CHECK CIRCUIT 8-XL9 (WH/VT) (PRIOR TO 10/2001) OR 8-LE54 (WH/BK) (FROM 10/2001)	
 VFE0030911	1 Key in ON position. 2 Measure the voltage between the rear headlamp levelling sensor, connector C94, pin 2, circuit 8-XL9 (WH/VT) (prior to 10/2001) or 8-LE54 (WH/BK) (from 10/2001), wiring harness side and ground. • Is battery voltage displayed? → **Yes**

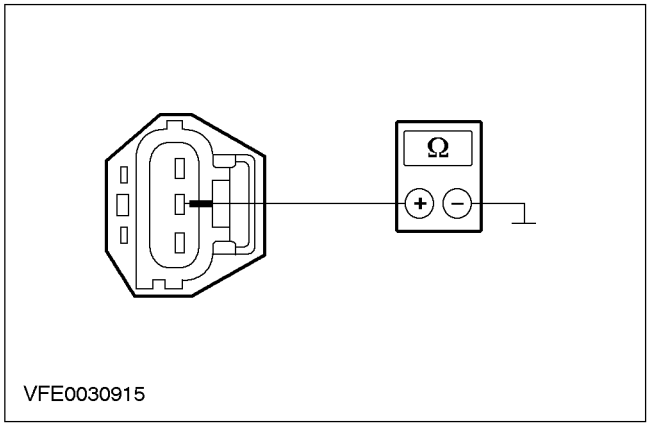
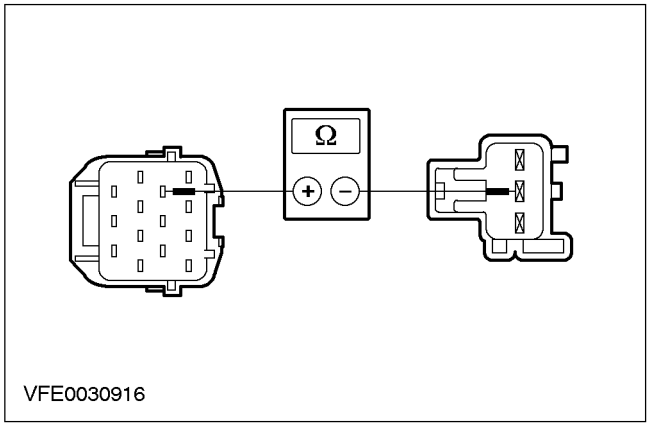
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	LOCATE and RECTIFY the short to battery voltage in circuit 8-XL9 (WH/VT) (prior to 10/2001) or 8-LE54 (WH/BK) (from 10/2001) between the headlamp and the headlamp levelling sensor with the aid of the Wiring Diagrams, and CHECK and RENEW the left-hand headlamp as necessary. CHECK the operation of the system. → **No** GO to **AC11**
AC11: CHECK CIRCUIT 8-XL9 (WH/VT) (PRIOR TO 10/2001) OR 8-LE54 (WH/BK) (FROM 10/2001)	
 VFE0030912	1 Key in OFF position. 2 Measure the resistance between the rear headlamp levelling sensor, connector C94, pin 2, circuit 8-XL9 (WH/VT) (prior to 10/2001) or 8-LE54 (WH/BK) (from 10/2001), wiring harness side and ground. • Is a resistance of more than 10 kOhms registered? → **Yes** GO to **AC12** → **No** LOCATE and RECTIFY the short to ground in circuit 8-XL9 (WH/VT) (prior to 10/2001) or 8-LE54 (WH/BK) (from 10/2001) between the headlamp and the headlamp levelling sensor with the aid of the Wiring Diagrams, and CHECK and RENEW the left-hand headlamp as necessary. CHECK the operation of the system.
AC12: CHECK CIRCUIT 7-XL9A (YE/VT) (PRIOR TO 10/2001) OR 7-LE53 (YE/BU) (FROM 10/2001)	
	1 Key in OFF position. 2 Disconnect Front headlamp levelling sensor C195. 3 Key in ON position.

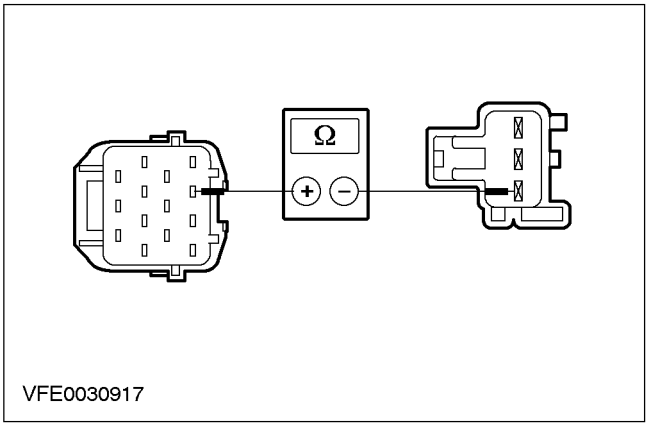
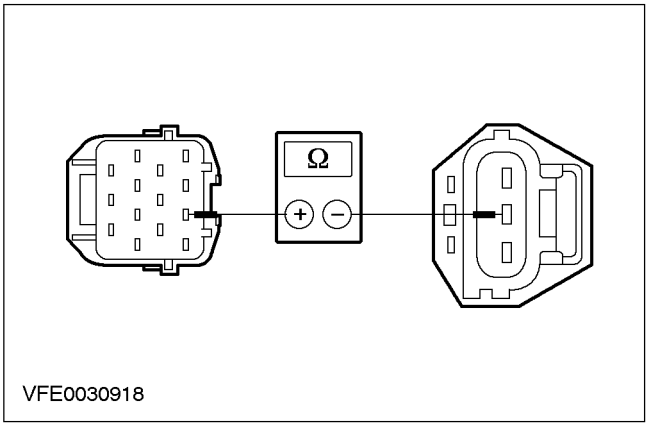
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0030913	**4** Measure the voltage between the front headlamp levelling sensor, connector C195, pin 3, circuit 7-XL9A (YE/VT) (prior to 10/2001) or 7-LE53 (YE/BU) (from 10/2001), wiring harness side and ground. • Is a voltage of 5 V displayed? → **Yes** GO to **AC13** → **No** REPAIR circuit 7-XL9A (YE/VT) (prior to 10/2001) or 7-LE53 (YE/BU) (from 10/2001) between the headlamp and the headlamp levelling sensor with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC13: CHECK CIRCUIT 8-XL9A (WH/VT) (PRIOR TO 10/2001) OR 8-LE53 (WH/BU) (FROM 10/2001)	
 VFE0030914	**1** Key in ON position. **2** Measure the voltage between the front headlamp levelling sensor, connector C195, pin 2, circuit 8-XL9A (WH/VT) (prior to 10/2001) or 8-LE53 (WH/BU) (from 10/2001), wiring harness side and ground. • Is battery voltage displayed ? → **Yes** LOCATE and RECTIFY the short to battery voltage in circuit 8-XL9A (WH/VT) (prior to 10/2001) or 8-LE53 (WH/BU) (from 10/2001) between the headlamp and the headlamp levelling sensor with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** GO to **AC14**

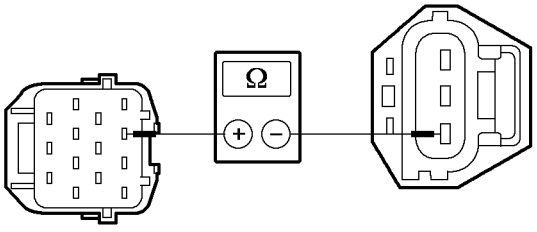
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
AC14: CHECK CIRCUIT 8-XL9A (WH/VT) (PRIOR TO 10/2001) OR 8-LE53 (WH/BU) (FROM 10/2001)	
 VFE0030915	1 Key in OFF position. 2 Measure the resistance between the front headlamp levelling sensor, connector C195, pin 2, circuit 8-XL9A (WH/VT) (prior to 10/2001) or 8-LE53 (WH/BU) (from 10/2001), wiring harness side and ground. • Is a resistance of more than 10 kOhms registered? → **Yes** GO to **AC15** → **No** LOCATE and RECTIFY the short to ground in circuit 8-XL9A (WH/VT) (prior to 10/2001) or 8-LE53 (WH/BU) (from 10/2001) between the headlamp and the headlamp levelling sensor with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC15: CHECK CIRCUIT 8-XL9 (WH/VT) (PRIOR TO 10/2001) OR 8-LE54 (WH/BK) (FROM 10/2001)	
 VFE0030916	1 Key in OFF position. 2 Disconnect Left-hand headlamp C1146. 3 Measure the resistance between the left-hand headlamp, connector C1146, pin 10, circuit 8-XL9 (WH/VT) (prior to 10/2001) or 8-LE54 (WH/BK) (from 10/2001), wiring harness side and the rear headlamp levelling sensor, connector C94, pin 2, circuit 8-XL9 (WH/VT) (prior to 10/2001) or 8-LE54 (WH/BK) (from 10/2001), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** GO to **AC16** → **No**

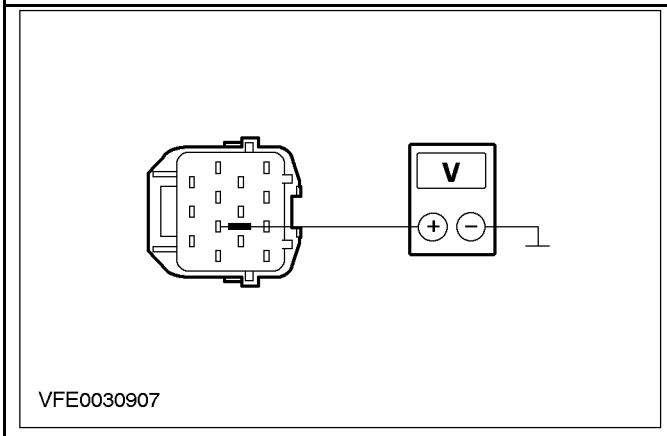
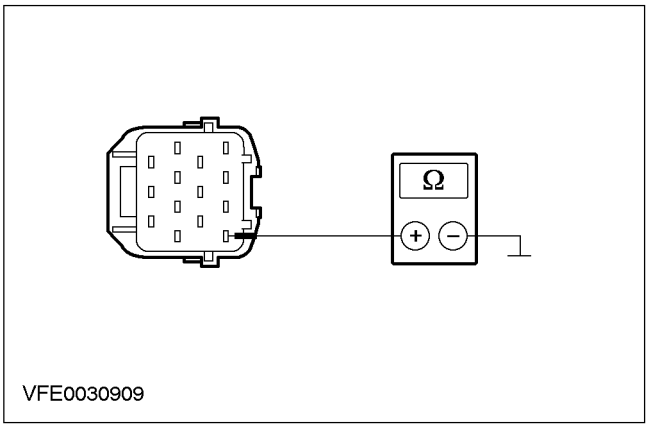
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR circuit 8-XL9 (WH/VT) (prior to 10/2001) or 8-LE54 (WH/BK) (from 10/2001) between the headlamp and the headlamp levelling sensor with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC16: CHECK CIRCUIT 9-XL9 (BN/WH) (PRIOR TO 10/2001) OR 9-LE54 (BN/YE) (FROM 10/2001)	
 VFE0030917	**1** Measure the resistance between the left-hand headlamp, connector C1146, pin 13, circuit 9-XL9 (BN/WH) (prior to 10/2001) or 9-LE54 (BN/YE) (from 10/2001), wiring harness side and the rear headlamp levelling sensor, connector C94, pin 1, circuit 9-XL9 (BN/WH) (prior to 10/2001) or 9-LE54 (BN/YE) (from 10/2001), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** GO to **AC17** → **No** REPAIR circuit 9-XL9 (BN/WH) (prior to 10/2001) or 9-LE54 (BN/YE) (from 10/2001) between the headlamp and the headlamp levelling sensor with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC17: CHECK CIRCUIT 8-XL9A (WH/VT) (PRIOR TO 10/2001) OR 8-LE53 (WH/BU) (FROM 10/2001)	
 VFE0030918	**1** Measure the resistance between the left-hand headlamp, connector C1146, pin 12, circuit 8-XL9A (WH/VT) (prior to 10/2001) or 8-LE53 (WH/BU) (from 10/2001), wiring harness side and the front headlamp levelling sensor, connector C195, pin 2, circuit 8-XL9A (WH/VT) (prior to 10/2001) or 8-LE53 (WH/BU) (from 10/2001), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** GO to **AC18** → **No**

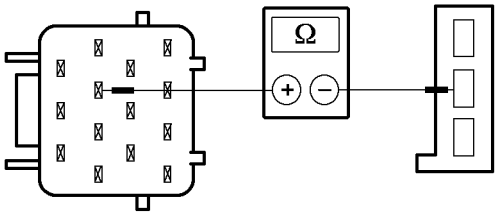
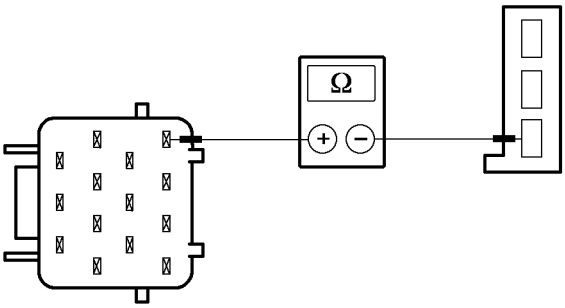
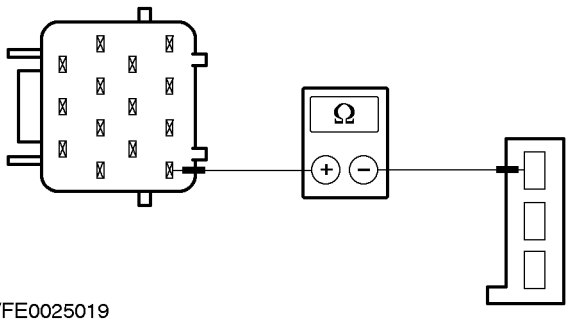
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR circuit 8-XL9A (WH/VT) (prior to 10/2001) or 8-LE53 (WH/BU) (from 10/2001) between the headlamp and the headlamp levelling sensor with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC18: CHECK CIRCUIT 9-XL9A (BN/WH) (PRIOR TO 10/2001) OR 9-LE53 (BN/BU) (FROM 10/2001)	
 VFE0030919	**1** Measure the resistance between the left-hand headlamp, connector C1146, pin 13, circuit 9-XL9 (BN/WH) (prior to 10/2001) or 9-LE54 (BN/YE) (from 10/2001), wiring harness side and the front headlamp levelling sensor, connector C195, pin 1, circuit 9-XL9A (BN/WH) (prior to 10/2001) or 9-LE53 (BN/BU) (from 10/2001), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** RENEW the front headlamp levelling sensor. CHECK the operation of the system. If the concern persists, RENEW the rear headlamp levelling sensor. CHECK the operation of the system. → **No** REPAIR circuit 9-XL9A (BN/WH) (prior to 10/2001) or 9-LE53 (BN/BU) (from 10/2001) between the headlamp and the headlamp levelling sensor with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC19: CHECK CIRCUIT 15-LE2A (GN/BU)	
	1 Key in OFF position. **2** Disconnect Left-hand headlamp C1146. **3** Key in ON position. **4** Switch on the dipped beam.

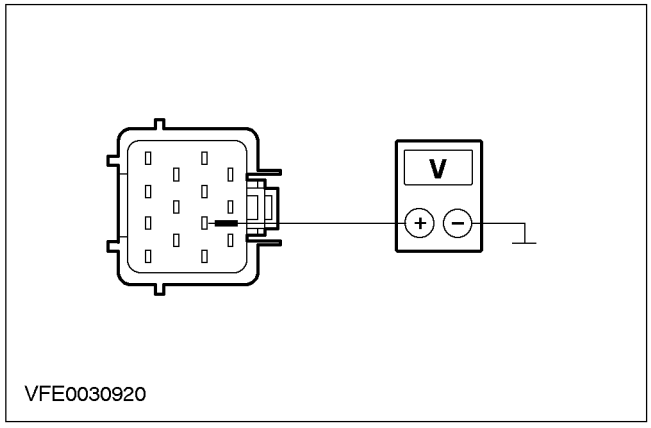
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0030907	**5** Measure the voltage between the left-hand headlamp, connector C1146, pin 5, circuit 15-LE2A (GN/BU), wiring harness side and ground. • Is battery voltage displayed? → **Yes** GO to **AC20** → **No** REPAIR circuit 15-LE2A (GN/BU) between soldered connection S335 and the headlamp with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC20: CHECK CIRCUIT 31-LE31 (BK)	
 VFE0030909	**1** Key in OFF position. **2** Measure the resistance between the left-hand headlamp, connector C1146, pin 11, circuit 31-LE31 (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** GO to **AC21** → **No** REPAIR circuit 31-LE31 (BK) between the headlamp and soldered connection S315 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC21: CHECK LEFT-HAND HEADLAMP LEVELLING MOTOR	
	1 Remove the left-hand headlamp. **2** Disconnect Left-hand headlamp levelling motor.

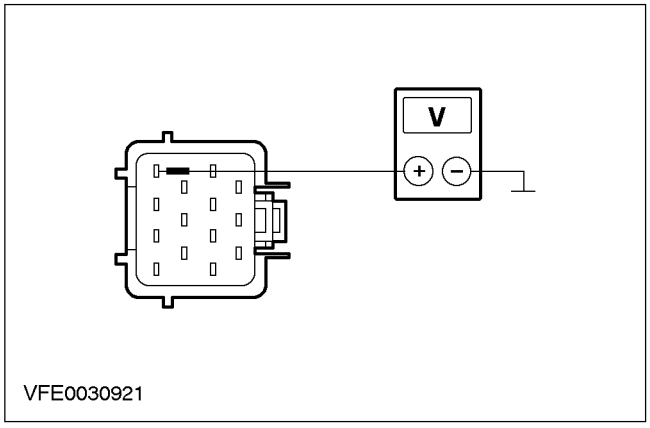
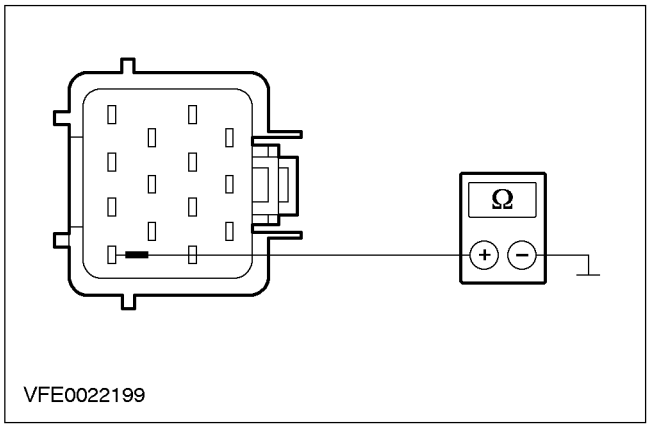
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0025020	**3** Measure the resistance at the left-hand headlamp between connector C1146, pin 5, circuit (BU), component side and the headlamp levelling motor, circuit (BU), wiring harness side.
 VFE0025018	**4** Measure the resistance at the left-hand headlamp between connector C1146, pin 11, circuit (BK), component side and the headlamp levelling motor, circuit (BK), wiring harness side.
 VFE0025019	**5** Measure the resistance at the left-hand headlamp between connector C1146, pin 14, circuit (VT/YE), component side and the headlamp levelling motor, circuit (VT/YE), wiring harness side.
	• Is the resistance in all three measurements less than 2 ohms? → **Yes** CHECK and if necessary RENEW the left-hand headlamp levelling motor. CHECK the operation of the system. If the concern persists, CHECK and if necessary RENEW the left-hand headlamp. CHECK the operation of the system. → **No**

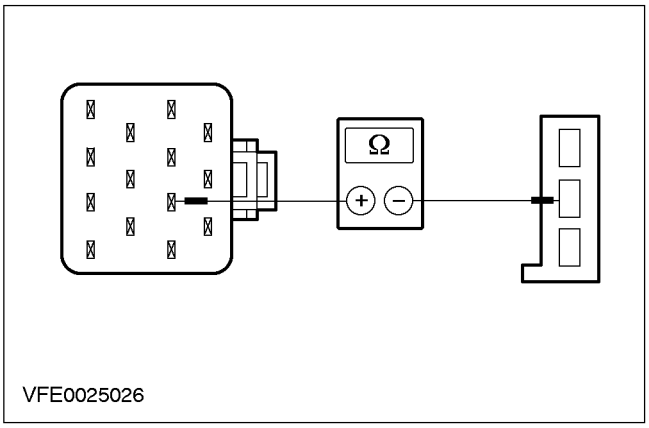
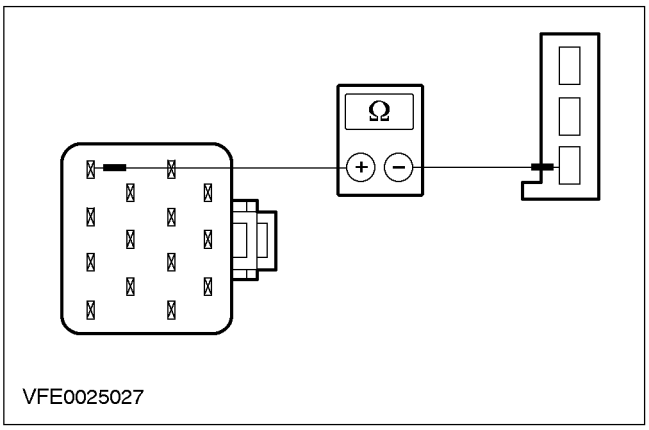
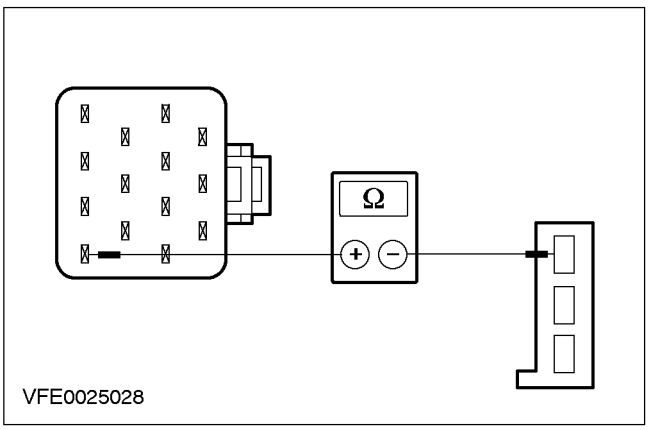
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR the affected circuit between the headlamp levelling motor and the headlamp with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC22: CHECK CIRCUIT 15-LE2B (GN/BU)	
	1 Key in OFF position. 2 Disconnect Right-hand headlamp C1147. 3 Key in ON position. 4 Switch on the dipped beam. 5 Measure the voltage between the right-hand headlamp, connector C1147, pin 5, circuit 15-LE2B (GN/BU), wiring harness side and ground. • Is battery voltage displayed? → **Yes** GO to **AC23** → **No** REPAIR circuit 15-LE2B (GN/BU) between soldered connection S335 and the headlamp with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC23: CHECK FUSE F18 (BJB)	
	1 Key in OFF position. 2 CHECK Fuse F18 (BJB). 3 Check fuse F18 (20 A) • Is the fuse OK? → **Yes** GO to **AC24** → **No** INSTALL a new fuse F18 (20 A). If the fuse blows again, LOCATE and RECTIFY the short circuit with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC24: CHECK THE VOLTAGE SUPPLY TO FUSE F18	
	1 Connect Fuse F18 (BJB). 2 Key in ON position. 3 Measure the voltage between fuse F18 (20A) (BJB) and ground.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is battery voltage displayed? → **Yes** GO to **AC25** → **No** REPAIR the voltage supply to fuse F18 with the aid of the Wiring Diagrams. If the concern is still not resolved CHECK and if necessary RENEW the BJB. CHECK the operation of the system.
AC25: CHECK CIRCUIT 15S-LE23 (GN/WH)	
 VFE0030921	1 Measure the voltage between the right-hand headlamp, connector C1147, pin 14, circuit 15S-LE23 (GN/WH), wiring harness side and ground. • Is battery voltage displayed? → **Yes** GO to **AC26** → **No** REPAIR circuit 15S-LE23 (GN/WH) between the BJB and the headlamp with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC26: CHECK CIRCUIT 31-LE30 (BK)	
 VFE0022199	1 Key in OFF position. 2 Measure the resistance between Right-hand headlamp, connector C1147, pin 11, circuit31-LE30 (BK), harness side and ground. • Is the resistance less than 2 ohms? → **Yes** GO to **AC27**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **No** REPAIR circuit 31-LE30 (BK) between the headlamp and soldered connection S317 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC27: CHECK RIGHT-HAND HEADLAMP LEVELLING MOTOR	
 VFE0025026	**1** Remove the right-hand headlamp. **2** Disconnect Right-hand headlamp levelling motor. **3** Measure the resistance at the right-hand headlamp between connector C1147, pin 5, circuit (BU), component side and the headlamp levelling motor, circuit (BU), wiring harness side.
 VFE0025027	**4** Measure the resistance at the right-hand headlamp between connector C1147, pin 11, circuit (BK), component side and the headlamp levelling motor, circuit (BK), wiring harness side.
 VFE0025028	**5** Measure the resistance at the right-hand headlamp between connector C1147, pin 14, circuit (VT/YE), component side and the headlamp levelling motor, circuit (VT/YE), wiring harness side. • Is the resistance in all three measurements less than 2 ohms?

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** CHECK and if necessary RENEW the right-hand headlamp levelling motor. CHECK the operation of the system. If the concern persists, CHECK and if necessary REPAIR control circuit 8-LE46 (WH/RD) between the headlamps. CHECK the operation of the system. → **No** REPAIR the affected circuit between the headlamp levelling motor and the headlamp with the aid of the Wiring Diagrams. If the concern persists CHECK the system with the aid of WDS.

GENERAL PROCEDURES

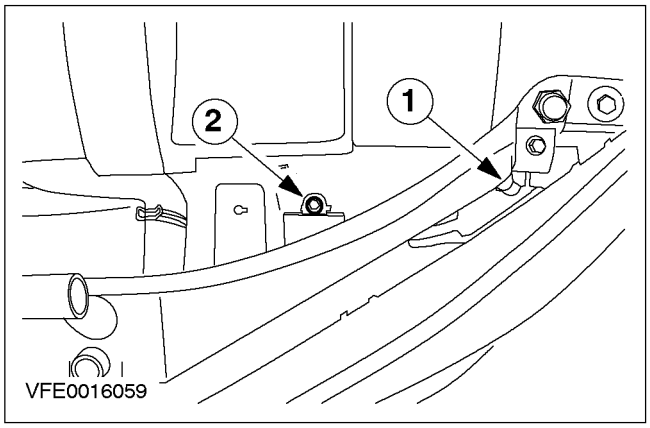
Headlamp Adjustment — Vehicles With: High Intensity Discharge Headlamps (32 113 0)

Vehicles with load-levelling shock absorbers

1. **Leave the vehicle for at least a minute without shaking or loading it before headlamp adjustment.**

All vehicles

2. **Place the vehicle on a level surface and make sure that the tire pressures are to specification and that the vehicle is not abnormally laden.**
3. **Set the measuring screen of the beam setting equipment to the following headlamp adjustment value (X): X = 10 cm/10 m = 0 degrees, 34 minutes = 1.0%.**
4. **Alignment screws for the headlamp adjustment.**
   1. Vertical alignment screw.
   2. Horizontal alignment screw.

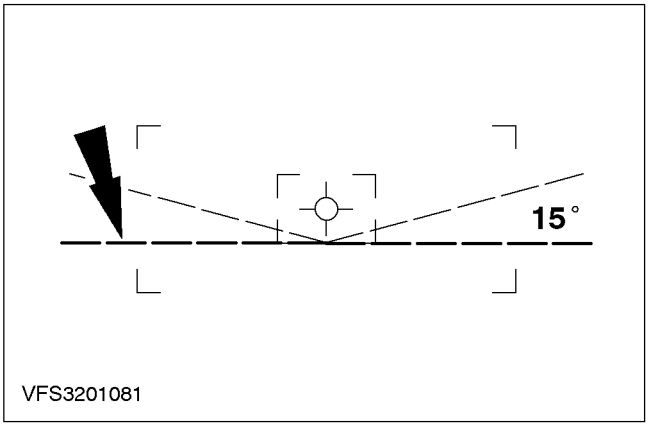


5. **NOTE:** Turn on the ignition key to position ""2", to adjust the headlamp levelling according the vehicle load.

NOTE: After replacing the left-hand headlamp assembly (Master), the system has to be initialized with WDS before the headlamp adjustment.

NOTE: Switch on the low beam.

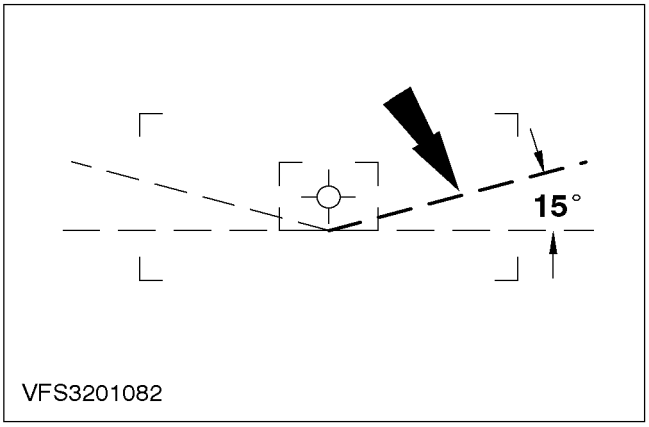
Adjust the headlamp so that the boundary line touches the horizontal line.



6. **NOTE:** Some scattered light from the low beam may lie above the 15 degrees line.

NOTE: Readjustment of the vertical axis may be necessary following adjustment of the horizontal axis.

Adjust the headlamp so that the rising line of the boundary line lies at the intersection of horizontal line and the 15 degrees line (left-hand drive vehicle shown).



GENERAL PROCEDURES

Headlamp Adjustment (32 113 0)

General Equipment
Beam setting equipment

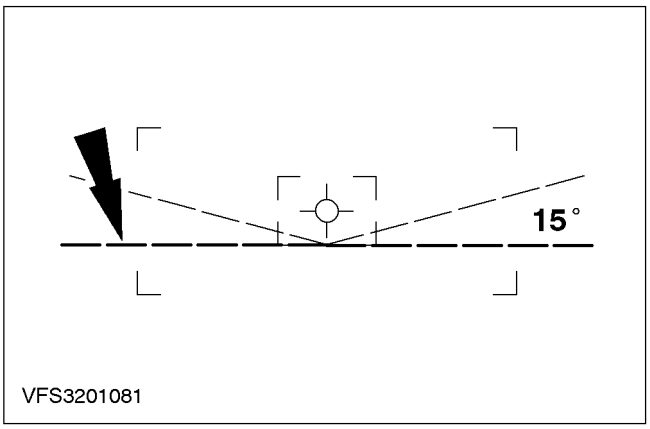
Vehicles with load-levelling shock absorbers

1. **Leave the vehicle for at least a minute without shaking or loading it before headlamp adjustment.**

All vehicles

2. **Place the vehicle on a level surface.**
3. **Make sure that the tire pressures are to specification and that the vehicle is not abnormally laden.**
4. **Operate the headlamp levelling system several times and then set the headlamp levelling switch to position 0.**
5. **Set the measuring screen of the beam setting equipment to the correct headlamp adjustment setting.**
6. **NOTE:** Switch on the low beam.

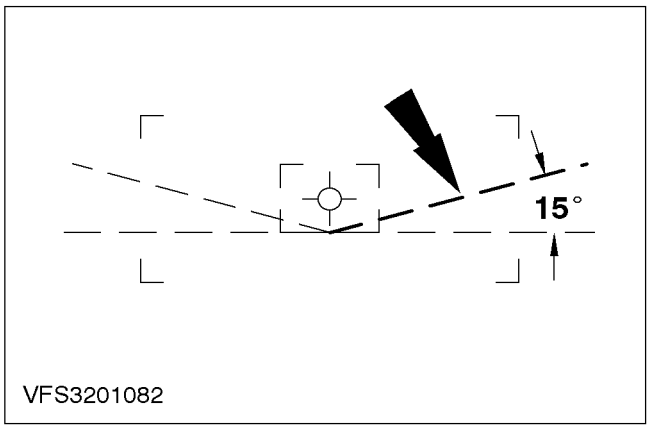
   Adjust the headlamp so that the boundary line touches the horizontal line.



7. **NOTE:** Some scattered light from the low beam may lie above the 15 degrees line.

NOTE: Readjustment of the vertical axis may be necessary following adjustment of the horizontal axis.

Adjust the headlamp so that the rising line of the boundary line lies at the intersection of horizontal line and the 15 degree line (left-hand drive vehicle shown).

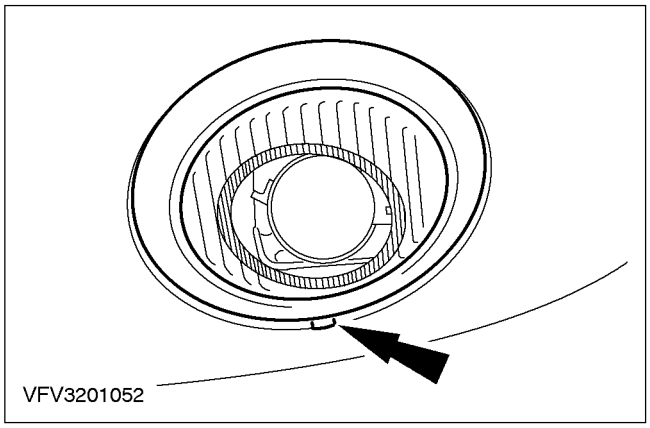


GENERAL PROCEDURES

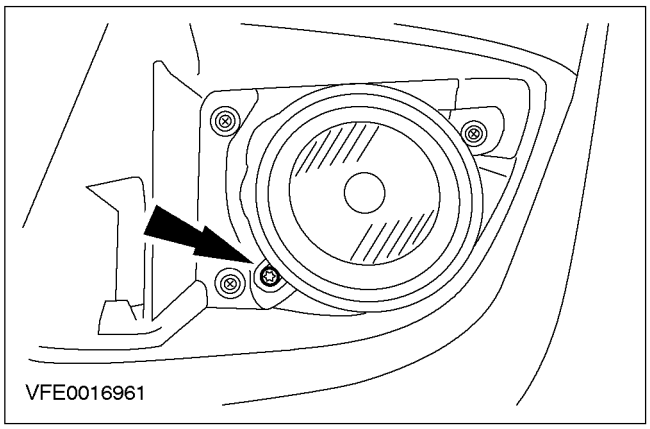
Front Fog Lamp Adjustment

General Equipment
Beam setting equipment

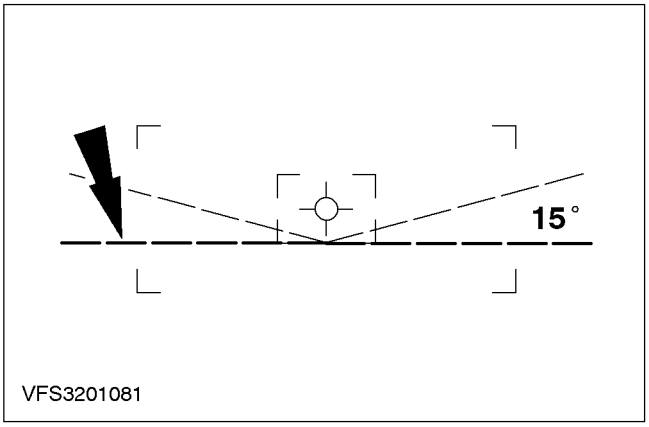
1. Remove the front fog lamp bezel.



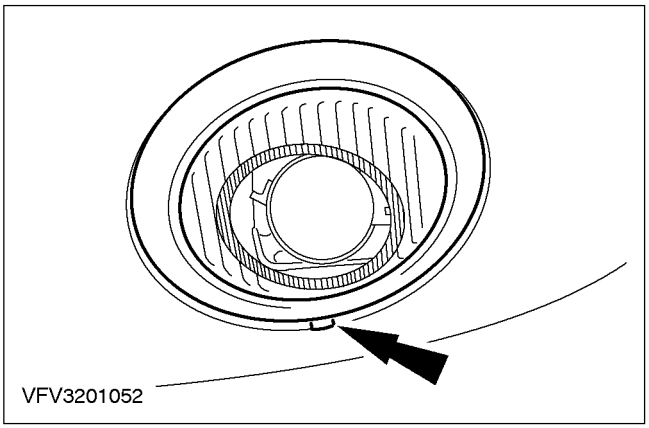
2. Place the vehicle on a level surface.
3. Make sure that the tire pressures are to specification and that the vehicle is not abnormally laden.
4. Set the measuring screen of the beam setting equipment to the correct front fog lamp adjustment setting.
5. Adjust the front fog lamp alignment screw.



6. Adjust the front fog lamp so that the boundary line touches the horizontal line.



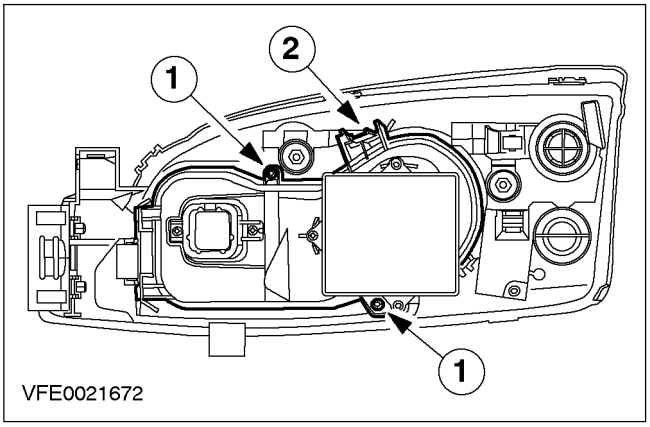
7. Install the front fog lamp bezel.



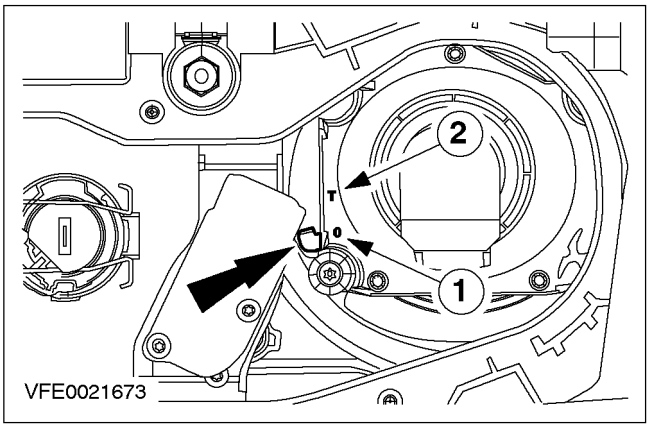
GENERAL PROCEDURES

Headlamp Masking — Vehicles With: High Intensity Discharge Headlamps

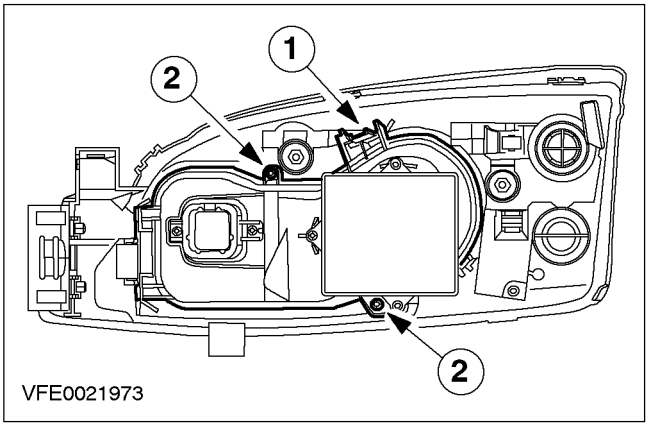
1. **Remove the headlamp assemblies. For additional information, refer to Headlamp Assembly in this section.**
2. **Detach the headlamp assembly rear cover.**
   1. Remove the retaining screws.
   2. Pull up the locking tab.



3. **Turn the alignment lever.**
   1. Normal position ""0”
   2. Travel position ""T”



4. **Install the headlamp assembly rear cover.**
   1. Push down the locking tab.
   2. Install the retaining screws.



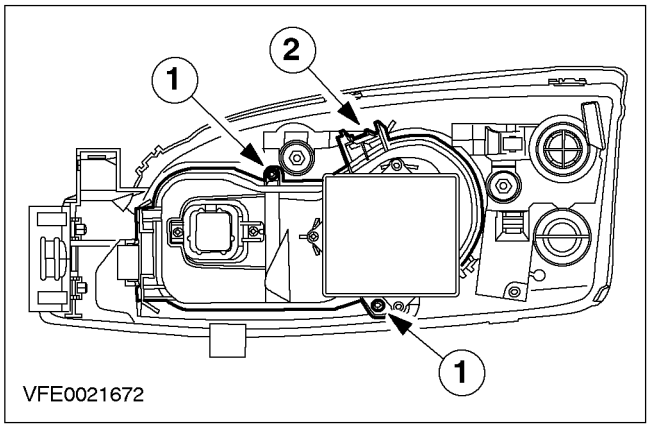
5. **Install the headlamp assemblies. For additional information, refer to Headlamp Assembly in this section.**

REMOVAL AND INSTALLATION

Headlamp Bulb — Vehicles With: High Intensity Discharge Headlamps (32 147 0)

Removal

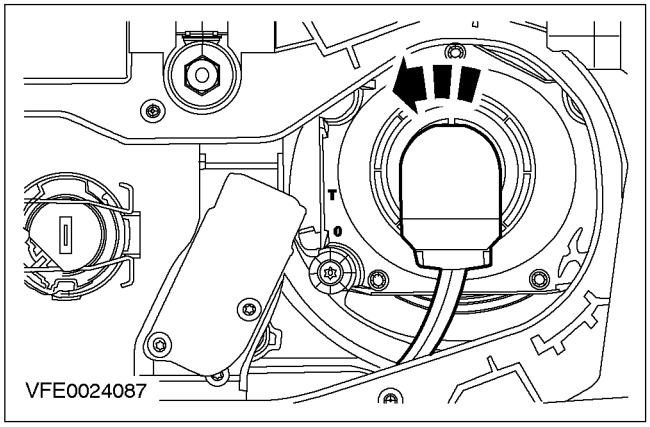
1. **Remove the headlamp assembly. For additional information, refer to Headlamp Assembly in this section.**
2. **Detach the headlamp assembly rear cover.**
   1. Remove the retaining screws.
   2. Pull the locking tab.



3. **WARNING: High voltages are present in this system. Ensure that the headlamp assembly electrical connector is disconnected if the headlamp assembly is removed.**

CAUTION: Ensure that the headlamps are not turned on with the headlamp bulb electrical connector is disconnected.

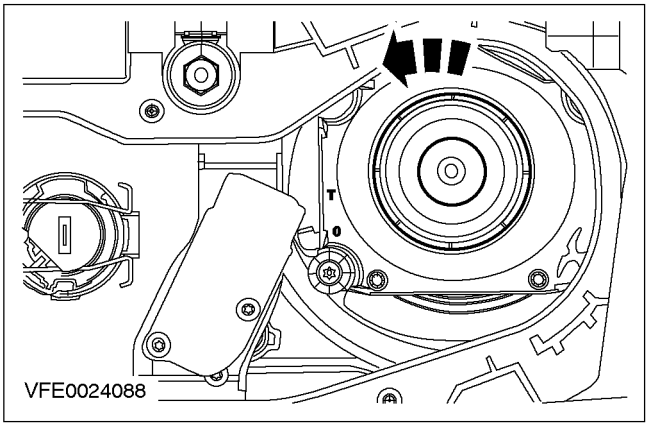
Disconnect the headlamp bulb electrical connector.



4. **WARNING: Always wear safety glasses and protective gloves when removing and installing Xenon headlamp bulbs. Failure to follow these instructions may result in personal injury.**

CAUTION: Do not touch the glass surface of the headlamp bulb.

Remove the headlamp bulb.



Installation

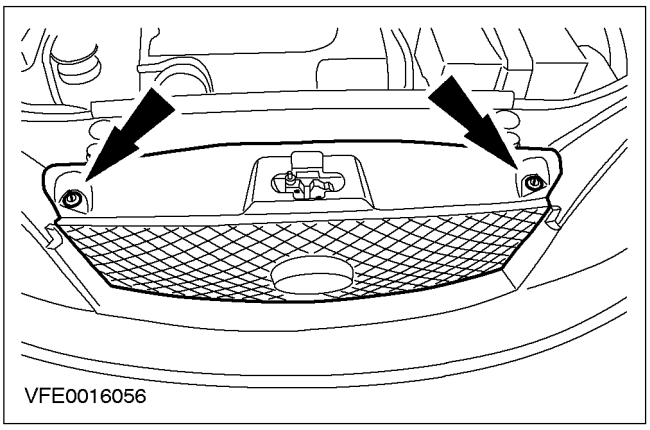
1. **To install, reverse the removal procedure.**

REMOVAL AND INSTALLATION

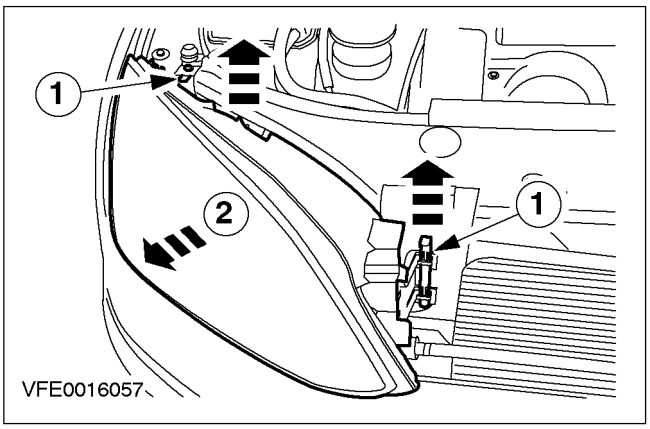
Headlamp Assembly (32 115 0)

Removal

1. **Remove the radiator grille.**



2. **Remove the headlamp assembly.**
   1. Remove the headlamp assembly retainers.
   2. Pull out the headlamp assembly.
   - Disconnect the headlamp assembly electrical connector.



Installation

1. **NOTE:** Clean the headlamp lens with a damp cloth to avoid any electrostatic charging which attracts dust to the plastic lens.

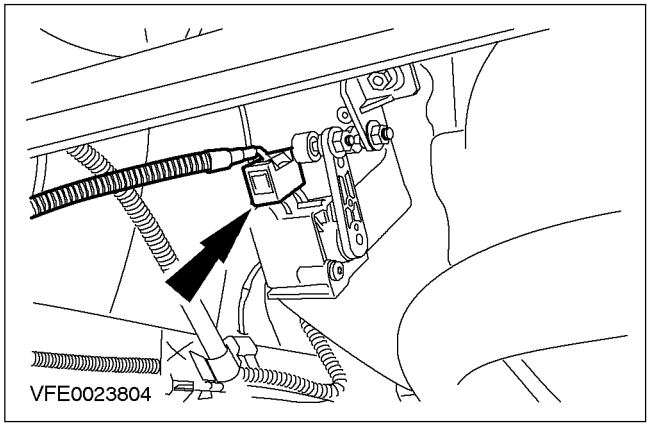
   To install, reverse the removal procedure.
2. **Adjust the headlamps.** **For additional information, refer to Headlamp Adjustment in this section.**

REMOVAL AND INSTALLATION

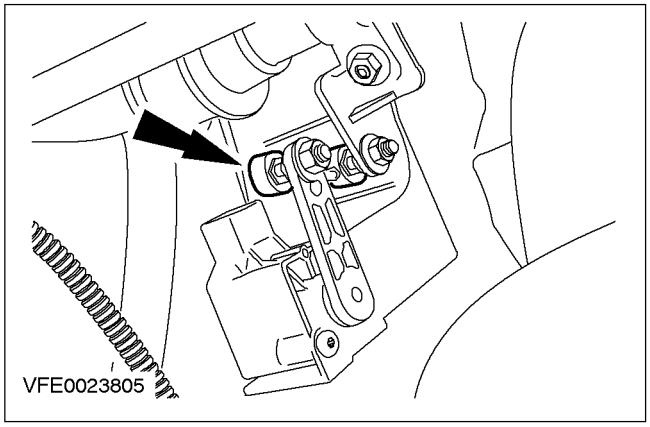
Headlamp Leveling Sensor — Vehicles With: High Intensity Discharge Headlamps

Removal

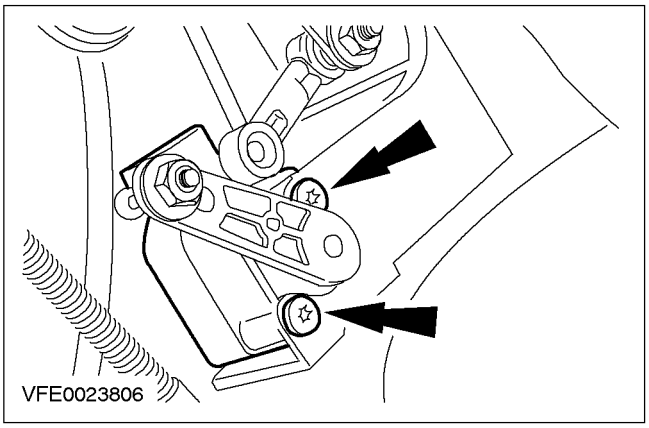
1. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
2. **Disconnect the headlamp levelling sensor electrical connector (rear sensor shown).**



3. **Disconnect the connecting rod (rear sensor shown).**



4. **Remove the headlamp levelling sensor (rear sensor shown).**



Installation

1. **NOTE:** After installing the headlamp levelling sensor the headlamp levelling system has to be intialized with WDS.

   To install, reverse the removal procedure.

SECTION 417-02 Interior Lighting

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS **PAGE**

DIAGNOSIS AND TESTING

Interior Lighting..... 417-02-2
Inspection and Verification 417-02-2

DIAGNOSIS AND TESTING

Interior Lighting

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
– Fuse(s)
– Bulb(s)
– Switch(es)
– Wiring harness
– Electrical connector(s)
– Generic electronic module (GEM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to WDS to diagnose the system.

SECTION 418-00 Module Communications Network

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS **PAGE**

DIAGNOSIS AND TESTING

Communications Network 418-00-2
Diagnosis and Testing 418-00-2
Symptom Chart 418-00-2
Pinpoint Tests 418-00-3

DIAGNOSIS AND TESTING

Communications Network

Refer to Wiring Diagrams Section 418-00 for schematic and connector information.

Diagnosis and Testing

1. CHECK the concern.
2. Visually inspect for obvious signs of mechanical or electricaldamage.

Visual Inspection Chart —

Electrical
Fuse(s)
Wiring harness
Electrical connector(s).

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step. CHECK the operation of the system.
4. If the concern is still present after the visual inspection has been carried out, REFER to the Symptom Chart and PROCEED in accordance with the fault symptom.

Symptom Chart

Condition	Possible Sources	Action
•Powertrain control module (PCM) not communicating with the diagnostic unit	•Fuse(s) •Circuit(s). •Powertrain control module (PCM)	•CARRY OUT a fault diagnosis with WDS.
•ABS control module or electronic stability program module (ESP) not communicating with the diagnostic unit	•Fuse(s) •Circuit(s). •ABS control module or electronic stability program (ESP) module	•CARRY OUT a fault diagnosis with WDS.
•Restraint control module (RCM) not communicating with the diagnostic unit	•Fuse(s) •Circuit(s). •Restraint control module (RCM)	•CARRY OUT a fault diagnosis with WDS.
•Generic electronic module (GEM) not communicating with the diagnostic unit	•Fuse(s) •Circuit(s). •Generic electronic module (GEM)	• GO to Pinpoint Test A
•Instrument cluster not communicating with the diagnostic unit	•Fuse(s) •Circuit(s). •Instrument cluster.	• GO to Pinpoint Test B
•Heating and air conditioning control module or EATC module not communicating with the diagnostic unit	•Fuse(s) •Circuit(s). •Heating and air conditioning control module or EATC module	• GO to Pinpoint Test C
•Fuel-fired additional heater not communicating with the diagnostic unit	•Fuse(s) •Circuit(s). •Fuel-fired additional heater	• GO to Pinpoint Test D
•Audio/navigation control unit VNR 9000 not communicating with the diagnostic unit	•Fuse(s) •Circuit(s). •Audio/navigation control unit VNR 9000	• GO to Pinpoint Test E

DIAGNOSIS AND TESTING (Continued)

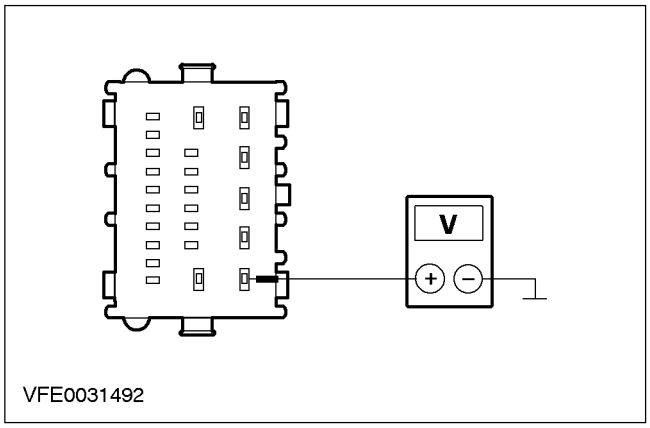
Condition	Possible Sources	Action
•Xenon headlamp(s) not communicating with the diagnostic unit	•Fuse(s) •Circuit(s). •Xenon headlamp(s)	• GO to Pinpoint Test F
•Faulty communications between the modules (CAN bus)	•Circuit(s). •Instrument cluster •Heating and air conditioning control module or EATC module •Powertrain control module (PCM) •ABS control module or electronic stability program (ESP) module **NOTE:** Vehicles with DuraTorq - DI engine only: •Injection pump **NOTE:** Vehicles with ESP only: •Steering shaft rotational angle sensor •Yaw rate sensor	• GO to Pinpoint Test G

Pinpoint Tests

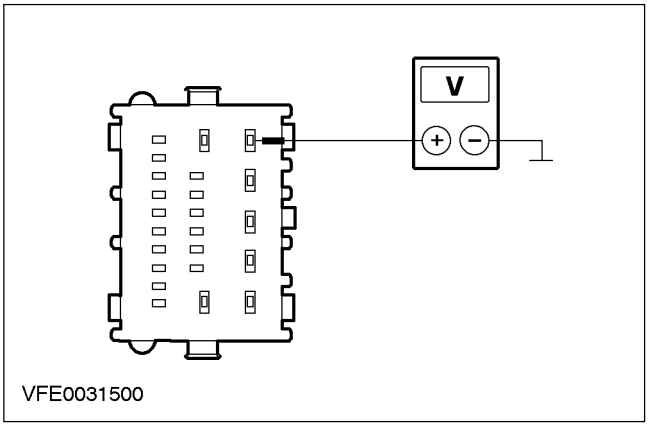
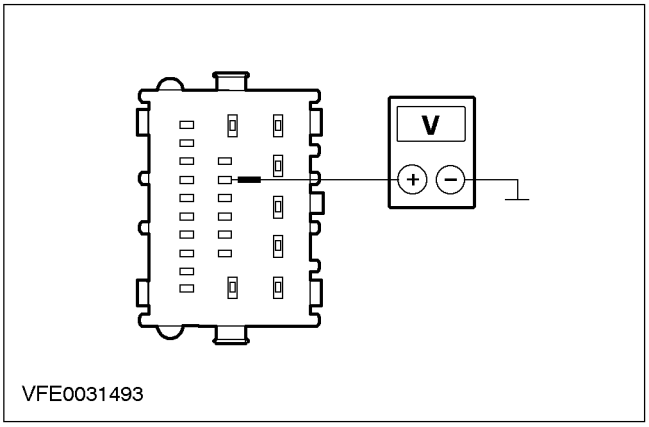
PINPOINT TEST A: GENERIC ELECTRONIC MODULE (GEM) NOT COMMUNICATING WITH THE DIAGNOSTIC UNIT

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK FUSE F24	
	1 Key in OFF position. 2 CHECK Fuse F24 (BJB). • Is the fuse OK? → **Yes** GO to **A2** → **No** RENEW fuse F24 (20 A). CHECK the system again. If the fuse blows again, LOCATE and RECTIFY the short to ground with the aid of the Wiring Diagrams.
A2: MEASURE THE VOLTAGE AT FUSE F24	
	1 Connect Fuse F24 (BJB). 2 Measure the voltage between fuse F24 (20 A) and ground. • Does the meter display battery voltage? → **Yes** GO to **A3** → **No** REPAIR the voltage supply to fuse F24 with the aid of the Wiring Diagrams. CHECK the operation of the system.
A3: CHECK FUSE F25	
	1 CHECK Fuse F25 (BJB).

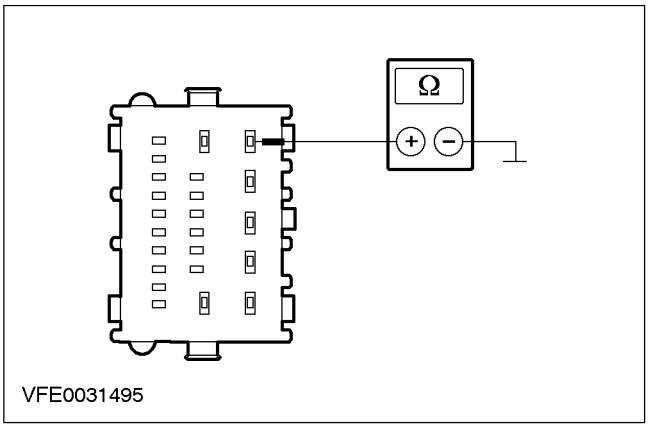
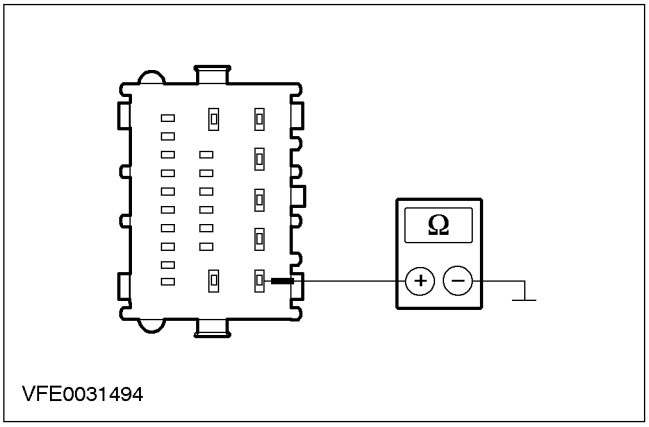
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is the fuse OK? → **Yes** GO to **A4** → **No** RENEW fuse F25 (15 A). CHECK the system again. If the fuse blows again, LOCATE and RECTIFY the short to ground with the aid of the Wiring Diagrams.
A4: MEASURE THE VOLTAGE AT FUSE F25	
	1 Connect Fuse F25 (BJB). 2 Measure the voltage between fuse F25 (15 A) and ground. • Does the meter display battery voltage? → **Yes** GO to **A5** → **No** REPAIR the voltage supply to fuse F25 with the aid of the Wiring Diagrams. CHECK the operation of the system.
A5: CHECK THE VOLTAGE AT THE GEM	
 VFE0031492	1 Disconnect GEM C426. 2 Measure the voltage between the GEM, connector C426, pin 1, circuit 29-AA17 (OG/WH), wiring harness side and ground. • Does the meter display battery voltage? → **Yes** GO to **A6** → **No** LOCATE and RECTIFY the break in the circuit between fuse F24 and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system.

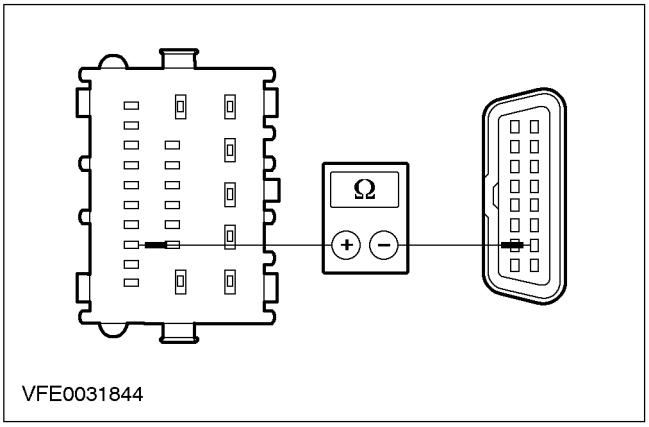
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A6: CHECK THE VOLTAGE AT THE GEM	
 VFE0031500	1 Measure the voltage between the GEM, connector C426, pin 5, circuit 29-LG25 (OG/BU), wiring harness side and ground. • Does the meter display battery voltage? → **Yes** GO to **A7** → **No** LOCATE and RECTIFY the break in the circuit between fuse F25 and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system.
A7: CHECK THE CONTROL VOLTAGE AT THE GEM	
 VFE0031493	1 Connect GEM C426. 2 Disconnect GEM C429. 3 Key in ON position. 4 Measure the voltage between the GEM, connector C429, pin 12, circuit 8-AA30 (WH), wiring harness side and ground. • Is a voltage of at least 10 Volts measured? → **Yes** GO to **A8** → **No** LOCATE and RECTIFY the break in circuit 8-AA30 (WH) between the instrument cluster and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system.

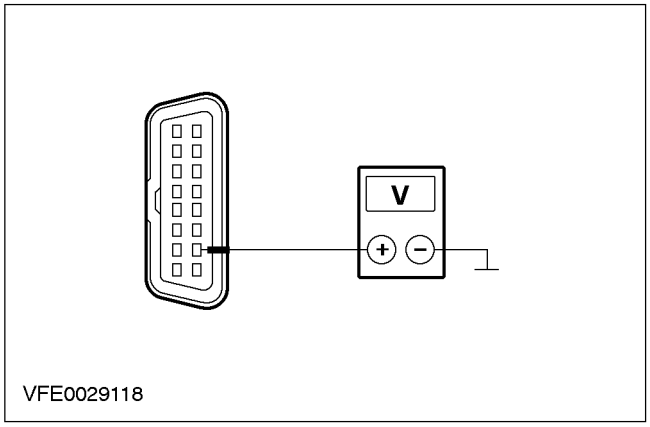
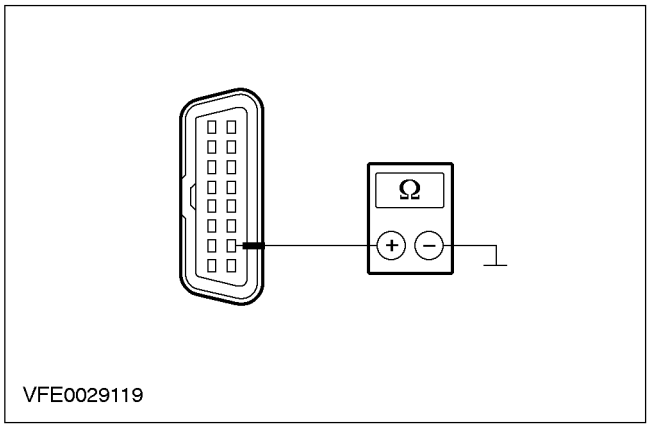
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A8: CHECK THE GROUND CONNECTION OF THE GEM	
 VFE0031495	1 Key in OFF position. 2 Disconnect GEM C427. 3 Measure the resistance between the GEM, connector C427, pin 5, circuit 31-DK20 (BK), wiring harness side and ground. • Is a resistance of less than 2 Ohm measured? → **Yes** GO to **A9** → **No** LOCATE and RECTIFY the break in circuit 31-DK20 (BK) between the GEM and ground connection G205 with the aid of the Wiring Diagrams. CHECK the operation of the system.
A9: CHECK THE GROUND CONNECTION OF THE GEM	
 VFE0031494	1 Measure the resistance between the GEM, connector C429, pin 1, circuit 91-DK20 (BK/RD), wiring harness side and ground. • Is a resistance of less than 2 Ohm measured? → **Yes** GO to **A10** → **No** LOCATE and RECTIFY the break in circuit 91-DK20 (BK/RD) between the GEM and ground connection G203 with the aid of the Wiring Diagrams. CHECK the operation of the system.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A10: CHECK THE CIRCUIT BETWEEN THE GEM AND THE DLC FOR OPEN CIRCUIT	
 VFE0031844	1 Measure the resistance between the GEM, connector C429, pin 16, circuit 8-EE9 (WH/GN), wiring harness side and the DLC, connector C418, pin 7, circuit 8-EE10 (WH/BK), wiring harness side. • Is a resistance of more than 2 Ohm measured? → **Yes** LOCATE and RECTIFY the break in circuit 8-EE9 (WH/GN) or 8-EE10 (WH/BK) between the GEM and the DLC with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** GO to **A11**
A11: CHECK THE CIRCUIT BETWEEN THE GEM AND THE DLC FOR A SHORT TO VOLTAGE SUPPLY	
WARNING: After disconnecting the battery wait at least 1 minute before disconnecting any connectors from the safety restraint system to prevent the risk of accidental deployment. Failure to observe this instruction can lead to injuries.	
WARNING: To prevent the risk of accidental deployment, do not connect a radio keycode saver when working on the safety restraint system. Failure to observe this instruction can lead to injuries.	
NOTE: The number of modules connected to the ISO 9141 bus depends on the equipment levels of the vehicle. As a result, not every vehicle is equipped with all of the following modules.	
	1 Disconnect Ground cable at the battery. 2 Disconnect Heating and air conditioning control module or EATC module C539b. 3 Disconnect Instrument cluster C449. 4 Disconnect Restraint control module (RCM) C490. 5 Disconnect ABS control module or electronic stability program (ESP) module C103. 6 Disconnect Fuel-fired additional heater C252. 7 Disconnect Xenon headlamp, left-hand side C1146. 8 Disconnect Xenon headlamp, right-hand side C1147. 9 Disconnect Audio/navigation control unit VNR 9000 C485.

DIAGNOSIS AND TESTING (Continued)

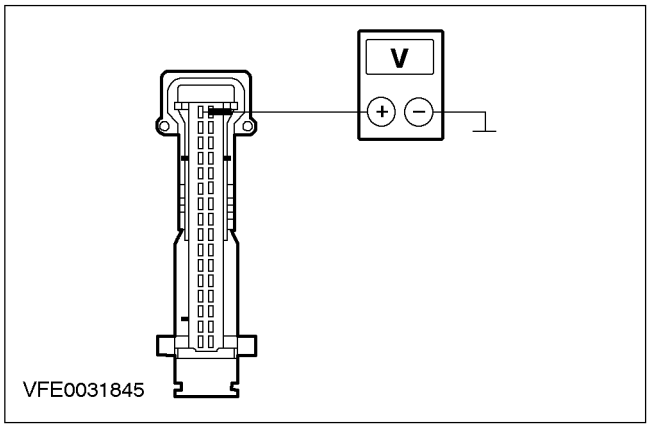
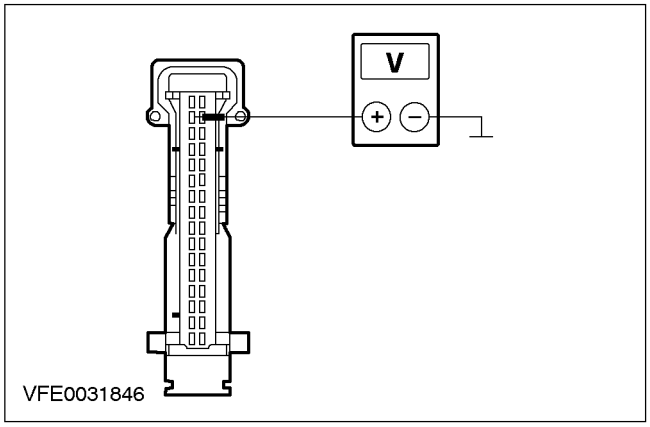
CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0029118	**10** Connect Ground cable at the battery. **11** Key in ON position. **12** Measure the voltage between the DLC, connector C418, pin 7, circuit 8-EE10 (WH/BK), wiring harness side and ground. • Is a voltage measured? → **Yes** LOCATE and RECTIFY the short to voltage supply in the circuits connected to soldered connection S178 with the aid of the Wiring Diagrams. CHECK the system again. → **No** GO to **A12**
A12: CHECK THE CIRCUIT BETWEEN THE GEM AND THE DLC FOR A SHORT TO GROUND	
 VFE0029119	**1** Key in OFF position. **2** Measure the resistance between the DLC, connector C418, pin 7, circuit 8-EE10 (WH/BK), wiring harness side and ground. • Is a resistance of less than 10 kOhm measured? → **Yes** LOCATE and RECTIFY the short to ground in the circuits connected to soldered connection S178 with the aid of the Wiring Diagrams. CHECK the system again. → **No** TEST the GEM and RENEW as necessary. CHECK the operation of the system.

DIAGNOSIS AND TESTING (Continued)

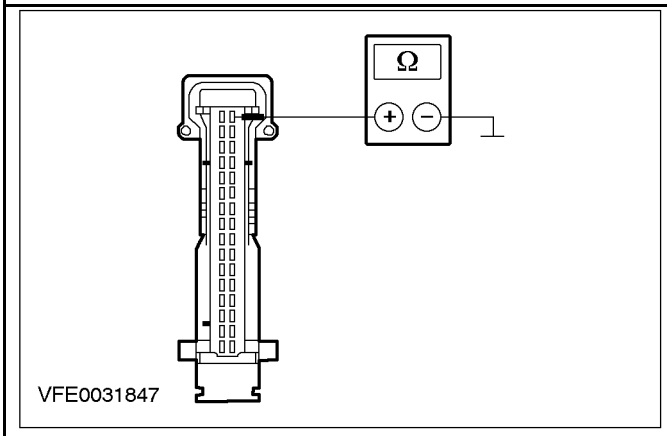
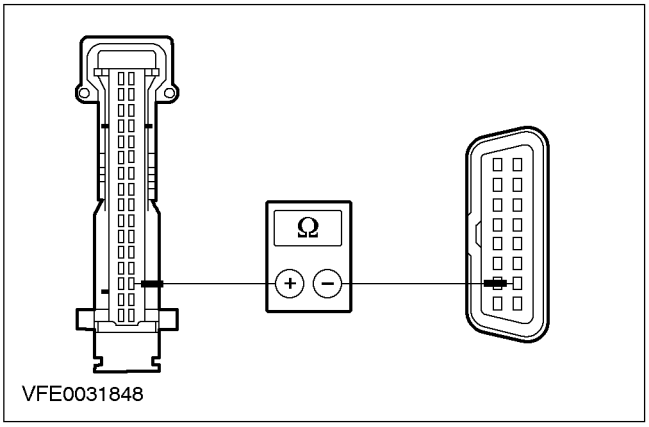
PINPOINT TEST B: INSTRUMENT CLUSTER NOT COMMUNICATING WITH THE DIAGNOSTIC UNIT

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK FUSE F75	
	1 Key in OFF position. 2 CHECK Fuse F75 (CJB). • Is the fuse OK? → **Yes** GO to **B2** → **No** RENEW fuse F75 (7.5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground with the aid of the Wiring Diagrams.
B2: MEASURE THE VOLTAGE AT FUSE F75	
	1 Connect Fuse F75 (CJB). 2 Measure the voltage between fuse F75 (7.5 A) and ground. • Does the meter display battery voltage? → **Yes** GO to **B3** → **No** REPAIR the voltage supply to fuse F75 with the aid of the Wiring Diagrams. CHECK the operation of the system.
B3: CHECK FUSE F78.	
	1 CHECK Fuse F78 (CJB). • Is the fuse OK? → **Yes** GO to **B4** → **No** RENEW fuse F78 (7.5 A). CHECK the system again. If the fuse blows again, LOCATE and RECTIFY the short to ground with the aid of the Wiring Diagrams.
B4: MEASURE THE VOLTAGE AT FUSE F78	
	1 Connect Fuse F78 (CJB). 2 Key in ON position. 3 Measure the voltage between fuse F78 (7.5 A) and ground. • Does the meter display battery voltage? → **Yes** GO to **B5** → **No** REPAIR the voltage supply to fuse F78 with the aid of the Wiring Diagrams. CHECK the operation of the system.

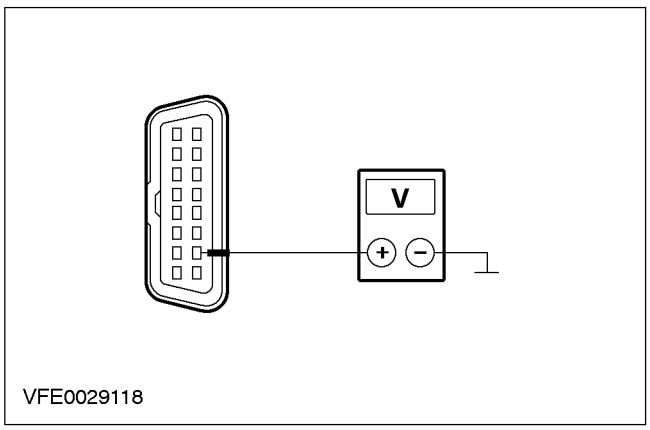
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
B5: CHECK THE VOLTAGE AT THE INSTRUMENT CLUSTER	
	1 Key in OFF position. 2 Disconnect Instrument cluster C449. 3 Measure the voltage between the instrument cluster, connector C449, pin 1, circuit 29-GG14 (OG), wiring harness side and ground. • Does the meter display battery voltage? → **Yes** GO to **B6** → **No** LOCATE and RECTIFY the break in the circuit between fuse F75 and the instrument cluster with the aid of the Wiring Diagrams. CHECK the operation of the system.
B6: CHECK THE CONTROL VOLTAGE AT THE INSTRUMENT CLUSTER	
	1 Key in ON position. 2 Measure the voltage between the instrument cluster, connector C449, pin 2, circuit 15-GG14 (GN/RD), wiring harness side and ground. • Does the meter display battery voltage? → **Yes** GO to **B7** → **No** LOCATE and RECTIFY the break in the circuit between fuse F78 and the instrument cluster with the aid of the Wiring Diagrams. CHECK the operation of the system.
B7: CHECK THE GROUND CONNECTION OF THE INSTRUMENT CLUSTER	
	1 Key in OFF position.

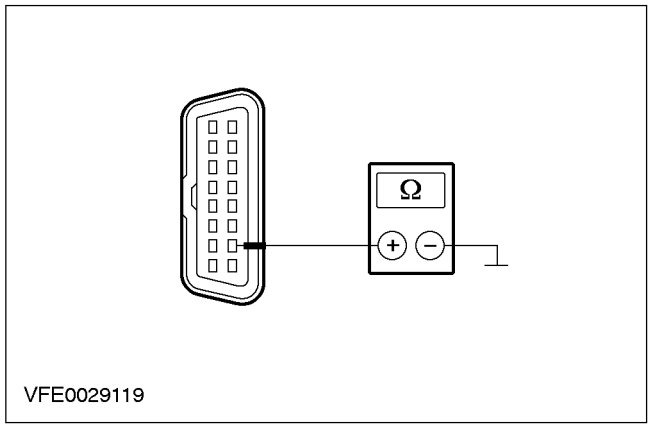
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**2** Measure the resistance between the instrument cluster, connector C449, pin 17, circuit 91-GG14 (BK/OG), wiring harness side and ground. • Is a resistance of less than 2 Ohm measured? → **Yes** GO to **B8** → **No** LOCATE and RECTIFY the break in the circuit between the instrument cluster and ground connection G203 with the aid of the Wiring Diagrams. CHECK the operation of the system.
B8: CHECK THE CIRCUIT BETWEEN THE INSTRUMENT CLUSTER AND THE DLC FOR OPEN CIRCUIT	
	**1** Measure the resistance between the instrument cluster, connector C449, pin 30, circuit 8-EE12 (WH), wiring harness side and the DLC, connector C418, pin 7, circuit 8-EE10 (WH/BK), wiring harness side. • Is a resistance of more than 2 Ohm measured? → **Yes** LOCATE and RECTIFY the break in circuit 8-EE12 (WH) or 8-EE10 (WH/BK) between the instrument cluster and the DLC with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** GO to **B9**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
B9: CHECK THE CIRCUIT BETWEEN THE INSTRUMENT CLUSTER AND THE DLC FOR A SHORT TO VOLTAGE SUPPLY	
WARNING: After disconnecting the battery wait at least 1 minute before disconnecting any connectors from the safety restraint system to prevent the risk of accidental deployment. Failure to observe this instruction can lead to injuries.	
WARNING: To prevent the risk of accidental deployment, do not connect a radio keycode saver when working on the safety restraint system. Failure to observe this instruction can lead to injuries.	
NOTE: The number of modules connected to the ISO 9141 bus depends on the equipment levels of the vehicle. As a result, not every vehicle is equipped with all of the following modules.	
	**1** Disconnect Ground cable at the battery. **2** Disconnect Heating and air conditioning control module or EATC module C539b. **3** Disconnect Generic electronic module (GEM) C429. **4** Disconnect Restraint control module (RCM) C490. **5** Disconnect ABS control module or electronic stability program (ESP) module C103. **6** Disconnect Fuel-fired additional heater C252. **7** Disconnect Xenon headlamp, left-hand side C1146. **8** Disconnect Xenon headlamp, right-hand side C1147. **9** Disconnect Audio/navigation control unit VNR 9000 C485. **10** Connect Ground cable at the battery. **11** Key in ON position. **12** Measure the voltage between the DLC, connector C418, pin 7, circuit 8-EE10 (WH/BK), wiring harness side and ground. • Is a voltage measured? → **Yes** LOCATE and RECTIFY the short to voltage supply in the circuits connected to soldered connection S178 with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	GO to **B10**
B10: CHECK THE CIRCUIT BETWEEN THE INSTRUMENT CLUSTER AND THE DLC FOR A SHORT TO GROUND	
 VFE0029119	1 Key in OFF position. 2 Measure the resistance between the DLC, connector C418, pin 7, circuit 8-EE10 (WH/BK), wiring harness side and ground. • Is a resistance of less than 10 kOhm measured? → **Yes** LOCATE and RECTIFY the short to ground in the circuits connected to soldered connection S178 with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** CHECK and if necessary RENEW the instrument cluster. CHECK the operation of the system.

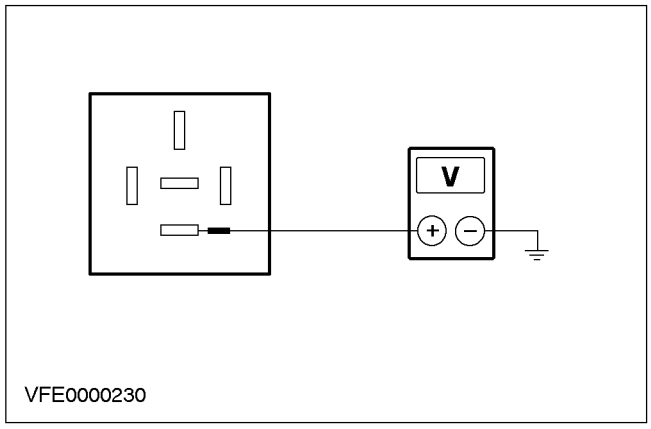
PINPOINT TEST C: HEATING AND AIR CONDITIONING CONTROL MODULE OR EATC MODULE NOT COMMUNICATING WITH THE DIAGNOSTIC UNIT

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK FUSE F65.	
	1 Key in OFF position. 2 CHECK Fuse F65 (CJB). • Is the fuse OK? → **Yes** GO to **C2** → **No** RENEW fuse F65 (7.5 A). CHECK the system again. If the fuse blows again, LOCATE and RECTIFY the short to ground with the aid of the Wiring Diagrams.
C2: MEASURE THE VOLTAGE AT FUSE F65	
	1 Connect Fuse F65 (CJB). 2 Measure the voltage between fuse F65 (7.5 A) and ground. • Does the meter display battery voltage? → **Yes**

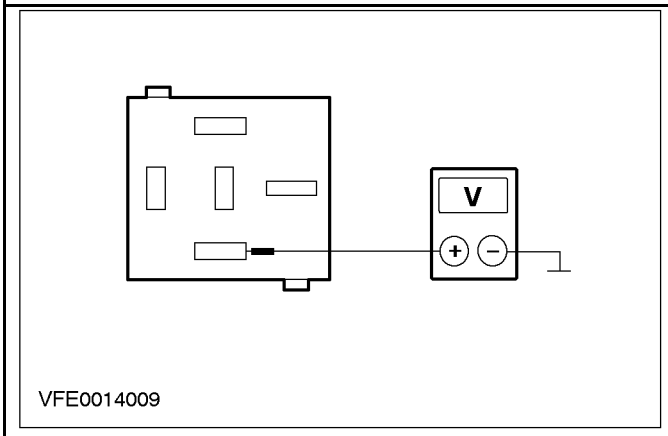
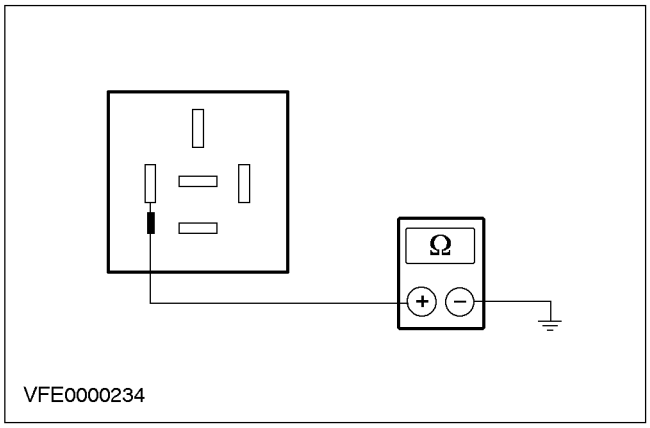
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	GO to **C3** → **No** REPAIR the voltage supply to fuse F65 with the aid of the Wiring Diagrams. CHECK the operation of the system.
C3: CHECK FUSE F76.	
	1 CHECK Fuse F76 (CJB). • Is the fuse OK? → **Yes** GO to **C4** → **No** RENEW fuse F76 (7.5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground with the aid of the Wiring Diagrams.
C4: MEASURE THE VOLTAGE AT FUSE F76	
	1 Connect Fuse F76 (CJB). 2 Key in ON position. 3 Measure the voltage between fuse F76 (7.5 A) and ground. • Does the meter display battery voltage? → **Yes** GO to **C13** → **No** GO to **C5**
C5: CHECK FUSE F6	
	1 Key in OFF position. 2 CHECK Fuse F6 (BJB). • Is the fuse OK? → **Yes** GO to **C6** → **No** RENEW fuse F6 (40 A). CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground with the aid of the Wiring Diagrams.
C6: MEASURE THE VOLTAGE AT FUSE F6	
	1 Connect Fuse F6 (BJB). 2 Measure the voltage between fuse F6 (40 A) and ground. • Does the meter display battery voltage? → **Yes** GO to **C7** → **No** REPAIR the voltage supply to fuse F6 with the aid of the Wiring Diagrams. CHECK the operation of the system.

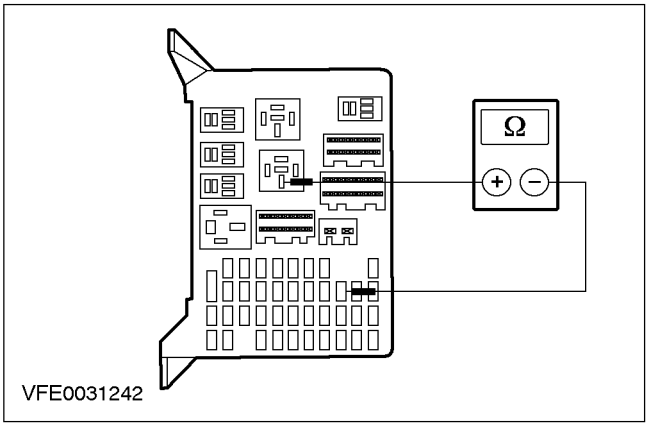
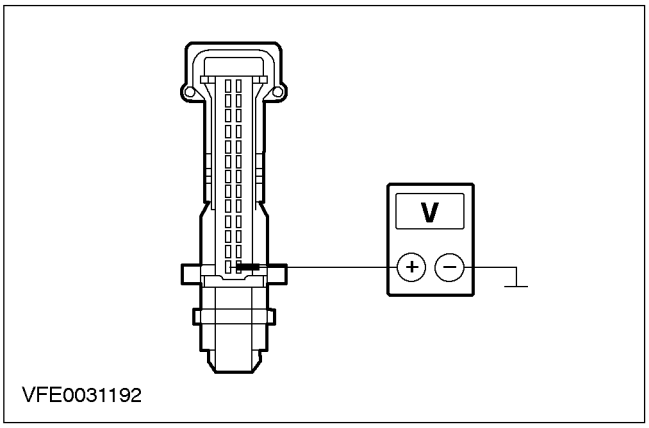
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
C7: CHECK FUSE F93.	
	1 CHECK Fuse F93 (CJB). • Is the fuse OK? → **Yes** GO to **C8** → **No** RENEW fuse F93 (10 A). CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground with the aid of the Wiring Diagrams.
C8: MEASURE THE VOLTAGE AT FUSE F93	
	1 Connect Fuse F93 (CJB). 2 Key in ON position. 3 Measure the voltage between fuse F93 (10 A) and ground. • Does the meter display battery voltage? → **Yes** GO to **C9** → **No** REPAIR the voltage supply to fuse F93 with the aid of the Wiring Diagrams. CHECK the operation of the system.
C9: CHECK THE VOLTAGE AT THE HEATER BLOWER RELAY	
 VFE0000230	1 Key in OFF position. 2 Disconnect Heater blower relay C920. 3 Measure the voltage between the heater blower relay, socket C920, pin 5, wiring harness side and ground. • Does the meter display battery voltage? → **Yes** GO to **C10** → **No** LOCATE and RECTIFY the break in the circuit between fuse F6 and the heater blower relay with the aid of the Wiring Diagrams. CHECK the operation of the system.
C10: CHECK THE CONTROL VOLTAGE AT THE HEATER BLOWER RELAY	
	1 Key in ON position.

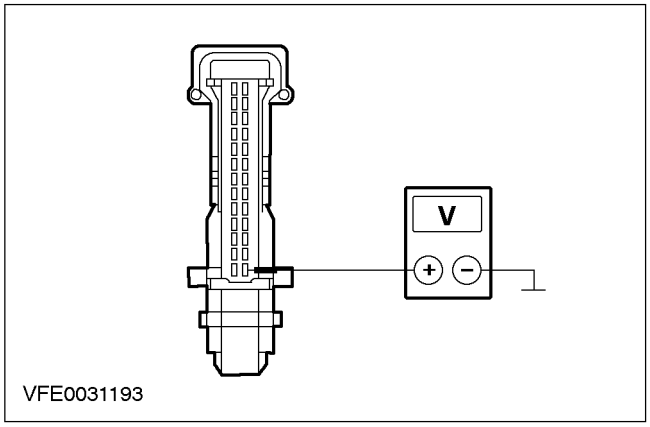
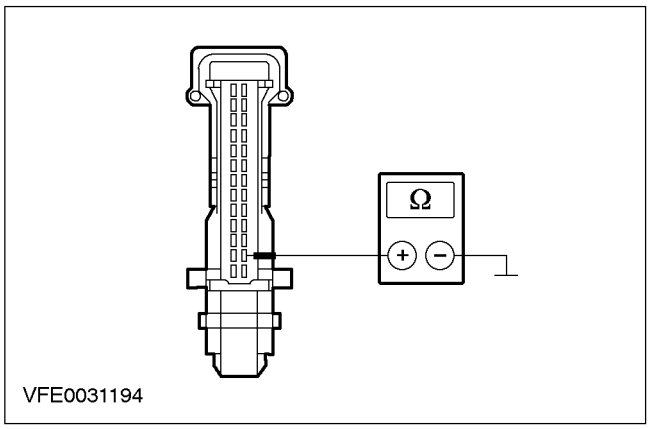
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0014009	**2** Measure the voltage between the heater blower relay, socket C920, pin 2, wiring harness side and ground. • Does the meter display battery voltage? → **Yes** GO to **C11** → **No** LOCATE and RECTIFY the break in the circuit between fuse F93 and the heater blower relay with the aid of the Wiring Diagrams. CHECK the operation of the system.
C11: CHECK THE GROUND CONNECTION OF THE HEATER BLOWER RELAY	
 VFE0000234	**1** Key in OFF position. **2** Measure the resistance between the heater blower relay, socket C920, pin 1, wiring harness side and ground. • Is a resistance of less than 2 Ohm measured? → **Yes** GO to **C12** → **No** LOCATE and RECTIFY the break in the circuit between the heater blower relay and ground connection G200 with the aid of the Wiring Diagrams. CHECK the operation of the system.

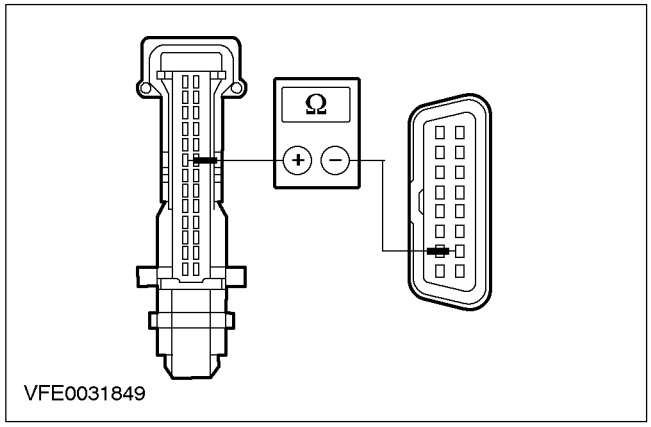
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
C12: CHECK THE CENTRAL JUNCTION BOX	
 VFE0031242	1 Measure the resistance between the heater blower relay, socket C920, pin 3, wiring harness side and fuse F76. • Is a resistance of less than 2 Ohm measured? → **Yes** RENEW the heater blower relay. CHECK the operation of the system. → **No** CHECK and if necessary RENEW the central junction box. CHECK the operation of the system.
C13: CHECK THE VOLTAGE AT THE HEATING AND AIR CONDITIONING CONTROL MODULE OR THE EATC MODULE	
 VFE0031192	1 Key in OFF position. 2 Disconnect Heating and air conditioning control module or EATC module C539b. 3 Measure the voltage between the EATC module or the heating and air conditioning control module, connector C539b, pin 1, circuit 29-FA43 (OG/WH), wiring harness side and ground. • Does the meter display battery voltage? → **Yes** GO to **C14** → **No** LOCATE and RECTIFY the break in the circuit between fuse F65 and the heating and air conditioning control module or the EATC module with the aid of the Wiring Diagrams. CHECK the operation of the system.

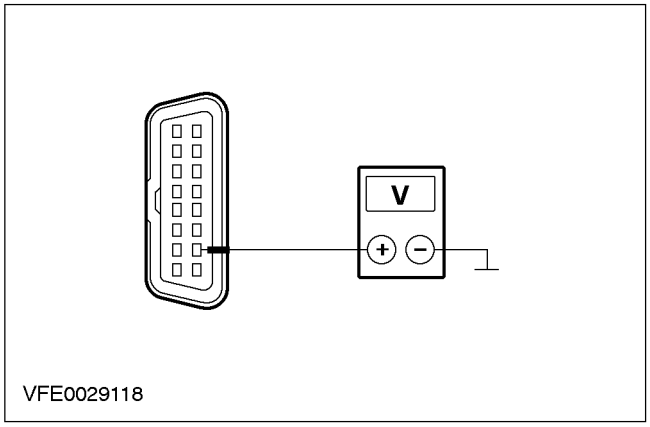
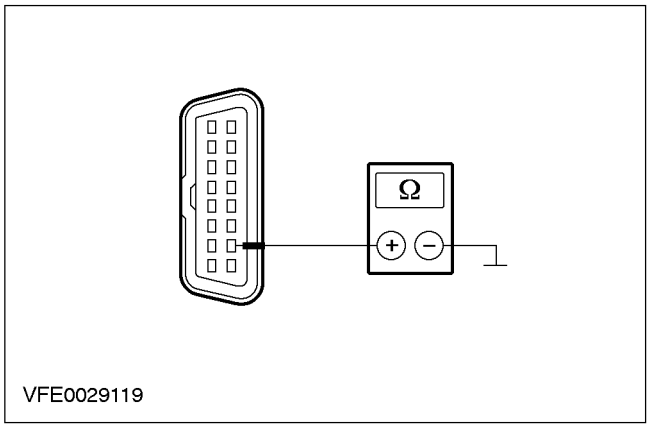
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
C14: CHECK THE CONTROL VOLTAGE AT THE HEATING AND AIR CONDITIONING CONTROL MODULE OR THE EATC MODULE	
 VFE0031193	**1** Key in ON position. **2** Measure the voltage between the EATC module or the heating and air conditioning control module, connector C539b, pin 14, circuit 15S-FA43 (GN/WH), wiring harness side and ground. • Does the meter display battery voltage? → **Yes** GO to **C15** → **No** LOCATE and RECTIFY the break in the circuit between fuse F76 and the heating and air conditioning control module or the EATC module with the aid of the Wiring Diagrams. CHECK the operation of the system.
C15: CHECK THE GROUND CONNECTION OF THE HEATING AND AIR CONDITIONING CONTROL MODULE OR THE EATC MODULE	
 VFE0031194	**1** Key in OFF position. **2** Measure the resistance between the EATC module or the heating and air conditioning control module, connector C539b, pin 15, circuit 31-FA43 (BK), wiring harness side and ground. • Is a resistance of less than 2 Ohm measured? → **Yes** GO to **C16** → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	LOCATE and RECTIFY the break in the circuit between the heating and air conditioning control module or the EATC module and ground connection G204 with the aid of the Wiring Diagrams. CHECK the operation of the system.
C16: CHECK THE CIRCUIT BETWEEN THE HEATING AND AIR CONDITIONING CONTROL MODULE OR THE EATC MODULE AND THE DLC FOR OPEN CIRCUIT	
	**1** Measure the resistance between the heating and air conditioning control module or the EATC module, connector C539b, pin 8, circuit 8-FA43 (WH/VT), wiring harness side and the DLC, connector C418, pin 7, circuit 8-EE10 (WH/BK), wiring harness side. • Is a resistance of more than 2 Ohm measured? → **Yes** LOCATE and RECTIFY the break in circuit 8-FA43 (WH/VT) or 8-EE10 (WH/BK) between the heating and air conditioning control module or the EATC module and the DLC with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** GO to **C17**
C17: CHECK THE CIRCUIT BETWEEN THE HEATING AND AIR CONDITIONING CONTROL MODULE OR THE EATC MODULE AND THE DLC FOR A SHORT TO VOLTAGE SUPPLY	
WARNING: After disconnecting the battery wait at least 1 minute before disconnecting any connectors from the safety restraint system to prevent the risk of accidental deployment. Failure to observe this instruction can lead to injuries.	
WARNING: To prevent the risk of accidental deployment, do not connect a radio keycode saver when working on the safety restraint system. Failure to observe this instruction can lead to injuries.	
NOTE: The number of modules connected to the ISO 9141 bus depends on the equipment levels of the vehicle. As a result, not every vehicle is equipped with all of the following modules.	
	1 Disconnect Ground cable at the battery. **2** Disconnect Instrument cluster C449. **3** Disconnect Generic electronic module (GEM) C429. **4** Disconnect Restraint control module (RCM) C490. **5** Disconnect ABS control module or electronic stability program (ESP) module C103.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0029118	**6** Disconnect Fuel-fired additional heater C252. **7** Disconnect Xenon headlamp, left-hand side C1146. **8** Disconnect Xenon headlamp, right-hand side C1147. **9** Disconnect Audio/navigation control unit VNR 9000 C485. **10** Connect Ground cable at the battery. **11** Key in ON position. **12** Measure the voltage between the DLC, connector C418, pin 7, circuit 8-EE10 (WH/BK), wiring harness side and ground. • Is a voltage measured? → **Yes** LOCATE and RECTIFY the short to voltage supply in the circuits connected to soldered connection S178 with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** GO to **C18**
C18: CHECK THE CIRCUIT BETWEEN THE HEATING AND AIR CONDITIONING CONTROL MODULE OR THE EATC MODULE AND THE DLC FOR A SHORT TO GROUND	
 VFE0029119	**1** Key in OFF position. **2** Measure the resistance between the DLC, connector C418, pin 7, circuit 8-EE10 (WH/BK), wiring harness side and ground. • Is a resistance of less than 10 kOhm measured? → **Yes**

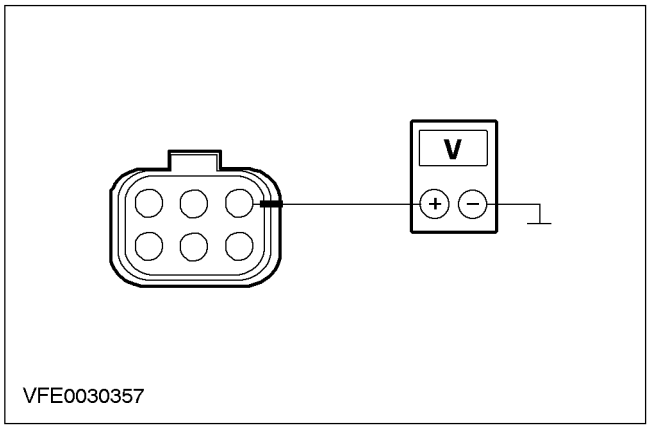
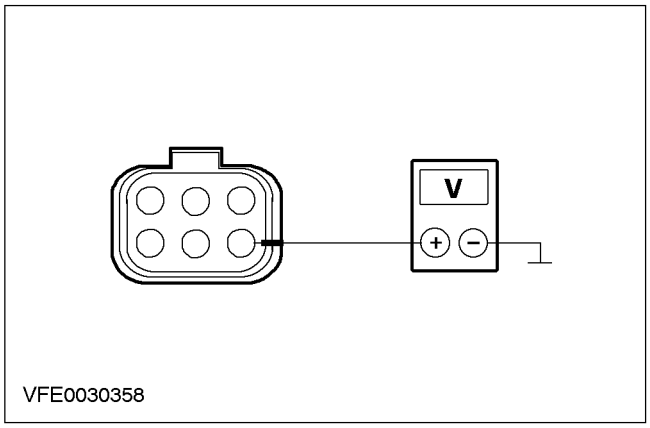
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	LOCATE and RECTIFY the short to ground in the circuits connected to soldered connection S178 with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** CHECK and if necessary RENEW the EATC module or the heating and air conditioning control module. CHECK the operation of the system.

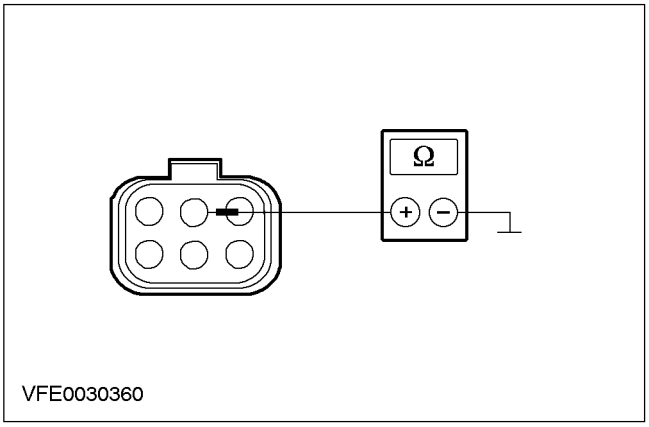
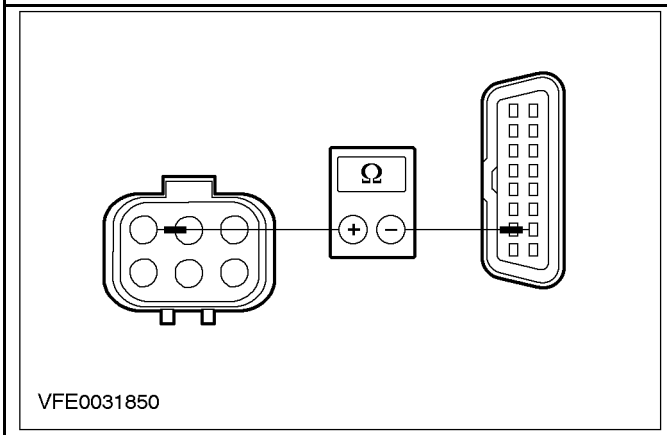
PINPOINT TEST D: FUEL-FIRED ADDITIONAL HEATER NOT COMMUNICATING WITH THE DIAGNOSTIC UNIT

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: CHECK FUSE F23	
	1 Key in OFF position. 2 CHECK Fuse F23 (BJB). • Is the fuse OK? → **Yes** GO to **D2** → **No** RENEW fuse F23 (15 A). CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground with the aid of the Wiring Diagrams.
D2: TEST THE VOLTAGE AT FUSE F23	
	1 Connect Fuse F23 (BJB). 2 Measure the voltage between fuse F23 (15 A) and ground. • Does the meter display battery voltage? → **Yes** GO to **D3** → **No** REPAIR the voltage supply to fuse F23 with the aid of the Wiring Diagrams. CHECK the operation of the system.
D3: CHECK FUSE F82.	
	1 CHECK Fuse F82 (CJB). • Is the fuse OK? → **Yes** GO to **D4** → **No** RENEW fuse F82 (7.5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground with the aid of the Wiring Diagrams.
D4: MEASURE THE VOLTAGE AT FUSE F82	
	1 Connect Fuse F82 (CJB). 2 Key in ON position.

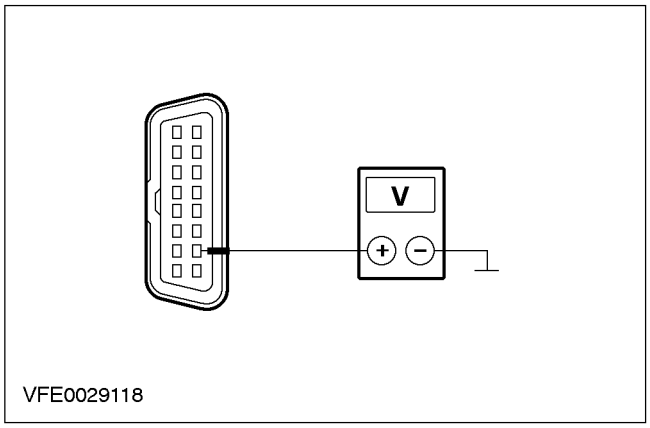
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	3 Measure the voltage between fuse F82 (7.5 A) and ground. • Does the meter display battery voltage? → **Yes** GO to **D5** → **No** REPAIR the voltage supply to fuse F82 with the aid of the Wiring Diagrams. CHECK the operation of the system.
D5: CHECK THE VOLTAGE AT THE ADDITIONAL HEATER	
 VFE0030357	1 Key in OFF position. 2 Disconnect Additional heater C252. 3 Measure the voltage between the additional heater, connector C252, pin 1, circuit 30-HA20 (RD), wiring harness side and ground. • Does the meter display battery voltage? → **Yes** GO to **D6** → **No** LOCATE and RECTIFY the break in the circuit between the additional heater and fuse F23 with the aid of the Wiring Diagrams. CHECK the operation of the system.
D6: CHECK THE CONTROL VOLTAGE AT THE ADDITIONAL HEATER	
 VFE0030358	1 Key in ON position. 2 Measure the voltage between the additional heater, connector C252, pin 4, circuit 15-HA20 (GN/WH), wiring harness side and ground. • Does the meter display battery voltage?

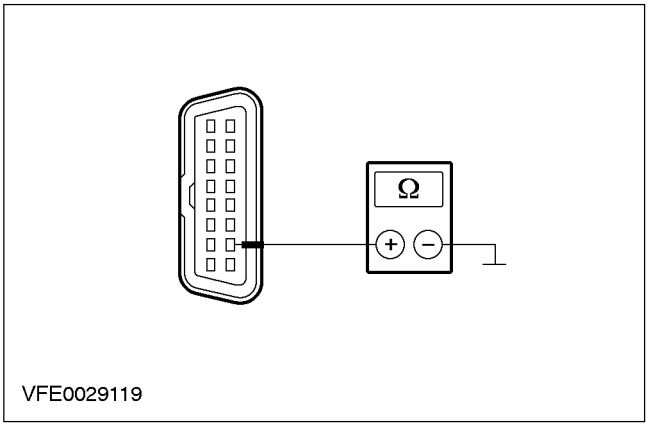
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** GO to **D7** → **No** LOCATE and RECTIFY the break in the circuit between the additional heater and fuse F82 with the aid of the Wiring Diagrams. CHECK the operation of the system.
D7: CHECK THE GROUND CONNECTION OF THE ADDITIONAL HEATER	
 VFE0030360	**1** Key in OFF position. **2** Measure the resistance between the additional heater, connector C252, pin 2, circuit 31-HA20 (BK), wiring harness side and ground. • Is a resistance of less than 2 Ohm measured? → **Yes** GO to **D8** → **No** LOCATE and RECTIFY the break in the circuit between the additional heater and ground connection G104 with the aid of the Wiring Diagrams. CHECK the operation of the system.
D8: CHECK THE CIRCUIT BETWEEN THE ADDITIONAL HEATER AND THE DLC FOR OPEN CIRCUIT	
 VFE0031850	**1** Measure the resistance between the additional heater, connector C252, pin 3, circuit 8-EE11 (WH/VT), wiring harness side and the DLC, connector C418, pin 7, circuit 8-EE10 (WH/BK), wiring harness side. • Is a resistance of more than 2 Ohm measured? → **Yes**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	LOCATE and RECTIFY the break in circuit 8-EE11 (WH/VT) or 8-EE10 (WH/BK) between the additional heater and the DLC with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** GO to **D9**
D9: CHECK THE CIRCUIT BETWEEN THE ADDITIONAL HEATER AND THE DLC FOR A SHORT TO VOLTAGE SUPPLY	
WARNING: After disconnecting the battery wait at least 1 minute before disconnecting any connectors from the safety restraint system to prevent the risk of accidental deployment. Failure to observe this instruction can lead to injuries.	
WARNING: To prevent the risk of accidental deployment, do not connect a radio keycode saver when working on the safety restraint system. Failure to observe this instruction can lead to injuries.	
NOTE: The number of modules connected to the ISO 9141 bus depends on the equipment levels of the vehicle. As a result, not every vehicle is equipped with all of the following modules.	
	**1** Disconnect Ground cable at the battery. **2** Disconnect Instrument cluster C449. **3** Disconnect Generic electronic module (GEM) C429. **4** Disconnect Restraint control module (RCM) C490. **5** Disconnect ABS control module or electronic stability program (ESP) module C103. **6** Disconnect Heating and air conditioning control module or EATC module C539b. **7** Disconnect Xenon headlamp, left-hand side C1146. **8** Disconnect Xenon headlamp, right-hand side C1147. **9** Disconnect Audio/navigation control unit VNR 9000 C485. **10** Connect Ground cable at the battery. **11** Key in ON position. **12** Measure the voltage between the DLC, connector C418, pin 7, circuit 8-EE10 (WH/BK), wiring harness side and ground. • Is a voltage measured?

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** LOCATE and RECTIFY the short to voltage supply in the circuits connected to soldered connection S178 with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** GO to **D10**
D10: CHECK THE CIRCUIT BETWEEN THE ADDITIONAL HEATER AND THE DLC FOR A SHORT TO GROUND	
	1 Key in OFF position. 2 Measure the resistance between the DLC, connector C418, pin 7, circuit 8-EE10 (WH/BK), wiring harness side and ground. • Is a resistance of less than 10 kOhm measured? → **Yes** LOCATE and RECTIFY the short to ground in the circuits connected to soldered connection S178 with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** CHECK and if necessary RENEW the additional heater. CHECK the operation of the system.

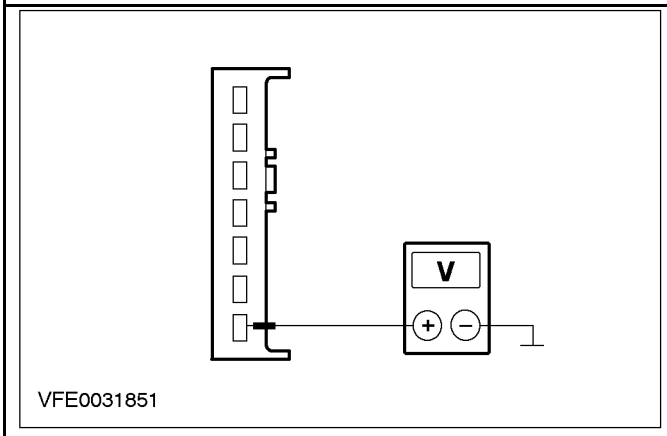
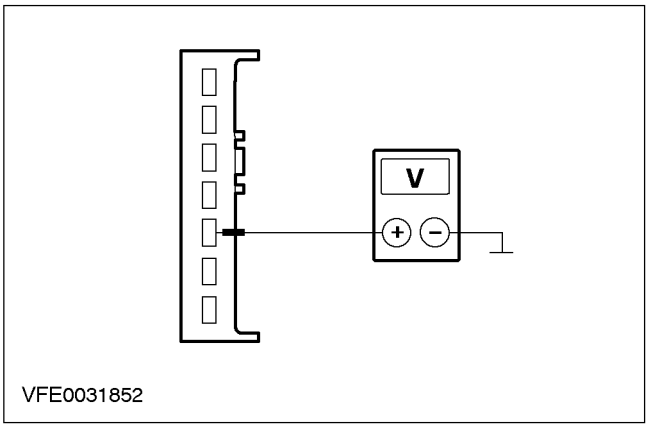
PINPOINT TEST E: AUDIO/NAVIGATION CONTROL UNIT VNR 9000 NOT COMMUNICATING WITH THE DIAGNOSTIC UNIT

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: CHECK FUSE F72	
	1 Key in OFF position. 2 CHECK Fuse F72 (CJB). • Is the fuse OK? → **Yes** GO to **E2** → **No** RENEW fuse F72 (20 A). CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground with the aid of the Wiring Diagrams.

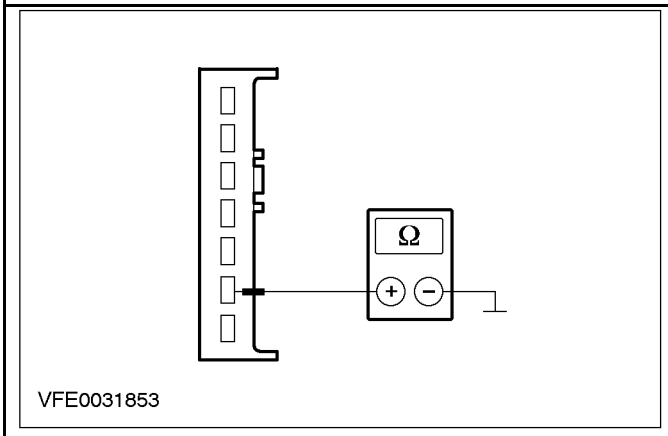
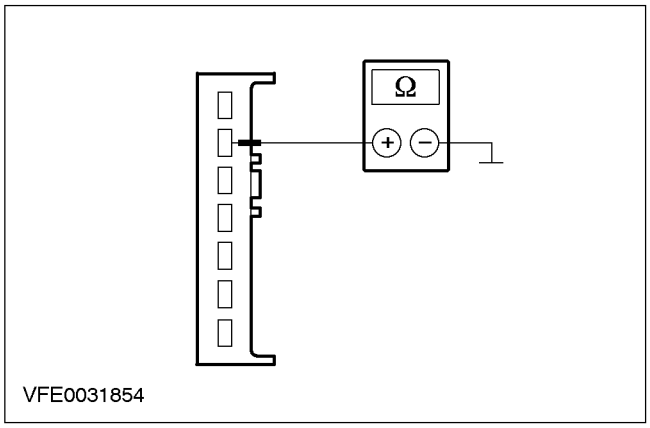
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
E2: MEASURE THE VOLTAGE AT FUSE F72	
	1 Connect Fuse F72 (CJB). 2 Measure the voltage between fuse F72 (20 A) and ground. • Does the meter display battery voltage? → **Yes** GO to **E3** → **No** REPAIR the voltage supply to fuse F72 with the aid of the Wiring Diagrams. CHECK the operation of the system.
E3: CHECK FUSE F69.	
	1 CHECK Fuse F69 (CJB). • Is the fuse OK? → **Yes** GO to **E4** → **No** RENEW fuse F69 (7.5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground with the aid of the Wiring Diagrams.
E4: MEASURE THE VOLTAGE AT FUSE F69	
	1 Connect Fuse F69 (CJB). 2 Key in ACCESSORY position. 3 Measure the voltage between fuse F69 (7.5 A) and ground. • Does the meter display battery voltage? → **Yes** GO to **E5** → **No** REPAIR the voltage supply to fuse F69 with the aid of the Wiring Diagrams. CHECK the operation of the system.
E5: CHECK THE VOLTAGE AT AUDIO/NAVIGATION CONTROL UNIT VNR 9000	
	1 Key in OFF position. 2 Disconnect Audio/navigation control unit C489 (vehicles with audio/navigation system built up to 09/2001: C483).

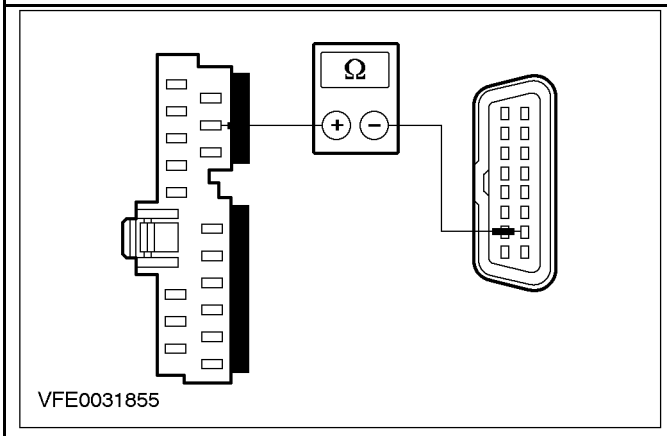
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031851	3 Measure the voltage between the audio/navigation control unit, connector C489 (vehicles with audio/navigation system built up to 09/2001: C483), pin 1, circuit 29-MD15A (OG/BK), wiring harness side and ground. • Does the meter display battery voltage? → **Yes** GO to **E6** → **No** LOCATE and RECTIFY the break in the circuit between fuse F72 and the audio/navigation control unit with the aid of the Wiring Diagrams. CHECK the operation of the system.
E6: CHECK THE VOLTAGE AT AUDIO/NAVIGATION CONTROL UNIT VNR 9000	
 VFE0031852	1 Key in ACCESSORY position. 2 Measure the voltage between the audio/navigation control unit, connector C489 (vehicles with audio/navigation system built up to 09/2001: C483), pin 3, circuit 75-MD15 (YE/GN), wiring harness side and ground. • Does the meter display battery voltage? → **Yes** GO to **E7** → **No** LOCATE and RECTIFY the break in the circuit between fuse F69 and the audio/navigation control unit with the aid of the Wiring Diagrams. CHECK the operation of the system.
E7: CHECK THE GROUND CONNECTION OF AUDIO/NAVIGATION CONTROL UNIT VNR 9000	
	1 Key in OFF position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031853	**2** Measure the resistance between the audio/navigation control unit, connector C489 (vehicles with audio/navigation system built up to 09/2001: C483), pin 2, circuit 91-MD34 (BK/YE), wiring harness side and ground. • Is a resistance of less than 2 Ohm measured? → **Yes** GO to **E8** → **No** LOCATE and RECTIFY the open circuit in circuit 91-MD34 (BK/YE) between ground connection G201 and the audio/navigation control unit with the aid of the Wiring Diagrams. CHECK the operation of the system.
E8: CHECK THE GROUND CONNECTION OF AUDIO/NAVIGATION CONTROL UNIT VNR 9000	
 VFE0031854	**1** Measure the resistance between the audio/navigation control unit, connector C489 (vehicles with audio/navigation system built up to 09/2001: C483), pin 6, circuit 91-MD15 (BK/GN), wiring harness side and ground. • Is a resistance of less than 2 Ohm measured? → **Yes** GO to **E9** → **No** LOCATE and RECTIFY the break in circuit 91-MD15 (BK/GN) or 91-MD15A (BK/GN) between ground connection G201 and the audio/navigation control unit with the aid of the Wiring Diagrams. CHECK the operation of the system.
E9: CHECK THE CIRCUIT BETWEEN AUDIO/NAVIGATION CONTROL UNIT VNR 9000 AND THE DLC FOR OPEN CIRCUIT	
	1 Disconnect Audio/navigation control unit C485.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**2** Measure the resistance between the audio/navigation control unit, connector C485, pin 16, circuit 8-MD15 (WH/GN), wiring harness side and the DLC, connector C418, pin 7, circuit 8-EE10 (WH/BK), wiring harness side. • Is a resistance of more than 2 Ohm measured? → **Yes** LOCATE and RECTIFY the break in circuit 8-MD15 (WH/GN) or 8-EE10 (WH/BK) between the audio/navigation control unit and the DLC with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** GO to **E10**

E10: CHECK THE CIRCUIT BETWEEN AUDIO/NAVIGATION CONTROL UNIT VNR 9000 AND THE DLC FOR A SHORT TO VOLTAGE SUPPLY

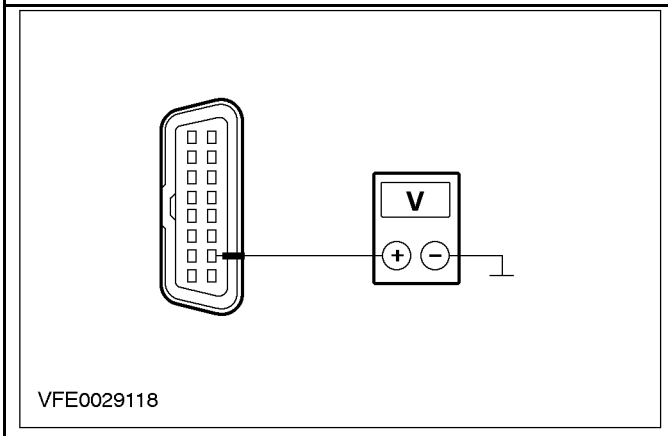
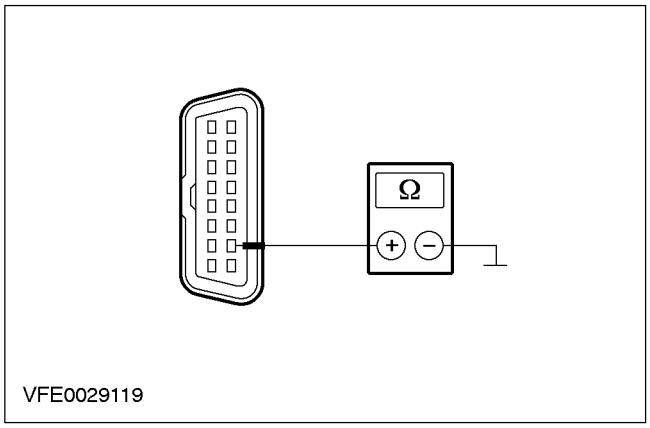
⚠ **WARNING: After disconnecting the battery wait at least 1 minute before disconnecting any connectors from the safety restraint system to prevent the risk of accidental deployment. Failure to observe this instruction can lead to injuries.**

⚠ **WARNING: To prevent the risk of accidental deployment, do not connect a radio keycode saver when working on the safety restraint system. Failure to observe this instruction can lead to injuries.**

NOTE: The number of modules connected to the ISO 9141 bus depends on the equipment levels of the vehicle. As a result, not every vehicle is equipped with all of the following modules.

1 Disconnect Ground cable at the battery.
2 Disconnect Instrument cluster C449.
3 Disconnect Generic electronic module (GEM) C429.
4 Disconnect Restraint control module (RCM) C490.
5 Disconnect ABS control module or electronic stability program (ESP) module C103.
6 Disconnect Heating and air conditioning control module or EATC module C539b.
7 Disconnect Xenon headlamp, left-hand side C1146.
8 Disconnect Xenon headlamp, right-hand side C1147.
9 Disconnect Additional heater C252.
10 Connect Ground cable at the battery.
11 Key in ON position.

DIAGNOSIS AND TESTING (Continued)

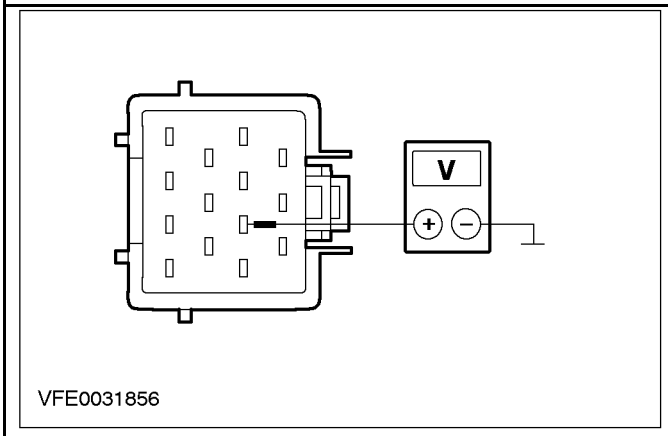
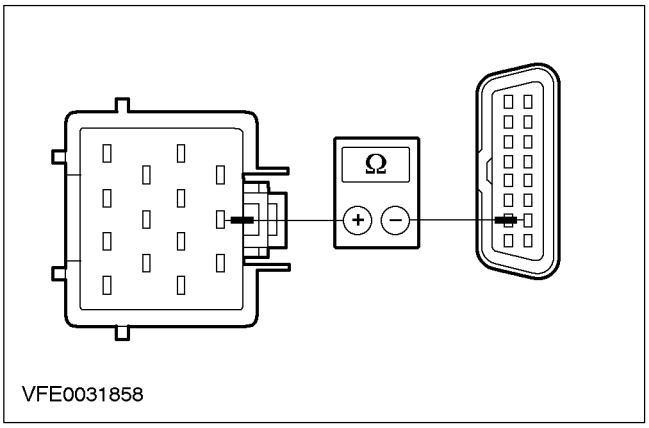
CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0029118	**12** Measure the voltage between the DLC, connector C418, pin 7, circuit 8-EE10 (WH/BK), wiring harness side and ground. • Is a voltage measured? → **Yes** LOCATE and RECTIFY the short to voltage supply in the circuits connected to soldered connection S178 with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** GO to **E11**
E11: CHECK THE CIRCUIT BETWEEN AUDIO/NAVIGATION CONTROL UNIT VNR 9000 AND THE DLC FOR A SHORT TO GROUND	
 VFE0029119	**1** Key in OFF position. **2** Measure the resistance between the DLC, connector C418, pin 7, circuit 8-EE10 (WH/BK), wiring harness side and ground. • Is a resistance of less than 10 kOhm measured? → **Yes** LOCATE and RECTIFY the short to ground in the circuits connected to soldered connection S178 with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** CHECK and if necessary RENEW the audio/navigation control unit. CHECK the operation of the system.

DIAGNOSIS AND TESTING (Continued)

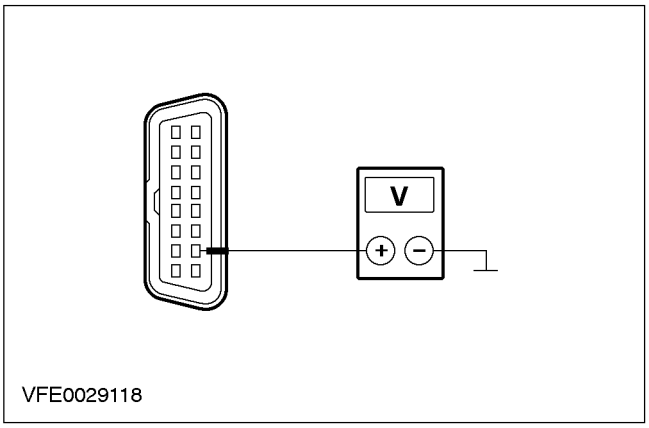
PINPOINT TEST F: XENON HEADLAMP(S) NOT COMMUNICATING WITH THE DIAGNOSTIC UNIT

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1: DETERMINE THE CONDITIONS UNDER WHICH THE FAULT OCCURS	
	1 Key in OFF position. 2 Connect the diagnostic tool. 3 Key in ON position. 4 Check the communications with the other Xenon headlamp. • Is there a fault in the communications with both of the Xenon headlamps? → **Yes** GO to **F2** → **No** Communications only faulty to the right-hand Xenon headlamp. GO to **F7** Communications only faulty to the left-hand Xenon headlamp. GO to **F10**
F2: CHECK FUSE F93	
	1 Key in OFF position. 2 CHECK Fuse F93 (CJB). • Is the fuse OK? → **Yes** GO to **F3** → **No** RENEW fuse F93 (10 A). CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground with the aid of the Wiring Diagrams.
F3: MEASURE THE VOLTAGE AT FUSE F93	
	1 Connect Fuse F93 (CJB). 2 Key in ON position. 3 Measure the voltage between fuse F93 (10 A) and ground. • Does the meter display battery voltage? → **Yes** GO to **F4** → **No** REPAIR the voltage supply to fuse F93 with the aid of the Wiring Diagrams. CHECK the operation of the system.
F4: CHECK THE VOLTAGE AT THE RIGHT-HAND XENON HEADLAMP	
⚠ **WARNING: High voltages are present in the system. Ensure that the headlamp connector is disconnected before starting work on the headlamps. Failure to observe this instruction can lead to injuries.**	
	1 Key in OFF position. 2 Disconnect Xenon headlamp, right-hand side C1147. 3 Key in ON position.

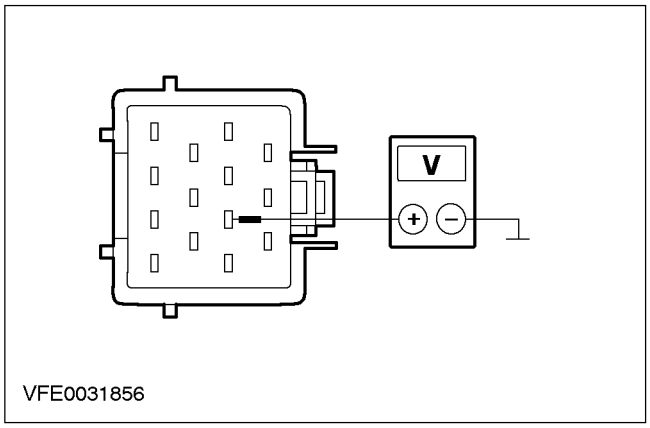
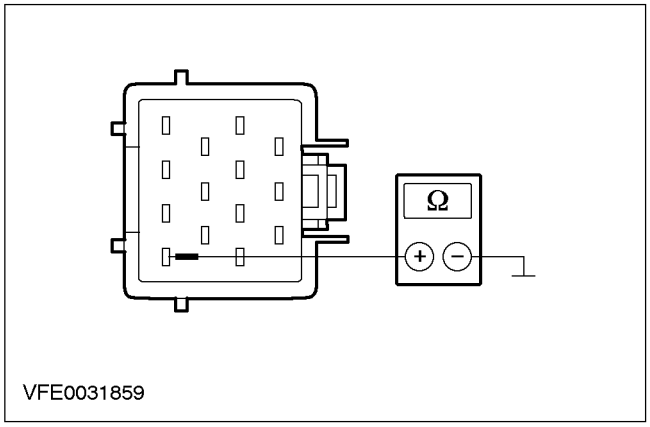
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031856	4 Measure the voltage between the right-hand Xenon headlamp, connector C1147, pin 5, circuit 15-LE2B (GN/BU), wiring harness side and ground. • Does the meter display battery voltage? → **Yes** GO to **F5** → **No** LOCATE and RECTIFY the break in the circuit between fuse F93 and soldered connection S335 with the aid of the Wiring Diagrams. CHECK the operation of the system.
F5: CHECK THE CIRCUIT BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE RIGHT-HAND XENON HEADLAMP FOR OPEN CIRCUIT	
 VFE0031858	1 Key in OFF position. 2 Measure the resistance between the right-hand Xenon headlamp, connector C1147, pin 2, circuit 8-LE30 (WH/RD), wiring harness side and the DLC, C418, pin 7, circuit 8-EE10 (WH/BK), wiring harness side. • Is a resistance of less than 2 Ohm measured? → **Yes** GO to **F6** → **No** LOCATE and RECTIFY the break in circuit 8-EE1 (WH/RD) or 8-EE10 (WH/BK) between the DLC and soldered connection S385 with the aid of the Wiring Diagrams. CHECK the operation of the system.

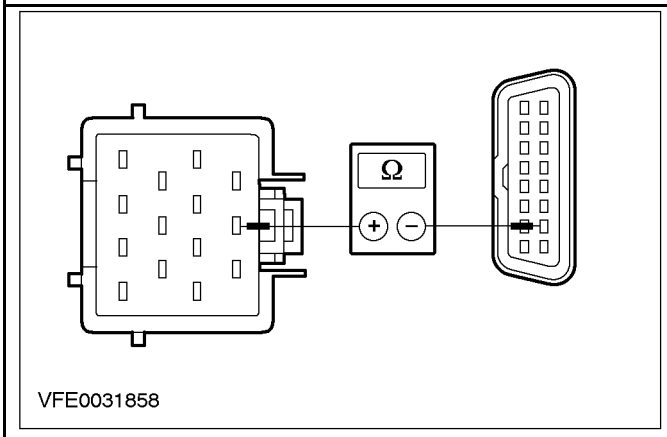
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
F6: CHECK THE CIRCUIT BETWEEN THE XENON HEADLAMP AND THE DLC FOR A SHORT TO VOLTAGE SUPPLY	
WARNING: After disconnecting the battery wait at least 1 minute before disconnecting any connectors from the safety restraint system to prevent the risk of accidental deployment. Failure to observe this instruction can lead to injuries.	
WARNING: To prevent the risk of accidental deployment, do not connect a radio keycode saver when working on the safety restraint system. Failure to observe this instruction can lead to injuries.	
NOTE: The number of modules connected to the ISO 9141 bus depends on the equipment levels of the vehicle. As a result, not every vehicle is equipped with all of the following modules.	
 VFE0029118	**1** Disconnect Ground cable at the battery. **2** Disconnect Instrument cluster C449. **3** Disconnect Generic electronic module (GEM) C429. **4** Disconnect Restraint control module (RCM) C490. **5** Disconnect ABS control module or electronic stability program (ESP) module C103. **6** Disconnect Heating and air conditioning control module or EATC module C539b. **7** Disconnect Xenon headlamp, left-hand side C1146. **8** Disconnect Audio/navigation control unit VNR 9000 C485. **9** Disconnect Additional heater C252. **10** Connect Ground cable at the battery. **11** Key in ON position. **12** Measure the voltage between the DLC, connector C418, pin 7, circuit 8-EE10 (WH/BK), wiring harness side and ground. • Is a voltage measured? → **Yes** LOCATE and RECTIFY the short to voltage supply in the circuits connected to soldered connection S178 with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No**

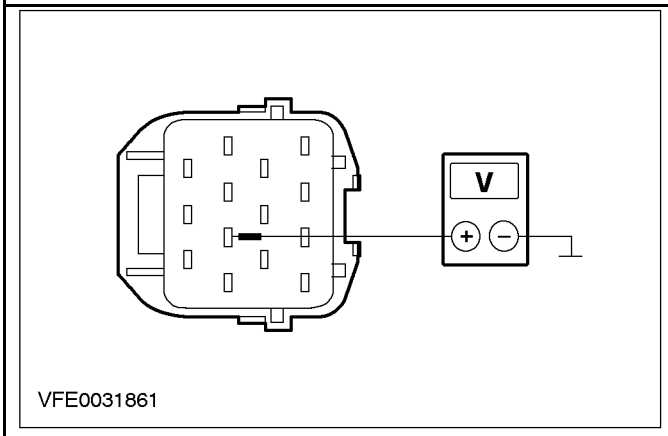
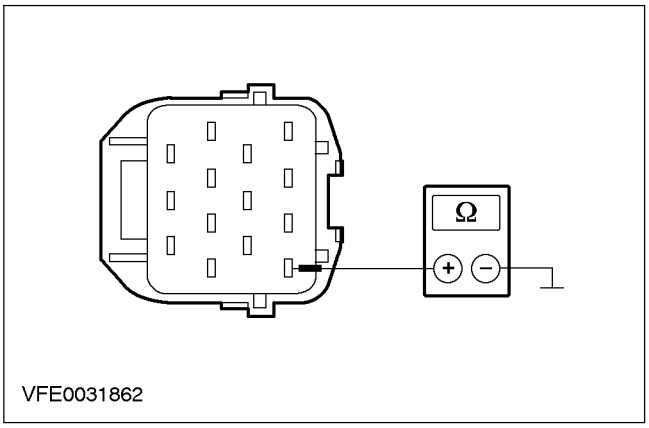
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	LOCATE and RECTIFY the short to ground in the circuits connected to soldered connection S178 with the aid of the Wiring Diagrams. CHECK the operation of the system.
F7: CHECK THE VOLTAGE AT THE RIGHT-HAND XENON HEADLAMP	
WARNING: High voltages are present in the system. Ensure that the headlamp connector is disconnected before starting work on the headlamps. Failure to observe this instruction can lead to injuries.	
	1 Key in OFF position. 2 Disconnect Xenon headlamp, right-hand side C1147. 3 Key in ON position. 4 Measure the voltage between the right-hand Xenon headlamp, connector C1147, pin 5, circuit 15-LE2B (GN/BU), wiring harness side and ground. • Does the meter display battery voltage? → **Yes** GO to **F8** → **No** LOCATE and RECTIFY the break in circuit 15-LE2B (GN/BU) between the right-hand Xenon headlamp and soldered connection S335 with the aid of the Wiring Diagrams. CHECK the operation of the system.
F8: CHECK THE GROUND CONNECTION OF THE RIGHT-HAND XENON HEADLAMP	
	1 Key in OFF position. 2 Measure the resistance between the right-hand Xenon headlamp, connector C1147, pin 11, circuit 31-LE30 (BK), wiring harness side and ground.

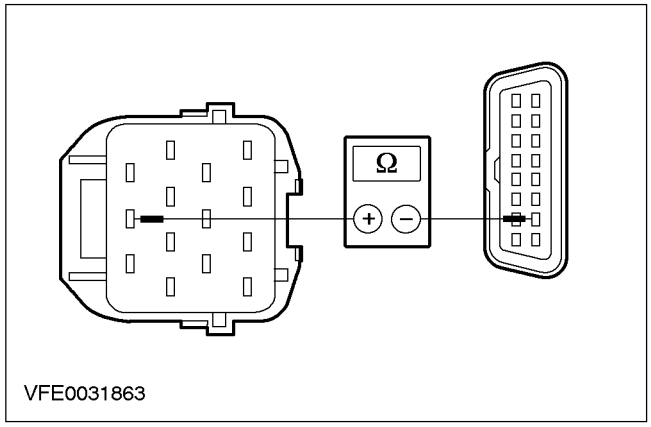
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is a resistance of less than 2 Ohm measured? → **Yes** GO to **F9** → **No** LOCATE and RECTIFY the break in the circuit between the right-hand Xenon headlamp and ground connection G105 with the aid of the Wiring Diagrams. CHECK the operation of the system.
F9: CHECK THE CIRCUIT BETWEEN THE RIGHT-HAND XENON HEADLAMP AND THE DATA LINK CONNECTOR (DLC) FOR OPEN CIRCUIT	
 VFE0031858	1 Measure the resistance between the right-hand Xenon headlamp, connector C1147, pin 2, circuit 8-LE30 (WH/RD), wiring harness side and the DLC, C418, pin 7, circuit 8-EE10 (WH/BK), wiring harness side. • Is a resistance of more than 2 Ohm measured? → **Yes** LOCATE and RECTIFY the break in circuit 8-LE30 (WH/RD) between the right-hand Xenon headlamp and soldered connection S385 with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** CHECK and if necessary RENEW the right-hand Xenon headlamp. CHECK the operation of the system.
F10: CHECK THE VOLTAGE AT THE LEFT-HAND XENON HEADLAMP	
WARNING: High voltages are present in the system. Ensure that the headlamp connector is disconnected before starting work on the headlamps. Failure to observe this instruction can lead to injuries.	
	1 Key in OFF position. 2 Disconnect Xenon headlamp, left-hand side C1146. 3 Key in ON position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031861	4 Measure the voltage between the left-hand Xenon headlamp, connector C1146, pin 5, circuit 15-LE2A (GN/BU), wiring harness side and ground. • Does the meter display battery voltage? → **Yes** GO to **F11** → **No** LOCATE and RECTIFY the break in the circuit between the left-hand Xenon headlamp and soldered connection S335 with the aid of the Wiring Diagrams. CHECK the operation of the system.
F11: CHECK THE GROUND CONNECTION OF THE LEFT-HAND XENON HEADLAMP	
 VFE0031862	1 Key in OFF position. 2 Measure the resistance between the left-hand Xenon headlamp, connector C1146, pin 11, circuit 31-LE31 (BK), wiring harness side and ground. • Is a resistance of less than 2 Ohm measured? → **Yes** GO to **F12** → **No** LOCATE and RECTIFY the break in the circuit between the left-hand Xenon headlamp and ground connection G104 with the aid of the Wiring Diagrams. CHECK the operation of the system.

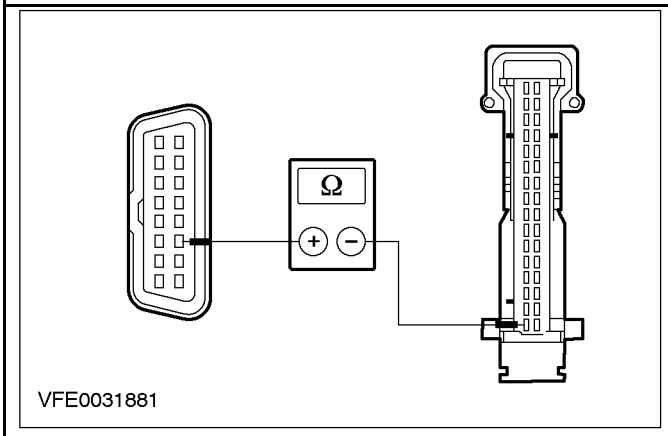
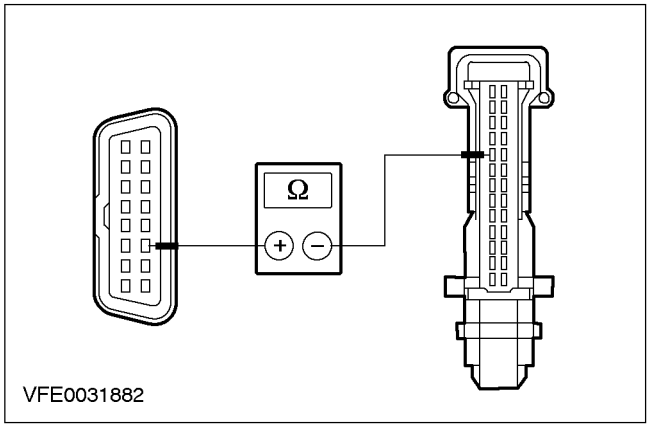
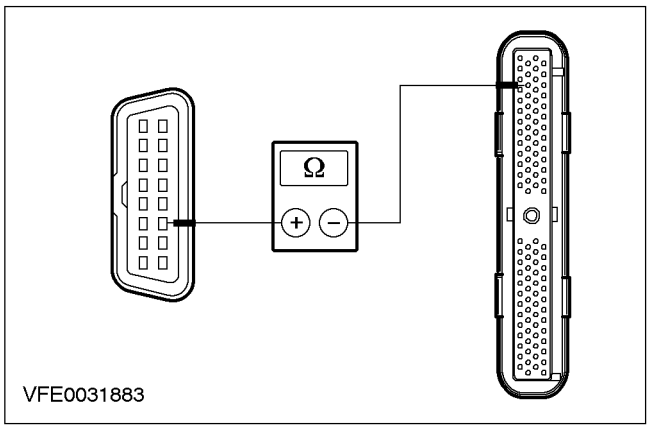
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
F12: CHECK THE CIRCUIT BETWEEN THE LEFT-HAND XENON HEADLAMP AND THE DATA LINK CONNECTOR (DLC) FOR OPEN CIRCUIT	
 VFE0031863	**1** Measure the resistance between the left-hand Xenon headlamp, connector C1146, pin 2, circuit 8-LE31 (WH), wiring harness side and the DLC, C418, pin 7, circuit 8-EE10 (WH/BK), wiring harness side. • Is a resistance of more than 2 Ohm measured? → **Yes** LOCATE and RECTIFY the break in circuit 8-LE31 (WH) between the left-hand Xenon headlamp and soldered connection S385 with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** CHECK and if necessary RENEW the left-hand Xenon headlamp. CHECK the operation of the system.

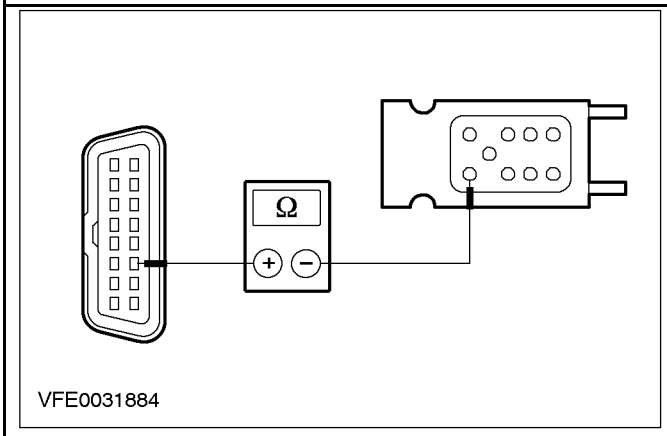
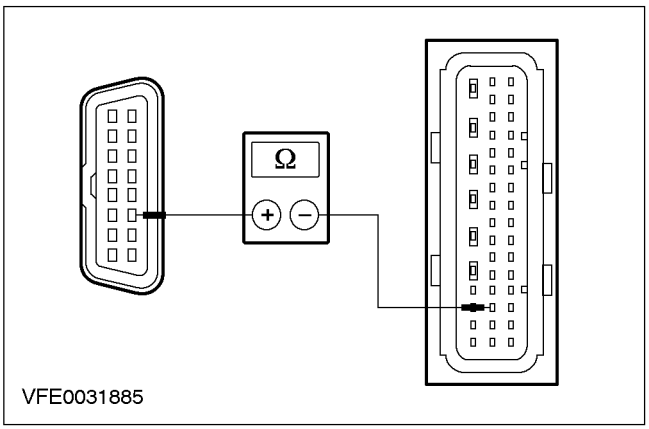
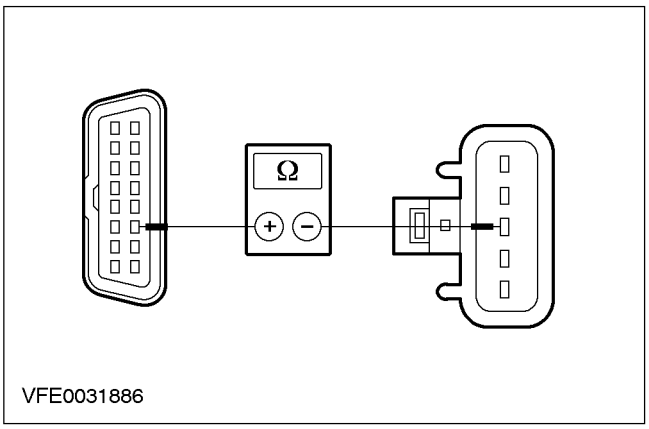
PINPOINT TEST G: FAULTY COMMUNICATIONS BETWEEN THE MODULES (CAN BUS)

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: The number of modules connected to the CAN bus depends on the equipment levels of the vehicle. As a result, not every vehicle is equipped with all of the following modules.	
G1: CHECK THE CAN BUS (+) FOR OPEN CIRCUIT	
	1 Key in OFF position. **2** Disconnect Instrument cluster C449. **3** Disconnect EATC module or heating and air conditioning control module C539b. **4** Disconnect Powertrain control module (PCM) C100. **5** Disconnect Injection pump C210. **6** Disconnect ABS control module or electronic stability program (ESP) module C103. **7** Disconnect Steering shaft rotational angle sensor C512. **8** Disconnect Yaw rate sensor C511.

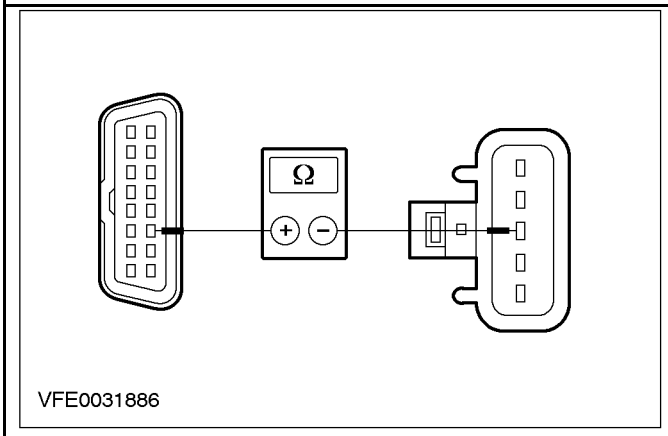
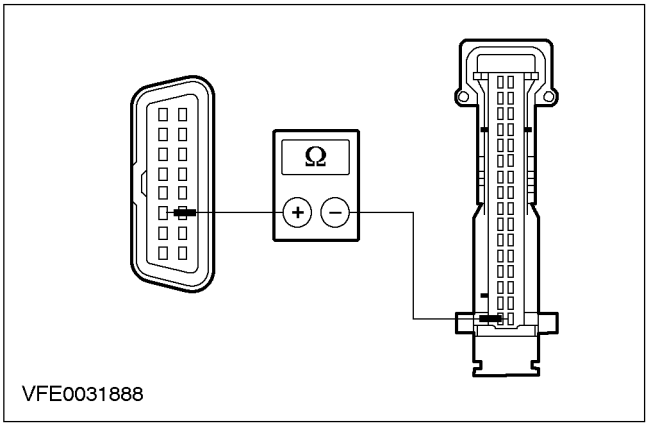
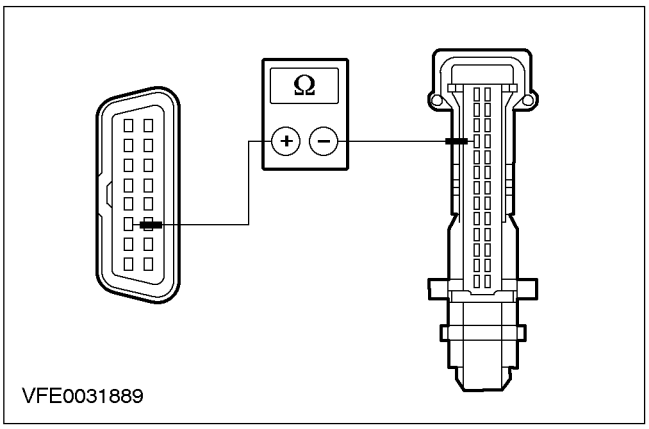
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**9** Measure the resistance between the data link connector (DLC), connector C418, pin 6, circuit 4-EC1 (GY/RD), wiring harness side and the instrument cluster, connector C449, pin 16, circuit 4-EC2 (GY/RD), wiring harness side.
	**10** Measure the resistance between the DLC, connector C418, pin 6, circuit 4-EC1 (GY/RD), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539b, pin 9, circuit 4-EC8 (GY/VT), wiring harness side.
	**11** Measure the resistance between the DLC, connector C418, pin 6, circuit 4-EC1 (GY/RD), wiring harness side and the PCM, connector C100, pin 50, circuit 4-EC7 (GY/RD), wiring harness side.

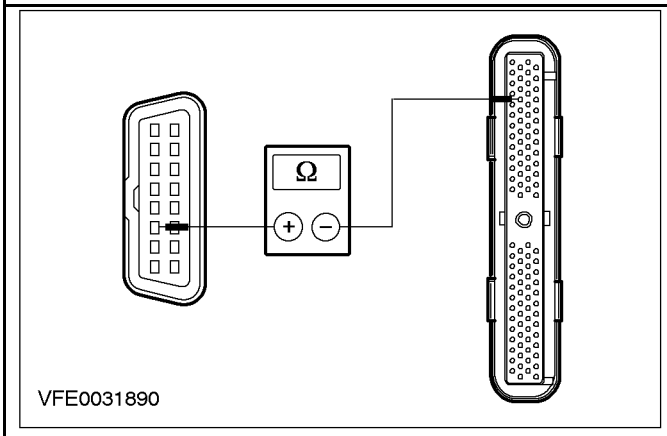
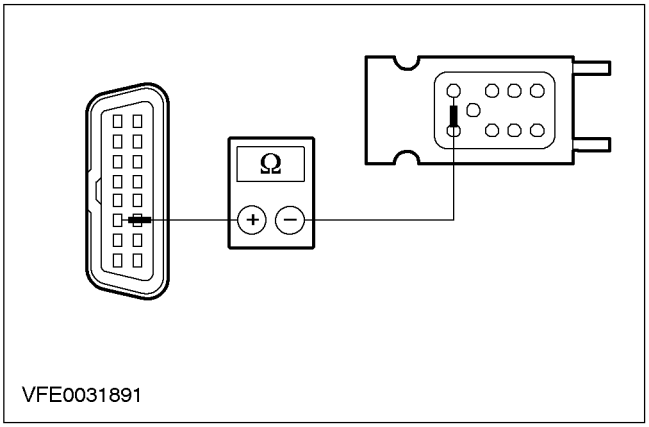
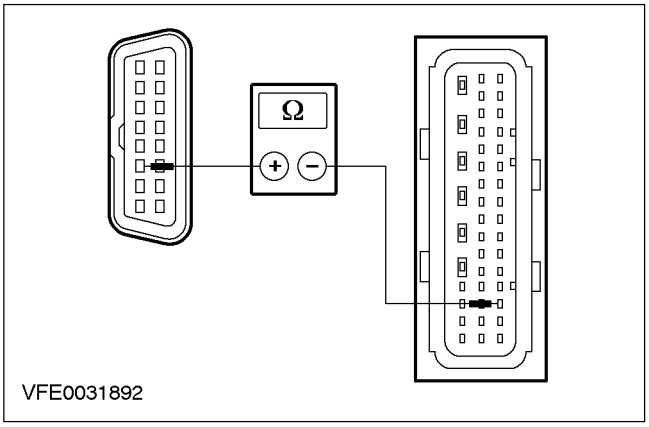
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031884	**NOTE:** Vehicles with DuraTorq - DI engine only: **12** Measure the resistance between the DLC, connector C418, pin 6, circuit 4-EC1 (GY/RD), wiring harness side and the injection pump, connector C210, pin 2, circuit 4-EC6 (GY), wiring harness side.
 VFE0031885	**13** Measure the resistance between the DLC, connector C418, pin 6, circuit 4-EC1 (GY/RD), wiring harness side and the ABS control module or the electronic stability program module (ESP), connector C103, pin 24, circuit 4-EC9 (GY), wiring harness side.
 VFE0031886	**NOTE:** Vehicles with ESP only: **14** Measure the resistance between the DLC, connector C418, pin 6, circuit 4-EC1 (GY/RD), wiring harness side and the steering shaft rotational angle sensor, connector C512, pin 3, circuit 4-EC11 (GY/OG), wiring harness side.

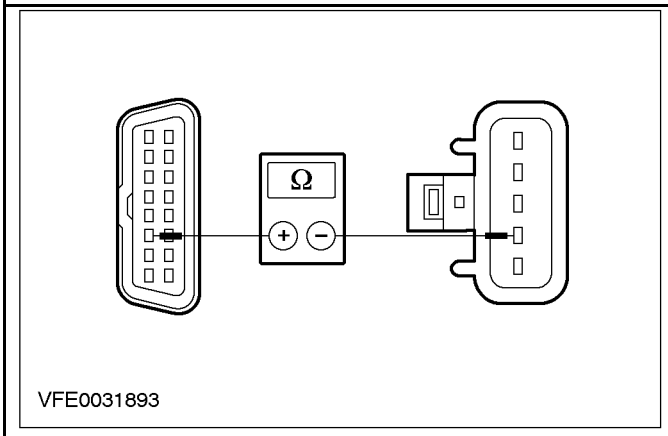
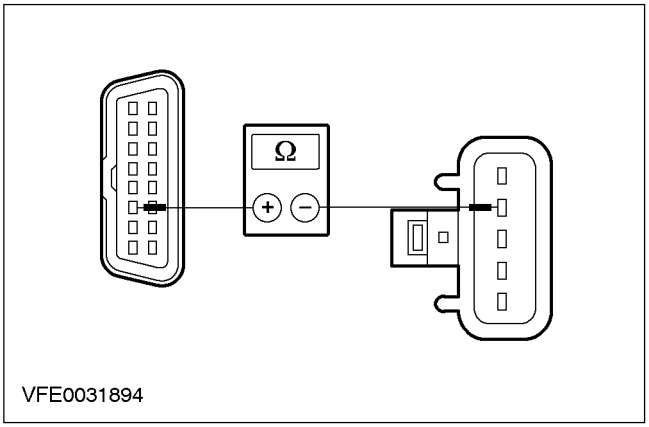
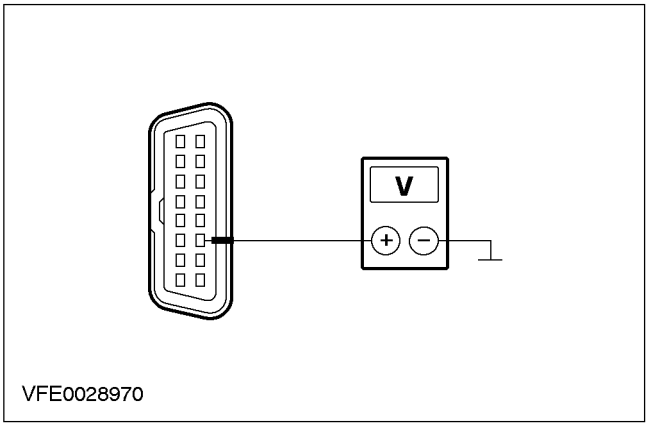
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031886	**NOTE:** Vehicles with ESP only: **15** Measure the resistance between the DLC, connector C418, pin 6, circuit 4-EC1 (GY/RD), wiring harness side and the steering shaft rotational angle sensor, connector C511, pin 3, circuit 4-EC12 (GY/RD), wiring harness side. • Is a resistance of less than 2 Ohms measured following all of the measurements? → **Yes** GO to **G2** → **No** LOCATE and RECTIFY the break in the affected circuit with the aid of the Wiring Diagrams. CHECK the operation of the system.
G2: CHECK THE CAN BUS (-) FOR OPEN CIRCUIT	
 VFE0031888	**1** Measure the resistance between the data link connector (DLC), connector C418, pin 14, circuit 5-EC1 (BU/RD), wiring harness side and the instrument cluster, connector C449, pin 32, circuit 5-EC2 (BU/RD), wiring harness side.
 VFE0031889	**2** Measure the resistance between the DLC, connector C418, pin 14, circuit 5-EC1 (BU/RD), wiring harness side and the EATC module or the heating and air conditioning control module, connector C539b, pin 10, circuit 5-EC8 (BU/WH), wiring harness side.

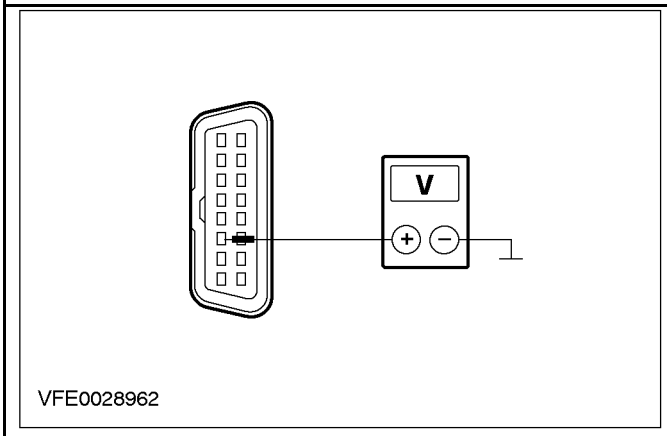
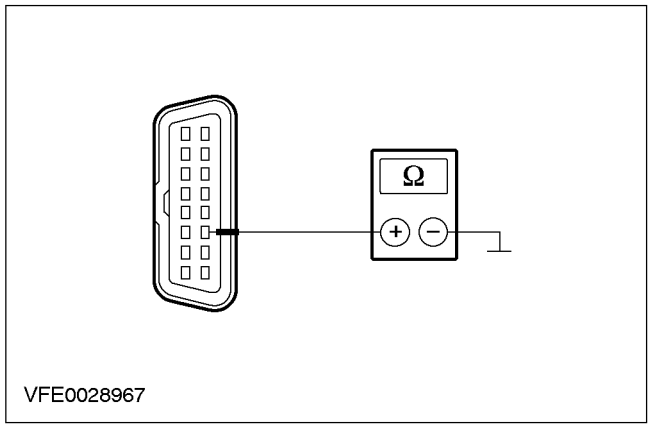
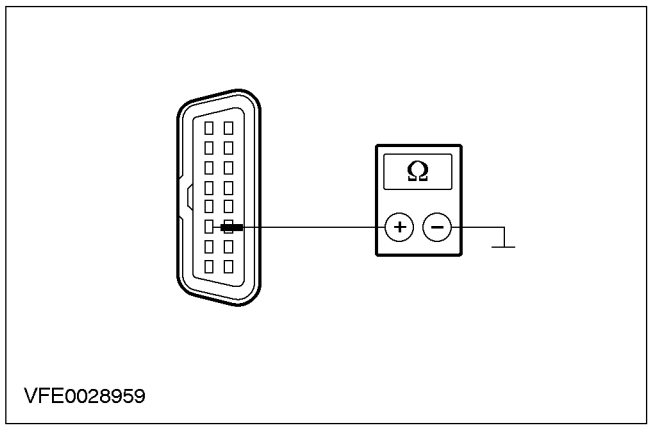
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031890	**3** Measure the resistance between the DLC, connector C418, pin 14, circuit 5-EC1 (BU/RD), wiring harness side and the PCM, connector C100, pin 49, circuit 5-EC7 (BU/RD), wiring harness side.
 VFE0031891	**NOTE:** Vehicles with DuraTorq - DI engine only: **4** Measure the resistance between the DLC, connector C418, pin 14, circuit 5-EC1 (BU/RD), wiring harness side and the injection pump, connector C210, pin 1, circuit 5-EC6 (BU), wiring harness side.
 VFE0031892	**5** Measure the resistance between the DLC, connector C418, pin 14, circuit 5-EC1 (BU/RD), wiring harness side and the ABS control module or the electronic stability program module (ESP), connector C103, pin 40, circuit 5-EC9 (BU), wiring harness side.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0031893	**NOTE:** Vehicles with ESP only: **6** Measure the resistance between the DLC, connector C418, pin 14, circuit 5-EC1 (BU/RD), wiring harness side and the steering shaft rotational angle sensor, connector C512, pin 4, circuit 5-EC11 (BU/BK), wiring harness side.
 VFE0031894	**NOTE:** Vehicles with ESP only: **7** Measure the resistance between the DLC, connector C418, pin 14, circuit 5-EC1 (BU/RD), wiring harness side and the steering shaft rotational angle sensor, connector C511, pin 2, circuit 5-EC12 (BU/RD), wiring harness side.
	• Is a resistance of less than 2 Ohms measured following all of the measurements? → **Yes** GO to **G3** → **No** LOCATE and RECTIFY the break in the affected circuit with the aid of the Wiring Diagrams. CHECK the operation of the system.
G3: CHECK THE CAN BUS FOR A SHORT TO VOLTAGE SUPPLY	
 VFE0028970	**1** Key in ON position. **2** Measure the voltage between the DLC, connector C418, pin 6, circuit 4-EC1 (GY/RD) and ground.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0028962	**3** Measure the voltage between the DLC, connector C418, pin 14, circuit 5-EC1 (BU/RD) and ground. • Is a voltage measured? → **Yes** LOCATE and RECTIFY the short to voltage in the affected circuit with the aid of the Wiring Diagrams. CHECK the operation of the system. → **No** GO to **G4**
G4: CHECK THE CAN BUS FOR A SHORT TO GROUND	
 VFE0028967	**1** Key in OFF position. **2** Measure the resistance between the DLC, connector C418, pin 6, circuit 4-EC1 (GY/RD) and ground.
 VFE0028959	**3** Measure the resistance between the DLC, connector C418, pin 14, circuit 5-EC1 (BU/RD) and ground.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is a resistance greater than 10 kOhm measured in both cases? → **Yes** CHECK and if necessary RENEW the affected module with faulty communications. CHECK the operation of the system. → **No** LOCATE and RECTIFY the short to ground in the affected circuit with the aid of the Wiring Diagrams. CHECK the operation of the system.

SECTION 418-01 Module Configuration

VEHICLE APPLICATION: 2003.0 Mondeo

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GENERAL PROCEDURES

Module Configuration 418-01-2

GENERAL PROCEDURES

Module Configuration

1. **In order to minimise module variations, different equipment levels and functionalities are incorporated in the same module. Following a replacement this module needs to be programmed or configured with the aid of WDS. All of the required data (software) are loaded by the WDS into the module. In the process it is for example also possible to replace older software versions with a more current version. If the required data are already present in the module then it needs to be configured. In this process certain parameters are set, and inputs and outputs are enabled or disabled. As a general rule, these parameters should be read out with the aid of WDS from the module which is to be replaced and then transferred to the new module. If this is not possible (e.g. because the old module will no longer react), then the vehicle-specific data will need to be entered manually via a selection list in WDS or via a code which can be obtained from the Technical Hotline. REFER TO WDS for further information.**
2. **The following need(s) to be programmed following a replacement:**
   - Powertrain control module (PCM)
3. **The following need(s) to be configured following a replacement:**
   - Restraint control module (RCM)
   - Generic electronic module (GEM)
   - Instrument cluster
4. **In order to adjust certain settings and function values, various modules will need to be initialised after the replacement or after disconnecting the power supply. Here, the input signals received by a module are for example allocated to a particular operating state. The initialisation process takes place on a system-specific basis. For further information REFER to the relevant section. The following need(s) to be initialised following a replacement:**
   - Passive anti-theft system (PATS)
   - Injection pump
   - Steering shaft rotational angle sensor (only on vehicles with ESP)
   - Sun roof module
   - Xenon headlamps (headlamp levelling)
   - Electric window lifter modules

SECTION 419-01 Anti-Theft - Passive

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

DESCRIPTION AND OPERATION

Anti-Theft - Passive 419-01-2

DIAGNOSIS AND TESTING

Anti-Theft - Passive 419-01-4
Principles of Operation 419-01-4
Inspection and Verification 419-01-5
Symptom Chart 419-01-6
Pinpoint Tests 419-01-6

GENERAL PROCEDURES

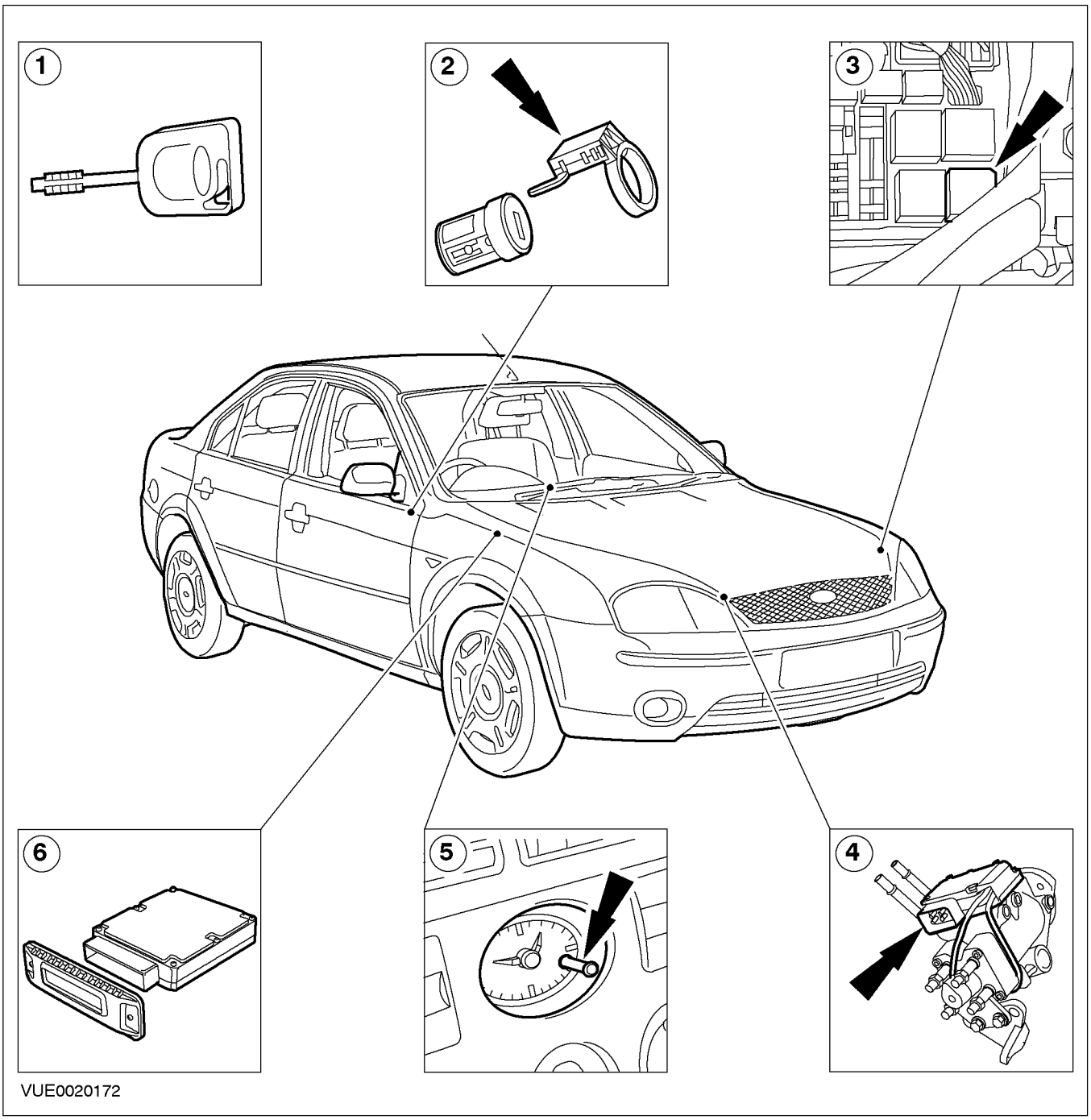
Key Programming Using Two Programmed Keys ..... (33 005 0) 419-01-12
Key Programming Using Diagnostic Equipment ..... (33 005 0) 419-01-13
Key Programming Switch State Control 419-01-14
Anti-Theft Security Access ..... (33 004 0) 419-01-15

REMOVAL AND INSTALLATION

Passive Anti-Theft System (PATS) Transceiver ..... (33 662 0) 419-01-16

DESCRIPTION AND OPERATION

Anti-Theft - Passive



Item	Part Number	Description
1	-	Ignition key (with integral transponder)
2	-	Passive anti-theft system (PATS) transceiver

Item	Part Number	Description
3	-	Starter relay
4	-	Fuel injection pump control unit - Vehicles with 2.0L diesel engine

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
5	-	PATS light emitting diode (LED)
6	-	Powertrain control module (PCM)

DIAGNOSIS AND TESTING

Anti-Theft - Passive

Refer to Wiring Diagrams Section 419-01 for schematic and connector information.

Principles of Operation

General

The passive anti-theft system (PATS) uses radio frequency identification technology and a unique encryption code to deter a drive away theft. Passive means that it does not require any activity from the user.

Encoded Ignition Key

The PATS uses a specially encoded ignition key. Each encoded ignition key contains a permanently installed electronic device called a transponder. Each transponder contains a unique electronic identification code which may be any one of millions of combinations. Each encoded ignition key must be programmed to the vehicle's PATS control function within the powertrain control module (PCM) before it can be used to start the engine. There are special diagnostic repair procedures outlined in this manual that must be carried out if an encoded ignition key needs to be changed.

The PATS transponder key is identified by a blue insert. Previous PATS transponder keys that have a red insert are not compatible with this vehicle and must not be used.

Only Ford approved ignition keys should be used as some aftermarket encoded ignition keys not purchased from a Ford approved source may fail to operate especially at extreme temperatures.

NOTE: If a non programmed key has been used, further key reading is inhibited for 20 seconds. During this 20 seconds, no ignition key will start the engine.

A minimum of 2 encoded ignition keys must be programmed to a vehicle in order for the engine to start. A maximum of 8 ignition keys may be programmed to a vehicle. The PATS control function within the PCM will enter Anti-Scan Mode if an attempt to start the vehicle with a non programmed ignition key (with the correct mechanical cut) is made.

PATS Control Function

The control functions are contained in the PCM. This module carries out all of the PATS functions, such as receiving the identification code from the encoded key and controlling engine enable. The PCM initiates the encoded key interrogation sequence when the vehicle ignition switch is turned to II or III. When the key is turned to the 0 position, the PCM will remain powered up for approximately five seconds. This is the maximum time allowed for the insertion of a second key to initiate the customer key programming sequence.

Transceiver Module

The transceiver module communicates with the PATS encoded ignition key. This module is located behind the steering column lower shroud and contains an antenna connected to a small electronic module. During each vehicle start sequence the transceiver module reads the encoded ignition key identification code and sends data to the PATS control function within the PCM. No re-initialization needs to occur with the removal or installation of a new PATS transceiver.

PATS Target Function - Vehicles with 2.0L diesel engine

The fuel injection pump is equipped with a fuel injection pump control module (PATS target function). The PATS control function within the PCM communicates with the fuel injection pump control module to enable or disable the engine from starting. The fuel injection pump control module must receive the correct enable sequence through the control area network (CAN) from the PCM within one second after the engine is started or the engine will be disabled.

The PATS control function and the fuel injection pump control module share security data when first installed together that makes them a matched pair. This shared security data is stored even if the vehicle battery has been disconnected. Therefore after this security data sharing, these modules will not function in other vehicles unless they are reconfigured using WDS.

DIAGNOSIS AND TESTING (Continued)

Special diagnostic procedures must be carried out using WDS if either the PCM or fuel injection pump are changed. All elements of the PATS must be functional before the engine is allowed to start. If any of the components are not working properly, the vehicle will not start and the anti-theft indicator will flash a fault code.

When the ignition key is turned to the II or III position the PCM sends an encrypted code to the fuel injection pump control unit. In turn the fuel injection pump control unit sends an encrypted code back to the PCM to indicate that it has recognized the PCM. The PCM then sends a signal back to the fuel injection pump control unit to allow fuelling to commence.

Anti-Theft Indicator

The PATS system uses a visual anti-theft indicator that is controlled by the PATS control function. The indicator will self-test for three seconds when the ignition switch is turned to II or III under normal operation. If there is a PATS concern, the indicator will either flash rapidly or glow steadily depending on the concern when the ignition switch is turned to II or III and then it will flash a fault code 10 times. Refer to WDS and follow the on-screen instructions. The PATS system also flashes the anti-theft indicator every two seconds at ignition OFF to act as a visual deterrent.

J1850 Communication Network

The J1850 standard corporate protocol (SCP) communications network is used for diagnostic purposes only. The CAN Bus is utilized to send and receive messages between the PATS control function and the fuel injection pump control module.

Starter Relay

The starter relay is also used as an additional means of disabling the vehicle engine. The starter relay ground connection is disabled when PATS cannot read an encoded or non encoded ignition key at ignition position II. However, the system will not store a DTC or flash the anti-theft indicator if a valid ignition key is read but a fault occurs in the starter relay circuit. REFER to Section 303-06. The relay is enabled when PATS control function reads a valid encoded ignition key when the ignition switch is in position II. The PATS will be activated and will disable the vehicle from starting if there is:

- A damaged encoded ignition key
- An unprogrammed key
- A non-encoded key (key has no electronics or does not have a blue insert)
- Damaged wiring
- Damaged transceiver
- Damaged PCM
- Shielded ignition key
- A mismatch between PCM and fuel injection pump control module - Vehicles with 2.0L diesel engine

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Ignition lock cylinder – PATS key – Use of an non-encoded PATS key – More than one PATS key on key chain – Use of an non-programmed PATS key	– Fuse(s) – Wiring harness – Electrical connector(s) – Relay(s) – PATS transceiver – Ignition switch – Transmission range sensor - Vehicles with automatic transaxle – PCM – Fuel injection pump control module - Vehicles with 2.0L diesel engine

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and use WDS to diagnose the system in conjunction with the following Flash Code Index, Symptom Chart and Pinpoint tests.

Flash Code Index

DIAGNOSIS AND TESTING

Indicator Flash Code	Description/Condition	Possible Source	Action
11	PATS transceiver signal is not received	Transceiver wiring transceiver connector, transceiver or PCM	GO to Pinpoint Test A.
12	Transceiver antenna coil concern, Vehicle does not start	Transceiver	Install a new transceiver
13	Non-PATS key or damaged encoded ignition key, or no key code received. Vehicle does not start	PATS encoded ignition key	REFER to WDS PATS test. Follow the instructions
13	Transponder programming concern, Crypto transponder only. Vehicle does not start	Ignition key	REFER to WDS PATS test. Follow the instructions
14	Partial key read of PATS key. Vehicle does not start	PATS encoded ignition key. Transceiver	REFER to WDS PATS test. Follow the instructions
15	Incorrect key code, Unprogrammed PATS key (keycode format OK). Vehicle does not start (20 second anti-scan invoked)	PATS encoded ignition key	REFER to WDS PATS test. Follow the instructions
16	CAN communication link between the PCM and Fuel injection pump control module (diesel only). Vehicle does not start	Circuit, Fuel injection pump control module or PCM	REFER to WDS PATS test. Follow the instructions
21	Number of programmed PATS encoded keys below minimum. Vehicle does not start	Incorrect number of keys programmed or PATS encoded ignition key	REFER to WDS PATS test. Follow the instructions
22	NVM Configuration failure. No security ID exchange between PCM and Fuel injection pump control module (diesel only). Vehicle does not start	New PCM or new fuel injection pump control module	REFER to WDS PATS test. Follow the instructions
23	Data mismatch (received data does not match what was expected) Security messages do not match between PCM and Fuel injection pump control module. Vehicle does not start	New PCM or new fuel injection pump control module	REFER to WDS PATS test. Follow the instructions

Symptom Chart

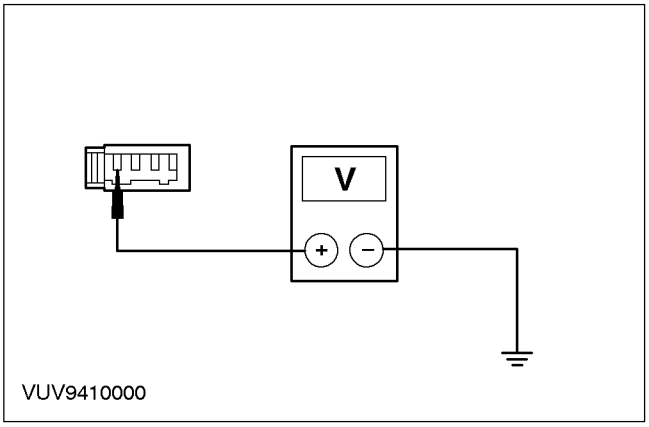
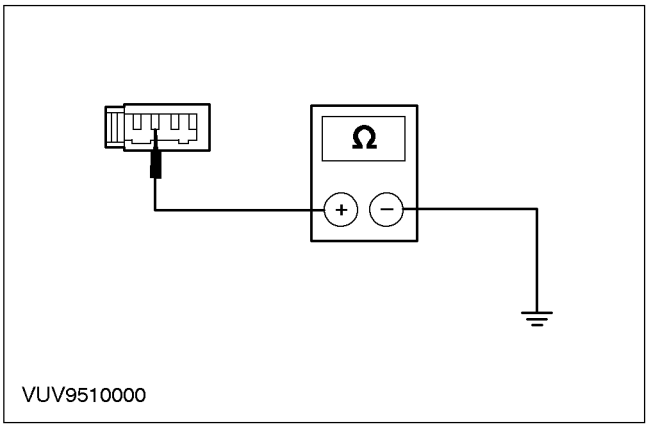
Condition	Possible Sources	Action
•The anti-theft indicator is always/never on - no anti-theft indicator self-test	•Fuse. •Circuit. •Anti-theft LED. •PCM.	•Carry out WDS PATS test. Follow the instructions.
•The anti-theft system does not operate correctly - engine does not crank	•Starter relay. •Circuit. •PCM.	•GO to Pinpoint Test B.

Pinpoint Tests

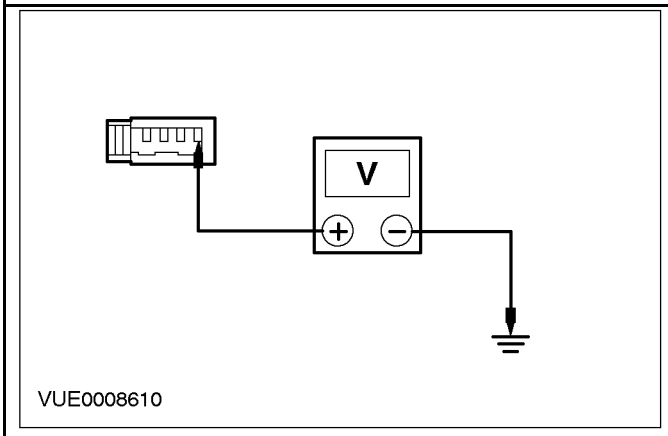
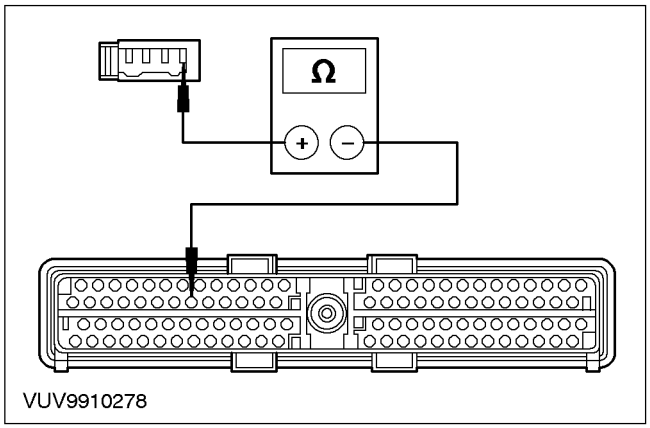
PINPOINT TEST A: THE PATS TRANSCEIVER SIGNAL IS NOT RECEIVED

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK THE TRANSCEIVER POWER CIRCUIT - CIRCUIT 15-GL37 (GN/BK)	
	1 Key in OFF position.

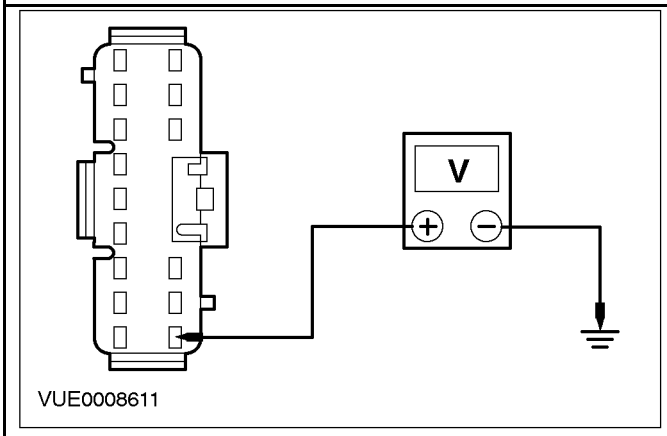
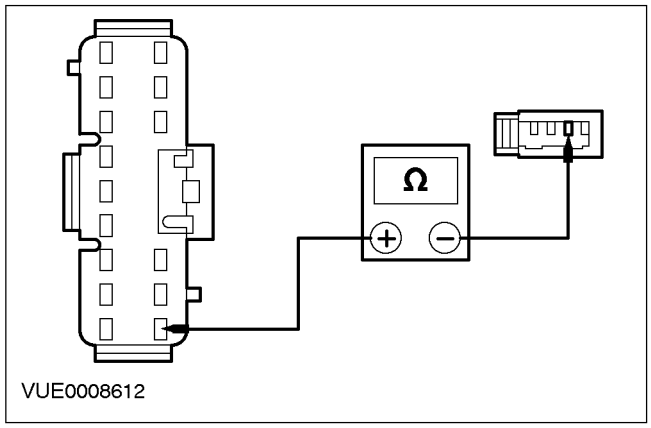
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VUV9410000	2 Disconnect PATS Transceiver Module C479. 3 Key in ON position. 4 Measure the voltage between PATS transceiver module C479 pin 1, circuit 15-GL37 (GN/BK), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **A2**. → **No** REPAIR circuit 15-GL37A (GN/BK). TEST the system for normal operation.
A2: CHECK THE TRANSCEIVER GROUND CIRCUIT - CIRCUIT 91-GL37 (BK/GN)	
 VUV9510000	1 Key in OFF position. 2 Measure the resistance between PATS transceiver module C479 pin 2, circuit 91-GL37 (BK/GN), harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **A3**. → **No** REPAIR circuit 91-GL37 (BK/GN). TEST the system for normal operation.
A3: CHECK THE PATS TRANSCEIVER FOR VOLTAGE - CIRCUIT 8-GL37 (WH/GN)	
	1 Key in ON position.

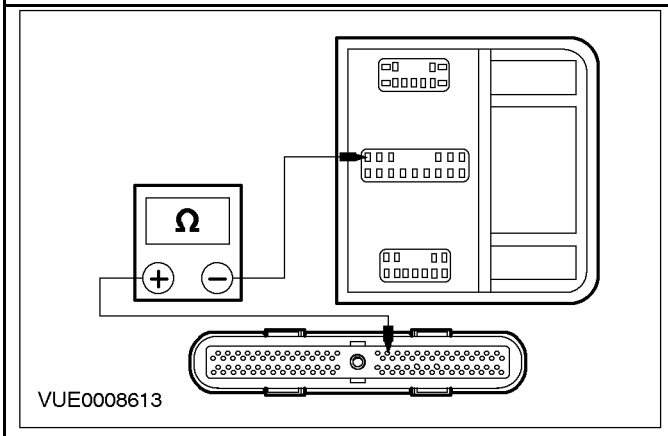
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VUE0008610	2 Measure the voltage between the PATS transceiver C479 pin 4, circuit 8-GL37 (WH/GN), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **A5**. → **No** GO to **A4**.
A4: CHECK CIRCUIT 8-GL37 (WH/GN) FOR OPEN	
NOTE: When a new PCM is installed, the encoded ignition keys must be reprogrammed	
 VUV9910278	1 Key in OFF position. 2 Disconnect PCM C100. 3 Measure the resistance between PATS transceiver C479 pin 4, circuit 8-GL37 (WH/GN), harness side and PCM C100 Pin 53, harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new PCM. REFER to Section 303-14. REPROGRAM the encoded ignition keys. REFER to Key Programming Using Diagnostic Equipment in this section. TEST the system for normal operation. → **No** REPAIR circuit 8-GL37 (WH/GN). TEST the system for normal operation.
A5: CHECK THE TRANSCEIVER TRANSMIT CIRCUIT FOR VOLTAGE - CIRCUIT 10-GL37 (GY/OG)	
	1 Connect PATS Transceiver Module C479. 2 Key in ON position.

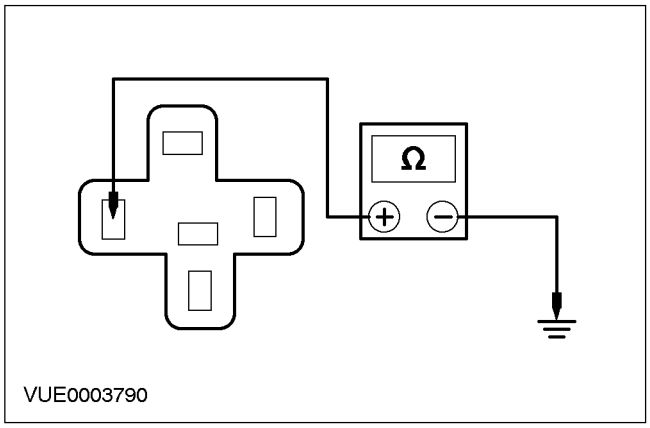
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VUE0008611	**3** Measure the voltage by carefully backprobing between C12, pin 12, circuit 10-GL37 (GY/OG), and ground. • Is the voltage greater than 8 volts? → **Yes** GO to **A7**. → **No** GO to **A6**.
A6: CHECK THE TRANSCEIVER TRANSMIT CIRCUIT FOR OPEN - CIRCUIT 10-GL37 (GY/OG)	
 VUE0008612	**1** Disconnect In-line Connector C12. **2** Disconnect PATS Transceiver Module C479. **3** Measure the resistance between PATS transceiver C479 pin 3, circuit 10-GL37 (GY/OG), harness side and C12 pin 12, harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new PATS transceiver. REFER to Passive Anti-Theft System (PATS) Transceiver in this section. TEST the system for normal operation. → **No** REPAIR circuit 10-GL37 (GY/OG). TEST the system for normal operation.
A7: CHECK THE TRANSCEIVER RECEIVE CIRCUIT FOR OPEN - CIRCUIT 10-GL37 (GY/OG)	
	1 Key in OFF position. **2** Disconnect PCM C100.

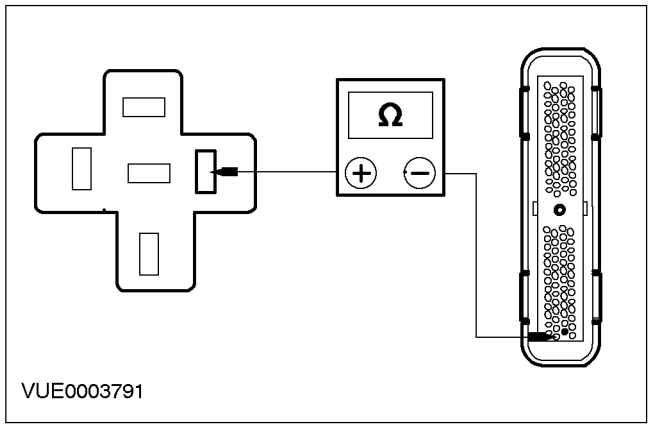
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**3** Measure the resistance between PCM C100 pin 19, circuit 10-GL37 (GY/OG), harness side and C12 pin 12, harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new PCM. REFER to Section 303-14. REPROGRAM the encoded ignition keys. REFER to Key Programming Using Diagnostic Equipment in this section. TEST the system for normal operation. → **No** REPAIR circuit 10-GL37 (GY/OG). TEST the system for normal operation.

PINPOINT TEST B: THE ANTI-THEFT SYSTEM DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK THE STARTING SYSTEM GROUND	
	**1** Key in OFF position. **2** Disconnect Starter Relay C910. **3** Key in START position. **4** Measure the resistance between starter relay pin 2, circuit 31S-BB12 (BK/YE), harness side and ground while holding the key in position III. • Is the resistance less than 5 ohms? → **Yes** DIAGNOSE the starting system. REFER to Section 303-06.. → **No** GO to **B2**.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
B2: CHECK CIRCUIT 31S-BB12 (BK/YE) FOR OPEN	
NOTE: When a new PCM is installed, the encoded ignition keys must be reprogrammed, TURN the ignition switch to position 0 then position II. RETRIEVE DTCs. If PATS DTCs are present, GO to PCM Diagnostic Trouble Code (DTC) Index. If no DTCs are retrieved, the PATS system is OK.	
	**1** Key in OFF position. **2** Disconnect PCM C100. **3** Measure the resistance between PCM C100 pin 27 (use pin 32 on 60 pin PCM connector), harness side and start relay C910 pin 2, circuit 31S-BB12 (BK/YE), harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new PCM. REFER to Section 303-14. REPROGRAM the encoded ignition keys. REFER to Key Programming Using Diagnostic Equipment in this section. TEST the system for normal operation. → **No** REPAIR circuit 31S-BB12 (BK/YE). TEST the system for normal operation.

GENERAL PROCEDURES

Key Programming Using Two Programmed Keys (33 005 0)

1. **NOTE:** This procedure only works if two or more programmed ignition keys are available and it is desired to program additional key(s). If two keys are not available. For additional information, refer to Key Programming-Erase All Keys and Program Two Keys in this section.

NOTE: The Spare Key Programming Switch is a WDS/FDS 2000 programmable switch which provides the capability to enable/disable the normal customer Spare Key Programming Procedure. If the Spare Key Programming Switch is not enabled , refer to Security Access then select Spare Key Programming Switch; Enabled.

NOTE: If the programming procedure is not successful, the new key(s) will not start the vehicle and the anti-theft indicator will flash. If the programming procedure was not successful leave the ignition switch in the RUN position for at least 30 seconds, repeat the Key Programming procedure from step 1. If the failure repeats, refer to Diagnostic and testing to review DTCs an carry out Pinpoint Tests.

NOTE: A maximum of eight ignition keys can be programmed to a passive anti-theft system (PATS) equipped vehicle.

NOTE: If the steps are not carried out as outlined, the programming procedure will end.

NOTE: Ignition keys must have correct mechanical key cut for the vehicle and must be a PATS encoded key.

Insert the first programmed key into the ignition lock cylinder and turn the lock cylinder from the OFF position to the RUN position (maintain ignition lock cylinder in the RUN position for one second).

2. **Turn ignition lock cylinder to the OFF position and remove the first key from the ignition lock cylinder.**
3. **Within five seconds of turning the ignition lock cylinder to the OFF position, insert the second programmed ignition key into the ignition lock cylinder and turn the ignition lock from the OFF position to the RUN position (maintain the ignition lock cylinder in the RUN position for one second).**
4. **Turn the ignition lock cylinder to the OFF position and remove the second key from the lock cylinder.**
5. **Within ten seconds of turning the ignition lock cylinder to the OFF position, insert the unprogrammed ignition key (new key) into the lock cylinder and turn the lock cylinder from the OFF position to the RUN position (maintain the ignition lock cylinder in the RUN position for less than 5 seconds).**
6. **Check the new programmed key starts the engine. Turn the ignition key to the OFF position for five seconds then try to start vehicle with the new programmed key.**
7. **To programme additional key(s), repeat the applicable key programming procedure from step 1.**

GENERAL PROCEDURES

Key Programming Using Diagnostic Equipment (33 005 0)

1. **NOTE:** This procedure is used when a customer needs keys programmed into the system and does not have two programmed ignition keys available. This procedure is also useful when programmed ignition key(s) have been lost or when the ignition lock cylinder has been replaced or when you are required to erase a key(s) from the passive anti-theft alarm system (PATS) memory.

NOTE: This procedure will erase all programmed ignition keys from the vehicle memory and the vehicle will not start until two keys have been reprogrammed to the vehicle.

NOTE: Two PATS encoded keys with the correct mechanical cut must be available to carry out this procedure. One or both of them may be the original keys.

NOTE: If the remaining keys are with the customer and are not available with the vehicle, then instruct the customer to refer to the Owner's Manual under the Programming Spare PATS Key Procedure, for instructions on programming the remaining keys.

Turn the ignition lock cylinder from the OFF position to the RUN position.

2. **Using WDS/FDS 2000 select Body/Security/PATS Functions from the menu. Obtain security access. For additional information, refer to Security Access in this section.**
3. **Using WDS/FDS 2000 menu select Ignition Key Code Erase.**
4. **Turn the ignition lock cylinder to the OFF position and disconnect WDS/FDS 2000.**
5. **Insert the first encoded key into the ignition lock cylinder and turn the lock cylinder to the RUN position for three seconds.**
6. **Remove the first encoded key from the ignition lock cylinder.**
7. **Insert the second encoded key into the ignition lock cylinder and turn the lock cylinder to the RUN position for three seconds.**
8. **Remove the second encoded key from the ignition lock cylinder.**
9. **The vehicle should now start with both ignition keys.**

GENERAL PROCEDURES

Key Programming Switch State Control

1. **NOTE:** The Spare Key Programming Switch is a WDS/FDS 2000 programmable switch which provides the capability to enable/disable the normal customer Spare Key Programming Procedure detailed in the owner's manual (customer scan program a spare ignition key by cycling two programmed ignition keys and then cycling the new key). This programmable switch is provided as a convenience for rental company fleets or other fleet purchasers who may not want the Spare Key Programming procedure available to the vehicle driver.

NOTE: The default setting on delivery of all new vehicles is ENABLE.

Insert a programmed ignition key into the ignition lock cylinder and turn the lock cylinder from the OFF position to the RUN position.

2. **Using WDS/FDS 2000 select Body/Security/PATS Functions from the menu.**
3. **Select Security Access. For additional information, refer to Security Access in this section.**
4. **Using WDS/FDS 2000 select Spare Key Programming Switch from the menu. Follow the on-screen directions.**

GENERAL PROCEDURES

Anti-Theft Security Access (33 004 0)

1. **NOTE:** This procedure is utilized to obtain passive anti-theft system (PATS) security access. PATS security access must be granted to erase ignition key codes or enable/disable the spare key programming switch. This procedure invokes an inherent 10 minute time delay prior to granting security access during which WDS/FDS 2000 must remain connected to the vehicle. Once security access has been granted, a security access command menu is displayed which offers various command options. For additional information, refer to Powertrain Control Module (PCM) Configuration Command Index in this section.

NOTE: Once security access has been granted, multiple security access commands should be executed (if necessary) prior to exiting the command menu. This avoids repeating the procedure and thus avoids any additional 10 minute time delay.

Use WDS/FDS 2000 to obtain anti-theft security access.

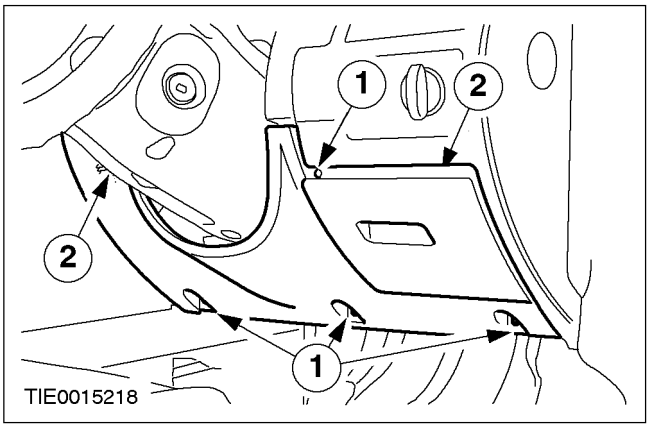
2. **After the 10 minute security access procedure has been completed, a new menu will be displayed with command options. Select the function as required before exiting out of this menu. (do not select more functions than the procedure calls for). Once exited out of this menu, the security access procedure must be carried out again to carry out additional commands.**

REMOVAL AND INSTALLATION

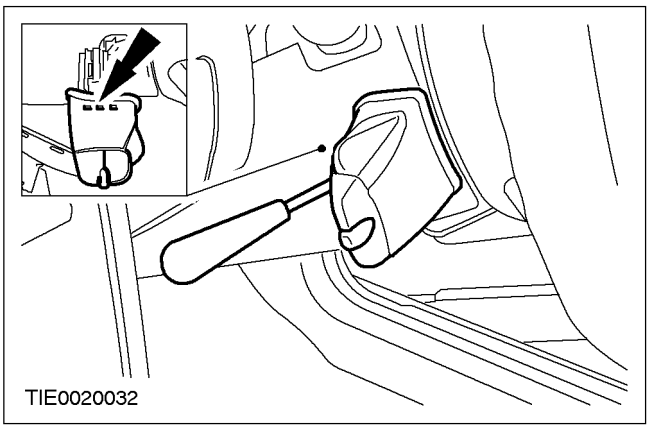
Passive Anti-Theft System (PATS) Transceiver (33 662 0)

Removal

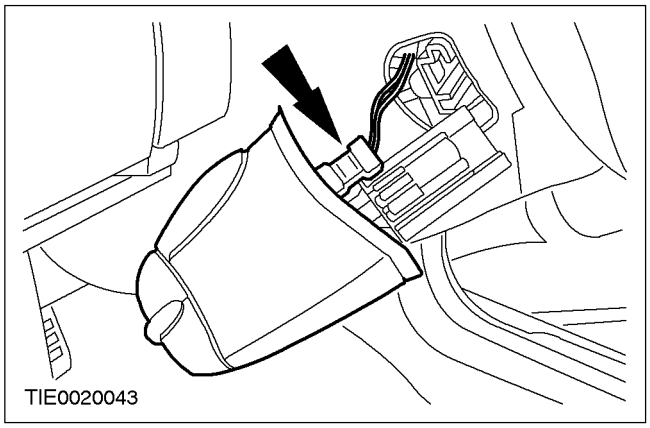
1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Remove the instrument panel lower panel.**
   1. Remove the retaining screws.
   2. Release the retaining clips.



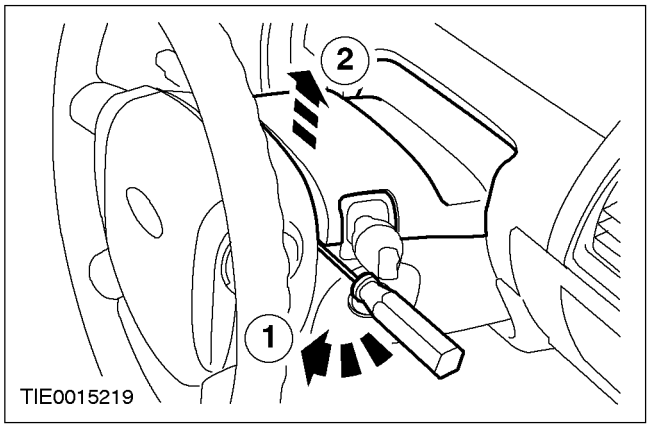
3. **Detach the audio control switch from the steering column lower shroud (if equipped).**
   - Using a thin bladed screwdriver, release the locking tang.



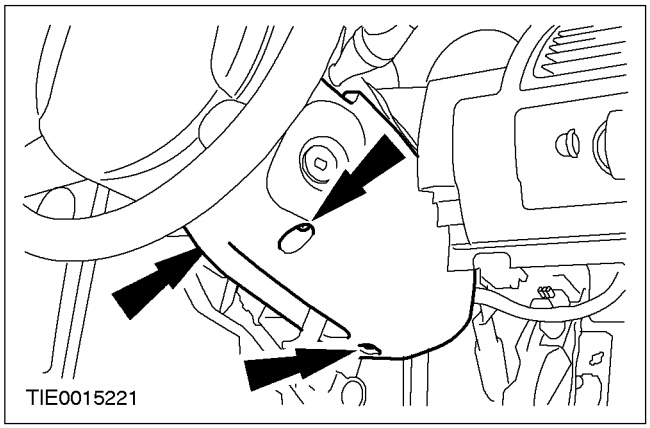
4. **Remove the audio control switch (if equipped).**
   - Disconnect the electrical connector.



5. **Detach the steering column upper shroud from the steering column lower shroud.**
   1. Using a thin bladed screwdriver, release the two clips (one each side).
   2. Detach the upper shroud.



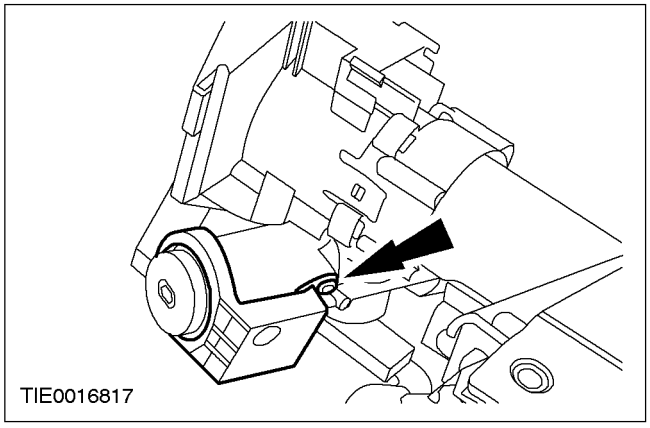
6. **Remove the steering column lower shroud.**



REMOVAL AND INSTALLATION (Continued)

7. Remove the PATS transceiver (steering column shown removed for clarity).

- Disconnect the electrical connector.



Installation

1. **To install, reverse the removal procedure.**
2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

SECTION 419-08 Cellular Phone

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

DESCRIPTION AND OPERATION

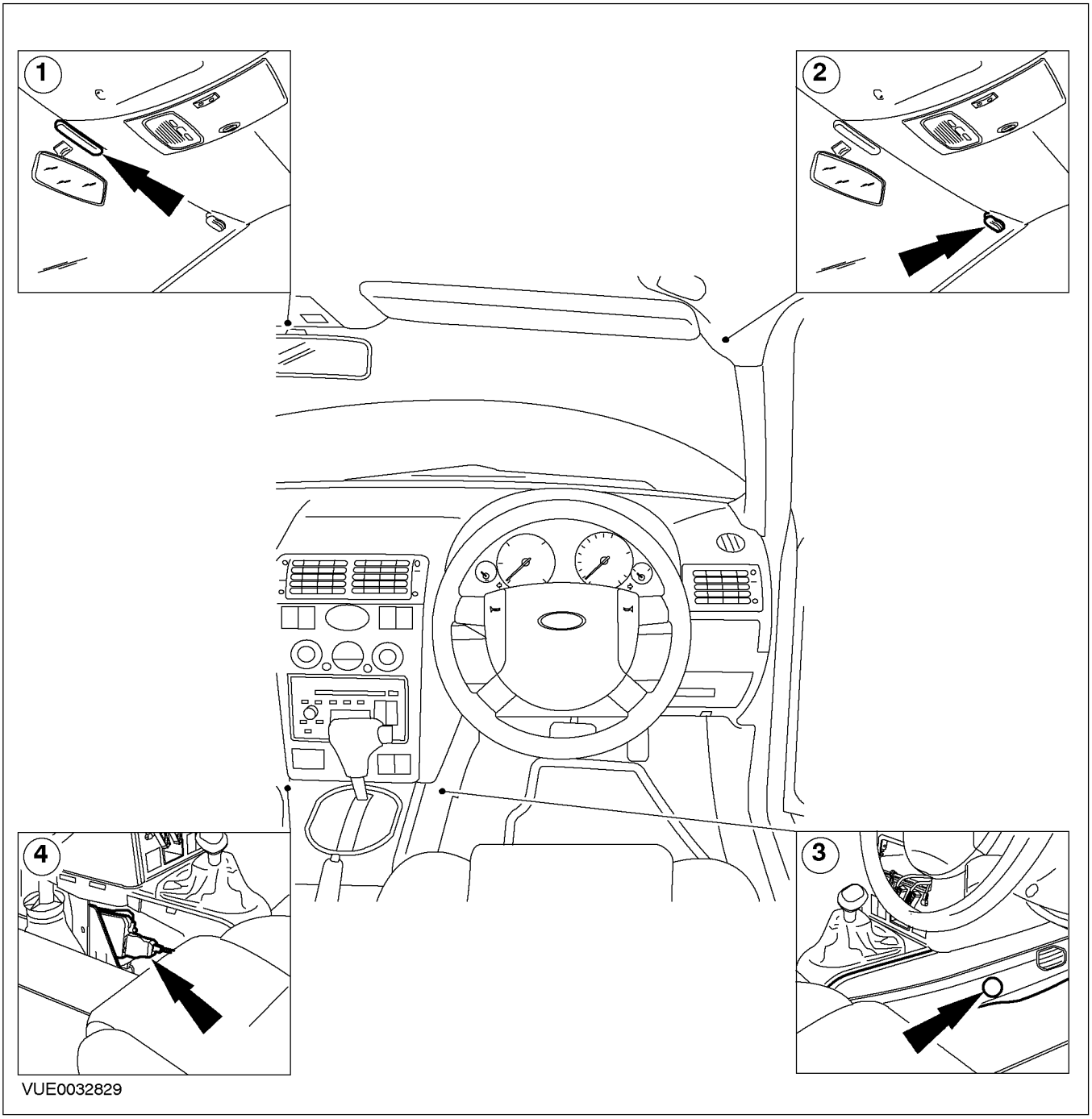
Cellular Phone 419-08-2

DIAGNOSIS AND TESTING

Cellular Phone 419-08-4
Inspection and Verification 419-08-4
Symptom Chart 419-08-4
Pinpoint Test 419-08-5

DESCRIPTION AND OPERATION

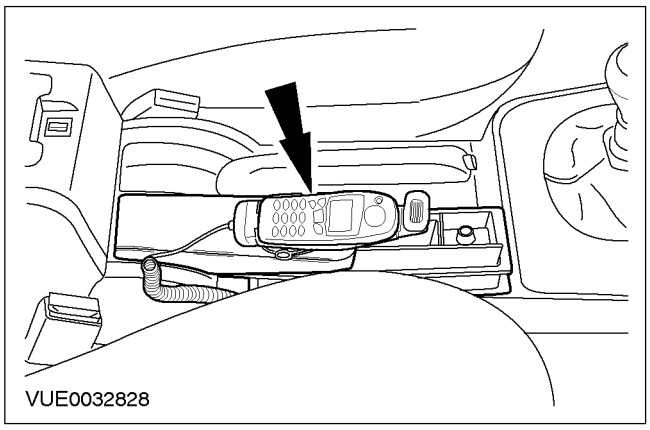
Cellular Phone



Item	Part Number	Description
1	-	Cellular phone antenna
2	-	Cellular phone microphone
3	-	Cellular phone speaker

Item	Part Number	Description
4	-	Portable support electronics (PSE) module

DESCRIPTION AND OPERATION (Continued)



Item	Part Number	Description
1	-	Cellular phone and handset holder

DIAGNOSIS AND TESTING

Cellular Phone

Refer to Wiring Diagrams Section 419-08 for schematic and connector information.

Inspection and Verification

1. Verify the customers concern.
2. Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
Fuse(s)
Wiring Harness
Electrical connector(s)
Microphone
Cellular phone antenna
Cellular phone speaker

Electrical
Handset holder
Cellular phone
Portable Support Electronics (PSE) Module

3. Verify that the cellular phone operates correctly out of the vehicle before proceeding to the next step.
4. Verify the audio unit or navigation system display module is working correctly before proceeding to the next step.
5. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
6. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

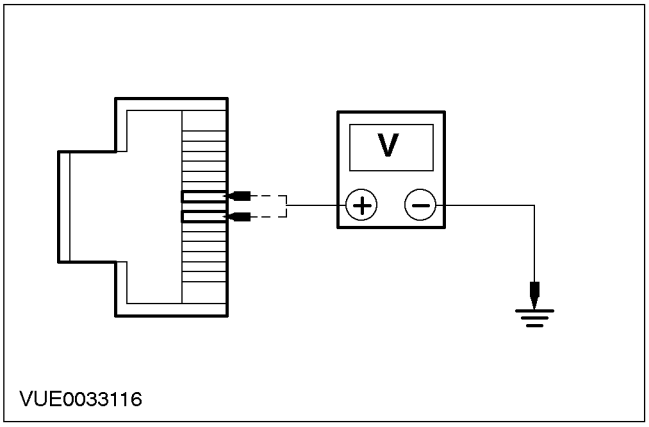
Condition	Possible Sources	Action
•The handset battery does not charge	•Circuit(s). •Handset holder. •Cellular phone. •PSE Module.	• GO to Pinpoint Test A.
•Interference from the cellular phone speaker - vehicles with Traffic Pro navigation system	•Incorrect navigation system display module settings.	•MAKE sure that MUTE is selected in the navigation system display module RADIO MODE. TEST the system for normal operation.
•Reduced sound or no sound through the speakers	•Circuit(s). •Cellular phone speaker. •Handset holder. •PSE Module.	• GO to Pinpoint Test B.
•No SVC display stays on	•Cellular phone antenna. •Handset holder.	• GO to Pinpoint Test C.
•The hands-free system is inoperative	•Cellular phone and handset holder electrical connectors.	•CHECK the cellular phone is correctly installed into the handset holder. TEST the system for normal operation.
•Microphone sensitivity too low (user is difficult to hear when making calls)	•Microphone incorrectly adjusted.	•INCREASE the microphone sensitivity on the PSE module during a conversation.
	•Microphone location incorrect.	•CHECK the location of the microphone. INSTALL the microphone in the correct location if necessary.

DIAGNOSIS AND TESTING (Continued)

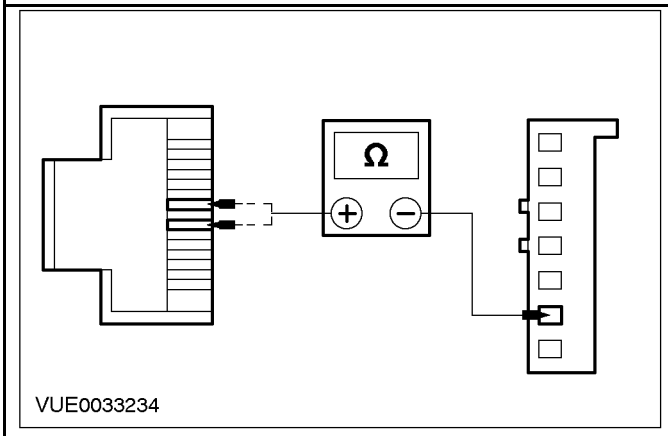
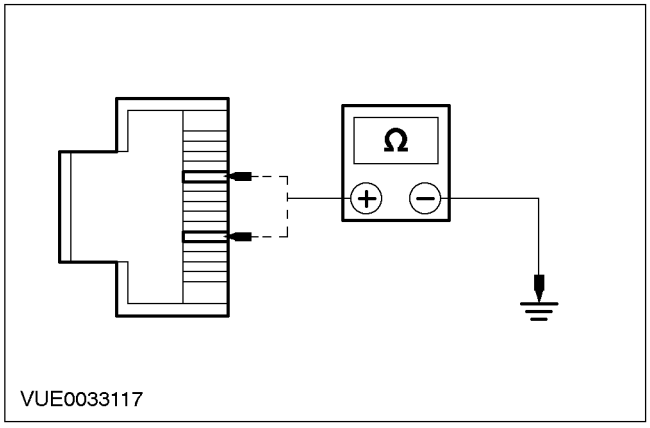
Condition	Possible Sources	Action
•Microphone sensitivity too high (user hears their own voice when making calls)	•Microphone incorrectly adjusted.	•DECREASE the microphone sensitivity on the PSE module during a conversation.
•Whistling noise when the cellular phone is in use	•Microphone incorrectly adjusted.	•DECREASE the microphone sensitivity on the PSE module during a conversation.
•The cellular phone speaker operates but the audio unit speakers do not mute.	•Electrical connection to the navigation system display module. •Threshold voltage to the navigation system display module is not achieved.	•INSTALL a new PSE module wiring harness. TEST the system for normal operation. If the concern persists, INSTALL a new PSE module. TEST the system for normal operation.
	•Audio unit or navigation system display module.	•INSTALL a new audio unit. •INSTALL a new navigation system display module.

Pinpoint Test

PINPOINT TEST A: THE HANDSET BATTERY DOES NOT CHARGE

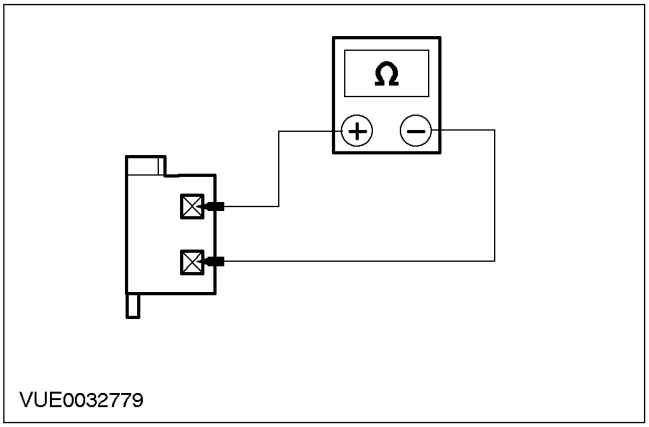
CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK THE POWER SUPPLY TO THE PSE MODULE	
 VUE0033116	1 Disconnect PSE Module C1002. 2 Key in ACCESSORY position. 3 Measure the voltage between the PSE module C1002 pin 4, harness side and ground; and the PSE module C1002 pin 5, harness side and ground. • Are the voltages greater than 10 volts? → **Yes** GO to **A3**. → **No** GO to **A2**.
A2: CHECK THE PSE MODULE WIRING HARNESS FOR OPEN	
	1 Disconnect PSE Module Wiring Harness. 2 Key in ACCESSORY position.

DIAGNOSIS AND TESTING (Continued)

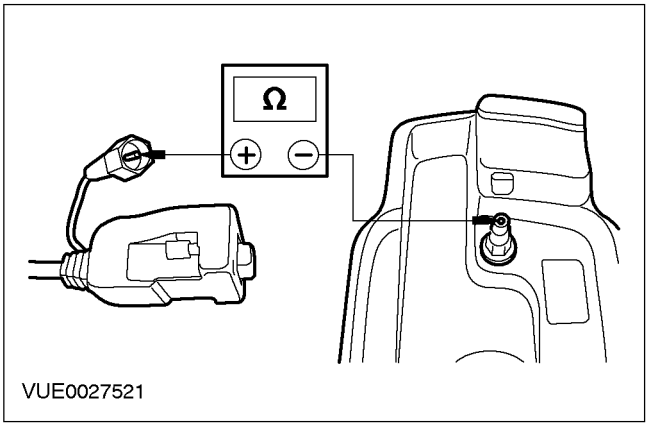
CONDITIONS	DETAILS/RESULTS/ACTIONS
	3 Measure the resistance between the PSE module C1002 pin 4, harness side and PSE module wiring harness, pin 6, harness side; and the PSE module C1002 pin 5, harness side and PSE module wiring harness, pin 6, harness side. • Are the resistances less than 5 ohms? → **Yes** GO to **A3**. → **No** REPAIR the circuit. TEST the system for normal operation.
A3: CHECK THE PSE MODULE FOR GROUND	
	1 Measure the resistance between the PSE module C1002 pin 6, harness side and ground; and the PSE module C1002 pin 3, harness side and ground. • Are the resistances less than 5 ohms? → **Yes** CLEAN the handset holder and cellular phone electrical connectors. TEST the system for normal operation. If the concern persists, INSTALL a new handset holder. TEST the system for normal operation. If the concern persists, INSTALL a new PSE module. → **No** INSTALL a new PSE module wiring harness. TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST B: REDUCED SOUND OR NO SOUND THROUGH THE SPEAKERS

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK THE CELLULAR PHONE SPEAKER	
 VUE0032779	**1** Disconnect Cellular Phone Speaker. **2** Measure the resistance between the speaker terminals (component side). • Is the resistance between 3 and 5 ohms? → **Yes** REPAIR if necessary the circuit between the cellular phone speaker and the PSE module. TEST the system for normal operation. If the concern persists, CLEAN the handset holder and cellular phone electrical connectors. TEST the system for normal operation. INSTALL a new handset holder. TEST the system for normal operation. If the concern still persists, INSTALL a new PSE module. TEST the system for normal operation. → **No** INSTALL a new cellular phone speaker. TEST the system for normal operation.

PINPOINT TEST C: NO SVC DISPLAY STAYS ON

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK THE HANDSET HOLDER ANTENNA CABLE FOR OPEN	
 VUE0027521	**1** Disconnect Handset Holder Antenna Cable. **2** Measure the resistance between the center pin of the handset holder antenna connection and the center pin of the antenna cable connector.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is the resistance less than 1 ohm? → **Yes** TEST the system for normal operation. → **No** INSTALL a new handset holder. TEST the system for normal operation.

SECTION 419-10 Multifunction Electronic Modules

VEHICLE APPLICATION: 2003.0 Mondeo

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DESCRIPTION AND OPERATION

Module Controlled Functions 419-10-2

DIAGNOSIS AND TESTING

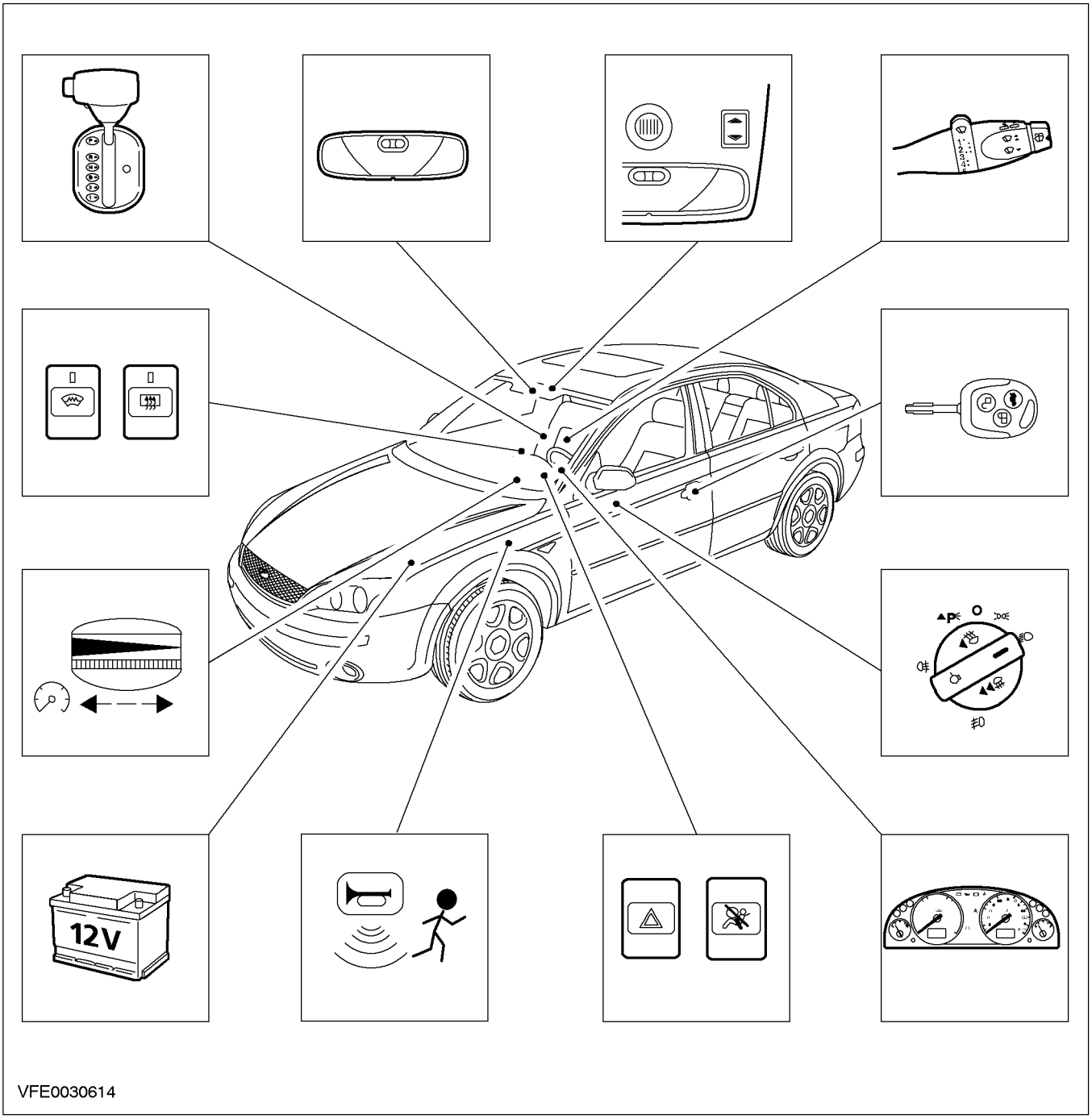
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Symptom Chart 419-10-7
Pinpoint Test 419-10-7

REMOVAL AND INSTALLATION

Generic Electronic Module (GEM) 419-10-14

DESCRIPTION AND OPERATION

Module Controlled Functions



General

From 2001.25 MY a generic electronic module (GEM) is used.

The module has the following functions:

DESCRIPTION AND OPERATION (Continued)

- Direction indicator / hazard warning light control
- Interior light control
- Dimmer control
- Heated windscreen and rear window control
- Wiper interval control
- Warning for lights switched on
- Warning for door not closed
- PRNDL warning
- Generation of warning and confirmation tones
- Battery protection function
- Closing system control
- Checking that doors and tailgate are closed
- Control of window regulators and sliding roof within scope of overall closing function
- Monitoring of static vehicle condition (anti-theft warning system)

For the European Area of Operations, two different GEMs are fitted ex works. They differ only with regard to the anti-theft warning function.

All other functions are available as standard in both modules.

Only the GEM with anti-theft warning function is available for servicing. This must be adapted to the vehicle equipment level using the WDS tester, as otherwise, the functions which are not available in the vehicle are recognised as faults and are stored in the memory.

Control Functions

The GEM monitors the following functions:

Interior Lights

The interior lights are activated, if:

- A vehicle door is opened and the ignition switch is in the OFF or ACC position.
- The ignition switch is turned from the ON or START position to the ACC or OFF position.
- The vehicle is unlocked by means of the radio remote control.

The interior lights are extinguished:

- 25 seconds after all doors were closed but the vehicle was not locked.
- If the vehicle is locked.
- If the ignition switch is turned from the OFF or ACC position to the ON or START position.

Deactivation is effected via the dimming function over a period of 1.7 seconds.

The interior lights consist of the front and rear dome lamps and the position lamps in the interior door trim panels.

Direction Indicators / Hazard Warning Lights

When the direction indicator control is actuated, the direction indicator lamps on the relevant side of the vehicle are activated with a frequency of 1.3 Hz (80 times per minute).

At the same time, a clicking sound is emitted via the steering column switch and the direction indicator telltale is activated.

In the event of a defective direction indicator lamp, the flashing frequency is doubled. However, this does not apply to hazard warning light mode.

Heated Windscreen

The heated windscreen can be activated via the ON / OFF switch after starting the engine.

The heated windscreen is deactivated:

- Automatically after 4 minutes.
- By switching off the ignition.
- Via the ON / OFF switch.
- If the engine stalls.
- If the charging system is defective.

The signal indicating whether or not the engine is running, is transmitted to the GEM from the instrument cluster.

Heated Rear Window

The heated rear window can be activated via the ON / OFF switch after switching on the ignition.

The heated rear window is deactivated:

- Automatically after 14 minutes.
- By switching off the ignition.
- Via the ON / OFF switch.

Windscreen Wipers

The GEM controls the windscreen washer function and the wipe interval.

If the windscreen washer function is actuated, the activation of the windscreen wipers is delayed. Three wipes are then performed. An additional wipe is performed after approx. 5 seconds.

The wipe interval is adjustable in 6 steps via the adjuster ring on the wiper lever.

The other functions are independent of the GEM and continue to be available in the event of failure of the GEM.

DESCRIPTION AND OPERATION (Continued)

Rear Window Wiper

For simultaneously operated windscreen wipers and rear window wiper as well as separately activated rear window wiper, only the intermittent wiping function is available for the rear window wiper.

Only the intermittent wiping function is available if reverse gear is engaged when the rear window wiper is switched on.

Rear Window Wiper Automatic Function

If the windscreen wipers are switched on and reverse gear is engaged, the rear window wiper is automatically activated, if it is switched off. In this case, the mode is adapted to the windscreen wiper mode. If the windscreen wipers are operated in intermittent mode, the rear window wiper is adapted to the currently selected interval step. If the windscreen wipers are operated in continuous wiping mode, the rear window wiper also switches to continuous wiping mode. In contrast to the windscreen wipers, only one wiping speed is available for the rear window wiper.

For the washer function, the GEM activates the wipers without delay.

Warning Buzzer when Leaving the Vehicle with the Lights Switched on

With the ignition switched off and the lights switched on, a warning signal is emitted via the GEM when a door is opened.

Door Open Warning

If a door is not closed and the ignition is switched on, a warning light illuminates in the instrument cluster.

PRNDL Warning (Automatic Transmission)

If the automatic transmission selector lever is not in the "P" position and the ignition is switched off, a warning signal sounds.

Trip Computer Entry Confirmation

For each entry via the control switch of the trip computer, the GEM emits a tone as entry confirmation

Battery Protection Function

In order to prevent discharge of the battery due to continuously-activated consumers, the interior lights are switched off automatically after 10 minutes and all other interior lamps (interior mirror, reading lamp, glove compartment, footwell) after 30 minutes.

In addition, all GEM warning signals are deactivated after 30 minutes.

The timer is activated if the ignition switch is turned to the OFF or the ACC position.

The timer is reset if:

- The ignition switch is turned to the ON or the START position.
- A door is opened (including luggage compartment lid or tailgate).
- A lock is released.

Automatic Re-locking

If the vehicle is unlocked via the radio remote control but no door is opened and the ignition is not switched on within 45 seconds, the GEM automatically re-locks the vehicle via central locking. The anti-theft warning system is also activated in vehicles equipped with this system.

Overall Closing Function

The electrically-operated windows and the electrically-operated sun roof (if fitted) can also be opened or closed when the ignition is switched off, using the radio remote control.

In order to open the electrically-operated windows and the electrically-operated sun roof (if fitted), the unlocking button on the radio remote control must be pressed for approx. 2 seconds.

The electrically-operated windows and the electrically-operated sun roof (if fitted) are then fully opened automatically. Therefore, the button can be released.

NOTE: The electrically-operated sun roof always opens in the sliding position, irrespective of the current position. If the electrically-operated sun roof is in the raised position, it is first closed and is then driven to the fully open position in sliding mode.

The opening movement is interrupted if one of the following conditions is fulfilled:

- The opening button on the radio remote control is pressed again.
- The closing button on the radio remote control is pressed.
- The ignition is switched on.

In order to close the electrically-operated windows and the electrically-operated sun roof (if fitted), the locking button on the radio remote control must be pressed for approx. 2 seconds.

The electrically-operated windows and the electrically-operated sun roof (if fitted) are then

DESCRIPTION AND OPERATION (Continued)

fully closed automatically. Therefore, the button can be released.

The closing movement is interrupted if one of the following conditions is fulfilled:

- The opening button on the radio remote control is pressed.
- The closing button on the radio remote control is pressed again.
- The ignition is switched on.
- An object becomes trapped.

WARNING: Each window regulator must be individually initialised after the battery has been disconnected. If individual window regulators are disconnected, only these must be initialised.For additional information, refer to Section 501-11.

NOTE: If an object has become trapped, the anti-pinch protection is activated and the window is driven back into a safe position.

Receiver Aerial for Radio Remote Control

The GEM aerial consists of a 1100 millimetre long wire, which is located in the wiring harness along the instrument panel carrier.

Anti-theft Warning System

The optional anti-theft warning system registers unauthorised interference with the vehicle visually and acoustically. If the vehicle is centrally or double locked with the ignition switched off, the anti-theft warning system is automatically activated after 20 seconds.

If the anti-theft warning system is activated, the following components are monitored:

- Vehicle doors
- Bonnet
- Luggage compartment lid or tailgate
- Radio
- Ignition

Electric Window Regulators

The global closing function is monitored by the GEM.

Electric Sliding Roof

The global closing function is monitored by the GEM.

DIAGNOSIS AND TESTING

Generic Electronic Module (GEM)

Refer to Wiring Diagrams Section 419-10 for schematic and connector information.

Description of operation

A diagnosis of the generic electronic module (GEM) can be performed with WDS. Furthermore, an integrated service mode enables testing of the input and output signals without the need for further tools. To enable activation of service mode:

- switch off the ignition and all other electrical loads,
- apply the handbrake,
- engage neutral or, on an automatic transmission, move the selector lever to "P",
- click the driver's side seat belt into the buckle (Japan only),
- and close the doors.

and close the doors.

Activating the service mode

Proceed as follows to activate the service mode:

NOTE: If the alarm sounds (in vehicles fitted with an anti-theft alarm system), service mode cannot be activated.

- Switch the ignition to the "On" position.
- Switch the ignition to the "Off" position.
- PRESS and HOLD the rear window heater switch
- Switch the ignition to the "On" position.
- RELEASE the rear window heater switch

A signal sounds and the turn signal lamps come on to indicate that service mode has been successfully activated.

Input signals

SWITCH the wiper switch to the "Off" position to test the input signals. The following is a list of the signals to be tested, in no particular order:

- Turn signals (right, left, hazard warning lights)
- Side lights
- Intermittent wipe, windshield
- Wash/wipe system, windshield
- Rear wiper
- Wash/wipe system, rear window
- Doors open/closed
- Remote release switch in the centre console for the tailgate / luggage compartment lid
- Tailgate / luggage compartment lid release button in the tailgate / luggage compartment lid
- Open the tailgate / luggage compartment lid with a key.
- Locking key on the remote control (the ignition key must not be in the ignition during the test)
- Release key on the remote control (the ignition key must not be in the ignition during the test)
- Tailgate / luggage compartment lid release key on the remote control (the ignition key must not be in the ignition during the test)
- Hood open/closed (in vehicles equipped with an anti-theft alarm system)
- Heated rear window
- Heated windshield (if equipped)
- Ignition on
- Automatic transmission, selector lever position "P"
- Driver's side seatbelt (Japan only)
- Reverse gear (Japan only)

An acoustic signal sounds and the turn signal lamps flash to indicate receipt of each input signal by the generic electronic module (GEM).

Output signals

SWITCH the wiper switch to the "Intermittent wipe" position to test the output signals. PRESSING the rear window heater switch activates or deactivates the output signals in the following order:

DIAGNOSIS AND TESTING (Continued)

– Front wipers (a signal sounds and the direction indicator lamps flash when the "Park" position is reached)
– Rear window heater
– Interior light(s) (the switch for the interior lights must be in the "Door contact" setting)
– "Door ajar" warning lamp in the instrument cluster
– Rear window wiper
– Windscreen heater (only activated if the engine is running)
– "Seatbelt" warning lamp in the instrument cluster (Japan only)
– Front wiper
– etc.

Ending the service mode

The GEM automatically exits the service mode 20 seconds after the last input or if the vehicle is driven. This is indicated with 3 acoustic signals and by flashing of the turn signal lamps.

Diagnosis and Testing

1. CHECK the concern.
2. Visually inspect for obvious signs of mechanical or electricaldamage.

— Visual Inspection Chart

Electrical
Fuse(s).
Wiring harness
Electrical connector(s).

3. If an obvious cause for an observed or reported concern is found,correct the cause (if possible) before proceeding to the next step. CHECK the operation of the system.
4. If the concern persists after the visual inspection, CARRY OUT a fault diagnosis on the generic electronic module (GEM) with WDS and RECTIFY any displayed faults in accordance with the fault description. CHECK the operation of the system.
5. If no faults are stored in the fault memory, proceed with the Symptom Chart according to the fault symptom.

Symptom Chart

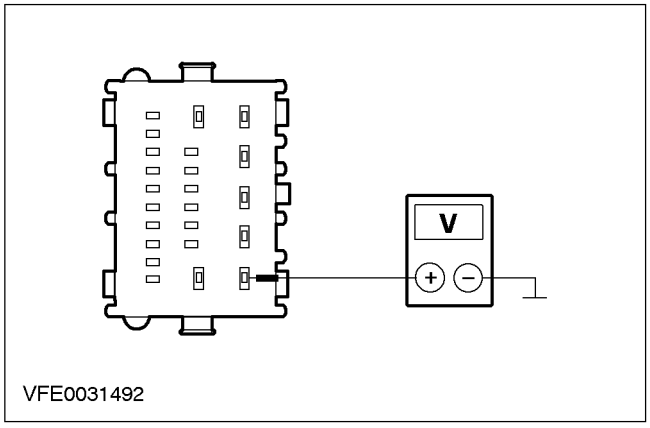
Condition	Possible Sources	Action
•Service mode cannot be activated	•Fuse(s). •Circuit(s). •Generic electronic module (GEM) •Rear window heater switch	• GO to Pinpoint Test A
•Generic electronic module (GEM) not communicating with the diagnostic unit	•Fuse(s). •Circuit(s). •Generic electronic module (GEM)	•REFER to Section 418-00.

Pinpoint Test

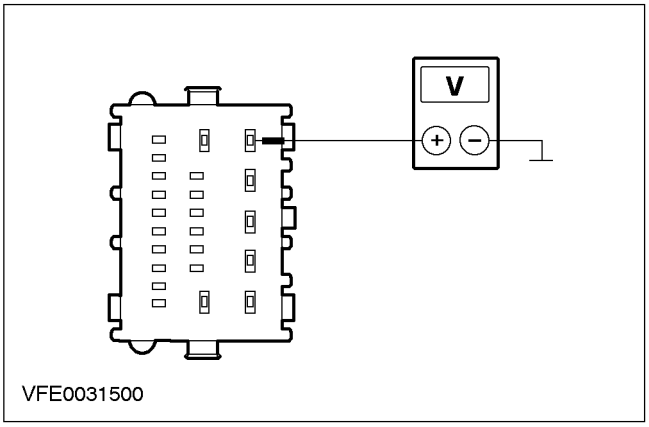
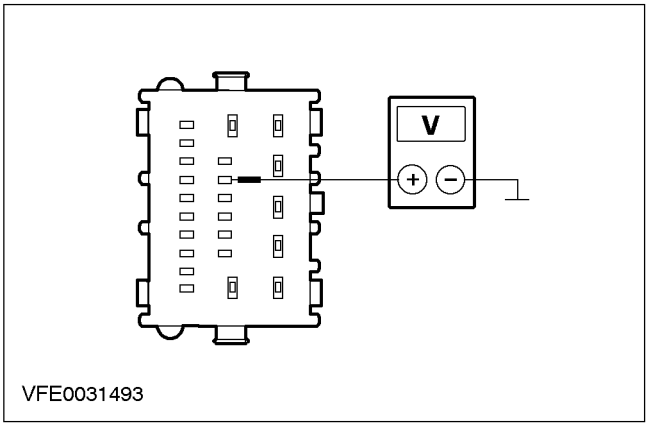
PINPOINT TEST A: SERVICE MODE CANNOT BE ACTIVATED

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK FUSE F24.	
	1 Key in OFF position. 2 CHECK Fuse F24 (BJB). • Is the fuse OK? → **Yes** GO to **A2** → **No** RENEW fuse F24 (20 A). CHECK the system again. If the fuse blows again, LOCATE and RECTIFY the short to ground with the aid of the Wiring Diagrams.

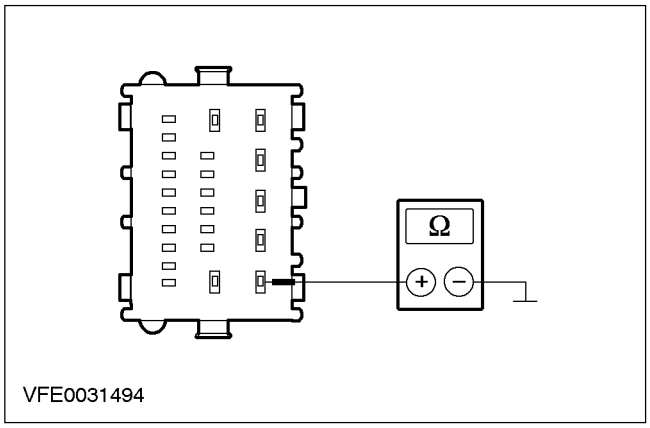
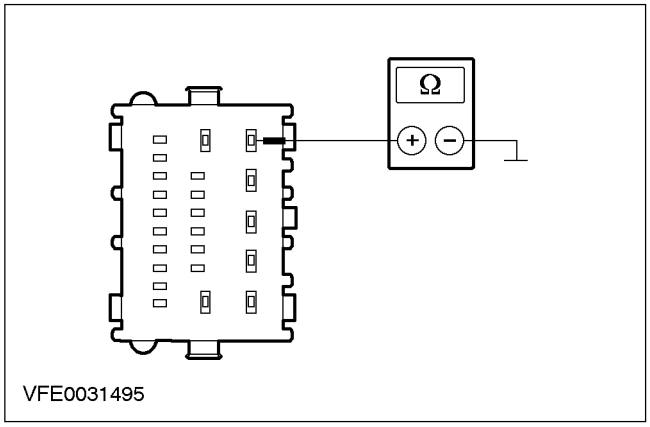
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A2: MEASURE THE VOLTAGE AT FUSE F24	
	1 Connect Fuse F24 (BJB). 2 Measure the voltage between fuse F24 (20 A) and ground. • Does the meter display battery voltage? → **Yes** GO to **A3** → **No** REPAIR the voltage supply to fuse F24 with the aid of the Wiring Diagrams. CHECK the operation of the system.
A3: CHECK FUSE F25	
	1 CHECK Fuse F25 (BJB). • Is the fuse OK? → **Yes** GO to **A4** → **No** RENEW fuse F25 (15 A). CHECK the system again. If the fuse blows again, LOCATE and RECTIFY the short to ground with the aid of the Wiring Diagrams.
A4: MEASURE THE VOLTAGE AT FUSE F25	
	1 Connect Fuse F25 (BJB). 2 Measure the voltage between fuse F25 (15 A) and ground. • Does the meter display battery voltage? → **Yes** GO to **A5** → **No** REPAIR the voltage supply to fuse F25 with the aid of the Wiring Diagrams. CHECK the operation of the system.
A5: CHECK THE VOLTAGE AT THE GENERIC ELECTRONIC MODULE (GEM)	
	1 Disconnect GEM C426. 2 Measure the voltage between the GEM, connector C426, pin 1, circuit 29-AA17 (OG/WH), wiring harness side and ground. • Does the meter display battery voltage?

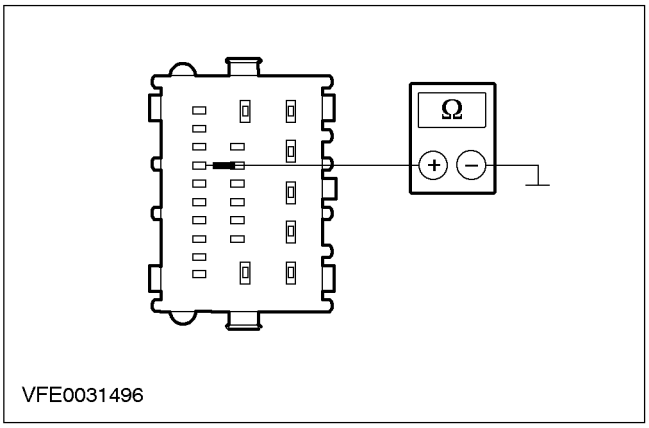
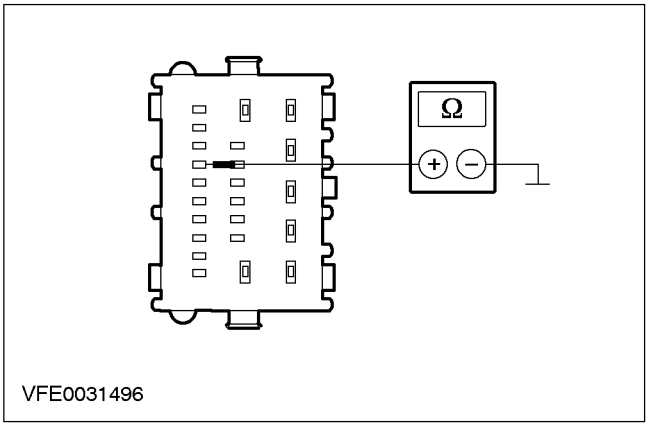
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** GO to **A6** → **No** LOCATE and RECTIFY the break in the circuit between the GEM and fuse F24 with the aid of the Wiring Diagrams. CHECK the operation of the system.
A6: CHECK THE VOLTAGE AT THE GEM	
 VFE0031500	**1** Measure the voltage between the GEM, connector C426, pin 5, circuit 29-LG25 (OG/BU), wiring harness side and ground. • Does the meter display battery voltage? → **Yes** GO to **A7** → **No** LOCATE and RECTIFY the break in the circuit between the GEM and fuse F25 with the aid of the Wiring Diagrams. CHECK the operation of the system.
A7: CHECK THE VOLTAGE AT THE GEM	
 VFE0031493	**1** Connect GEM C426. **2** Disconnect GEM C429. **3** Key in ON position. **4** Measure the voltage between the GEM, connector C429, pin 12, circuit 8-AA30 (WH), wiring harness side and ground. • Is a voltage of at least 10 Volts measured? → **Yes** GO to **A8** → **No**

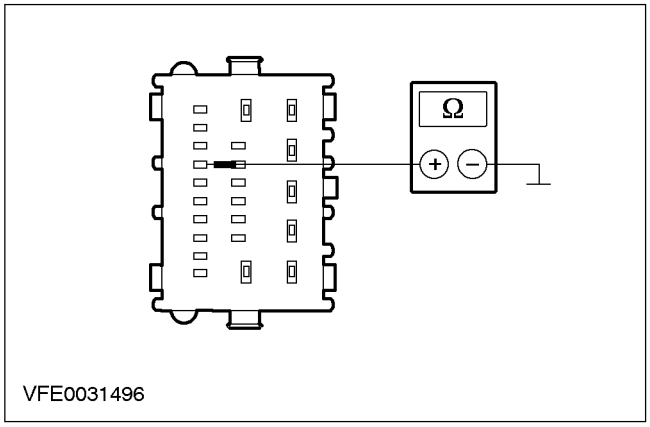
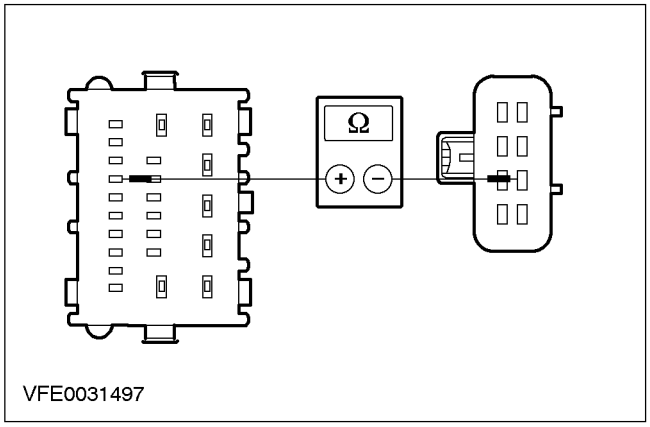
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	LOCATE and RECTIFY the break in circuit 8-AA30 (WH) between the instrument cluster and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system.
A8: CHECK THE GROUND CONNECTION OF THE GEM	
 VFE0031494	1 Key in OFF position. 2 Measure the resistance between the GEM, connector C429, pin 1, circuit 91-DK20 (BK/RD), wiring harness side and ground. • Is a resistance of less than 2 Ohm measured? → **Yes** GO to **A9** → **No** LOCATE and RECTIFY the break in circuit 91-DK20 (BK/RD) between the GEM and ground connection G203 with the aid of the Wiring Diagrams. CHECK the operation of the system.
A9: CHECK THE GROUND CONNECTION OF THE GEM	
 VFE0031495	1 Disconnect GEM C427. 2 Measure the resistance between the GEM, connector C427, pin 5, circuit 31-DK20 (BK), wiring harness side and ground. • Is a resistance of less than 2 Ohm measured? → **Yes** GO to **A10** → **No**

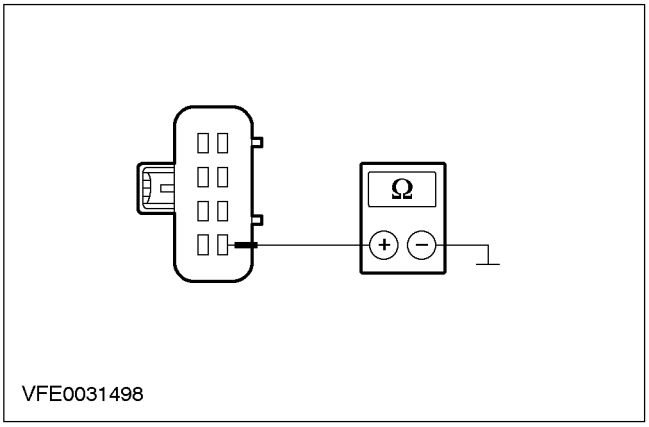
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	LOCATE and RECTIFY the break in circuit 31-DK20 (BK) between the GEM and ground connection G205 with the aid of the Wiring Diagrams. CHECK the operation of the system.
A10: CHECK THE GROUND CONNECTION VIA THE REAR WINDOW HEATER SWITCH	
 VFE0031496	**1** Press and hold the rear window heater switch. **2** Measure the resistance between the GEM, connector C429, pin 20, circuit 31S-HB22 (BK/GN), wiring harness side and ground. • Is a resistance of less than 2 Ohm measured? → **Yes** GO to **A11** → **No** GO to **A13**
A11: CHECK THE GROUND CONNECTION VIA THE REAR WINDOW HEATER SWITCH	
 VFE0031496	**1** Release the rear window heater switch. **2** Measure the resistance between the GEM, connector C429, pin 20, circuit 31S-HB22 (BK/GN), wiring harness side and ground. • Is a resistance of more than 10 kOhms measured? → **Yes** CHECK the GEM and RENEW as necessary. CHECK the operation of the system. → **No** GO to **A12**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A12: CHECK THE CIRCUIT BETWEEN THE GEM AND THE REAR WINDOW HEATER SWITCH FOR A SHORT TO GROUND	
 VFE0031496	1 Disconnect Rear window heater switch C488. 2 Measure the resistance between the GEM, connector C429, pin 20, circuit 31S-HB22 (BK/GN), wiring harness side and ground. • Is a resistance of more than 10 kOhms measured? → **Yes** RENEW the rear window heater switch. CHECK the operation of the system. → **No** LOCATE and RECTIFY the short to ground in circuit 31S-HB22 (BK/GN) between the GEM and the rear window heater switch with the aid of the Wiring Diagrams. CHECK the operation of the system.
A13: CHECK THE CIRCUIT BETWEEN THE GEM AND THE REAR WINDOW HEATER SWITCH FOR OPEN CIRCUIT	
 VFE0031497	1 Disconnect Rear window heater switch C488. 2 Measure the resistance between the GEM, connector C429, pin 20, circuit 31S-HB22 (BK/GN), wiring harness side and the rear window heater switch, connector C488, pin 2, circuit 31S-HB22 (BK/GN), wiring harness side. • Is a resistance of less than 2 Ohm measured? → **Yes** GO to **A14** → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	LOCATE and RECTIFY the break in circuit 31S-HB22 (BK/GN) between the GEM and the rear window heater switch with the aid of the Wiring Diagrams. CHECK the operation of the system.
A14: CHECK THE CIRCUIT BETWEEN THE REAR WINDOW HEATER SWITCH AND GROUND FOR OPEN CIRCUIT	
 VFE0031498	**1** Measure the resistance between the rear window heater switch, connector C488, pin 1, circuit 31-HB22 (BK), wiring harness side and ground. • Is a resistance of less than 2 Ohm measured? → **Yes** RENEW the rear window heater switch. CHECK the operation of the system. → **No** LOCATE and RECTIFY the break in the circuit between the rear window heater switch and ground connection G204 with the aid of the Wiring Diagrams. CHECK the operation of the system.

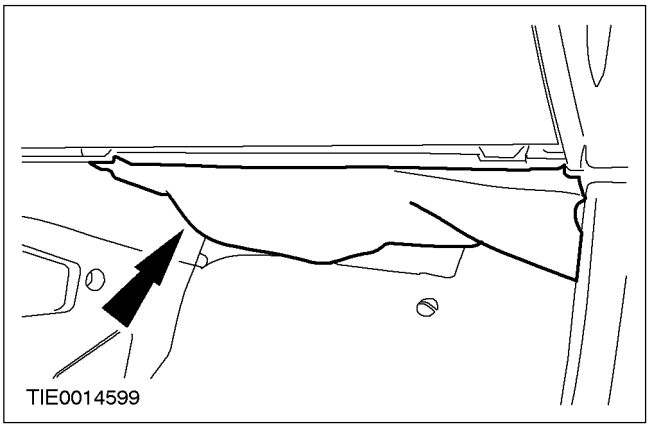
REMOVAL AND INSTALLATION

Generic Electronic Module (GEM)

Removal

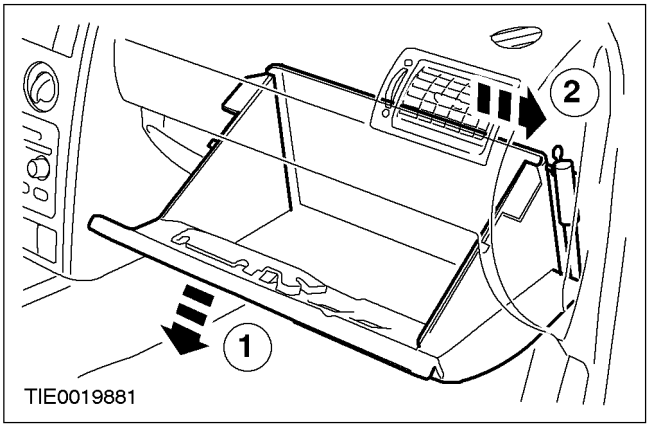
Left-hand drive vehicles

1. Remove the bottom footwell trim (5 clips).



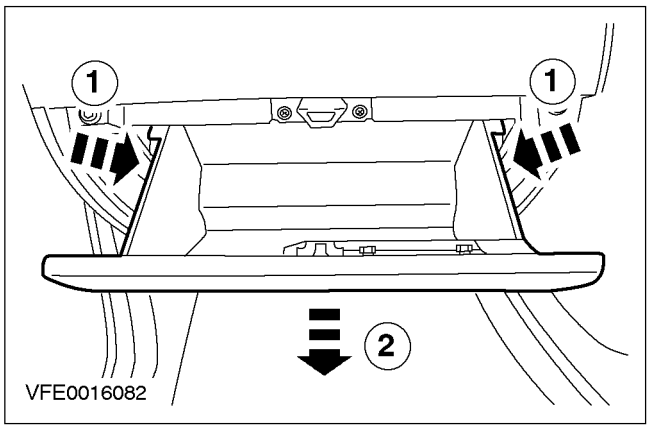
2. Detach the opening damper from the glove compartment.

1. Open the glove compartment to gain access to the opening damper.
2. Slide the upper part of the opening damper away from the glove compartment.



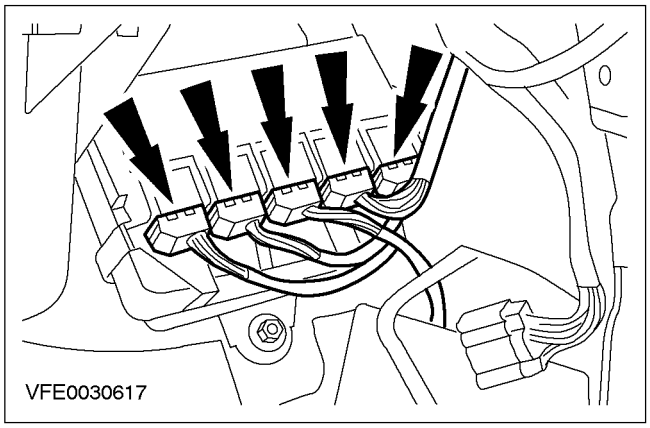
3. Remove the glove compartment.

1. Press the sides towards the centre to release the glove compartment.
2. Pull the glove compartment out of the hinges.

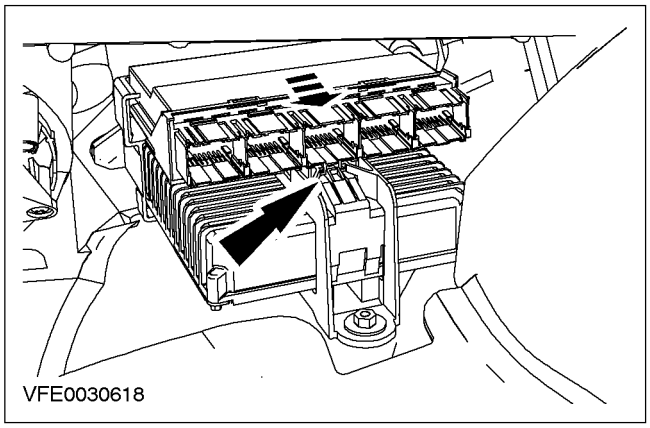


All vehicles

4. Pull off the GEM connector.



5. Remove the GEM.



REMOVAL AND INSTALLATION (Continued)

Installation

1. **NOTE:** Initialise the GEM with WDS after installation.

   Install the components in reverse order.

Group

5

Body and Paint

SECTION TITLE	PAGE
Body	
Front End Body Panels	501-02-1
Body Closures	501-03-1
Interior Trim and Ornamentation	501-05-1
Rear View Mirrors	501-09-1
Seating	501-10-1
Glass, Frames and Mechanisms	501-11-1
Instrument Panel and Console	501-12-1
Handles, Locks, Latches and Entry Systems	501-14-1
Wipers and Washers	501-16-1
Roof Opening Panel	501-17-1
Bumpers	501-19-1
Safety Belt System	501-20A-1
Supplemental Restraint System	501-20B-1
Frame and Mounting	
Uni-Body, Subframe and Mounting System	502-00-1

SECTION 501-02 Front End Body Panels

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

SPECIFICATIONS

Specifications 501-02-2

GENERAL PROCEDURES

Hood Alignment ..... (41 213 0) 501-02-3

REMOVAL AND INSTALLATION

Fender ..... (44 252 0) 501-02-7

SPECIFICATIONS

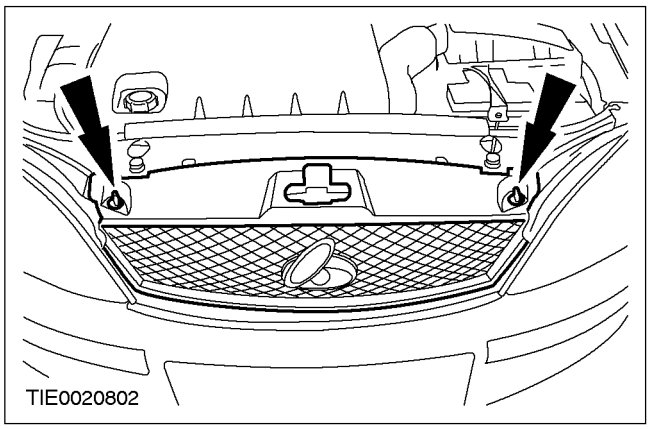
Torque Specifications

Description	Nm	lb-ft	lb-in
Fender splash shield retaining bolts	3	-	27
Fender splash shield retaining screws	3	-	27
Fender front retaining bolts	7	-	62
Fender inner retaining bolts to the a-pillar	7	-	62
Fender lower retaining bolt to the a-pillar	7	-	62
Fender upper retaining bolt to the a-pillar	6	-	53
Fender flange bolts	7	-	62
Fender grille opening panel bolts	25	18	-
Hood latch to the grille opening panel	8	-	71
Windshield wiper arm retaining nuts	22	16	-
Hood hinge retaining bolts to the body	25	18	-
Hood hinge retaining bolts to the hood	25	18	-

GENERAL PROCEDURES

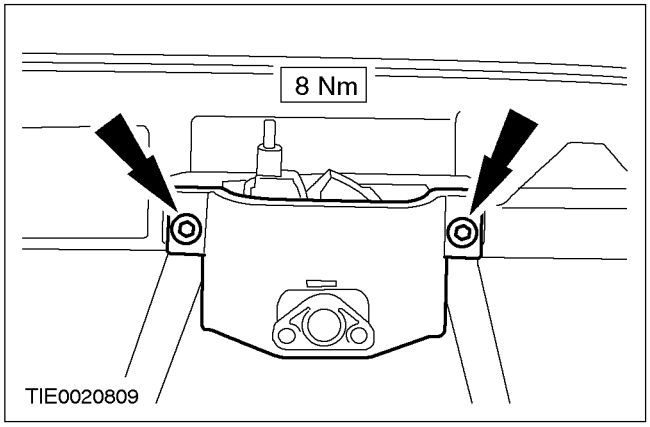
Hood Alignment (41 213 0)

1. Remove the radiator grille.



2. NOTE: The hood must be adjusted with the hood latch removed.

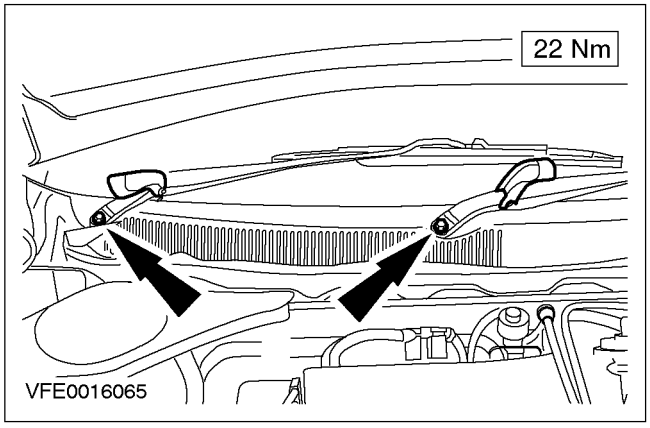
Remove the hood latch.



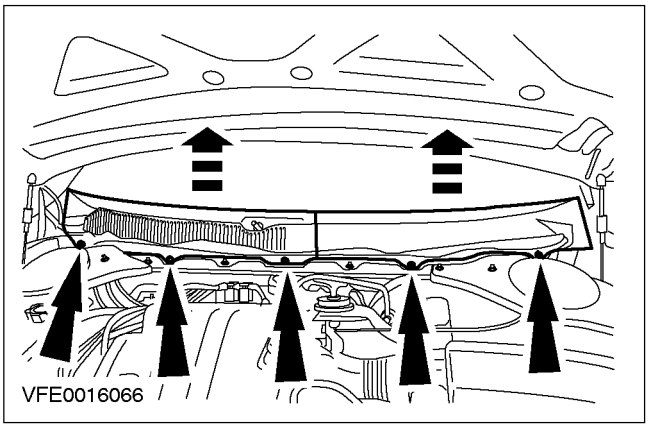
3. NOTE: Make sure that the windshield wiper motor is in the park position.

Remove the windshield wiper arms.

- Lift up the covers.

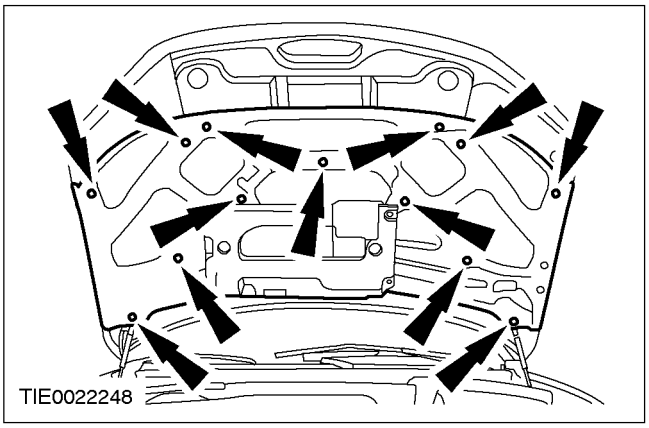


4. Remove the cowl trim panel.



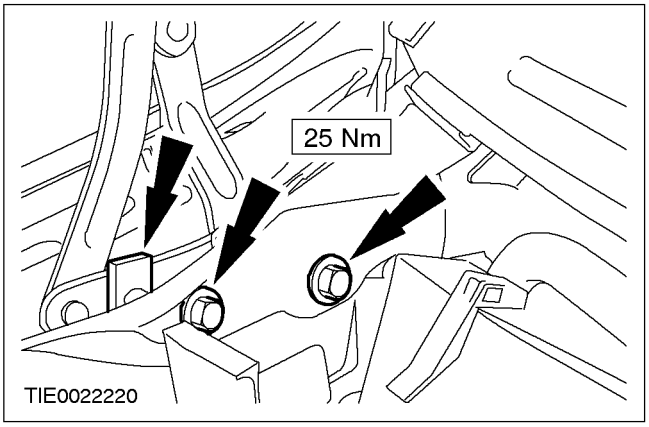
5. Remove the resonator and the hood insulator.

- Release the clips.



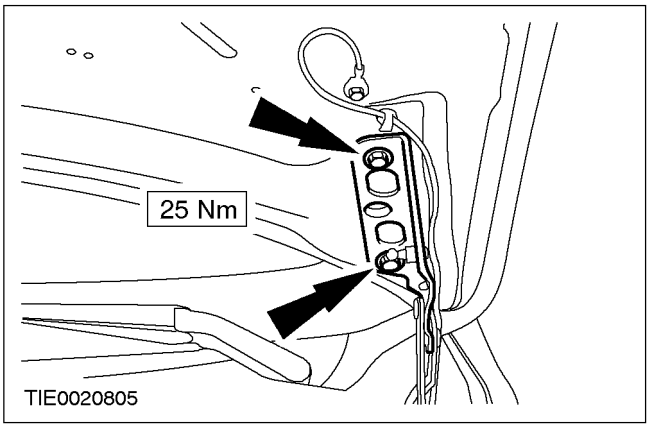
6. Remove the plastic clip from the body mounted hinge part.

- Loosen the body mounted hinge retaining bolts. Using the centre position of the body holes, tighten the bolts on both sides.



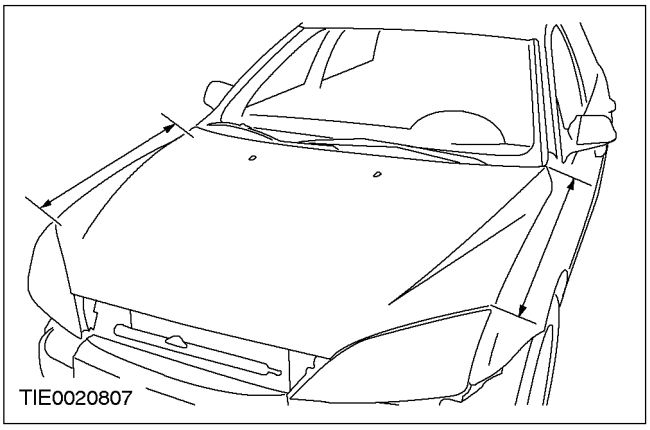
GENERAL PROCEDURES (Continued)

7. Loosen the hood hinge retaining bolts to finger tight.

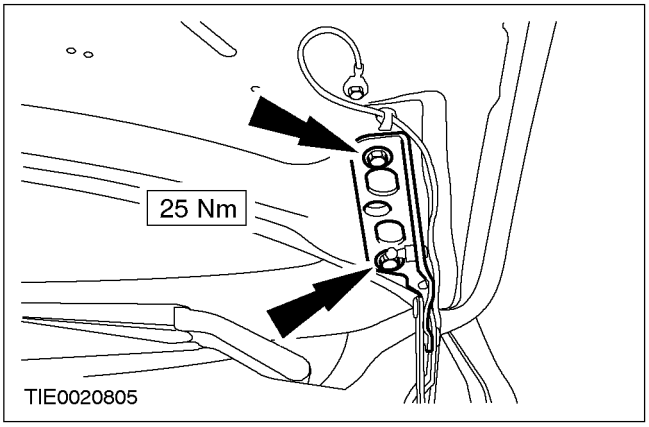


8. Align the hood.

- Adjust the hood so that the edges of the fender and the edge of the hood line up. Check that the clearances with the left and right-hand fenders run parallel and correct as necessary.
- The clearances with the fenders must be the same width on the left and right-hand sides. The clearances can be equalised by opening the hood and pushing the hood to the left or right.



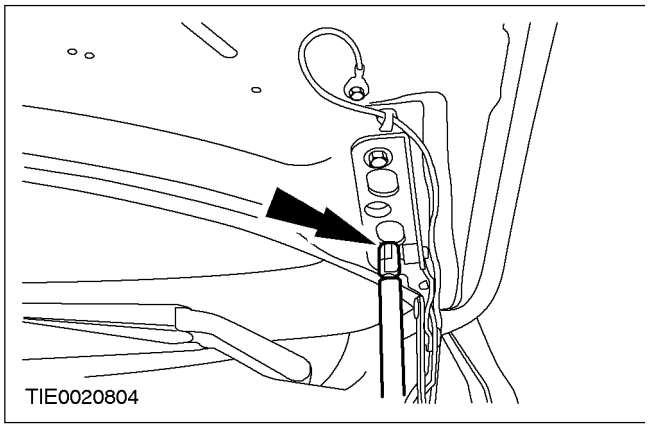
9. Tighten the hood hinge retaining bolts on both sides.



10. ⚠ CAUTION: Support the hood with a suitable wooden block to prevent the hood from closing.

Remove the hood support strut.

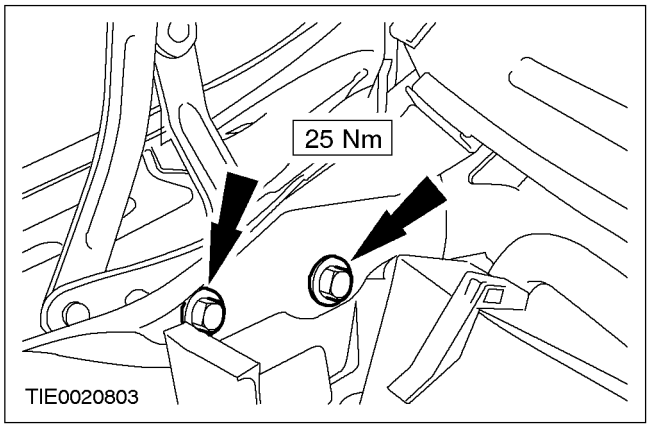
- Release the clips on both sides of the hood support strut.



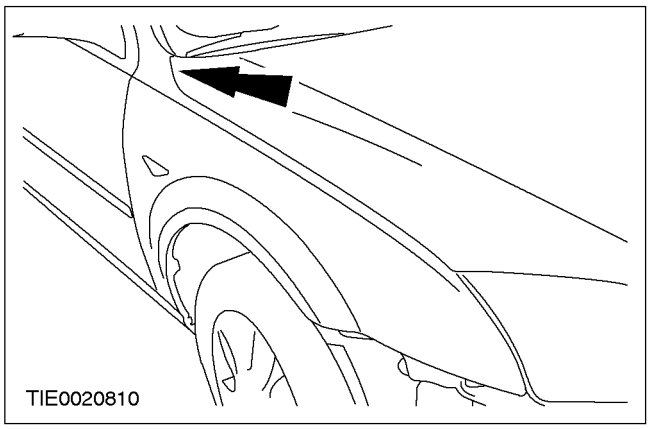
GENERAL PROCEDURES (Continued)

11. Loosen the body mounted hinge retaining bolts and move hinges to uppermost position.

- Tighten the retaining bolts until hinges keep position.

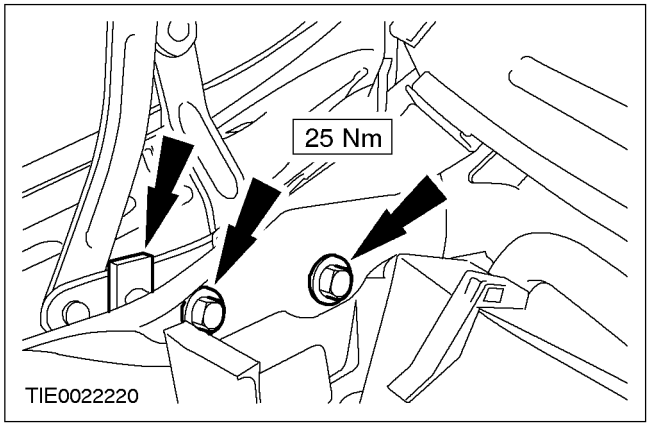


12. Align the hood height to the height of the fender by pushing down the rear edges of the hood.

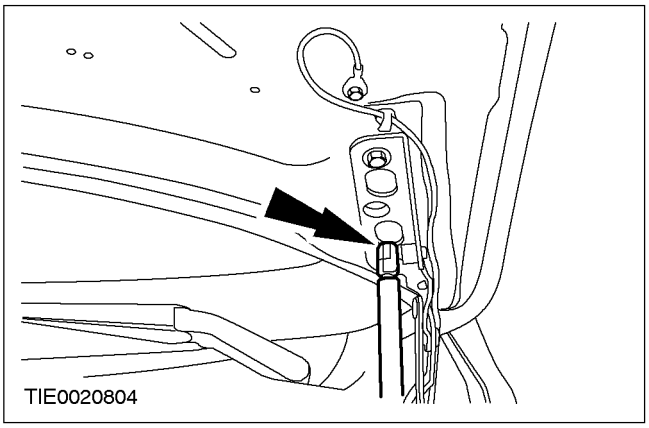


13. Tighten the hood rear hinge retaining bolts on both sides, to eliminate any movement.

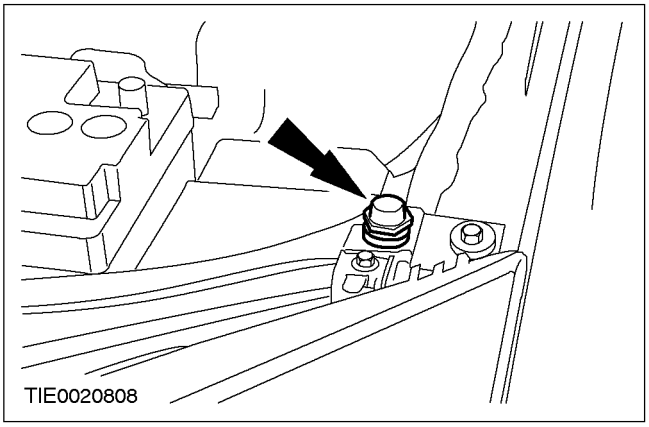
- Install the clip on both sides to pretension the hinges.



14. Install the hood support strut.



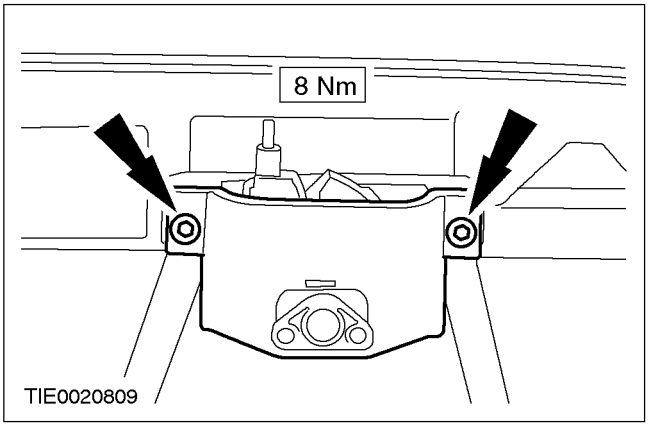
15. Adjust the front of the hood flushness to the fenders and the headlamps by screwing the bump stop rubbers in or out.



16. NOTE: All adjustment must be carried out before installing the hood latch.

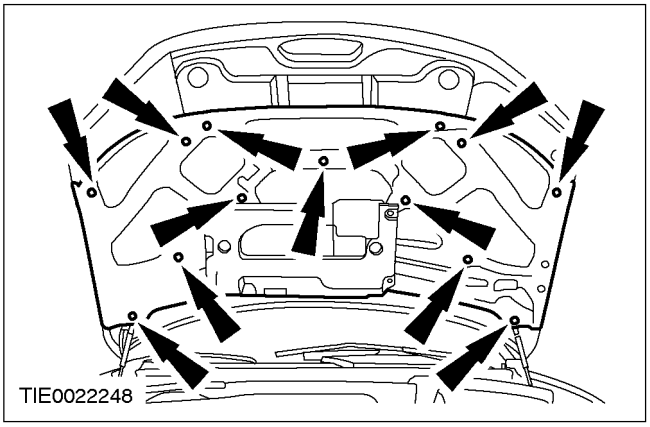
Install the hood latch.

- The hood latch must be installed so that the hood engages without stress and the clearances on the left and right-hand sides remain equal.

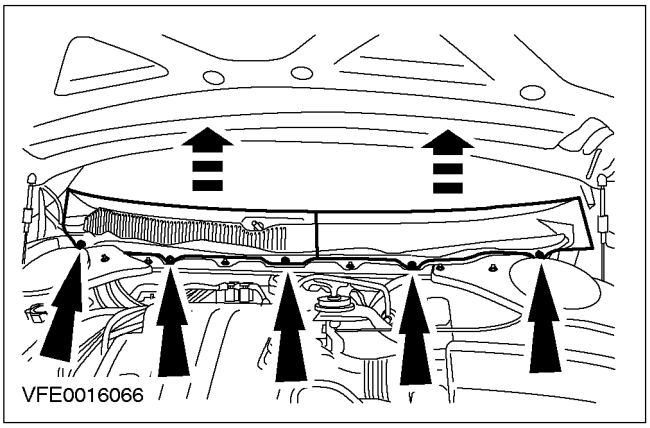


GENERAL PROCEDURES (Continued)

17. Install the hood insulator and the resonator.



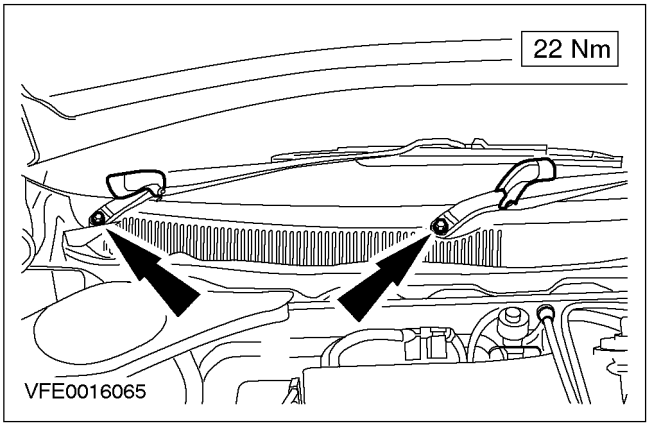
18. Install the cowl trim panel.



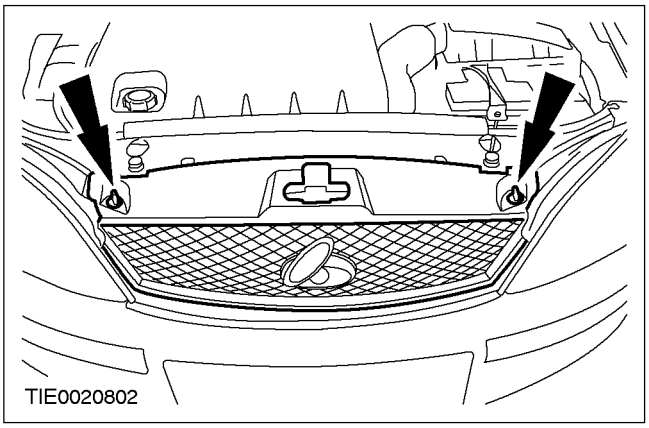
19. NOTE: Make sure that the windshield wiper motor is in the park position.

Install the windshield wiper arms.

- Clip on the covers.



20. Install the radiator grille.



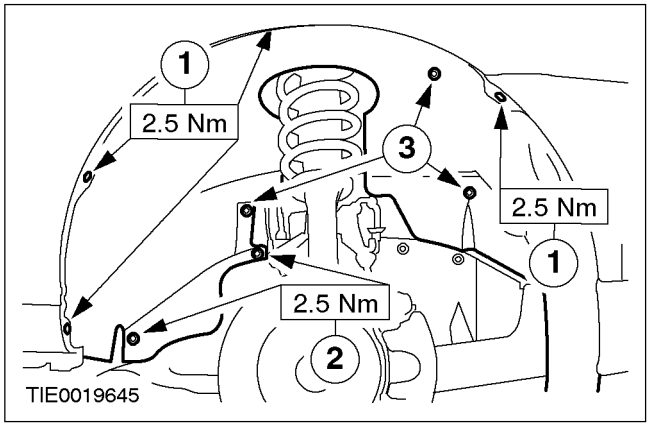
REMOVAL AND INSTALLATION

Fender (44 252 0)

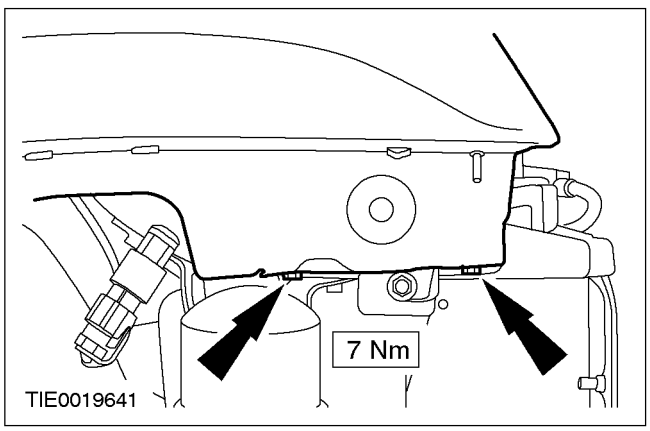
Removal

1. **NOTE:** This procedure is for removing the right-hand fender. The procedure for removing the left hand fender is similar.

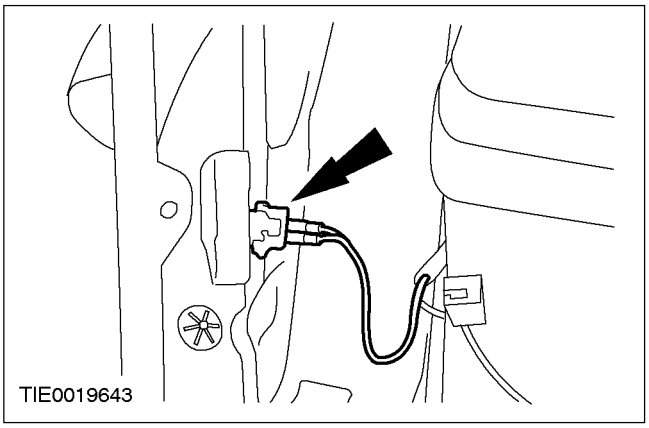
   Remove the front bumper. For additional information, refer to Section 501-19.
2. **Remove the headlamps. For additional information, refer to Section 417-01.**
3. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
4. **Remove the wheel and tire. For additional information, refer to Section 204-04.**
5. **Remove the fender splash shield.**
   1. Remove the retaining screws.
   2. Remove the retaining bolts (two bolts).
   3. Remove the plastic fixings (three fixings).



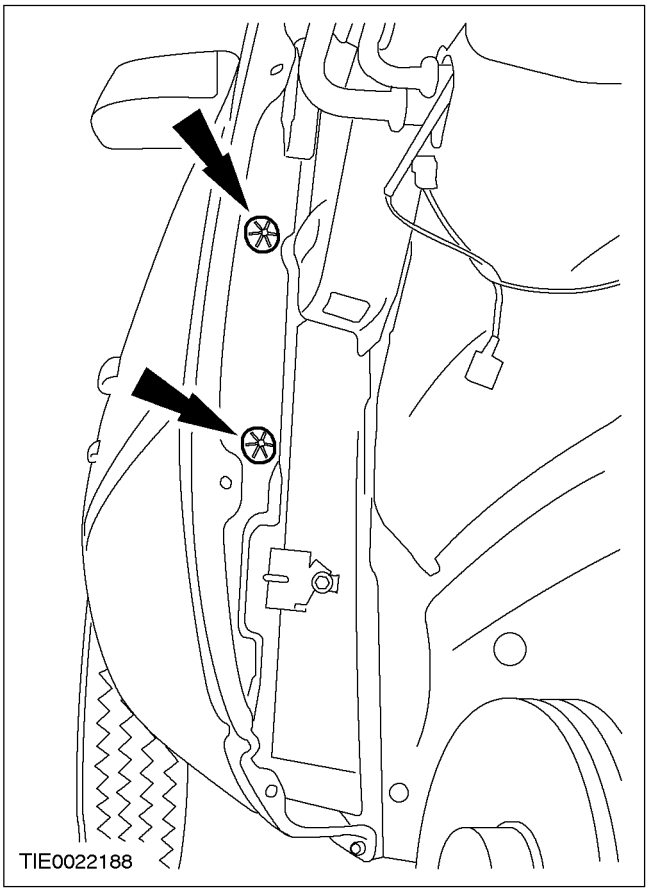
6. **Remove the fender front retaining bolts.**



7. **Disconnect the direction indicator electrical connector.**

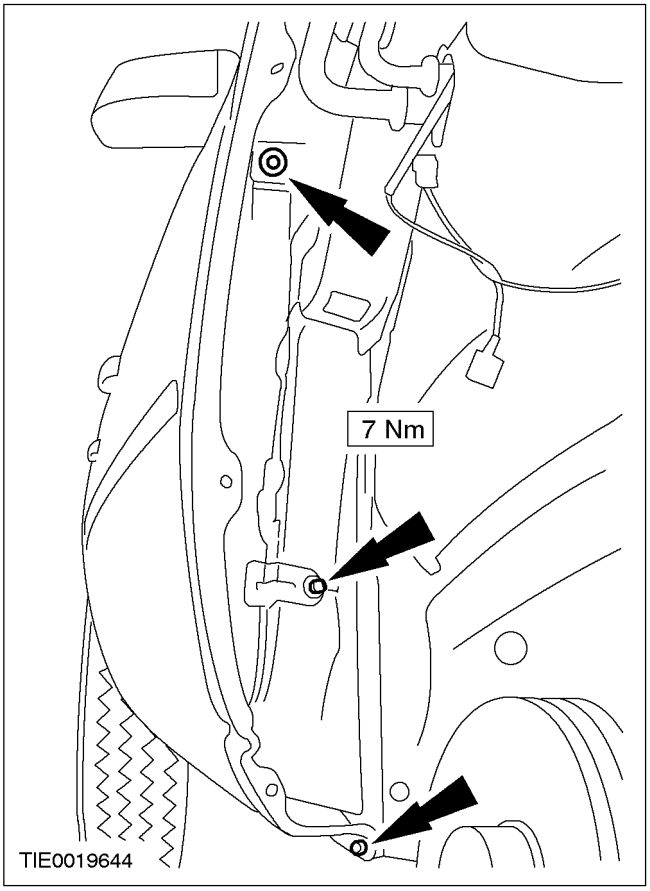


8. **Remove the fender front sound insulator.**

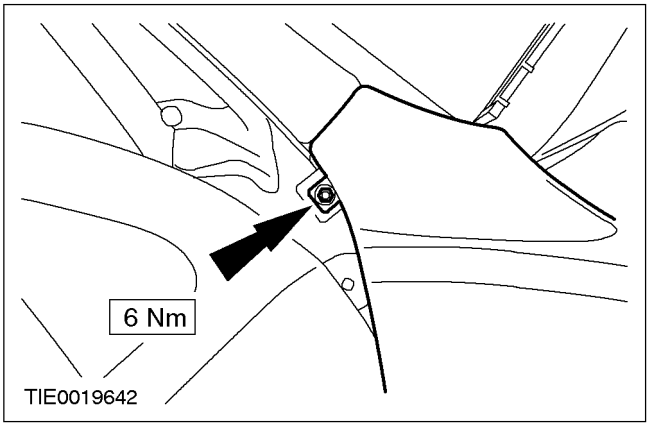


REMOVAL AND INSTALLATION (Continued)

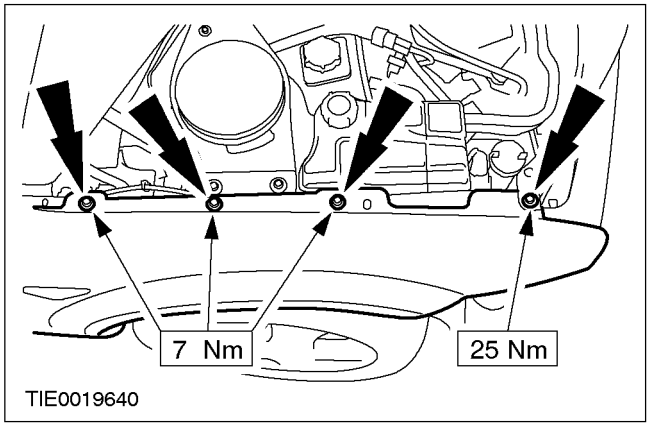
9. Remove the fender inner retaining bolts and the fender lower retaining bolt from the a-pillar.



10. Remove the fender upper retaining bolt from the a-pillar.



11. Remove the fender flange bolts and the fender grille opening panel bolt.



Installation

1. To install, reverse the removal procedure

SECTION 501-03 Body Closures

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

Specifications 501-03-2

GENERAL PROCEDURES

Luggage Compartment Lid Alignment..... 501-03-3

SPECIFICATIONS

Torque Specifications

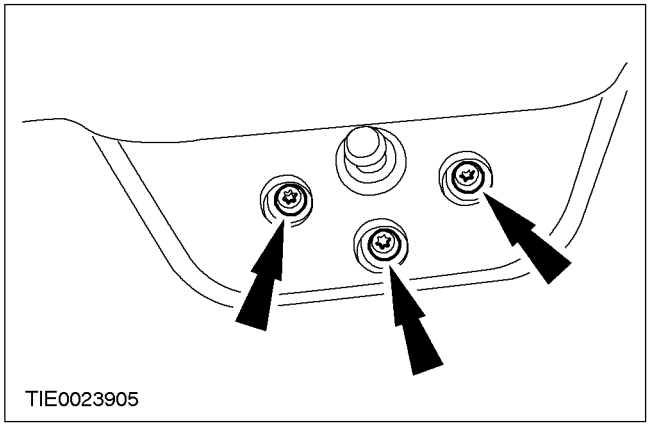
Description	Nm	lb-ft	lb-in
Door check strap to door pillar retaining bolts	23	17	–
Door check strap to door retaining bolts	6	–	53
Door striker plate retaining bolts	28	21	–
Door hinge retaining bolts	35	26	–
Luggage compartment hinge retaining bolts	23	17	–
Liftgate hinge retaining bolts	11	8	–

GENERAL PROCEDURES

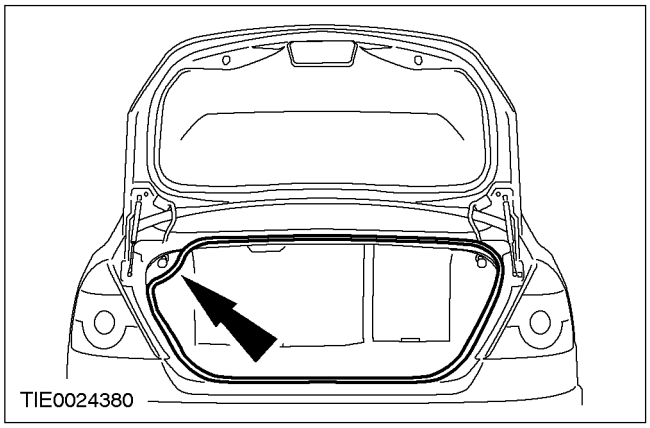
Luggage Compartment Lid Alignment

General Equipment
4 mm Margin Blades

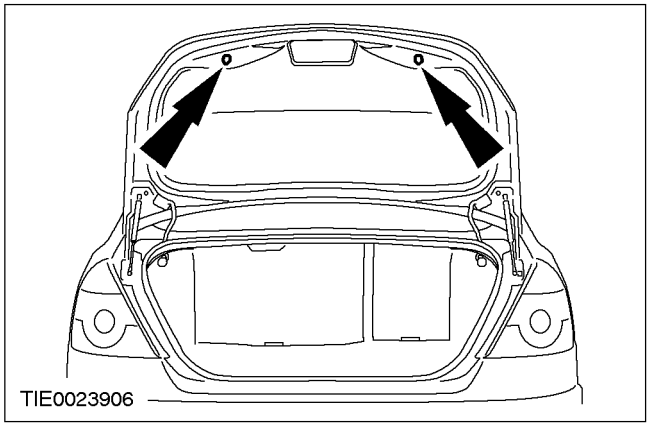
1. Loosen the luggage compartment lid striker plate retaining bolts.



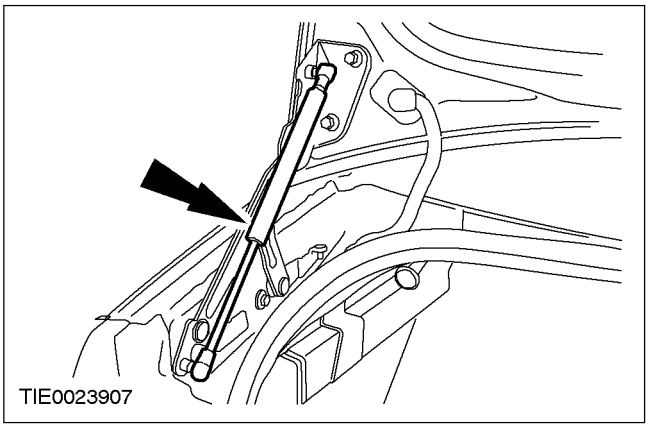
2. Remove the luggage compartment lid opening weatherstrip.



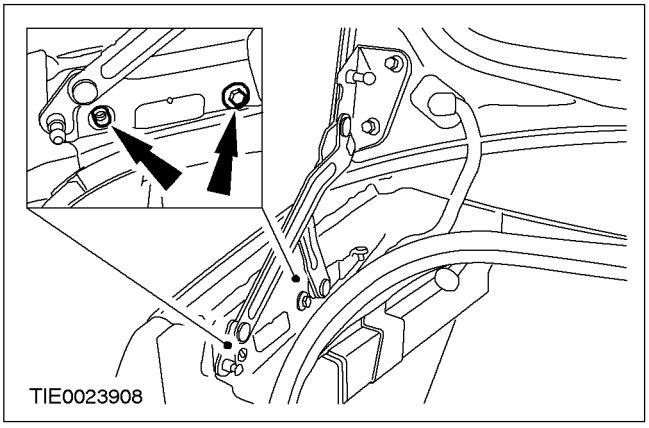
3. Remove the luggage compartment lid bump stops.



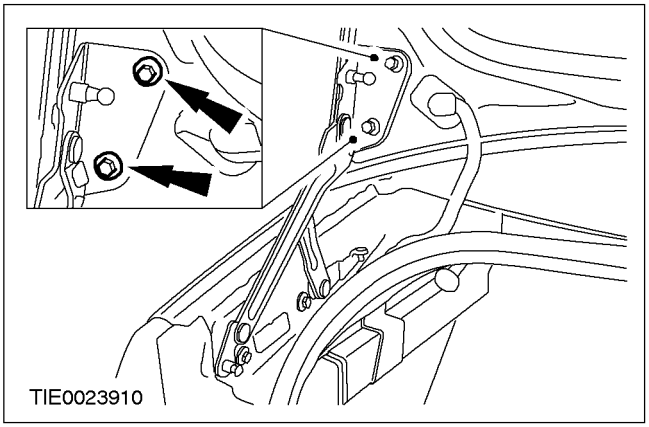
4. Remove the luggage compartment lid support struts.



5. Adjust the luggage compartment lid hinge to align the luggage compartment lid hinge to body retaining bolts centrally in the hinge holes.



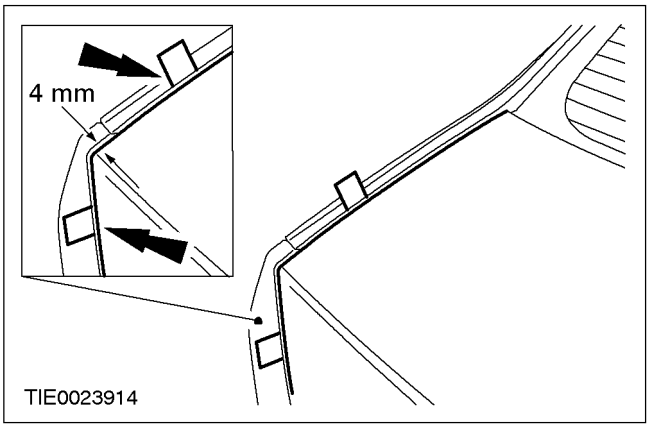
6. Loosen the luggage compartment lid to hinge retaining bolts.



GENERAL PROCEDURES (Continued)

7. **NOTE:** Make sure the luggage compartment lid is in the fully closed position.

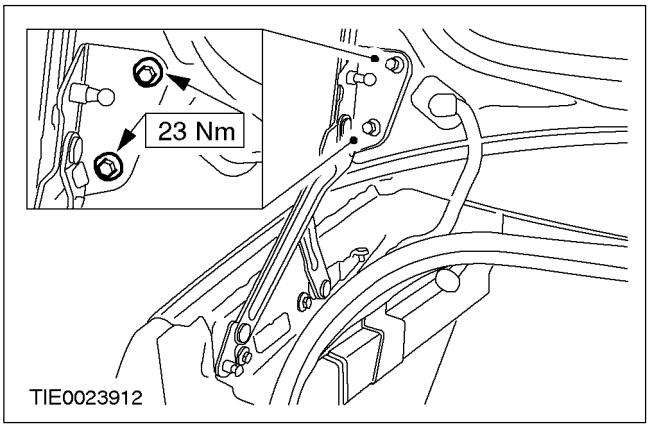
   Align the luggage compartment lid by inserting 4 mm margin blades between the outer edges of the luggage compartment lid and the rear quarter panels.



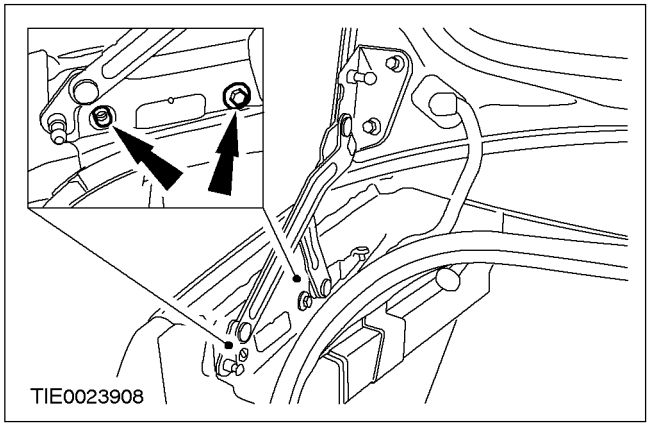
8. **Remove the 4 mm margin blades.**

9. **CAUTION: While opening the luggage compartment lid, make sure it does not move on the hinges.**

   Open the luggage compartment lid and tighten the luggage compartment lid to hinge retaining bolts.

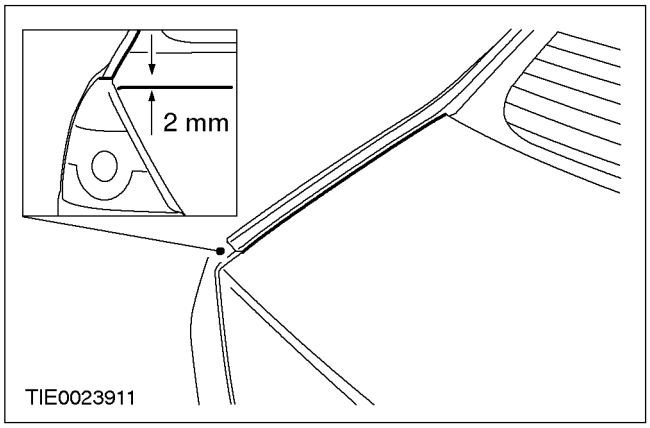


10. **Loosen the luggage compartment lid hinge to body retaining bolts.**



11. **NOTE:** Make sure the luggage compartment lid is in the fully closed position.

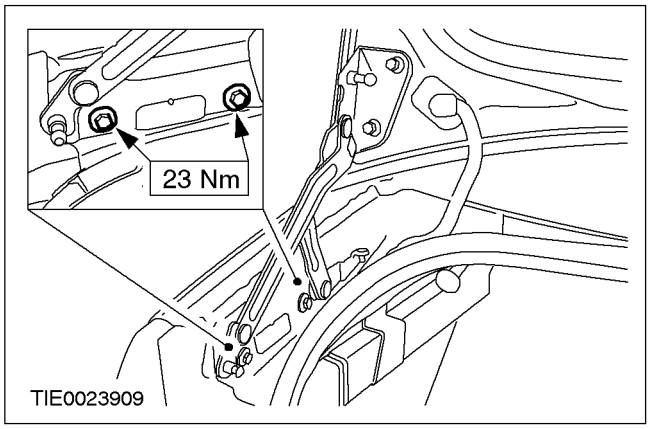
    Push the luggage compartment lid in the hinge area until it aligns 2 mm below flush with the rear quarter panel.



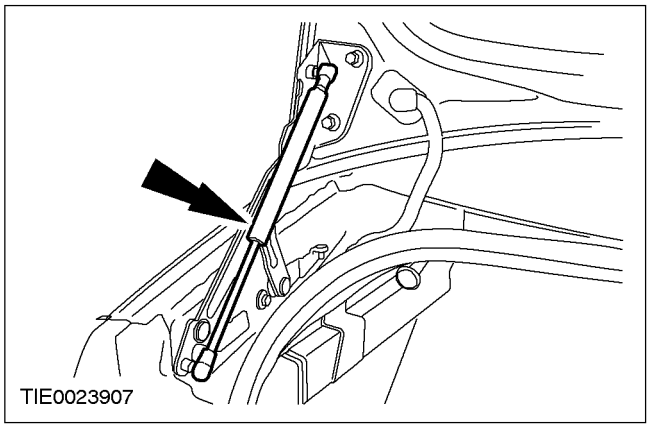
GENERAL PROCEDURES (Continued)

12. **CAUTION: While opening the luggage compartment lid, make sure the luggage compartment lid hinge does not move.**

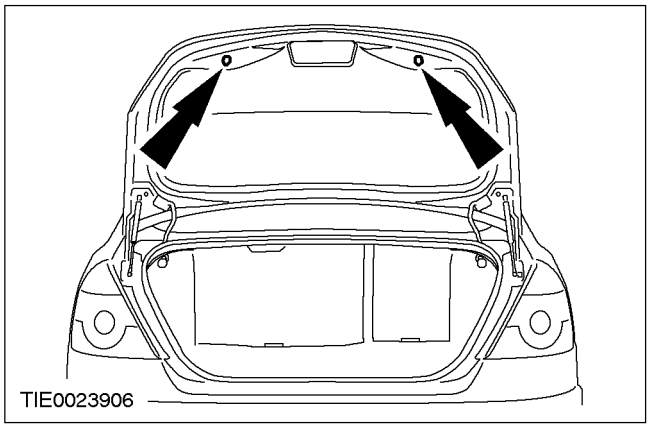
    Open the luggage compartment lid and tighten the luggage compartment lid hinge to body retaining bolts.



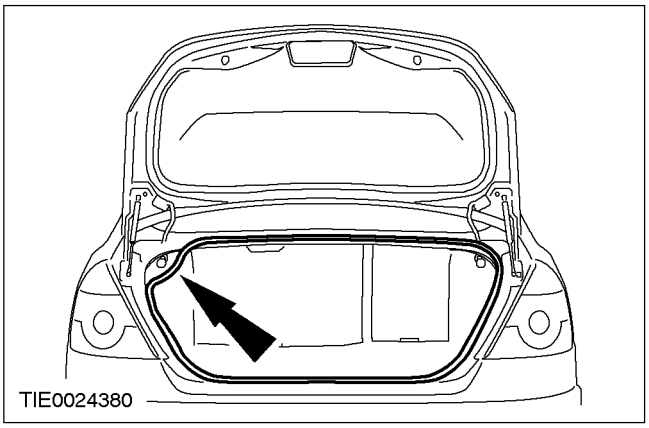
13. **Install the luggage compartment lid support struts.**



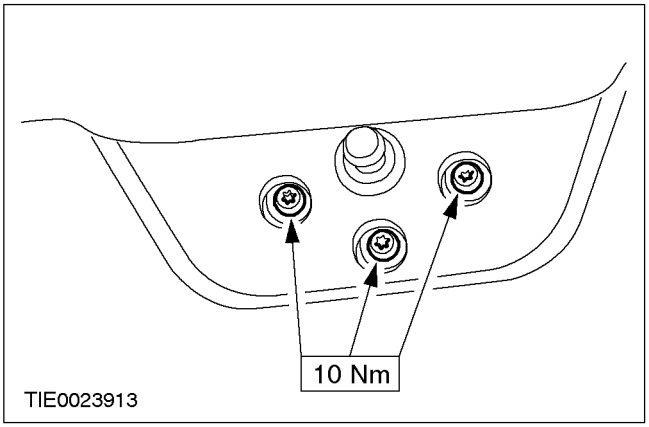
14. **Install the luggage compartment lid bump stops.**



15. **Install the luggage compartment lid opening weatherstrip.**



16. **Fully close the luggage compartment.**
17. **Open the luggage compartment lid and tighten the luggage compartment lid striker plate retining bolts.**



18. **NOTE:** Make sure the luggage compartment lid is in the fully closed position.

    Check the alignemnt of the luggage compartment lid.

SECTION 501-05 Interior Trim and Ornamentation

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

SPECIFICATIONS

Specifications 501-05-2

REMOVAL AND INSTALLATION

A-Pillar Trim Panel	(43 616 0)	501-05-3
Headliner — Vehicles Without: Diversity Antenna	(43 612 0)	501-05-4
Headliner — Vehicles With: Diversity Antenna	(43 612 0)	501-05-12
Front Door Trim Panel	(43 705 0)	501-05-23
Rear Door Trim Panel	(43 706 0)	501-05-25

SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Safety belt upper anchor retaining bolt	38	28	-

REMOVAL AND INSTALLATION

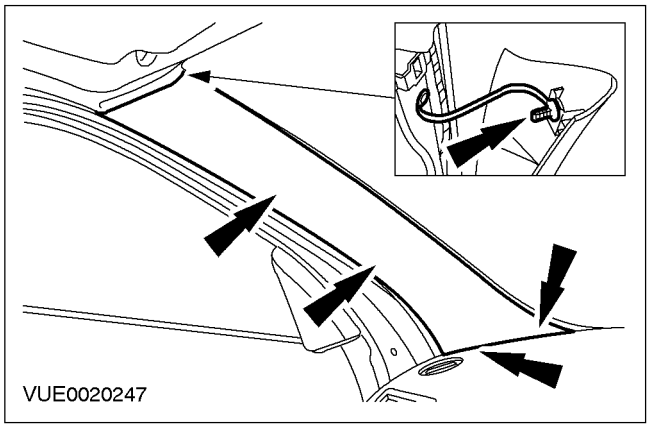
A-Pillar Trim Panel (43 616 0)

Removal

Vehicles with side air curtains

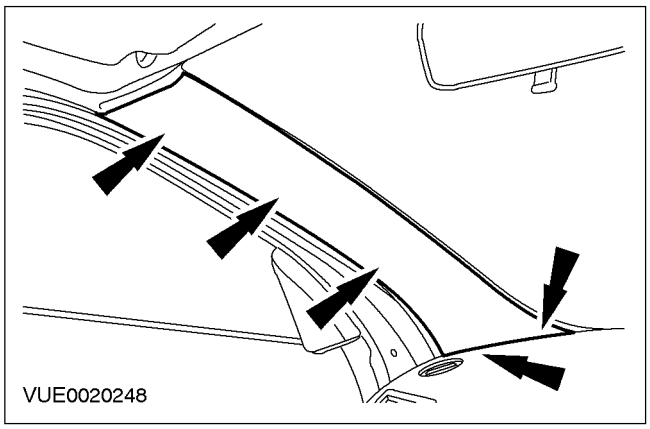
1. **NOTE:** The A-pillar trim panel is secured to the top of the A-pillar by a retaining strap. The retaining strap must be detached from the A-pillar before the A-pillar trim panel is removed.

   Remove the A-pillar trim panel.



Vehicles without side air curtains

2. **Remove the A-pillar trim panel.**



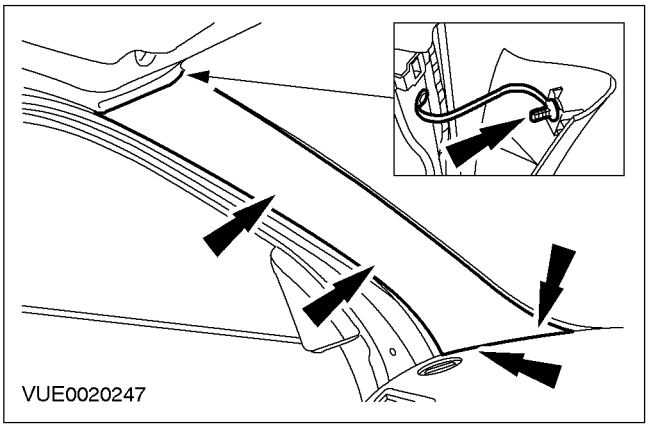
Installation

Vehicles with side air curtains

1. **Inspect the A-pillar trim panel and retaining strap. If the A-pillar trim panel or retaining strap are damaged or broken install new parts as necessary.**

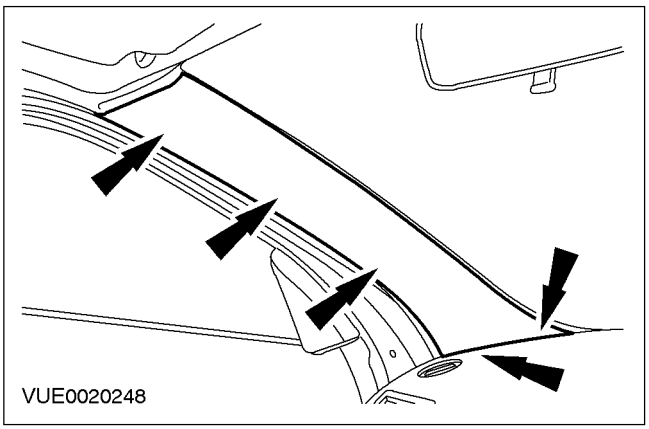
2. **WARNING: Make sure the A-pillar trim panel retaining strap is correctly attached to the A-pillar trim panel. Failure to follow this instruction may result in personal injury.**

   Install the A-pillar trim panel.



Vehicles without side air curtains

3. **Install the A-pillar trim panel.**



REMOVAL AND INSTALLATION

Headliner — Vehicles Without: Diversity Antenna (43 612 0)

General Equipment
Draw cord with a minimum length of one meter

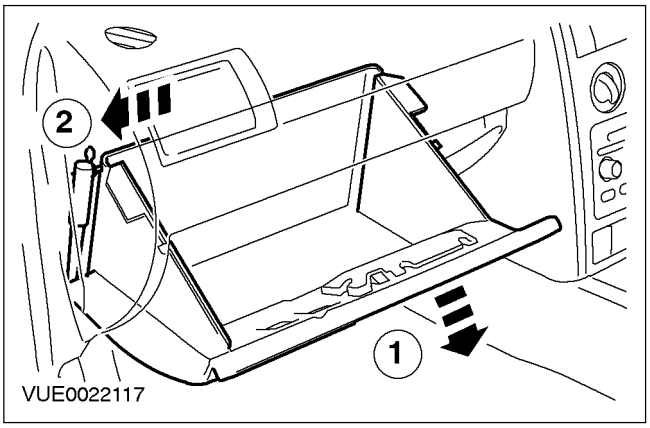
Removal

All vehicles

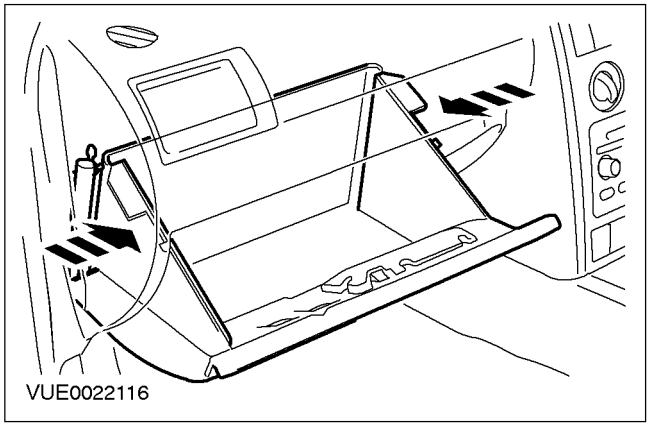
1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Remove the A-pillar trim panels.** **For additional information, refer to A-Pillar Trim Panel in this section.**

Right-hand drive vehicles

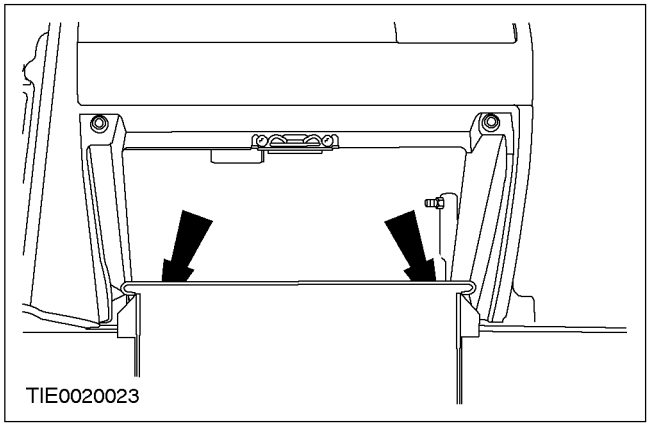
3. **Detach the damper from the glove compartment.**
   1. Open the glove compartment to access the damper.
   2. Push the top of the damper away from the glove compartment.



4. **Fully open the glove compartment.**
   - Press the sides of the glove compartment towards the center to release the glove compartment stops.



5. **Remove the glove compartment.**
   - Detach the hinges.

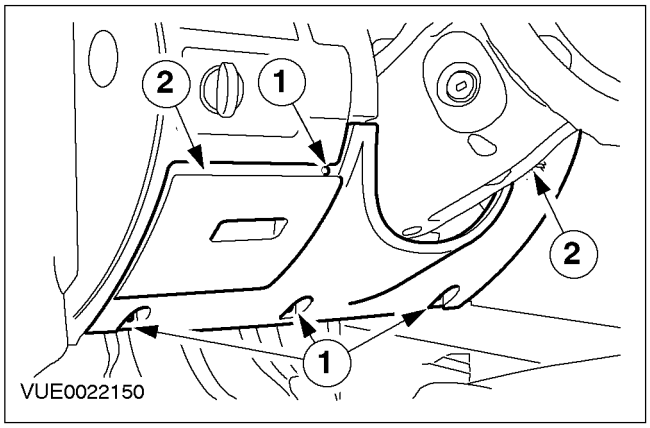


REMOVAL AND INSTALLATION (Continued)

Left-hand drive vehicles

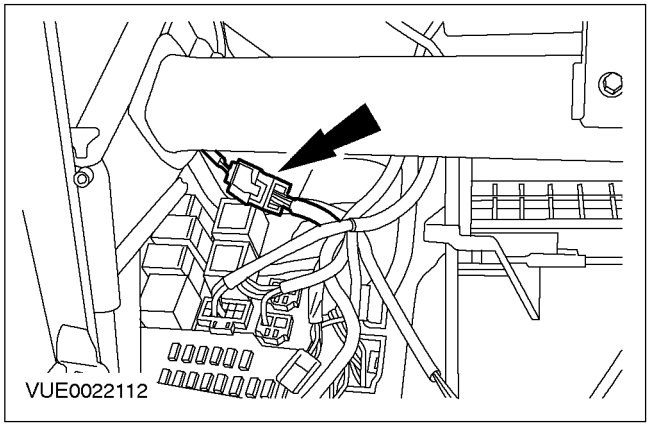
6. Remove the instrument panel lower panel.

1. Remove the instrument panel lower panel retaining screws.
2. Release the instrument panel lower panel retaining clips.

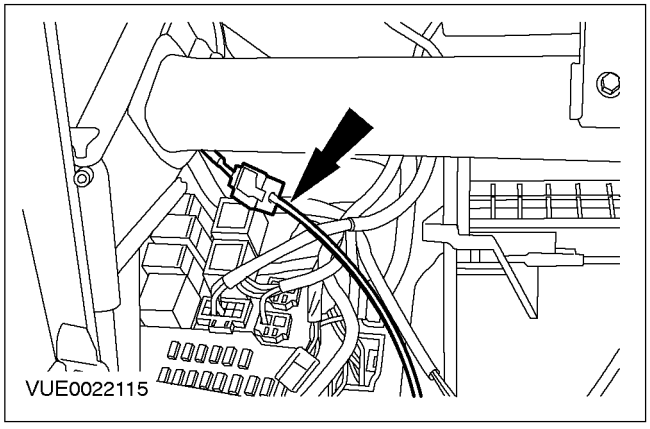


All vehicles

7. Detach the interior lighting wiring harness from the central junction box (CJB) and disconnect the electrical connector.

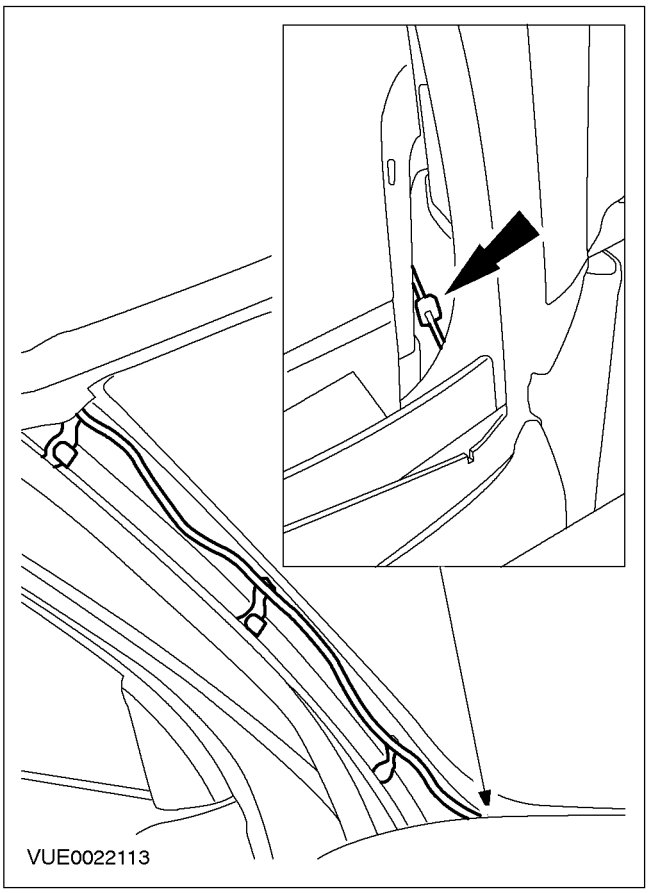


8. Attach a suitable draw cord to the interior lighting wiring harness electrical connector.

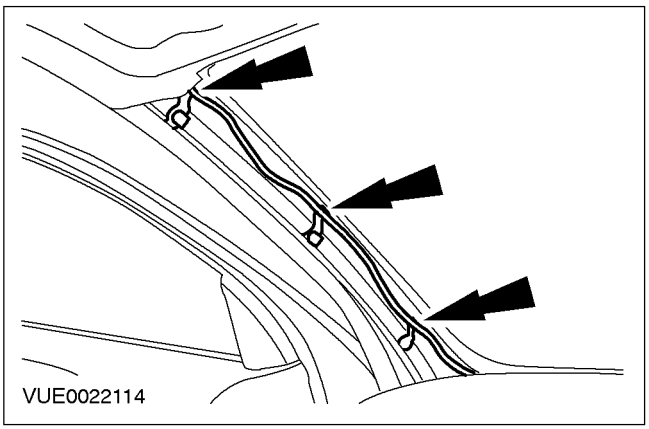


9. NOTE: The lower fixing is located below the instrument panel and can only be viewed from outside the vehicle.

Detach the interior lighting wiring harness from the A-pillar.



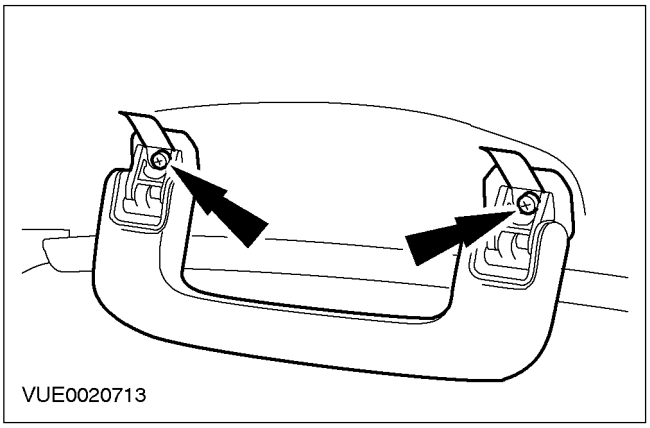
10. Detach the interior lighting wiring harness from the A-pillar.



11. Pull the interior lighting wiring harness through the instrument panel to expose the electrical connector and the attached wire.

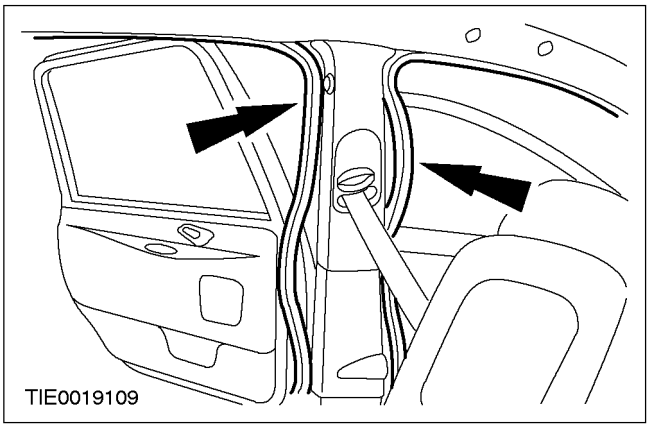
REMOVAL AND INSTALLATION (Continued)

12. Remove the passenger assist handles.



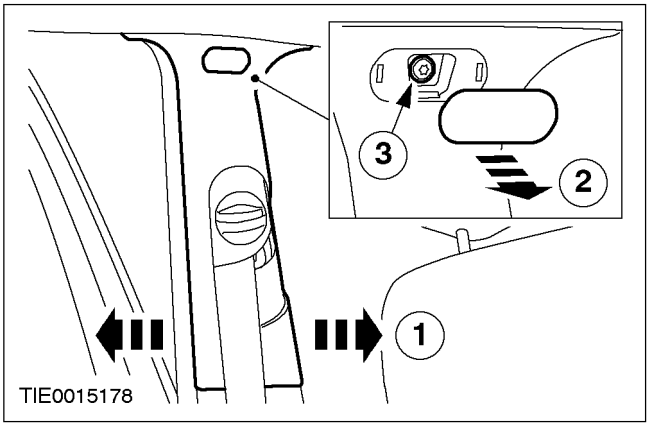
13. Move the front safety belt shoulder height adjuster to its lowest position.

14. Detach the door opening weatherstrips from the B-pillars.

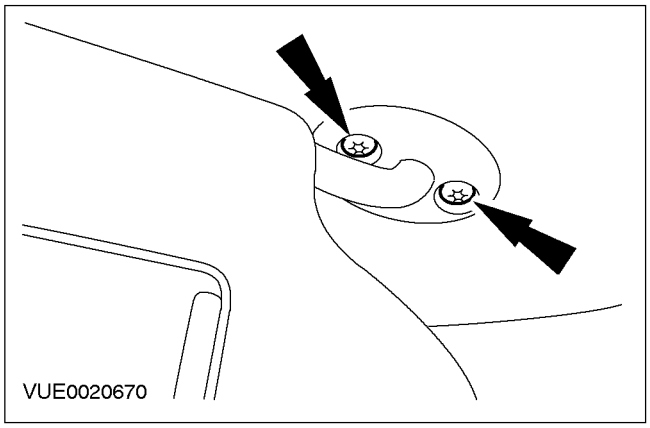


15. Detach the B-pillar upper trim panels from the B-pillars and position them to one side.

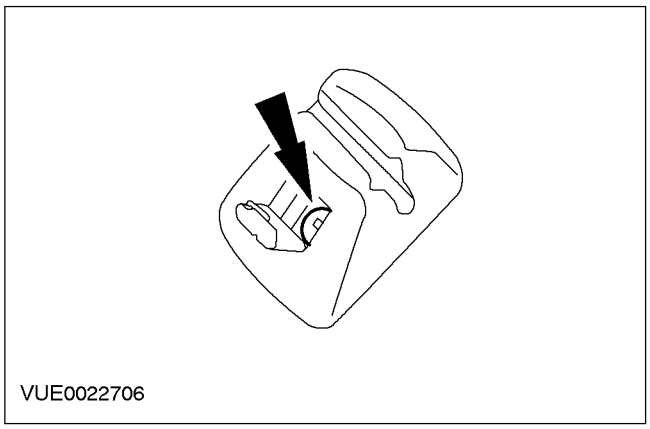
1. Detach the locating tangs from the B-pillar lower trim panel.
2. Remove the screw cover.
3. Remove the retaining screw.



16. Remove the sun visors.

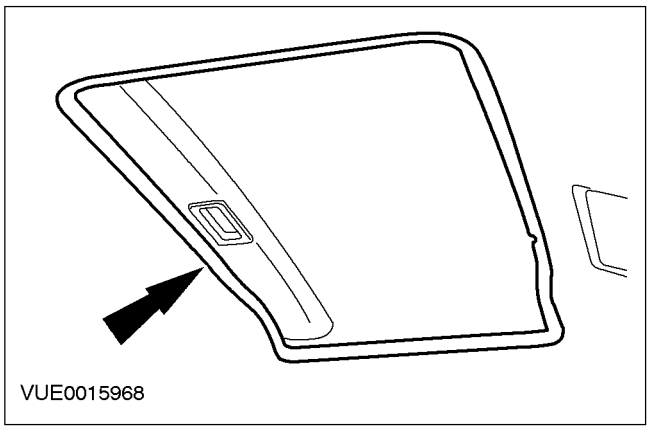


17. Remove the sun visor retaining clips.



Vehicles with power roof opening panel

18. Remove the roof opening panel weatherstrip.



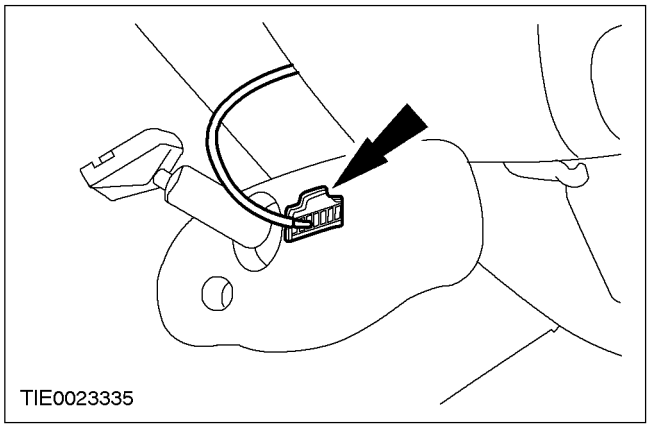
All vehicles

19. Remove the overhead console. For additional information, refer to Section 501-12.

REMOVAL AND INSTALLATION (Continued)

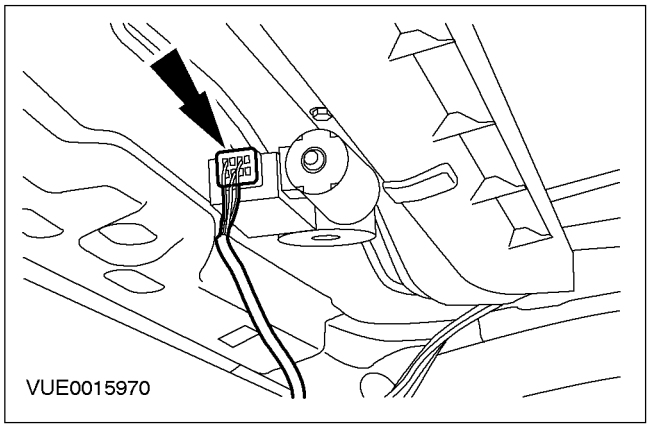
Vehicles with auto-dimming interior mirror

20. Disconnect the interior mirror electrical connector (if equipped).



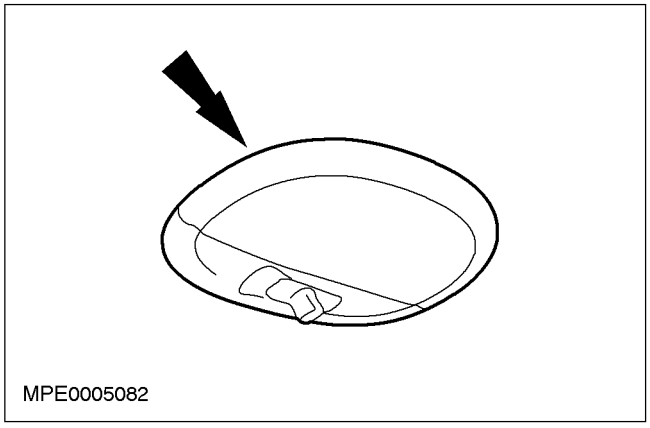
Vehicles with power roof opening panel

21. Partially lower the headliner and disconnect the roof opening panel motor electrical connector (headliner shown removed for clarity).

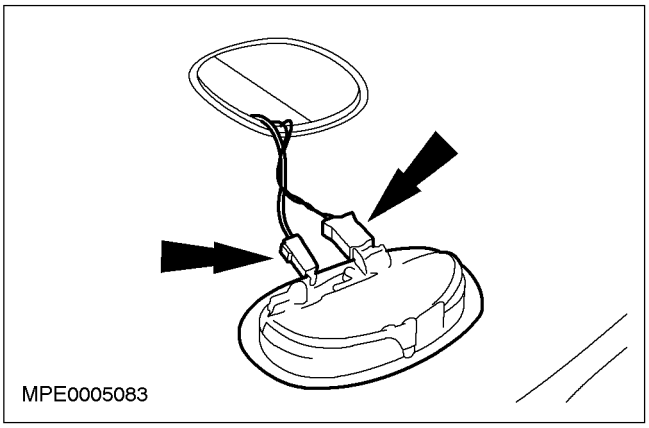


All vehicles

22. Detach the rear interior lamp (if equipped).



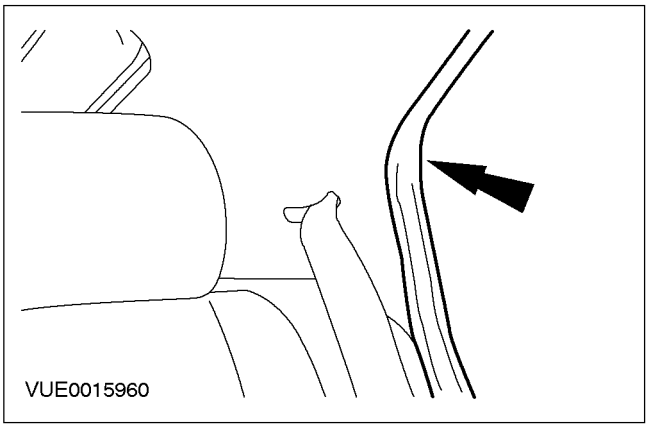
23. Disconnect the electrical connectors and remove the rear interior lamp (if equipped).



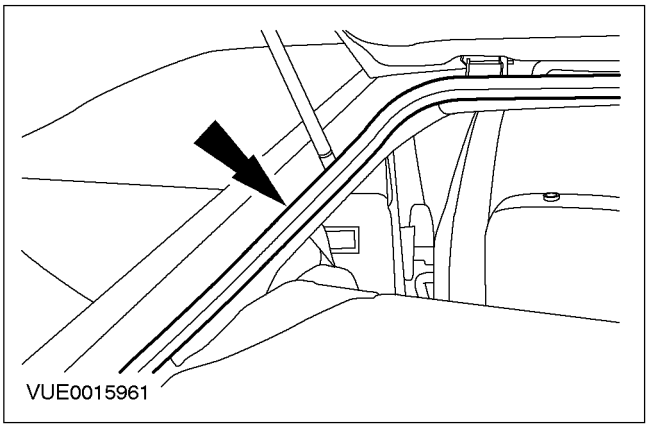
24. Pull down on the rear interior lamp opening to detach the headliner spacer glue fixing from the roof panel.

5-door

25. Detach the rear door opening weatherstrips from the C-pillars.



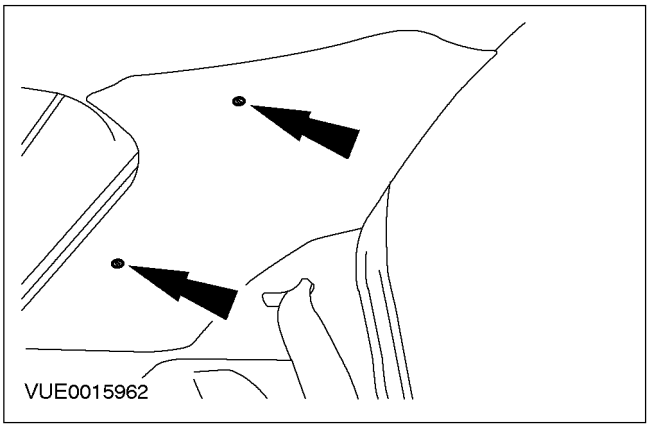
26. Detach the liftgate opening weatherstrip from the C-pillars.



REMOVAL AND INSTALLATION (Continued)

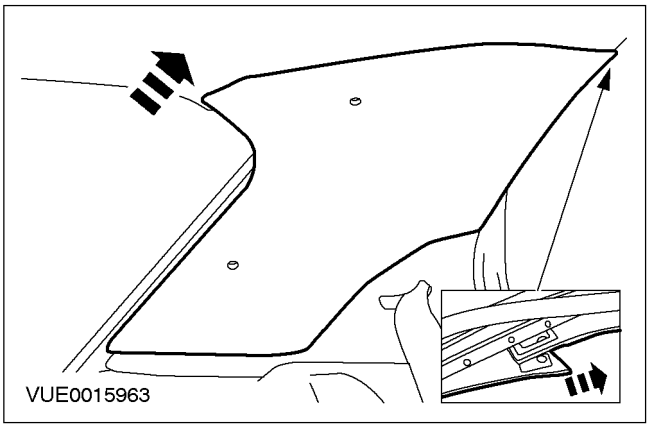
27. Remove the C-pillar upper trim panel retaining screws.

- Remove the blanking plugs and retaining screws.



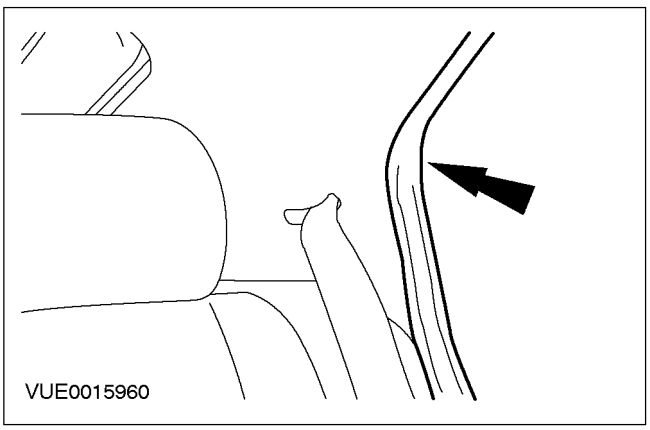
28. Remove the C-pillar upper trim panels.

- Detach the retaining clips.



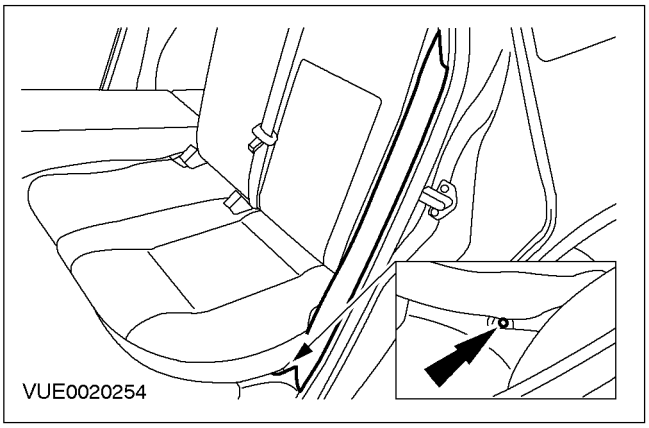
4-door

29. Detach the rear door opening weatherstrips from the C-pillars.



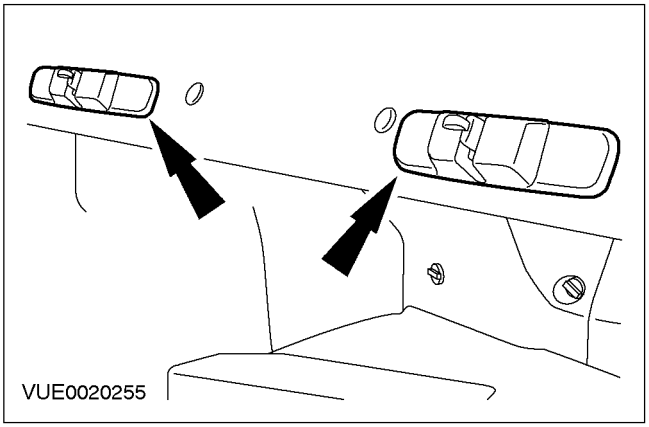
30. Remove the C-pillar lower trim panels (vehicle with trim panel shown, vehicles with seat bolster similar).

- Remove the C-pillar lower trim panel retaining screw.

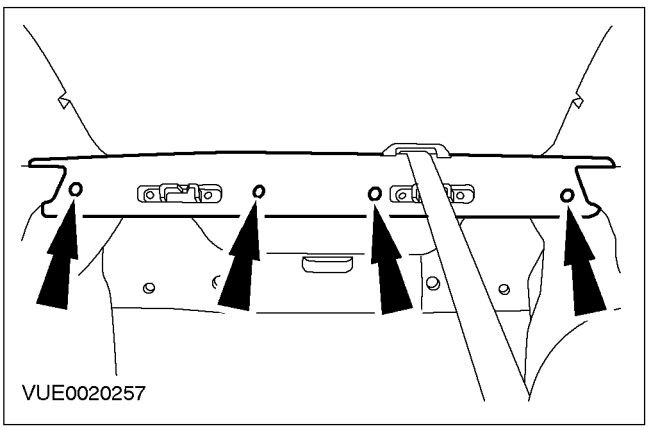


31. Fold down the rear seat backrests.

32. Remove the rear seat backrest latch covers.

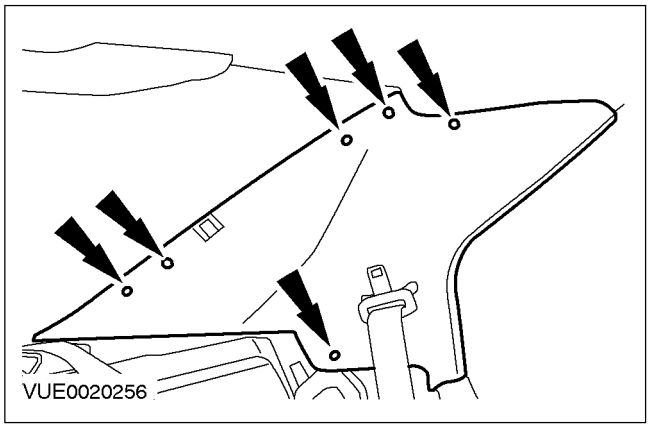


33. Detach the parcel shelf trim panel.

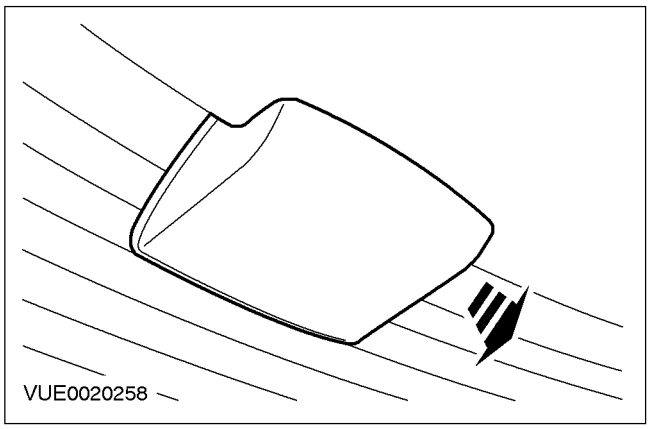


REMOVAL AND INSTALLATION (Continued)

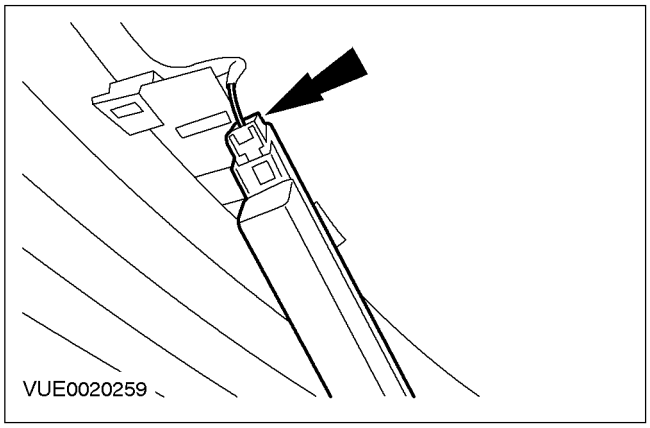
34. **Detach the C-pillar upper trim panels from the C-pillars and position them to one side.**



35. **Remove the high mounted stoplamp cover.**

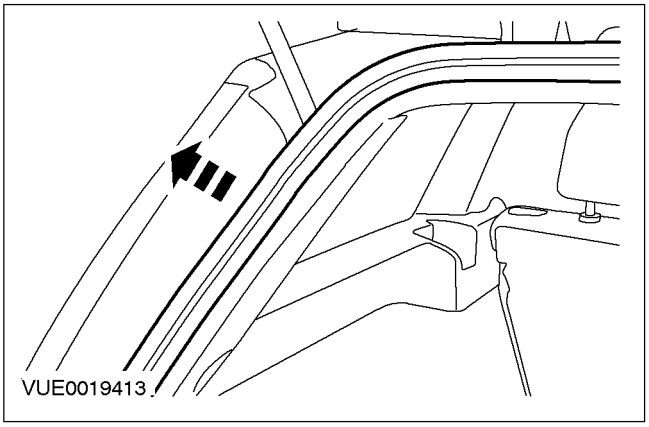


36. **Disconnect the high mounted stoplamp electrical connector and remove the high mounted stoplamp.**

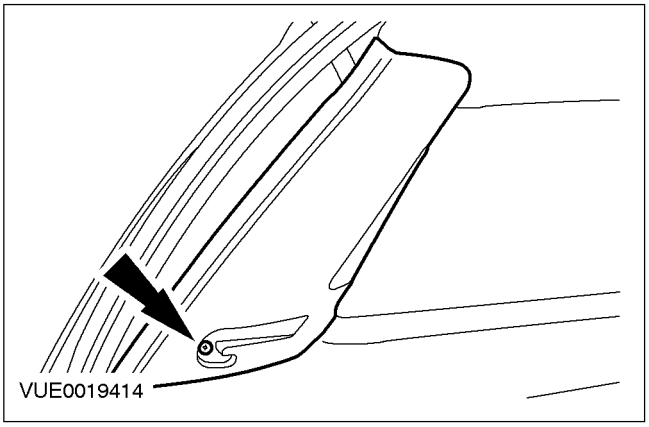


Wagon

37. **Detach the liftgate opening weatherstrip.**



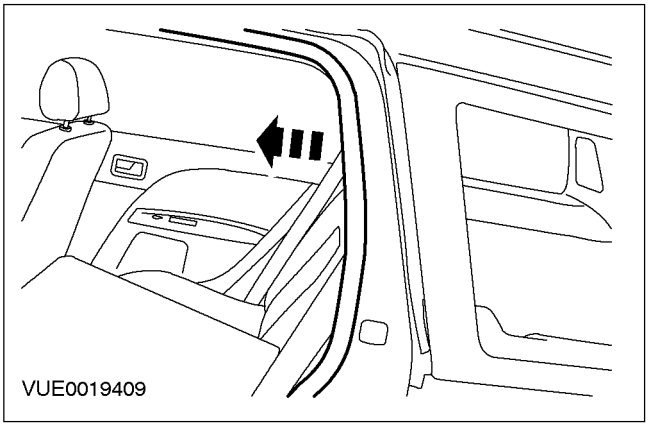
38. **Remove the D-pillar trim retaining screws.**



39. **⚠ CAUTION: Disconnect the rear window washer tube from the right-hand D-pillar trim panel.**

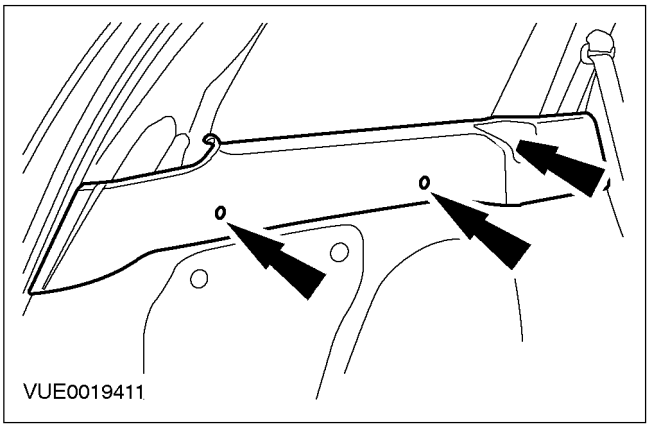
    Detach the D-pillar trim panel retaining clips and remove the D-pillar trim panels.

40. **Detach the rear door opening weather-strip.**

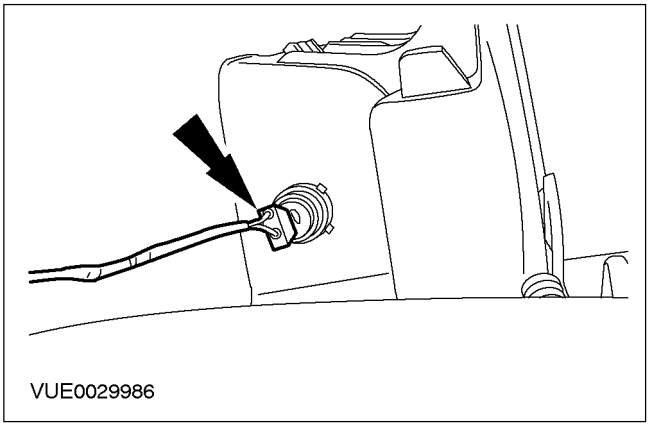


REMOVAL AND INSTALLATION (Continued)

41. Remove the load space upper trim panel retaining screws and remove the load space upper trim panels.



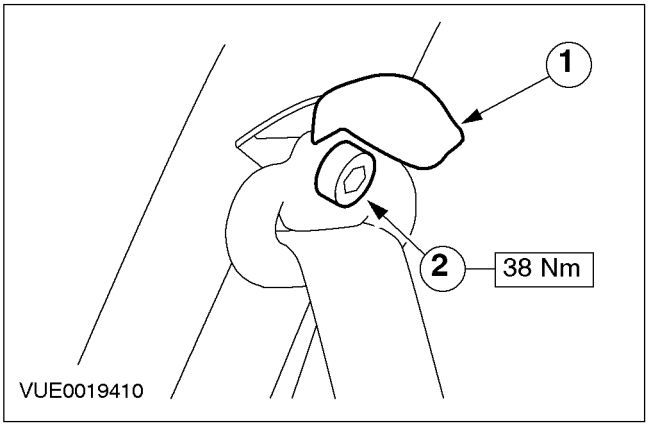
42. Disconnect the power outlet electrical connector on the right-hand load space upper trim panel (if equipped).



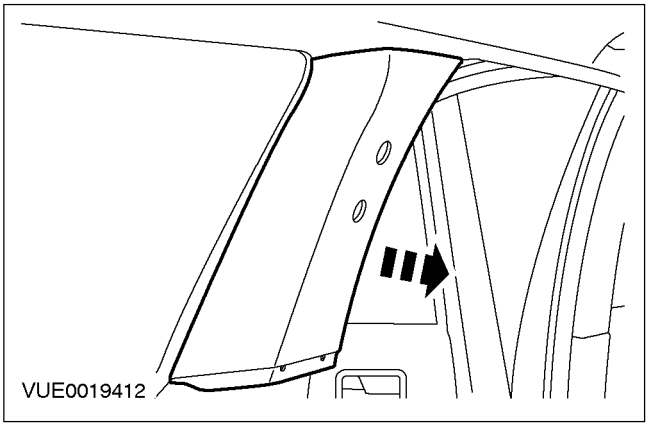
43. CAUTION: The bolt securing the safety belt anchor is held captive by a paper washer. The bolt, spacer and paper washer must remain on the safety belt anchor at all times when the safety belt is detached or removed.

Detach the safety belt upper anchors.

1. Detach the trim panel.
2. Detach the safety belt upper anchors.



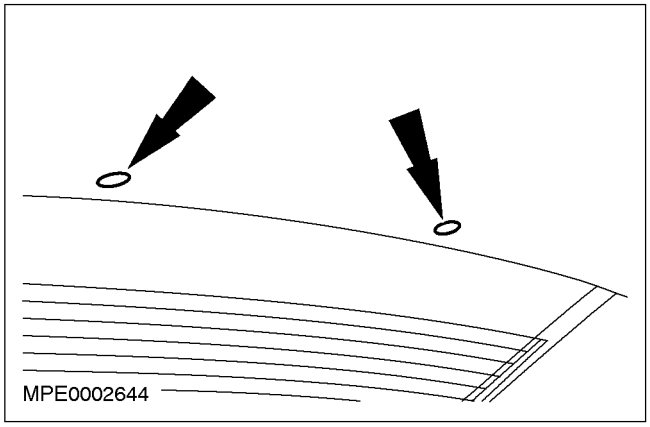
44. Remove the C-pillar trim panel.



REMOVAL AND INSTALLATION (Continued)

5-door and wagon

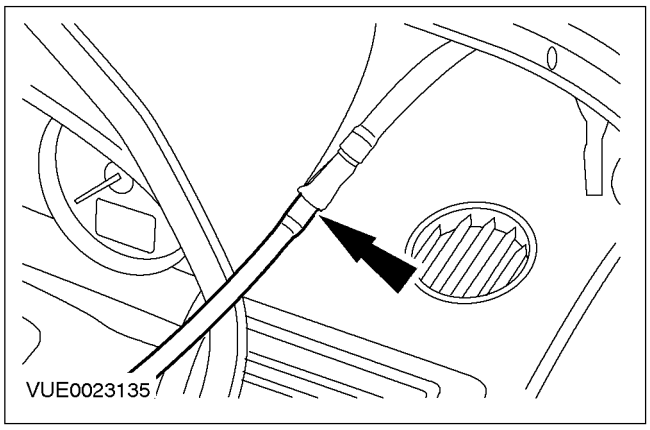
45. Remove the headliner retaining clips.



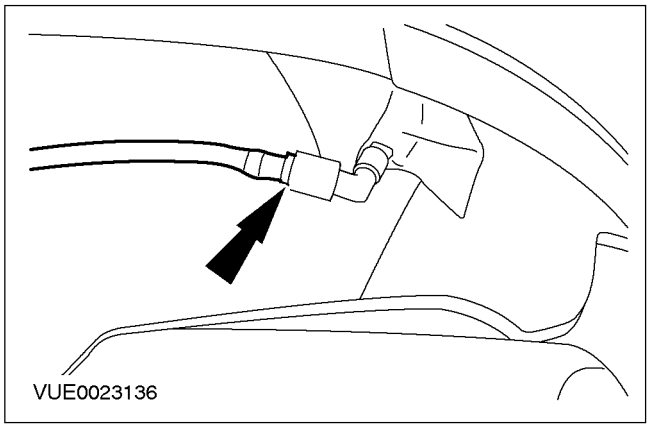
All vehicles

46. Detach the draw cord from the interior lighting wiring harness electrical connector.

47. Disconnect the rear window washer tube from the right-hand A-pillar.

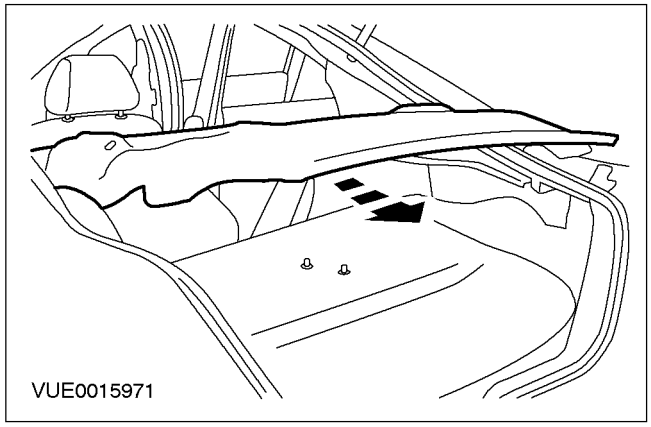


48. Disconnect the rear window washer tube from the rear right-hand side of the headliner.



5-door and wagon

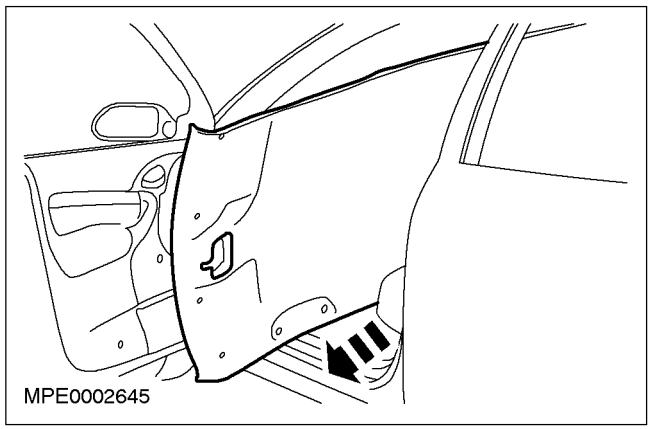
49. Remove the headliner (5-door shown).



4-door

50. Recline the front seat backrests to allow removal of the headliner through the passenger door opening.

51. Remove the headliner.



Installation

NOTE: Make sure the front safety belt shoulder height adjuster locking control is correctly located on the safety belt shoulder height adjuster.

1. To install, reverse the removal procedure.

2. Initialize the door window motors. For additional information, refer to Section 501-11.

REMOVAL AND INSTALLATION

Headliner — Vehicles With: Diversity Antenna (43 612 0)

General Equipment
Draw cord with a minimum length of one meter
Audio unit removal tools

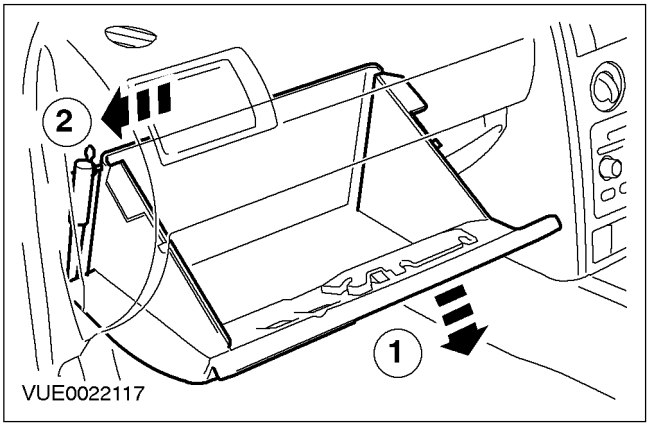
Removal

All vehicles

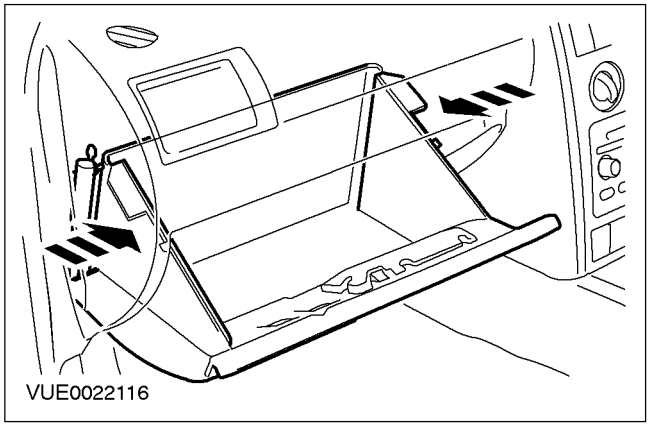
1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Remove the A-pillar trim panels.** **For additional information, refer to A-Pillar Trim Panel in this section.**

Right-hand drive vehicles

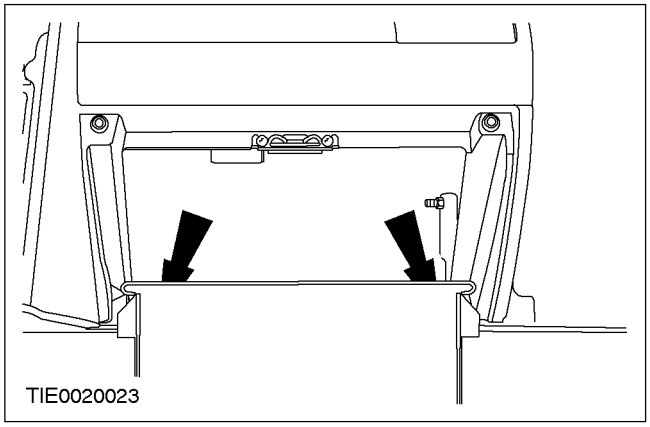
3. **Detach the damper from the glove compartment.**
   1. Open the glove compartment to access the damper.
   2. Push the top of the damper away from the glove compartment.



4. **Fully open the glove compartment.**
   - Press the sides of the glove compartment towards the center to release the glove compartment stops.



5. **Remove the glove compartment.**
   - Detach the hinges.

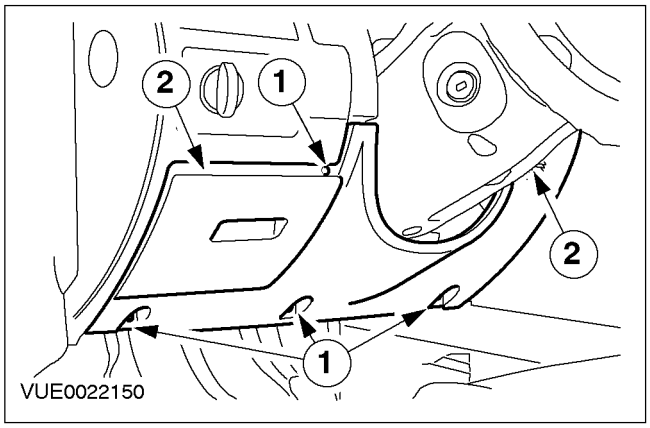


REMOVAL AND INSTALLATION (Continued)

Left-hand drive vehicles

6. Remove the instrument panel lower panel.

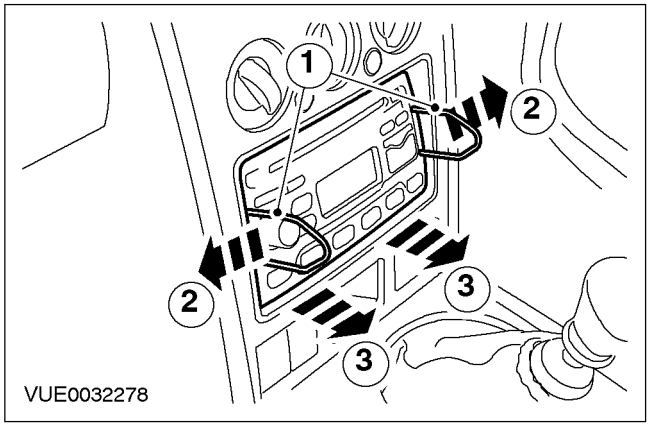
1. Remove the instrument panel lower panel retaining screws.
2. Release the instrument panel lower panel retaining clips.



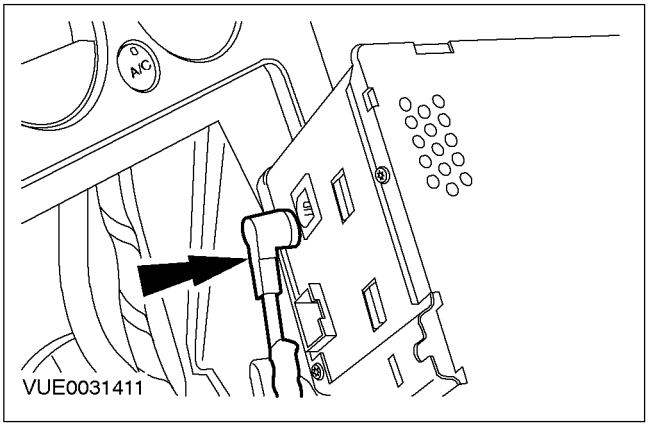
All vehicles

7. Detach the audio unit from the instrument panel.

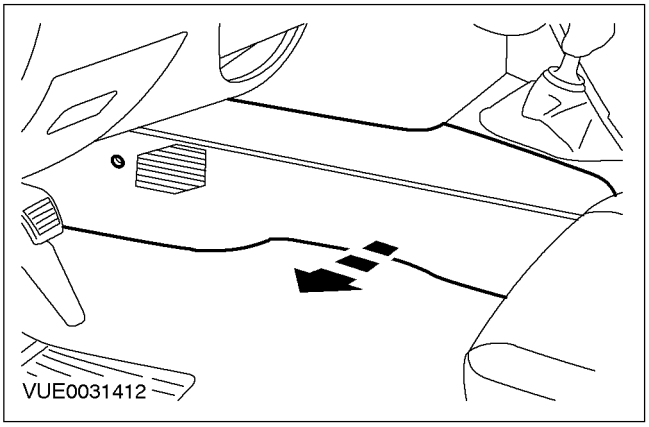
1. Insert the audio unit removal tools.
2. Pull the audio unit removal tools outwards.
3. Detach the audio unit.



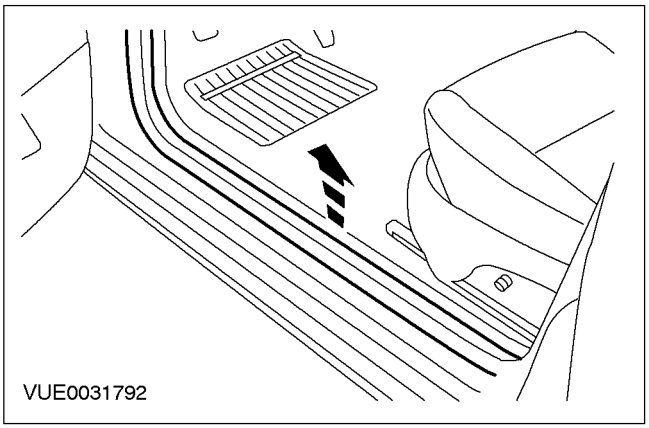
8. Disconnect the diversity antenna cable from the audio unit.



9. Remove the left-hand trim panel from the floor console.

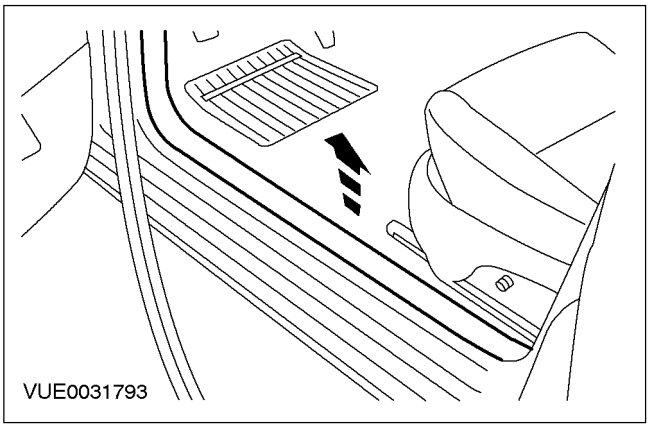


10. Detach the left-hand front door weather-strip.

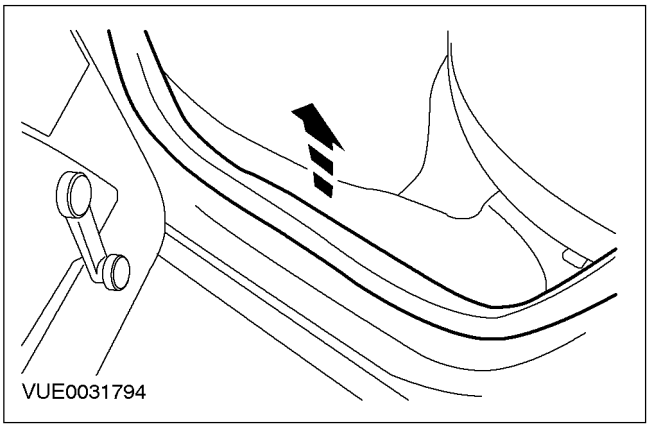


REMOVAL AND INSTALLATION (Continued)

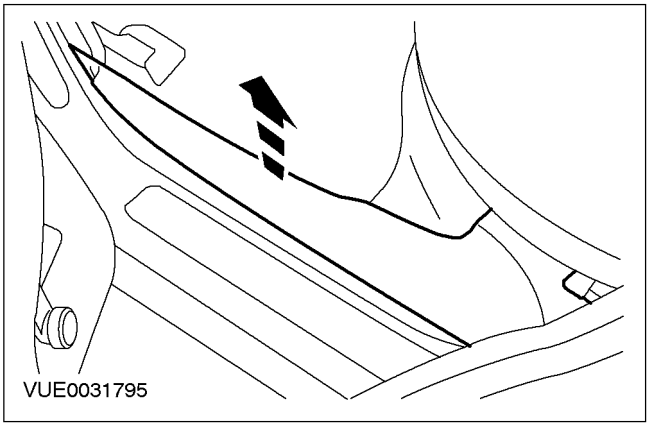
11. Detach the left-hand cowl trim.



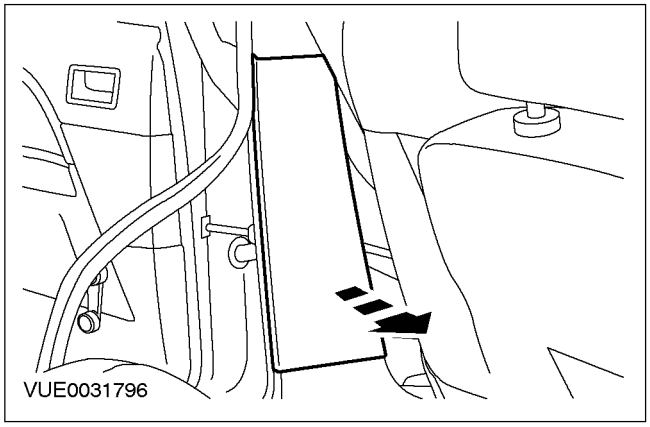
12. Detach the left-hand rear door weather-strip.



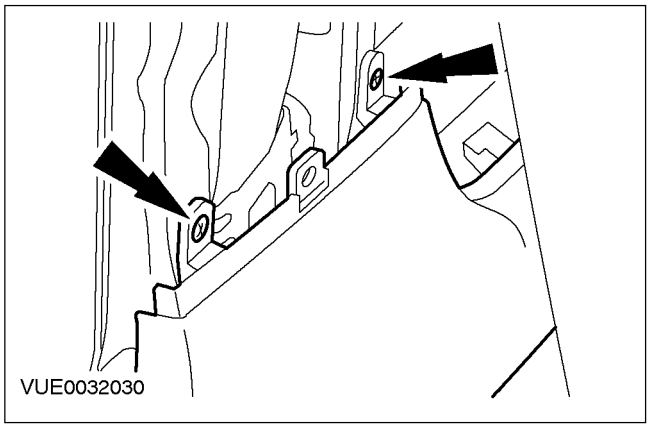
13. Detach the left-hand cowl trim.



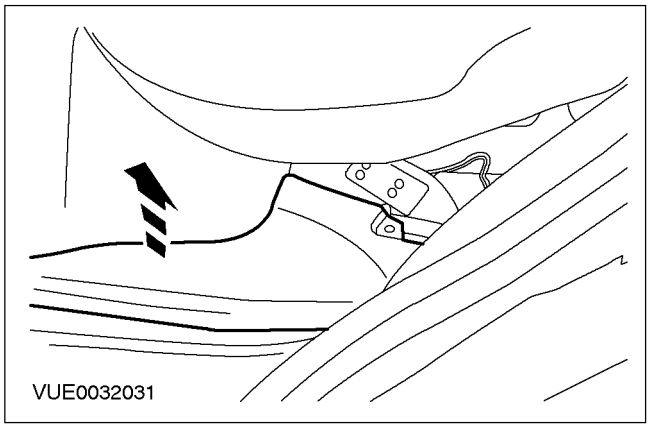
14. Detach the left-hand lower B-pillar trim panel.



15. Detach the left-hand cowl trim panel.



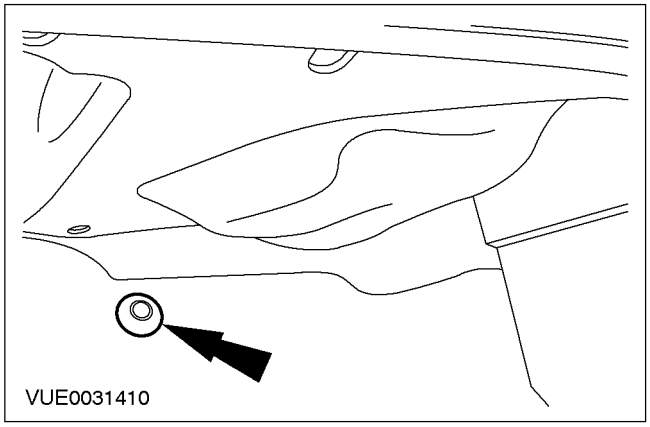
16. Lift the rear seat cushion.
17. Remove the left-hand cowl trim panel.



REMOVAL AND INSTALLATION (Continued)

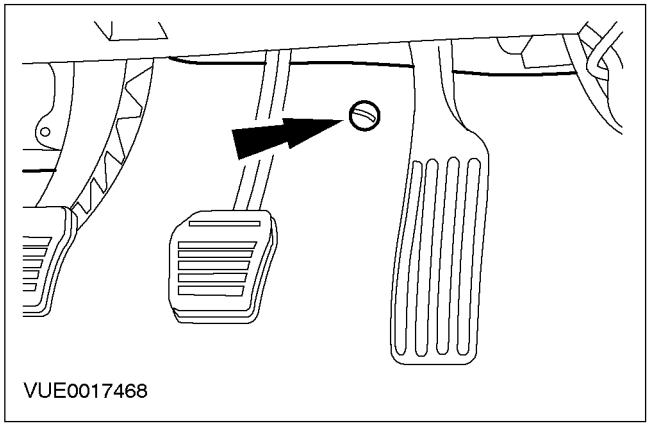
Right-hand drive vehicles

18. Detach the floor covering.



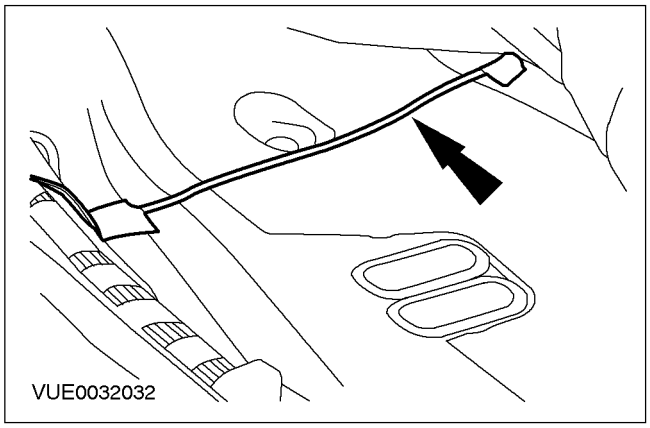
Left-hand drive vehicles

19. Detach the floor covering.



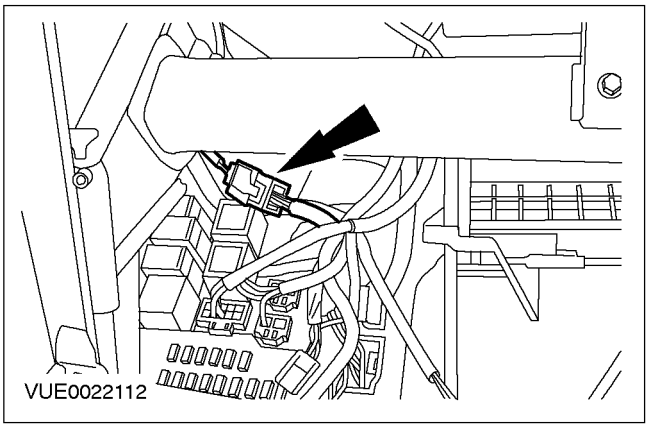
All vehicles

20. Detach the diversity antenna cable from the floor.

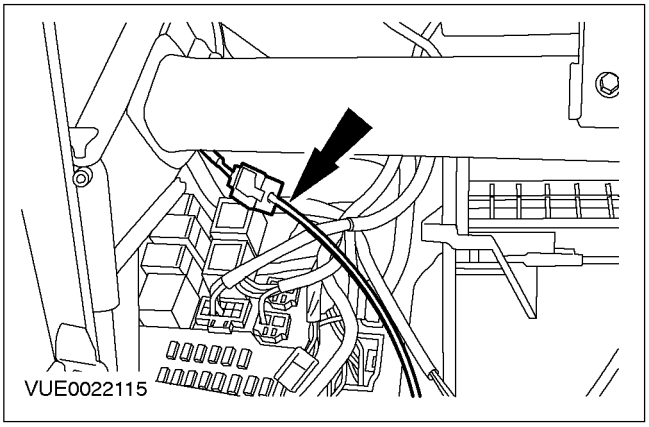


21. Detach the central junction box (CJB) and position to one side.

22. Detach the interior lighting wiring harness from the CJB and disconnect the electrical connector.



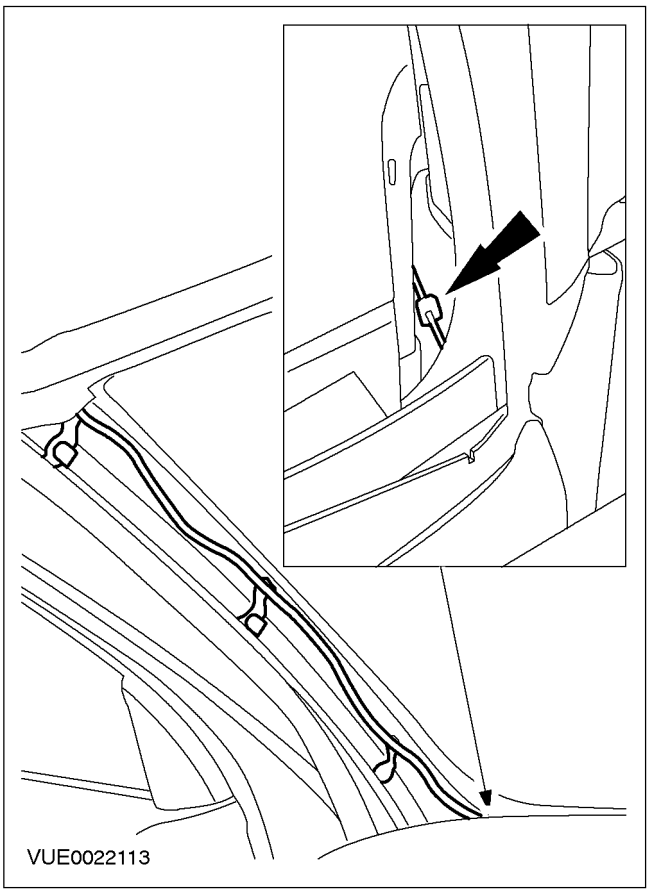
23. Attach a suitable draw cord to the interior lighting wiring harness electrical connector.



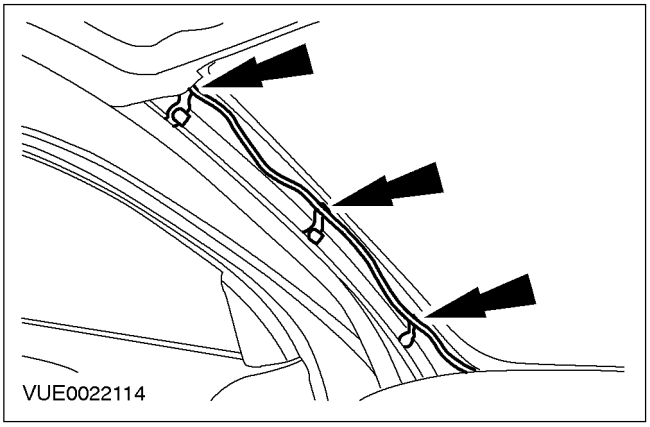
REMOVAL AND INSTALLATION (Continued)

24. **NOTE:** The lower fixing is located below the instrument panel and can only be viewed from outside the vehicle.

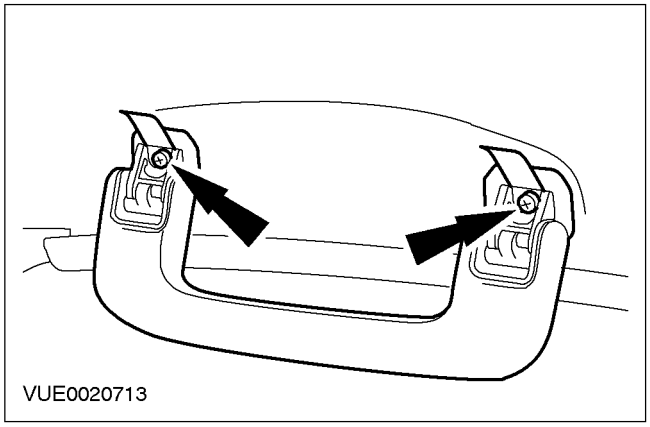
    Detach the interior lighting wiring harness from the A-pillar.



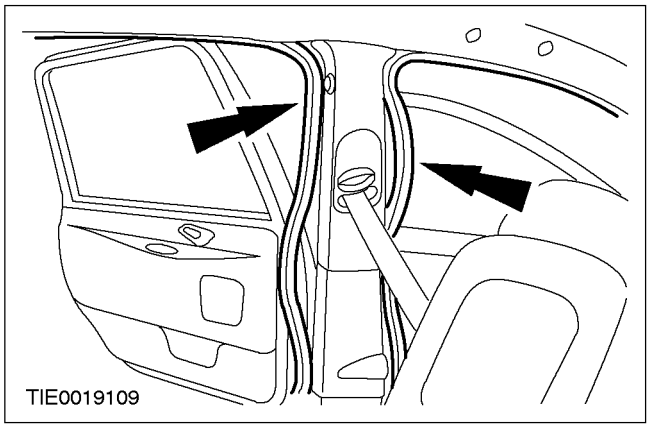
25. **Detach the interior lighting wiring harness and diversity antenna cable from the A-pillar.**



26. **Pull the interior lighting wiring harness through the instrument panel to expose the electrical connector and the attached wire.**
27. **Attach a suitable draw cord to the diversity antenna cable.**
28. **Pull the diversity antenna cable up the A-pillar to expose the suitable draw cord.**
29. **Detach the draw cord from the diversity antenna cable.**
30. **Remove the passenger assist handles.**



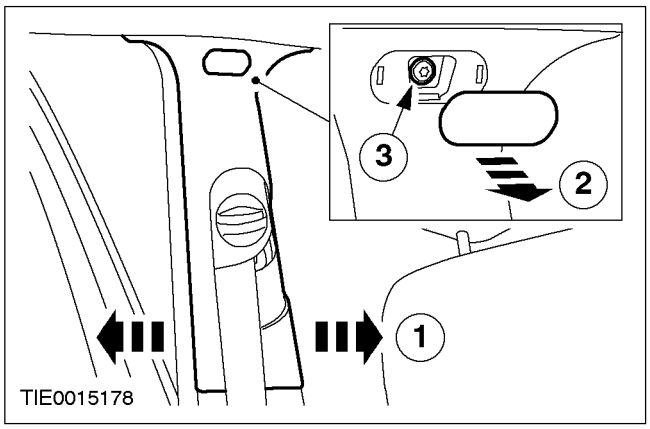
31. **Move the front safety belt shoulder height adjuster to its lowest position.**
32. **Detach the door opening weatherstrips from the B-pillars.**



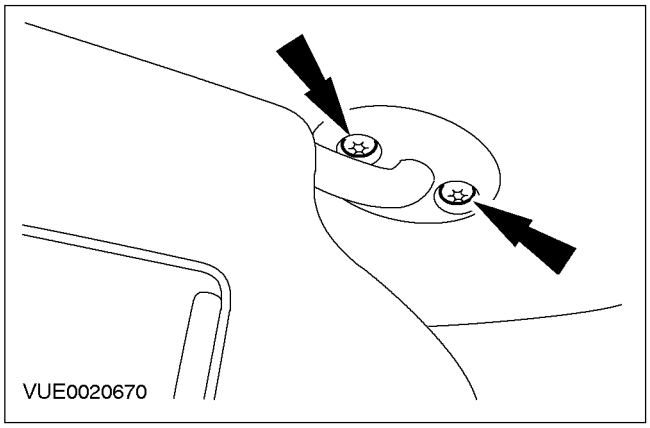
REMOVAL AND INSTALLATION (Continued)

33. Detach the B-pillar upper trim panels from the B-pillars and position them to one side.

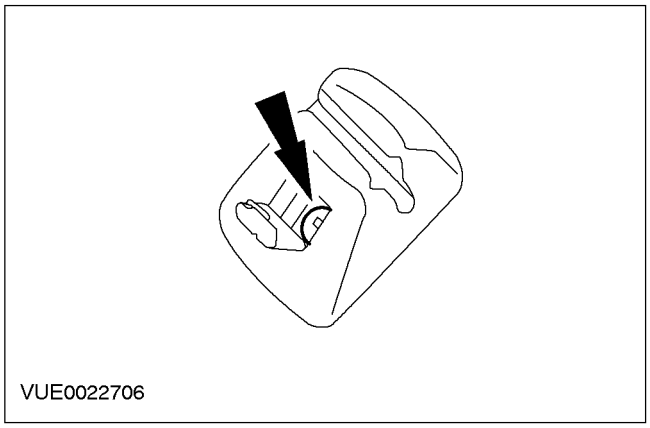
1. Detach the locating tangs from the B-pillar lower trim panel.
2. Remove the screw cover.
3. Remove the retaining screw.



34. Remove the sun visors.

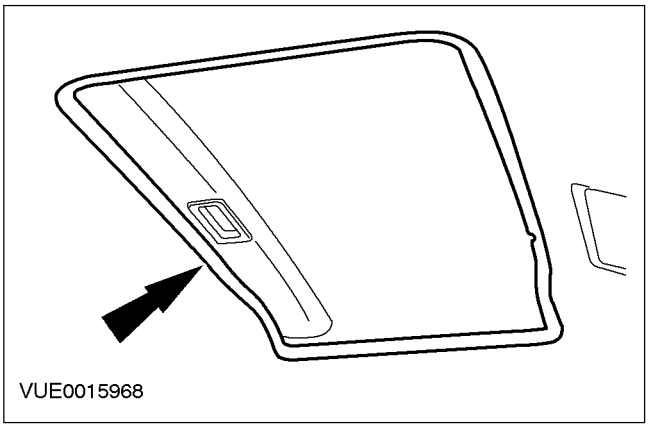


35. Remove the sun visor retaining clips.



Vehicles with power roof opening panel

36. Remove the roof opening panel weather-strip.

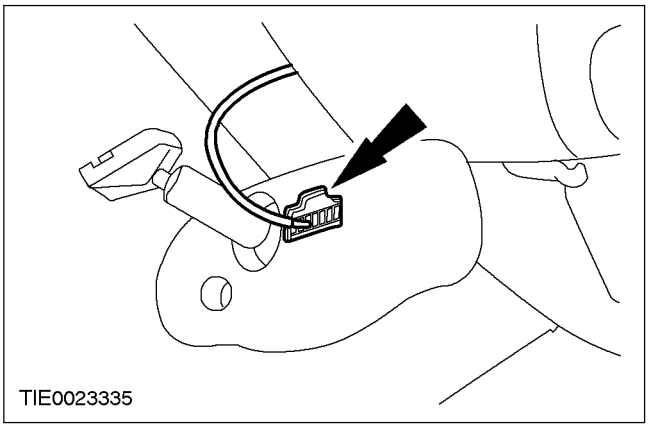


All vehicles

37. Remove the overhead console. For additional information, refer to Section 501-12.

Vehicles with auto-dimming interior mirror

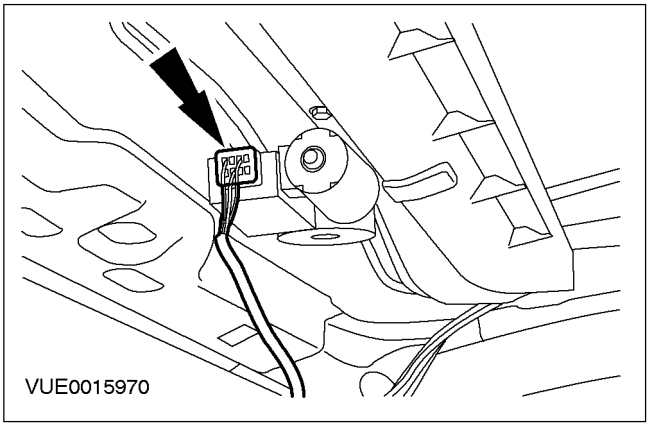
38. Disconnect the interior mirror electrical connector.



REMOVAL AND INSTALLATION (Continued)

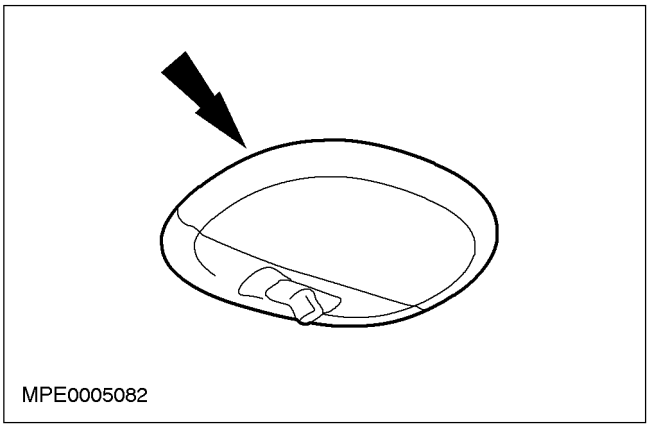
Vehicles with power roof opening panel

39. Partially lower the headliner and disconnect the roof opening panel motor electrical connector (headliner shown removed for clarity).

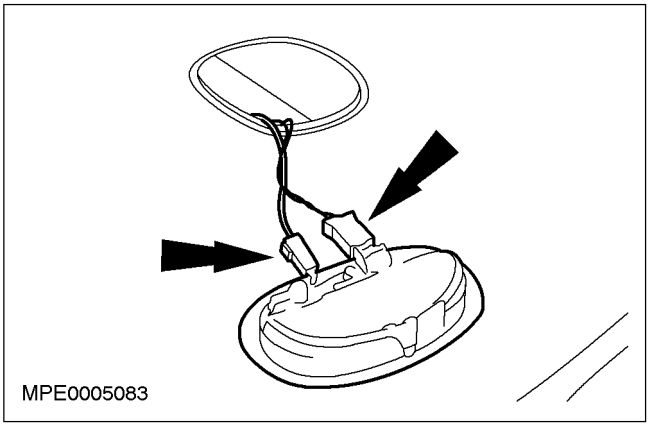


All vehicles

40. Detach the rear interior lamp (if equipped).



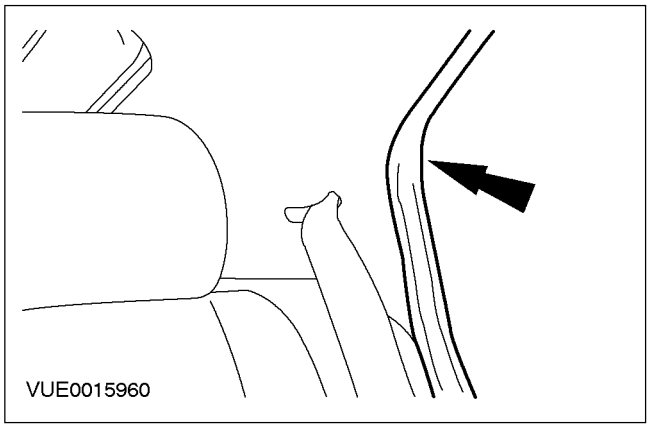
41. Disconnect the electrical connectors and remove the rear interior lamp (if equipped).



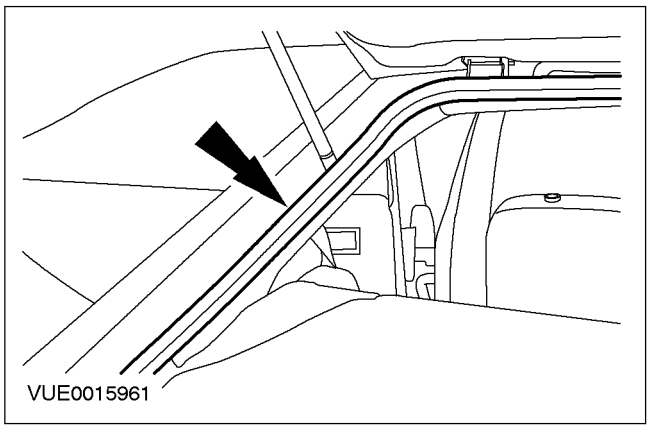
42. Pull down on the rear interior lamp opening to detach the headliner spacer glue fixing from the roof panel.

5-door

43. Detach the rear door opening weatherstrips from the C-pillars.

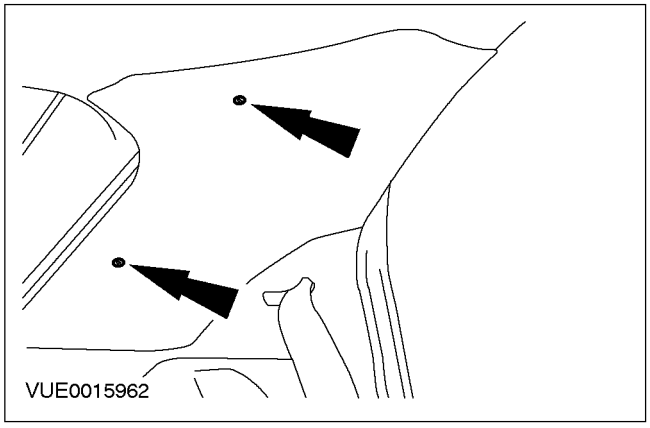


44. Detach the liftgate opening weatherstrip from the C-pillars.



45. Remove the C-pillar upper trim panel retaining screws.

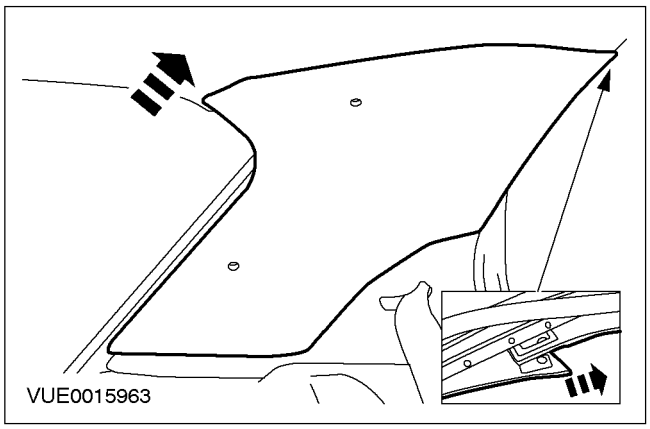
- Remove the blanking plugs and retaining screws.



REMOVAL AND INSTALLATION (Continued)

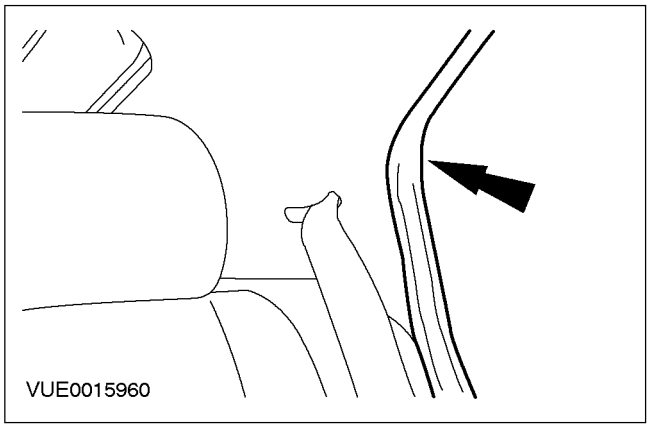
46. Remove the C-pillar upper trim panels.

- Detach the retaining clips.



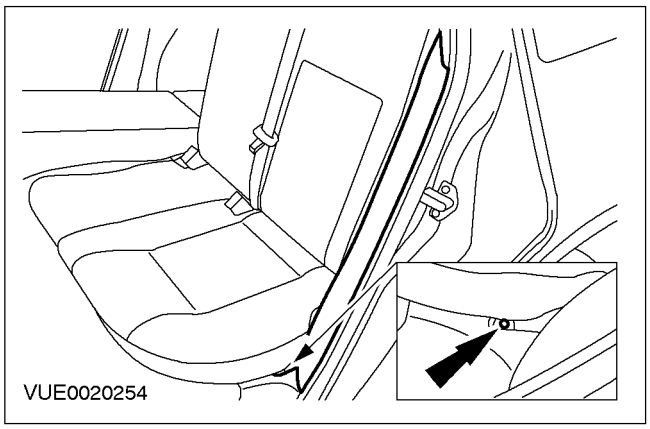
4-door

47. Detach the rear door opening weatherstrips from the C-pillars.



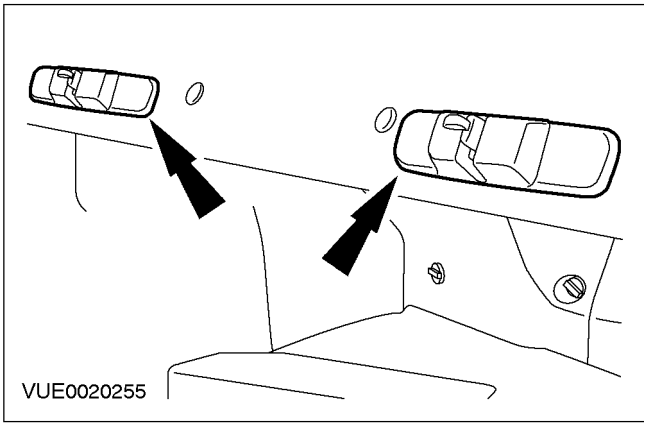
48. Remove the C-pillar lower trim panels (vehicle with trim panel shown, vehicles with seat bolster similar).

- Remove the C-pillar lower trim panel retaining screw.

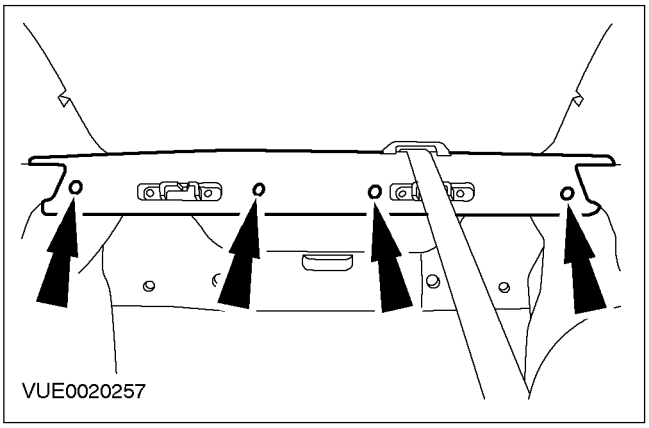


49. Fold down the rear seat backrests.

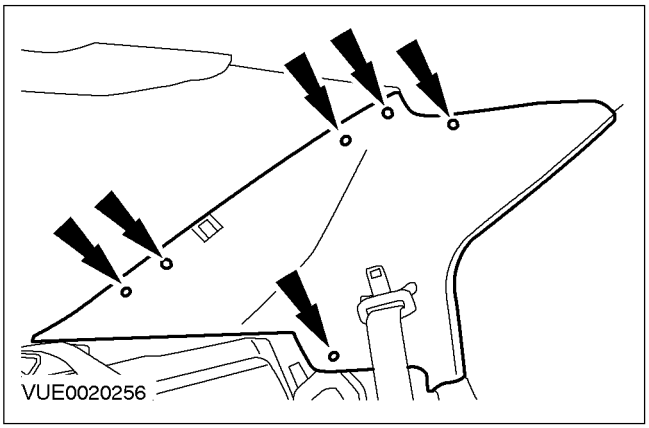
50. Remove the rear seat backrest latch covers.



51. Detach the parcel shelf trim panel.

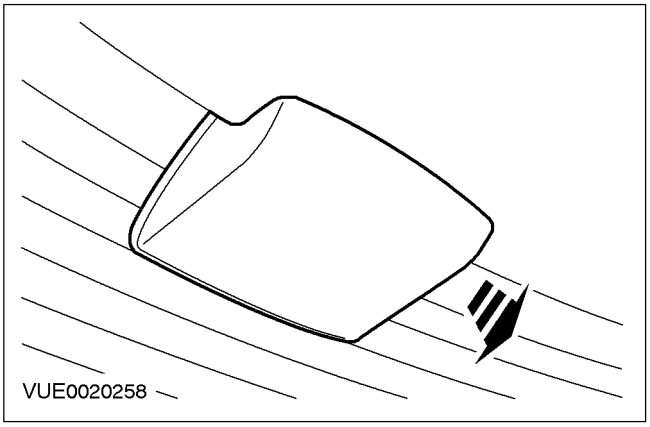


52. Detach the C-pillar upper trim panels from the C-pillars and position them to one side.

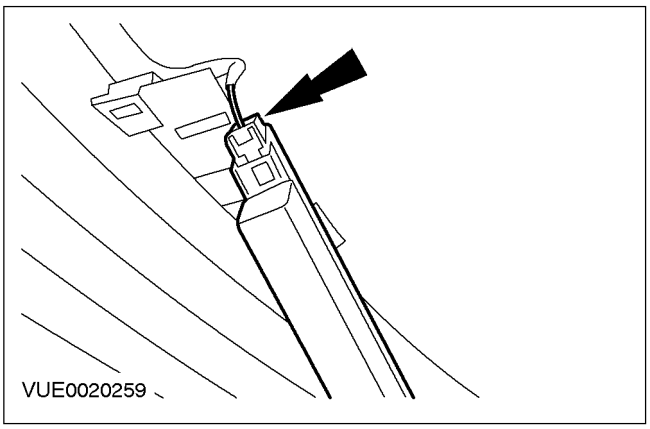


REMOVAL AND INSTALLATION (Continued)

53. Remove the high mounted stoplamp cover.

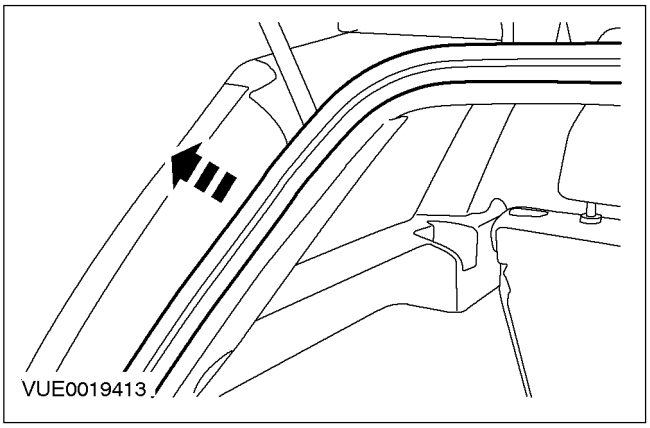


54. Disconnect the high mounted stoplamp electrical connector and remove the high mounted stoplamp.

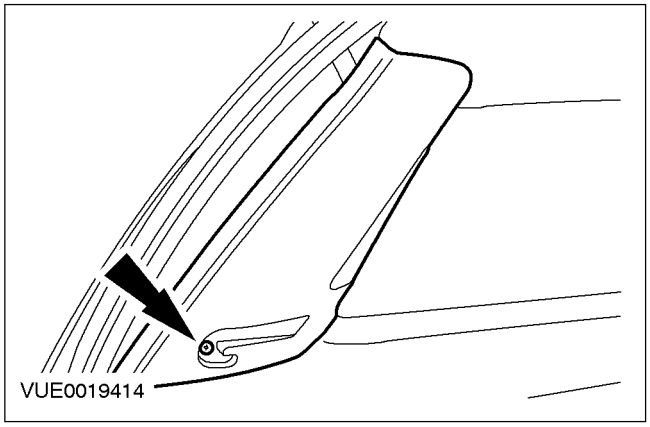


Wagon

55. Detach the liftgate opening weatherstrip.



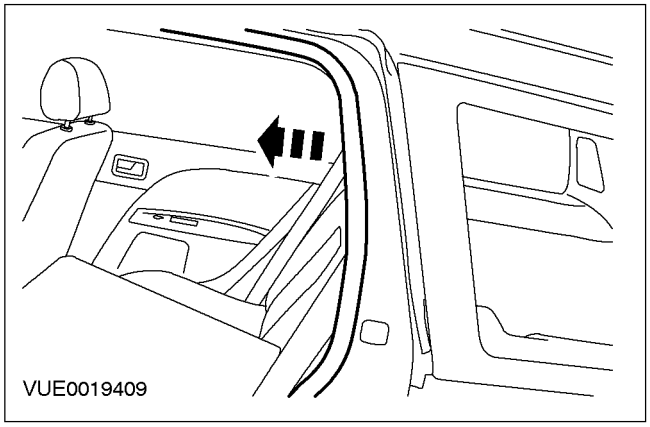
56. Remove the D-pillar trim retaining screws.



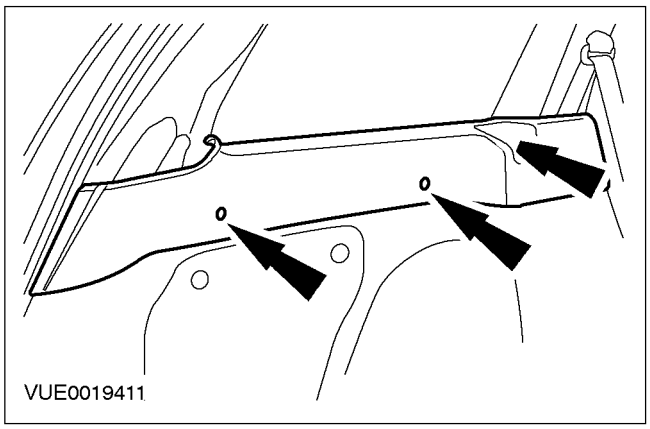
57. ⚠ CAUTION: Disconnect the rear window washer tube from the right-hand D-pillar trim panel.

Detach the D-pillar trim panel retaining clips and remove the D-pillar trim panels.

58. Detach the rear door opening weather-strip.

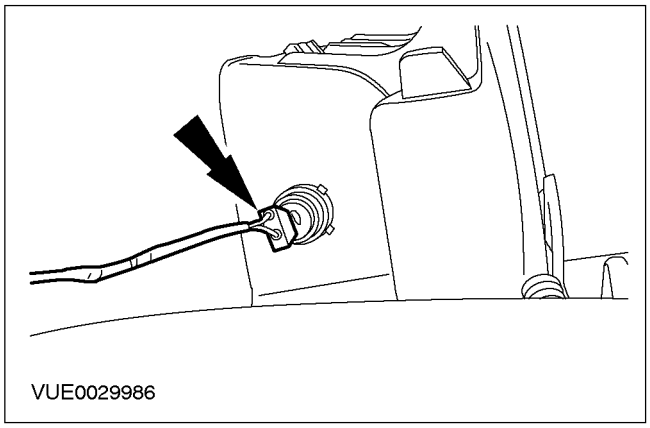


59. Remove the load space upper trim panel retaining screws and remove the load space upper trim panels.



REMOVAL AND INSTALLATION (Continued)

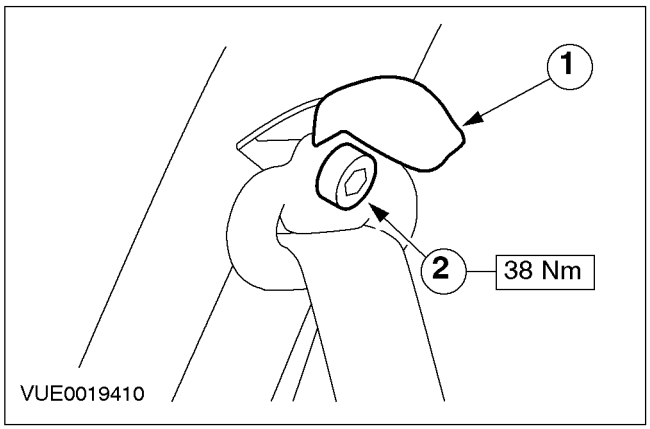
60. Disconnect the power outlet electrical connector on the right-hand load space upper trim panel (if equipped).



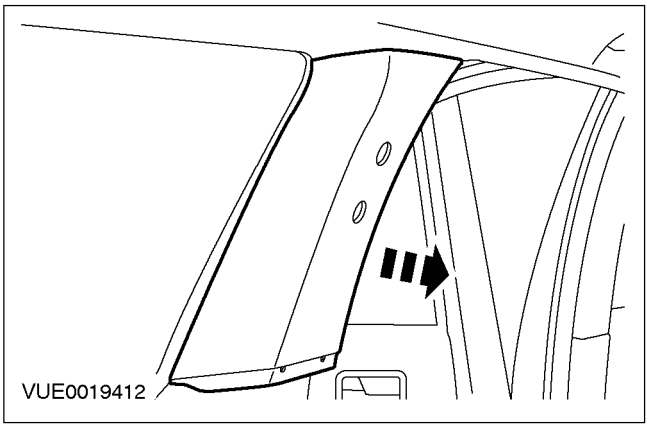
61. ⚠ CAUTION: The bolt securing the safety belt anchor is held captive by a paper washer. The bolt, spacer and paper washer must remain on the safety belt anchor at all times when the safety belt is detached or removed.

Detach the safety belt upper anchors.

1. Detach the trim panel.
2. Detach the safety belt upper anchors.



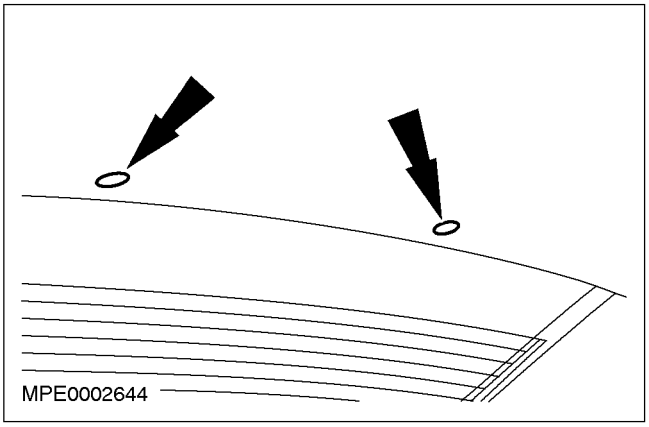
62. Remove the C-pillar trim panel.



63. Disconnect the diversity antenna cable connector from the rear quarter window glass.

5-door and wagon

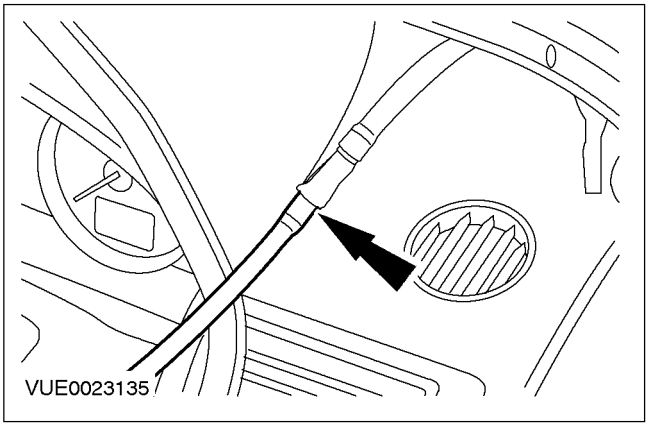
64. Remove the headliner retaining clips.



All vehicles

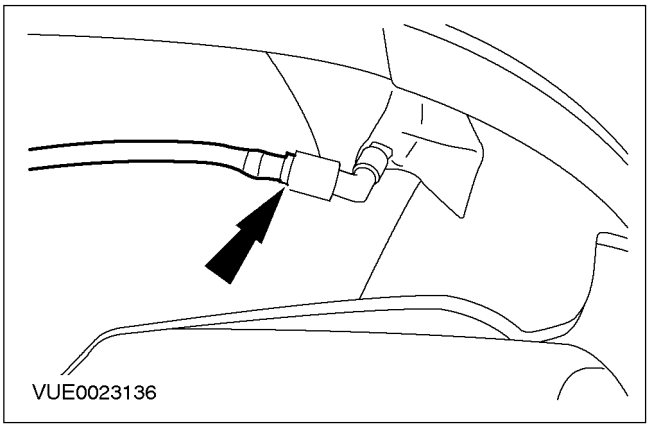
65. Detach thedraw cordfrom the interior lighting wiring harness electrical connector.

66. Disconnect the rear window washer tube from the right-hand A-pillar.



REMOVAL AND INSTALLATION (Continued)

67. Disconnect the rear window washer tube from the rear right-hand side of the headliner.

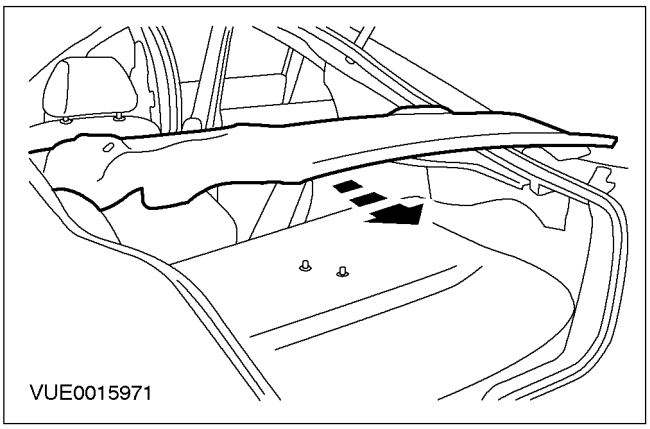


4-door and 5-door

68. Disconnect the diversity antenna cable from the roof panel.

5-door and wagon

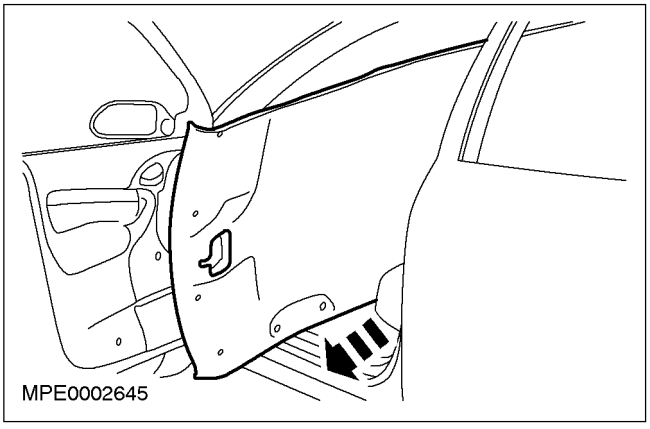
69. Remove the headliner (5-door shown).



4-door

70. Recline the front seat backrests to allow removal of the headliner through the passenger door opening.

71. Remove the headliner.



Installation

NOTE: Make sure the front safety belt shoulder height adjuster locking control is correctly located on the safety belt shoulder height adjuster.

1. **To install, reverse the removal procedure.**
2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

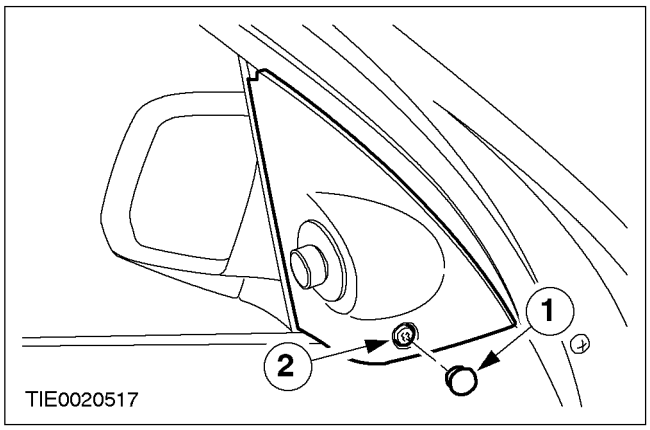
REMOVAL AND INSTALLATION

Front Door Trim Panel (43 705 0)

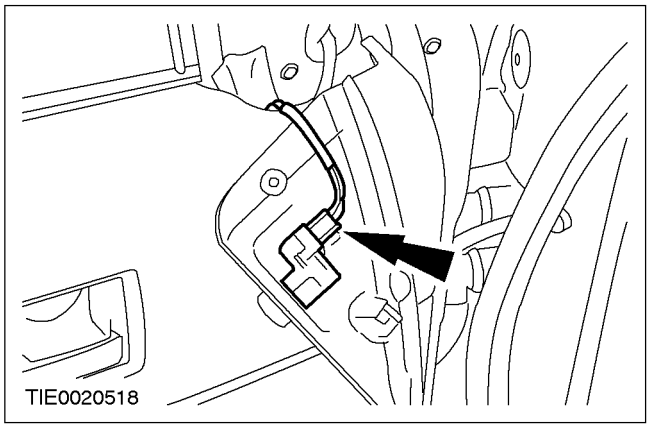
Removal

1. Detach the exterior mirror trim panel.

1. Remove the screw cover.
2. Remove the screw.

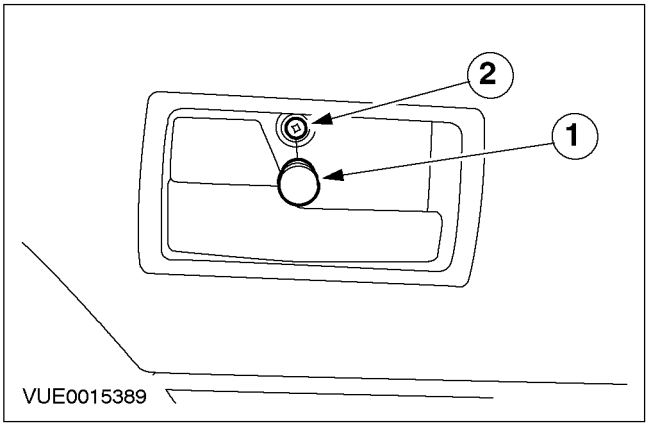


2. Disconnect the exterior mirror control switch electrical connector and remove the exterior mirror trim panel.

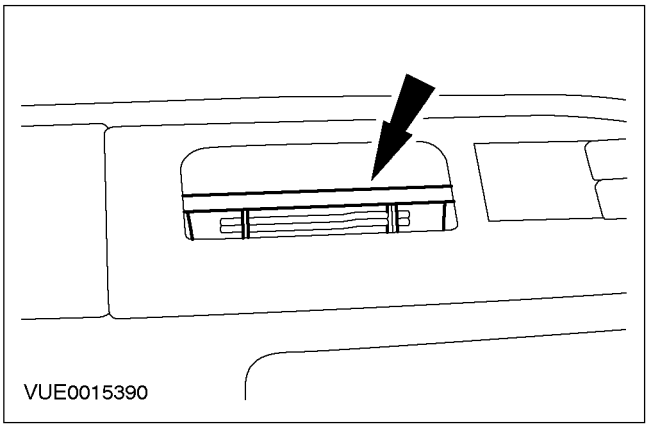


3. Remove the front door latch remote control handle bezel.

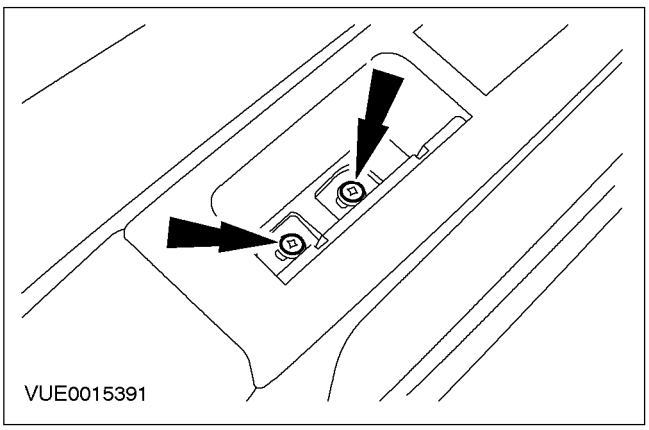
1. Remove the screw cover.
2. Remove the screw.



4. Remove the door pull handle cover.

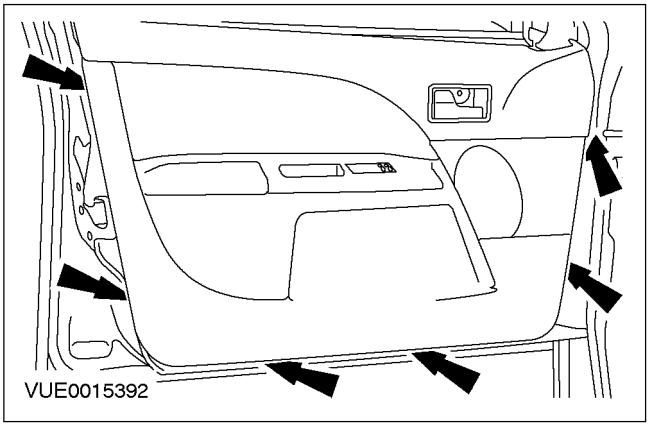


5. Remove the retaining screws.

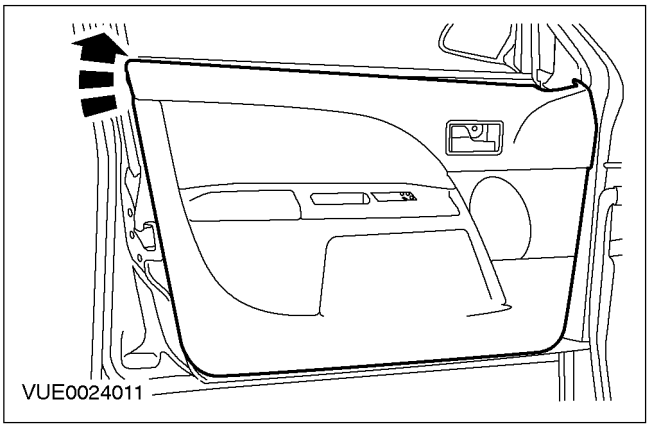


REMOVAL AND INSTALLATION (Continued)

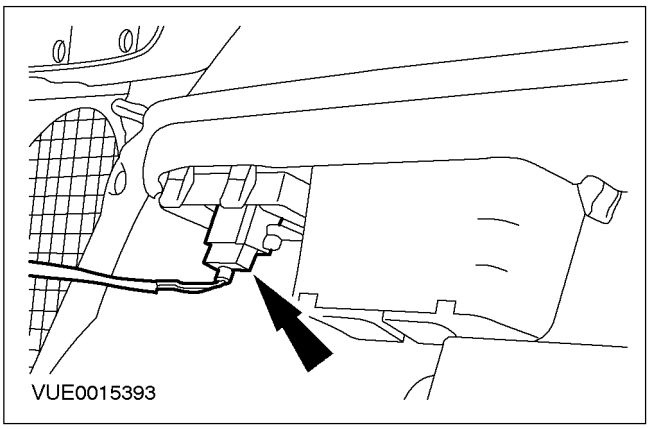
6. Remove the door trim panel retaining screws.



7. Detach the door trim panel.



8. Disconnect the power window electrical connector and remove the door trim panel.



Installation

1. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

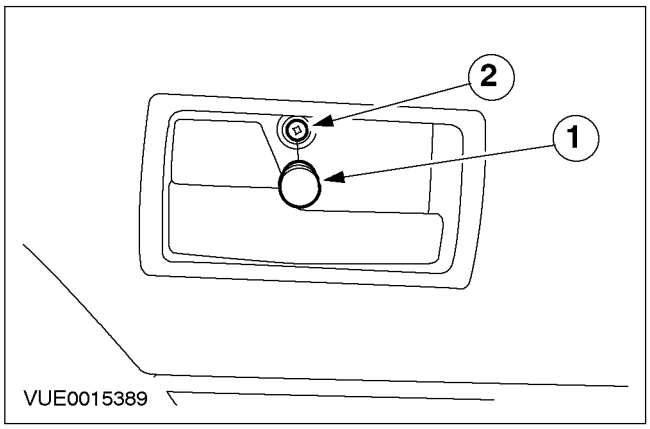
Rear Door Trim Panel (43 706 0)

Removal

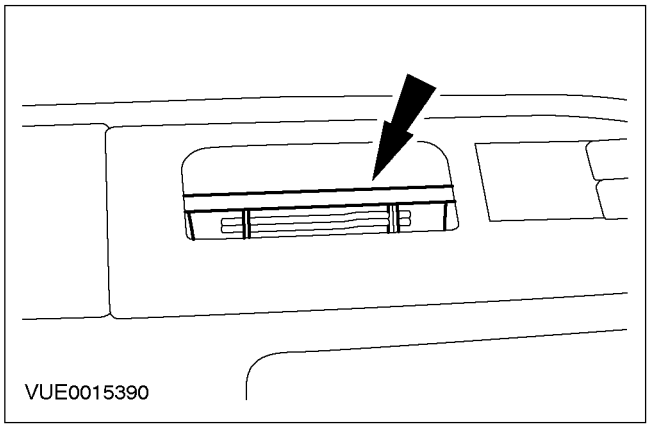
All vehicles

1. Remove the rear door latch remote control handle bezel.

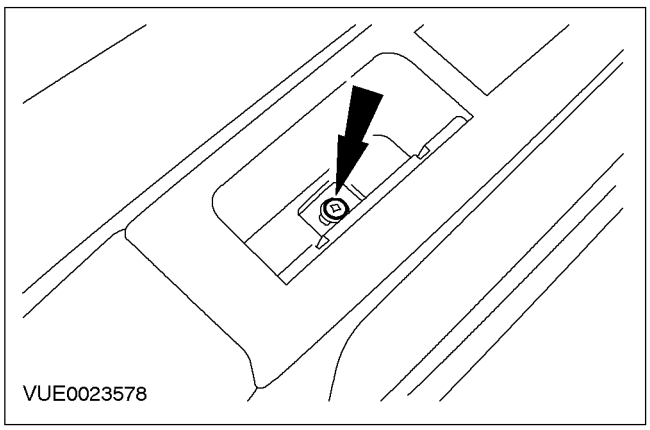
1. Remove the screw cover.
2. Remove the screw.



2. Remove the door pull handle cover.



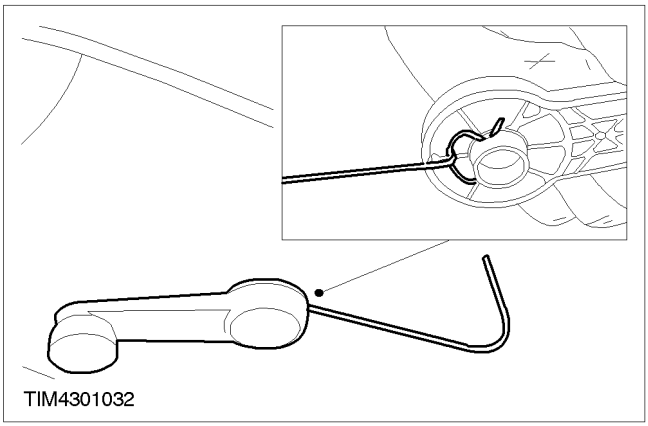
3. Remove the retaining screw.



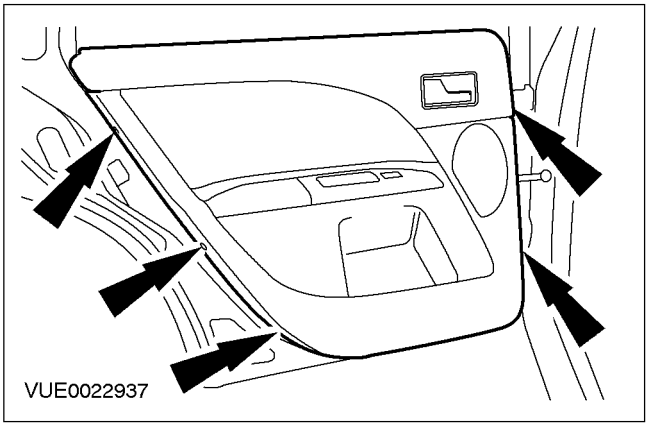
Vehicles with manual windows

4. Remove the window regulator handle.

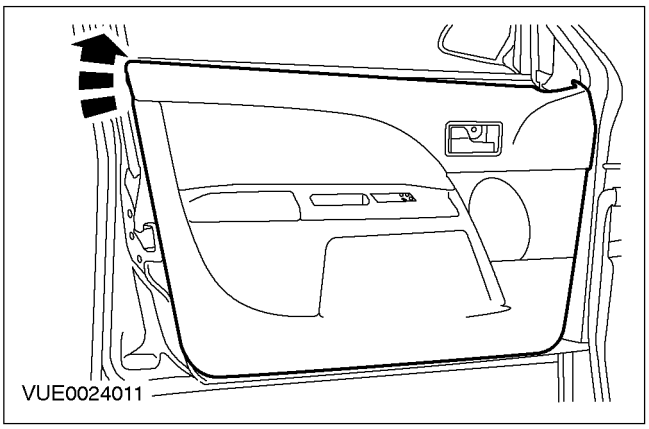
- Use a suitable piece of wire.



5. Remove the door trim panel retaining screws.



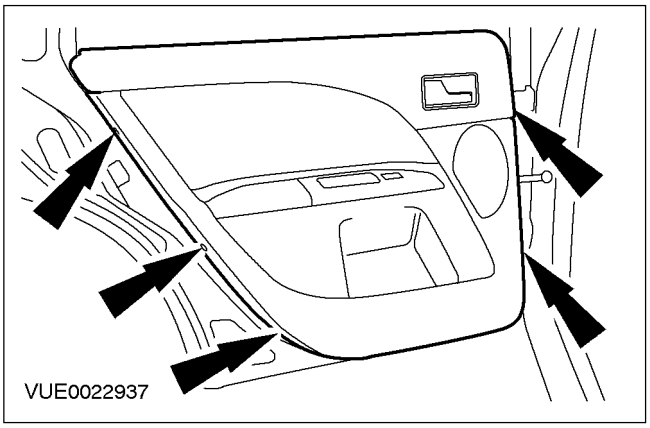
6. Remove the door trim panel.



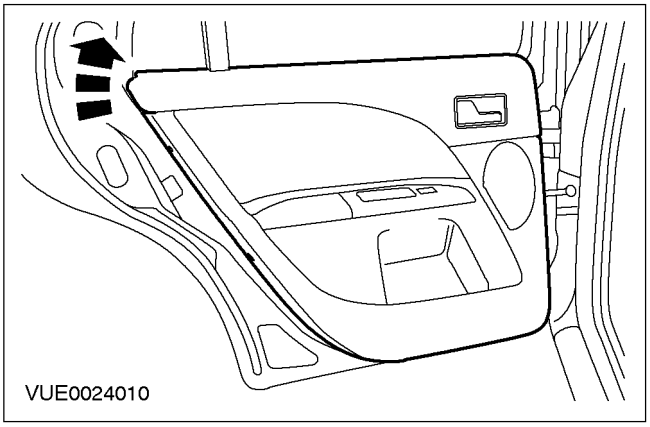
REMOVAL AND INSTALLATION (Continued)

Vehicles with power windows

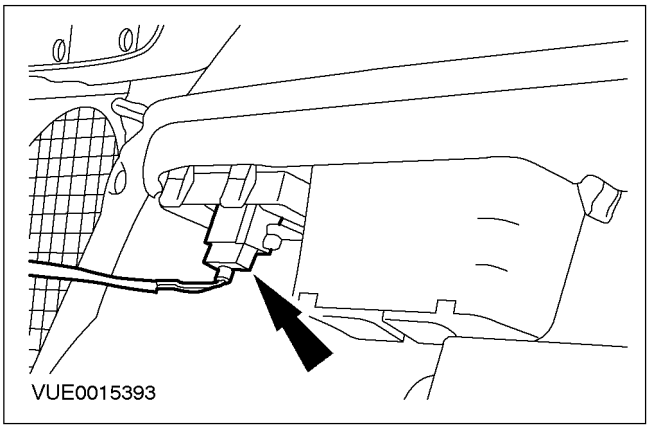
7. Remove the door trim panel retaining screws.



8. Detach the door trim panel.



9. Disconnect the power window electrical connector and remove the door trim panel.



Installation

1. To install, reverse the removal procedure.

SECTION 501-09 Rear View Mirrors

VEHICLE APPLICATION: 2003.0 Mondeo

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Pinpoint Tests 501-09-3

REMOVAL AND INSTALLATION

Exterior Mirror ..... (43 364 0) 501-09-18
Auto-dimming Interior Mirror 501-09-19

SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Exterior mirror retaining screws	2	-	18

DIAGNOSIS AND TESTING

Rear View Mirrors

Refer to Wiring Diagrams Section 501-09 for schematic and connector information.

Mechanical	Electrical
Exterior mirror(s)	Fuse(s) Relay Electrical connector(s) Switch

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Visual Inspection Chart

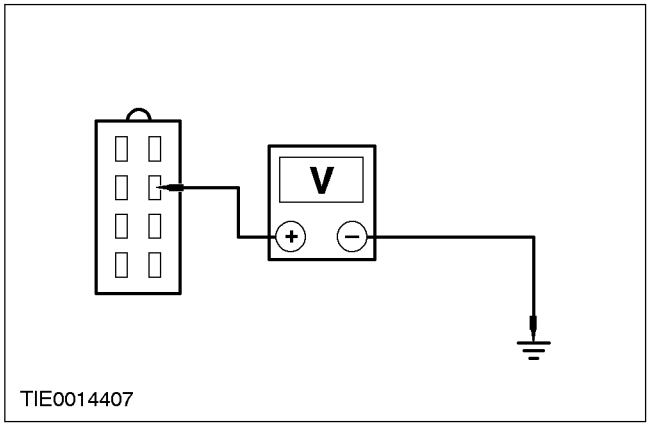
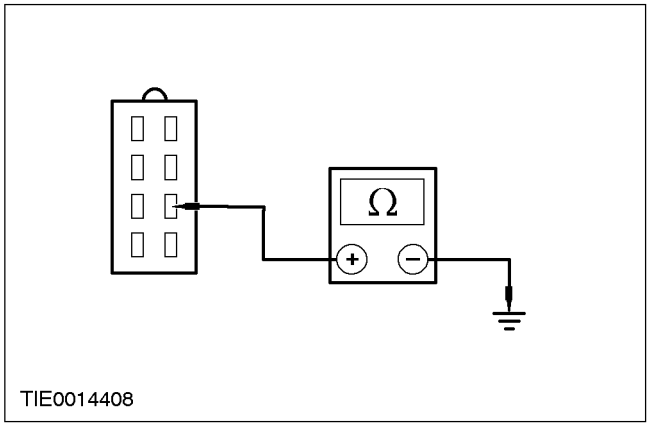
Condition	Possible Sources	Action
•The mirrors are inoperative	•Exterior mirror control switch.	•CARRY OUT the Exterior Mirror Control Switch Component Test. REFER to the Wiring Diagrams.
	•Circuit(s).	• GO to Pinpoint Test A.
•A single mirror is inoperative	•Exterior mirror control switch.	•CARRY OUT the Exterior Mirror Control Switch Component Test. REFER to the Wiring Diagrams.
	•Exterior mirror motor(s). •Circuit(s).	• GO to Pinpoint Test B.
•A single mirror does not function with switch logic	•Exterior mirror control switch.	•CARRY OUT the Exterior Mirror Control Switch Component Test. REFER to the Wiring Diagrams.
	•Exterior mirror motor(s). •Circuit(s).	• GO to Pinpoint Test C.
•The heated exterior mirror does not defrost	•Heated rear window control switch.	•CARRY OUT the Heated Rear Window Control Switch Component Test. REFER to the Wiring Diagrams.
	•Relay. •Heated mirror element(s). •Circuit(s).	• GO to Pinpoint Test D.
•The power folding mirrors do not operate	•Power fold mirror module. •Circuit(s).	• GO to Pinpoint Test E.
•The power folding mirrors do not operate correctly	•Power fold mirror motor(s). •Circuit(s).	• GO to Pinpoint Test F
•The auto-dimming interior mirror does not operate correctly	•Auto-dimming interior mirror. •Circuit(s).	• GO to Pinpoint Test G

Pinpoint Tests

NOTE: Use a digital multimeter for all electrical measurements.

DIAGNOSIS AND TESTING

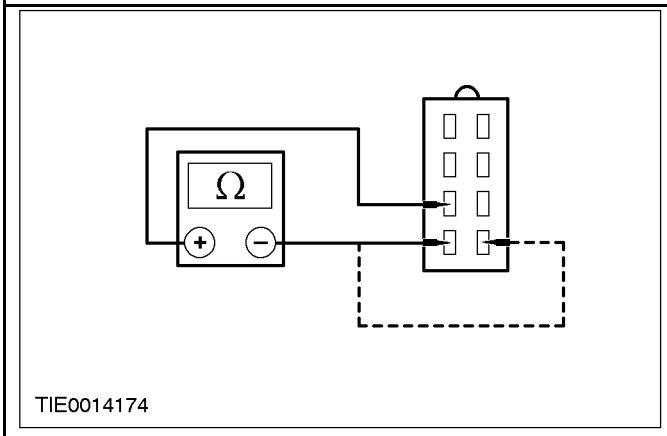
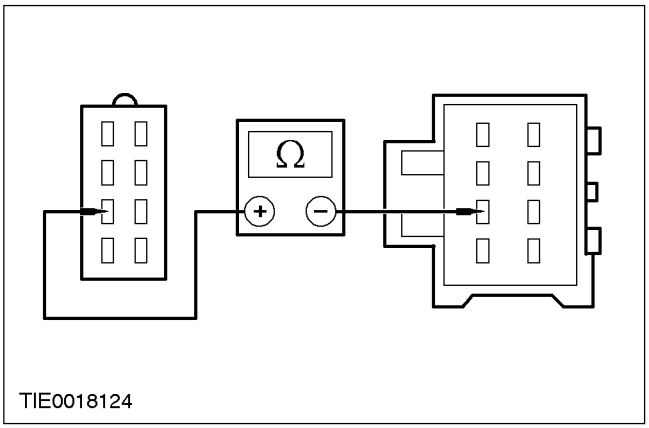
PINPOINT TEST A: THE MIRRORS ARE INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK THE VOLTAGE TO THE EXTERIOR MIRROR CONTROL SWITCH	
	1 Disconnect Exterior Mirror Control Switch C733. 2 Measure the voltage between the exterior mirror control switch C733 pin 6, circuit 29-AD12 (OG/YE), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **A2**. → **No** REPAIR circuit 29-AD12 (OG/YE). TEST the system for normal operation.
A2: CHECK THE EXTERIOR MIRROR CONTROL SWITCH GROUND CIRCUIT FOR CONTINUITY	
	1 Measure the resistance between the exterior mirror control switch C733 pin 4, circuit 31-AD12 (BK), harness side and ground. • Is the resistance less than 5 ohms? → **Yes** VERIFY the customer concern. → **No** REPAIR circuit 31-AD12 (BK). TEST the system for normal operation.

PINPOINT TEST B: A SINGLE MIRROR IS INOPERATIVE

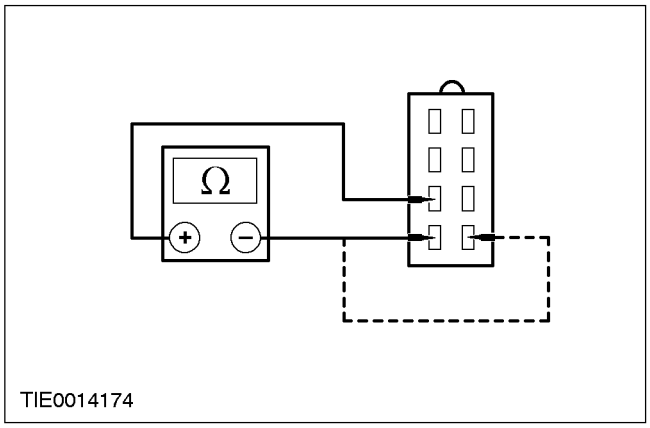
CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK THE EXTERIOR MIRROR MOTOR CIRCUIT FOR CONTINUITY	
	1 Disconnect Exterior Mirror Control Switch C733.

DIAGNOSIS AND TESTING (Continued)

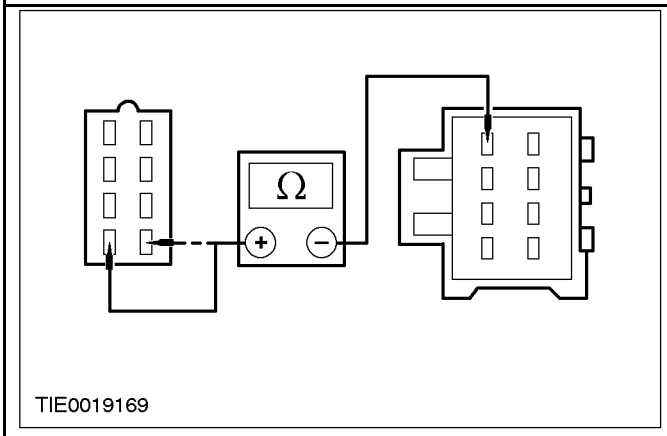
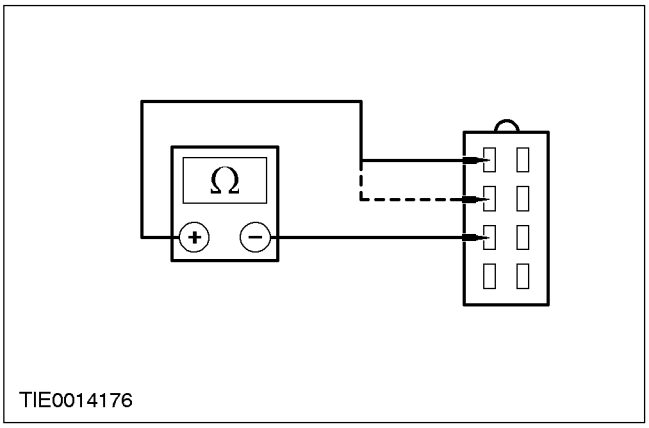
CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0014174	**2** Measure the resistance between: **NOTE:** LHD Driver Exterior Mirror - the exterior mirror control switch C733 pin 3, circuit 32-AD16 (WH) and pin 1, circuit 33-AD32 (YE/RD), harness side. **NOTE:** LHD Passenger Exterior Mirror - the exterior mirror control switch C733 pin 3, circuit 32-AD17 (WH/GN) and pin 2, circuit 33-AD30 (YE/BK), harness side. **NOTE:** RHD Driver Exterior Mirror - the exterior mirror control switch C733 pin 3, circuit 32-AD16 (WH) and pin 2, circuit 33-AD30 (YE/BK), harness side. **NOTE:** RHD Passenger Exterior Mirror - the exterior mirror control switch C733 pin 3, circuit 32-AD17 (WH/GN) and pin 1, circuit 33-AD32 (YE/RD), harness side. • Is the resistance between 70 and 125 ohms? → **Yes** VERIFY the customer concern. → **No** GO to **B2**.
B2: CHECK FOR CONTINUITY BETWEEN THE EXTERIOR MIRROR CONTROL SWITCH AND THE EXTERIOR MIRROR	
 TIE0018124	**1** Disconnect Driver Exterior Mirror C730 or Passenger Exterior Mirror C731. **2** Measure the resistance between: **NOTE:** Driver Exterior Mirror - the exterior mirror control switch C733 pin 3, circuit 32-AD16 (WH), harness side and the driver exterior mirror C730 pin 2, circuit 32-AD16 (WH), harness side. **NOTE:** Passenger Exterior Mirror - the exterior mirror control switch C733 pin 3, circuit 32-AD17 (WH/GN), harness side and the passenger exterior mirror C731 pin 2, circuit 32-AD17 (WH/GN), harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new exterior mirror. TEST the system for normal operation. → **No** REPAIR circuit 32-AD16 (WH) driver exterior mirror, or circuit 32-AD17 (WH/GN) passenger exterior mirror. TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

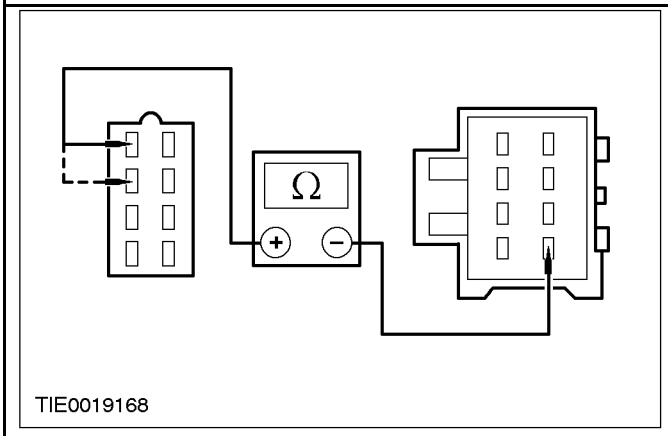
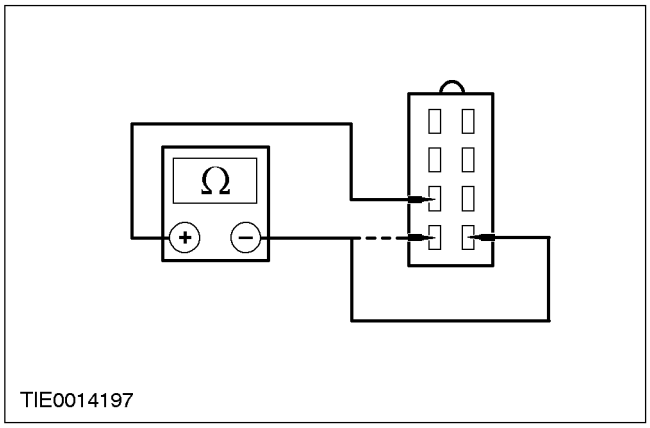
PINPOINT TEST C: A SINGLE MIRROR DOES NOT FUNCTION WITH SWITCH LOGIC

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK THE EXTERIOR MIRROR FUNCTIONS WITH SWITCH LOGIC	
	1 Key in ON position. 2 Operate the exterior mirror control switch. • Does the exterior mirror function with switch logic? → **Yes** VERIFY the customer concern. → **No** Driver exterior mirror up/down function inoperative GO to **C2**. Driver exterior mirror left/right function inoperative GO to **C4**. Passenger exterior mirror up/down function inoperative GO to **C6**. Passenger exterior mirror left/right function inoperative GO to **C8**.
C2: CHECK THE DRIVER EXTERIOR MIRROR UP/DOWN CIRCUIT	
 TIE0014174	1 Key in OFF position. 2 Disconnect Exterior Mirror Control Switch C733. 3 Measure the resistance between: **NOTE:** LHD - the exterior mirror control switch C733 pin 3, circuit 32-AD16 (WH) and pin 1, circuit 33-AD32 (YE/RD), harness side. **NOTE:** RHD - the exterior mirror control switch C733 pin 3, circuit 32-AD16 (WH) and pin 2, circuit 33-AD30 (YE/BK), harness side. • Is the resistance between 70 and 125 ohms? → **Yes** VERIFY the customer concern. → **No** GO to **C3**.
C3: CHECK FOR CONTINUITY BETWEEN THE EXTERIOR MIRROR CONTROL SWITCH AND THE EXTERIOR MIRROR	
	1 Disconnect Driver Exterior Mirror C730.

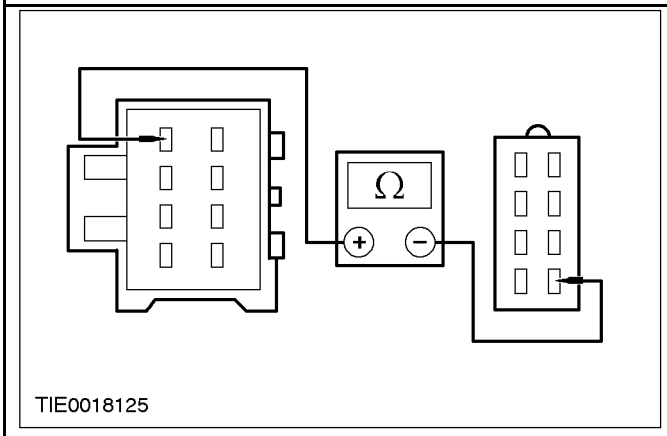
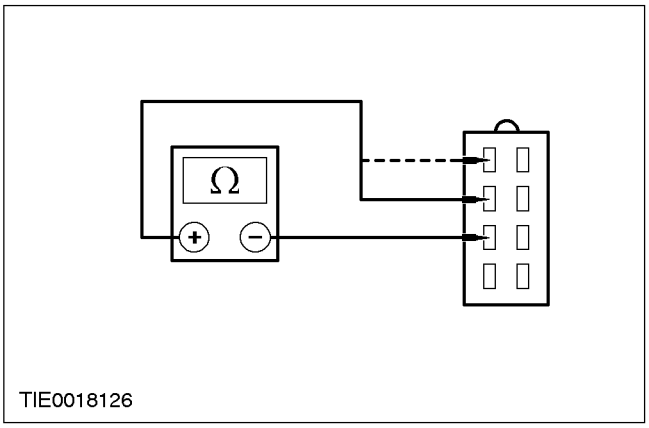
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0019169	2 Measure the resistance between: **NOTE:** LHD - the exterior mirror control switch C733 pin 1, circuit 33-AD32 (YE/RD), harness side and the driver exterior mirror C730 pin 4, circuit 33-AD32 (YE/RD), harness side. **NOTE:** RHD - the exterior mirror control switch C733 pin 2, circuit 33-AD30 (YE/BK), harness side and the driver exterior mirror C730 pin 4, circuit 33-AD30 (YE/BK), harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new exterior mirror. TEST the system for normal operation. → **No** REPAIR circuit 33-AD32 (YE/RD) LHD (circuit 33-AD30 [YE/BK] RHD). TEST the system for normal operation.
C4: CHECK THE DRIVER EXTERIOR MIRROR LEFT/RIGHT CIRCUIT	
 TIE0014176	1 Key in OFF position. 2 Disconnect Exterior Mirror Control Switch C733. 3 Measure the resistance between: **NOTE:** LHD - the exterior mirror control switch C733 pin 3, circuit 32-AD16 (WH) and pin 7, circuit 33-AD31 (YE/BU), harness side. **NOTE:** RHD - the exterior mirror control switch C733 pin 3, circuit 32-AD16 (WH) and pin 5, circuit 33-AD29 (YE/VT), harness side. • Is the resistance between 70 and 125 ohms? → **Yes** VERIFY the customer concern. → **No** GO to **C5**.
C5: CHECK FOR CONTINUITY BETWEEN THE EXTERIOR MIRROR CONTROL SWITCH AND THE EXTERIOR MIRROR	
	1 Disconnect Driver Exterior Mirror C730.

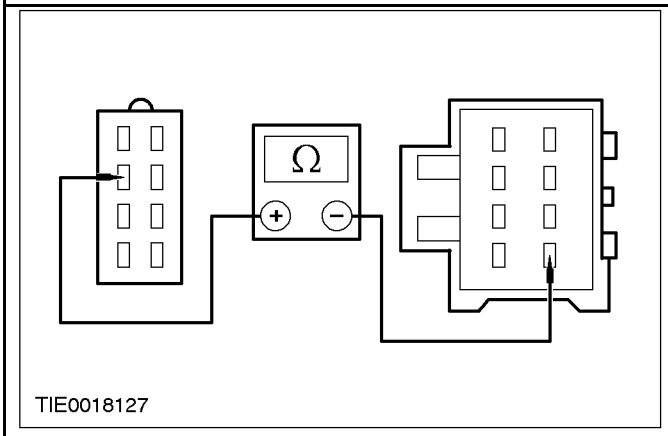
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0019168	**2** Measure the resistance between: **NOTE:** LHD - the exterior mirror control switch C733 pin 7, circuit 33-AD31 (YE/BU), harness side and the driver exterior mirror C730 pin 5, circuit 33-AD31 (YE/BU), harness side. **NOTE:** RHD - the exterior mirror control switch C733 pin 5, circuit 33-AD29 (YE/VT), harness side and the driver exterior mirror C730 pin 5, circuit 33-AD29 (YE/VT), harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new exterior mirror. TEST the system for normal operation. → **No** REPAIR circuit 33-AD31 (YE/BU) LHD (circuit 33-AD29 [YE/VT] RHD). TEST the system for normal operation.
C6: CHECK THE PASSENGER EXTERIOR MIRROR UP/DOWN CIRCUIT	
 TIE0014197	**1** Key in OFF position. **2** Disconnect Exterior Mirror Control Switch C733. **3** Measure the resistance between: **NOTE:** LHD - the exterior mirror control switch C733 pin 3, circuit 32-AD17 (WH/GN) and pin 2, circuit 33-AD30 (YE/BK), harness side. **NOTE:** RHD - the exterior mirror control switch C733 pin 3, circuit 32-AD17 (WH/GN) and pin 1, circuit 33-AD32 (YE/RD), harness side. • Is the resistance between 70 and 125 ohms? → **Yes** VERIFY the customer concern. → **No** GO to **C7**.
C7: CHECK FOR CONTINUITY BETWEEN THE EXTERIOR MIRROR CONTROL SWITCH AND THE EXTERIOR MIRROR	
	1 Disconnect Passenger Exterior Mirror C731.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0018125	**2** Measure the resistance between: **NOTE:** LHD - the exterior mirror control switch C733 pin 2, circuit 33-AD30 (YE/BK), harness side and the passenger exterior mirror C731 pin 4, circuit 33-AD10 (YE/BK), harness side. **NOTE:** RHD - the exterior mirror control switch C733 pin 1, circuit 33-AD32 (YE/RD), harness side and the passenger exterior mirror C731 pin 4, circuit 33-AD10 (YE/BK), harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new exterior mirror. TEST the system for normal operation. → **No** REPAIR circuit 33-AD30 (YE/BK) LHD, (circuit 33-AD32 [YE/RD] RHD) or circuit 33-AD10 (YE/BK). TEST the system for normal operation.
C8: CHECK THE PASSENGER EXTERIOR MIRROR LEFT/RIGHT CIRCUIT	
 TIE0018126	**1** Key in OFF position. **2** Disconnect Exterior Mirror Control Switch C733. **3** Measure the resistance between: **NOTE:** LHD - the exterior mirror control switch C733 pin 3, circuit 32-AD17 (WH/GN) and pin 5, circuit 33-AD29 (YE/VT), harness side. **NOTE:** RHD - the exterior mirror control switch C733 pin 3, circuit 32-AD17 (WH/GN) and pin 7, circuit 33-AD31 (YE/BU), harness side. • Is the resistance between 70 and 125 ohms? → **Yes** VERIFY the customer concern. → **No** GO to **C9**.
C9: CHECK FOR CONTINUITY BETWEEN THE EXTERIOR MIRROR CONTROL SWITCH AND THE EXTERIOR MIRROR	
	1 Disconnect Passenger Exterior Mirror C731.

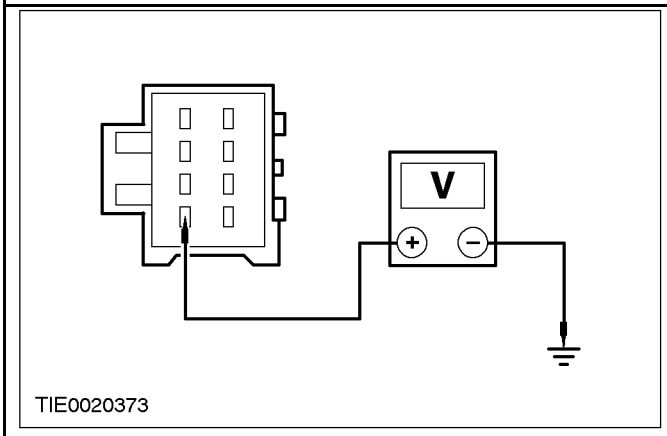
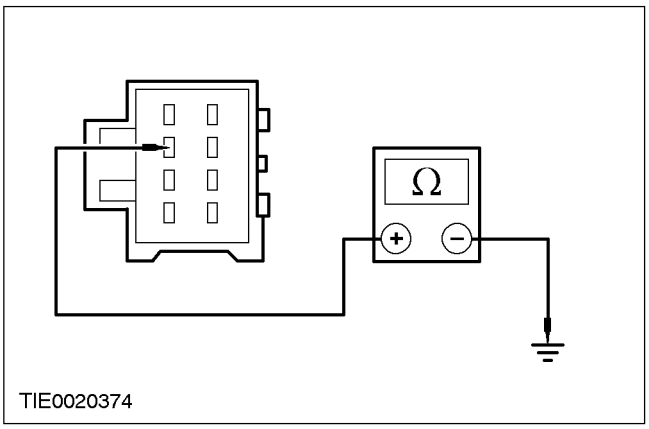
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	2 Measure the resistance between: **NOTE:** LHD - the exterior mirror control switch C733 pin 5, circuit 33-AD29 (YE/VT), harness side and the passenger exterior mirror C731 pin 5, circuit 33-AD11 (YE/VT), harness side. **NOTE:** RHD - the exterior mirror control switch C733 pin 7, circuit 33-AD31 (YE/BU), harness side and the passenger exterior mirror C731 pin 5, circuit 33-AD11 (YE/VT), harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new exterior mirror. TEST the system for normal operation. → **No** REPAIR circuit 33-AD29 (YE/VT) LHD, (circuit 33-AD31 [YE/BU] RHD) or circuit 33-AD11 (YE/VT). TEST the system for normal operation.

PINPOINT TEST D: THE HEATED EXTERIOR MIRROR DOES NOT DEFROST

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: CHECK THE HEATED EXTERIOR MIRROR DEFROSTS	
	1 Operate the heated rear window control switch. • Does the heated exterior mirror defrost? → **Yes** VERIFY the customer concern. → **No** GO to **D2**.
D2: CHECK THE SUPPLY VOLTAGE TO THE INOPERATIVE EXTERIOR MIRROR	
	1 Disconnect Inoperative Exterior Mirror C730 or C731. 2 Key in ON position. 3 Operate the heated rear window control switch.

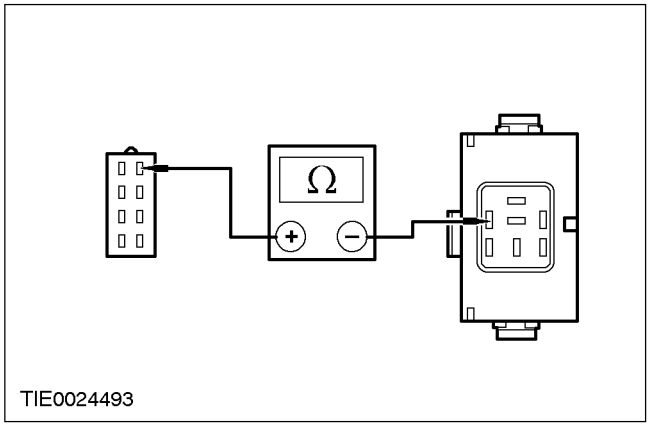
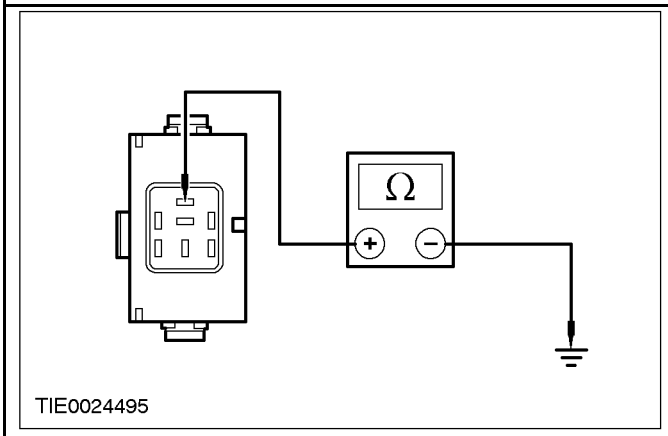
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020373	4 Measure the voltage between: **NOTE:** Driver Exterior Mirror - the driver exterior mirror C730 pin 1, circuit 15S-HB35 (GN/BK), harness side and ground. **NOTE:** Passenger Exterior Mirror - the passenger exterior mirror C731 pin 1, circuit 15S-HB36 (GN/OG), harness side and ground • Is the voltage greater than 10 volts? → **Yes** GO to **D3** → **No** Repair circuit 15S-HB35 (GN/BK); or circuit 15S-HB36 (GN/OG). TEST the system for normal operation.
D3: CHECK THE INOPERATIVE EXTERIOR MIRROR GROUND CIRCUIT FOR CONTINUITY	
 TIE0020374	1 Key in OFF position. 2 Measure the resistance between: **NOTE:** Driver exterior mirror - the driver exterior mirror C730 pin 3, circuit 31–HB35 (BK), harness side and ground. **NOTE:** Passenger exterior mirror - the passenger exterior mirror C731 pin 3, circuit 31–HB36 (BK), harness side and ground. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new heated exterior mirror glass. TEST the system for normal operation. → **No** REPAIR circuit 31-HB35 (BK) or circuit 31-HB36 (BK). TEST the system for normal operation.

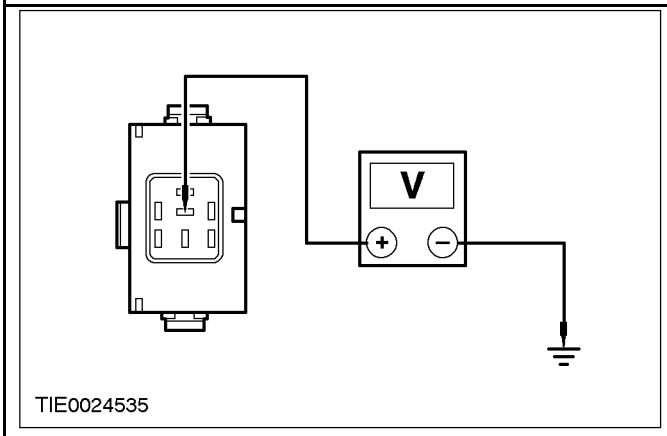
PINPOINT TEST E: THE POWER FOLDING MIRRORS DO NOT OPERATE

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: CHECK FOR CONTINUITY BETWEEN THE EXTERIOR MIRROR CONTROL SWITCH AND THE POWER FOLDING MIRROR MODULE	
	1 Disconnect Fuse 75.

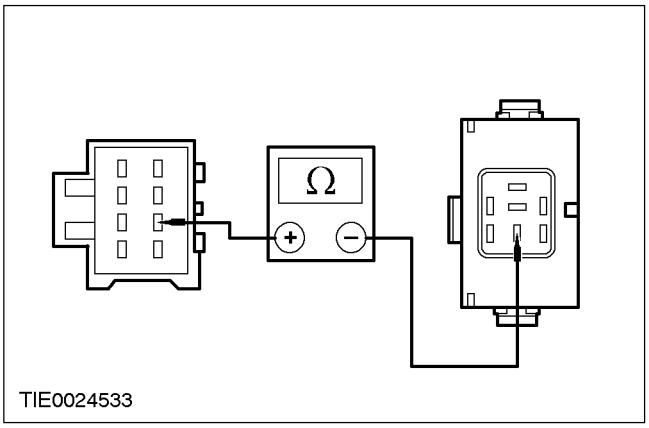
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**2** Disconnect Power Folding Mirror Module C753. **3** Measure the resistance between the exterior mirror control switch C733 pin 8, circuit 31S-AD24 (BK/RD), harness side and the power folding mirror module C753 pin 2, circuit 31S-AD24 (BK/RD), harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **E2**. → **No** REPAIR circuit 31S-AD24 (BK/RD). TEST the system for normal operation.
E2: CHECK THE POWER FOLDING MIRROR MODULE GROUND CIRCUIT FOR CONTINUITY	
	**1** Measure the resistance between the power folding mirror module C753 pin 5, circuit 31-AD25 (BK), harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **E3**. → **No** REPAIR circuit 31-AD25 (BK). TEST the system for normal operation.
E3: CHECK THE VOLTAGE TO THE POWER FOLDING MIRROR MODULE	
	1 Connect Fuse 75.

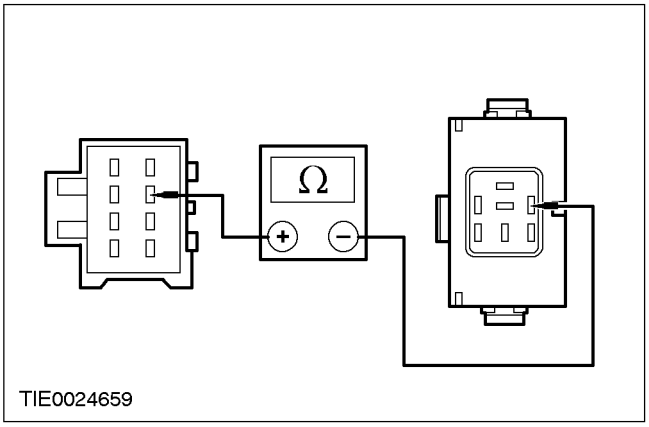
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0024535	**2** Measure the voltage between the power folding mirror module C753 pin 4, circuit 29-AD25 (OG), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** INSTALL a new power folding mirror module. TEST the system for normal operation. → **No** REPAIR circuit 29-AD25 (OG). TEST the system for normal operation.

PINPOINT TEST F: THE POWER FOLDING MIRRORS DO NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1: CHECK FOR CONTINUITY BETWEEN THE INOPERATIVE POWER FOLDING MIRROR MOTOR AND THE POWER FOLDING MIRROR MODULE	
 TIE0024533	**1** Disconnect Inoperative Power Folding Mirror Motor C730 or C731. **2** Measure the resistance between: **NOTE:** LHD Driver power folding mirror - the power folding mirror motor C730 pin 6, circuit 32-AD26 (WH/GN), harness side and the power folding mirror module C753 pin 3, circuit 32-AD27 (WH/GN), harness side. **NOTE:** LHD Passenger power folding mirror - the power folding mirror motor C731 pin 6, circuit 32-AD26 (WH/GN), harness side and the power folding mirror module C753 pin 3, circuit 32-AD28 (WH/GN), harness side. **NOTE:** RHD Driver power folding mirror - the power folding mirror motor C730 pin 6,circuit 32-AD26 (WH/GN), harness side and the power folding mirror module C753 pin 3, circuit 32-AD28 (WH/GN), harness side. **NOTE:** RHD Passenger power folding mirror - the power folding mirror motor C731 pin 6,circuit 32-AD26 (WH/GN), harness side and power folding mirror module C753 pin 3, circuit 32-AD27 (WH/GN), harness side. • Is the resistance less than 5 ohms? → **Yes**

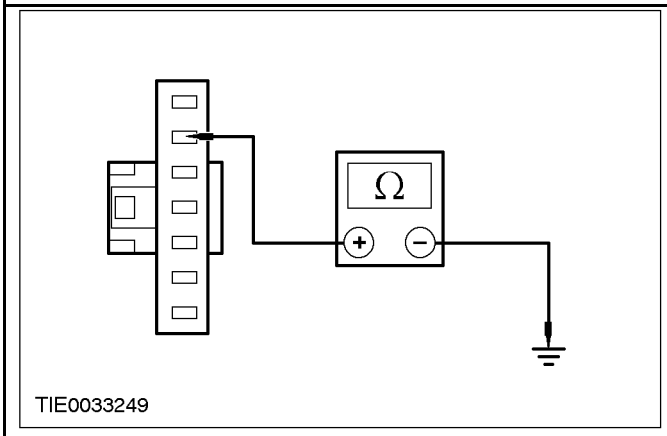
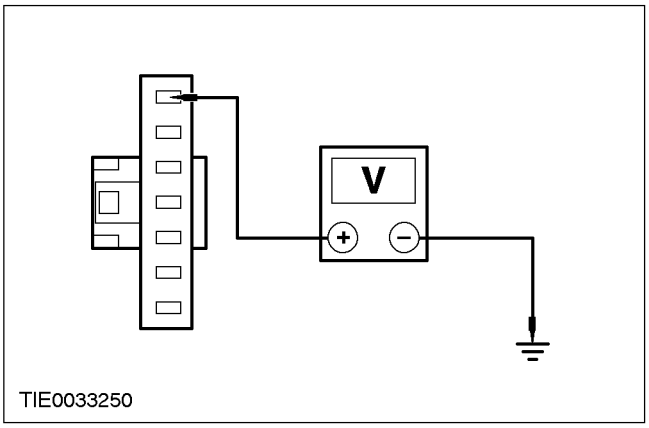
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	GO to **F2**. → **No** REPAIR circuit 32-AD26 (WH/GN); or circuit 32-AD27 (WH/GN); or circuit 32-AD28 (WH/GN). TEST the system for normal operation.
F2: CHECK FOR CONTINUITY BETWEEN THE INOPERATIVE POWER FOLDING MIRROR MOTOR AND THE POWER FOLDING MIRROR MODULE	
 TIE0024659	1 Measure the resistance between: **NOTE:** LHD Driver power folding mirror - the power folding mirror motor C730 pin 7, circuit 33-AD26 (YE/GN), harness side and the power folding mirror module C753 pin 1, circuit 33-AD27 (YE/GN), harness side. **NOTE:** LHD Passenger power folding mirror - the power folding mirror motor C731 pin 7, circuit 33-AD26 (YE/GN), harness side and the power folding mirror module C753 pin 1, circuit 33-AD28 (YE/GN), harness side. **NOTE:** RHD Driver power folding mirror - the power folding mirror motor C730 pin 7, circuit 33-AD26 (YE/GN), harness side and the power folding mirror module C753 pin 1, circuit 33-AD28 (YE/GN), harness side. **NOTE:** RHD Passenger power folding mirror - the power folding mirror motor C731 pin 7, circuit 33-AD26 (YE/GN), harness side and the power folding mirror module C753 pin 1, circuit 33-AD27 (YE/GN), harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new power fold motor . TEST the system for normal operation. → **No** REPAIR circuit 33-AD26 (YE/GN); or circuit 33-AD27 (YE/GN); or circuit 33-AD28 (YE/GN). TEST the system for normal operation.

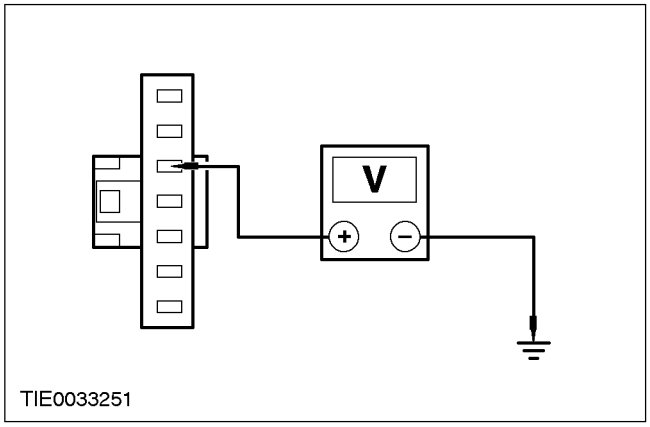
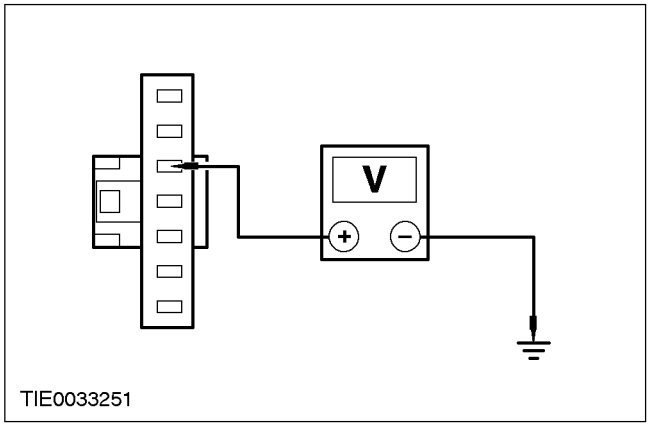
PINPOINT TEST G: THE AUTO-DIMMING INTERIOR MIRROR DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1: CHECK FOR CONTINUITY BETWEEN THE AUTO-DIMMING INTERIOR MIRROR AND GROUND	
	1 Disconnect Auto-dimming Interior Mirror C473.

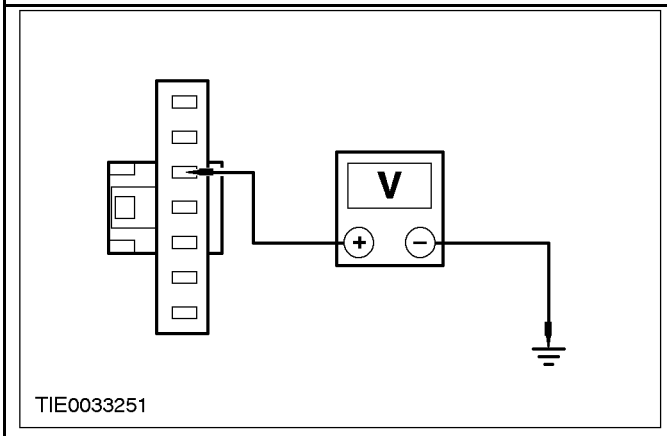
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0033249	**2** Measure the resistance between the auto-dimming interior mirror C473 pin 2, circuit 31-AD15 (BK), harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **G2** → **No** REPAIR circuit 31-AD15 (BK). TEST the system for normal operation.
G2: CHECK THE VOLTAGE TO THE AUTO-DIMMING INTERIOR MIRROR	
 TIE0033250	**1** Key in ON position. **2** Measure the voltage between the auto-dimming interior mirror C473 pin 1, circuit 15-AD15 (GN/RD), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **G3** → **No** REPAIR circuit 15-AD15 (GN/RD). TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
G3: CHECK THE REVERSE CUT-OUT VOLTAGE TO THE AUTO-DIMMING INTERIOR MIRROR	
 TIE0033251	**NOTE:** Make sure the transmission is in NEUTRAL. 1 Measure the voltage between the auto-dimming interior mirror C473 pin 3, circuit 15S-AD15 (GN/RD), harness side and ground. • Is any voltage present? → **Yes** GO to **G4** → **No** GO to **G5**
G4: CHECK FOR VOLTAGE TO THE AUTO-DIMMING INTERIOR MIRROR	
 TIE0033251	1 Key in OFF position. 2 Disconnect Transmission Switch C181 (manual)/Transmission Range Sensor C187 (automatic). 3 Key in ON position. 4 Measure the voltage between the auto-dimming interior mirror C473 pin 3, circuit 15S-AD15 (GN/RD), harness side and ground. • Is any voltage present? → **Yes** INSTALL a new transmission switch (manual)/transmission range sensor (automatic). TEST the system for normal operation. → **No** REPAIR circuit 15S-AD15 (GN/RD). TEST the system for normal operation.
G5: CHECK THE REVERSE CUT-OUT VOLTAGE TO THE AUTO-DIMMING INTERIOR MIRROR	
	1 Place the gearshift lever/selector lever in reverse.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0033251	**2** Measure the voltage between the auto-dimming interior mirror C473 pin 3, circuit 15S-AD15 (GN/RD), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** INSTALL a new auto-dimming interior mirror. TEST the system for normal operation. → **No** REPAIR circuit 15S-AD15 (GN/RD). TEST the system for normal operation.

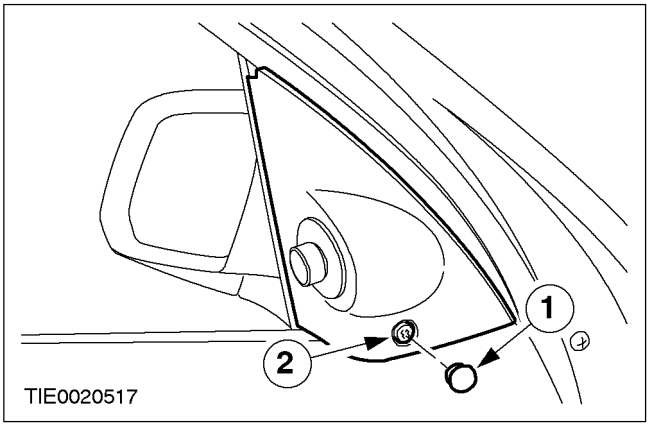
REMOVAL AND INSTALLATION

Exterior Mirror (43 364 0)

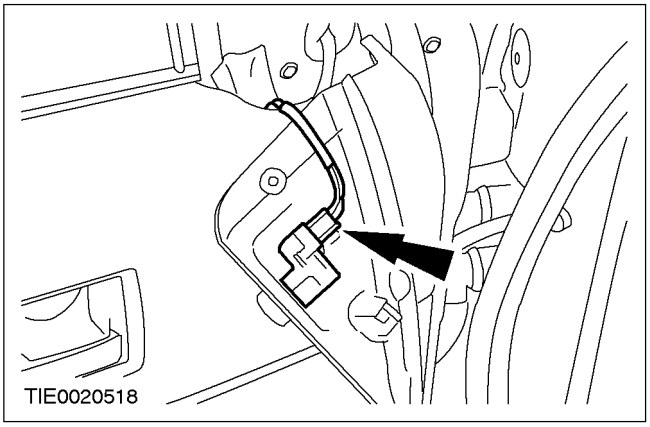
Removal

1. Remove the exterior mirror trim panel.

1. Remove the screw cover.
2. Remove the retaining screw.

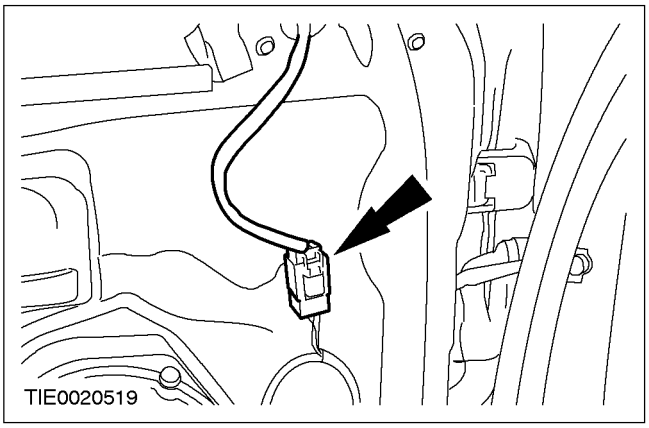


2. Disconnect the mirror control switch electrical connector.

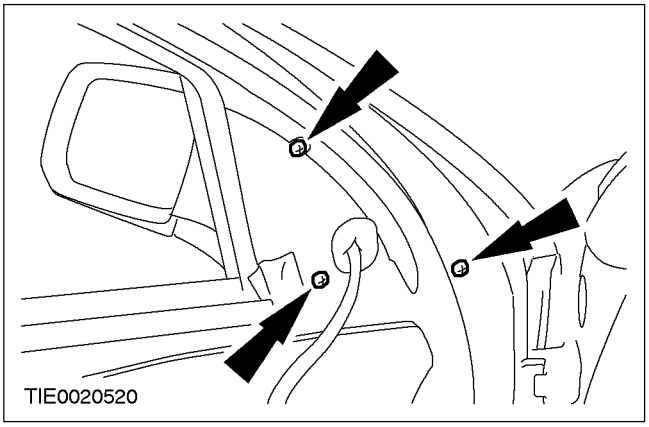


3. Remove the front door trim panel. For additional information, refer to Section 501-05.

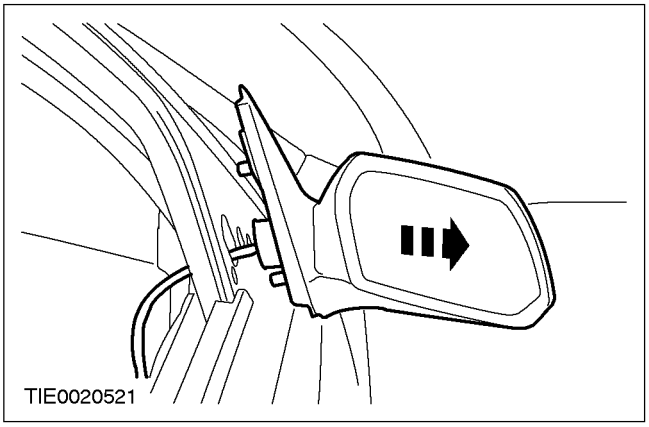
4. Disconnect the mirror electrical connector.



5. Remove the mirror retaining screws.



6. Remove the mirror.

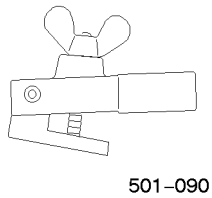


Installation

1. To install, reverse the removal procedure.

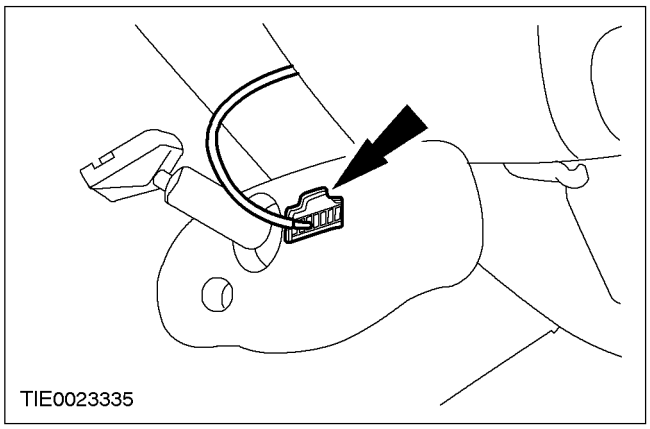
REMOVAL AND INSTALLATION

Auto-dimming Interior Mirror

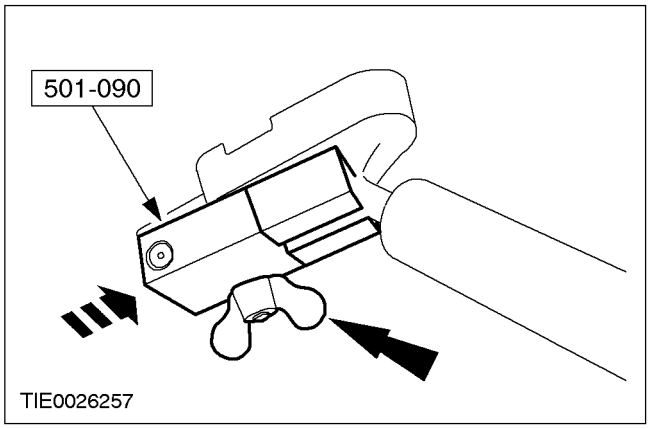
Special Tool(s)	
	Remover, Interior Rear View Mirror 501-090 (43-002)

Removal

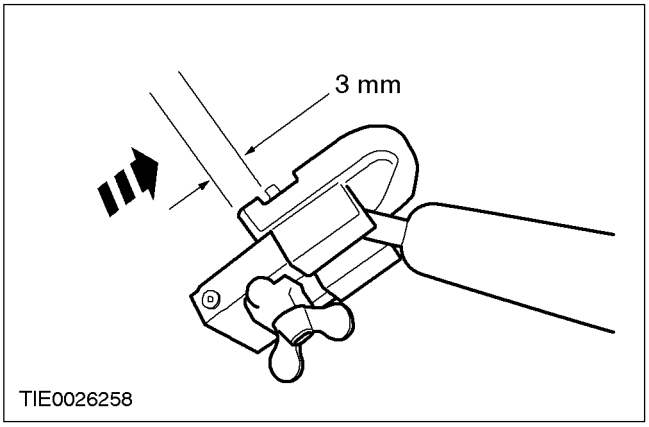
1. **Disconnect the auto-dimming interior mirror electrical connector.**



2. **Install the special tool to the auto-dimming interior mirror.**
   - Tighten the retaining nut.



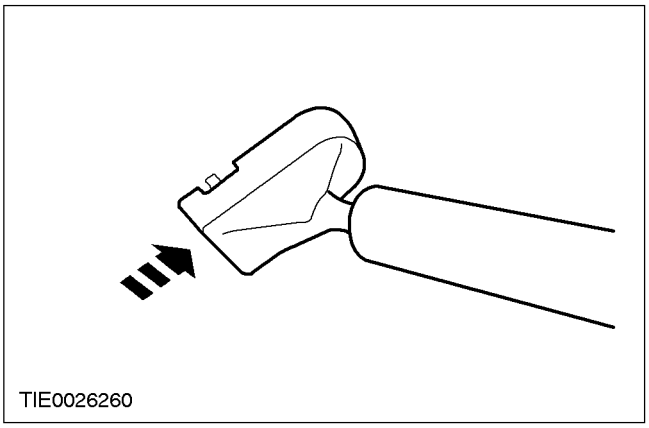
3. **Using a suitable wooden block and a soft faced hammer, push the special tool upwards to release the locking tang.**



4. **Remove the special tool.**
   - Loosen the retaining nut
5. **CAUTION: Care must be taken when removing the auto-dimming interior mirror to prevent damage to the windshield glass.**

NOTE: Support the auto-dimming interior mirror.

Using a suitable wooden block and a soft faced hammer, remove the auto-dimming interior mirror.

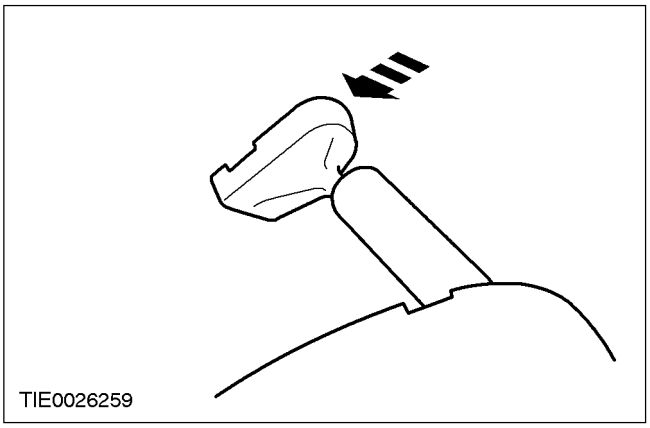


REMOVAL AND INSTALLATION (Continued)

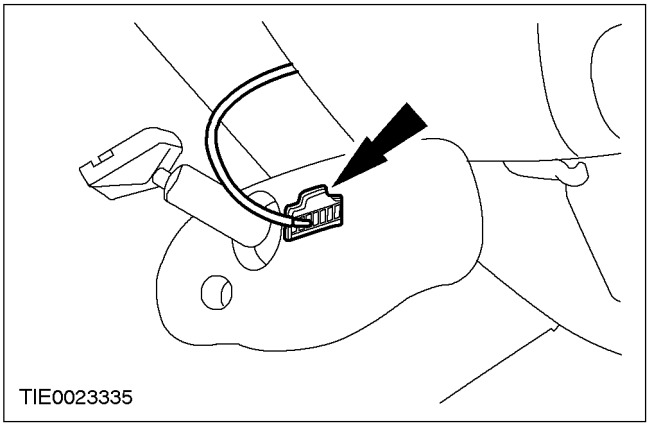
Installation

1. **NOTE:** Make sure the auto-dimming interior mirror is correctly located.

   Attach the auto-dimming interior mirror to the mounting bracket.



2. **Using a suitable wooden block and a soft faced hammer, install the auto-dimming interior mirror.**
3. **Connect the auto-dimming interior mirror electrical connector.**



SECTION 501-10 Seating

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

SPECIFICATIONS

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Occupant Classification Sensor 501-10-5

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Principals of Operation 501-10-6
Inspection and Verification 501-10-6
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Front Seat ..... (40 100 0) 501-10-19
Front Seat Backrest 501-10-21
Front Seat Cushion ..... (40 104 0) 501-10-23
Rear Seat Backrest ..... (40 128 0) 501-10-24
Rear Seat Backrest Latch ..... (40 534 0) 501-10-26

DISASSEMBLY AND ASSEMBLY

Front Seat Cushion — 1.8L/2.0L/2.5L/2.0L Diesel ..... (40 104 0) 501-10-27
Front Seat Backrest — 1.8L/2.0L/2.5L/2.0L Diesel ..... (40 106 0) 501-10-28
Rear Seat Cushion — Vehicles With: Integrated Child Safety Seat 501-10-31
Rear Seat Backrest ..... (40 127 0) 501-10-33

SPECIFICATIONS

Torque Specifications

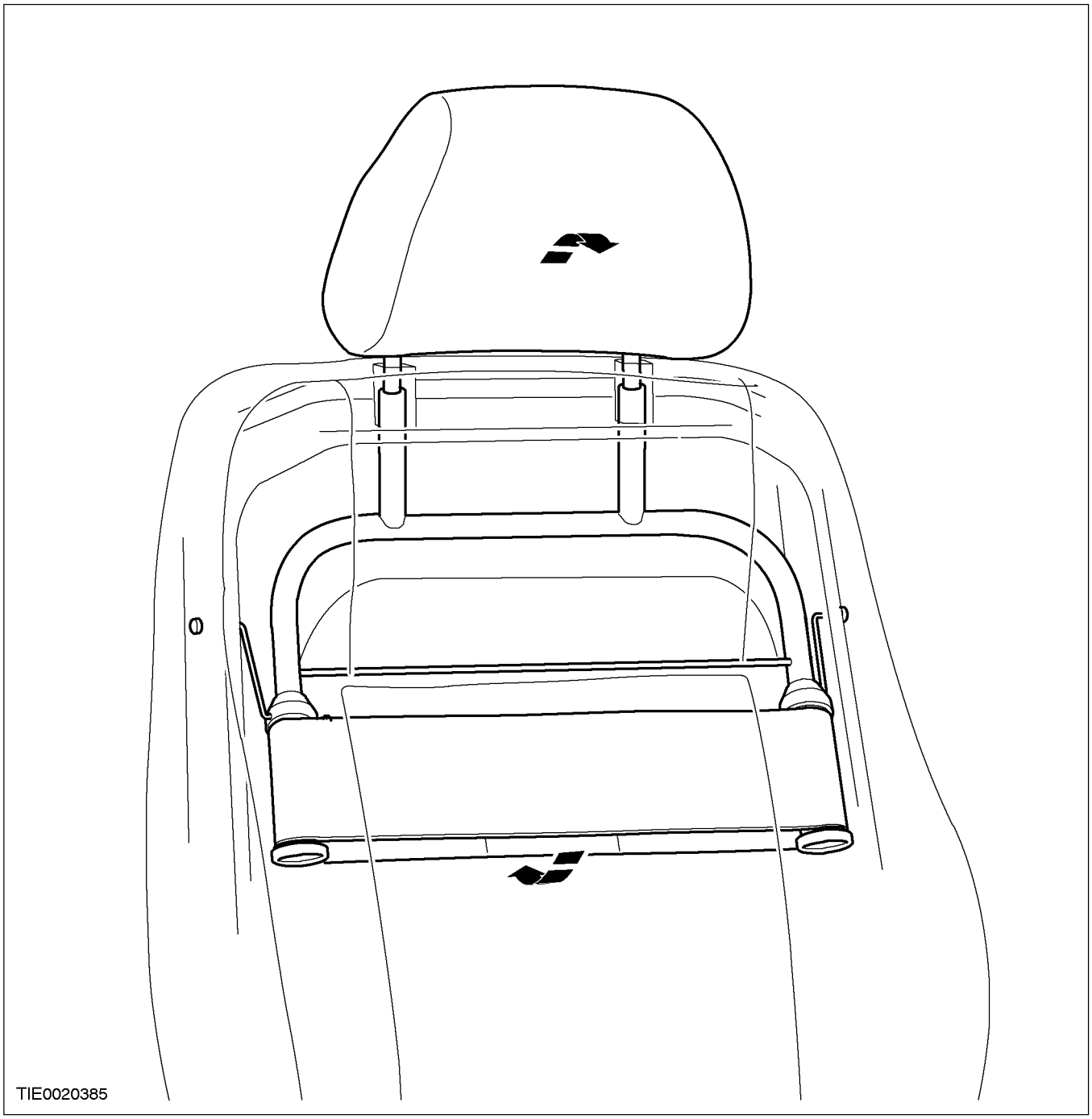
Description	Nm	lb-ft	lb-in
Front seat retaining bolts	25	18	–
Front seat backrest retaining bolts	45	33	–
Front seat cushion retaining nuts	15	11	–
Front safety belt lower anchor retaining bolt	35	26	-
Rear seat backrest center hinge pin	20	15	–
Rear seat backrest hinge retaining bolts	55	41	–
Rear seat backrest retaining bolts (4 door)	25	18	–
Rear seat backrest center hinge locking plate retaining bolt (5 door and Wagon)	25	18	-
Rear seat backrest latch bolts	30	22	–
Rear center safety belt lower anchor and buckle assembly retaining bolt	55	41	-
Rear seat cushion retaining bolts	25	18	–
Rear seat cushion integrated child safety seat retaining bolts	7	-	62

DESCRIPTION AND OPERATION

Seats

Depending on vehicle specifications the driver seat can be equipped with two-way power seat height adjustment or with eight-way power seat adjustment. The eight-way power seat adjustment functions are controlled electrically.

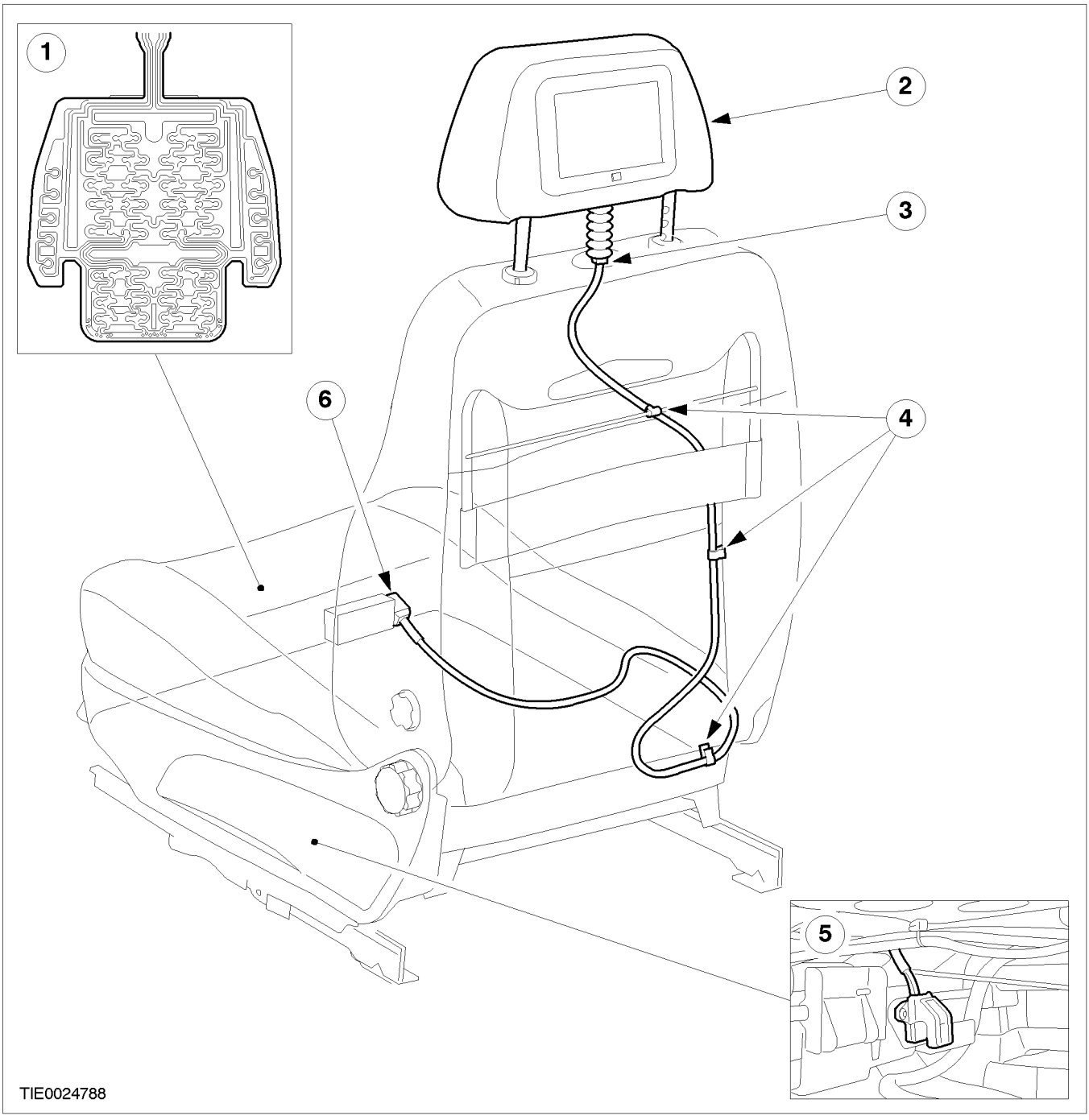
Front Seat Active Head Restraint



Both front seats are equipped with active head restraints that move forwards in the event of a rear collision. The two supports of the head restraints inside the seat backrest are joined together with a very hard wearing fabric tape. In the event of a rear collision the back of the occupant presses against the fabric tape which then presses the upper part of the head restraint

DESCRIPTION AND OPERATION (Continued)

upwards and forwards by means of a pivot point. When the pressure of the occupant is released the head restraint returns to its initial position by a spring mechanism.



Item	Part Number	Description
1		Occupant classification sensor (passenger seat only)
2		Head restraint with visual display screen

Item	Part Number	Description
3		Head restraint electrical connector
4		Video system harness retaining clips

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
5		Seat position sensor (driver seat only)
6		Under seat electrical connector

The vehicle can be specified with a video system. Visual display screens are fitted within the head restraint. An electrical wiring harness within the seat backrest carries the electrical signals from the control unit to the display screens. This wiring harness has a connector attached to the seat cushion base and at the top of the backrest for ease of servicing. If the display screen is inoperative, a new head restraint must be installed.

Seat Position Sensor

The seat position sensor is located on the driver seat track. The seat position sensor determines the position of the driver seat. For additional information, refer to Section 501-20A / 501-20B.

Occupant Classification Sensor

NOTE: The occupant classification sensor is an integral part of the passenger seat cushion and cannot be serviced separately.

The occupant classification sensor detects, by integrated pressure sensors, the presence of a passenger or object on the seat cushion. For additional information, refer to Section 501-20A / 501-20B.

DIAGNOSIS AND TESTING

Seats

For Wiring Scematics and Connector Information, refer to the Wiring Diagram Cell 501-10.

Principals of Operation

The vehicle is equipped with a bi-directional power operated driver seat as standard where the power function is limited to seat height adjustment only. Vehicles equipped with the full eight-way power seat functionality are controlled by a single multifunction control switch. In each case the switch is mounted onto the seat base panel within easy reach of the driver.

Seats with power height adjustment retain manual adjustment controls to attain seat adjustment. The bi-directional switch controls the operation of a single motor which depending on switch operation will either raise or lower the seat height through a series of mechanical linkages.

Seats with full eight-way adjustment are able to adjust the seat position through any one of four different motors. Each seat function is controlled by a single multifunction switch, which in turn controls the operation of the bi-directional motor of the selected adjustment feature to achieve:

- Vertical adjustment of the front of the seat cushion;
- Vertical adjustment of the rear of the seat cushion;
- Horizontal seat movement along the seat track through a mechanical worm drive;
- Seat backrest position adjustment of the backrest rake angle.

Inspection and Verification

1. Verify the customer concern
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
Damaged switch(es).	Fuse(s). Wiring harness Electrical connector(s). Motor(s). Switch(es).

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Condition	Possible Sources	Action
•The power seat is inoperative	•Seat control switch.	•CARRY OUT the Seat Control Switch Component Test. REFER to the Wiring Diagrams.
	•Circuit(s). •Motor(s).	• GO to Pinpoint Test A
•The power seat does not move horizontally	•Seat control switch.	•CARRY OUT the Seat Control Switch Component Test. REFER to the Wiring Diagrams.
	•Circuit(s). •Motor(s).	• GO to Pinpoint Test B
•The power seat does not move vertically	•Seat control switch.	•CARRY OUT the Seat Control Switch Component Test. REFER to the Wiring Diagrams.

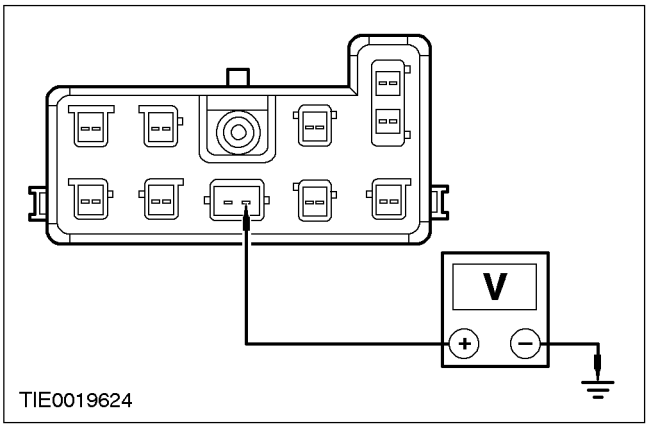
DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
	•Circuit(s). •Motor(s)	• GO to Pinpoint Test C
•The power seat does not recline	•Seat control switch.	•CARRY OUT the Seat Control Switch Component Test. REFER to the Wiring Diagrams.
	•Circuit. •Motor.	• GO to Pinpoint Test D
•The heated seat is inoperative	•Heated seat control switch(es).	•CARRY OUT the Heated Seat Control Switch Component Test. REFER to the Wiring Diagrams.
	•Circuit(s).	• GO to Pinpoint Test E

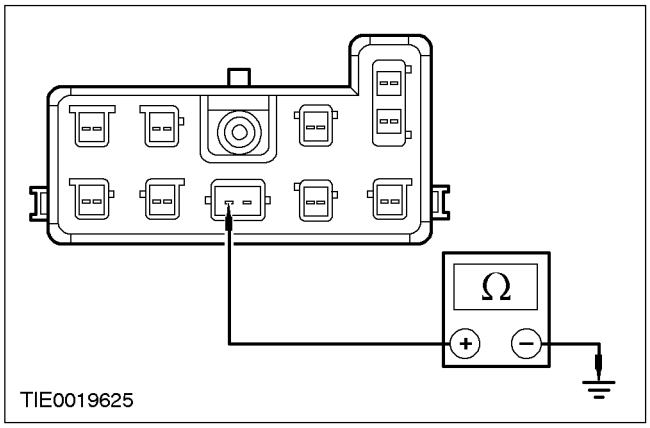
Pinpoint Tests

NOTE: Use a digital multimeter for all electrical measurements.

PINPOINT TEST A: THE POWER SEAT IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK THE VOLTAGE TO THE POWER SEAT SWITCH CIRCUIT 29-AH35 (OG/YE)	
	1 Disconnect Inoperative power seat control switch. 2 Key in ON position. 3 Measure the voltage between the power seat control switch C60 pin 15, circuit 29-AH35 (OG/YE) harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **A2** → **No** REPAIR circuit 29-AH35 (OG/YE). TEST the system for normal operation.
A2: CHECK THE POWER SEAT SWITCH GROUND CIRCUIT 31-AH35 (BK) FOR CONTINUITY	
	1 Key in OFF position.

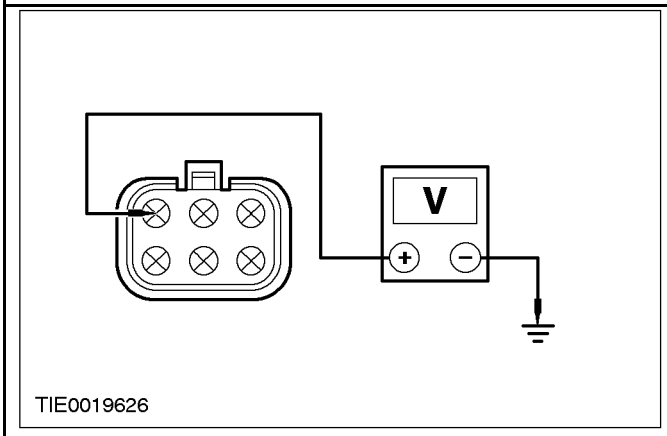
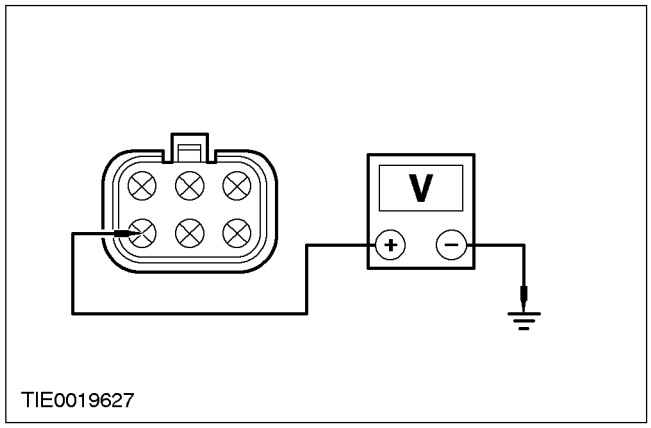
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**2** Measure the resistance between the power seat control switch C60 pin 16, circuit 31-AH35 (BK) harness side and ground. • Is the resistance less than 5 ohms? → **Yes** Eight-way power seat, INSTALL a new power seat control switch. Two-Way power seat, INSTALL a new power seat control switch and motor. → **No** REPAIR circuit 31-AH35 (BK). TEST the system for normal operation.

PINPOINT TEST B: THE POWER SEAT DOES NOT MOVE HORIZONTALLY

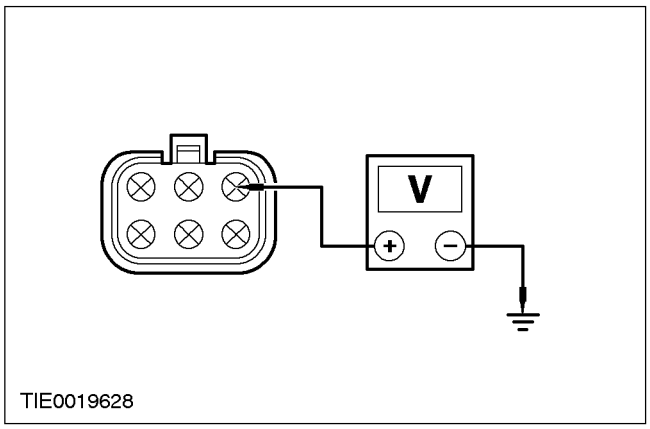
CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK THE REARWARD VOLTAGE TO THE SEAT HORIZONTAL MOVEMENT MOTOR	
	1 Key in OFF position. **2** Detach the seat assembly from the floor. **3** Disconnect C467 Power seat horizontal motor. **4** Key in ON position. **5** Operate the power seat horizontal control switch to the REARWARD position. **6** Measure the voltage between the power seat horizontal control switch C467 pin 1, circuit 33-AH9 (YE/GN), harness side and ground.

DIAGNOSIS AND TESTING (Continued)

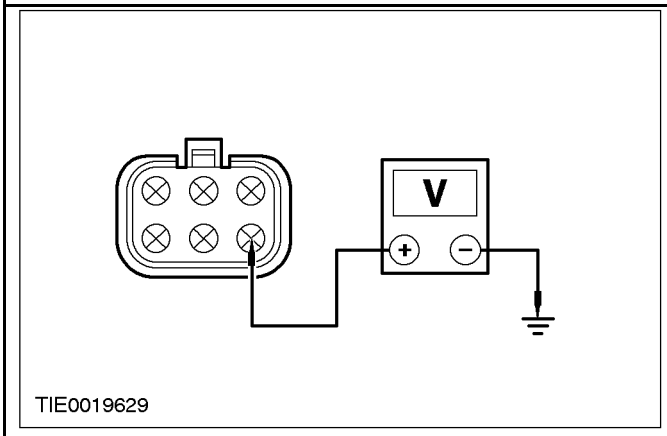
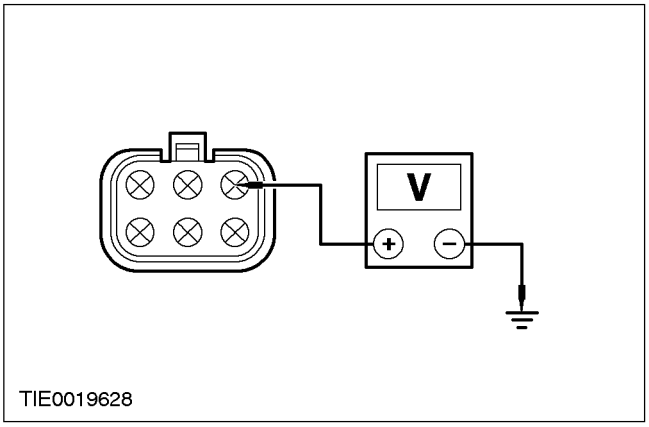
CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0019626	• Is the voltage greater than 10 volts? → **Yes** GO to **B2** → **Yes** REPAIR circuit 33-AH9 (YE/GN). TEST the system for normal operation.
B2: CHECK THE FORWARD VOLTAGE TO THE SEAT HORIZONTAL MOVEMENT MOTOR	
 TIE0019627	1 Operate the power seat horizontal control switch to the FORWARD position. 2 Measure the voltage between the power seat horizontal control switch C467 pin 4, circuit 32-AH9 (WH/GN), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** INSTALL a new seat horizontal movement motor. TEST the system for normal operation. → **No** REPAIR circuit 32-AH9 (WH/GN). TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

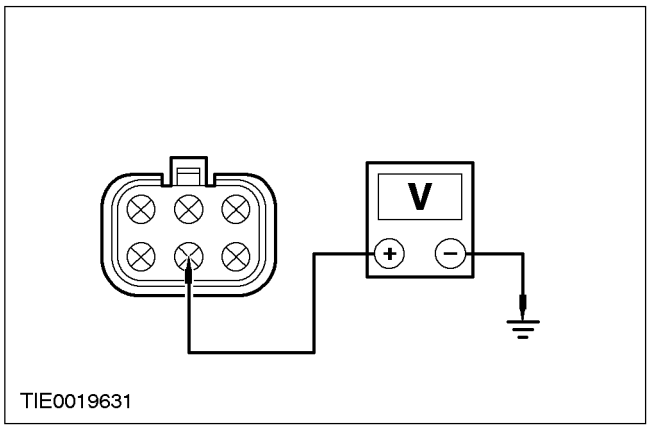
PINPOINT TEST C: THE POWER SEAT DOES NOT MOVE VERTICALLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK THE DOWN VOLTAGE TO THE SEAT FRONT HEIGHT MOVEMENT MOTOR	
NOTE: If the front seat height motor is inoperative GO to C1, if the rear seat height motor is inoperative GO to C3.	
 TIE0019628	1 Key in OFF position. 2 1. Detach the seat assembly from the floor. 3 Disconnect C467 Power seat front height motor. 4 Key in ON position. 5 Operate the power seat front height control switch to the DOWN position. 6 Measure the voltage between the power seat front height control switch C467 pin 3, circuit 33-AH10 (YE/BK), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **C4** → **No** REPAIR circuit 33-AH10 (YE/BK). TEST the system for normal operation.
C2: CHECK THE UP VOLTAGE TO THE SEAT FRONT HEIGHT MOVEMENT MOTOR	
	1 Operate the power seat front height control switch to the UP position. 2 Measure the voltage between the power seat front height control switch C467 pin 6, circuit 32-AH10 (WH/BK), harness side and ground.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0019629	• Is the voltage greater than 10 volts? → **Yes** INSTALL a new seat front height movement motor. TEST the system for normal operation. → **No** REPAIR circuit 32-AH10 (WH/BK). TEST the system for normal operation.
C3: CHECK THE DOWN VOLTAGE TO THE SEAT REAR HEIGHT MOVEMENT MOTOR	
 TIE0019628	1 Key in OFF position. 2 1. Detach the seat assembly from the floor. 3 Disconnect C467 Power seat rear height motor. 4 Key in ON position. 5 Operate the power seat rear height control switch to the DOWN position. 6 Measure the voltage between the power seat rear height control switch C467 pin 2, circuit 33-AH11 (YE/VT), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** C6 doesn't exist. → **No**

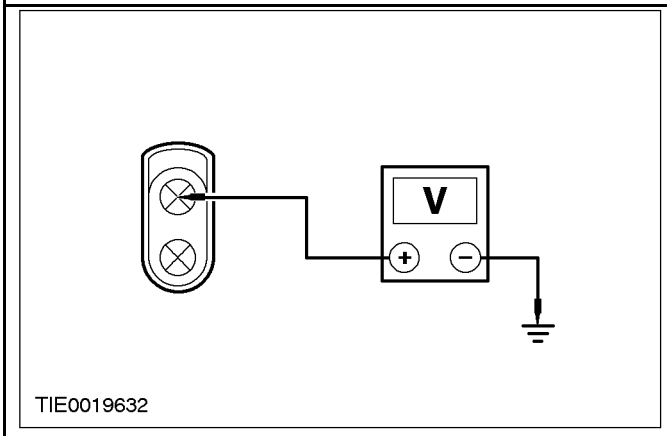
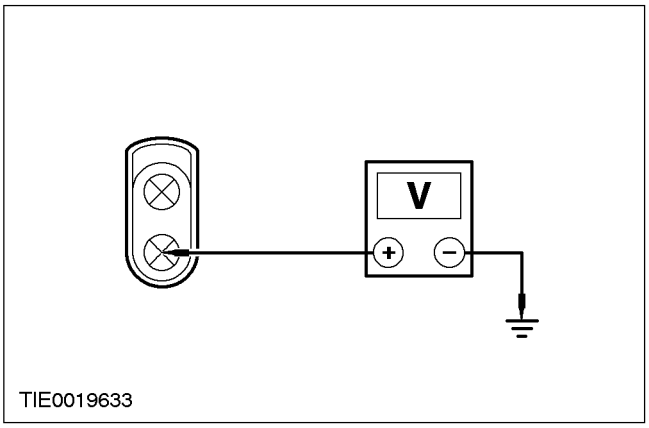
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR circuit 33-AH11 (YE/VT). TEST the system for normal operation.
C4: CHECK THE UP VOLTAGE TO THE SEAT REAR HEIGHT MOVEMENT MOTOR	
 TIE0019631	1 Operate the power seat rear height control switch in the UP position. 2 Measure the voltage between the power seat rear height control switch C467 pin 5, circuit 32-AH11 (WH/VT), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** INSTALL a new seat rear height movement motor. TEST the system for normal operation. → **No** REPAIR circuit 32-AH11 (WH/VT). TEST the system for normal operation.

PINPOINT TEST D: THE POWER SEAT DOES NOT RECLINE

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: CHECK THE REARWARD VOLTAGE TO THE SEAT BACKREST MOVEMENT MOTOR	
	1 Key in OFF position. 2 Detach the seat assembly from the floor. 3 Disconnect . 4 Key in ON position. 5 C463 Power seat backrest motor 6 Operate the power seat rear backrest control switch to the REARWARD position. 7 Measure the voltage between the power seat rear height control switch C463 pin 1, circuit 33-AH7 (YE/RD), harness side and ground.

DIAGNOSIS AND TESTING (Continued)

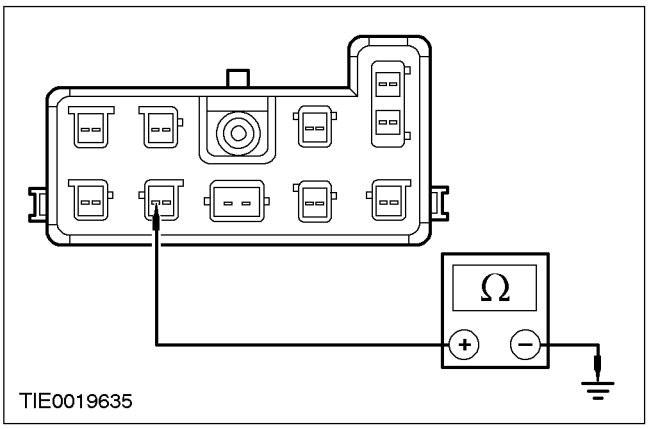
CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0019632	• Is the voltage greater than 10 volts? → **Yes** GO to **D2** → **No** REPAIR circuit 33-AH7 (YE/RD). TEST the system for normal operation.
D2: CHECK THE FORWARD VOLTAGE TO THE SEAT BACKREST MOVEMENT MOTOR	
 TIE0019633	1 Operate the power seat backrest control switch in the FORWARD position. 2 Measure the voltage between the power seat rear height control switch C463 pin 2, circuit 32-AH7 (WH/RD), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** INSTALL a new seat backrest movement motor. TEST the system for normal operation. → **No** REPAIR circuit 32-AH7 (WH/RD). TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

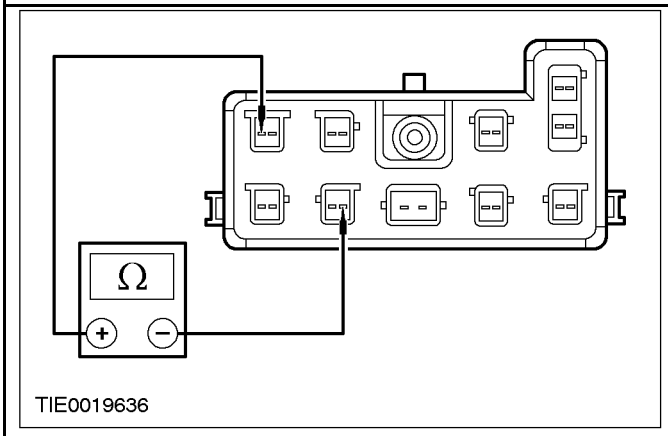
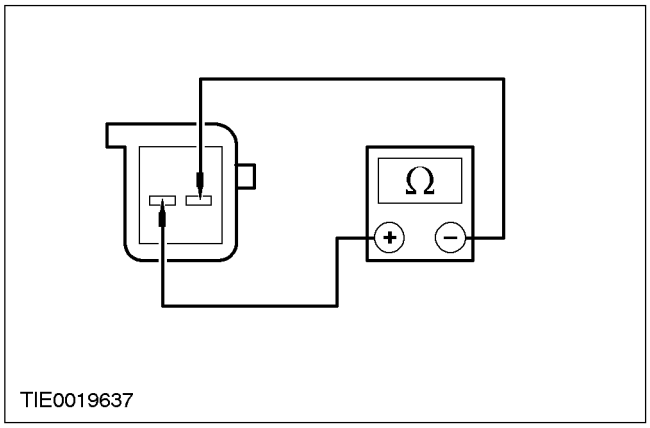
PINPOINT TEST E: THE HEATED SEAT IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: CHECK FOR VOLTAGE TO THE HEATED SEAT CONTROL SWITCH	
	1 Key in ON position. 2 Operate the heated seat control switch. • Does the yellow heated seat control switch LED illuminate? → **Yes** GO to **E2** → **No** GO to **E7**
E2: CHECK FOR VOLTAGE TO THE INOPERATIVE HEATED SEAT	
	1 Key in OFF position. 2 Disconnect Inoperative heated seat C60 or C61. 3 Key in ON position. 4 Operate the heated seat control switch. 5 Measure the voltage between: **NOTE:** LHD Driver Side Heated Seat - the heated seat cushion C60 pin 9, circuit 15S-HC6 (GN/YE) harness side and ground. **NOTE:** LHD Passenger Side Heated Seat - the heated seat cushion C61 pin 9, circuit 15S-HC9 (GN/BK) harness side and ground. **NOTE:** RHD Driver Side Heated Seat - the heated seat cushion C60 pin 9, circuit 15S-HC9 (GN/BK) harness side and ground. **NOTE:** RHD Passenger Side Heated Seat - the heated seat cushion C61 pin 9, circuit 15S-HC6 (GN/YE) harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **E3** → **No** REPAIR circuit 15S-HC6 (GN/YE) left front seat or circuit 15S-HC9 (GN/BK) right front seat. TEST the system for normal operation.
E3: CHECK THE INOPERATIVE HEATED SEAT GROUND CIRCUIT	
	1 Key in OFF position.

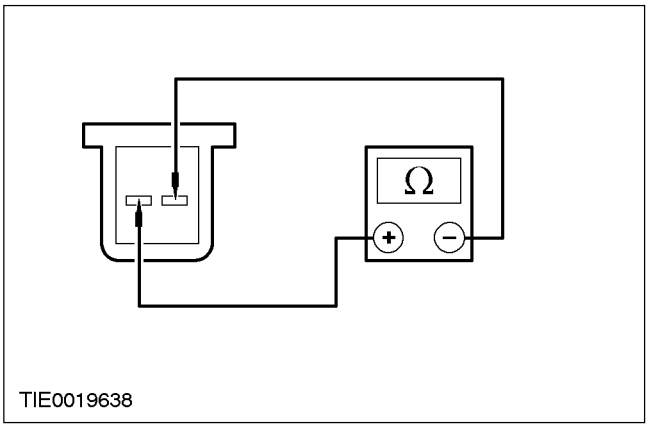
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	2 1. Measure the resistance between: **NOTE:** LHD Driver Side Heated Seat - the heated seat backrest C60 pin 18, circuit 31-HC7 (BK) harness side and ground. **NOTE:** LHD Passenger Side Heated Seat - the heated seat cushion C61 pin 18, circuit 31-HC18 (BK) harness side and ground. **NOTE:** RHD Driver Side Heated Seat - the heated seat cushion C60 pin 18, circuit 31-HC18 (BK) harness side and ground. **NOTE:** RHD Passenger Side Heated Seat - the heated seat backrest C61 pin 18, circuit 31-HC7 (BK) harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **E4** → **No** REPAIR circuit 31-HC7 (BK) left front seat or circuit 31-HC10 (BK) right front seat. TEST the system for normal operation.
E4: CHECK FOR CONTINUITY BETWEEN THE BACKREST AND CUSHION HEATER MATS	
	1 Measure the resistance between **NOTE:** LHD Driver Side Heated Seat - the heated seat C60 pins 10 and 17, circuit 15S-HC7 (GN/BU) harness side. **NOTE:** LHD Passenger Side Heated Seat - the heated seat C61 pins 10 and 17, circuit 15S-HC10 (GN/OG) harness side. **NOTE:** RHD Driver Side Heated Seat - the heated seat C61 pins 10 and 17, circuit 15S-HC10 (GN/OG) harness side. **NOTE:** RHD Passenger Side Heated Seat - the heated seat C60 pins 10 and 17, circuit 15S-HC7 (GN/BU) harness side.

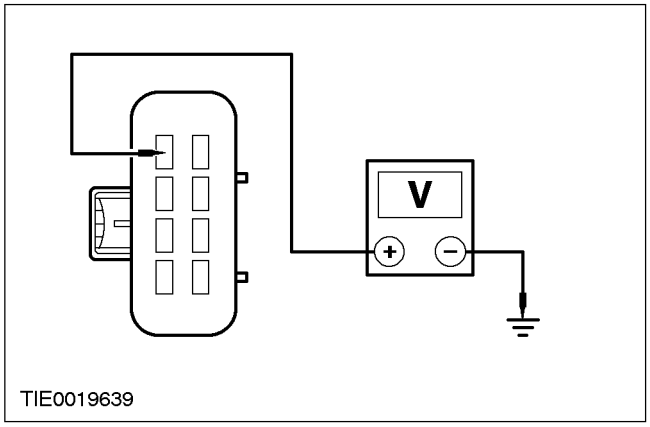
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0019636	• Is the resistance less than 5 ohms? → **Yes** GO to **E5** REPAIR circuit 15S-HC7 (GN/BU) left front seat or circuit 15S-HC10 (GN/OG) right front seat). TEST the system for normal operation.
E5: CHECK THE HEATED SEAT BACKREST HEATER MAT FOR CONTINUITY	
 TIE0019637	1 Measure the resistance between: **NOTE:** LHD Driver Side Heated Seat - the heated seat backrest C60h pins 1 and 2, circuit 31-HC7 (BK) component side. **NOTE:** LHD Passenger Side Heated Seat - the heated seat backrest C61h pins 1 and 2, circuit 31-HC10 (BK) component side. **NOTE:** RHD Driver Side Heated Seat - the heated seat backrest C61h pins 1 and 2, circuit 31-HC10 (BK) component side. **NOTE:** RHD Passenger Side Heated Seat - the heated seat backrest C60h pins 1 and 2, circuit 31-HC7 (BK) component side • Is the resistance less than 9 ohms? → **Yes** GO to **E6**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **No** INSTALL a new heated seat backrest heater mat. TEST the system for normal operation.
E6: CHECK THE HEATED SEAT CUSHION HEATER MAT FOR CONTINUITY	
 TIE0019638	1 Disconnect 1. C60d Heated seat cushion heater Graphic C60d pin 1 to pin 2 - ohms. 2 Measure the resistance between: **NOTE:** LHD Driver Side Heated Seat - the heated seat backrest C60d pins 1 and 2, circuit 15S-HC6 (GN/YE) component side. **NOTE:** LHD Passenger Side Heated Seat - the heated seat backrest C61d pins 1 and 2, circuit 15S-HC9 (GN/BK) component side. **NOTE:** RHD Driver Side Heated Seat - the heated seat backrest C61d pins 1 and 2, circuit 15S-HC9 (GN/BK) component side. **NOTE:** RHD Passenger Side Heated Seat - the heated seat backrest C60d pins 1 and 2, circuit 15S-HC6 (GN/YE) component side. • Is the resistance less than 9 ohms? → **Yes** VERIFY the customer concern. → **No** INSTALL a new heated seat cushion heater mat. TEST the system for normal operation.
E7: CHECK FOR IGNITION VOLTAGE TO THE HEATED SEAT CONTROL SWITCH	
	1 Operate the vehicle light switch. • Does the heated seat control switch green LED illuminate? → **Yes** REPAIR circuit 15-HC6 (GN/YE) left front seat or circuit 15-HC9 (GN/BK) right front seat. TEST the system for normal operation. → **No** GO to **E8**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
E8: CHECK FOR SWITCH VOLTAGE TO THE HEATED SEAT CONTROL SWITCH	
	1 Key in OFF position. 2 Disconnect Inoperative heated seat control switch. 3 Key in ON position. 4 Measure the voltage between the inoperative heated seat control switch C471 pin 8, circuit 64S-LH29 (BU) (C472 circuit 64S-LH43 [BU/RD] right front seat), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** REPAIR circuit 31-LH29 (BK) left front seat or circuit 31-LH43 (BK) right front seat. TEST the system for normal operation. → **No** REPAIR circuit 64S-LH29 (BU) (circuit 64S-LH43 [BU/RD] right front seat). TEST the system for normal operation.

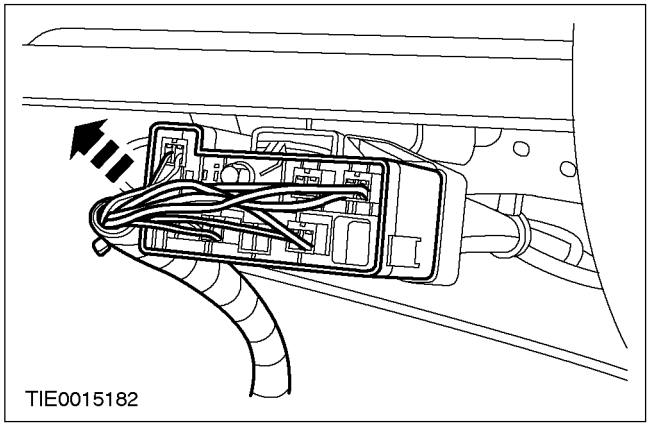
REMOVAL AND INSTALLATION

Front Seat (40 100 0)

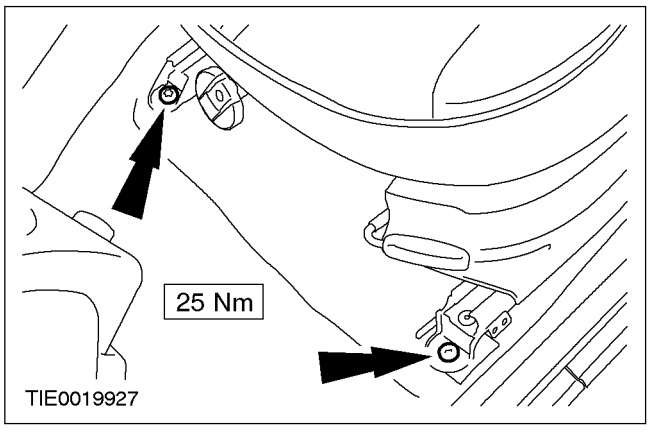
Removal

WARNING: To avoid accidental deployment the air bag control module backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Move the seat fully rearwards.**
3. **Disconnect the underseat electrical connector and video system electrical connector (if equipped).**

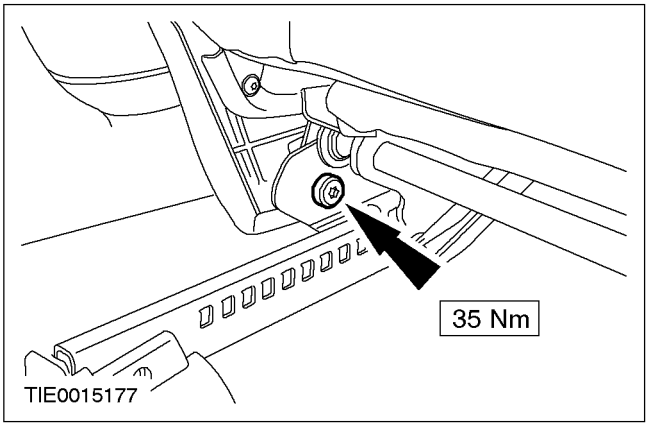

TIE0015182

4. **Remove the seat front retaining bolts.**



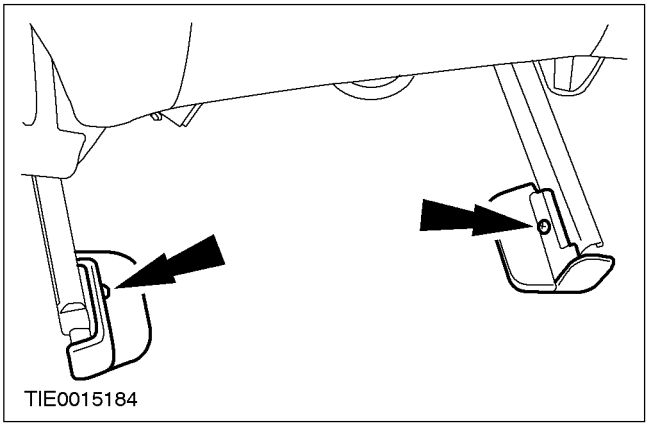
TIE0019927

5. **Move the seat fully forwards.**
6. **Detach the safety belt lower anchor from the underside of the seat.**

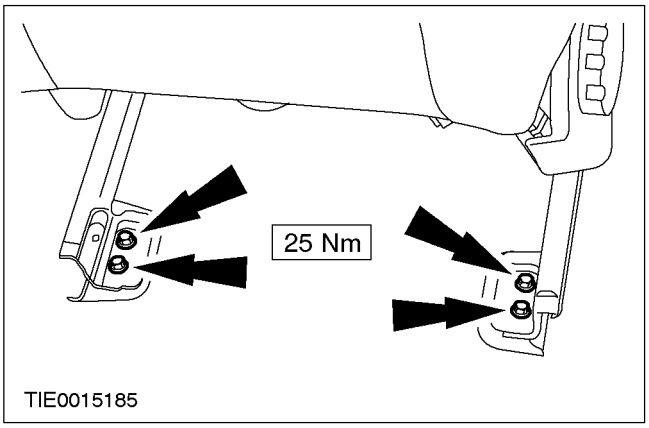


TIE0015177

7. **Remove the seat rear retaining bolt covers.**


TIE0015184

8. **Remove the seat rear retaining bolts and remove the seat.**



TIE0015185

REMOVAL AND INSTALLATION (Continued)

Installation

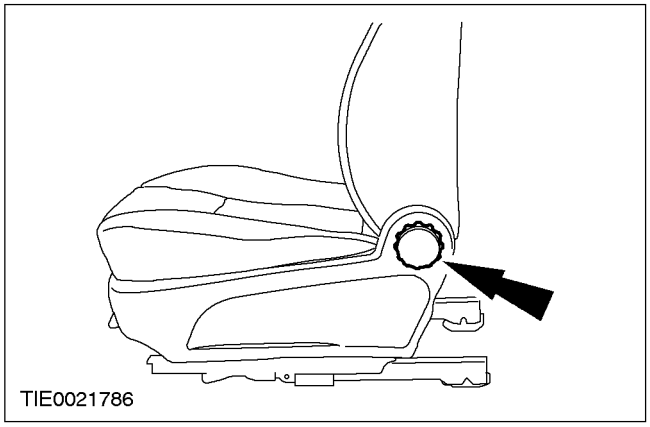
1. **To install, reverse the removal procedure.**
2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

REMOVAL AND INSTALLATION

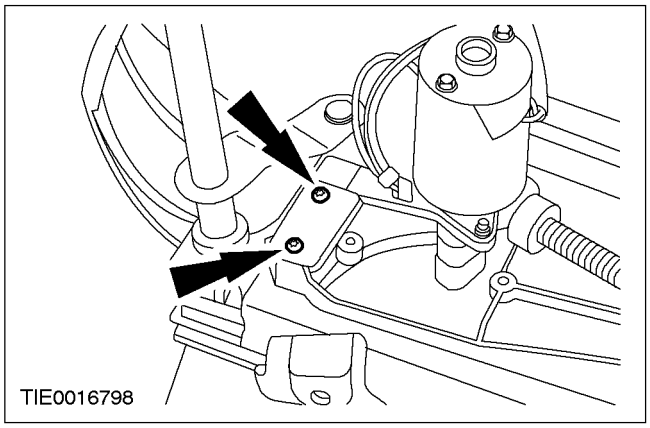
Front Seat Backrest

Removal

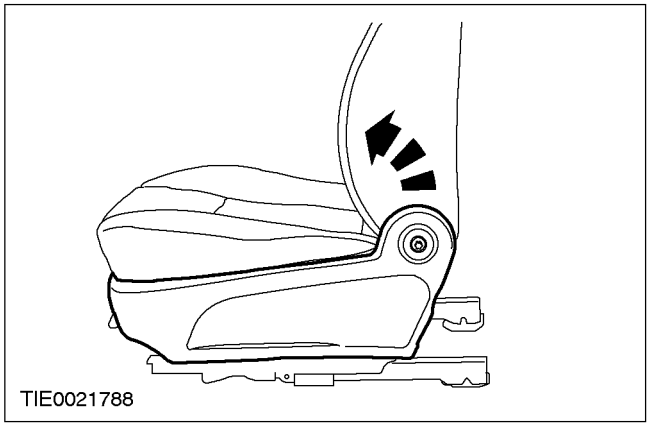
1. **Remove the front seat.** **For additional information, refer to Front Seat in this section.**
2. **Remove the backrest recliner handwheel (if equipped).**



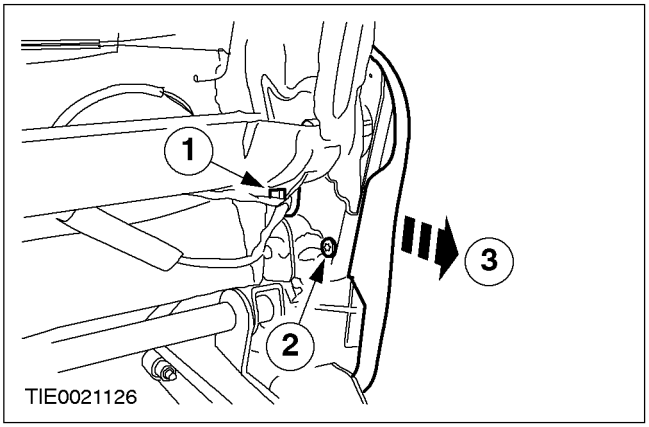
3. **Partially detach the outer side trim panel.**
   - Remove the screws.



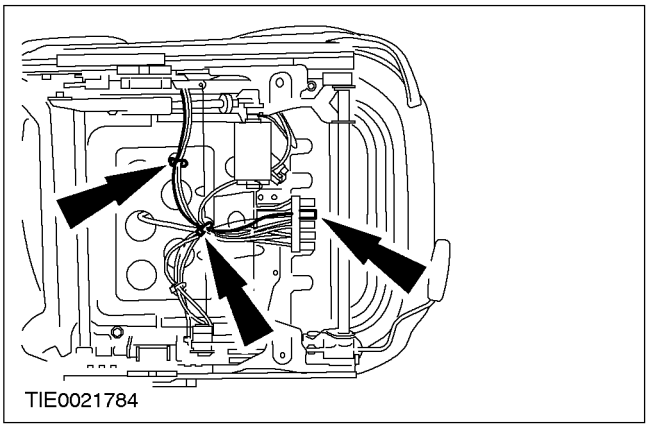
4. **Remove the outer side trim panel.**



5. **Remove the inner side trim panel.**
   1. Detach the wiring harness retaining clip.
   2. Remove the trim panel retaining screw.
   3. Detach the trim panel retaining clip.



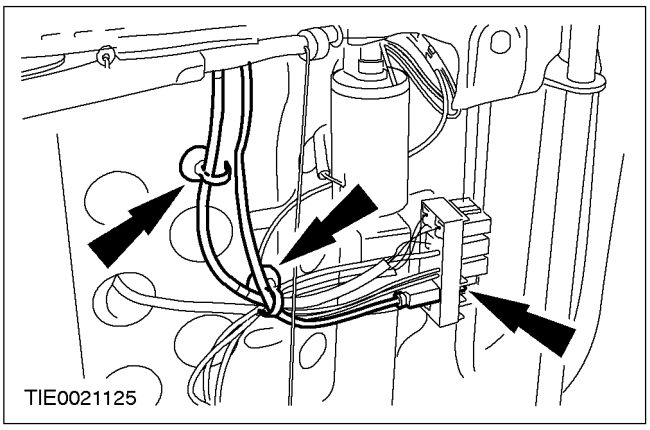
6. **Detach the side air bag module electrical connector from the underside of the seat.**
   - Detach the clips.
   - Detach the electrical connector.



REMOVAL AND INSTALLATION (Continued)

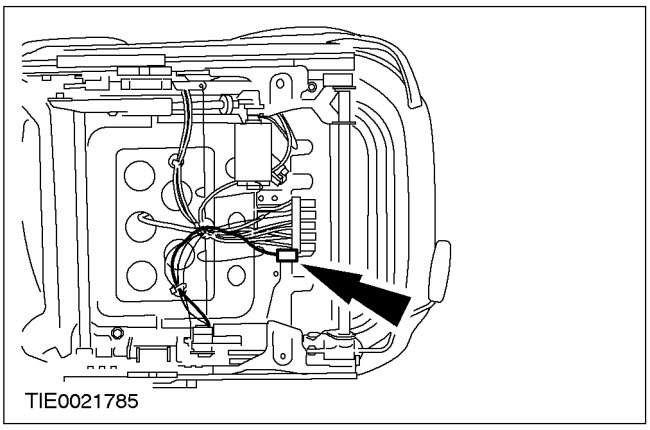
7. Detach the backrest heater mat electrical connector from the underside of the seat (if equipped).

- Detach the clips.
- Detach the electrical connector.

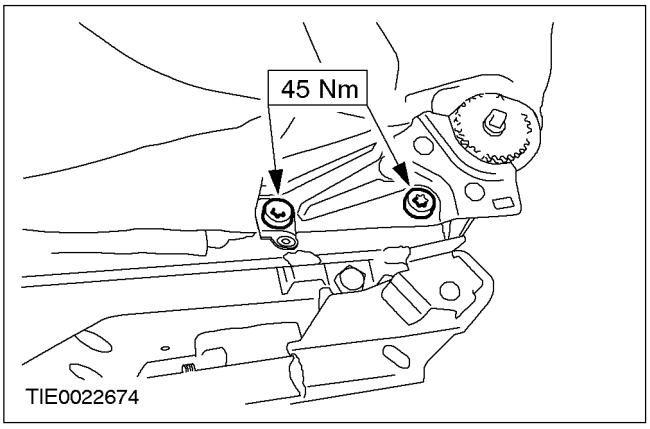


8. Detach the video system connector from the underside of the seat (if equipped).

- Detach the clips.
- Detach the electrical connector.



9. Remove the front seat backrest.



Installation

1. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

Front Seat Cushion (40 104 0)

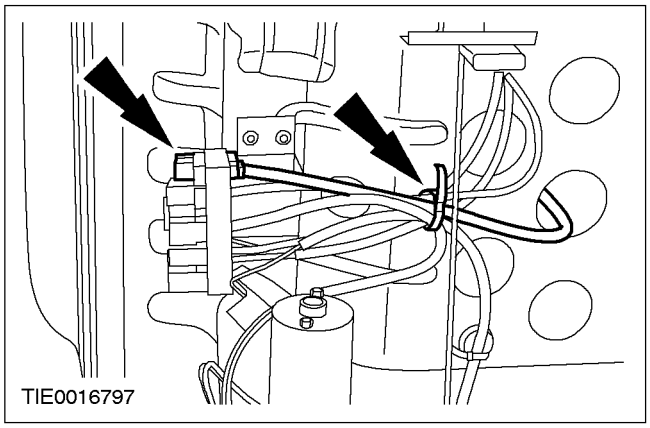
Removal

All vehicles

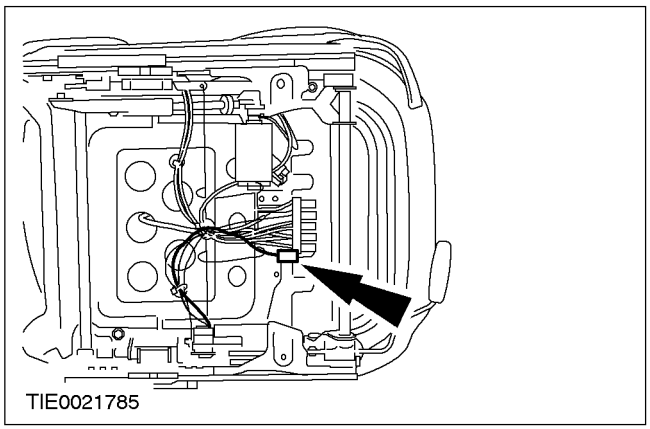
1. **Remove the front seat.** **For additional information, refer to Front Seat in this section.**

Driver and passenger seat

2. **Detach the cushion heater mat electrical connector (if equipped).**
   - Cut the cable tie.
   - Disconnect the electrical connector.



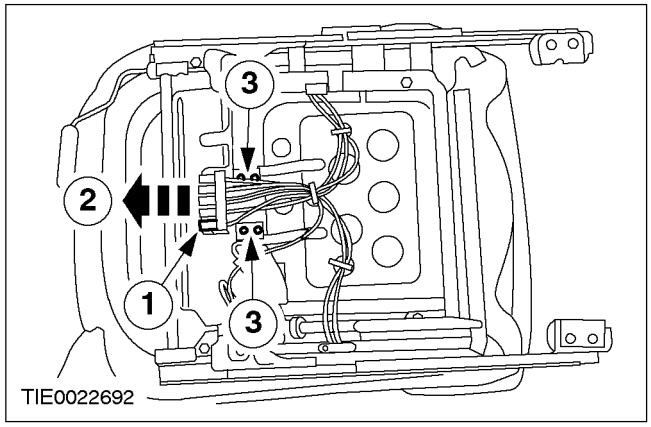
3. **Detach the video system electrical connector (if equipped).**



4. **Adjust the backrest to the fully upright position.**

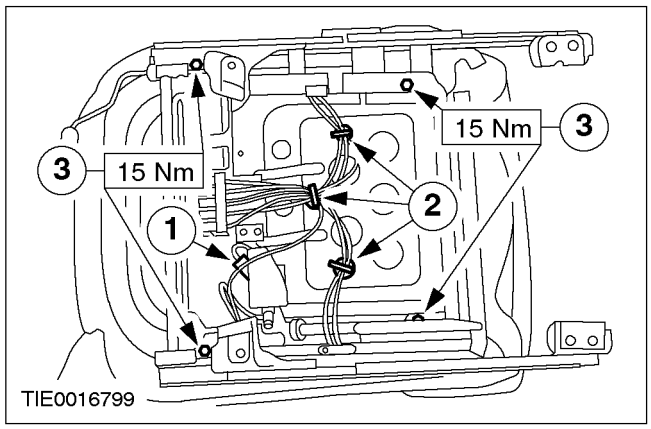
Passenger seat

5. **Remove the seat electrical connector mounting bracket.**
   1. Disconnect the occupant classification sensor electrical connector from the underseat connector.
   2. Detach the underseat connector from the underside of the seat.
   3. Drill out the rivets.



Driver and passenger seat

6. **Remove the front seat cushion.**
   1. Disconnect the seat height adjust motor electrical connector.
   2. Detach the wiring harness retaining clips.
   3. Remove the nuts.



Installation

1. **To install, reverse the removal procedure.**

REMOVAL AND INSTALLATION

Rear Seat Backrest (40 128 0)

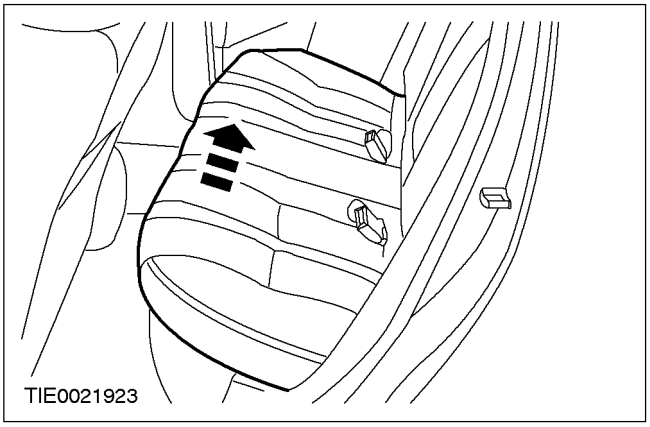
Removal

4-door and wagon

1. **NOTE:** Remove and discard the retaining clips.

   Remove the rear seat cushion.

   - Raise the front edge of the rear seat cushion.



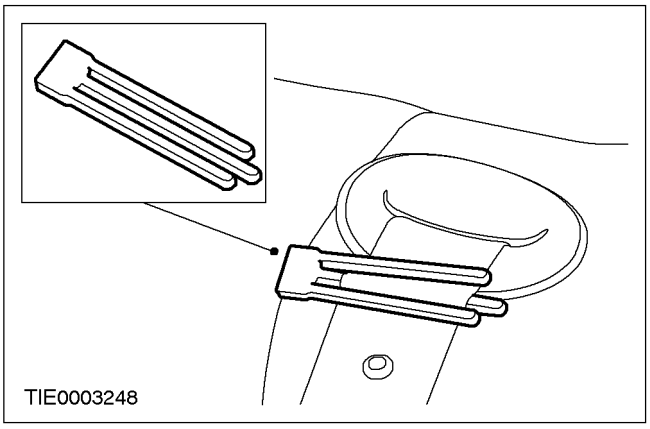
5-door

2. **Raise the rear edge of the rear seat cushion.**

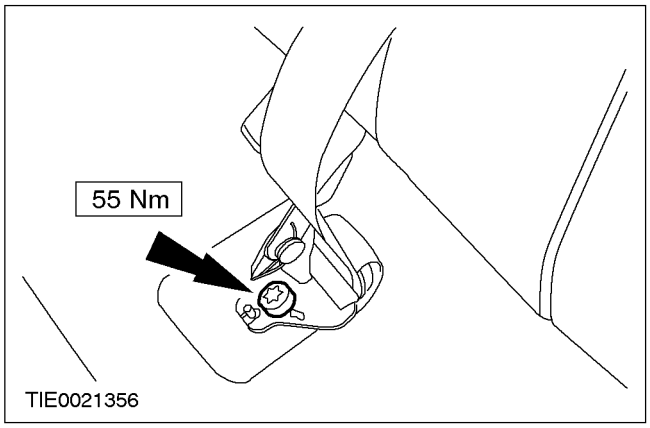
All vehicles

3. **CAUTION: Make sure a webbing retainer is fitted at least 200 mm towards the safety belt retractor from the webbing stop.**

   Install the safety belt webbing retainer.

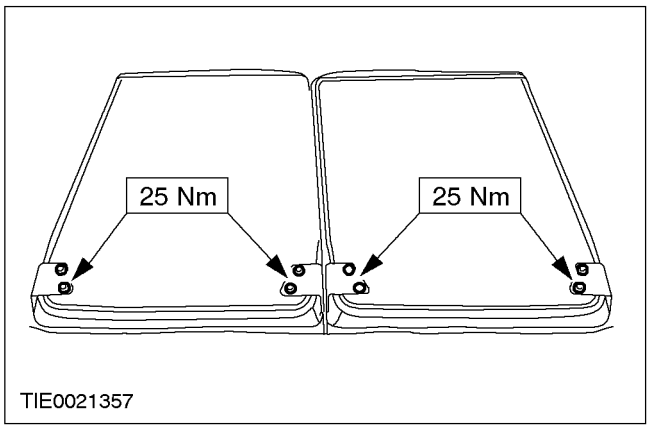


4. **Detach the rear center safety belt buckle.**



4-door

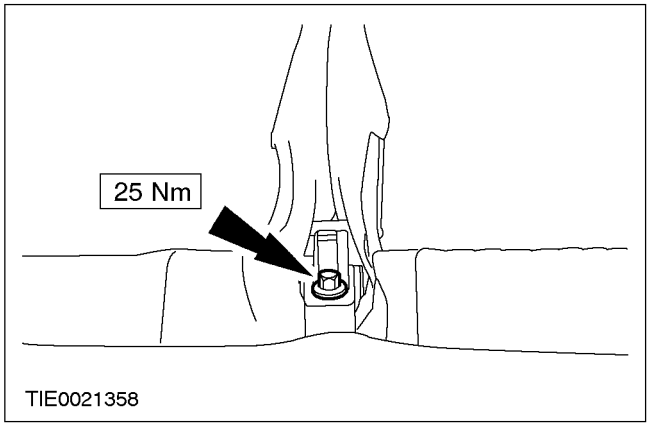
5. **Remove the rear seat backrest.**



5-door and wagon

6. **Fold the rear seat backrest forwards.**
7. **Remove the rear seat backrest center hinge locking plate.**

   - Remove the rear seat backrest center hinge locking plate retaining bolt.



REMOVAL AND INSTALLATION (Continued)

8. **NOTE:** Remove and discard the rear seat backrest outer hinge retaining clip.

   Remove the rear seat backrest.

Installation

1. ⚠ **CAUTION: Check for correct operation of the center safety belt retractor.**

NOTE: Install new retaining clips.

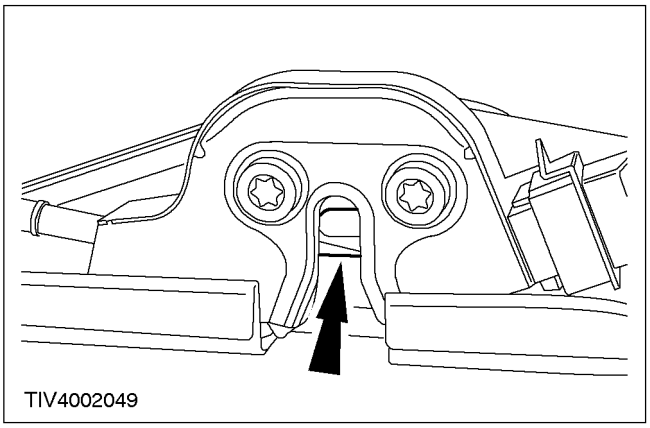
To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

Rear Seat Backrest Latch (40 534 0)

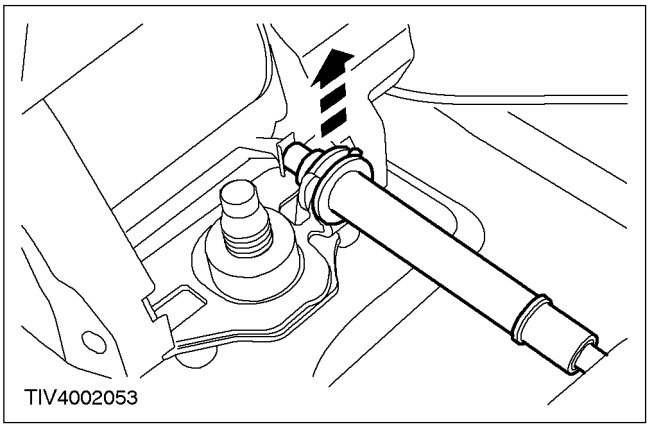
Removal

1. **Disassemble the rear seat backrest. For additional information, refer to Rear Seat Backrest in this section.**
2. **Lock the rear seat backrest latch.**

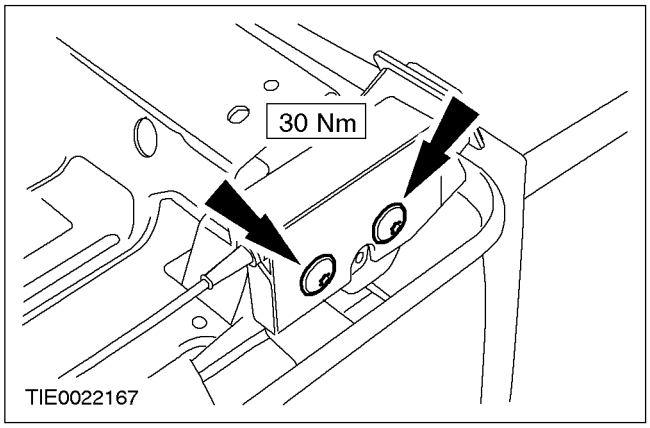


3. **NOTE:** To aid installation, note the backrest latch cable position on the safety belt retractor.

   Detach the backrest latch cable from the safety belt retractor.



4. **Remove the rear seat backrest latch.**



Installation

1. **CAUTION: Check the backrest latch cable routing, and the operation of the safety belt retractor and interlock before fully assembling the rear seat backrest.**

   To install, reverse the removal procedure.

DISASSEMBLY AND ASSEMBLY

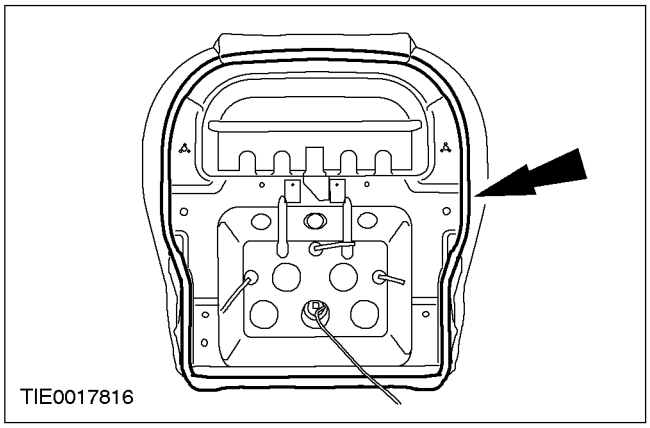
Front Seat Cushion — 1.8L/2.0L/2.5L/2.0L Diesel (40 104 0)

Disassembly

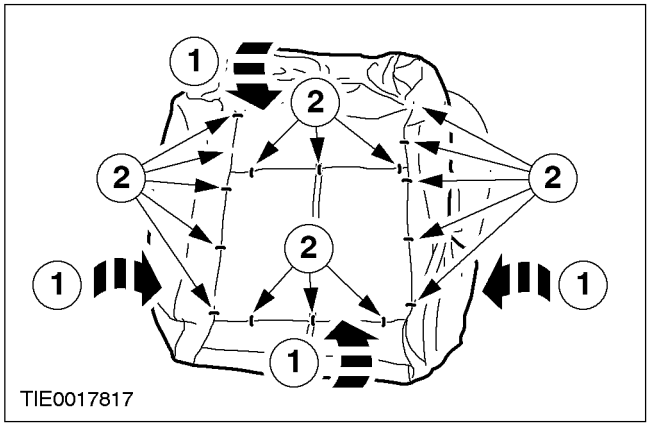
1. **NOTE:** The occupant classification sensor is an integral part of the passenger seat cushion and cannot be serviced separately. If the occupant classification sensor is found to be unserviceable, following the correct diagnosis and testing, a new passenger seat cushion must be installed.

   Detach the cushion cover from the underside of the seat.

   - Detach the retaining strips.



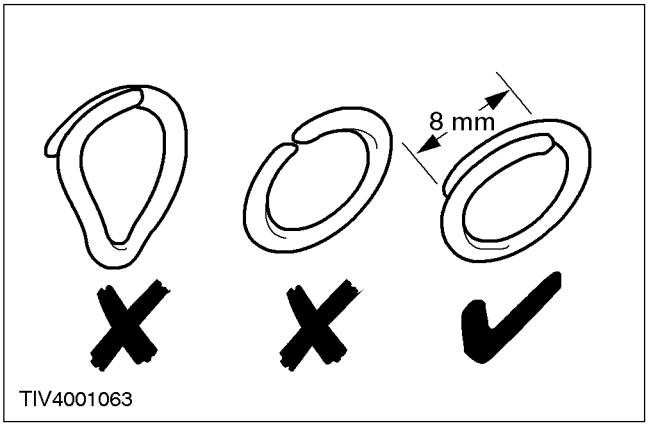
2. **Remove the cushion and heater mat (if equipped)from the seat base.**
3. **Remove the cushion cover.**
   1. Roll the cushion cover back to access the pleating hog rings.
   2. Cut the hog rings.



Assembly

1. **NOTE:** Use hog ring pliers to close the hog rings. Do not use any other tool. The hog rings must be closed to overlap as illustrated.

   To assemble, reverse the disassembly procedure.

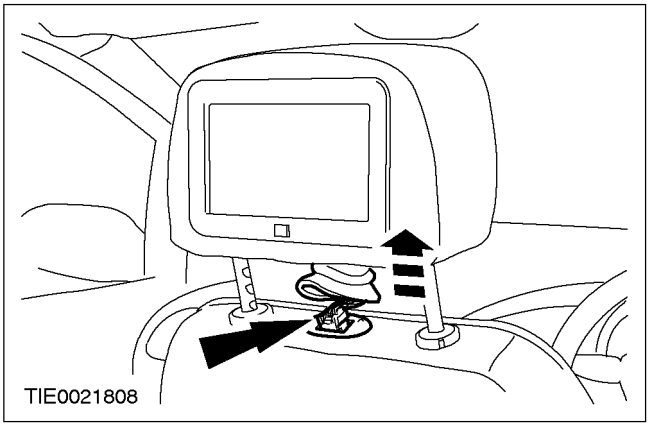


DISASSEMBLY AND ASSEMBLY

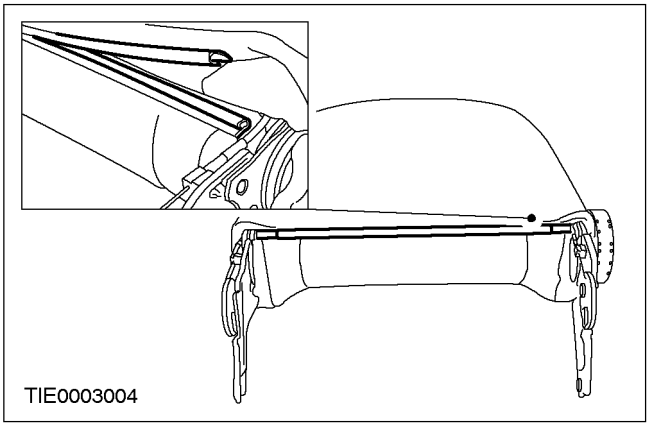
Front Seat Backrest — 1.8L/2.0L/2.5L/2.0L Diesel (40 106 0)

Disassembly

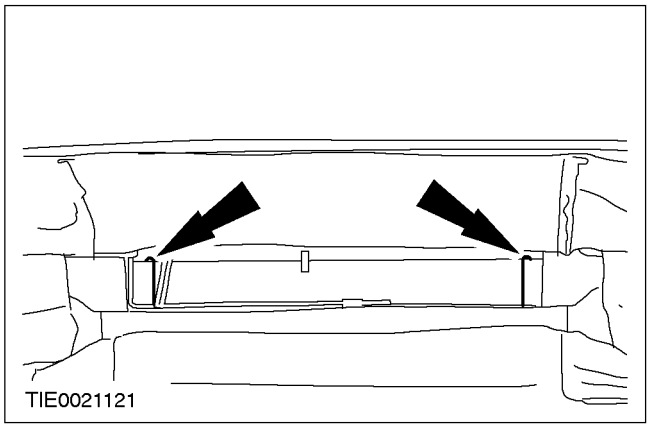
1. **Remove the head restraint.**
   - Detach the video system electrical connector (if equipped).



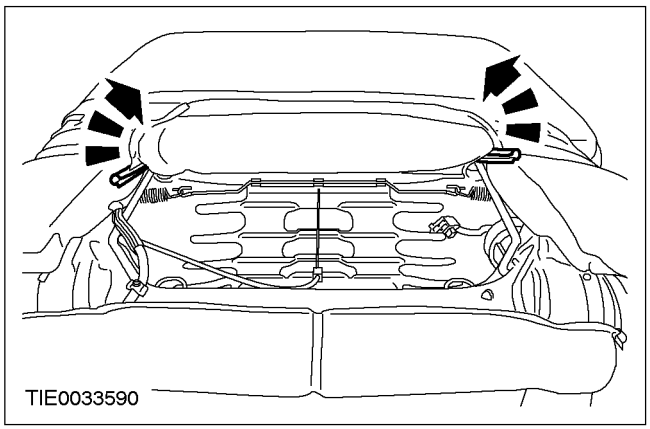
2. **Remove the backrest lumbar support adjust handwheel (if equipped).**
3. **Detach the backrest cover from the underside of the backrest.**
   - Detach the retaining strip.



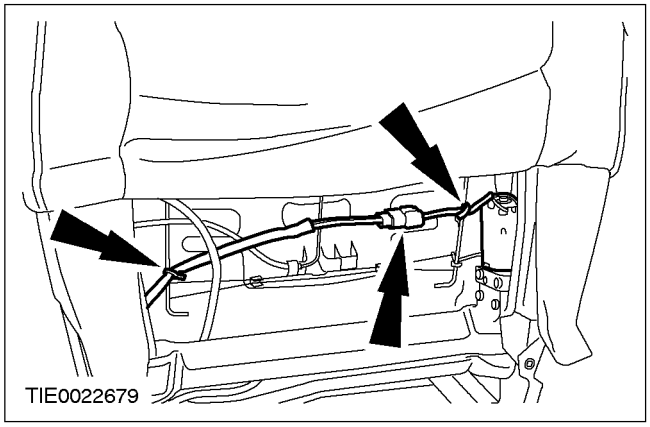
4. **Detach the backrest cover tensioning cords from the backrest.**



5. **Detach the backrest vertical retaining strips from the backrest frame.**

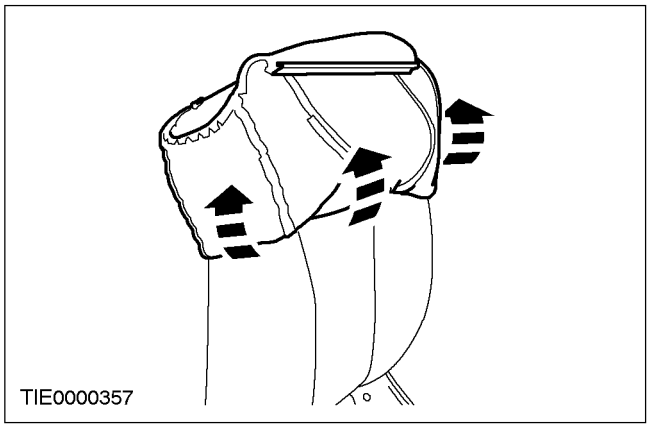


6. **Detach the backrest recline motor wiring harness from the backrest (if equipped).**
   - Disconnect the electrical connector.
   - Detach the clips.



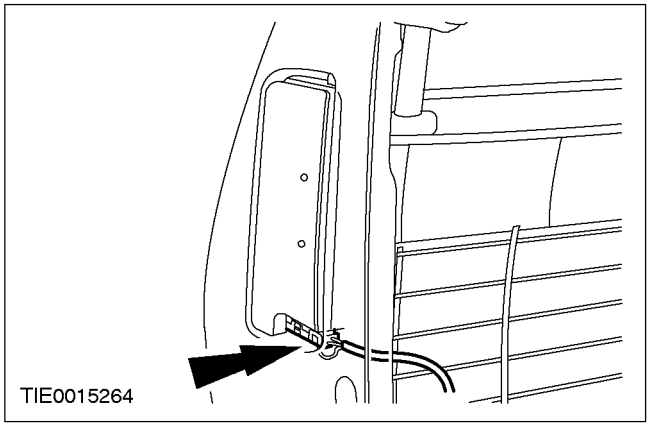
DISASSEMBLY AND ASSEMBLY (Continued)

7. Roll the backrest cover up the backrest.



8. ⚠ WARNING: Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury

Disconnect the side air bag module electrical connector.

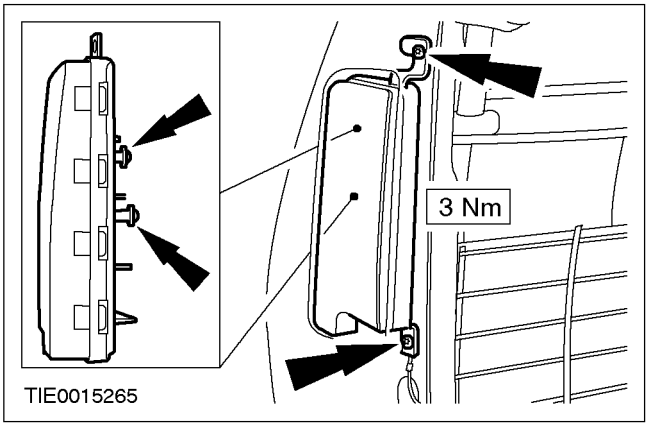


9. ⚠ WARNING: To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury

⚠ WARNING: To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury

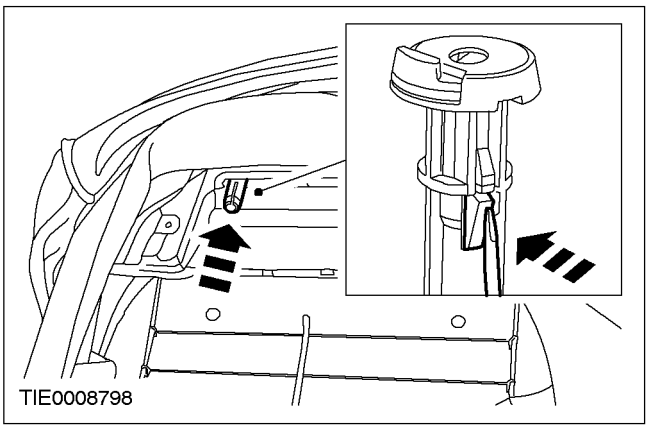
NOTE: To aid installation, note the position of the ground cable attached to the side air bag module lower retaining screw and the locating tangs on the rear of side air bag module.

Remove the side air bag module.



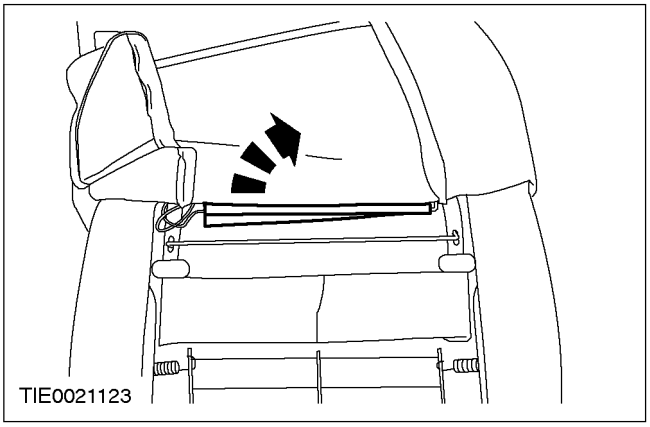
10. Remove the head restraint guides.

- Using a suitable screwdriver, depress the locking tang.

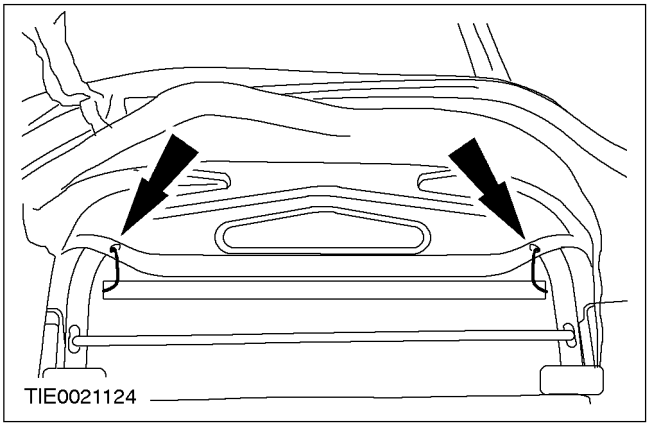


DISASSEMBLY AND ASSEMBLY (Continued)

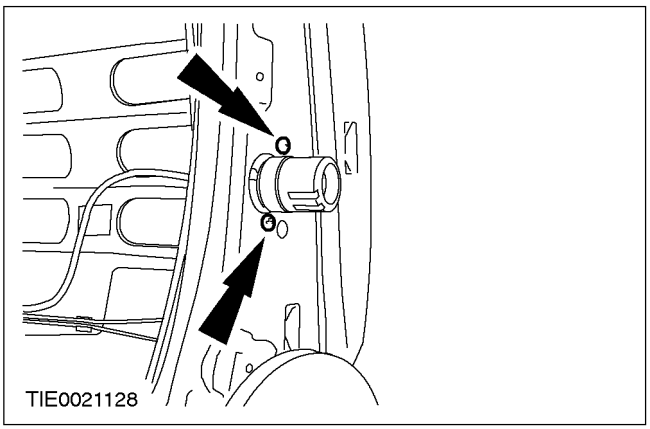
11. **Detach the backrest cover upper retaining strip from the backrest.**



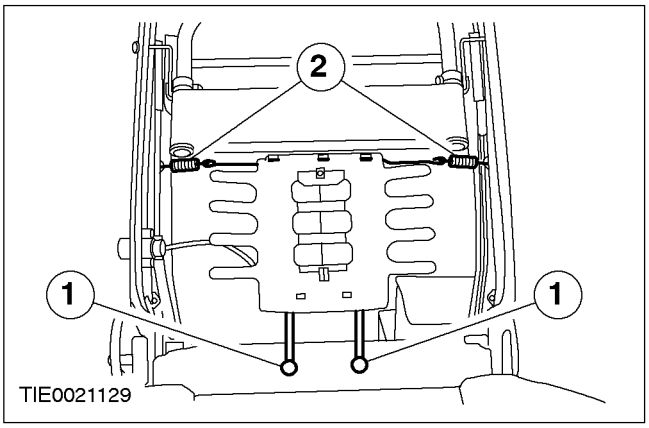
12. **Detach the backrest cover tensioning cords from the backrest.**



13. **Remove the backrest cover.**
14. **Detach the lumbar support adjuster from the backrest.**



15. **Remove the lumbar support.**



Assembly

1. **To assemble, reverse the disassembly procedure.**

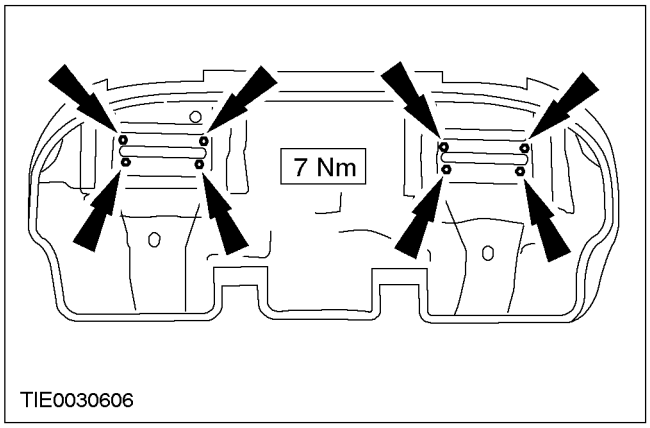
DISASSEMBLY AND ASSEMBLY

Rear Seat Cushion — Vehicles With: Integrated Child Safety Seat

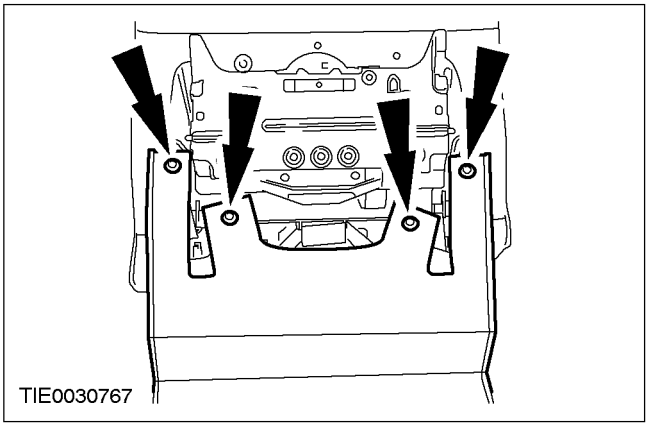
Disassembly

1. **CAUTION: The integrated child safety seats have a warning label, which is sewn to the cushion cover and attached to the safety seat cushion frame with clips.**

   Detach the integrated child safety seats from the cushion frame.

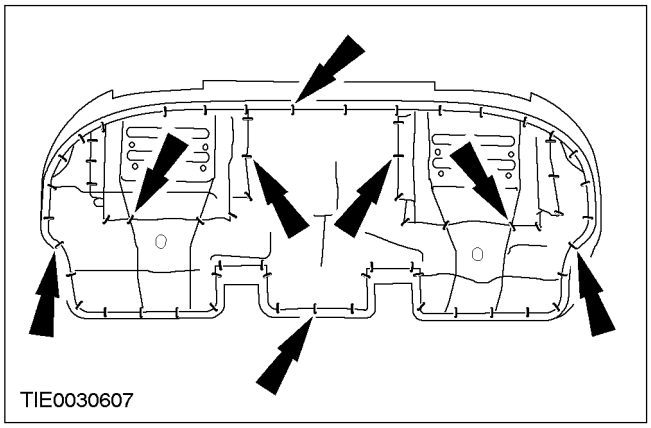


2. **Remove the integrated child safety seat.**
   - Remove the retaining clips.



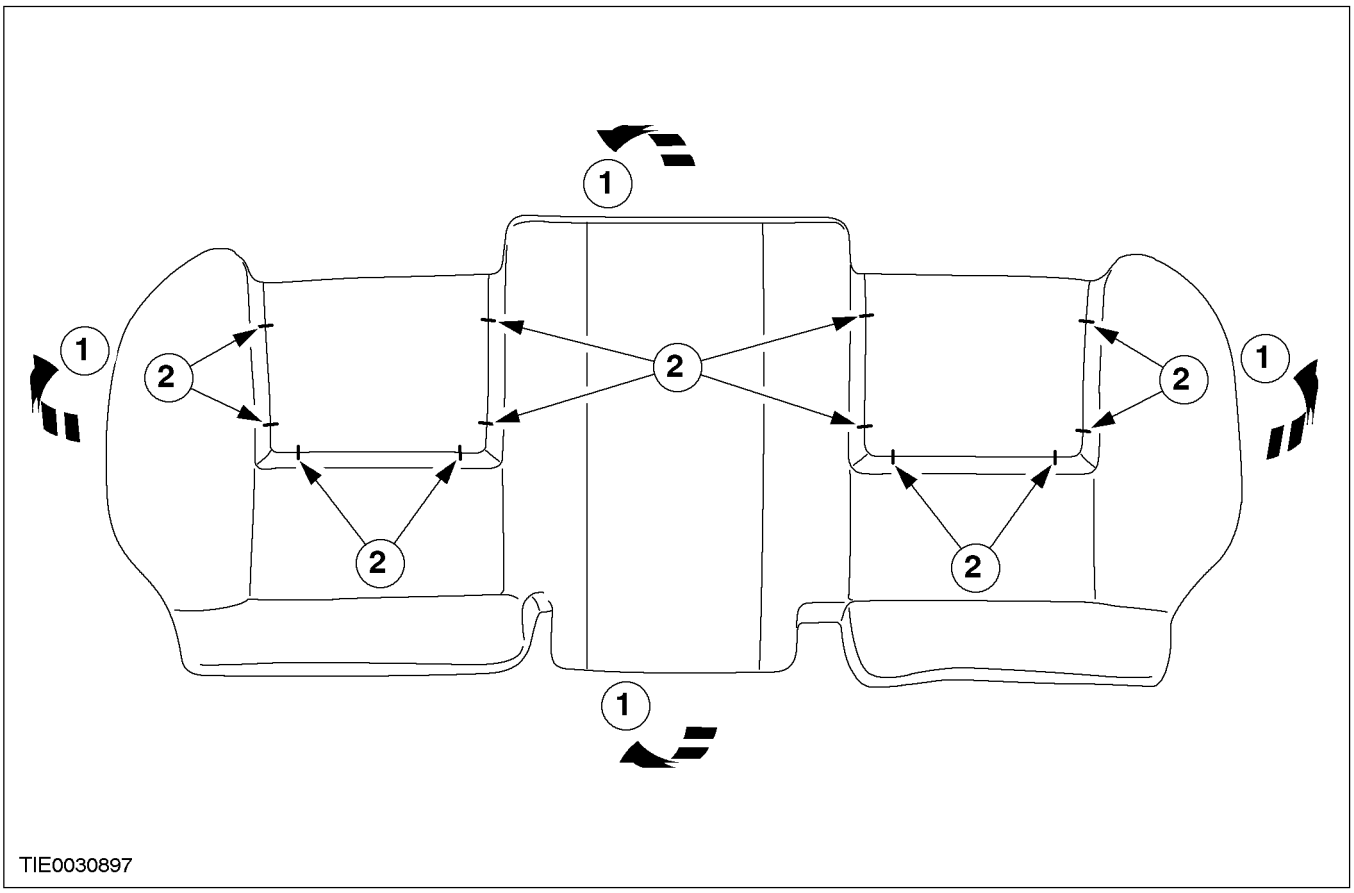
3. **NOTE:** Note the position of the hog rings, to aid installation.

   Detach the cushion cover and carpet from the underside of the seat.
   - Cut the hog rings.



4. **Remove the cushion cover.**
   1. Roll the cushion cover inwards to access the pleating hog rings.
   2. Cut the hog rings.

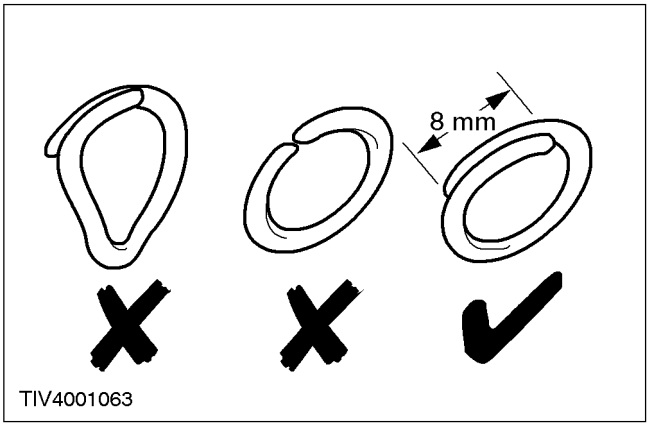
DISASSEMBLY AND ASSEMBLY (Continued)



Assembly

1. **NOTE:** Use hog ring pliers to close the hog rings. Do not use any other tool. The hog rings must be closed to overlap as illustrated.

   To assemble, reverse the disassembly procedure.

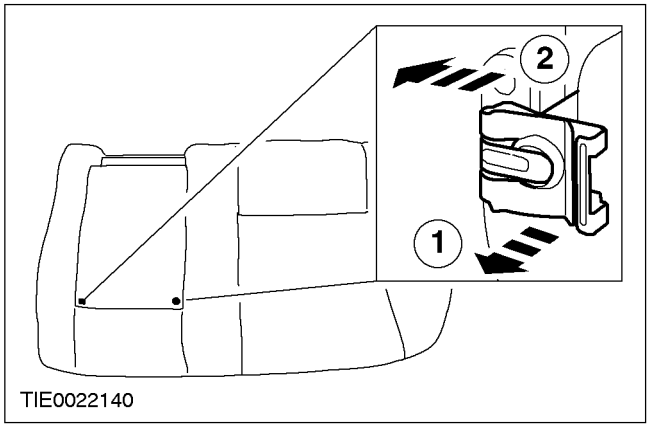


DISASSEMBLY AND ASSEMBLY

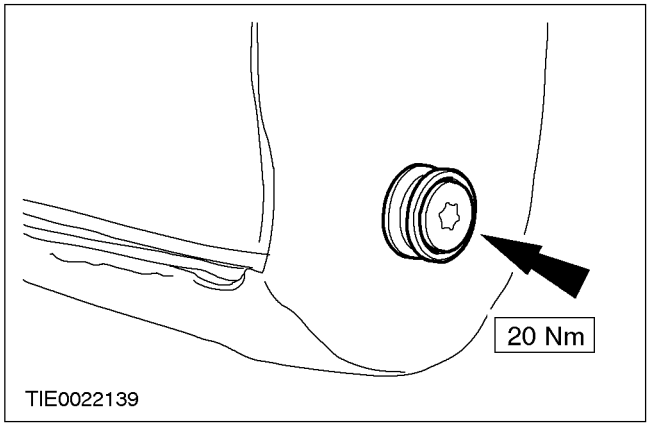
Rear Seat Backrest (40 127 0)

Disassembly

1. **Remove the head restraint(s).**
2. **Remove the armrest.**
   1. Release the retaining clips.
   2. Slide the retaining clips forwards.

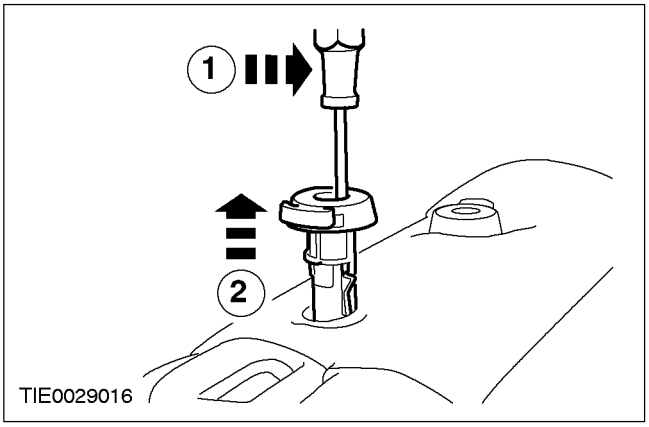


3. **Remove the backrest center hinge pin.**
   - Remove and discard the pin.

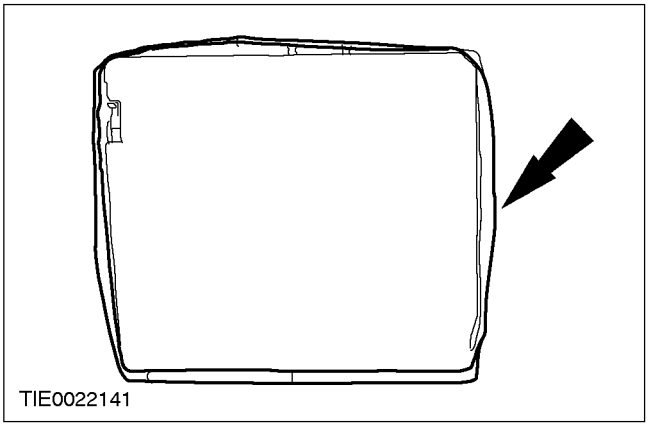


4. **NOTE:** The locking tang releases in the opposite direction for inner and outer head restraint guides.

   Remove the outer head restraint guides.
   1. Using a suitable screwdriver, depress the locking tang.
   2. Pull the guide upwards.

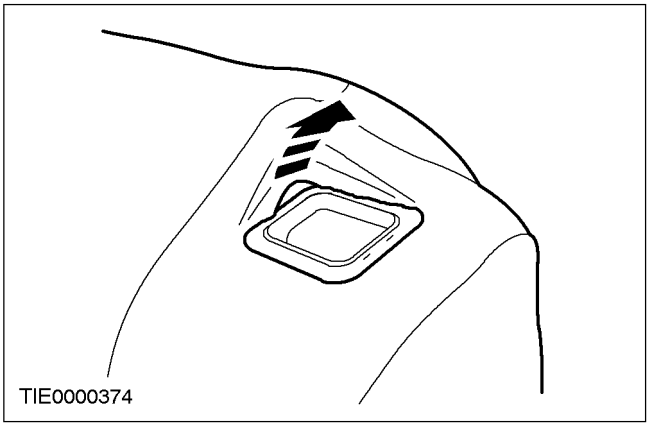


5. **Detach the backrest cover from the backrest.**
   - Detach the retaining strip.

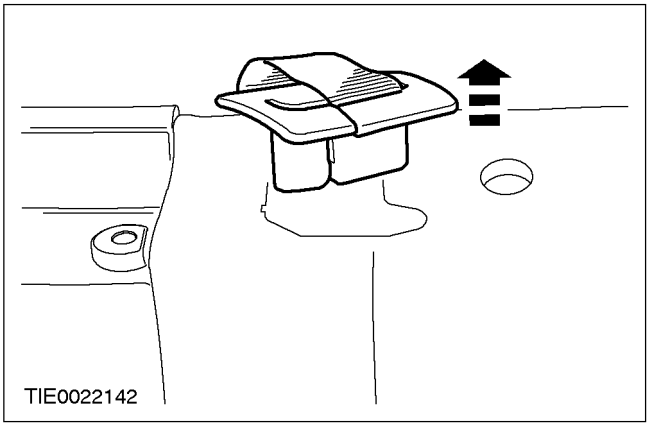


DISASSEMBLY AND ASSEMBLY (Continued)

6. Detach the backrest cover from the backrest release button.

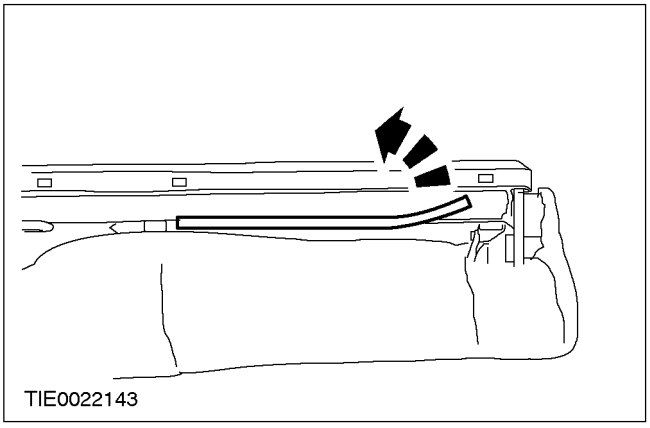


7. Remove the safety belt webbing trim panel.



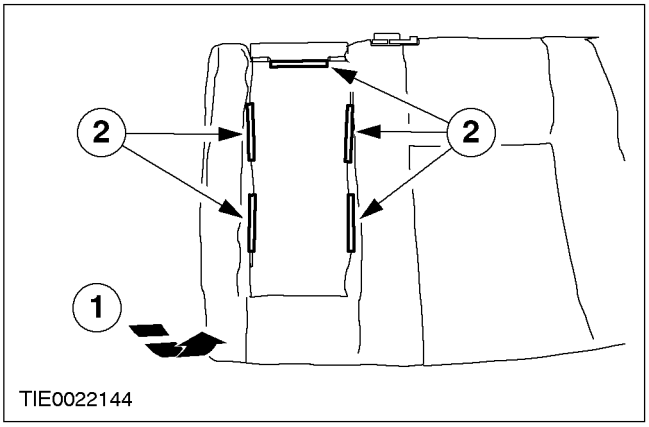
8. Detach the backrest cover from the underside of the armrest mounting bracket.

- Detach the retaining strip.



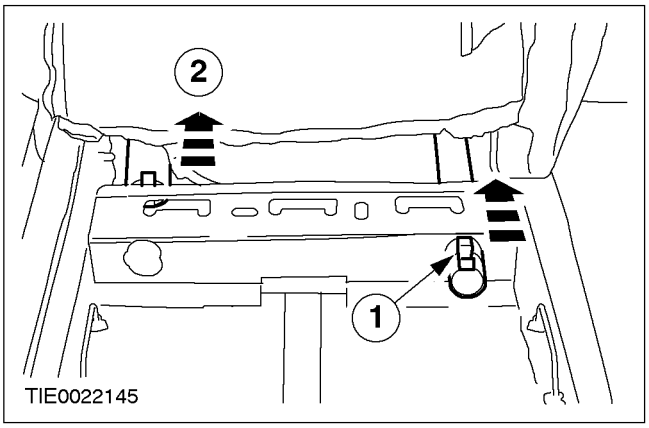
9. Detach the backrest cover from the armrest mounting.

1. Roll the backrest cover inwards to access the retaining strips.
2. Detach the retaining strips.



10. Remove the center head restraint guides.

1. From the underside of the rear seat backrest, depress the locking tang.
2. Slide the head restraint guides upwards through the backrest cover.



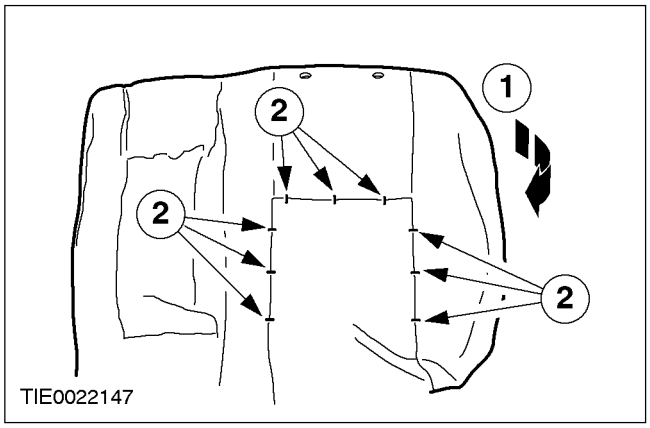
DISASSEMBLY AND ASSEMBLY (Continued)

11. **CAUTION: When removing the backrest cover take care not to detach the webbing retainer.**

Remove the backrest cover.

1. Roll the backrest cover inwards to access the pleating hog rings.
2. Cut the hog rings.

- Feed the safety belt webbing through the backrest cover.



12. **Remove the rear seat backrest.**
    - Feed the safety belt webbing through the backrest.
13. **Remove the rear seat backrest latch.** **For additional information, refer to Backrest Latch in this section.**
14. **Remove the center safety belt retractor. For additional information, refer to Section 501-20A / 501-20B.**

Assembly

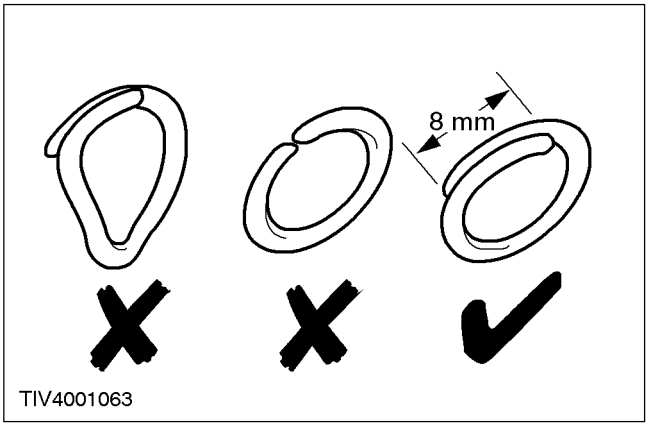
1. **WARNING: If the safety belt webbing retracts further than the stop on the webbing, a new safety belt retractor must be installed.**

CAUTION: Make sure the webbing retainer is fitted at least 200 mm from the webbing stop towards the retractor.

NOTE: Use hog ring pliers to close the hog rings. Do not use any other tool. The hog rings must be closed to overlap as illustrated.

NOTE: Use new hinge pins.

To assemble, reverse the disassembly procedure.



SECTION 501-11 Glass, Frames and Mechanisms

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Cleaner/activator	99-SX-M2G342-BA
Primer	99-SX-M2G343-AA
2K Adhesive	99-SX-M2G322-AA
2K Hardener/mixer	99-SX-M2G322-BA

Torque Specifications

Description	Nm	lb-ft	lb-in
Door window regulator retaining bolts	7	–	62
Door window glass clamp retaining bolts	7	–	62
Windshield wiper arm retaining nut	15	11	–
Rear window wiper arm retaining nut	14	10	–
Rear window wiper motor retaining bolts	8	–	71

DIAGNOSIS AND TESTING

Glass, Frames and Mechanisms

Refer to Wiring Diagrams Section 501-11 for schematic and connector information.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Mechanical	Electrical
Window seal Door window frame	Fuse(s) Electrical connector(s) Switch(es) Circuit(s) Initialization process

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Visual Inspection Chart

Symptom Chart

Condition	Possible Sources	Action
•A single power window is inoperative - front and rear power windows - driver power window	•Driver power window control switch.	•CARRY OUT the Driver Power Window Control Switch Component Test. REFER to the Wiring Diagrams.
	•Circuit(s).	• GO to Pinpoint Test A
•A single power window is inoperative - front and rear power windows - front passenger power window	•Inoperative power window control switch.	•CARRY OUT the Power Window Control Switch Component Test. REFER to the Wiring Diagrams.
	•Driver power window control switch.	•CARRY OUT the Driver Power Window Control Switch Component Test. REFER to the Wiring Diagrams.
	•Circuit(s).	• GO to Pinpoint Test B
•A single power window is inoperative - front and rear power windows - rear passenger power window	•Inoperative power window control switch.	•CARRY OUT the Power Window Control Switch Component Test. REFER to the Wiring Diagrams.
	•Driver power window control switch.	•CARRY OUT the Driver Power Window Control Switch Component Test. REFER to the Wiring Diagrams.
	•Circuit(s).	• GO to Pinpoint Test C
•The one-touch up/down feature is inoperative - front and rear power windows	•Driver power window control switch.	•CARRY OUT the Driver Power Window Control Switch Component Test. REFER to the Wiring Diagrams.
	•Inoperative power window control switch.	•CARRY OUT the Power Window Control Switch Component Test. REFER to the Wiring Diagrams.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
	•Power window motor.	•INSTALL a new power window motor. REFER to Section 501-11.
•Global closing is inoperative	•Generic electronic module (GEM). •Circuit(s).	•For additional information, REFER to WDS.
•A single power window is inoperative - driver side	•Driver power window control switch.	•CARRY OUT the Driver Power Window Control Switch Component Test. REFER to the Wiring Diagrams.
	•Driver power window motor. •Circuit(s).	• GO to Pinpoint Test D
•A single power window is inoperative - passenger side	•Passenger power window control switch.	•CARRY OUT the Passenger Power Window Control Switch Component Test. REFER to the Wiring Diagrams.
	•Passenger power window motor. •Circuit(s).	• GO to Pinpoint Test E
•The one-touch up/down feature is inoperative - front power windows	•Power window control switch.	•CARRY OUT the Power Window Control Switch Component Test. REFER to the Wiring Diagrams.
•The defrost system is inoperative	•Generic electronic module (GEM). •Heated windshield relay. •Heated windshield control switch. •Heated rear window relay. •Heated rear window control switch. •Heated rear window grid wire. •Circuit(s).	•For additional information, REFER to WDS.
•The defrost system will not shut off automatically	•Central timer module. •Heated windshield relay. •Heated rear window relay.	•For additional information, REFER to WDS.

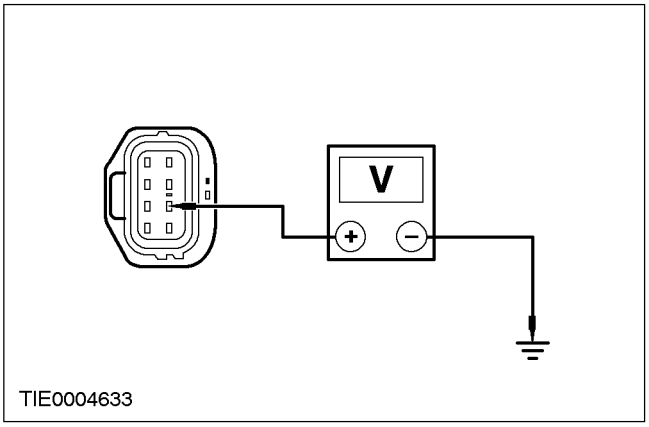
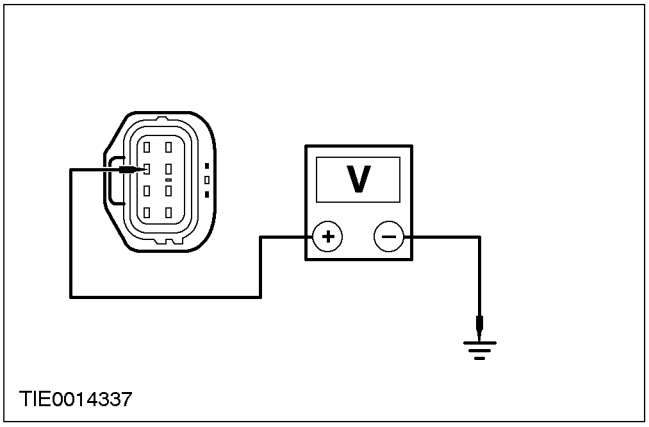
Pinpoint Tests

NOTE: Use a digital multimeter for all electrical measurements.

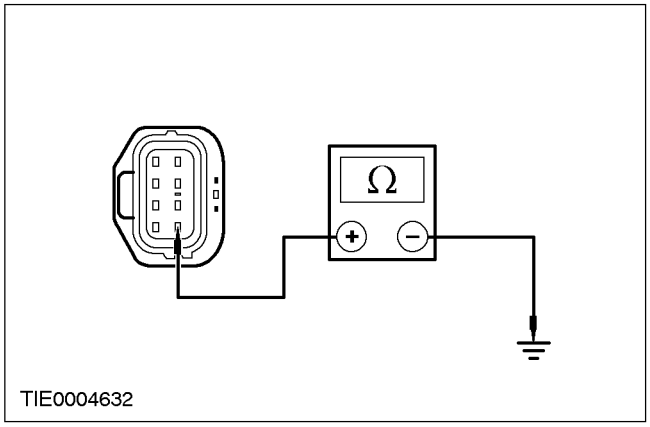
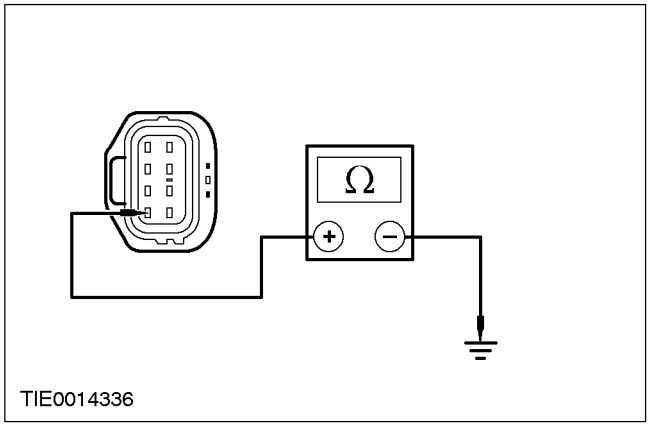
PINPOINT TEST A: A SINGLE POWER WINDOW IS INOPERATIVE - FRONT AND REAR POWER WINDOWS - DRIVER POWER WINDOW

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK FOR VOLTAGE TO THE DRIVER POWER WINDOW CONTROL SWITCH	
	1 Key in ON position.

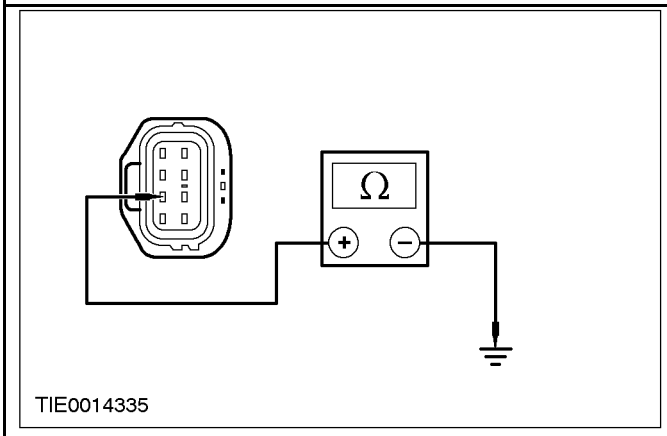
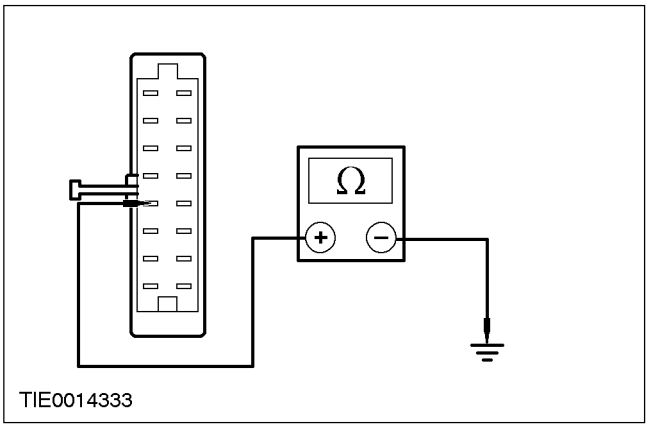
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Does the driver power window control switch LED illuminate? → **Yes** GO to **A2** → **No** GO to **A7**
A2: CHECK FOR BATTERY VOLTAGE TO THE DRIVER POWER WINDOW MOTOR	
 TIE0004633	1 Key in OFF position. 2 Disconnect Driver Power Window Motor C705. 3 Key in ON position. 4 Measure the voltage between the driver power window motor C705 pin 7, circuit 29-AJ26 (OG/YE) harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **A3** → **No** REPAIR circuit 29-AJ26 (OG/YE). TEST the system for normal operation.
A3: CHECK FOR IGNITION VOLTAGE TO THE DRIVER POWER WINDOW MOTOR	
 TIE0014337	1 Measure the voltage between the driver power window motor C705 pin 2, circuit 15-AJ26A (GN/YE) harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **A4** → **No** REPAIR circuit 15-AJ26A (GN/YE). TEST the system for normal operation.

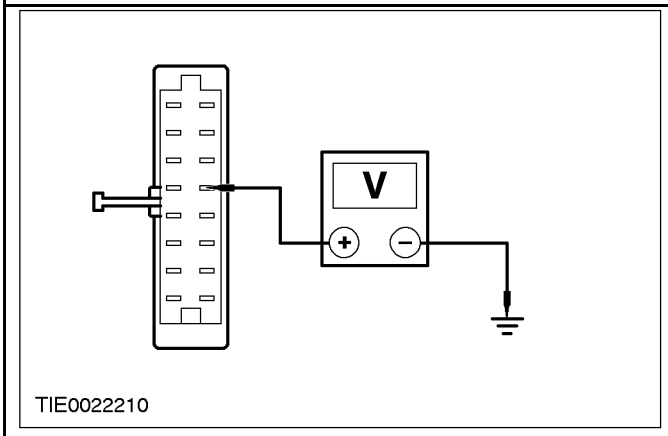
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A4: CHECK FOR CONTINUITY BETWEEN THE DRIVER POWER WINDOW MOTOR AND GROUND	
 TIE0004632	1 Key in OFF position. 2 Measure the resistance between the driver power window motor C705 pin 8, circuit 31-AJ26 (BK) harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **A5** → **No** REPAIR circuit 31-AJ26 (BK). TEST the system for normal operation.
A5: CHECK FOR CONTINUITY BETWEEN THE DRIVER POWER WINDOW MOTOR DOWN CIRCUIT AND GROUND	
 TIE0014336	1 Operate and hold the driver power window motor control switch in the DOWN position. 2 Measure the resistance between the driver power window motor C705 pin 4, circuit 31S-AJ40 (BK/GN) harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **A6** → **No** REPAIR circuit 31S-AJ40 (BK/GN). TEST the system for normal operation.
A6: CHECK FOR CONTINUITY BETWEEN THE DRIVER POWER WINDOW MOTOR UP CIRCUIT AND GROUND	
	1 Operate and hold the driver power window motor control switch in the UP position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0014335	**2** Measure the resistance between the driver power window motor C705 pin 3, circuit 31S-AJ41 (BK/RD) harness side and ground. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new power window motor. REFER to the procedure in this Section: Door Window Regulator and Motor. TEST the system for normal operation. → **No** REPAIR circuit 31S-AJ41 (BK/RD). TEST the system for normal operation.
A7: CHECK THE DRIVER POWER WINDOW CONTROL SWITCH GROUND CIRCUIT	
 TIE0014333	**1** Key in OFF position. **2** Disconnect Driver Power Window Control Switch C709. **3** Measure the resistance between the driver power window control switch C709 pin 4, circuit 31-AJ7 (BK) harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **A8** → **No** REPAIR circuit 31-AJ7 (BK). TEST the system for normal operation.
A8: CHECK FOR IGNITION VOLTAGE TO THE DRIVER POWER WINDOW CONTROL SWITCH	
	1 Key in ON position.

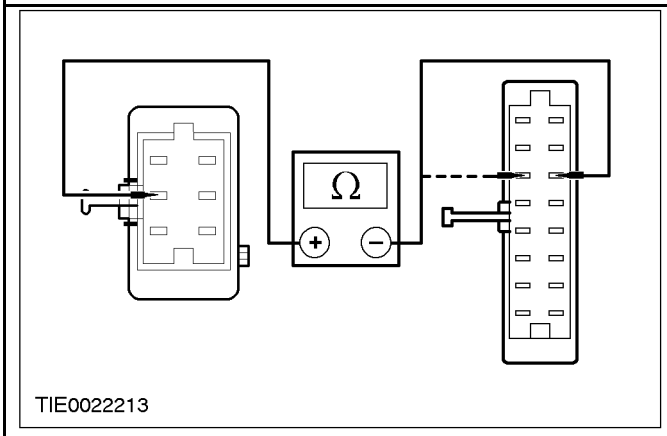
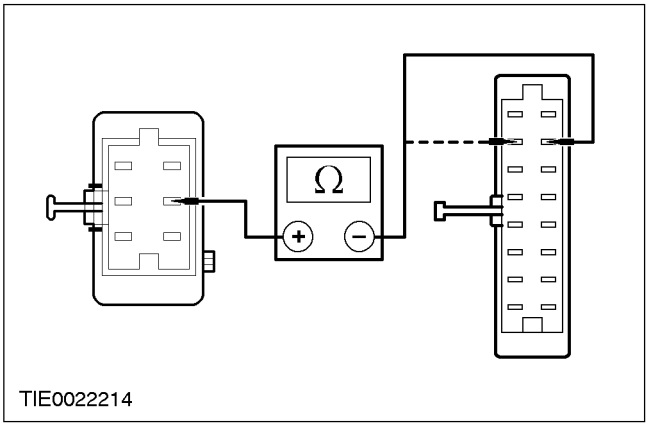
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	2 Measure the voltage between the driver power window control switch C709 pin 13, circuit 15-LH14 (GN/YE) harness side and ground. • Is the voltage greater than 10 volts? → **Yes** VERIFY the customer concern. → **No** REPAIR circuit 15-LH14 (GN/YE). TEST the system for normal operation.

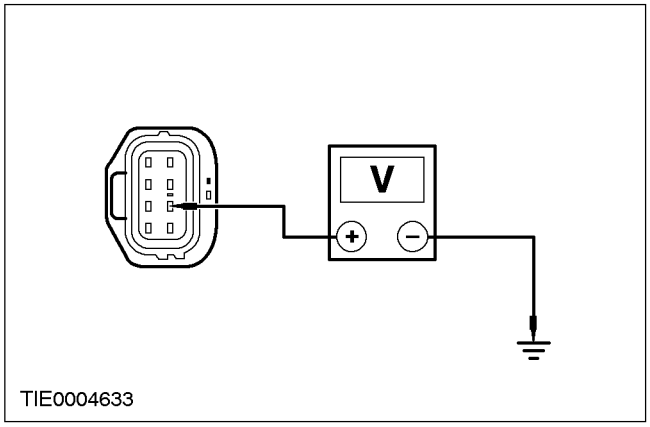
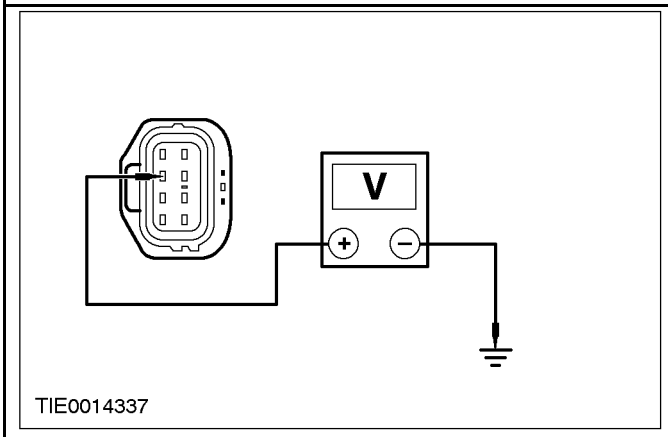
PINPOINT TEST B: A SINGLE POWER WINDOW IS INOPERATIVE - FRONT AND REAR POWER WINDOWS - FRONT PASSENGER POWER WINDOW

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK THE INOPERATIVE WINDOW FOR OPERATION FROM THE DRIVER POWER WINDOW CONTROL SWITCH	
	1 Key in ON position. 2 Operate the driver power window control switch. • Does the front passenger power window operate correctly? → **Yes** GO to **B2** → **No** GO to **B4**
B2: CHECK FOR CONTINUITY BETWEEN THE INOPERATIVE PASSENGER POWER WINDOW CONTROL SWITCH AND THE MOTOR DOWN CIRCUIT	
	1 Key in OFF position. 2 Disconnect Driver Power Window Control Switch C709. 3 Disconnect Passenger Power Window Control Switch C710.

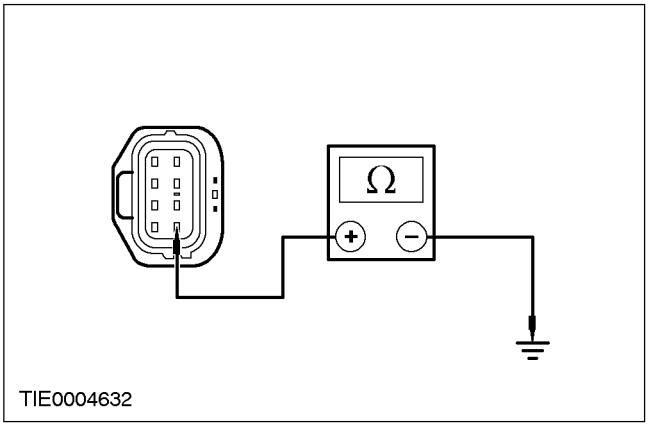
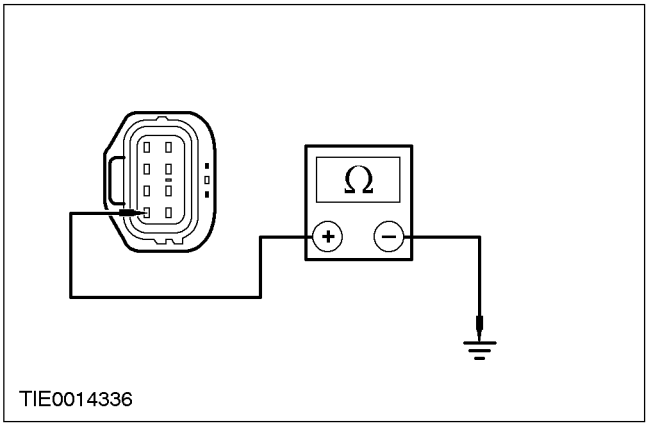
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0022213	**4** Measure the resistance between: **NOTE:** Left-hand Drive Front Passenger Power Window - the front passenger power window control switch C710 pin 2, circuit 31S-AJ54B (BK/GN) harness side and the driver power window control switch C709 pin 14, circuit 31S-AJ54 (BK/GN) harness side. **NOTE:** Right-hand Drive Front Passenger Power Window - the front passenger power window control switch C710 pin 2, circuit 31S-AJ54B (BK/GN) harness side and the driver power window control switch C709 pin 6, circuit 31S-AJ54 (BK/GN) harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **B3** → **No** REPAIR circuit 31S-AJ54B (BK/GN). TEST the system for normal operation.
B3: CHECK FOR CONTINUITY BETWEEN THE INOPERATIVE PASSENGER POWER WINDOW CONTROL SWITCH AND THE MOTOR UP CIRCUIT	
 TIE0022214	**1** Measure the resistance between: **NOTE:** Left-hand Drive Front Passenger Power Window - the front passenger power window control switch C710 pin 5, circuit 31S-AJ55B (BK/RD) harness side and the driver power window control switch C709 pin 15, circuit 31S-AJ55 (BK/RD) harness side. **NOTE:** Right-hand Drive Front Passenger Power Window - the front passenger power window control switch C710 pin 5, circuit 31S-AJ55B (BK/RD) harness side and the driver power window control switch C709 pin 7, circuit 31S-AJ55 (BK/RD) harness side. • Is the resistance less than 5 ohms? → **Yes** VERIFY the customer concern. → **No** REPAIR circuit 31S-AJ55B (BK/RD). TEST the system for normal operation.
B4: CHECK FOR VOLTAGE TO THE INOPERATIVE PASSENGER POWER WINDOW CONTROL SWITCH	
	1 Key in ON position. • Does the front passenger power window control switch LED illuminate? → **Yes**

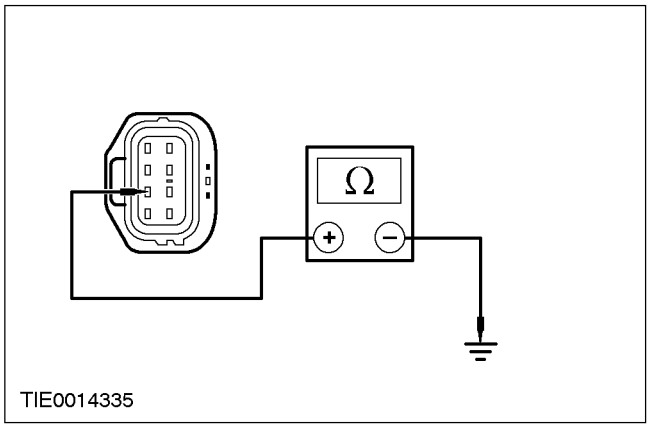
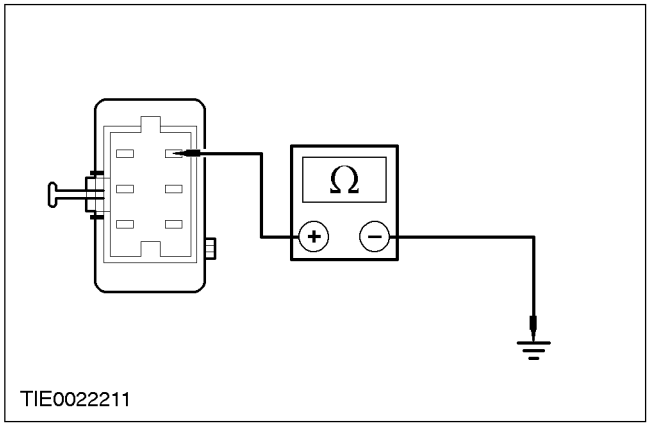
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	GO to **B5** → **No** GO to **B10**
B5: CHECK FOR BATTERY VOLTAGE TO THE INOPERATIVE PASSENGER POWER WINDOW MOTOR	
 TIE0004633	1 Key in OFF position. 2 Disconnect Passenger Power Window Motor C706. 3 Key in ON position. 4 Measure the voltage between the passenger power window motor C706 pin 7, circuit 29-AJ27 (OG/WH) harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **B6** → **No** REPAIR circuit 29-AJ27 (OG/WH). TEST the system for normal operation.
B6: CHECK FOR IGNITION VOLTAGE TO THE INOPERATIVE PASSENGER POWER WINDOW MOTOR	
 TIE0014337	1 Measure the voltage between the passenger power window motor C706 pin 2, circuit 15-AJ27A (GN/WH) harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **B7** → **No** REPAIR circuit 15-AJ27A (GN/WH). TEST the system for normal operation.

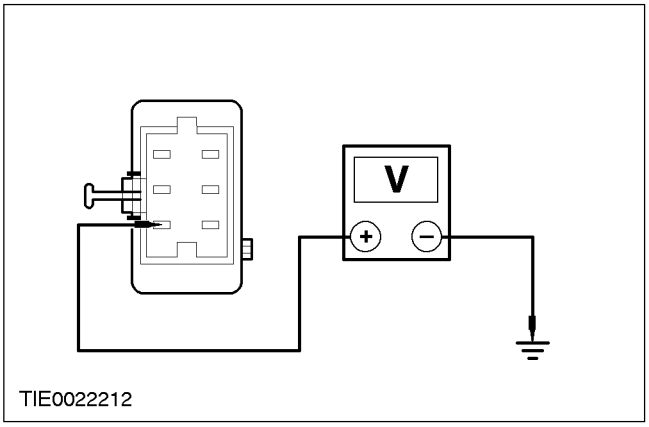
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
B7: CHECK THE INOPERATIVE PASSENGER POWER WINDOW MOTOR GROUND CIRCUIT	
 TIE0004632	1 Key in OFF position. 2 Measure the resistance between the passenger power window motor C706 pin 8, circuit 31-AJ27 (BK) harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **B8** → **No** REPAIR circuit 31-AJ27 (BK). TEST the system for normal operation.
B8: CHECK FOR CONTINUITY BETWEEN THE INOPERATIVE PASSENGER POWER WINDOW MOTOR DOWN CIRCUIT AND GROUND	
 TIE0014336	1 Operate and hold the inoperative passenger power window motor control switch in the DOWN position. 2 Measure the resistance between the passenger power window motor C706 pin 4, circuit 31S-AJ54A (BK/GN) harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **B9** → **No** REPAIR circuit 31S-AJ54A (BK/GN). TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
B9: CHECK FOR CONTINUITY BETWEEN THE INOPERATIVE PASSENGER POWER WINDOW MOTOR UP CIRCUIT AND GROUND	
 TIE0014335	1 Operate and hold the inoperative passenger power window motor control switch in the UP position. 2 Measure the resistance between the passenger power window motor C706 pin 3, circuit 31S-AJ55A (BK/RD) harness side and ground. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new power window motor. REFER to the procedure in this Section: Door Window Regulator and Motor. TEST the system for normal operation. → **No** REPAIR circuit 31S-AJ55A (BK/RD). TEST the system for normal operation.
B10: CHECK THE INOPERATIVE PASSENGER POWER WINDOW CONTROL SWITCH GROUND CIRCUIT	
 TIE0022211	1 Key in OFF position. 2 Disconnect Passenger Power Window Control Switch C710. 3 Measure the resistance between the passenger power window control switch C710 pin 6, circuit 31-AJ18 (BK) harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **B11** → **No**

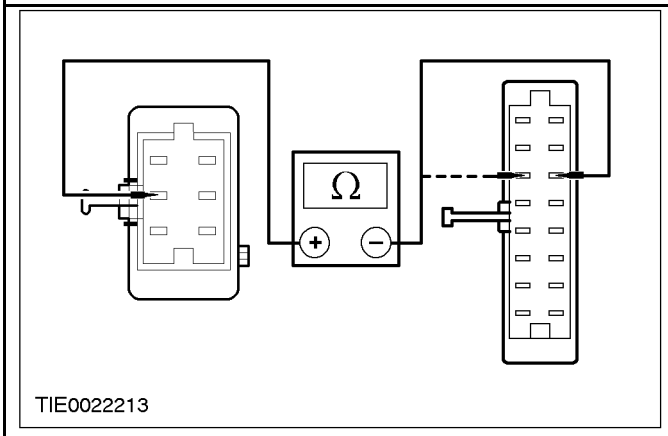
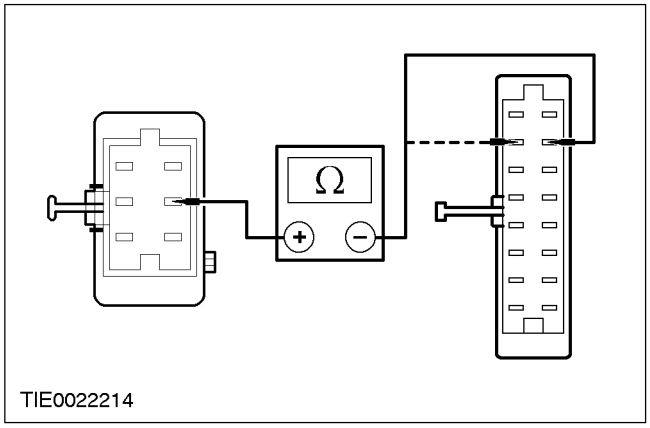
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR circuit 31-AJ18 (BK). TEST the system for normal operation.
B11: CHECK FOR IGNITION VOLTAGE TO THE INOPERATIVE PASSENGER POWER WINDOW CONTROL SWITCH	
	1 Key in ON position. 2 Measure the voltage between the passenger power window control switch C710 pin 1, circuit 15-LH31 (GN/BU) harness side and ground. • Is the voltage greater than 10 volts? → **Yes** VERIFY the customer concern. → **No** REPAIR circuit 15-LH31 (GN/BU). TEST the system for normal operation.

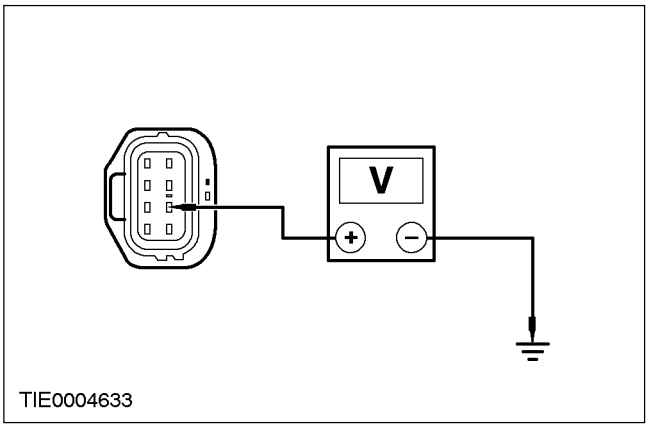
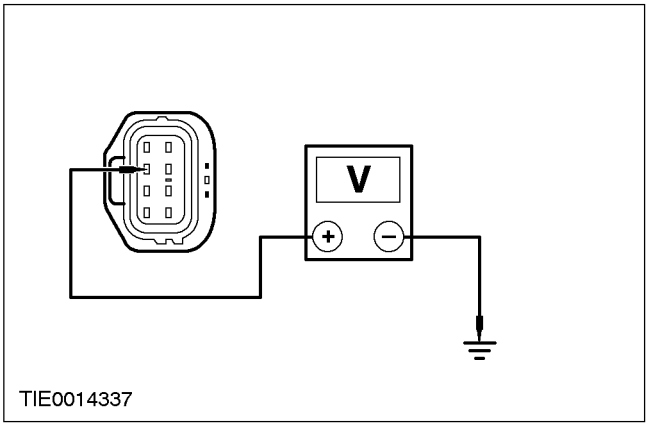
PINPOINT TEST C: A SINGLE POWER WINDOW IS INOPERATIVE - FRONT AND REAR POWER WINDOWS - REAR PASSENGER POWER WINDOW

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK THE INOPERATIVE WINDOW FOR OPERATION FROM THE DRIVER POWER WINDOW CONTROL SWITCH	
	1 Key in ON position. 2 Operate the driver power window control switch. • Does the inoperative rear passenger power window operate correctly? → **Yes** GO to **C2** → **No** GO to **C4**
C2: CHECK FOR CONTINUITY BETWEEN THE INOPERATIVE PASSENGER POWER WINDOW CONTROL SWITCH AND THE MOTOR DOWN CIRCUIT	
	1 Key in OFF position. 2 Disconnect Driver Power Window Control Switch C709. 3 Disconnect Inoperative Passenger Power Window Control Switch C711 or C712.

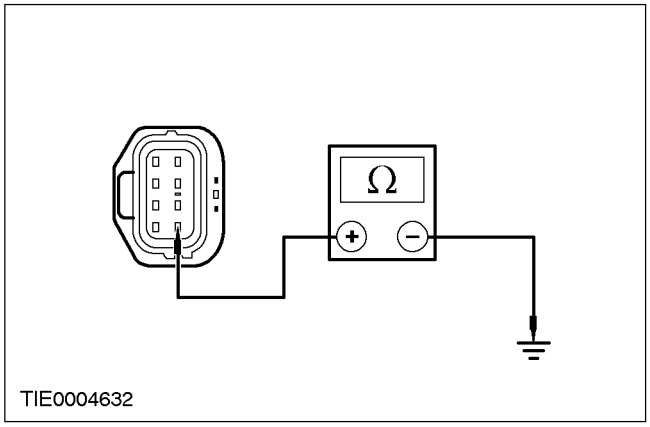
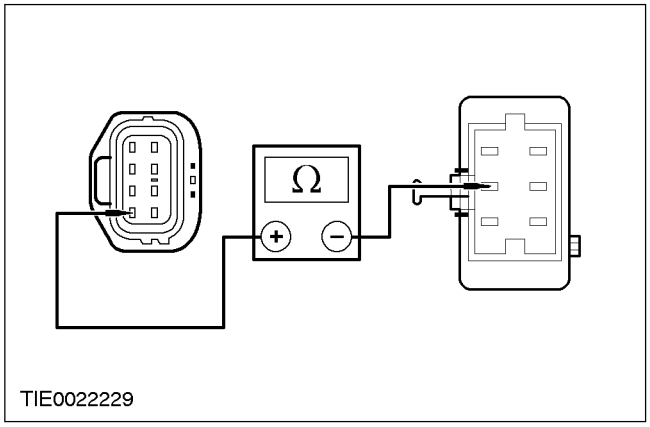
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0022213	**4** Measure the resistance between: **NOTE:** Left-hand Rear Passenger Power Window - the driver power window control switch C709 pin 2, circuit 31S-AJ57 (BK/BU) harness side and the left-hand rear passenger power window control switch C711 pin 2, circuit 31S-AJ63A (BK/BU) harness side. **NOTE:** Right-hand Rear Passenger Power Window - the driver power window control switch C709 pin 10, circuit 31S-AJ60 (BK/BU) harness side and the right-hand rear passenger power window control switch C712 pin 2, circuit 31S-AJ63A (BK/BU) harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **C3** → **No** REPAIR circuit 31S-AJ63A (BK/BU). TEST the system for normal operation.
C3: CHECK FOR CONTINUITY BETWEEN THE INOPERATIVE PASSENGER POWER WINDOW CONTROL SWITCH AND THE MOTOR UP CIRCUIT	
 TIE0022214	**1** Measure the resistance between **NOTE:** Left-hand Rear Passenger Power Window - the driver power window control switch C709 pin 3, circuit 31S-AJ58 (BK/OG) harness side and the left-hand rear passenger power window control switch C711 pin 5, circuit 31S-AJ64A (BK/OG) harness side. **NOTE:** Right-hand Rear Passenger Power Window - the driver power window control switch C709 pin 11, circuit 31S-AJ61 (BK/OG) harness side and the right-hand rear passenger power window control switch C712 pin 5, circuit 31S-AJ64A (BK/OG) harness side. • Is the resistance less than 5 ohms? → **Yes** VERIFY the customer concern. → **No** REPAIR circuit 31S-AJ64A (BK/OG). TEST the system for normal operation.
C4: CHECK FOR VOLTAGE TO THE INOPERATIVE PASSENGER POWER WINDOW CONTROL SWITCH	
	1 Key in ON position. • Does the inoperative passenger power window control switch LED illuminate? → **Yes** GO to **C5** → **No**

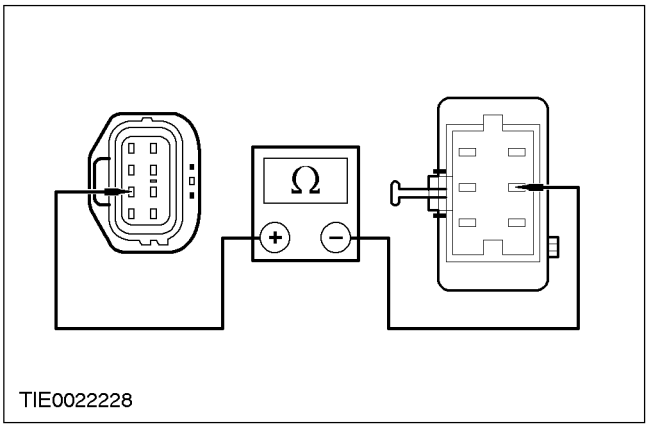
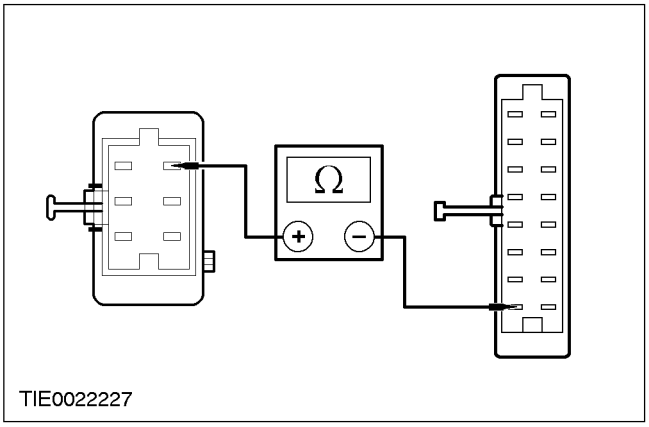
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	GO to **C10**
C5: CHECK FOR BATTERY VOLTAGE TO THE INOPERATIVE PASSENGER POWER WINDOW MOTOR	
 TIE0004633	1 Key in OFF position. 2 Disconnect Inoperative Passenger Power Window Motor C707 or C708. 3 Key in ON position. 4 Measure the voltage between: **NOTE:** Left-hand Rear Passenger Power Window - the inoperative passenger power window control switch C707 pin 7, circuit 29-AJ31 (OG/BU) harness side and ground. **NOTE:** Right-hand Rear Passenger Power Window - the inoperative passenger power window control switch C708 pin 7, circuit 29-AJ31 (OG/BU) harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **C6** → **No** REPAIR circuit 29-AJ31 (OG/BU). TEST the system for normal operation.
C6: CHECK FOR IGNITION VOLTAGE TO THE INOPERATIVE PASSENGER POWER WINDOW MOTOR	
 TIE0014337	1 Measure the voltage between: **NOTE:** Left-hand Rear Passenger Power Window - the inoperative passenger power window motor C707 pin 2, circuit 15-AJ31 (GN/BU) harness side and ground. **NOTE:** Right-hand Rear Passenger Power Window - the inoperative passenger power window motor C708 pin 2, circuit 15-AJ31 (GN/BU) harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **C7** → **No** REPAIR circuit 15-AJ31 (GN/BU). TEST the system for normal operation.

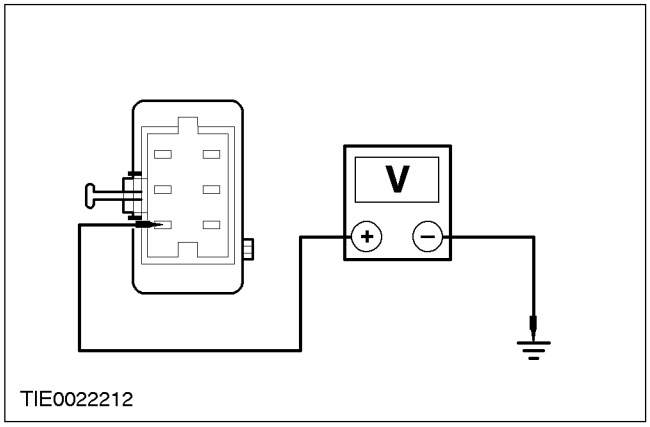
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
C7: CHECK FOR CONTINUITY BETWEEN THE INOPERATIVE PASSENGER POWER WINDOW MOTOR AND GROUND	
	1 Key in OFF position. 2 Measure the resistance between: **NOTE:** Left-hand Rear Passenger Power Window - the inoperative passenger power window motor C707 pin 8, circuit 31-AJ31 (BK) harness side and ground. **NOTE:** Right-hand Rear Passenger Power Window - the inoperative passenger power window motor C708 pin 8, circuit 31-AJ31 (BK) harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **C8** → **No** REPAIR circuit 31-AJ31 (BK). TEST the system for normal operation.
C8: CHECK FOR CONTINUITY BETWEEN THE INOPERATIVE PASSENGER POWER WINDOW MOTOR DOWN CIRCUIT AND GROUND	
	1 Disconnect Inoperative Passenger Power Window Control Switch C711 or C712. 2 Operate and hold the inoperative passenger power window motor control switch in the DOWN position. 3 Measure the resistance between: **NOTE:** Left-hand Rear Passenger Power Window - the inoperative passenger power window motor C707 pin 4, circuit 31S-AJ63 (BK/BU) harness side and the inoperative passenger power window control switch C711 pin 2, circuit 31S-AJ63A (BK/BU) harness side. **NOTE:** Right-hand Rear Passenger Power Window - the inoperative passenger power window motor C708 pin 4, circuit 31S-AJ63 (BK/BU) harness side and the inoperative passenger power window control switch C712 pin 2, circuit 31S-AJ63A (BK/BU) harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **C9** → **No** REPAIR circuit 31S-AJ63 (BK/BU). TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
C9: CHECK FOR CONTINUITY BETWEEN THE INOPERATIVE PASSENGER POWER WINDOW MOTOR UP CIRCUIT AND GROUND	
 TIE0022228	1 Operate and hold the inoperative passenger power window motor control switch in the UP position. 2 Measure the resistance between: **NOTE:** Left-hand Rear Passenger Power Window - the inoperative passenger power window motor C707 pin 3, circuit 31S-AJ64 (BK/OG) harness side and the inoperative passenger power window control switch C711 pin 5, circuit 31S-AJ64A (BK/OG) harness side. **NOTE:** Right-hand Rear Passenger Power Window - the inoperative passenger power window motor C708 pin 3, circuit 31S-AJ64 (BK/OG) harness side and the inoperative passenger power window control switch C712 pin 5, circuit 31S-AJ64A (BK/OG) harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new motor. REFER to the procedure in this Section: Door Window Regulator and Motor. TEST the system for normal operation. → **No** REPAIR circuit 31S-AJ64 (BK/OG). TEST the system for normal operation.
C10: CHECK THE INOPERATIVE PASSENGER POWER WINDOW CONTROL SWITCH GROUND CIRCUIT	
 TIE0022227	1 Key in OFF position. 2 Disconnect Inoperative Passenger Power Window Control Switch C711 or C712. 3 Measure the resistance between: **NOTE:** Left-hand Rear Passenger Power Window - the inoperative passenger power window control switch C711 pin 6, circuit 31S-AJ32 (BK/OG) harness side and the driver power window control switch C709 pin 1, circuit 31S-AJ1 (BK/BU) harness side. **NOTE:** Right-hand Rear Passenger Power Window - the inoperative passenger power window control switch C711 pin 6, circuit 31S-AJ32 (BK/OG) harness side and the driver power window control switch C709 pin 1, circuit 31S-AJ1 (BK/BU) harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **C11** → **No**

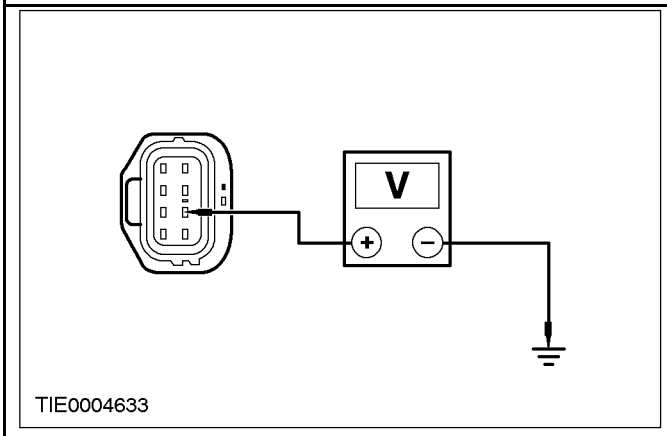
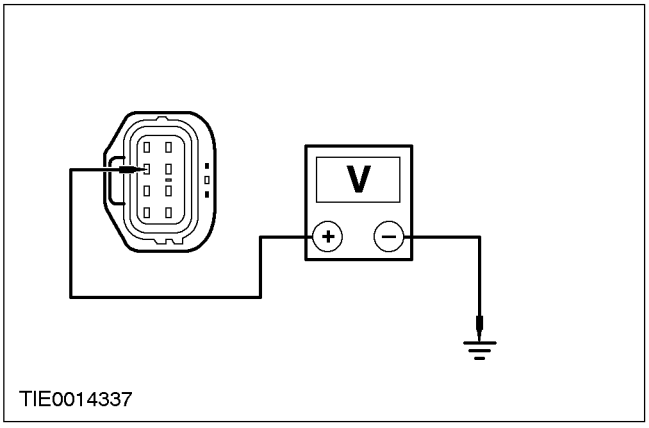
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR circuit 31S-AJ32 (BK/OG). TEST the system for normal operation.
C11: CHECK FOR IGNITION VOLTAGE TO THE INOPERATIVE PASSENGER POWER WINDOW CONTROL SWITCH	
 TIE0022212	1 Key in ON position. 2 Measure the voltage between: **NOTE:** Left-hand Rear Passenger Power Window - the inoperative passenger power window control switch C711 pin 1, circuit 15-LH36 (GN/RD) harness side and ground. **NOTE:** Right-hand Rear Passenger Power Window - the inoperative passenger power window control switch C712 pin 1, circuit 15-LH36 (GN/RD) harness side and ground. • Is the voltage greater than 10 volts? → **Yes** VERIFY the customer concern. → **No** REPAIR circuit 15-LH36 (GN/RD). TEST the system for normal operation.

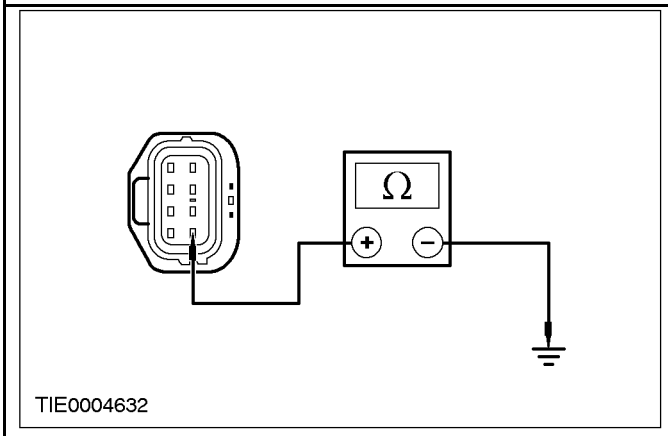
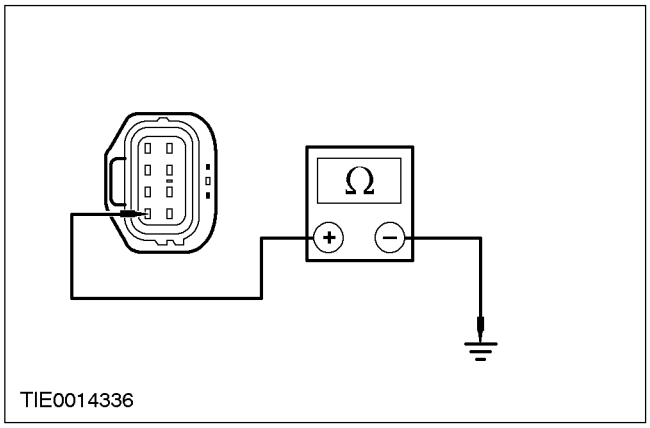
PINPOINT TEST D: A SINGLE POWER WINDOW IS INOPERATIVE - DRIVER SIDE

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: CHECK FOR VOLTAGE TO THE DRIVER POWER WINDOW CONTROL SWITCH	
	1 Key in ON position. • Does the driver power window control switch LED illuminate? → **Yes** GO to **D2** → **No** GO to **D7**
D2: CHECK FOR BATTERY VOLTAGE TO THE DRIVER POWER WINDOW MOTOR	
	1 Key in OFF position. 2 Disconnect Driver power window motor C705. 3 Key in ON position.

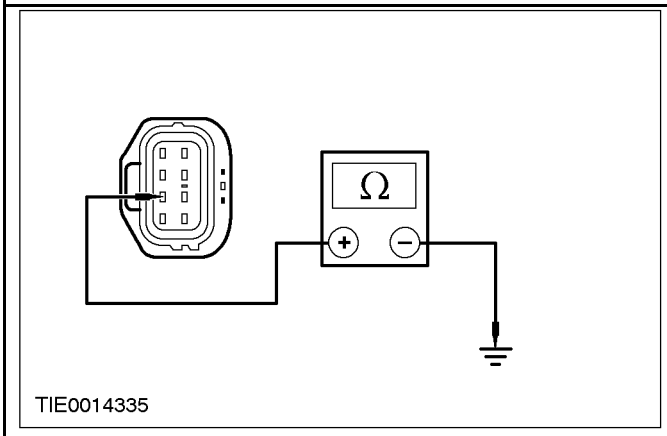
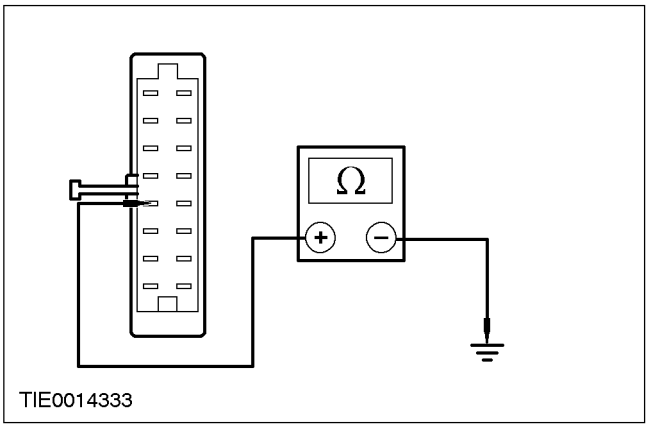
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0004633	**4** Measure the voltage between the driver power window motor C705 pin 7, circuit 29-AJ26 (OG/YE) harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **D3** → **No** REPAIR circuit 29-AJ26 (OG/YE). TEST the system for normal operation.
D3: CHECK FOR IGNITION VOLTAGE TO THE DRIVER POWER WINDOW MOTOR	
 TIE0014337	**1** Measure the voltage between the driver power window motor C705 pin 2, circuit 15-AJ26A (GN/YE) harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **D4** → **No** REPAIR circuit 15-AJ26A (GN/YE). TEST the system for normal operation.
D4: CHECK FOR CONTINUITY BETWEEN THE DRIVER POWER WINDOW MOTOR AND GROUND	
	1 Key in OFF position.

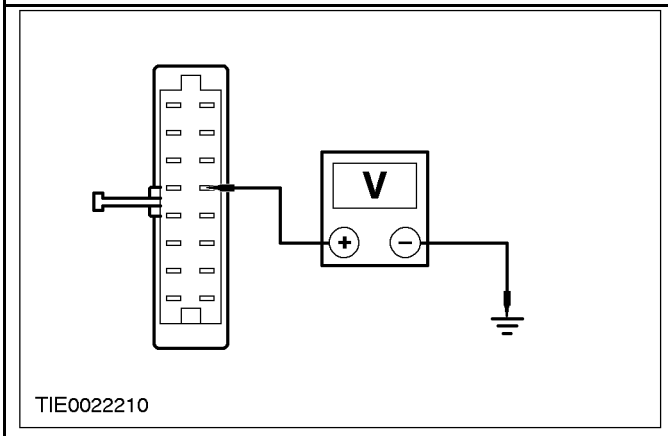
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0004632	**2** Measure the resistance between the driver power window motor C705 pin 8, circuit 31-AJ26 (BK) harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **D5** → **No** REPAIR circuit 31-AJ26 (BK). TEST the system for normal operation.
D5: CHECK FOR CONTINUITY BETWEEN THE DRIVER POWER WINDOW MOTOR UP CIRCUIT AND GROUND	
 TIE0014336	**1** Operate and hold the inoperative driver power window motor control switch in the UP position. **2** Measure the resistance between the driver power window motor C705 pin 4, circuit 31S-AJ40 (BK/GN) harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **D6** → **No** REPAIR circuit 31S-AJ40 (BK/GN). TEST the system for normal operation.
D6: CHECK FOR CONTINUITY BETWEEN THE DRIVER POWER WINDOW MOTOR DOWN CIRCUIT AND GROUND	
	1 Operate and hold the inoperative driver power window motor control switch in the DOWN position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0014335	**2** Measure the resistance between the driver power window motor C705 pin 3, circuit 31S-AJ41 (BK/RD) harness side and ground. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new motor. REFER to the procedure in this Section: Door Window Regulator and Motor. TEST the system for normal operation. → **No** REPAIR circuit 31S-AJ41 (BK/RD). TEST the system for normal operation.
D7: CHECK THE DRIVER POWER WINDOW CONTROL SWITCH GROUND CIRCUIT	
 TIE0014333	**1** Key in OFF position. **2** Disconnect Driver Power Window Control Switch C709. **3** Measure the resistance between the driver power window control switch C709 pin 4, circuit 31-AJ7 (BK) harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **D8** → **No** REPAIR circuit 31-AJ7 (BK). TEST the system for normal operation.
D8: CHECK FOR IGNITION VOLTAGE TO THE DRIVER POWER WINDOW CONTROL SWITCH	
	1 Key in ON position.

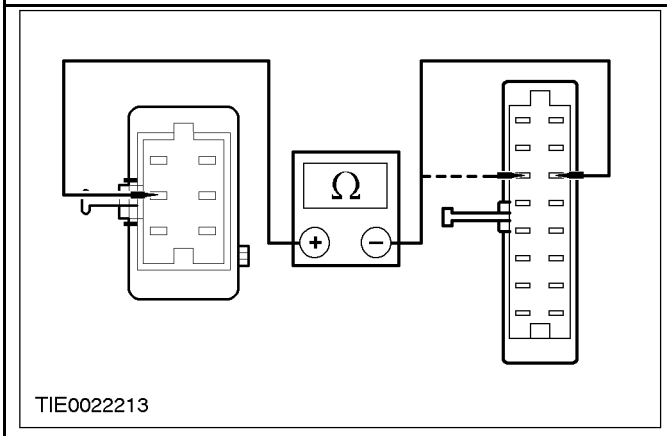
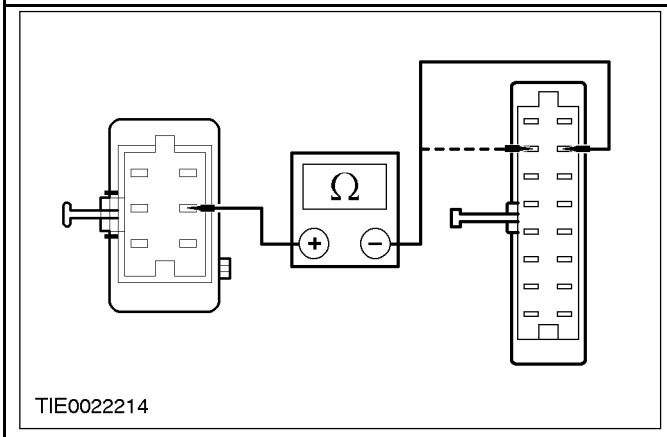
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	2 Measure the voltage between the driver power window control switch C709 pin 13, circuit 15-LH14 (GN/YE) harness side and ground. • Is the voltage greater than 10 volts? → **Yes** VERIFY the customer concern. → **No** REPAIR circuit 15-LH14 (GN/YE). TEST the system for normal operation.

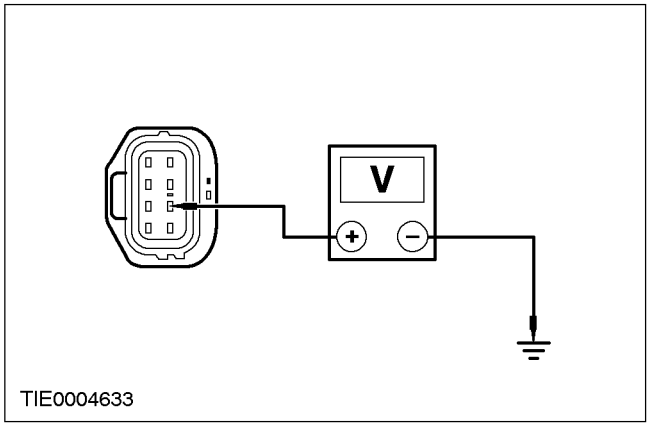
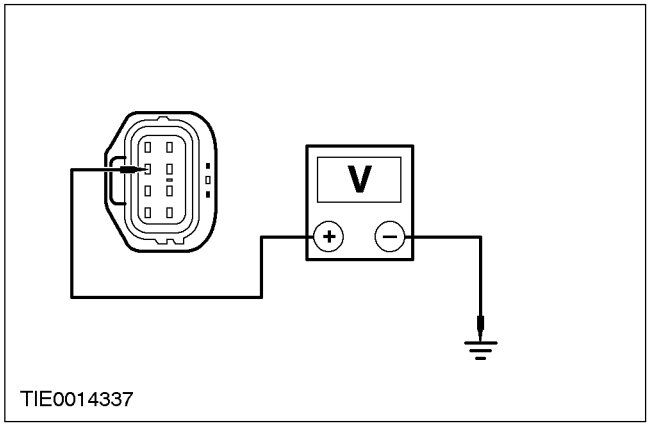
PINPOINT TEST E: A SINGLE POWER WINDOW IS INOPERATIVE - PASSENGER SIDE

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: CHECK THE INOPERATIVE WINDOW FOR OPERATION FROM THE DRIVER POWER WINDOW CONTROL SWITCH	
	1 Key in ON position. 2 Operate the passenger power window from the driver power window control switch. • Does the passenger power window operate correctly? → **Yes** GO to **E2** → **No** GO to **E4**
E2: CHECK FOR CONTINUITY BETWEEN THE INOPERATIVE PASSENGER POWER WINDOW CONTROL SWITCH AND THE MOTOR DOWN CIRCUIT	
	1 Key in OFF position. 2 Disconnect Driver Power Window Control Switch C709. 3 Disconnect Passenger Power Window Control Switch C710.

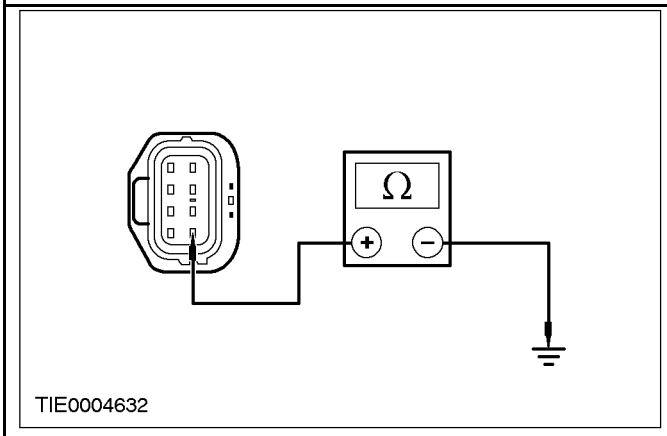
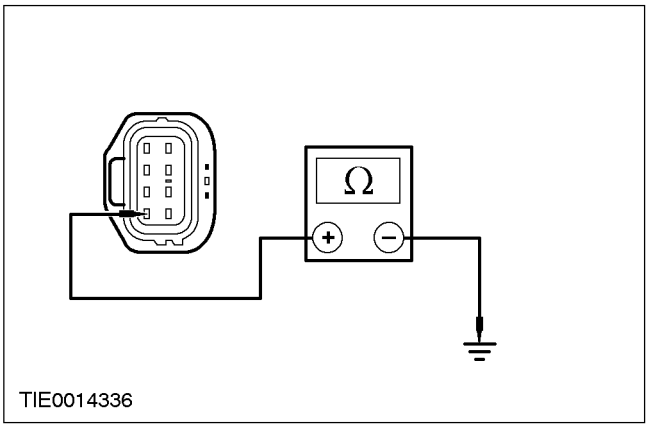
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0022213	**4** Measure the resistance between: **NOTE:** Left-hand Drive - the inoperative passenger power window motor C710 pin 2, circuit 31S-AJ54B (BK/GN) harness side and the driver power window control switch C709 pin 14, circuit 31S-AJ54 (BK/GN) harness side. **NOTE:** Right-hand Drive - the inoperative passenger power window motor C710 pin 2, circuit 31S-AJ54B (BK/GN) harness side and the driver power window control switch C709 pin 6, circuit 31S-AJ54 (BK/GN) harness side. • Is the resistance less than 5 ohms? → **Yes** GO to **E3** → **No** REPAIR circuit 31S-AJ54B (BK/RD). TEST the system for normal operation.
E3: CHECK FOR CONTINUITY BETWEEN THE PASSENGER POWER WINDOW CONTROL SWITCH AND THE MOTOR UP CIRCUIT	
 TIE0022214	**1** Measure the resistance between: **NOTE:** Left-hand Drive - the inoperative passenger power window motor C710 pin 5, circuit 31S-AJ55B (BK/RD) harness side and the driver power window control switch C709 pin 15, circuit 31S-AJ55 (BK/RD) harness side. **NOTE:** Right-hand Drive - the inoperative passenger power window motor C710 pin 5, circuit 31S-AJ55B (BK/RD) harness side and the driver power window control switch C709 pin 7, circuit 31S-AJ55 (BK/RD) harness side. • Is the resistance less than 5 ohms? → **Yes** VERIFY the customer concern. → **No** REPAIR circuit 31S-AJ55B (BK/RD). TEST the system for normal operation.
E4: CHECK FOR VOLTAGE TO THE INOPERATIVE PASSENGER POWER WINDOW CONTROL SWITCH	
	1 Key in ON position. • Does the passenger power window control switch LED illuminate? → **Yes** GO to **E5** → **No** GO to **E10**

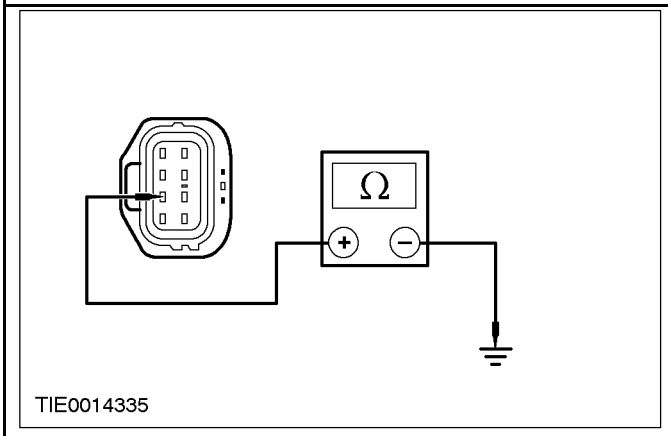
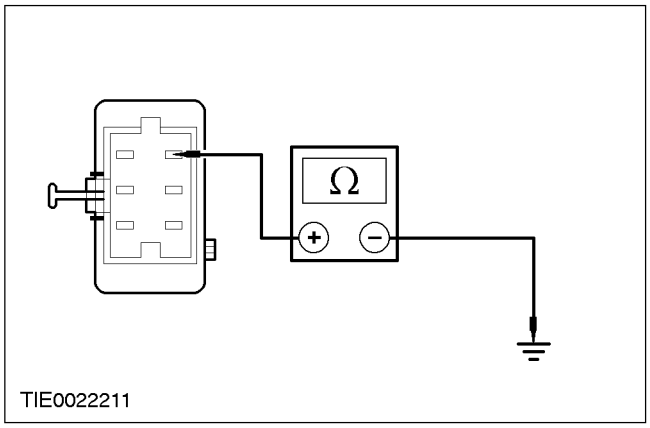
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
E5: CHECK FOR BATTERY VOLTAGE TO THE INOPERATIVE PASSENGER POWER WINDOW MOTOR	
 TIE0004633	1 Key in OFF position. 2 Disconnect Passenger Power Window Motor C706. 3 Key in ON position. 4 Measure the voltage between the passenger power window motor C706 pin 7, circuit 29-AJ27 (OG/WH) harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **E6** → **No** REPAIR circuit 29-AJ27 (OG/WH). TEST the system for normal operation.
E6: CHECK FOR IGNITION VOLTAGE TO THE INOPERATIVE PASSENGER POWER WINDOW MOTOR	
 TIE0014337	1 Measure the voltage between the passenger power window motor C706 pin 2, circuit 15-AJ27A (GN/WH) harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **E7** → **No** REPAIR circuit 15-AJ27A (GN/WH). TEST the system for normal operation.
E7: CHECK THE INOPERATIVE PASSENGER POWER WINDOW MOTOR GROUND CIRCUIT	
	1 Key in OFF position.

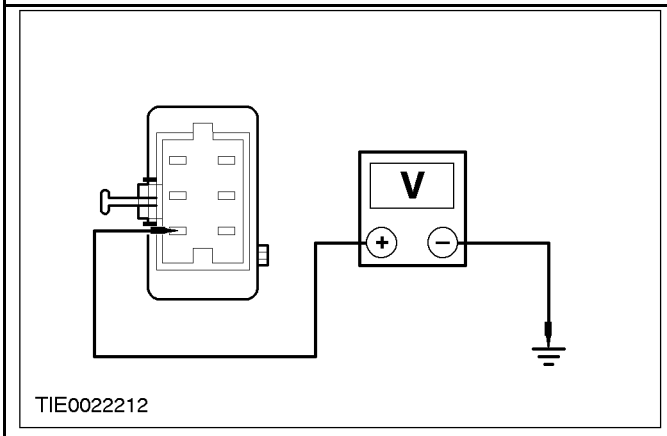
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0004632	**2** Measure the resistance between the passenger power window motor C706 pin 8, circuit 31-AJ27 (BK) harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **E8** → **No** REPAIR circuit 31-AJ27 (BK). TEST the system for normal operation.
E8: CHECK FOR CONTINUITY BETWEEN THE INOPERATIVE PASSENGER POWER WINDOW MOTOR DOWN CIRCUIT AND GROUND	
 TIE0014336	**1** Operate and hold the inoperative passenger power window motor control switch in the DOWN position. **2** Measure the resistance between the passenger power window motor C706 pin 4, circuit 31S-AJ54A (BK/GN) harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **E9** → **No** REPAIR circuit 31S-AJ54A (BK/GN). TEST the system for normal operation.
E9: CHECK FOR CONTINUITY BETWEEN THE INOPERATIVE PASSENGER POWER WINDOW MOTOR UP CIRCUIT AND GROUND	
	1 Operate and hold the inoperative passenger power window motor control switch in the UP position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0014335	**2** Measure the resistance between the passenger power window motor C706 pin 3, circuit 31S-AJ55A (BK/RD) harness side and ground. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new motor. REFER to the procedure in this Section: Door Window Regulator and Motor. TEST the system for normal operation. → **No** REPAIR circuit 31S-AJ55A (BK/RD). TEST the system for normal operation.
E10: CHECK THE INOPERATIVE PASSENGER POWER WINDOW CONTROL SWITCH GROUND CIRCUIT	
 TIE0022211	**1** Key in OFF position. **2** Disconnect Passenger Power Window Control Switch C710. **3** Measure the resistance between the passenger power window control switch C710 pin 6, circuit 31-AJ18 (BK) harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **E11** → **No** REPAIR circuit 31-AJ18 (BK). TEST the system for normal operation.
E11: CHECK FOR IGNITION VOLTAGE TO THE INOPERATIVE PASSENGER POWER WINDOW CONTROL SWITCH	
	1 Key in ON position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0022212	**2** Measure the voltage between the passenger power window control switch C710 pin 1, circuit 15-LH31 (GN/BU) harness side and ground. • Is the voltage greater than 10 volts? → **Yes** VERIFY the customer concern. → **No** REPAIR circuit 15-LH31 (GN/BU). TEST the system for normal operation.

GENERAL PROCEDURES

Door Window Motor Initialization

WARNING: The door window anti-trap function will not operate during the door window motor initialization procedure. Make sure that the door window opening is free of all foreign material. Failure to follow this instruction may result in personal injury.

NOTE: After the battery has been disconnected it is necessary to initialize each door window motor separately.

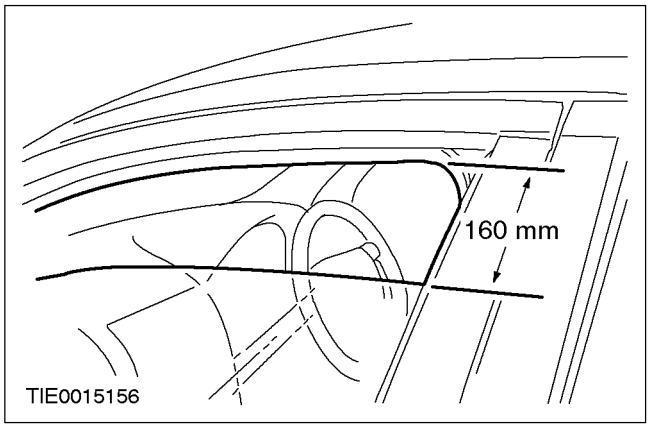
1. **Press the power window control switch close button until the door window is fully closed and hold the button in the close position for a further second.**
2. **Release the power window control switch close button and press again two or three more times, for one second each time.**
3. **Press the power window control switch open button until the door window is fully open.**
4. **Briefly press the power window control switch close button to the second detent and release the button.**
   - If the door window does not close automatically, repeat the complete procedure.
5. **Repeat the door window motor initialization for each door window motor.**

REMOVAL AND INSTALLATION

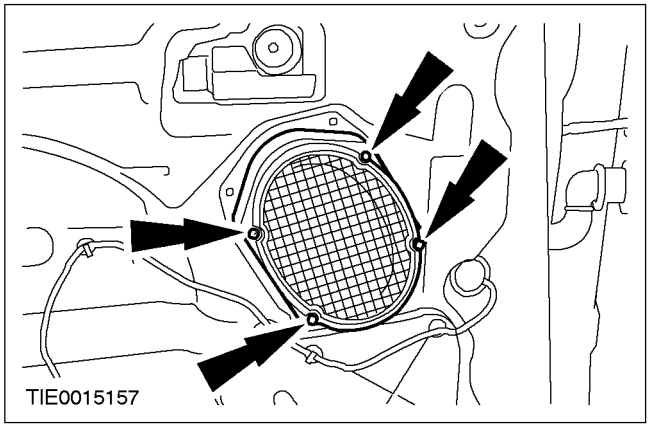
Front Door Window Glass (42 314 0)

Removal

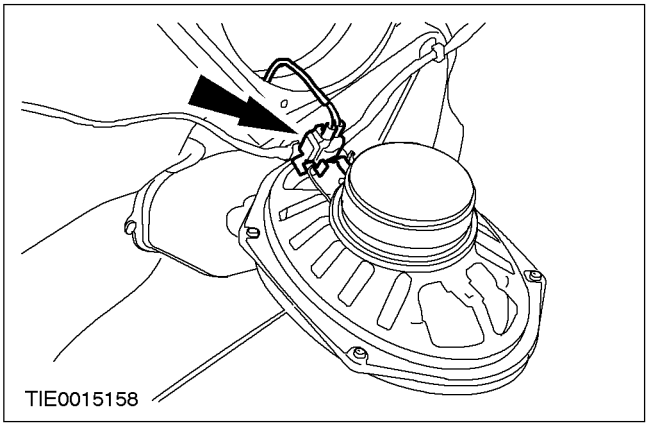
1. **Lower the front door window glass to the position shown.**



2. **Remove the front door trim panel. For additional information, refer to Section 501-05.**
3. **Detach the speaker from the front door panel.**

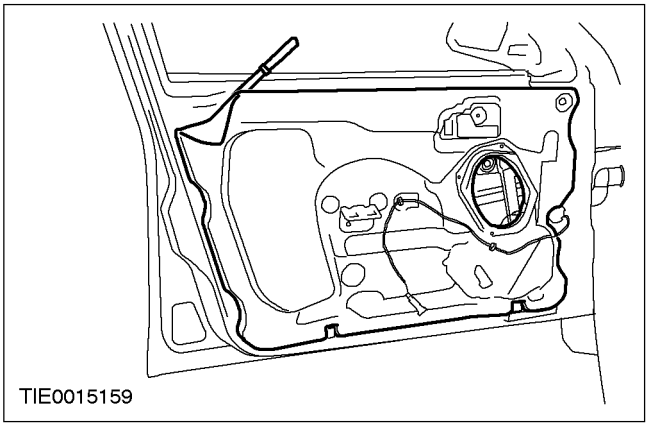


4. **Remove the speaker.**
   - Disconnect the electrical connector.

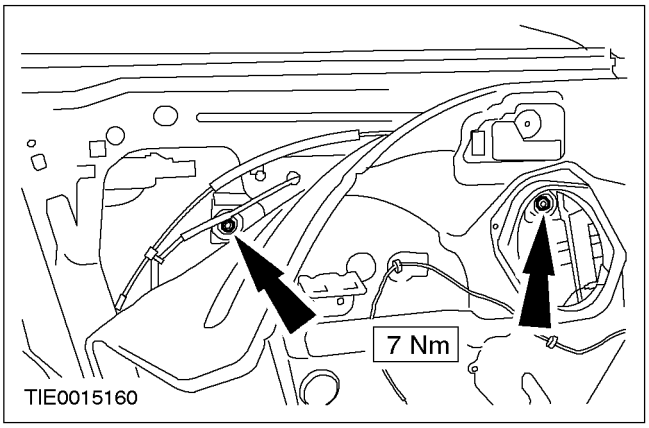


5. **CAUTION: Do not touch the adhesive surface as re-bonding will be impaired.**

   Detach the watershield from the front door panel.

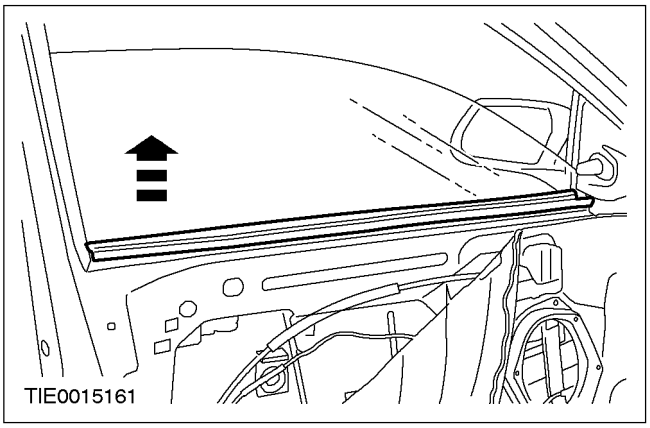


6. **Loosen the front door window glass clamp bolts.**



REMOVAL AND INSTALLATION (Continued)

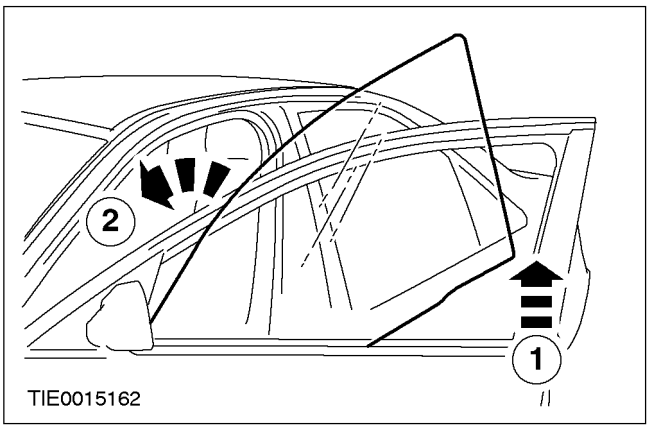
7. Remove the front door window glass weatherstrip.



8. NOTE: The front door window glass must be removed towards the outside of the window opening.

Remove the front door window glass.

1. Lift the glass.
2. Tip the glass forwards and remove the glass from the front door.



Installation

1. NOTE: The front door window glass must be installed towards the outside of the window opening.

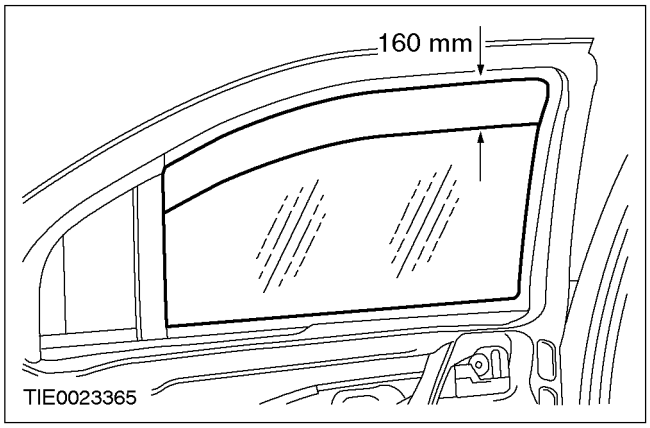
To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

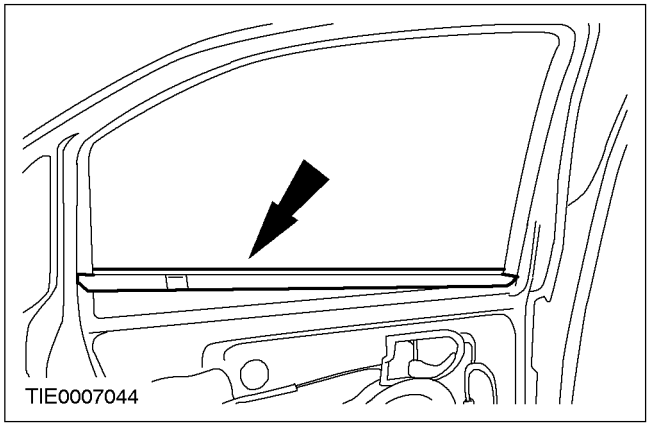
Rear Door Window Glass (42 315 0)

Removal

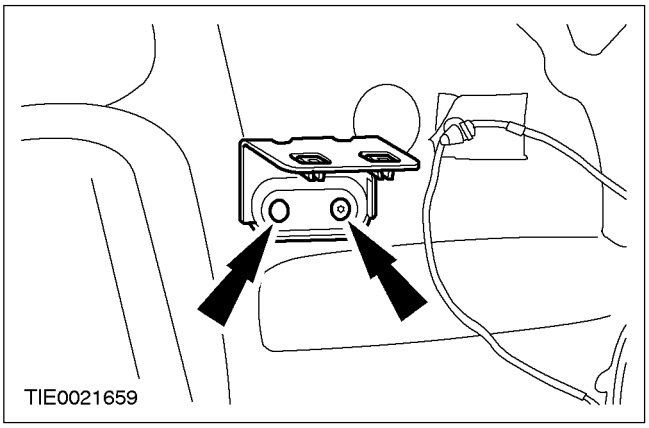
1. **Lower the rear door window glass to the position shown.**



2. **Remove the rear door trim panel. For additional information, refer to Section 501-05.**
3. **Remove the rear door window glass opening inner weatherstrip.**

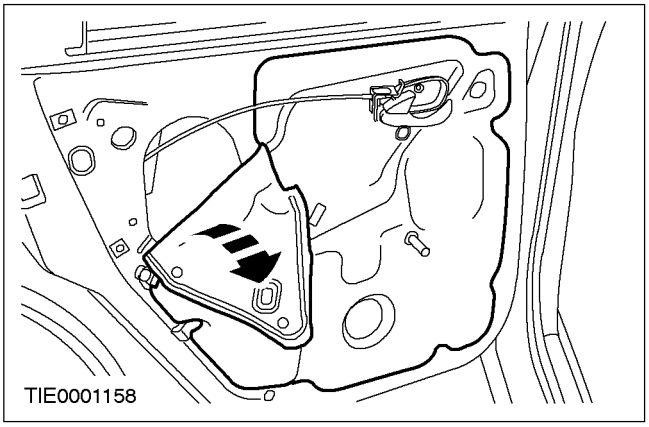


4. **Remove the rear door handle support bracket.**



5. **CAUTION: Do not touch the adhesive surface as re-bonding will be impaired.**

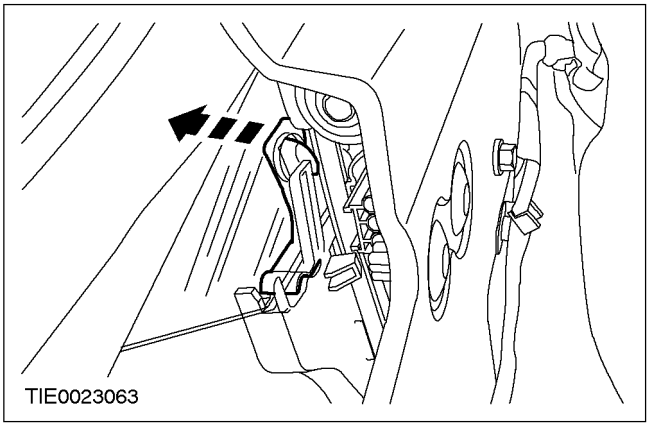
   Detach the watershield from the rear door panel.



REMOVAL AND INSTALLATION (Continued)

6. Detach the rear door window glass from the window regulator and remove the rear door window glass.

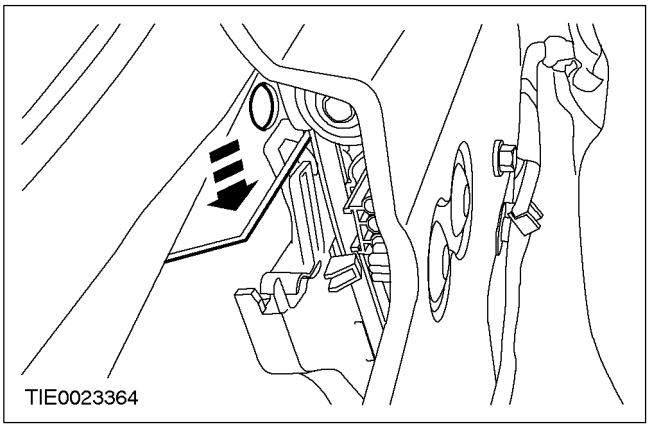
- Access the window glass retaining clip from both sides, detach the window glass retaining clip and lift the window glass.



Installation

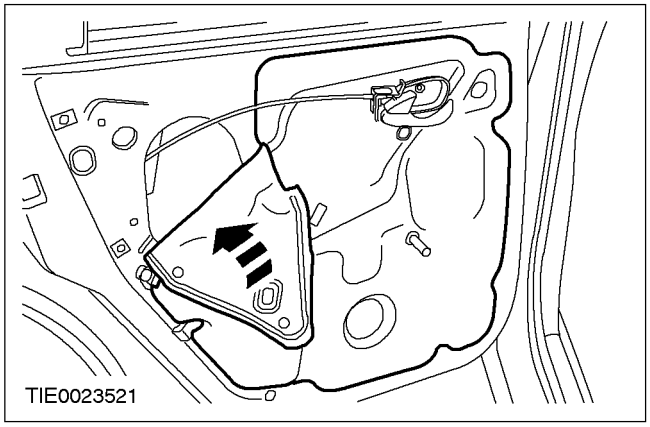
1. Install the rear door window glass.

- Push the rear door window glass down firmly onto the rear door window regulator to engage the window glass retaining clip.

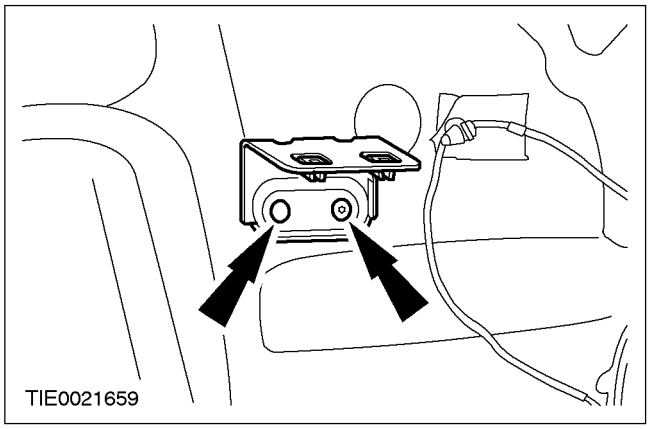


2. CAUTION: Do not touch the adhesive surface as re-bonding will be impaired.

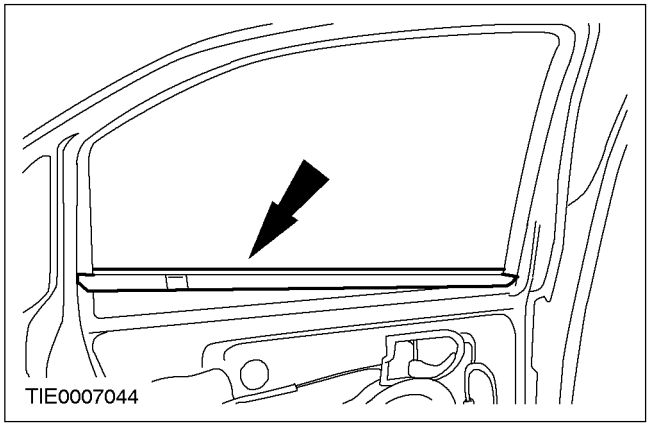
Attach the watershield to the rear door panel.



3. Install the rear door handle support bracket.



4. Install the rear door window glass opening inner weatherstrip.



REMOVAL AND INSTALLATION (Continued)

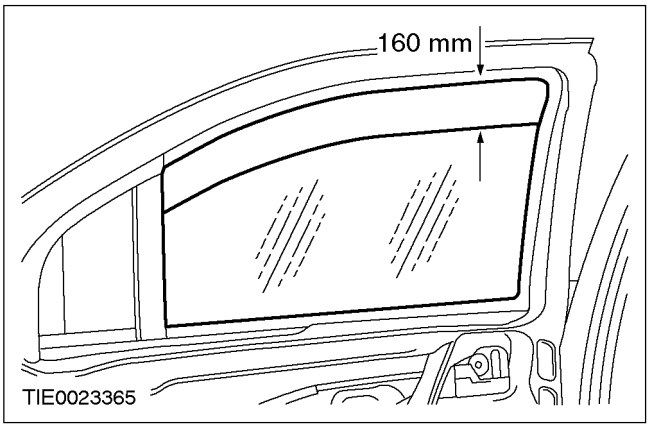
5. **Install the rear door trim panel. For additional information, refer to Section 501-05.**

REMOVAL AND INSTALLATION

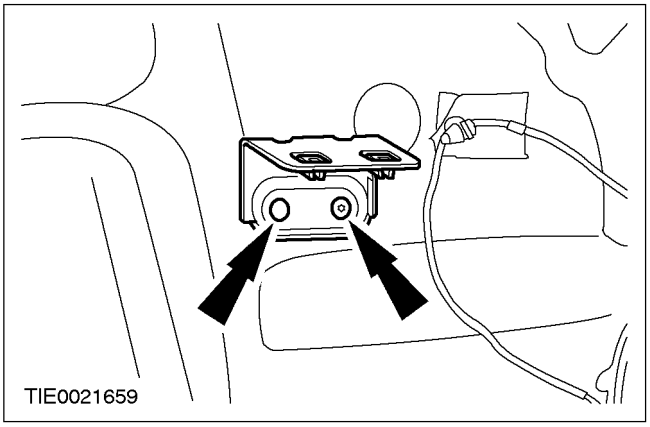
Rear Quarter Window Glass — 4-Door/5-Door (42 514 0)

Removal

1. **Lower the rear door window glass to the position shown.**

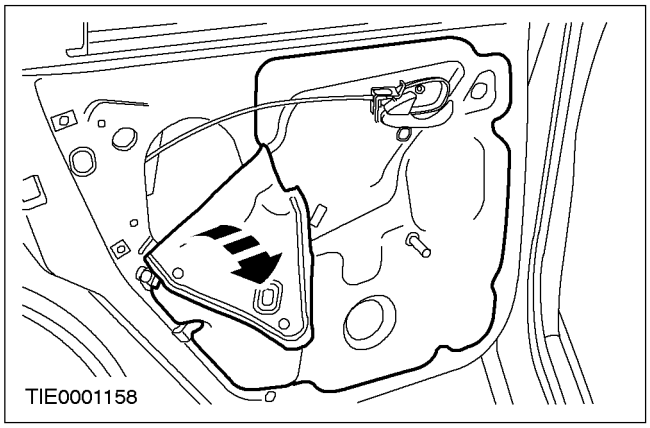


2. **Remove the rear door trim panel. For additional information, refer to Section 501-05.**
3. **Remove the rear door handle support bracket.**

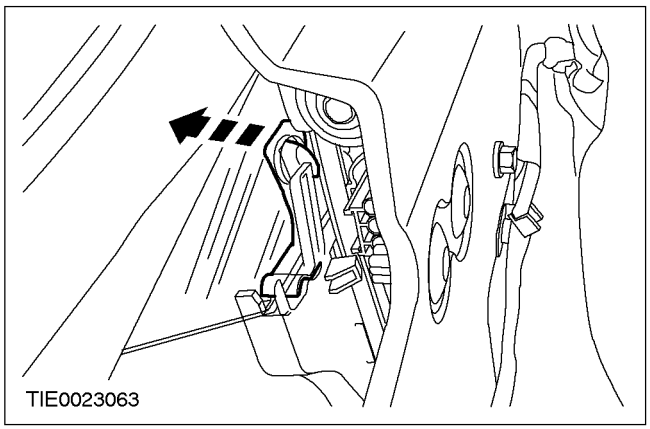


4. **CAUTION: Do not touch the adhesive surface as re-bonding will be impaired.**

   Detach the watershield from the rear door panel.

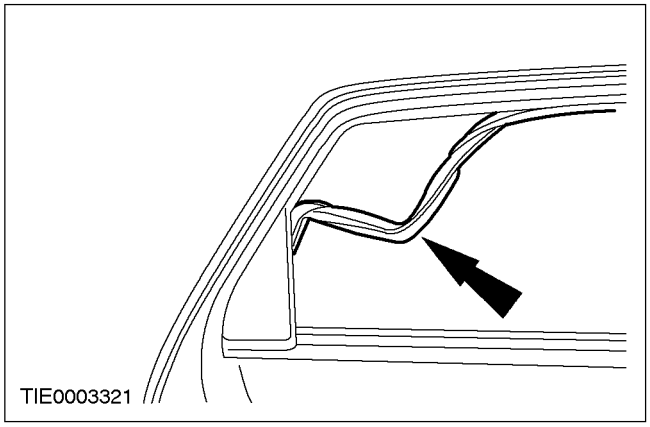


5. **Detach the rear door window glass from the window regulator and lower the window glass to the base of the door.**
   - Access the window glass retaining clip from both sides, detach the window glass retaining clip and lift the window glass.

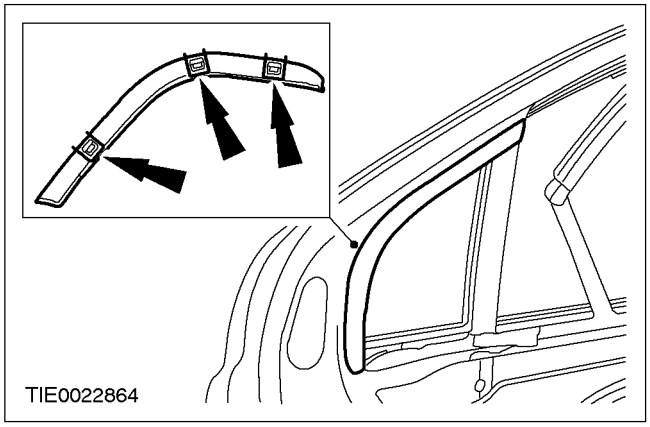


REMOVAL AND INSTALLATION (Continued)

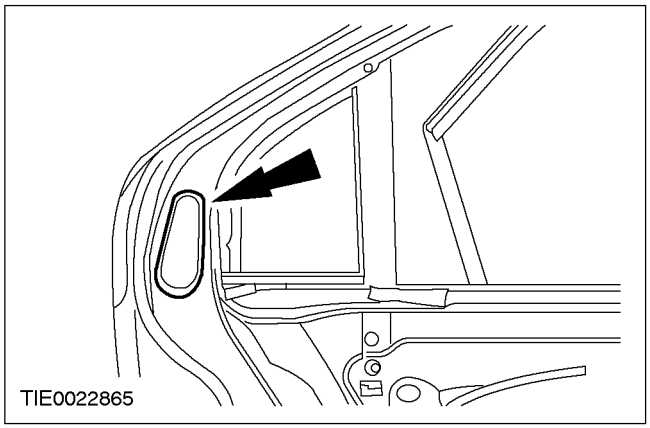
6. Detach the rear door glass top run from the rear door window opening.



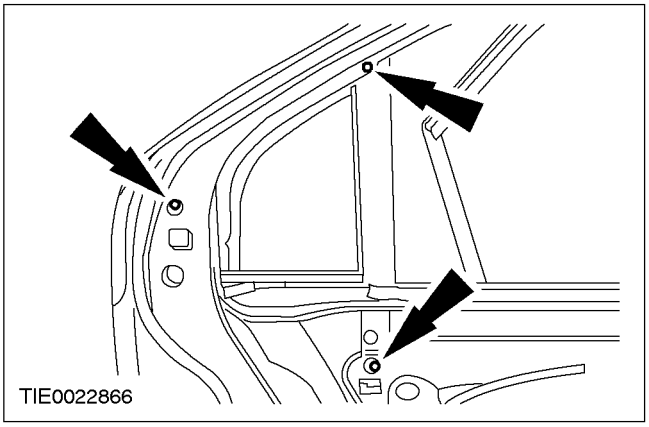
7. Remove the rear quarter window glass trim panel.



8. Remove the rear quarter window glass screw cover.

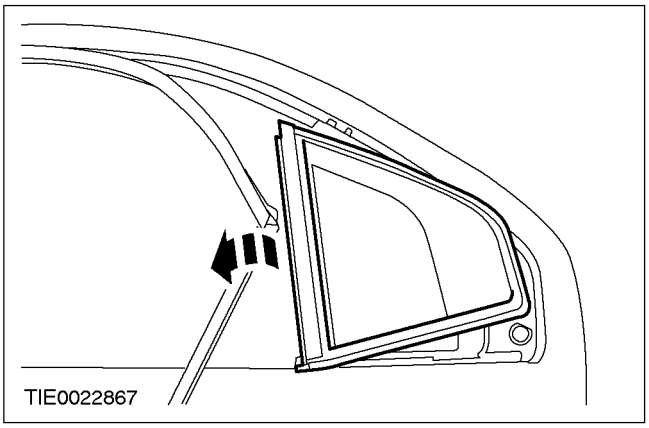


9. Remove the rear quarter window glass retaining screws.



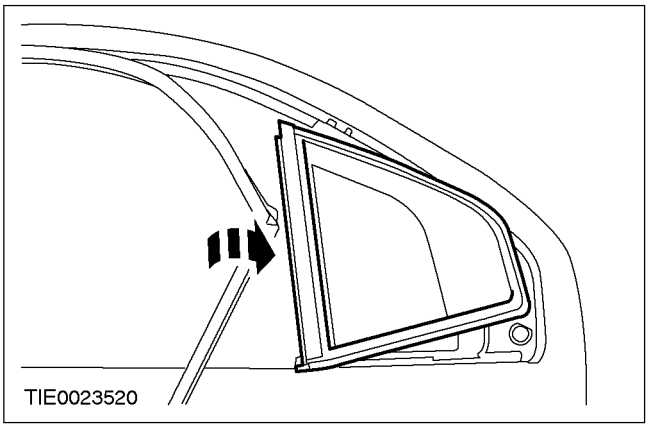
10. Remove the rear quarter window glass.

- Tip the glass forwards and remove the glass from the rear door.



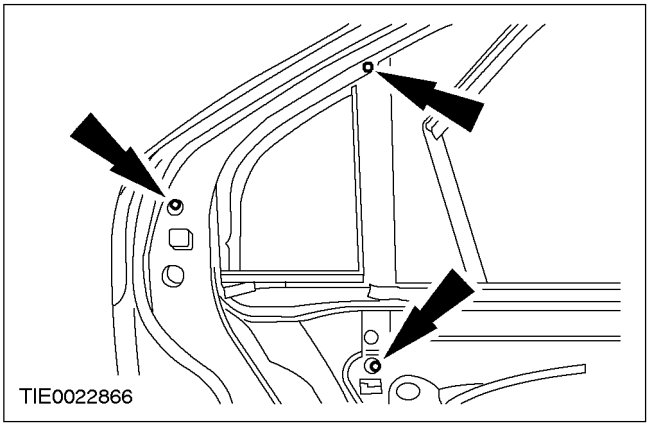
Installation

1. Install the rear quarter window glass.

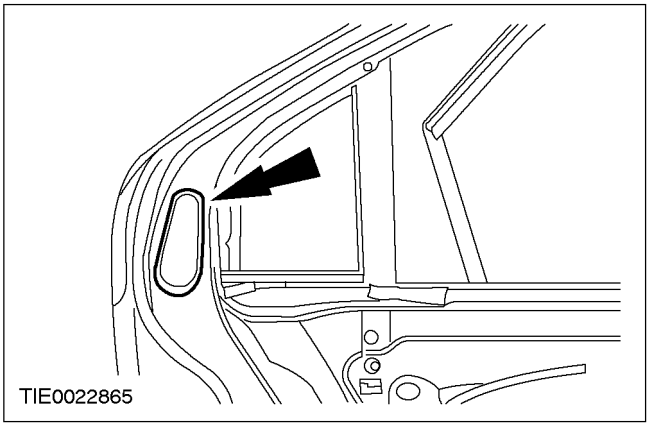


REMOVAL AND INSTALLATION (Continued)

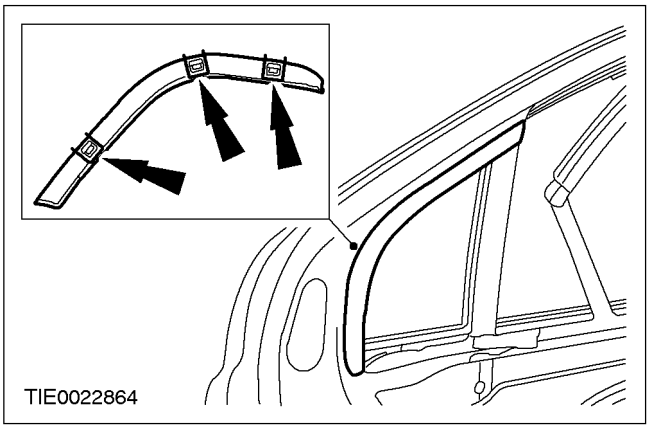
2. Install the rear quarter window glass retaining screws.



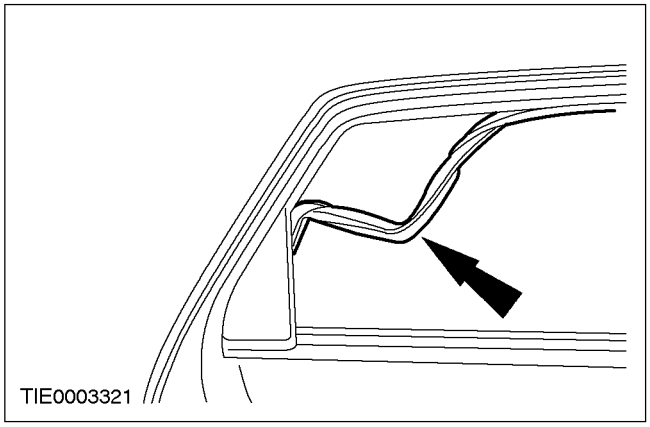
3. Install the rear quarter window glass screw cover.



4. Install the rear quarter window glass trim panel.

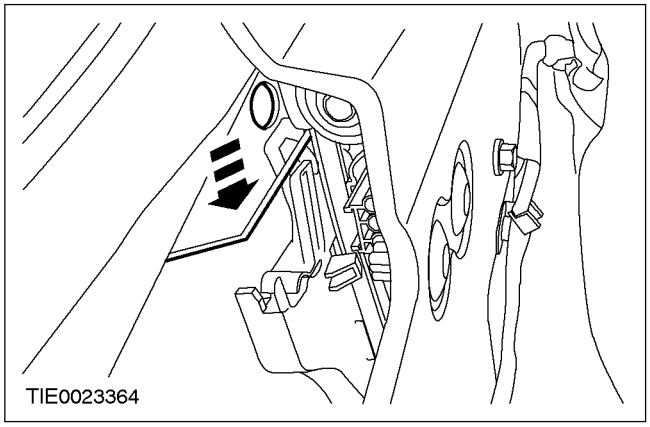


5. Attach the rear door glass top run to the rear door window opening.



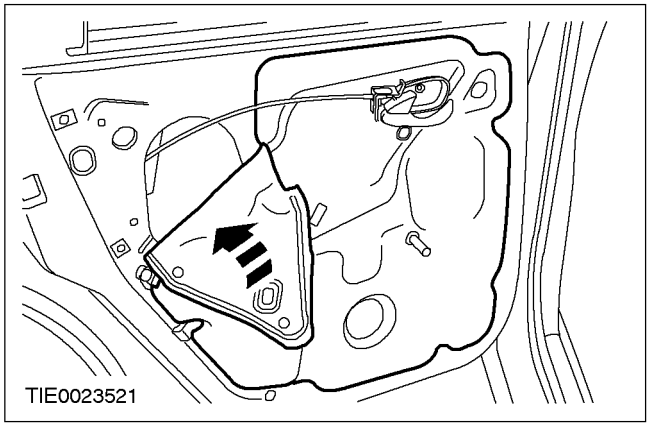
6. Install the rear door window glass.

- Push the rear door window glass down firmly onto the rear door window regulator to engage the window glass retaining clip.



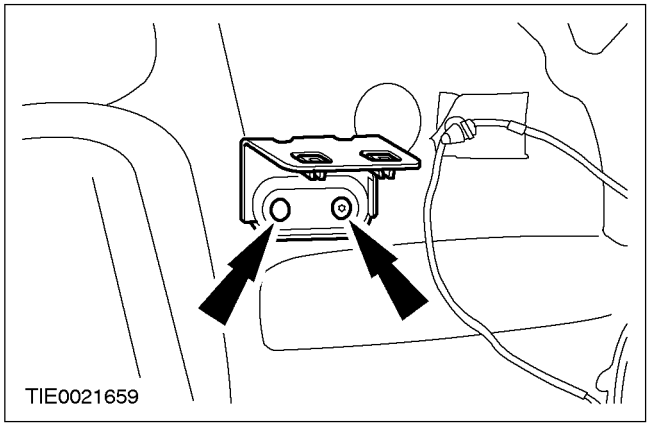
7. ⚠ CAUTION: Do not touch the adhesive surface as re-bonding will be impaired.

Attach the watershield to the rear door panel.



REMOVAL AND INSTALLATION (Continued)

8. **Install the rear door handle support bracket.**



9. **Install the rear door trim panel. For additional information, refer to Section 501-05.**

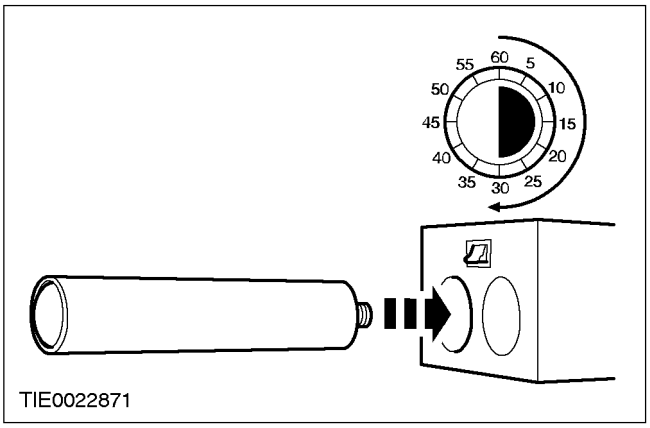
REMOVAL AND INSTALLATION

Rear Quarter Window Glass — Wagon (42 514 0)

General Equipment
Hot air gun
Direct glazing cutter for bonded glass
Direct glazing adhesive kit
Direct glazing adhesive oven
Glazing suction cups

Removal

1. **Remove the polyurethane (PU) adhesive cap and heat the PU adhesive for a minimum of 30 minutes**



2. **Disconnect the diversity antenna electrical connector (if equipped).**

3. **WARNING: Wear gloves and eye protection when working with the glass cutting tool as the cutting operation may produce splinters. When using the cutter wear ear protectors. Failure to follow these instructions may result in personal injury.**

CAUTION: Make sure the cutting blades are changed where the cutting depth changes to avoid damage to the body and trim panels.

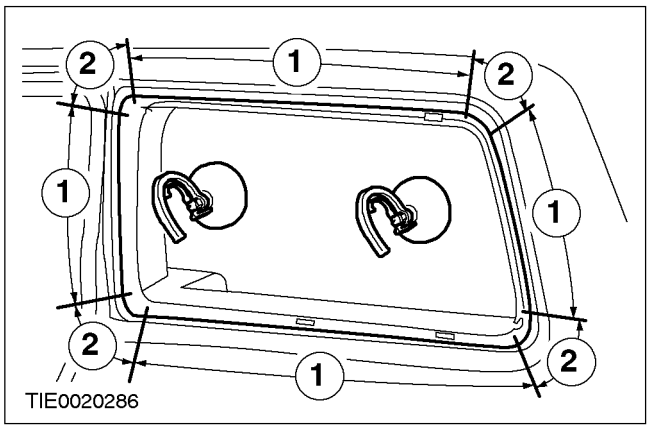
CAUTION: On vehicles equipped with a diversity antenna, make sure the cutting blades do not damage the antenna grid wire.

NOTE: Some resistance may be encountered when cutting through the glass locating pegs in the lower corners of the glass.

Using a suitable direct glazing cutter, cut the PU adhesive and, with the aid of another technician, use glazing suction cups to remove the rear quarter window glass.

- Cut the PU adhesive from inside the vehicle to the given maximum depths.

1. 10 mm
2. 15 mm

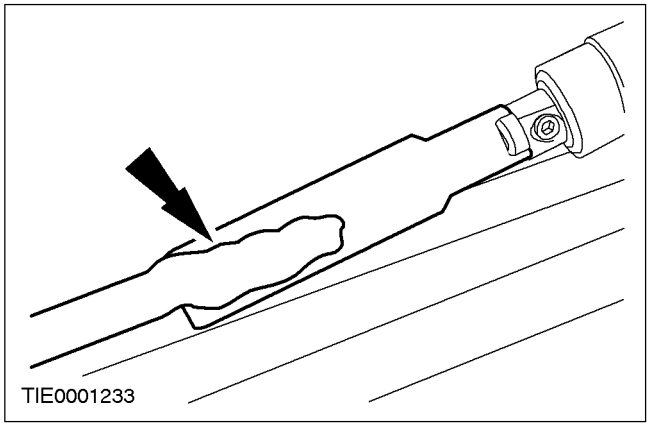


Installation

1. **Carefully remove the remaining part of the locating pegs from the rear quarter window glass flange.**

REMOVAL AND INSTALLATION (Continued)

2. Carefully trim the remaining PU adhesive from the rear quarter window glass flange to leave approximately 1 mm of trimmed PU adhesive adhered to the flange.



3. Check the rear quarter window glass flange for damaged sheet metal, rust or foreign material which may have caused, or may cause, glass breakage.

4. CAUTION: During the curing period of the PU adhesive, the door windows must be left open to avoid a build up of pressure when the doors are opened and closed.

CAUTION: Do not touch the adhesive surface as re-bonding will be impaired.

CAUTION: To make sure that the PU adhesive cures, it is essential that all bonding surfaces are free of moisture.

Using a hot air gun, apply warm air (25°C) to the rear quarter window glass flange and glass bond line to remove all traces of moisture.

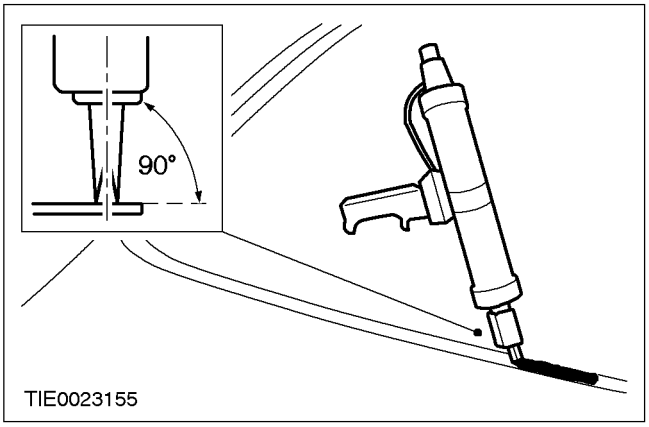
5. Prepare the glass, rear quarter window glass flange and trimmed PU adhesive in accordance with the instructions supplied with the adhesive kit.

6. CAUTION: On vehicles equipped with diversity antenna, make sure the PU adhesive does not cover the antenna grid wire.

NOTE: Discard the first 100 mm of PU adhesive as this may have a reduced working time.

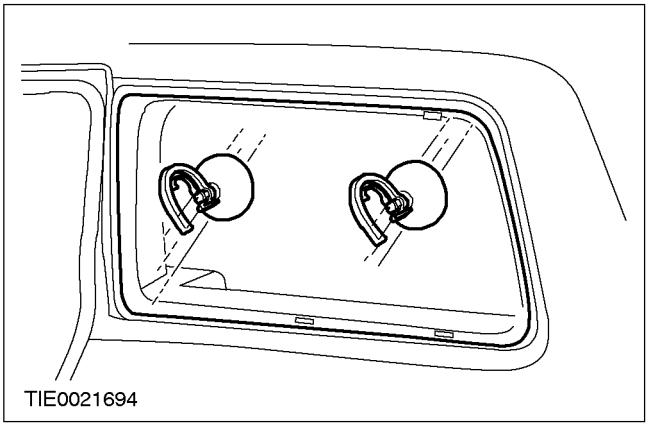
NOTE: To avoid water leaks, any breakage in the continuous bead must be overlapped by 20 mm.

Apply the PU adhesive in a continuous bead of between 8 and 10 mm in height to the rear quarter window glass flange along the bond line.



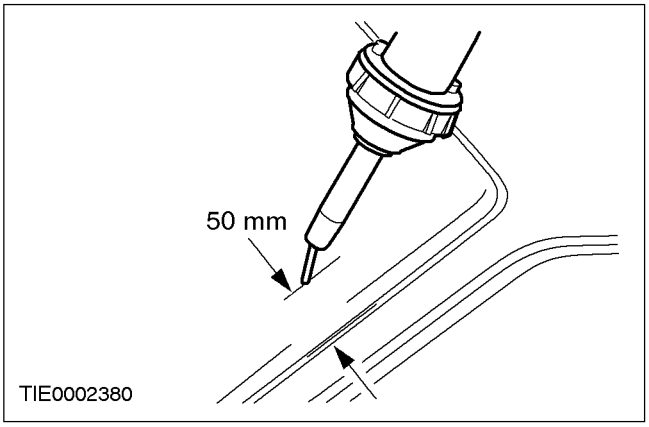
7. With the aid of another technician, use glazing suction cups to install the rear quarter window glass.

- Press firmly and evenly into position.



8. Using suitable tape, secure the rear quarter window glass in the correct position until the PU adhesive has cured.

9. If the ambient temperature falls below 10°C, use a hot air gun and apply warm air (25°C) continuously for 15 minutes (inside or outside the vehicle).



REMOVAL AND INSTALLATION (Continued)

10. **Connect the diversity antenna electrical connector (if equipped).**

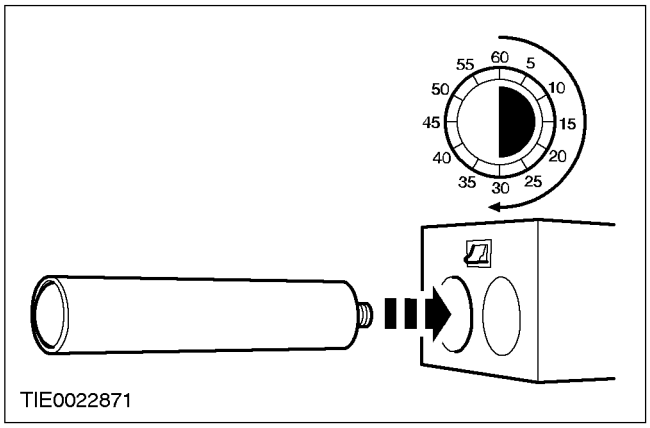
REMOVAL AND INSTALLATION

Rear Window Glass — 4-Door

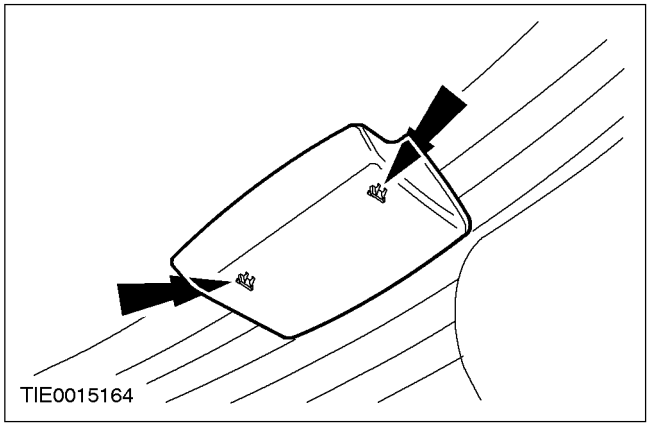
General Equipment
Hot air gun
Direct glazing cutter for bonded glass
Direct glazing adhesive kit
Direct glazing adhesive oven
Glazing suction cups

Removal

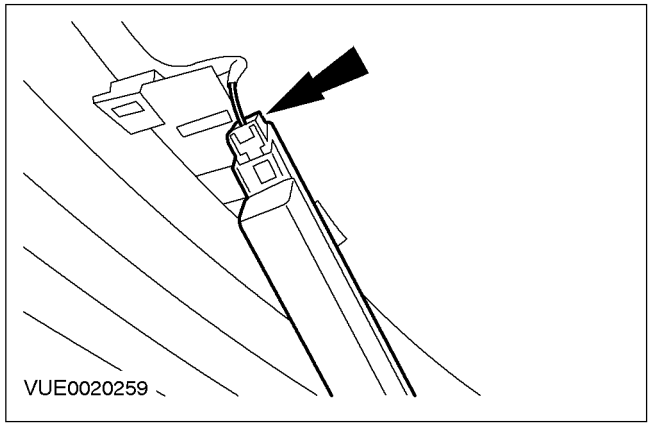
1. **Remove the polyurethane (PU) adhesive cap and heat the PU adhesive for a minimum of 30 minutes.**



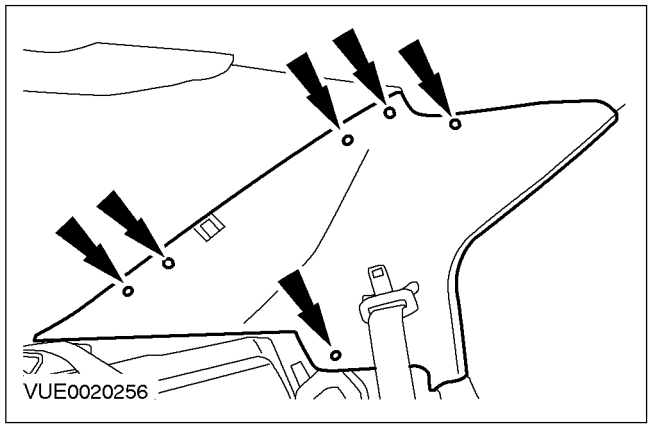
2. **Remove the high mounted stoplamp cover.**



3. **Disconnect the electrical connector and remove the high mounted stoplamp.**



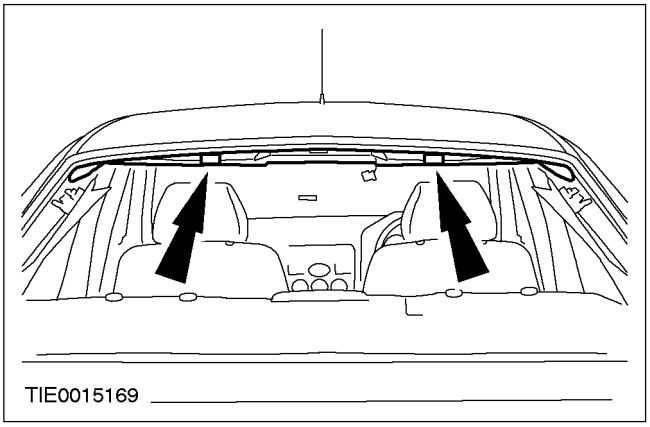
4. **Remove the rear seat backrest outer head restraints.**
5. **Detach the C-pillar trim panels from the C-pillars and position them to one side (left-hand side shown).**



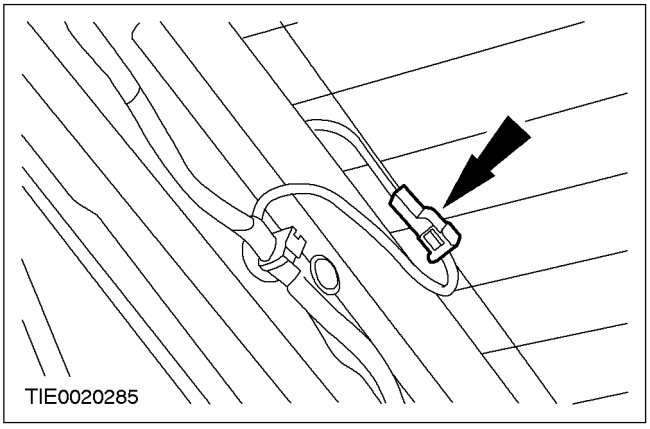
REMOVAL AND INSTALLATION (Continued)

6. Detach the rear of the headliner from the roof panel.

- Place blocks of suitable material between the headliner and the roof panel to act as spacers.



7. Disconnect the heated rear window glass electrical connectors (right-hand side shown).



8. Disconnect the diversity antenna electrical connector (if equipped).

9. WARNING: Wear gloves and eye protection when working with the glass cutting tool as the cutting operation may product splinters. When using the cutter wear ear protectors. Failure to follow these instructions may result in personal injury.

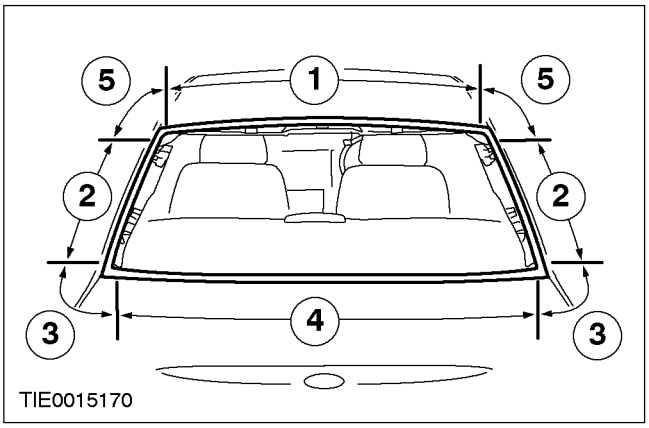
CAUTION: Make sure the cutting blades are changed where the cutting depth changes to avoid damage to the body and trim panels.

CAUTION: On vehicles equipped with a diversity antenna, make sure the cutting blades do not damage the antenna grid wire.

Using a suitable direct glazing cutter, cut the PU adhesive and, with the aid of another technician, use glazing suction cups to remove the rear window glass.

- Cut the PU adhesive from inside the vehicle to the given maximum depths.

1. 20 mm.
2. 23 mm.
3. 35 mm.
4. 40 mm.
5. 45 mm.

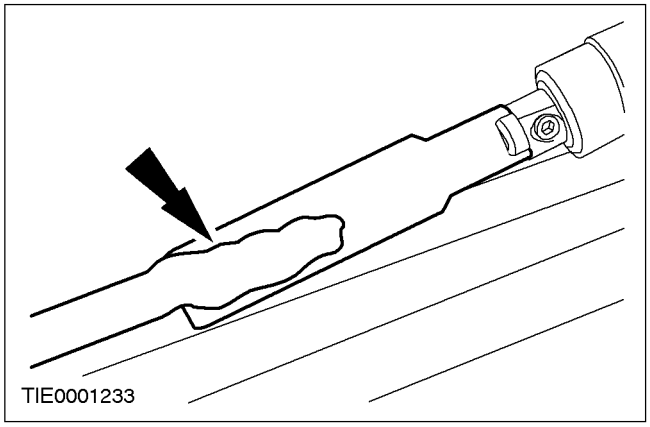


Installation

1. Carefully trim the remaining PU adhesive from the rear window glass flange to leave

REMOVAL AND INSTALLATION (Continued)

approximately 1 mm of trimmed PU adhesive adhered to the flange.



2. **Check the rear window glass flange for damaged sheet metal, rust or foreign material which may have caused, or may cause, glass breakage.**
3. **CAUTION: Do not touch the adhesive surface as re-bonding will be impaired.**

CAUTION: To make sure that the PU adhesive cures, it is essential that all bonding surfaces are free of moisture.

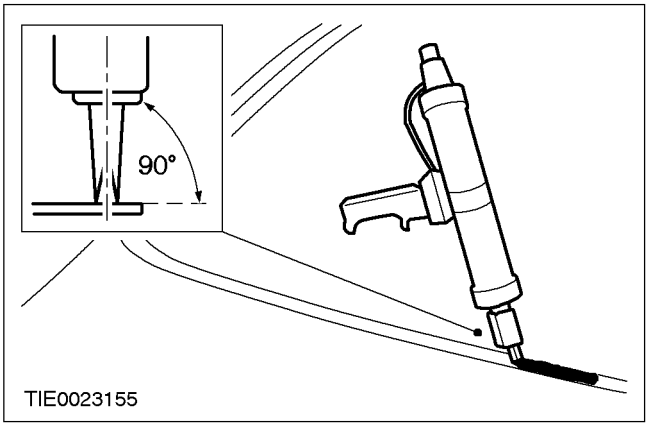
Using a hot air gun, apply warm air (25°C) to the rear window glass flange and glass bond line to remove all traces of moisture.

4. **Prepare the glass, rear window glass flange and trimmed PU adhesive in accordance with the instructions supplied with the PU adhesive kit.**
5. **CAUTION: On vehicles equipped with a diversity antenna, make sure the PU adhesive does not cover the antenna grid wire.**

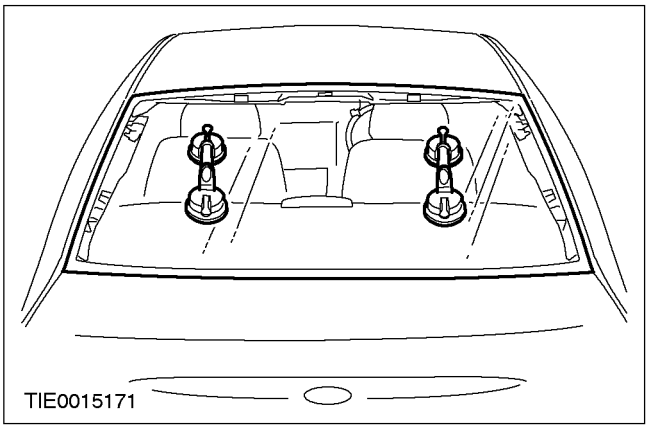
NOTE: Discard the first 100 mm of PU adhesive as this may have a reduced working time.

NOTE: To avoid water leaks, any breakage in the continuous bead must be overlapped by 20 mm.

Apply the PU adhesive in a continuous bead of between 8 and 10 mm in height to the rear window glass flange along the bond line.



6. **With the aid of another technician, use glazing suction cups to install the rear window glass.**
   - Press firmly and evenly into position.

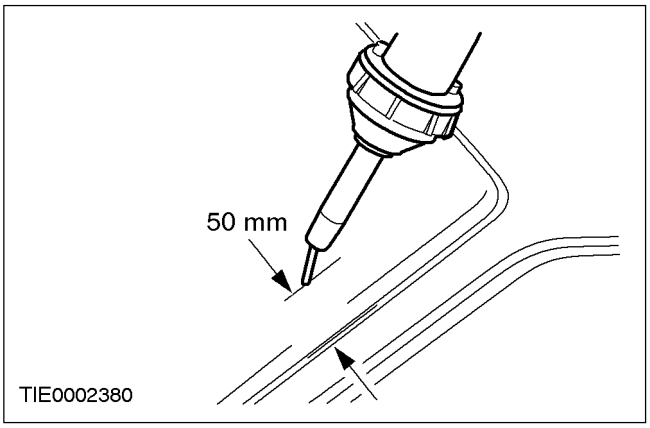


REMOVAL AND INSTALLATION (Continued)

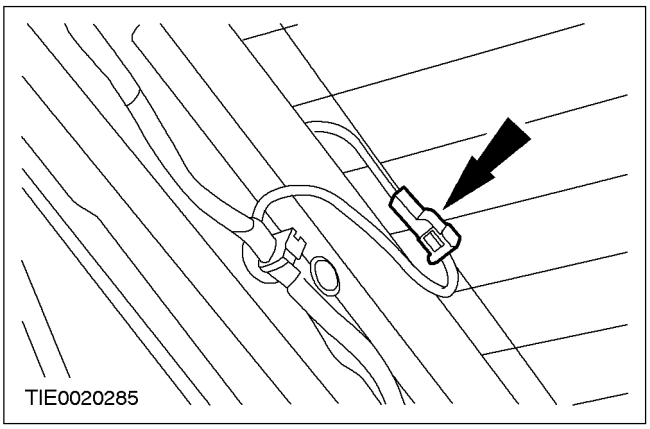
7. **⚠ CAUTION: During the curing period of the PU adhesive, the door windows must be left open to avoid a build up of pressure when the doors are opened and closed.**

   Using suitable tape, secure the rear window glass in the correct position until the PU adhesive has cured.

8. **If the ambient temperature falls below 10°C, use a hot air gun and apply warm air (25°C) continuously for 15 minutes (inside or outside the vehicle).**

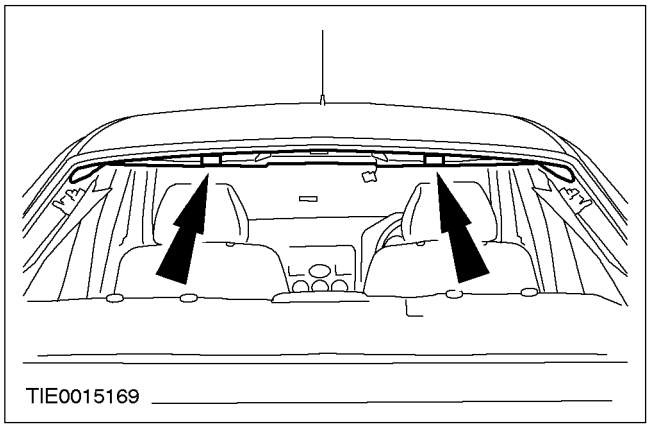


9. **Connect the heated rear window glass electrical connectors (right-hand side shown).**

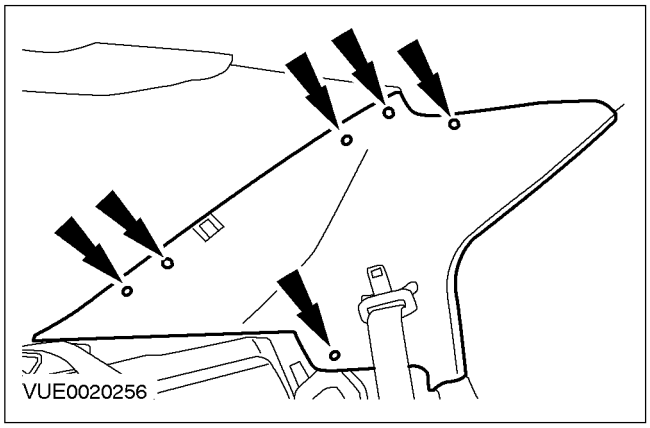


10. **Connect the diversity antenna electrical connector (if equipped).**

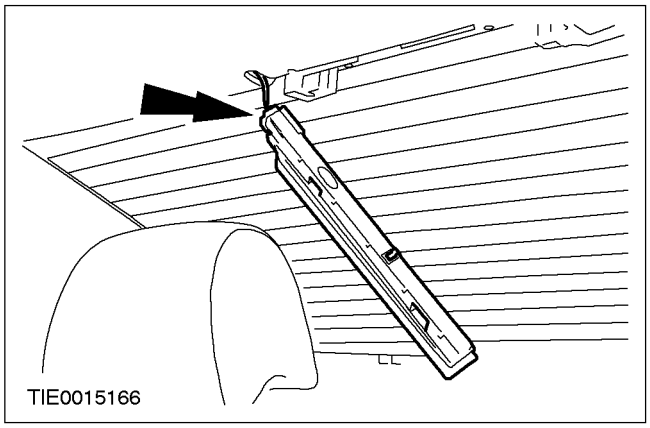
11. **Attach the rear of the headliner to the roof panel.**
    - Remove the spacers.



12. **Attach the C-pillar trim panels to the C-pillars (left-hand side shown).**

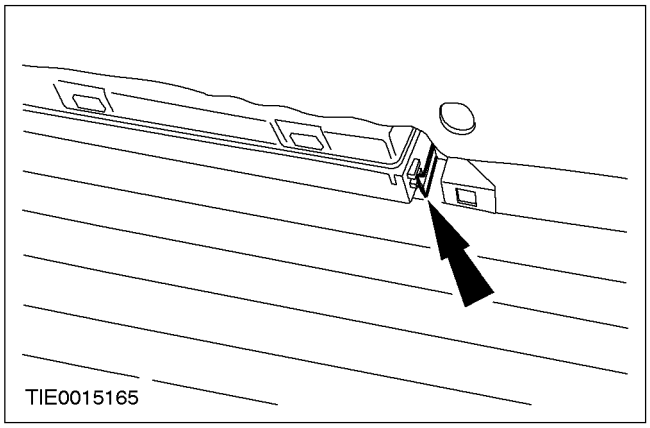


13. **Install the rear seat backrest outer head restraints.**
14. **Connect the high mounted stoplamp electrical connector.**

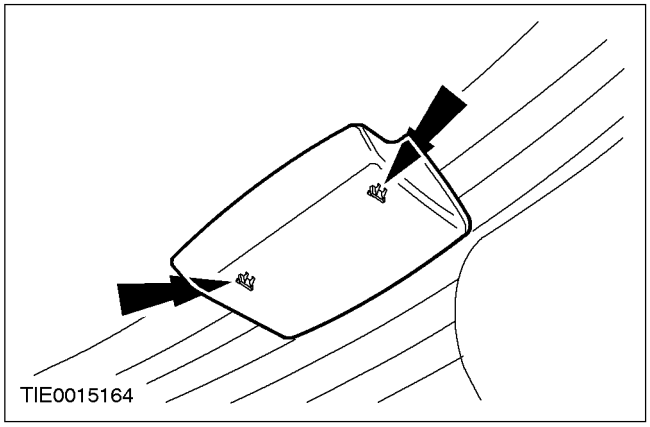


REMOVAL AND INSTALLATION (Continued)

15. Install the high mounted stoplamp.



16. Install the high mounted stoplamp cover.



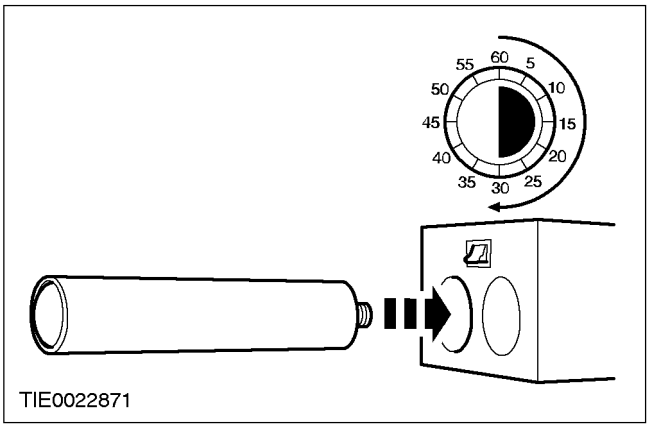
REMOVAL AND INSTALLATION

Rear Window Glass — 5-Door

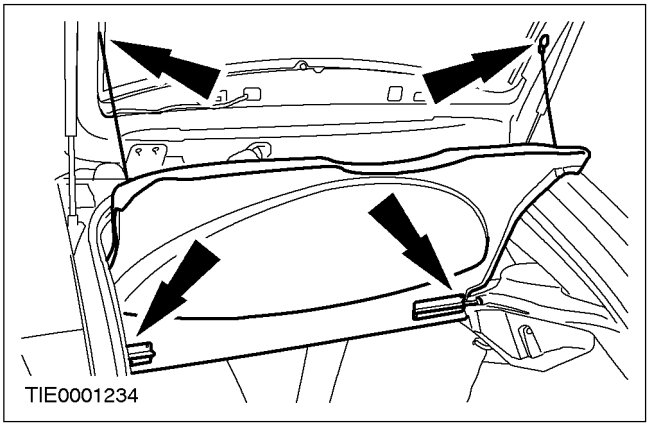
General Equipment
Hot air gun
Direct glazing cutter for bonded glass
Direct glazing adhesive kit
Direct glazing adhesive oven
Glazing suction cups

Removal

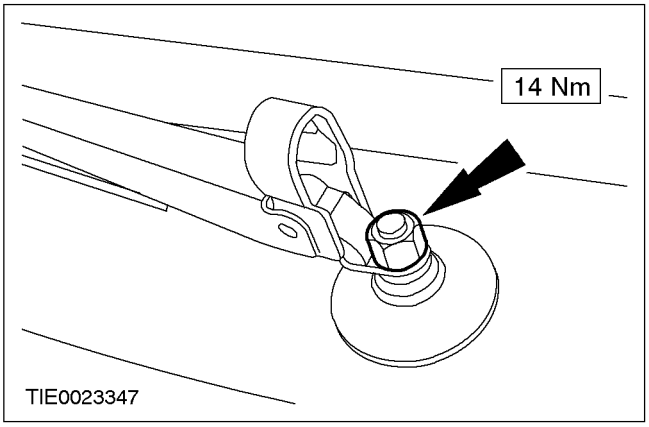
1. Remove the polyurethane (PU) adhesive cap and heat the PU adhesive for a minimum of 30 minutes.



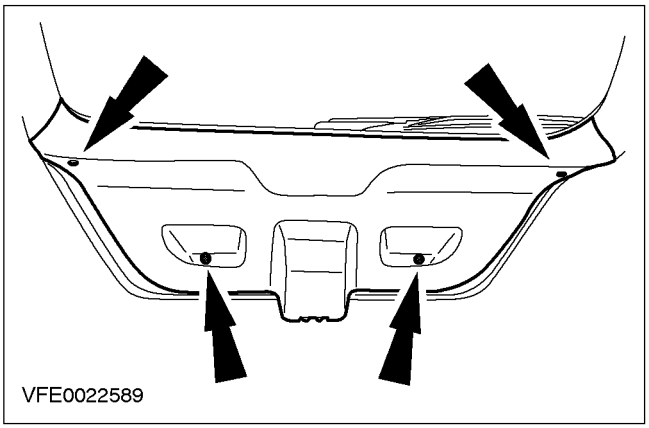
2. Remove the parcel shelf.



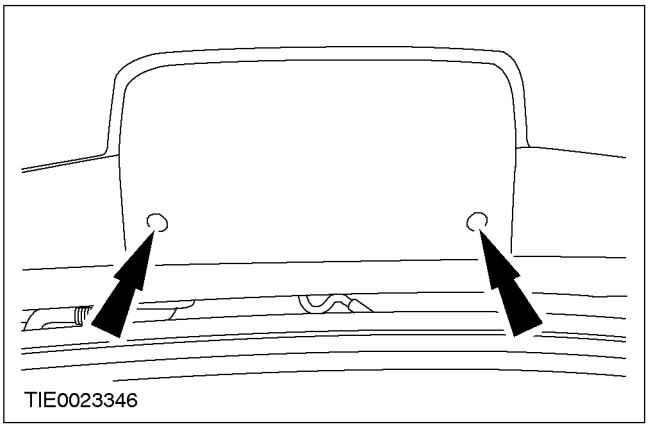
3. Remove the rear window wiper arm (if equipped).



4. Remove the liftgate trim panel.

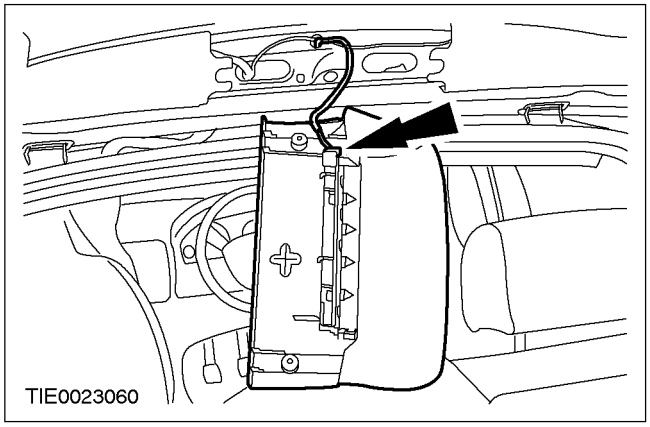


5. Detach the high mounted stoplamp from the liftgate.

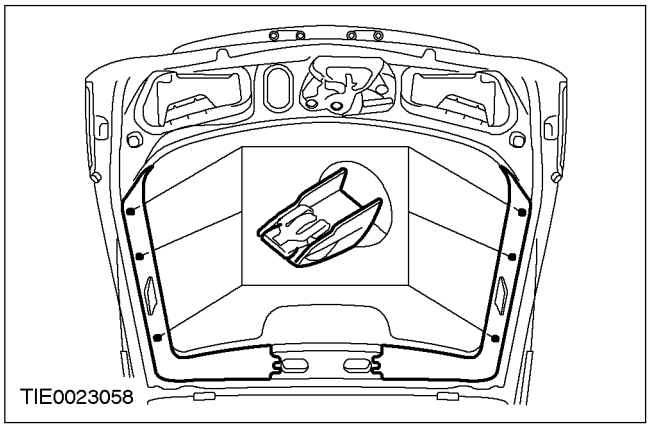


REMOVAL AND INSTALLATION (Continued)

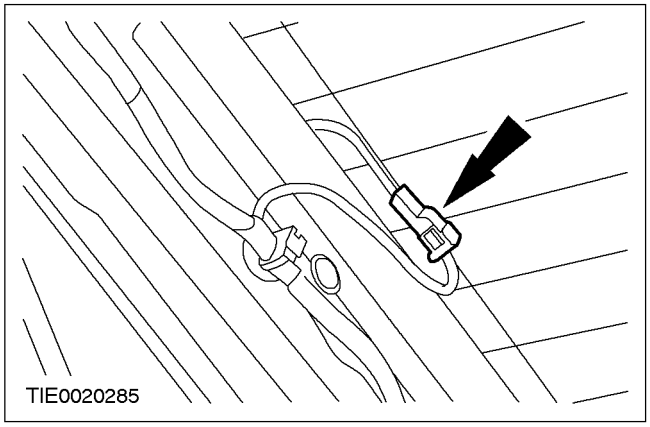
6. **Disconnect the electrical connector and remove the high mounted stoplamp.**



7. **Remove the liftgate side trim panels.**



8. **Disconnect the heated rear window glass electrical connectors (right-hand side shown).**



9. **Disconnect the diversity antenna electrical connector (if equipped).**

10. **WARNING: Wear gloves and eye protection when working with the glass cutting tool as the cutting operation may product splinters. When using the cutter wear ear protectors. Failure to follow these instructions may result in personal injury.**

CAUTION: Make sure the cutting blades are changed where the cutting depth changes to avoid damage to the body and trim panels.

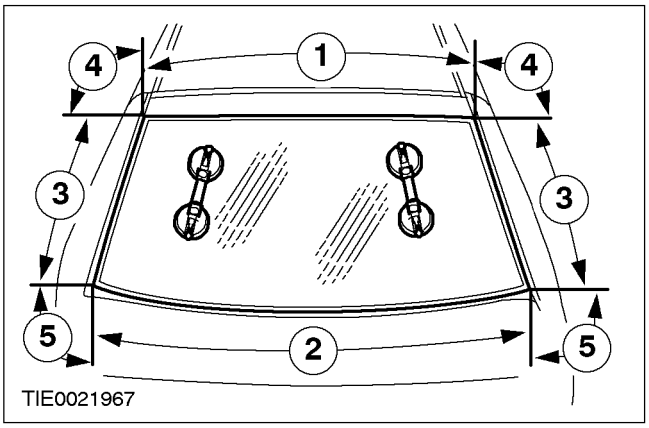
CAUTION: On vehicles equipped with a diversity antenna, make sure the cutting blades do not damage the antenna grid wire.

NOTE: Some resistance may be encountered when cutting through the glass locating pegs in the lower corners of the glass.

Using a suitable direct glazing cutter, cut the PU adhesive and, with the aid of another technician, use glazing suction cups to remove the rear window glass.

- Cut the PU adhesive from inside the vehicle to the given maximum depths.

1. 35 mm.
2. 30 mm.
3. 125 mm.
4. 150 mm.
5. 135 mm.

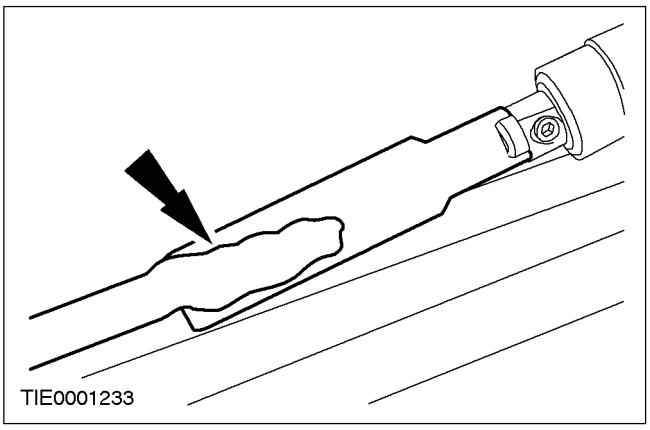


Installation

1. **Carefully remove the remaining part of the locating pegs from the rear window glass flange.**

REMOVAL AND INSTALLATION (Continued)

2. Carefully trim the remaining PU adhesive from the rear window glass flange to leave approximately 1 mm of trimmed PU adhesive adhered to the flange.



3. Check the rear window glass flange for damaged sheet metal, rust or foreign material which may have caused, or may cause, glass breakage.

4. CAUTION: Do not touch the adhesive surface as re-bonding will be impaired.

CAUTION: To make sure that the PU adhesive cures, it is essential that all bonding surfaces are free of moisture.

Using a hot air gun, apply warm air (25°C) to the rear window glass flange and glass bond line to remove all traces of moisture.

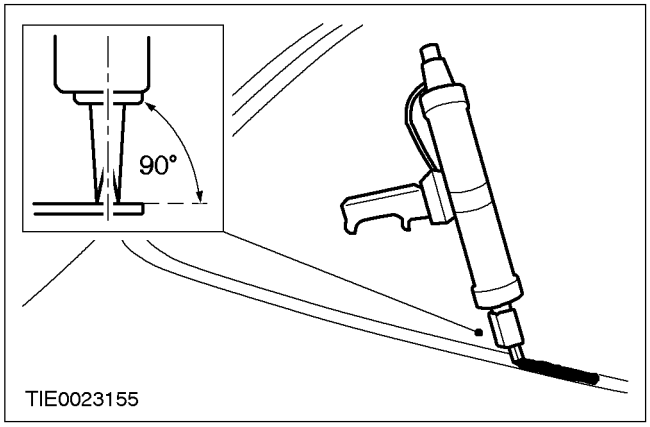
5. Prepare the glass, rear window glass flange and trimmed PU adhesive in accordance with the instructions supplied with the PU adhesive kit.

6. CAUTION: On vehicles equipped with a diversity antenna, make sure the PU adhesive does not cover the antenna grid wire.

NOTE: Discard the first 100 mm of PU adhesive as this may have a reduced working time.

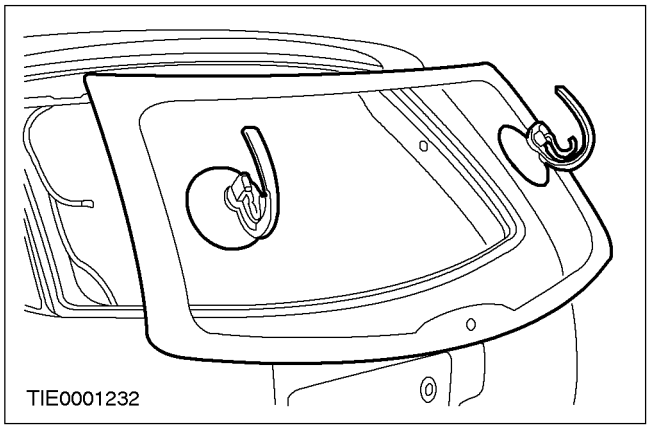
NOTE: To avoid water leaks, any breakage in the continuous bead must be overlapped by 20 mm.

Apply the PU adhesive in a continuous bead of between 8 and 10 mm in height to the rear window glass flange along the bond line.



7. With the aid of another technician, use glazing suction cups to install the rear window glass.

- Press firmly and evenly into position.

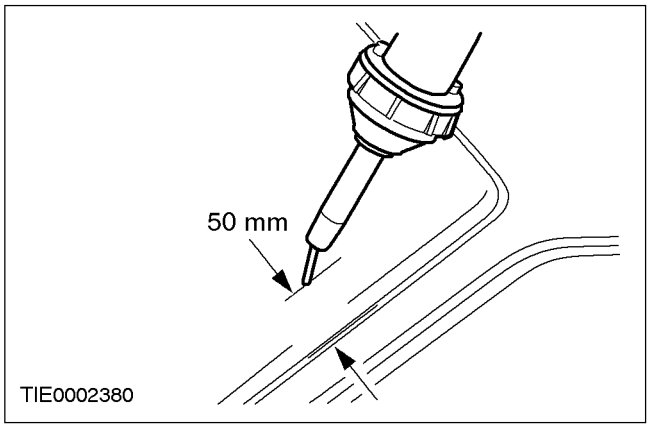


REMOVAL AND INSTALLATION (Continued)

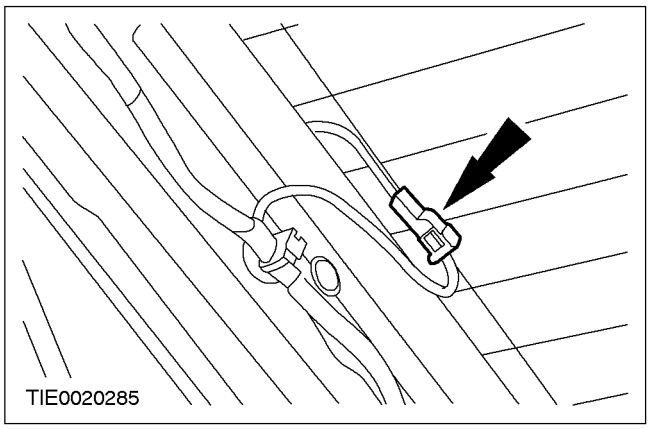
8. **CAUTION: During the curing period of the PU adhesive, the door windows must be left open to avoid a build up of pressure when the doors are opened and closed.**

   Using suitable tape, secure the rear window glass in the correct position until the PU adhesive has cured.

9. **If the ambient temperature falls below 10°C, use a hot air gun and apply warm air (25°C) continuously for 15 minutes (inside or outside the vehicle).**

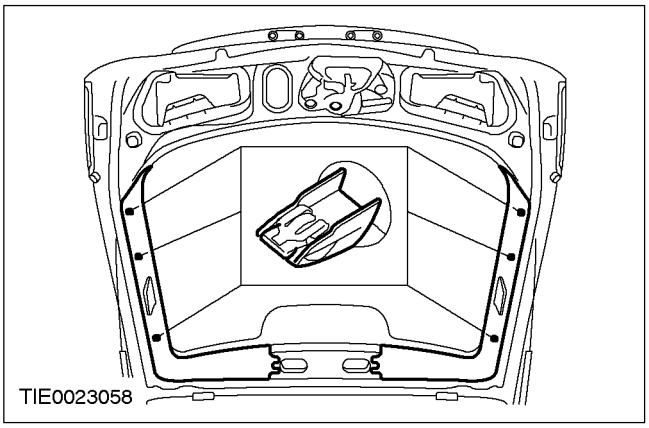


10. **Connect the heated rear window glass electrical connectors (right-hand side shown).**

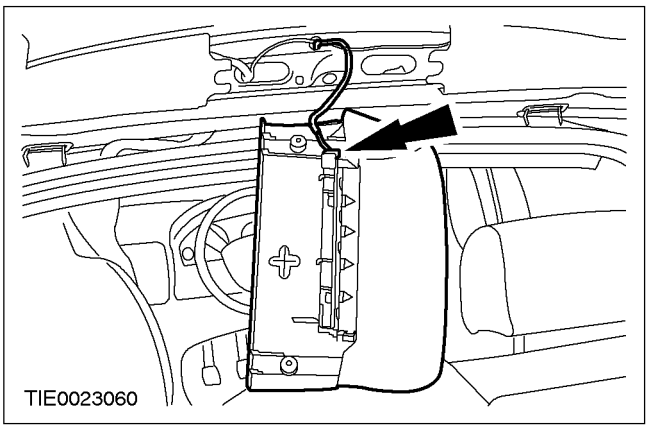


11. **Connect the diversity antenna electrical connector (if equipped).**

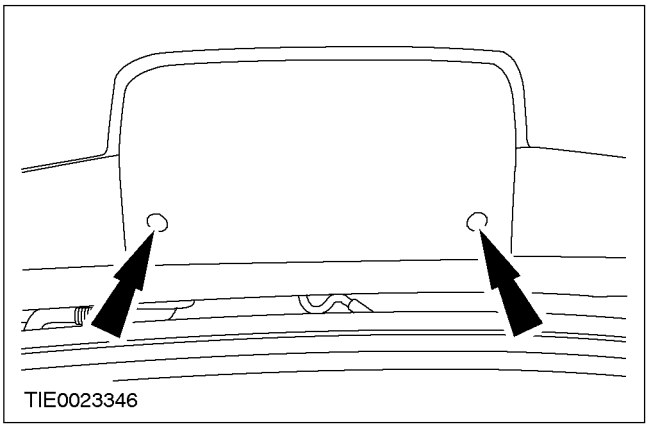
12. **Install the liftgate side trim panels.**



13. **Connect the high mounted stoplamp electrical connector.**

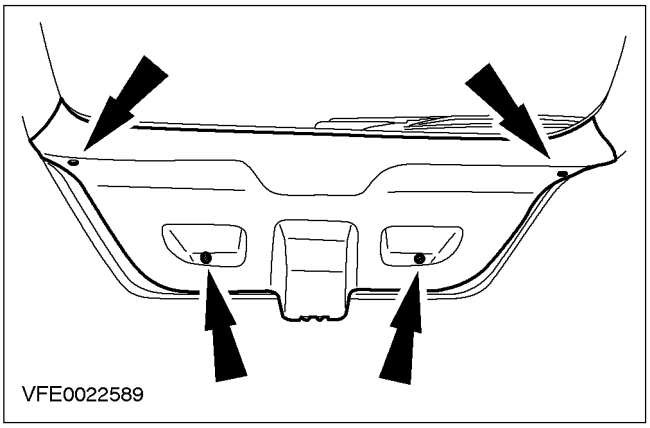


14. **Attach the high mounted stoplamp to the liftgate.**

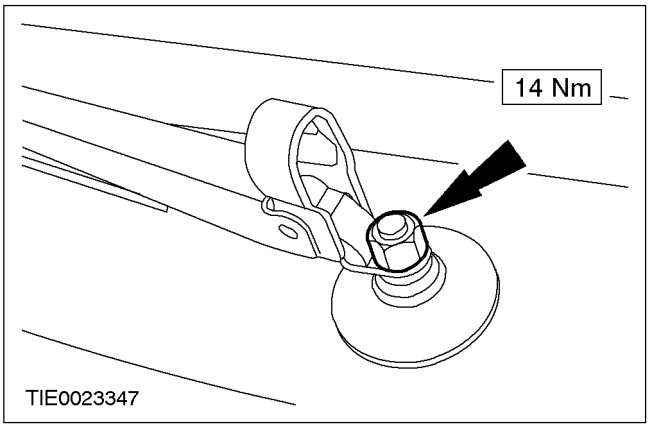


REMOVAL AND INSTALLATION (Continued)

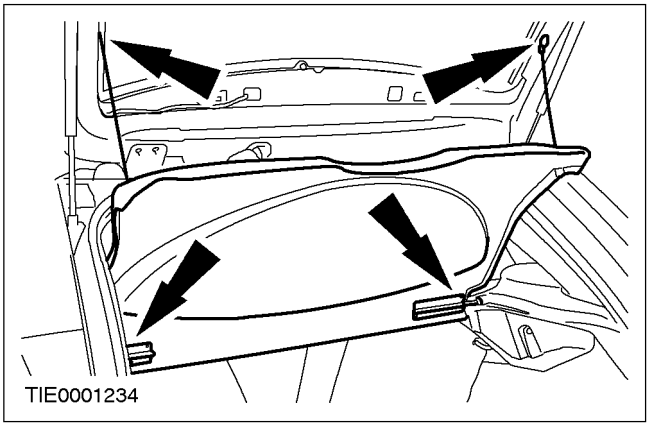
15. Install the liftgate trim panel.



16. Install the rear window wiper arm (if equipped).



17. Install the parcel shelf.



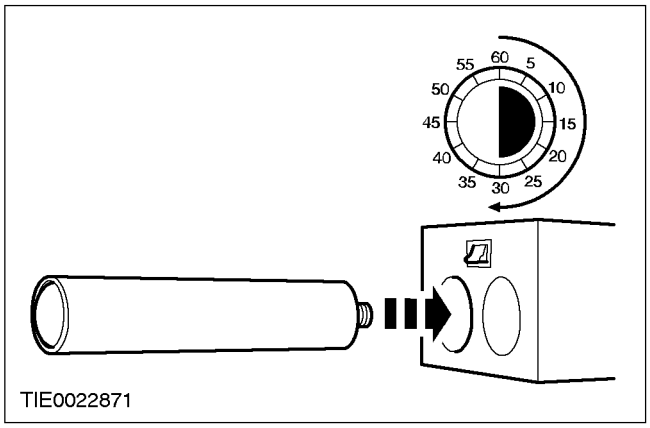
REMOVAL AND INSTALLATION

Rear Window Glass — Wagon

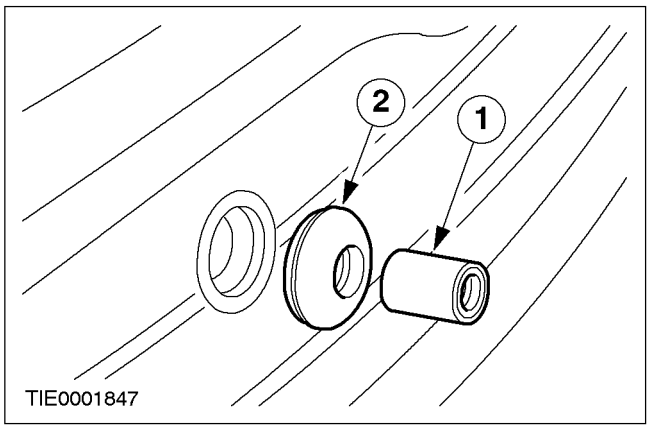
General Equipment
Hot air gun
Direct glazing cutter for bonded glass
Direct glazing adhesive kit
Direct glazing adhesive oven
Glazing suction cups

Removal

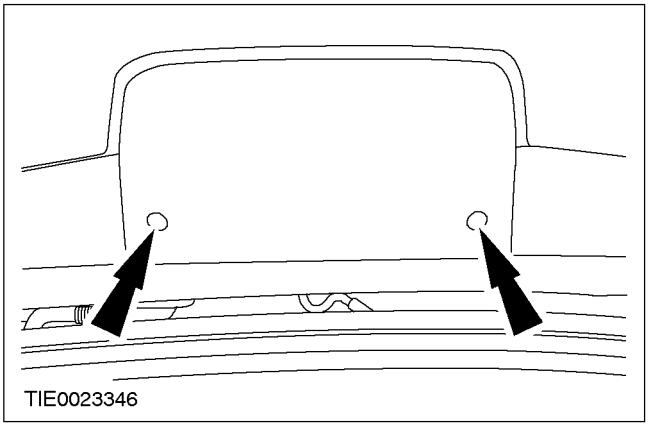
1. **Remove the polyurethane (PU) adhesive cap and heat the PU adhesive for a minimum of 30 minutes.**



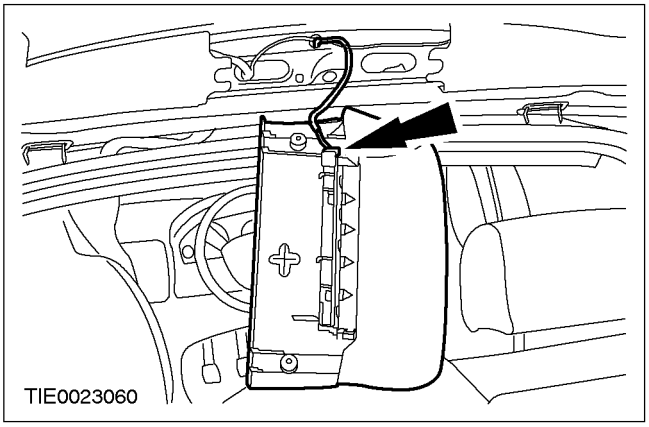
2. **Remove the rear window wiper motor. For additional information, refer to Section 501-16.**
3. **Remove the rear window wiper motor spindle grommet.**
   1. Remove the sleeve.
   2. Remove the grommet.



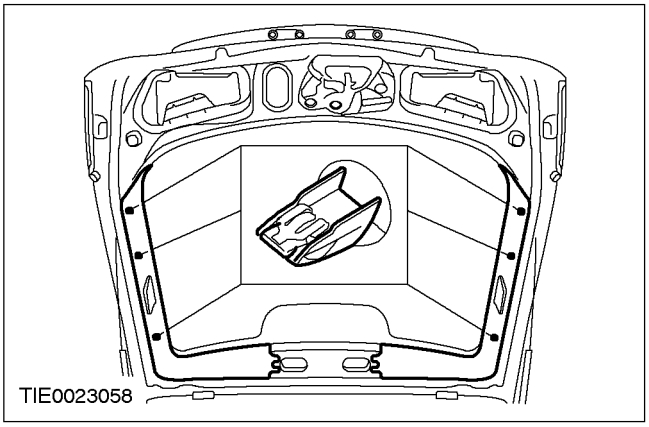
4. **Detach the high mounted stoplamp from the liftgate.**



5. **Disconnect the electrical connector and remove the high mounted stoplamp.**

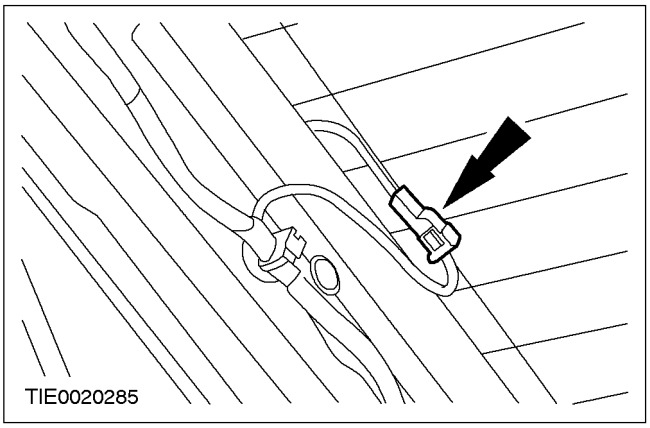


6. **Remove the liftgate side trim panels.**



REMOVAL AND INSTALLATION (Continued)

7. Disconnect the heated rear window glass electrical connectors (right-hand side shown).



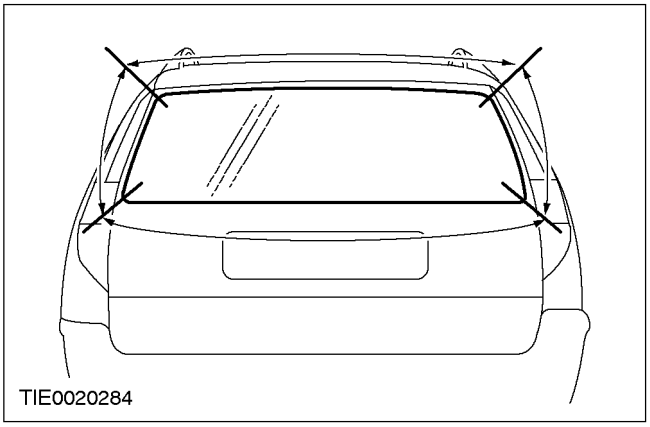
8. WARNING: Wear gloves and eye protection when working with the glass cutting tool as the cutting operation may product splinters. When using the cutter wear ear protectors. Failure to follow these instructions may result in personal injury.

CAUTION: Make sure the cutting blades are changed where the cutting depth changes to avoid damage to the body and trim panels.

NOTE: Some resistance may be encountered when cutting through the glass locating pegs in the lower corners of the glass.

Using a suitable direct glazing cutter, cut the PU adhesive and, with the aid of another technician, use glazing suction cups to remove the rear window glass.

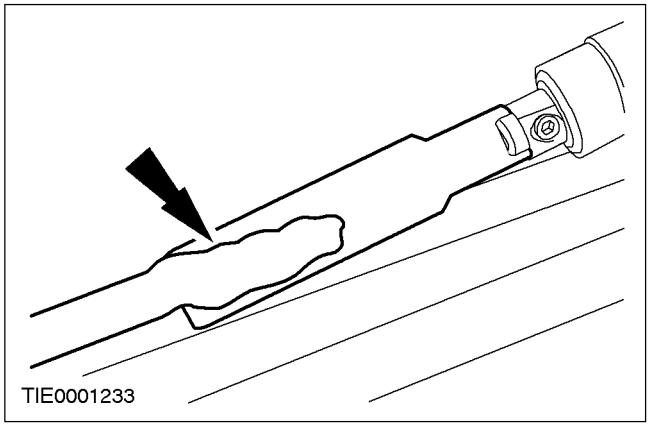
- Cut the PU adhesive from inside the vehicle to a maximum depth of 25 mm.



Installation

1. Carefully remove the remaining part of the locating pegs from the window glass flange.

2. Carefully trim the remaining PU adhesive from the rear window glass flange to leave approximately 1 mm of trimmed PU adhesive adhered to the flange.



3. Check the window glass flange for damaged sheet metal, rust or foreign material which may have caused, or may cause, glass breakage.

4. CAUTION: Do not touch the adhesive surface as re-bonding will be impaired.

CAUTION: To make sure that the PU adhesive cures, it is essential that all bonding surfaces are free of moisture.

Using a hot air gun, apply warm air (25°C) to the rear window glass flange and glass bond line to remove all traces of moisture.

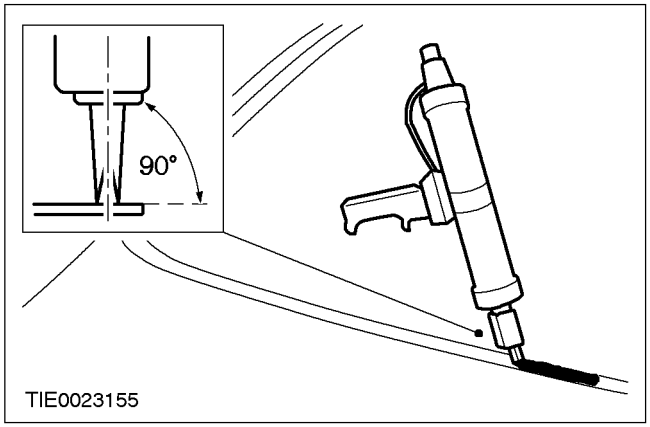
5. Prepare the glass, rear window glass flange and trimmed PU adhesive in accordance with the instructions supplied with the PU adhesive kit.

REMOVAL AND INSTALLATION (Continued)

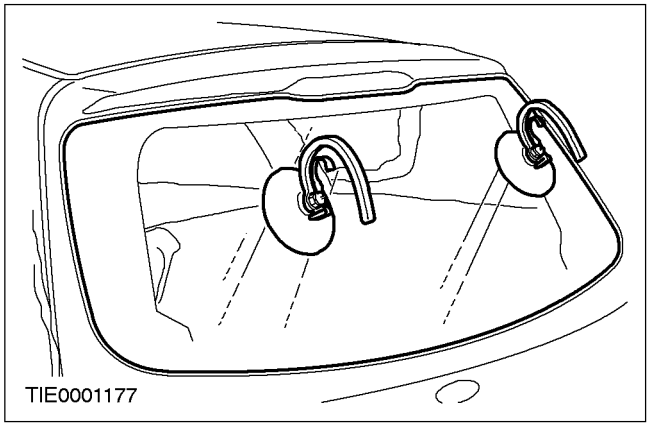
6. **NOTE:** Discard the first 100 mm of PU adhesive as this may have a reduced working time.

NOTE: To avoid water leaks, any breakage in the continuous bead must be overlapped by 20 mm.

Apply the PU adhesive in a continuous bead of between 8 and 10 mm in height to the rear window glass flange along the bond line.



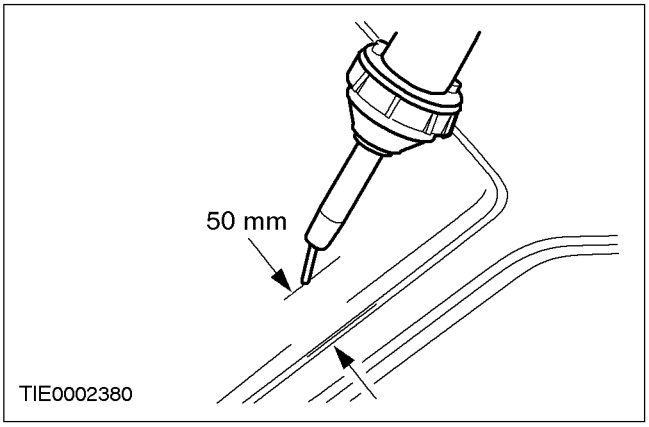
7. **With the aid of another technician, use glazing suction cups to install the rear window glass.**
   - Press firmly and evenly into position.



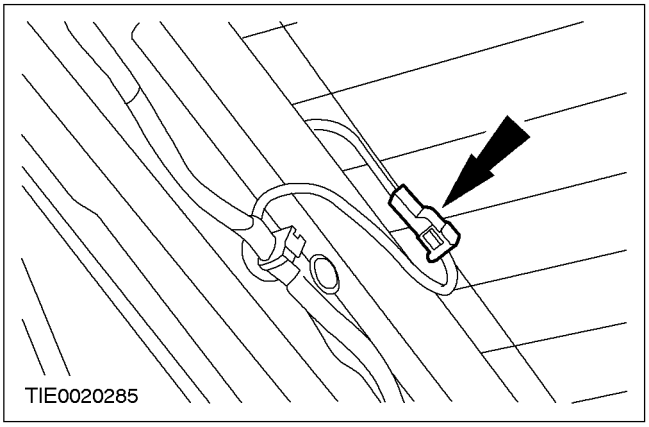
8. **CAUTION: During the curing period of the PU adhesive, the door windows must be left open to avoid a build up of pressure when the doors are opened and closed.**

Using suitable tape, secure the rear window glass in the correct position until the PU adhesive has cured.

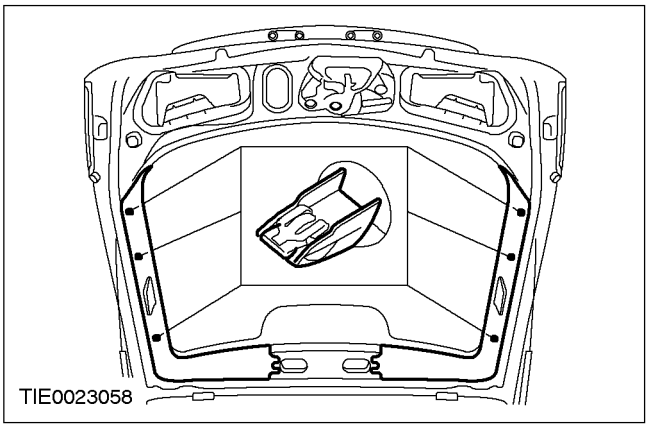
9. **If the ambient temperature falls below 10°C, use a hot air gun and apply warm air (25°C) continuously for 15 minutes (inside or outside the vehicle).**



10. **Connect the heated rear window glass electrical connectors (right-hand side shown).**

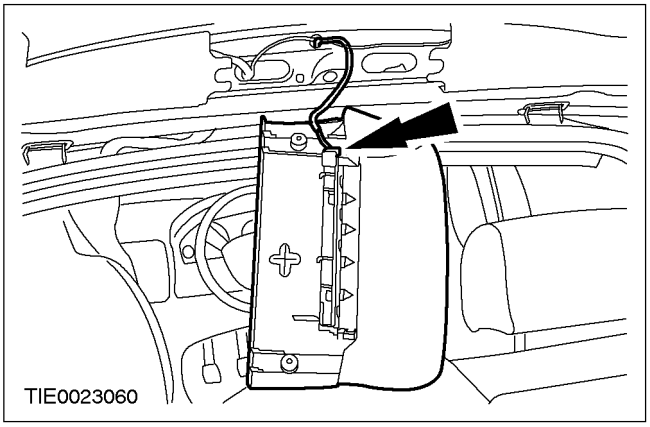


11. **Install the liftgate side trim panels.**

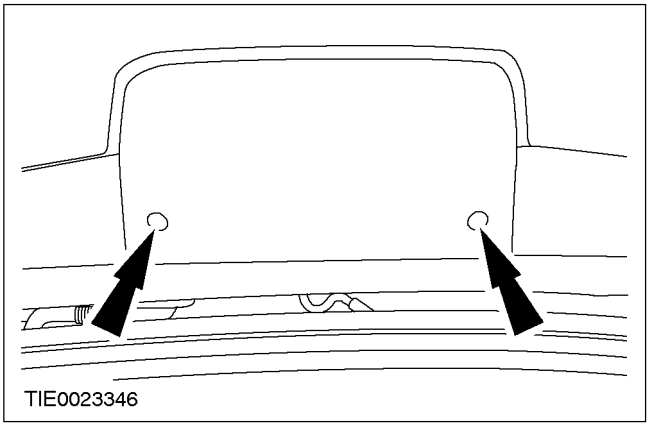


REMOVAL AND INSTALLATION (Continued)

12. Connect the high mounted stoplamp electrical connector.

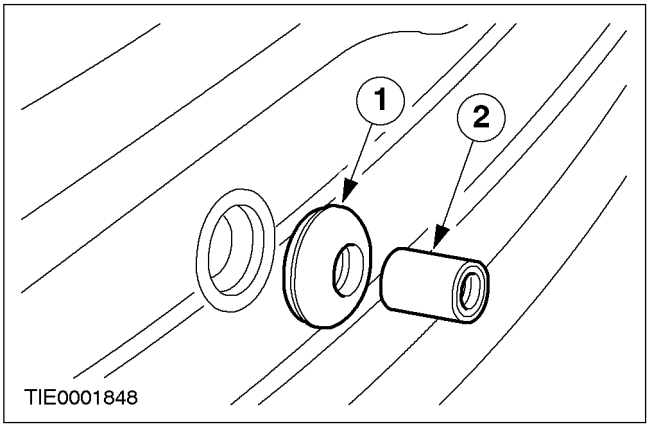


13. Attach the high mounted stoplamp to the liftgate.



14. Install the rear window wiper motor spindle grommet.

1. Install the grommet.
2. Install the sleeve.



15. Install the rear window wiper motor. For additional information, refer to Section 501-16.

REMOVAL AND INSTALLATION

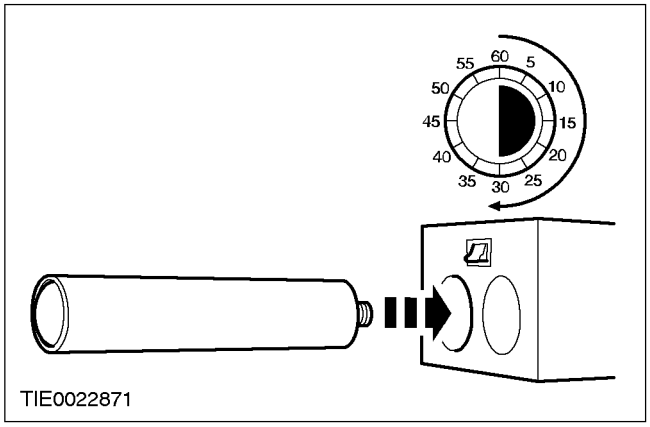
Windshield Glass (42 115 0)

General Equipment
Hot air gun
Direct glazing cutter for bonded glass
Direct glazing adhesive kit
Direct glazing adhesive oven
Glazing suction cups

Removal

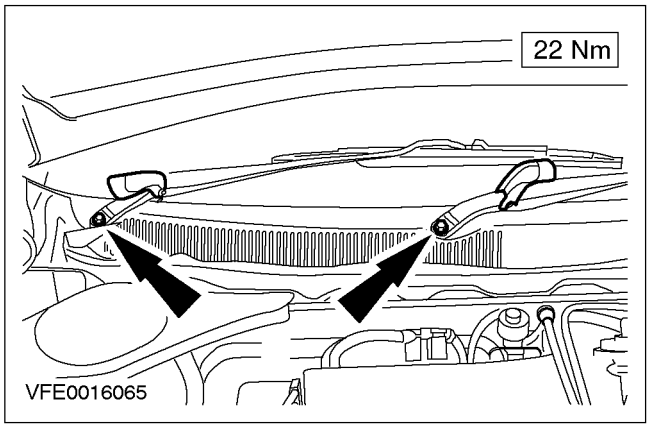
All vehicles

1. **Remove the polyurethane (PU) adhesive cap and heat the PU adhesive for a minimum of 30 minutes.**

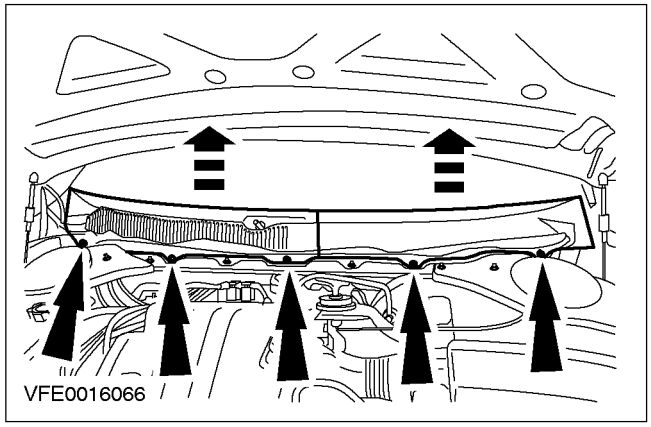


2. **Raise the hood.**
3. **NOTE:** Make sure that the windshield wiper motor is in the park position.

   Remove the windshield wiper arms.

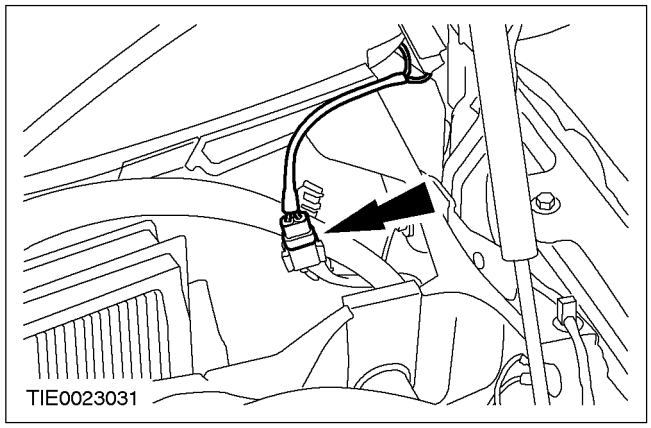


4. **Remove the cowl panels.**
   - Pull the cowl panels out of the retaining groove.



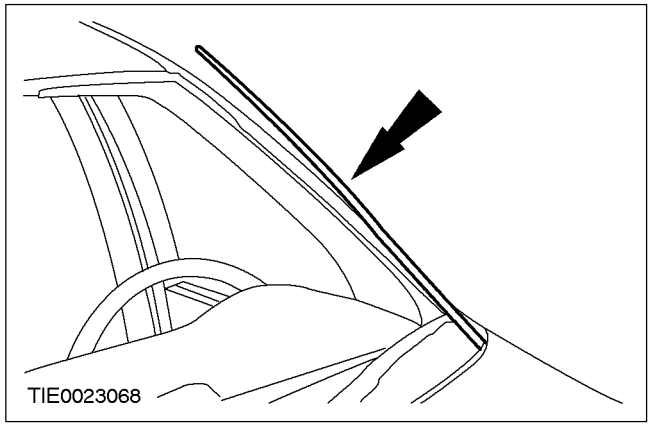
Vehicles with heated windshield

5. **Disconnect the heated windshield electrical connectors (left-hand side shown).**



All vehicles

6. **Lower the hood.**
7. **Remove the A-pillar exterior trim panels.**

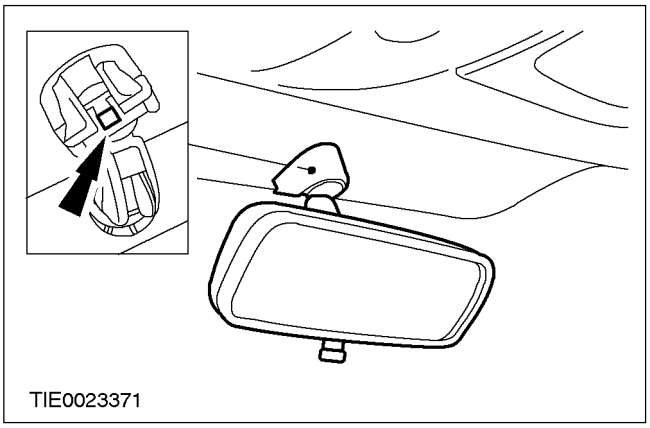


REMOVAL AND INSTALLATION (Continued)

Vehicles with manual dimming interior mirror

8. Remove the manual dimming interior mirror.

- Release the clip.

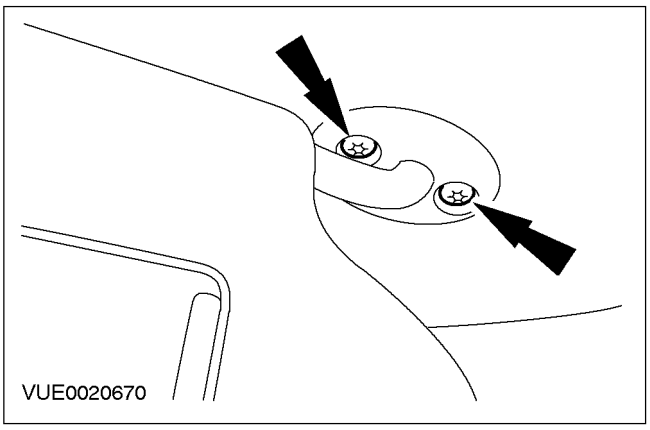


Vehicles with auto-dimming interior mirror

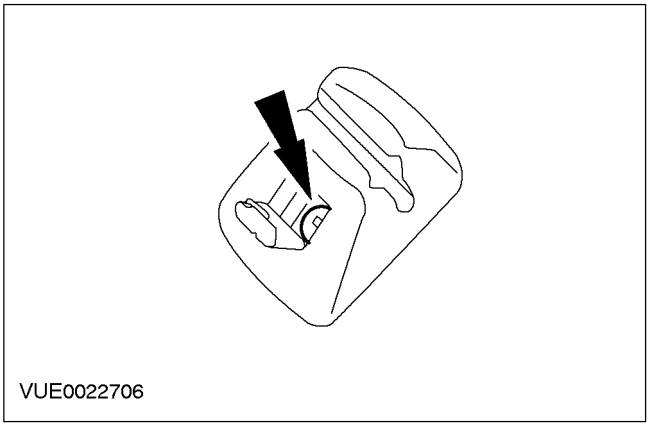
9. Remove the auto-dimming interior mirror. For additional information, refer to Section 501-09.

All vehicles

10. Remove the sun visors.



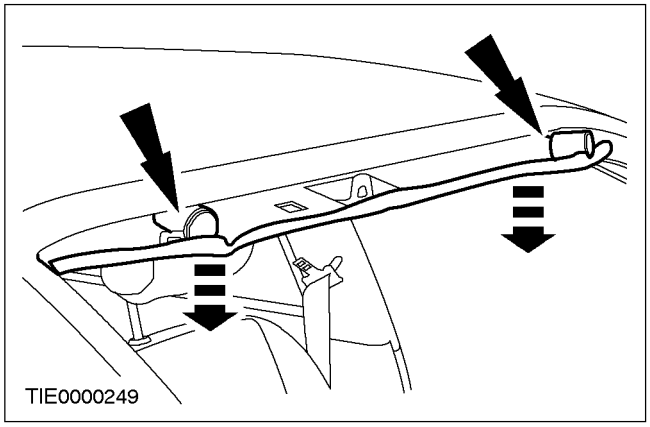
11. Lever open the covers to expose the screws and remove the sun visor retaining clips.



12. Remove the overhead console. For additional information, refer to Section 501-12.

13. Remove the A-pillar trim panels. For additional information, refer to Section 501-05.

14. Detach the leading edge of the headliner and place two blocks of suitable material between the headliner and the roof panel to act as spacers.



REMOVAL AND INSTALLATION (Continued)

15. **WARNING: Wear gloves and eye protection when working with the glass cutting tool as the cutting operation may produce splinters. When using the cutter wear ear protectors. Failure to follow these instructions may result in personal injury.**

CAUTION: Make sure the cutting blades are changed where the cutting depth changes to avoid damage to the body and trim panels.

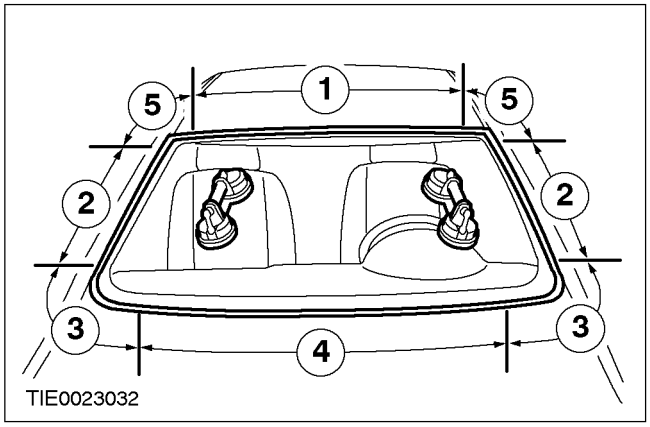
NOTE: Some resistance may be encountered when cutting through the glass locating pegs in the lower corners of the glass.

NOTE: Care must be taken when cutting in the area of the locating blocks along the lower edge of the windshield glass.

Using a suitable direct glazing cutter, cut the PU adhesive and, with the aid of another technician, use glazing suction cups to remove the windshield glass.

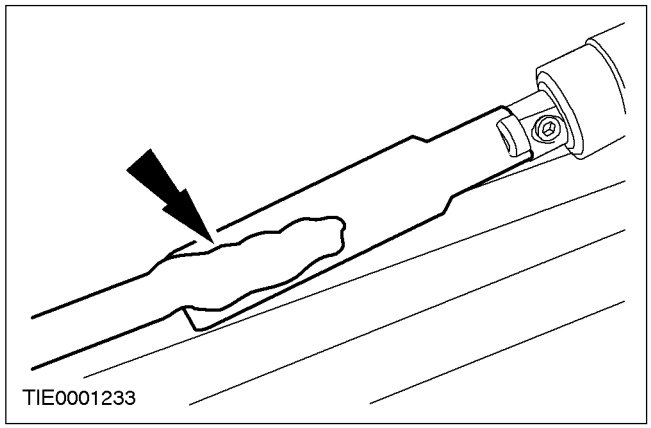
- Cut the PU adhesive from inside the vehicle to the given maximum depths.

1. 15 mm.
2. 20 mm.
3. 25 mm.
4. 40 mm.
5. 70 mm.



2. **CAUTION: Do not touch the adhesive surface as re-bonding will be impaired.**

Carefully trim the remaining PU adhesive from the windshield glass flange to leave approximately 1 mm of trimmed PU adhesive adhered to the flange.



3. **Check the windshield glass flange for damaged sheet metal, rust or foreign material which may have caused, or may cause, glass breakage.**
4. **CAUTION: To make sure that the PU adhesive cures, it is essential that all bonding surfaces are free of moisture.**

Using a hot air gun, apply warm air (25°C) to the windshield glass flange and glass bond line to remove all traces of moisture.

5. **Prepare the glass, windshield glass flange and trimmed PU adhesive in accordance with the instructions supplied with the PU adhesive kit.**

Installation

All vehicles

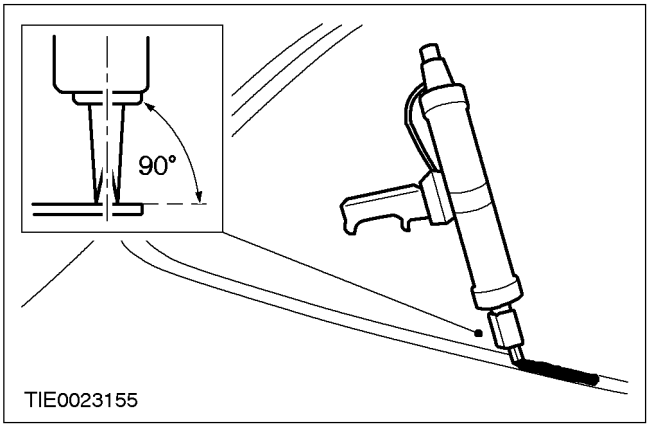
1. **Carefully remove the remaining part of the glass locating pegs from the windshield glass flange.**

REMOVAL AND INSTALLATION (Continued)

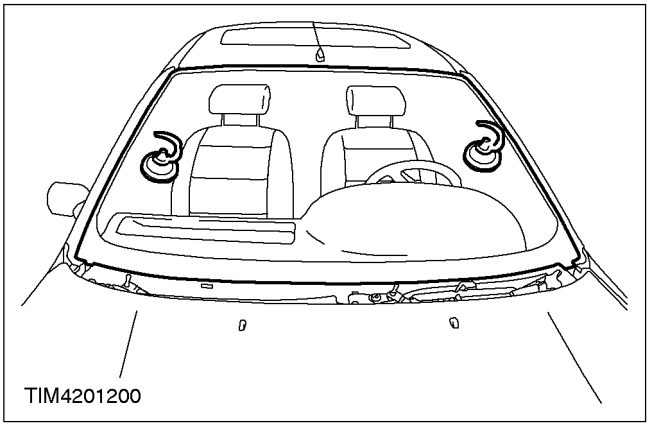
6. **NOTE:** Discard the first 100 mm of PU adhesive as this may have a reduced working time.

NOTE: To avoid water leaks, any breakage in the continuous bead must be overlapped by 20 mm.

Apply the PU adhesive in a continuous bead of between 8 and 10 mm in height to the windshield glass flange along the bond line.



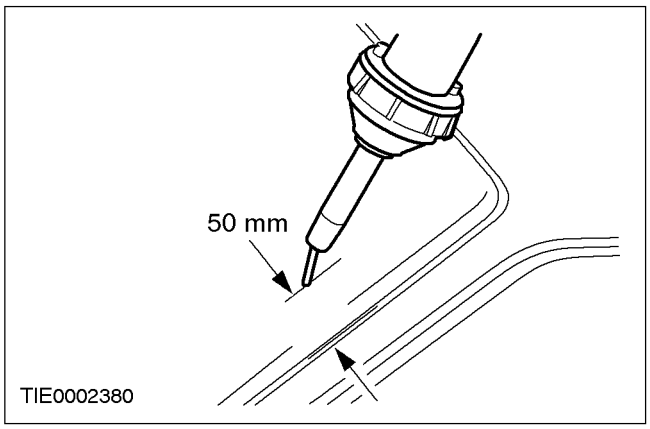
7. **With the aid of another technician, use glazing suction cups to install the windshield glass.**
   - Press firmly and evenly into position.



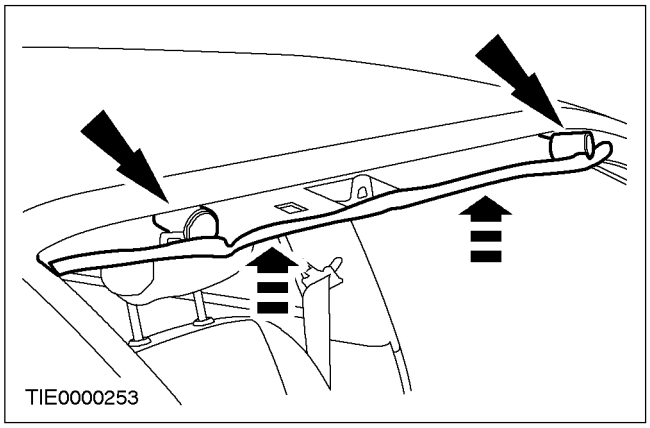
8. **CAUTION: During the curing period of the PU adhesive, the door windows must be left open to avoid a build up of pressure when the doors are open and closed.**

Using suitable tape, secure the windshield glass in the correct position until the PU adhesive has cured.

9. **If the ambient temperature falls below 10°C, use a hot air gun and apply warm air (25°C) continuously for 15 minutes (inside or outside the vehicle).**



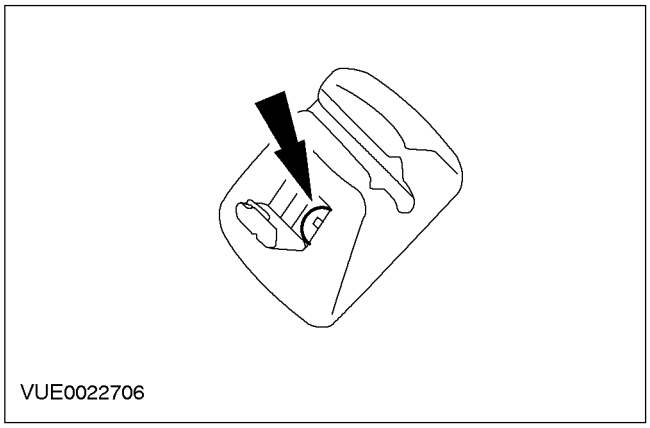
10. **Remove the spacers and attach the leading edge of the headliner to the roof panel.**



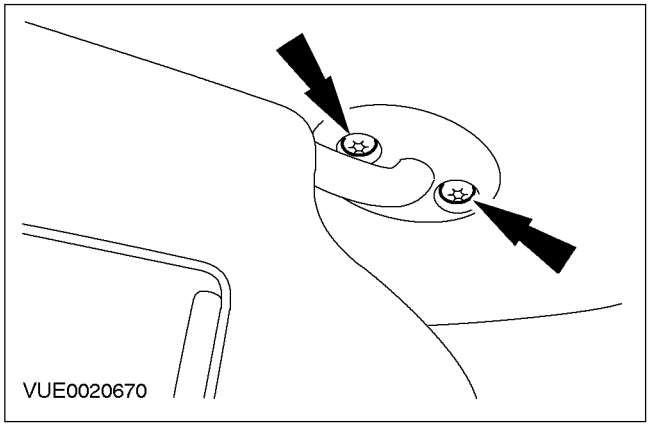
11. **Install the A-pillar trim panels. For additional information, refer to Section 501-05.**
12. **Install the overhead console. For additional information, refer to Section 501-12.**

REMOVAL AND INSTALLATION (Continued)

13. Install the sun visor retaining clips.



14. Install the sun visors.



Vehicles with manual dimming interior mirror

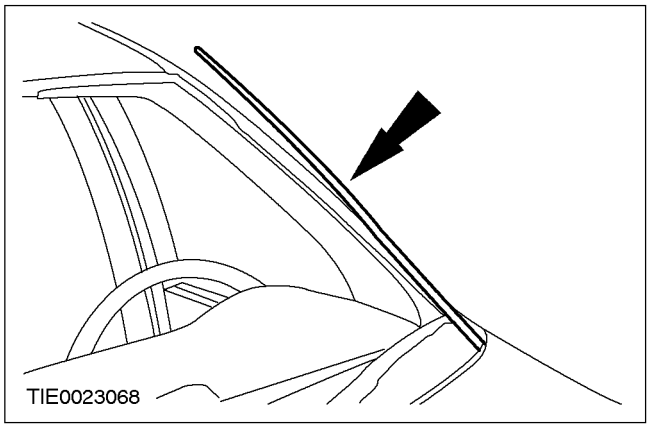
15. Install the manual dimming interior mirror.

Vehicles with auto-dimming interior mirror

16. Instal the auto-dimming interior mirror. For additional information, refer to Section 501-09.

All vehicles

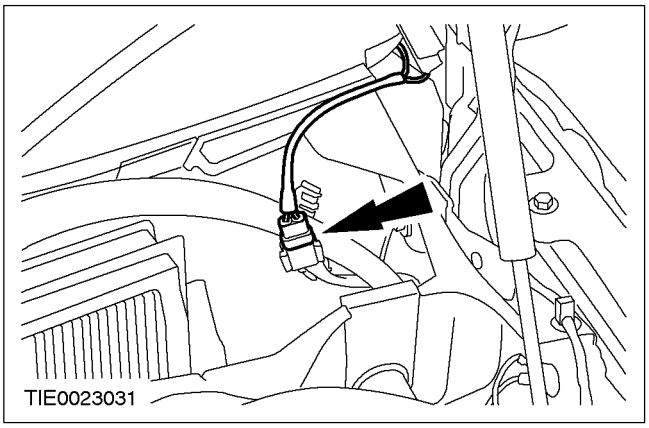
17. Install the A-pillar exterior trim panels.



18. Raise the hood.

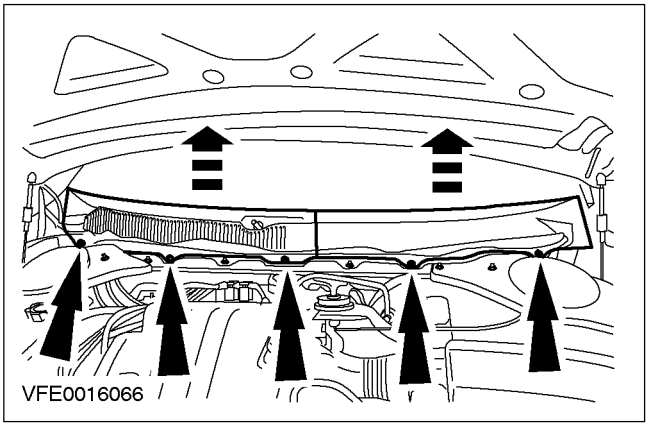
Vehicles with heated windshield

19. Connect the heated windshield electrical connectors.

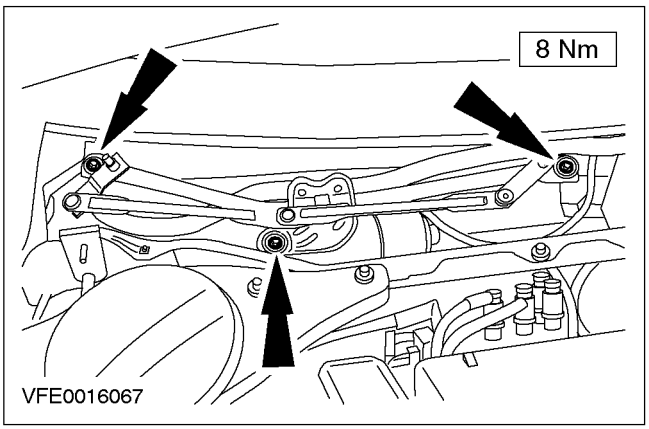


All vehicles

20. Install the cowl panels.



21. Install the windshield wiper arms.



22. Lower the hood.

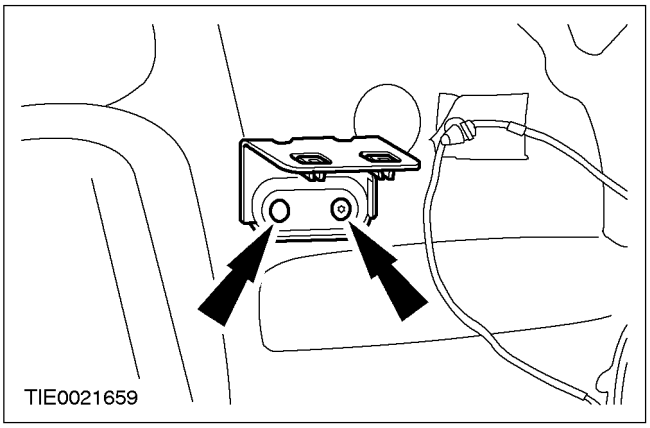
REMOVAL AND INSTALLATION

Front Door Window Regulator and Motor (42 338 0)

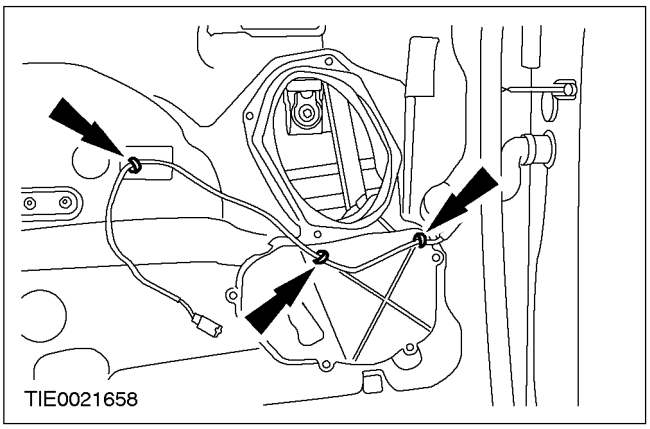
Removal

All vehicles

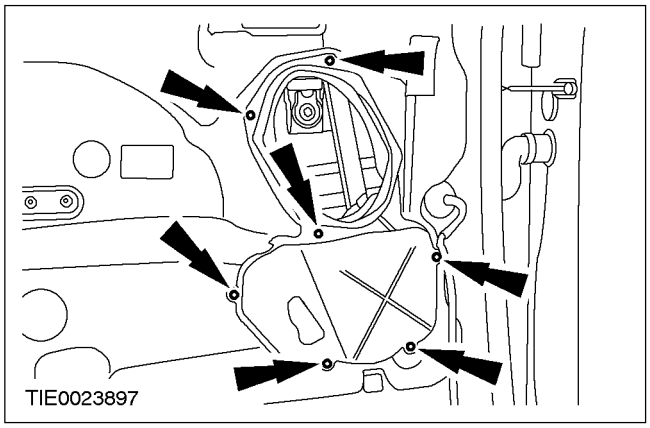
1. **Remove the front door window glass. For additional information, refer to Front Door Window Glass in this section.**
2. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
3. **Remove the front door handle support bracket.**



4. **Detach the power window wiring harness retaining clips from the door panel.**

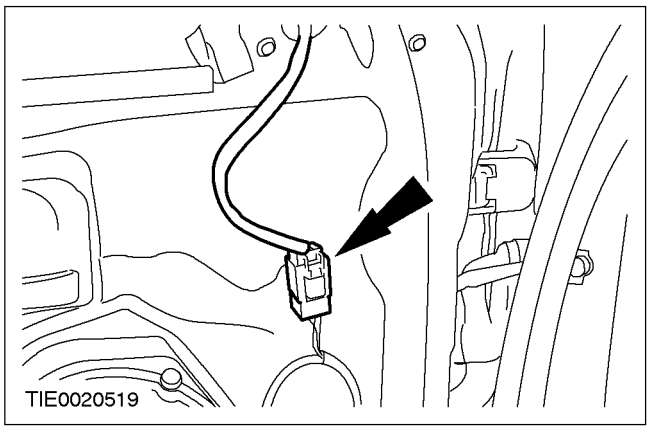


5. **Remove the speaker housing.**



Vehicles with power mirrors

6. **Detach the power mirror electrical connector from the door panel.**



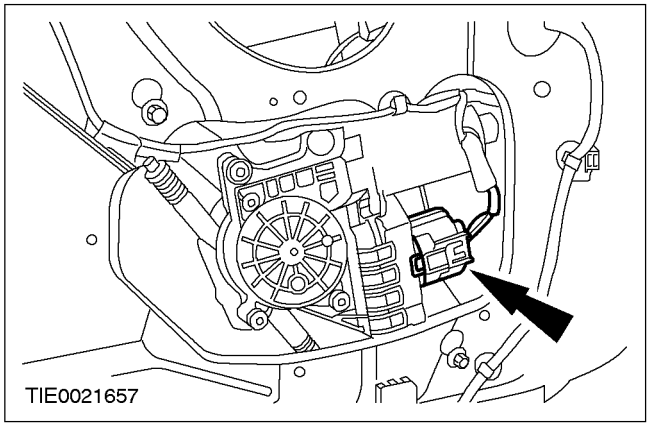
All vehicles

7. **CAUTION: Do not touch the adhesive surface as re-bonding will be impaired.**

   Remove the watershield.

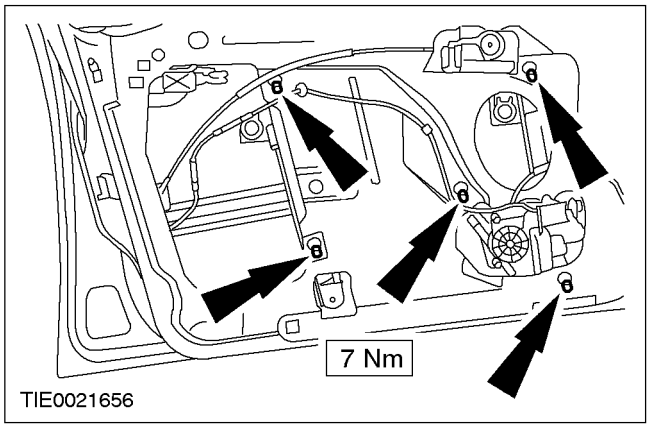
REMOVAL AND INSTALLATION (Continued)

8. Disconnect the front door window regulator motor electrical connector.

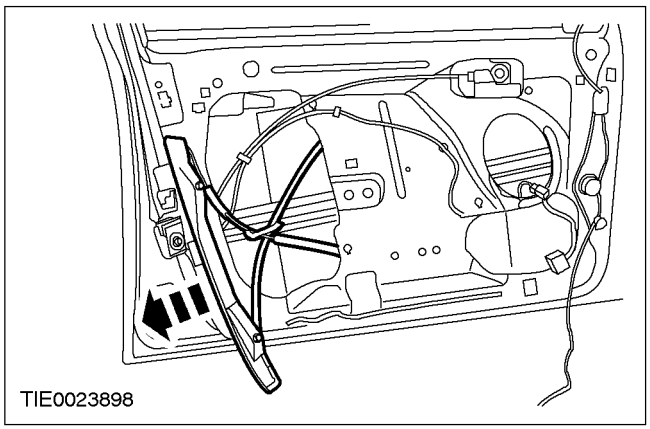


9. Detach the front door window regulator and motor from the door panel.

- Loosen the bolts.



10. Remove the front door window regulator and motor.



Installation

1. To install, reverse the removal procedure.

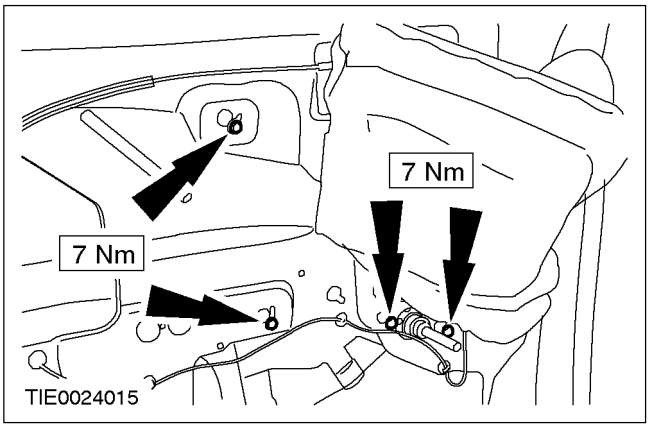
2. Initialize the door window motors. For additional information, refer to Door Window Motor Initialization in this section.

REMOVAL AND INSTALLATION

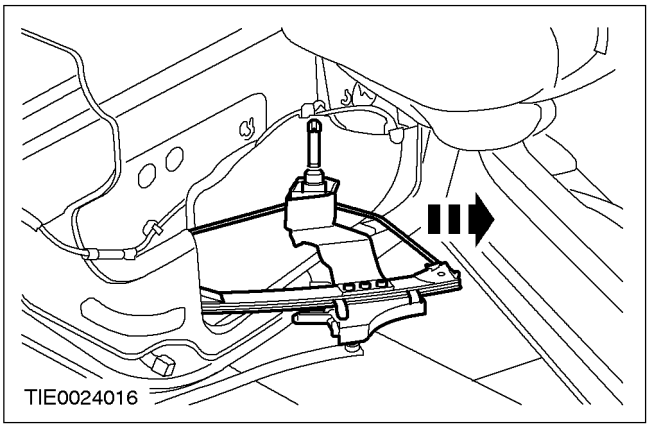
Rear Door Window Regulator (42 338 0)

Removal

1. **Remove the rear door window glass.** **For additional information, refer to Rear Door Window Glass in this section.**
2. **Detach the rear door window regulator from the door panel.**
   - Loosen the bolts.



3. **Remove the rear door window regulator.**



Installation

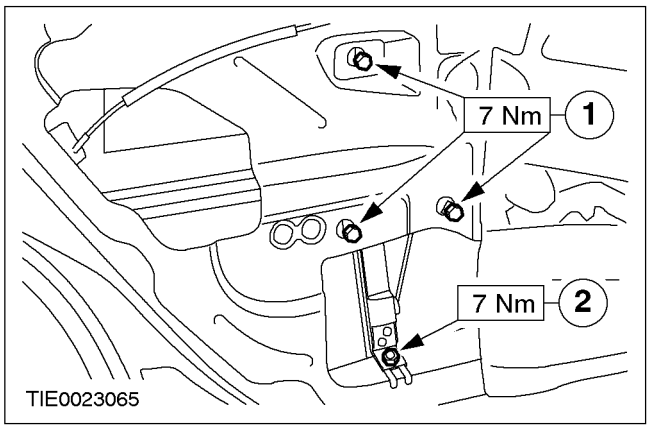
1. **To install, reverse the removal procedure.**

REMOVAL AND INSTALLATION

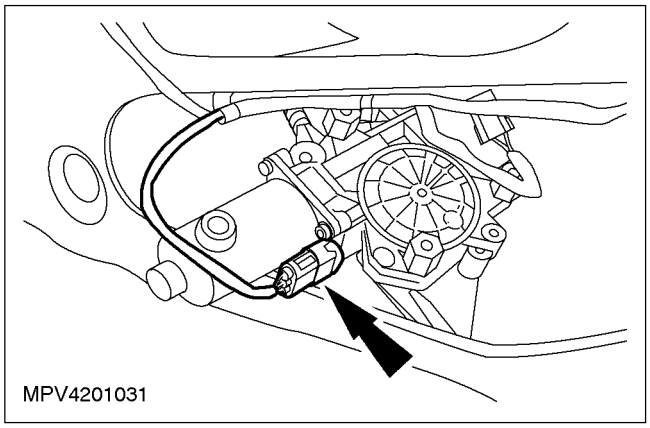
Rear Door Window Regulator and Motor (42 338 0)

Removal

1. **Remove the rear door window glass. For additional information, refer to Rear Door Window Glass in this section.**
2. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
3. **Detach the rear door window regulator from the door panel.**
   1. Loosen the bolts.
   2. Remove the bolt.



4. **Remove the rear door window regulator and motor.**
   - Disconnect the electrical connector.



Installation

1. **To install, reverse the removal procedure.**
2. **Initialize the door window motors. For additional information, refer to Door Window Motor Initialization in this section.**

SECTION 501-12 Instrument Panel and Console

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

SPECIFICATIONS

Specifications 501-12-2

REMOVAL AND INSTALLATION

Instrument Panel ..... (43 644 0) 501-12-3
Floor Console ..... (43 814 0) 501-12-10
Overhead Console..... (43 813 0) 501-12-12

SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Instrument panel support bracket retaining screws	5	–	44
Instrument panel support bracket retaining nut	7	–	62
Instrument panel side retaining bolts	9	–	80
Passenger air bag module to cross-vehicle beam bolts	10	–	89
Floor console retaining bolts	4	–	35

REMOVAL AND INSTALLATION

Instrument Panel (43 644 0)

General Equipment
Audio unit removal tools

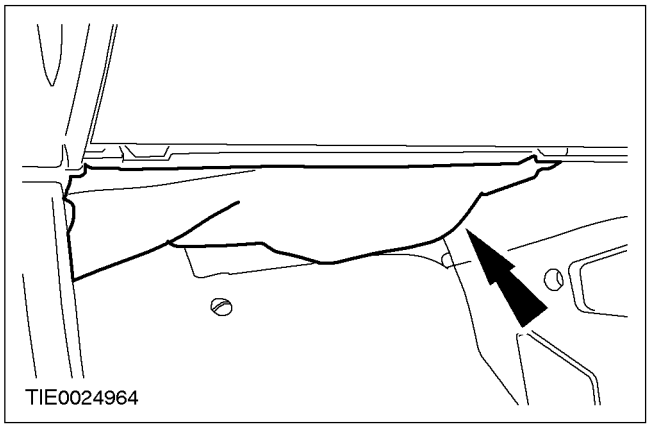
Removal

All Vehicles

1. **Remove the floor console.** **For additional information, refer to Floor Console in this section.**
2. **Remove the steering column. For additional information, refer to Section 211-04.**

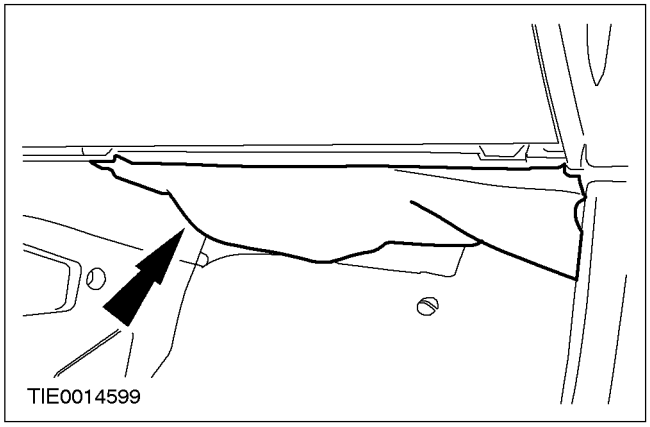
Vehicles with 2.5L or diesel engine

3. **Remove the driver side lower footwell trim.**

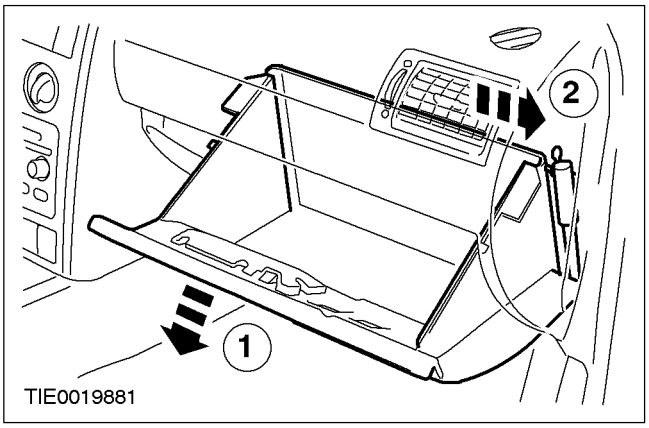

TIE0024964

All vehicles

4. **Remove the passenger side lower footwell trim.**

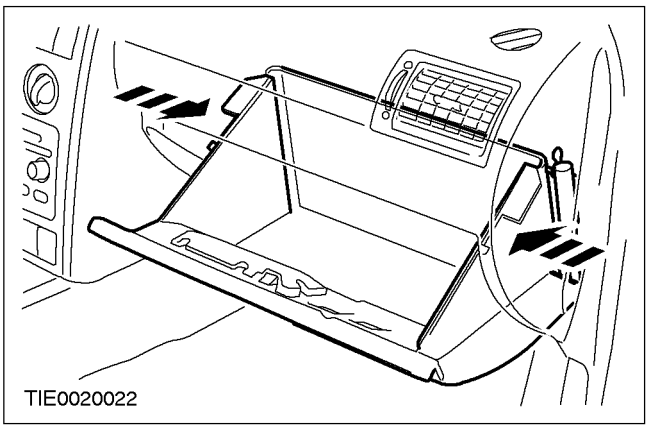

TIE0014599

5. **Detach the damper from the glove compartment.**
   1. Open the glove compartment to access the damper.
   2. Push the top of the damper away from the glove compartment.



TIE0019881

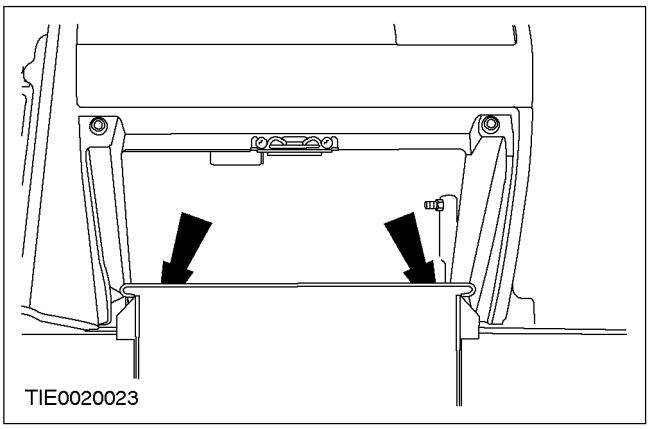
6. **Fully open the glove compartment.**
   - Press the sides of the glove compartment towards the center to release the glove compartment stops.


TIE0020022

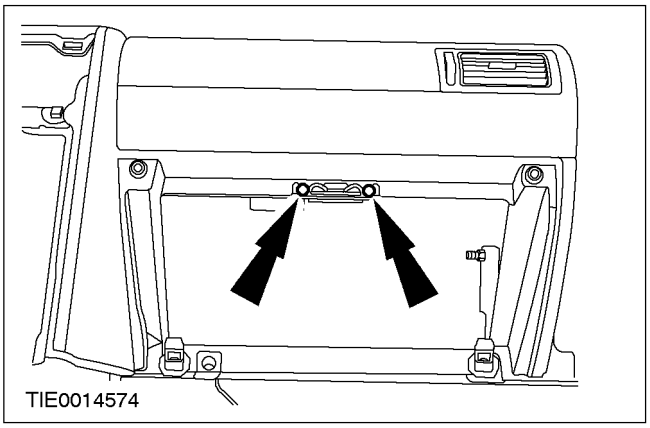
REMOVAL AND INSTALLATION (Continued)

7. Remove the glove compartment.

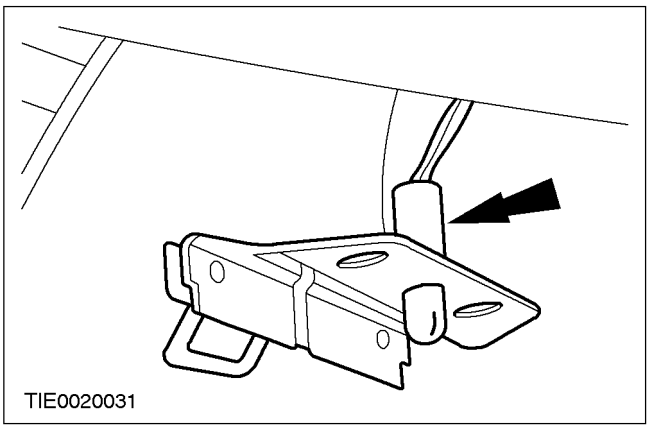
- Detach the hinges.



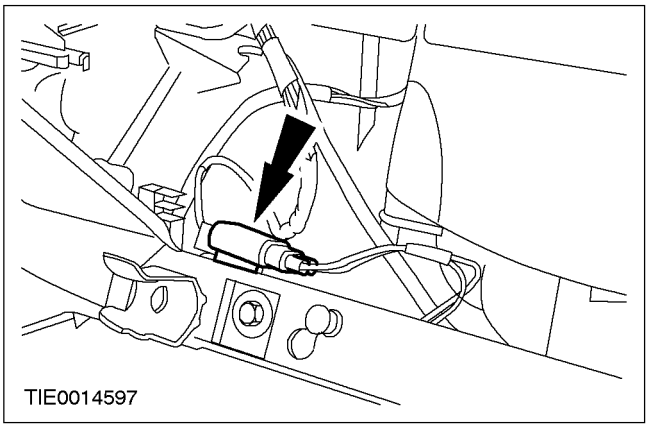
8. Detach the glove compartment latch from the instrument panel.



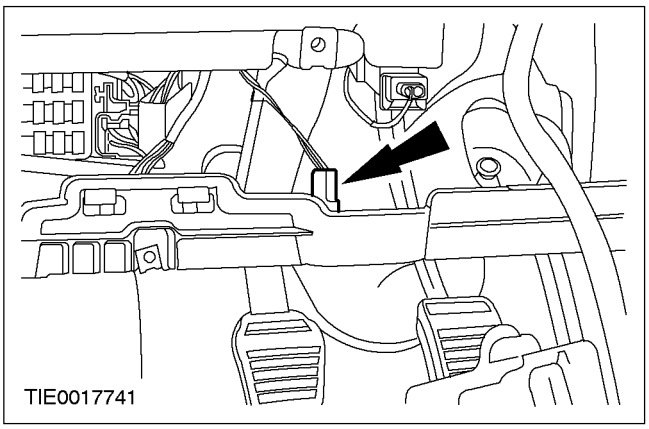
9. Detach the glove compartment light and remove the glove compartment latch.



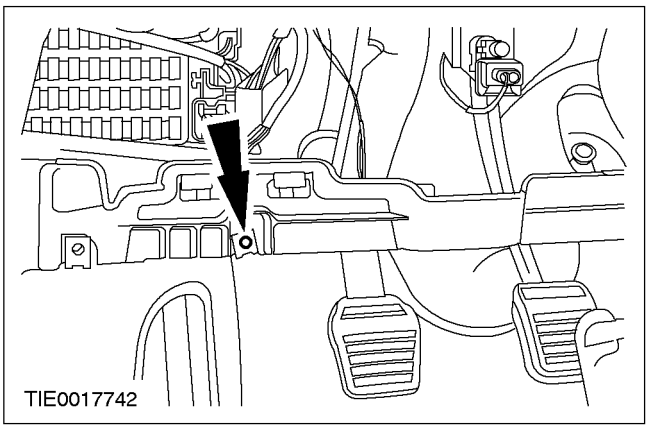
10. Detach the glove compartment light switch electrical connector from the lower instrument panel.



11. Detach the driver and passenger footwell light from the lower instrument panel (If equipped).

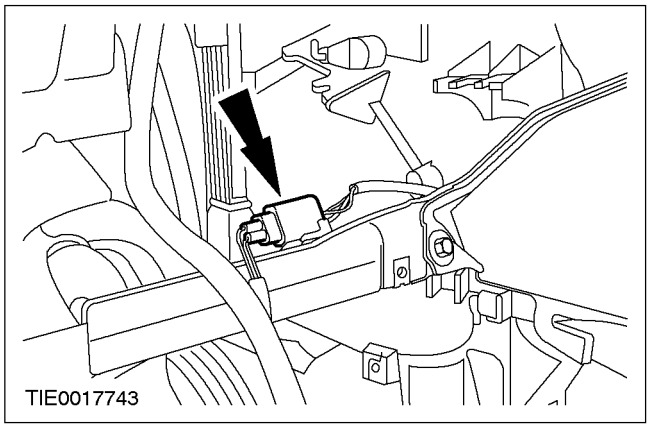


12. Detach the data link connector (DLC) from the driver side lower instrument panel.

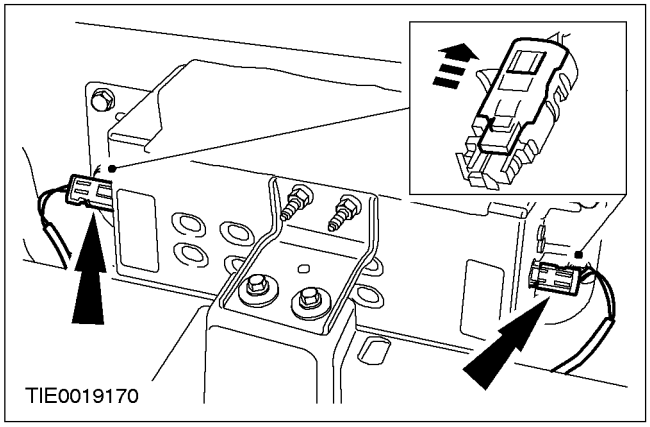


REMOVAL AND INSTALLATION (Continued)

13. **Detach the internal temperature sensor from the driver side lower instrument panel (if equipped).**



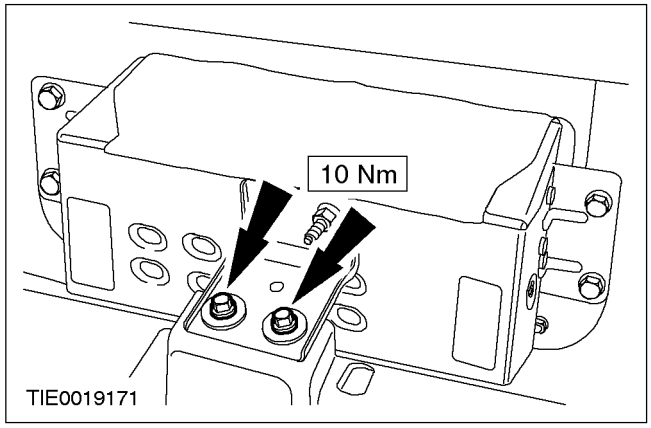
14. **Disconnect the passenger air bag module electrical connectors.**



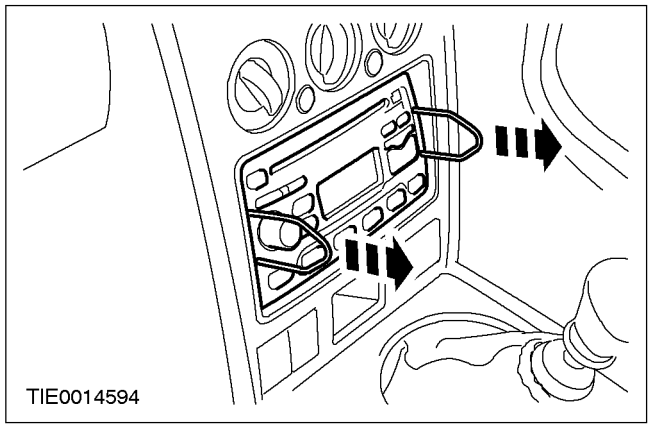
15. **CAUTION: The passenger air bag module retaining bolts must only be used three times.**

NOTE: After removal, stamp the passenger air bag module retaining bolts with a center punch to indicate usage.

Detach the passenger air bag module from the cross-vehicle beam.

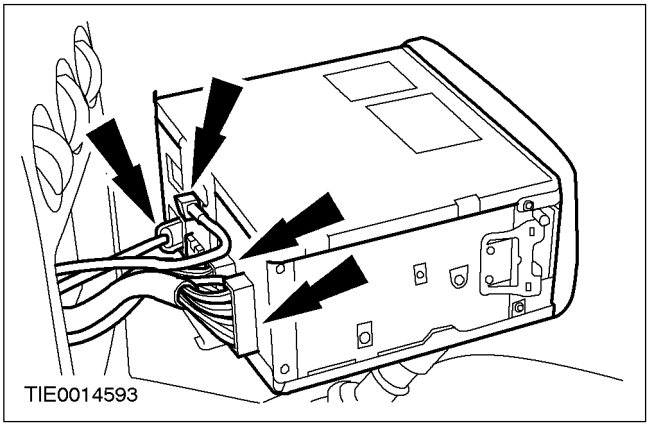


16. **Using the audio unit removal tools, detach the audio unit from the instrument panel.**

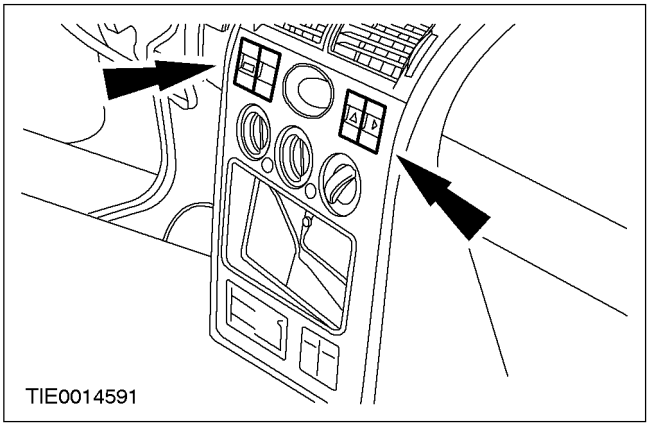


REMOVAL AND INSTALLATION (Continued)

17. Disconnect the electrical connectors and remove the audio unit.

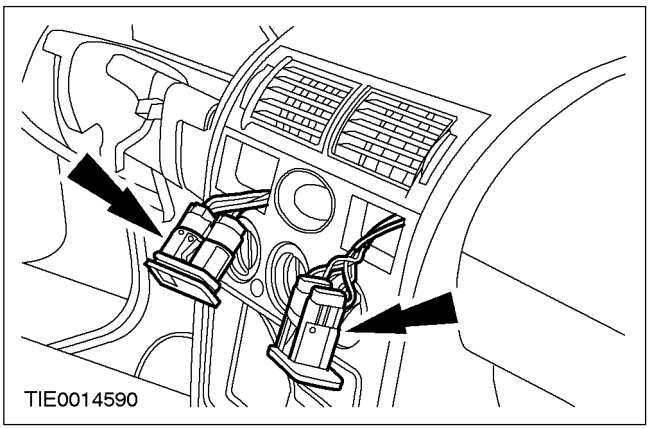


18. Detach the accessory switches from the heater control trim panel.



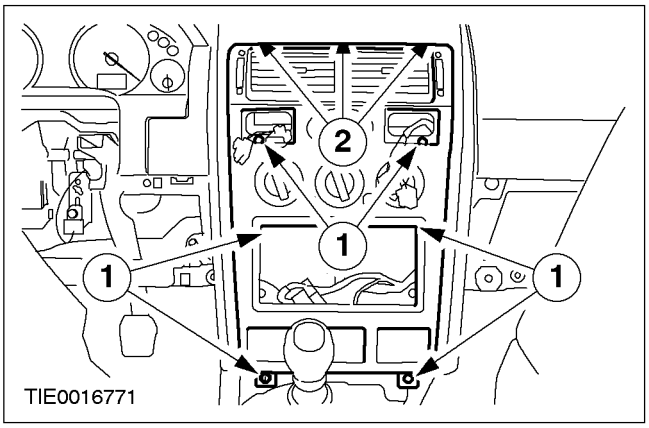
19. Remove the heater control trim panel accessory switches.

- Disconnect the electrical connectors.

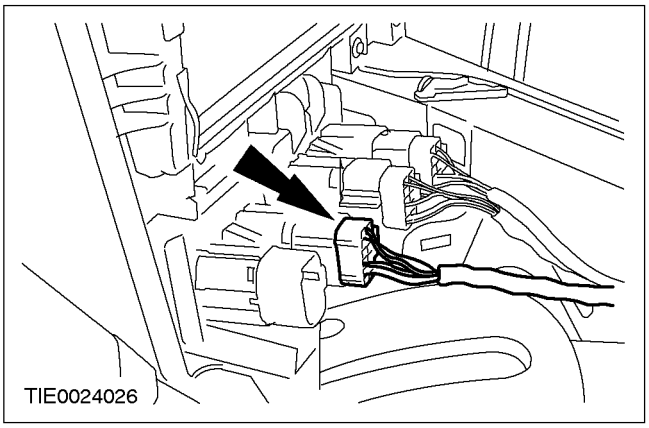


20. Detach the heater control trim panel from the instrument panel.

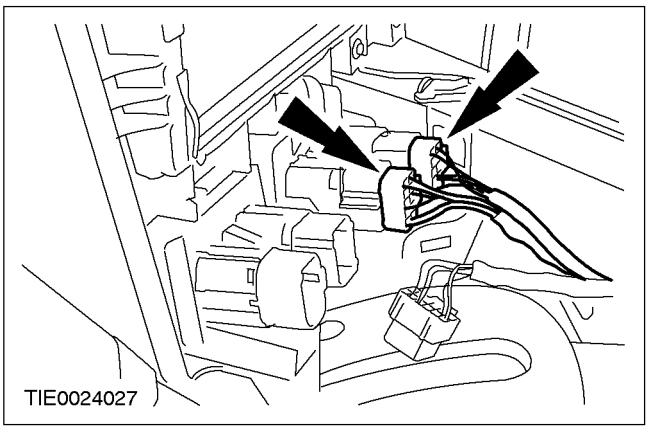
1. Remove the retaining screws.
2. Detach the retaining clips.



21. Disconnect the liftgate release switch electrical connector.

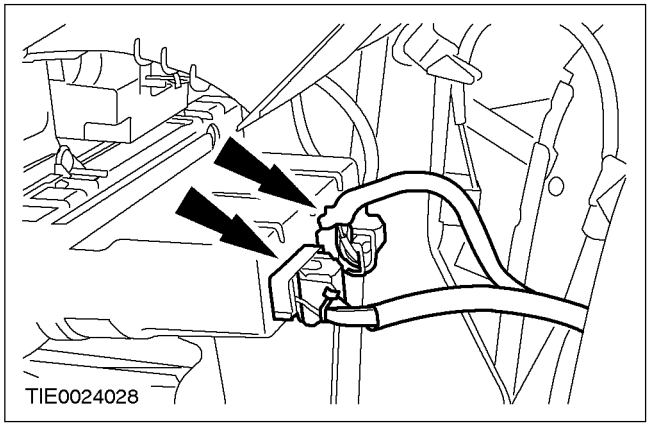


22. Disconnect the heated front seats electrical connectors.



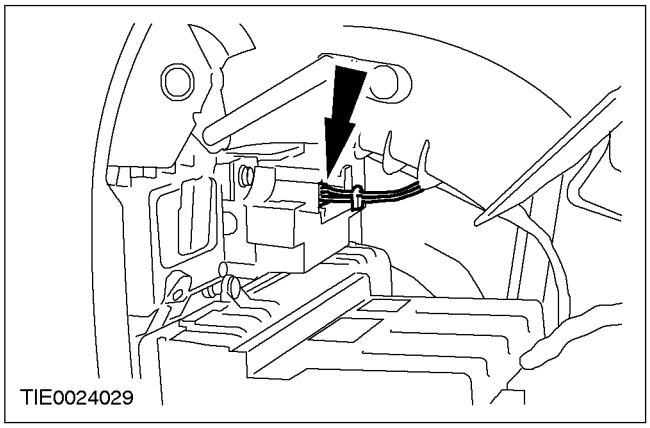
REMOVAL AND INSTALLATION (Continued)

23. Disconnect the auxiliary climate control electrical connectors.



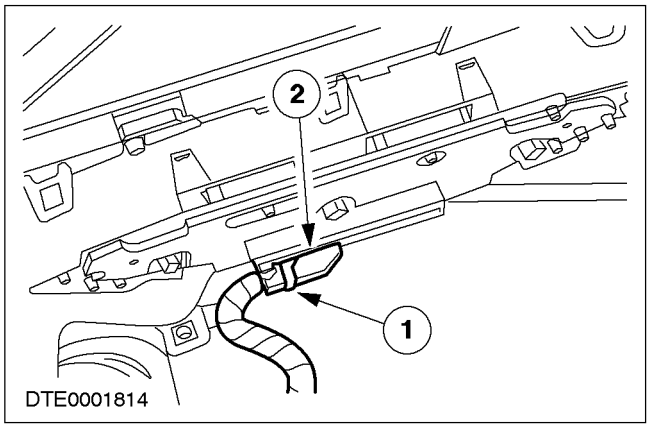
24. Remove the heater control trim panel.

- Disconnect the clock electrical connector.

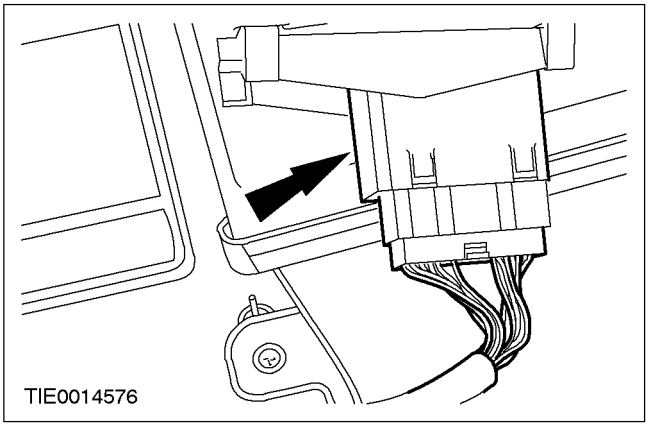


25. Disconnect the instrument cluster electrical connector.

1. Release the locking tang.
2. Disconnect the electrical connector.

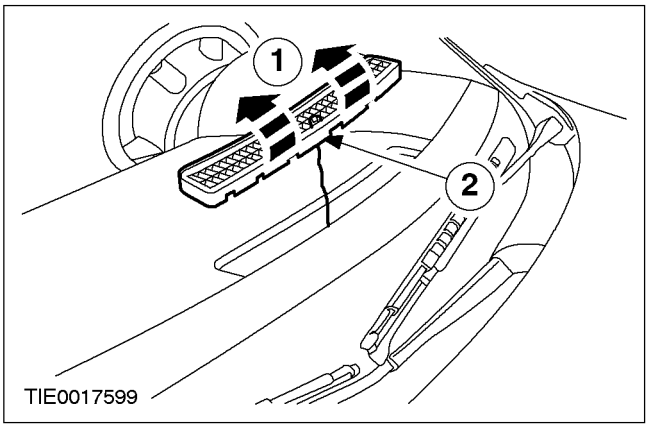


26. Disconnect the instrument cluster lamp electrical connector.

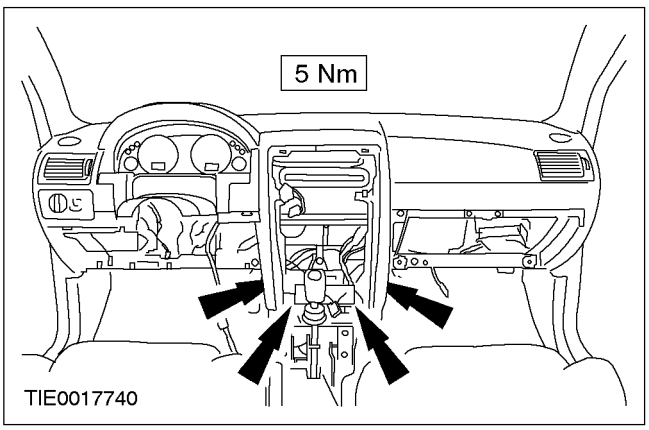


27. Remove the keyless entry antenna.

1. Detach the windshield register from the instrument panel.
2. Disconnect the keyless entry antenna electrical connector.

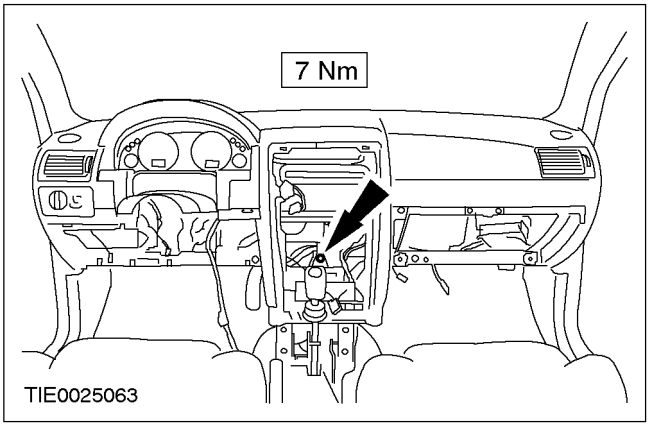


28. Remove the instrument panel support bracket retaining screws.

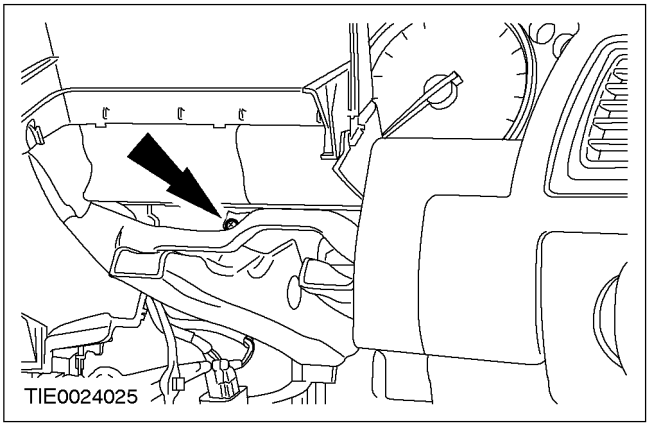


REMOVAL AND INSTALLATION (Continued)

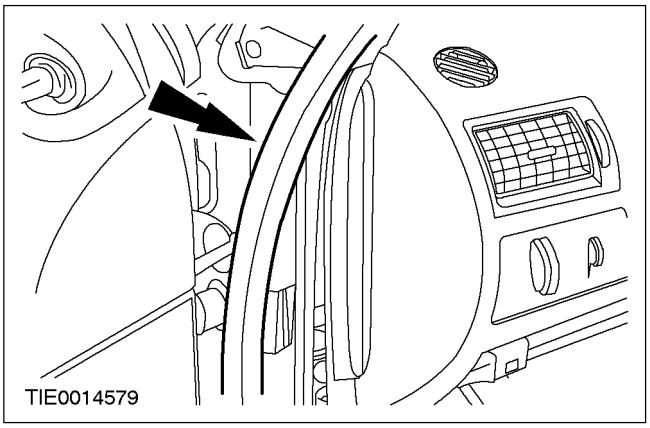
29. **Remove the instrument panel support bracket retaining nut.**



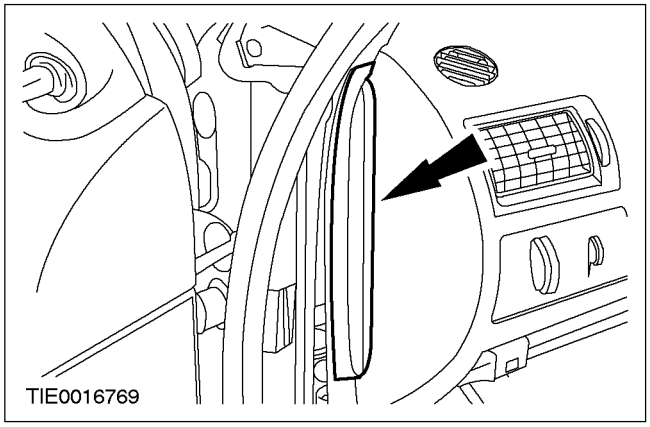
30. **Detach the instrument panel from the cross-vehicle beam.**



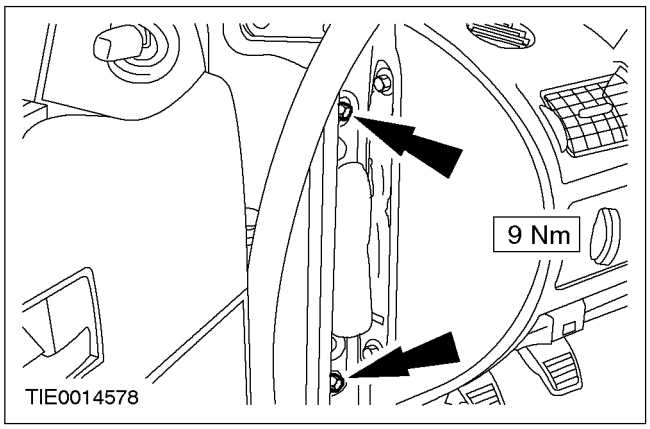
31. **Remove the A-pillar trim panels. For additional information, refer to Section 501-05.**
32. **Detach the weatherstrips from the A-pillars.**



33. **Remove the instrument panel side trim panels**

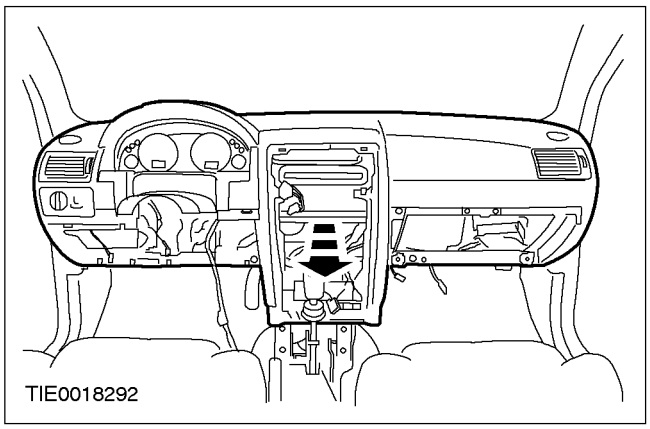


34. **Remove the instrument panel side retaining bolts (left-hand side shown, right-hand side similar).**



35. **CAUTION: The instrument cluster must be kept upright to avoid silicone liquid leaking from the guages.**

    Remove the instrument panel.



REMOVAL AND INSTALLATION (Continued)

Vehicles with automatic transaxle

36. Move the selector lever to the "P" position.

Installation

1. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

Floor Console (43 814 0)

Removal

Vehicles with automatic transaxle

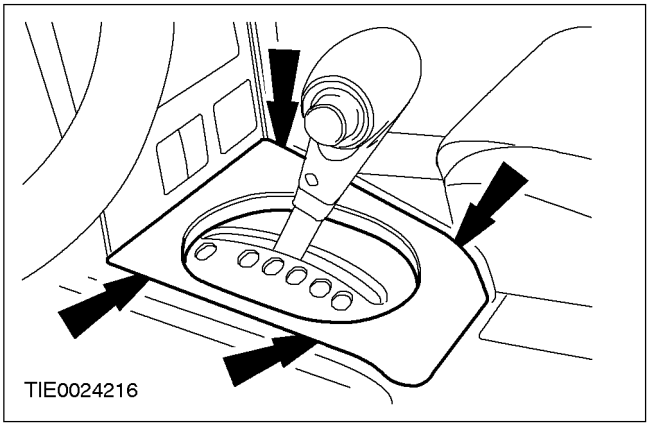
1. **Move the automatic transaxle selector lever to the "N" position.**

All vehicles

2. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**

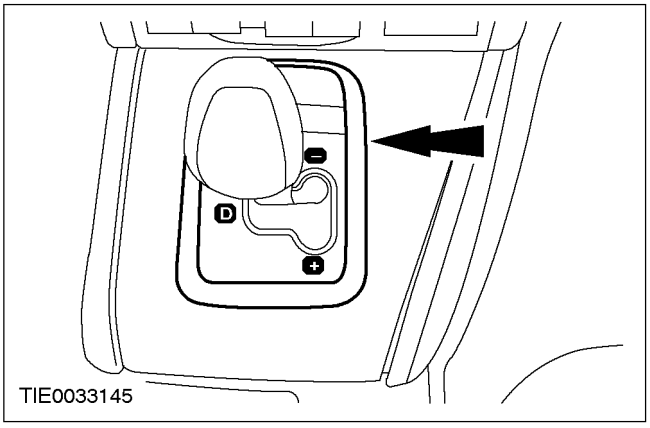
Vehicles with 4-speed automatic transaxle

3. **Remove the automatic transaxle selector lever trim panel.**

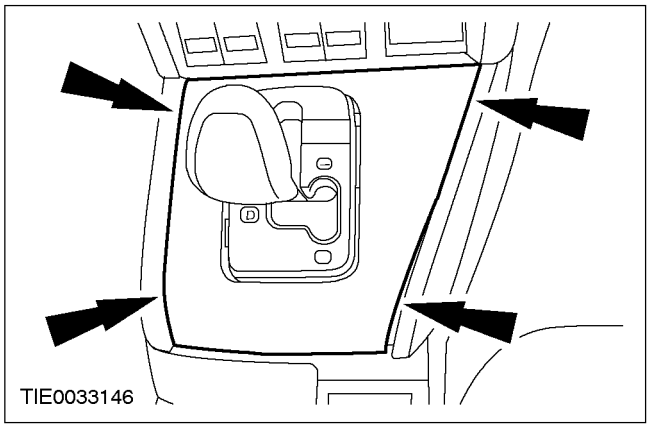


Vehicles with 5-speed automatic transaxle

4. **Remove the automatic transaxle selector lever trim panel.**

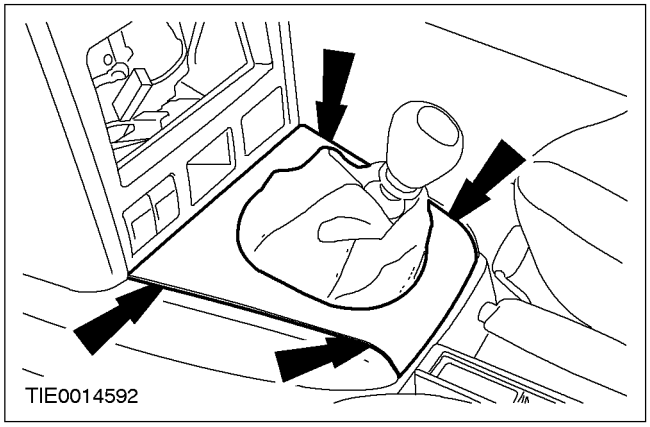


5. **Remove the floor console trim panel.**

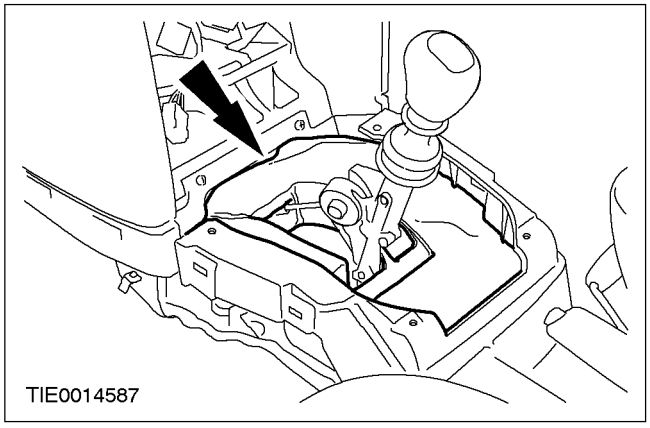


Vehicles with manual transaxle

6. **Remove the gearshift lever boot.**



7. **Remove the insulation pad.**

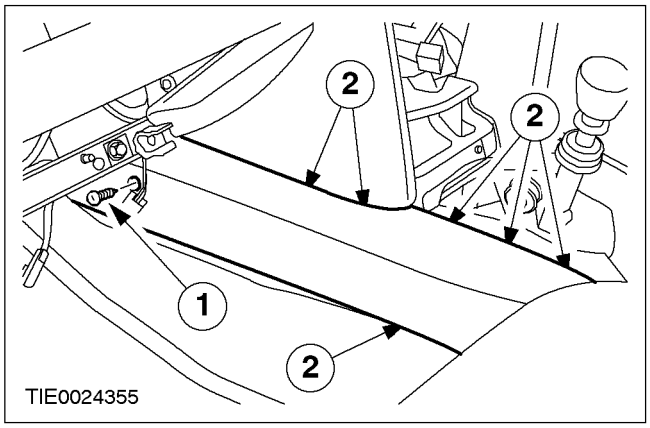


REMOVAL AND INSTALLATION (Continued)

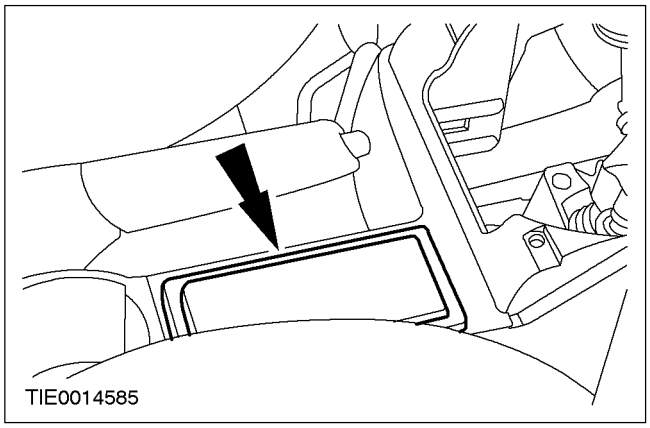
All vehicles

8. Remove the floor console side trim panels.

1. Remove the retaining screw.
2. Detach the retaining clips.

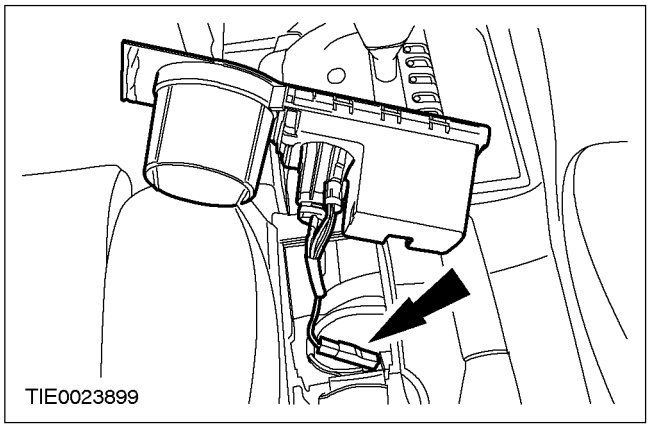


9. Detach the ashtray and cup holder assembly from the floor console.



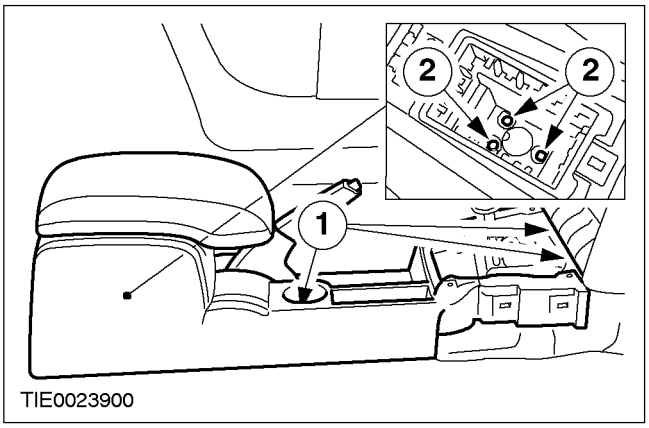
10. Remove the ashtray and cup holder assembly.

- Disconnect the cigar lighter electrical connector.



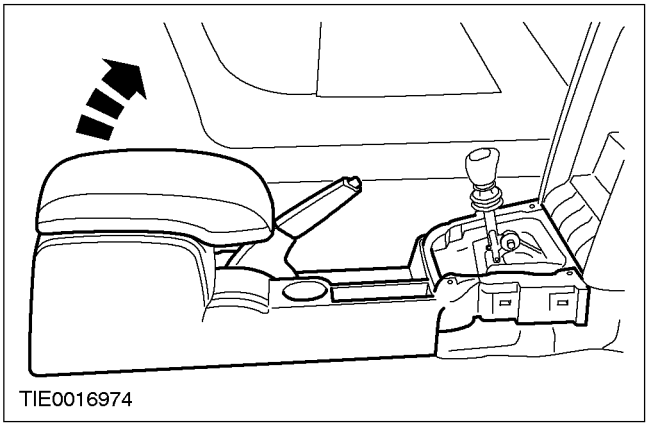
11. Detach the floor console from the floor panel.

1. Remove the retaining screws.
2. Remove the retaining bolts.



12. Remove the floor console.

- Fully raise the parking brake lever.



Vehicles with automatic transaxle

13. Move the automatic transaxle selector lever to the "P" position.

Installation

1. **To install, reverse the removal procedure.**
2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

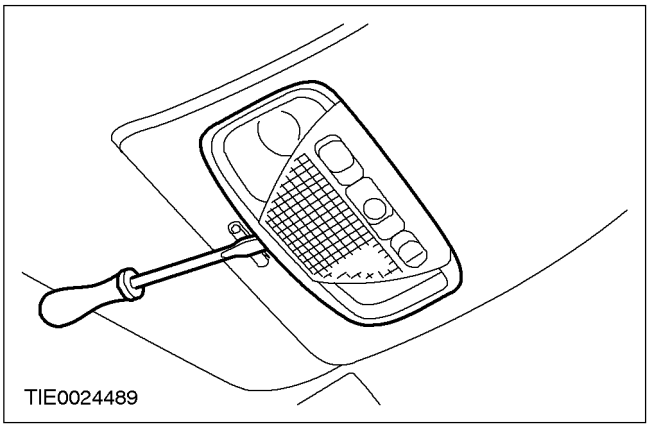
REMOVAL AND INSTALLATION

Overhead Console (43 813 0)

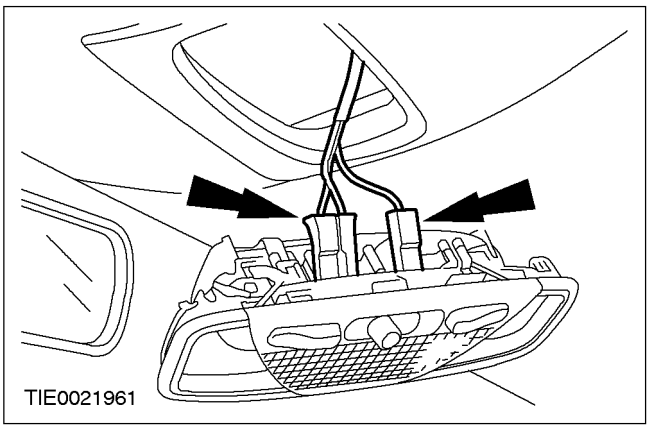
Removal

All vehicles

1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Using a suitable screwdriver, detach the interior lamp from the overhead console.**

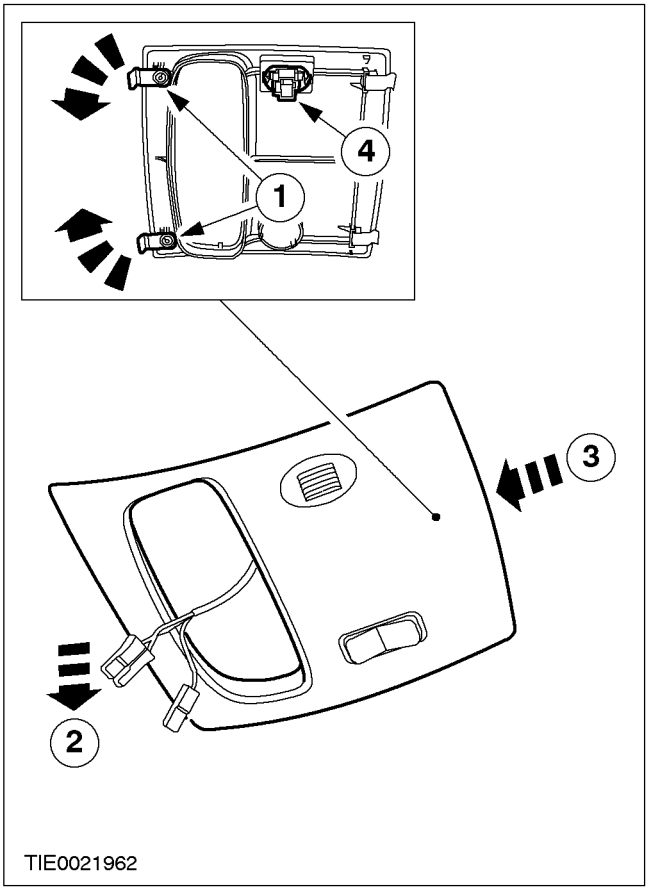


3. **Disconnect the electrical connectors and remove the interior lamp.**



Vehicles with roof opening panel

4. **Remove the overhead console.**
   1. Turn the front retaining clips 90 degrees.
   2. Lower the front of the overhead console.
   3. Detach the rear retaining clips.
   4. Disconnect the power roof opening panel control switch electrical connector.

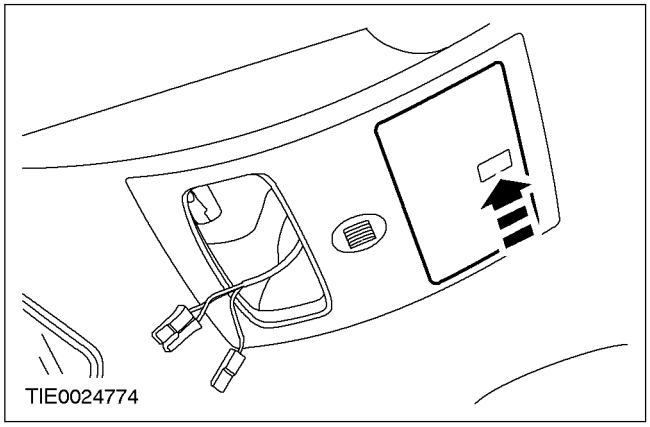


5. **Remove the power roof opening panel control switch.**

REMOVAL AND INSTALLATION (Continued)

Vehicles without roof opening panel

6. Open the storage compartment.

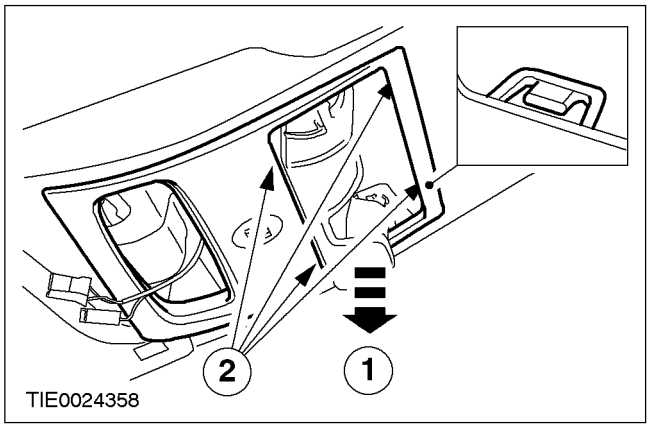


7. CAUTION: To avoid damage, the storage compartment must only be pulled downwards enough to detach the retaining clips.

NOTE: The rear of the overhead console is held in position by the storage compartment cover retaining clips.

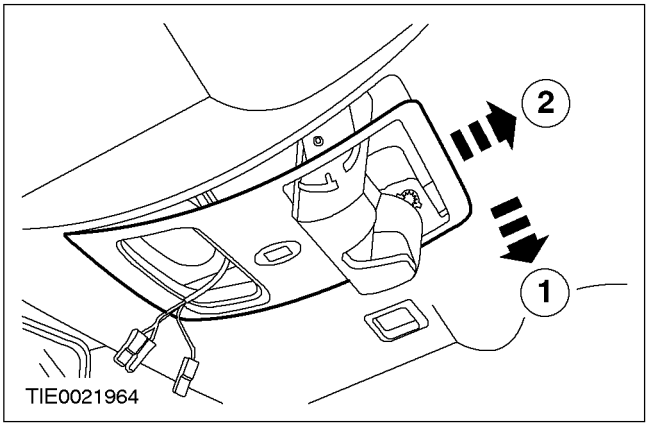
Detach the storage compartment from the storage compartment cover.

1. Pull the storage compartment downwards.
2. Using a suitable screwdriver, detach the storage compartment cover retaining clips.



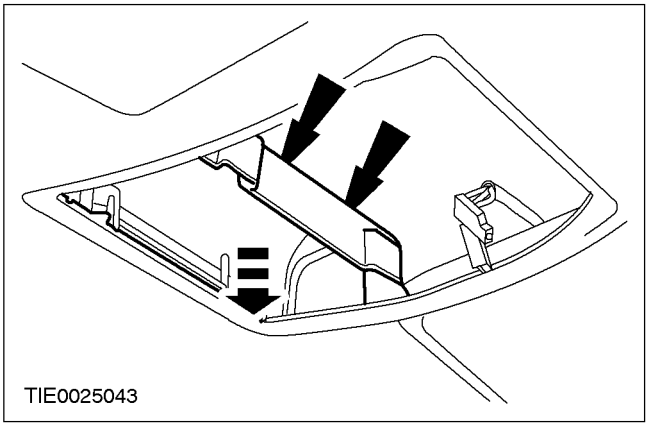
8. Remove the overhead console.

1. Lower the rear of the overhead console.
2. Detach the front retaining clips.



9. Remove the storage compartment cover.

- Detach the hook loop tape.



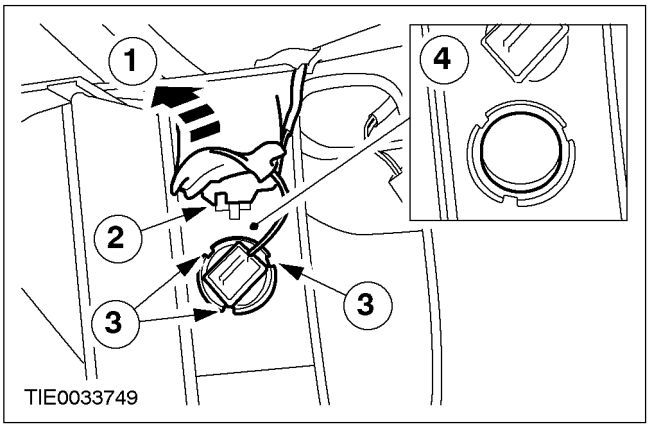
REMOVAL AND INSTALLATION (Continued)

Vehicles with telematics

10. ⚠ CAUTION: The microphone has two installation positions, one is for left-hand drive vehicles and one for right-hand drive vehicles. To aid installation, make a note of the position of the microphone.

Remove the microphone.

1. Detach the adhesive tape from the electrical connector and the wiring harness.
2. Detach the microphone electrical connector from the overhead console.
3. Detach the microphone from the overhead console.
4. Remove the microphone foam pad.



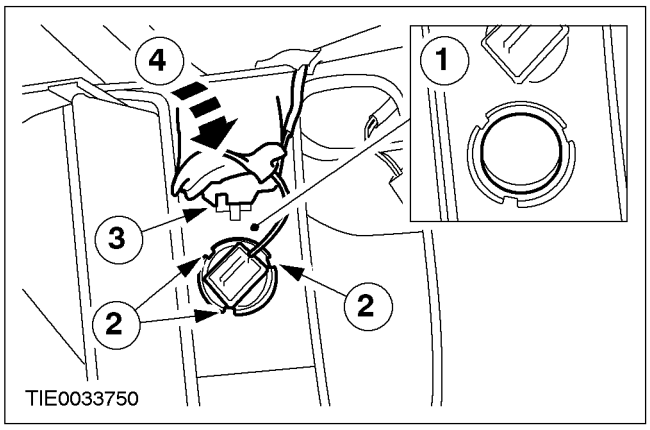
Installation

Vehicles with telematics

1. ⚠ CAUTION: Make sure the microphone is installed in the correct position.

Install the microphone.

1. Install the microphone foam pad.
2. Attach the microphone to the overhead console.
3. Attach the microphone electrical connector to the overhead console.
4. Attach the adhesive tape to the electrical connector and the wiring harness.



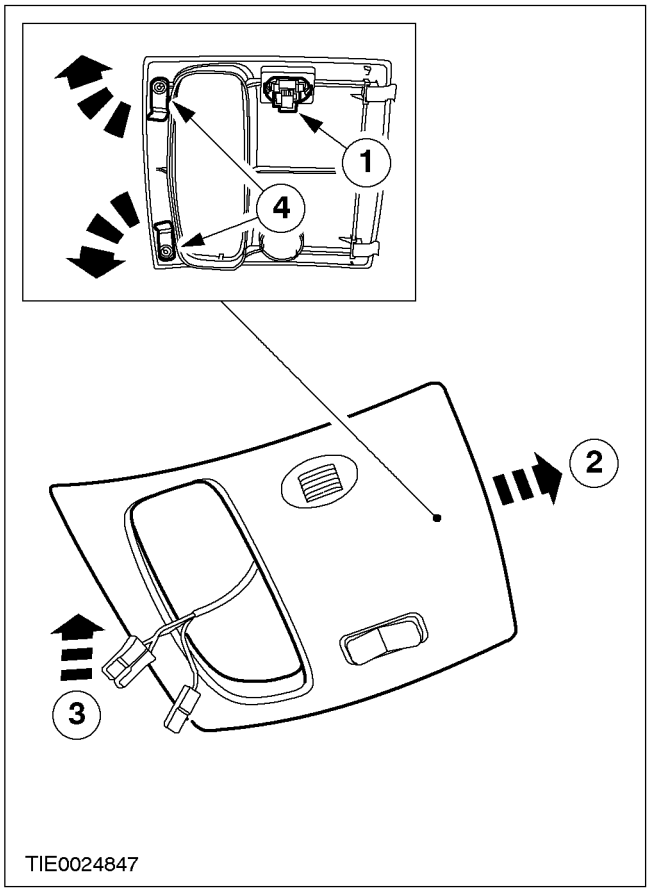
Vehicles with roof opening panel

2. Install the power roof opening panel control switch.

REMOVAL AND INSTALLATION (Continued)

3. Install the overhead console.

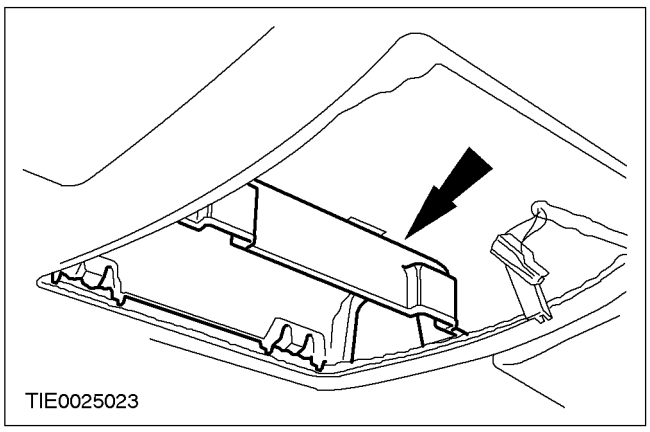
1. Connect the power roof opening panel control switch electrical connector.
2. Attach the rear retaining clips.
3. Raise the front of the overhead console.
4. Turn the front retaining clips 90 degrees.



Vehicles without roof opening panel

4. NOTE: Do not attach the storage compartment cover hook loop tape at this stage.

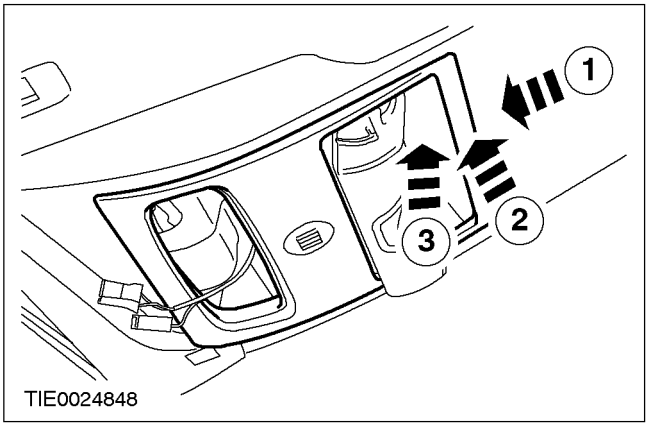
Position the storage compartment cover through the overhead console opening.



5. CAUTION: Avoid attaching the hook loop tape when attaching the storage compartment cover retaining clips.

Install the storage compartment cover and the overhead console.

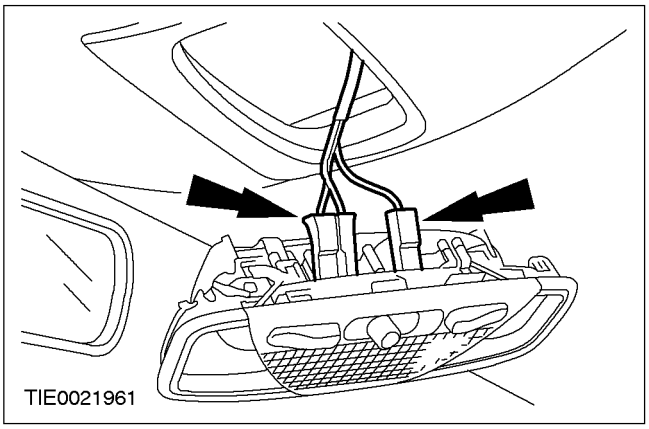
1. Attach the front retaining clips.
2. Push the rear of the overhead console upwards to attach the storage compartment cover retaining clips.
3. Push the overhead console upwards to attach the hook loop tape.



6. Close the storage compartment.

All vehicles

7. Connect the interior lamp electrical connectors.



8. Attach the interior lamp to the overhead console.

9. Connect the battery ground cable. For additional information, refer to Section 414-01.

10. Initialize the door window motors. For additional information, refer to Section 501-11.

SECTION 501-14 Handles, Locks, Latches and Entry Systems

VEHICLE APPLICATION: 2003.0 Mondeo

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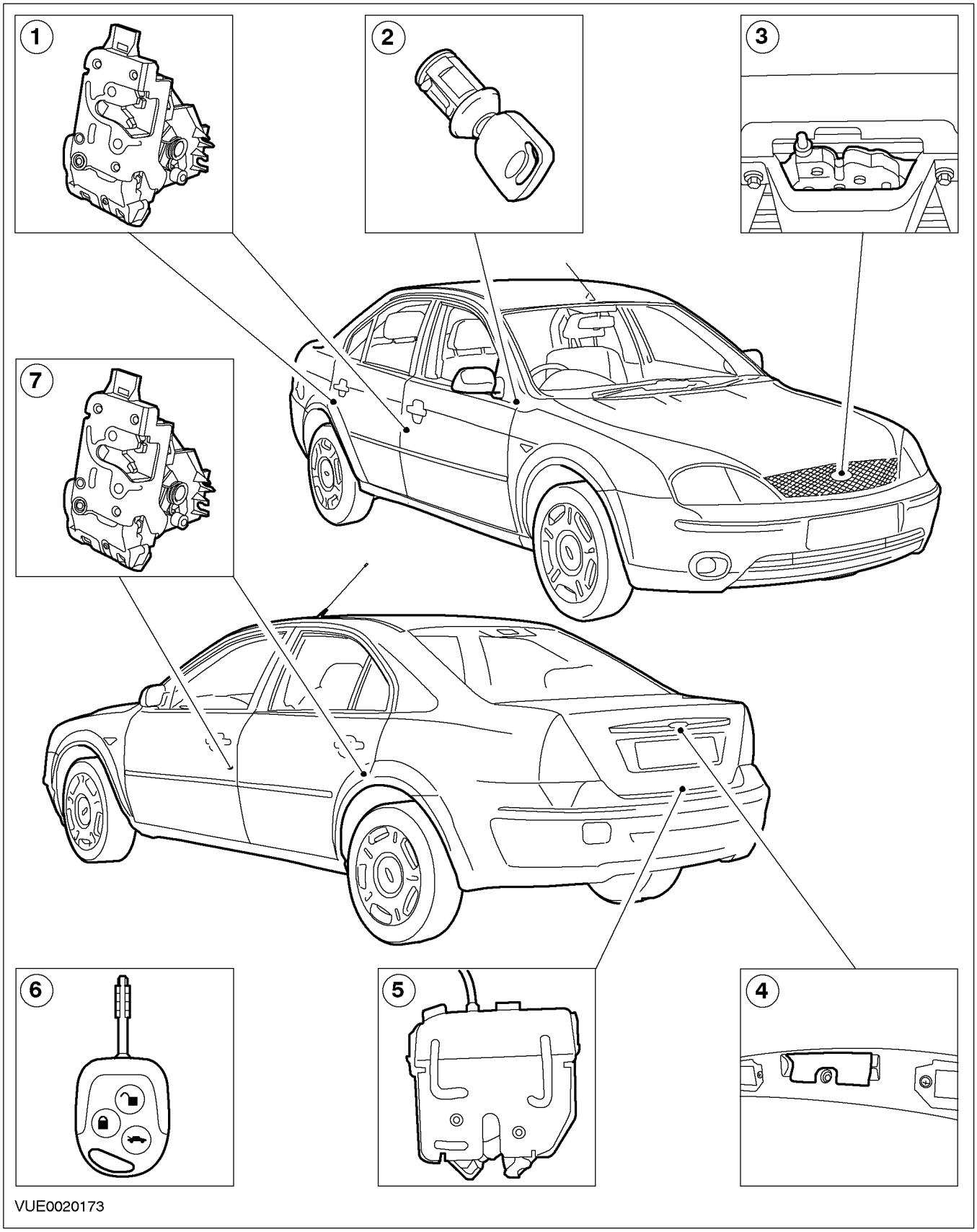
SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Door latch retaining screws	5	-	44
Hood latch retaining bolts	7	-	62
Liftgate latch retaining screws	8	-	71
Tailgate latch retaining screws	8	-	71
Luggage compartment lid latch retaining screws	8	-	71

DESCRIPTION AND OPERATION

Handles, Locks, Latches and Entry Systems



DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1		Front and rear door lock actuator RH
2		Ignition lock cylinder and ignition key
3		Hood latch
4		Liftgate exterior release switch
5		Luggage compartment lid latch actuator
6		Keyless entry remote transmitter
7		Front and rear door lock actuator LH

DIAGNOSIS AND TESTING

Locks, Latches and Entry Systems

Refer to Wiring Diagrams Section 501-14 for schematic and connector information.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Misaligned door(s), hood, liftgate, tailgate, luggage compartment and hood – Door latch(es) – Liftgate exterior release switch – Actuating rod(s) – Exterior door handle(s) – Door latch remote control(s) – Door lock cylinder – Cable(s)	– Fuse(s) – Wiring harness – Electrical connector(s) – Door latch actuator(s) – Remote transmitter batteries – Vehicle battery – Remote transmitter – Door lock switch(es) – Generic electronic module (GEM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to WDS to diagnose the system.

GENERAL PROCEDURES

Remote Transmitter Programming (41 004 0)

1. **NOTE:** A maximum of four keyless entry remote transmitters can be programmed to the generic electronic module (GEM). Programming must be done at the same time for all the transmitters.

NOTE: To enter programming mode, first make sure that the vehicle battery is fully charged and the anti-theft system is not armed or triggered (if equipped).

Close all doors and fasten the safety belts to make sure conflicting chimes do not sound during programming.

2. **Turn the ignition switch from position I to position II at least four times in six seconds.**
3. **Turn the ignition switch to position I.**
4. **The GEM is now in the learning mode.**
5. **Press and hold one of the buttons on the remote transmitter until a chime sounds. This indicates a new transmitter code has been successfully received.**
6. **After each successful programming, another 10 second learning mode is automatically entered, up to a maximum of four times.**
7. **To program additional transmitters, repeat step 5.**
8. **The system will leave the learning mode after the ignition switch is turned to position III, or if no new transmitter is programmed during the 10 seconds, or if four remote transmitters have been programmed.**
9. **NOTE:** An incorrect programming procedure does not affect the stored codes.

After successful programming, only the new programmed transmitters will be accepted.

10. **Test all the programmed transmitters, by activating and deactivating the locking/unlocking functions.**

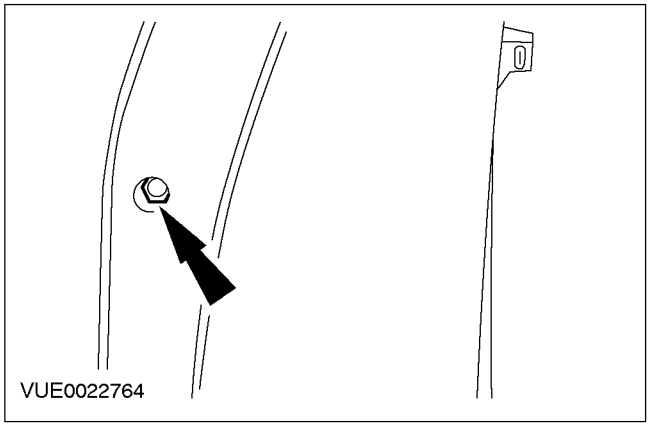
REMOVAL AND INSTALLATION

Front Door Latch (41 351 0)

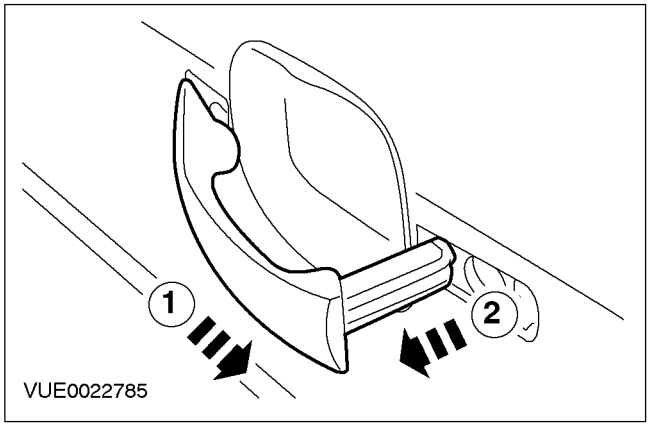
Removal

1. **NOTE:** Pull out and hold the exterior front door handle.

   Remove the exterior front door handle access hole grommet and loosen the exterior front door handle retaining screw.



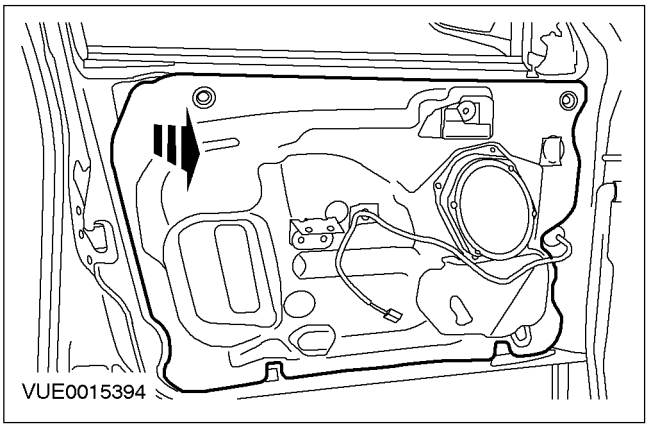
2. **Remove the exterior front door handle.**
   1. Slide the exterior front door handle to release.
   2. Pull the exterior front door handle to remove.



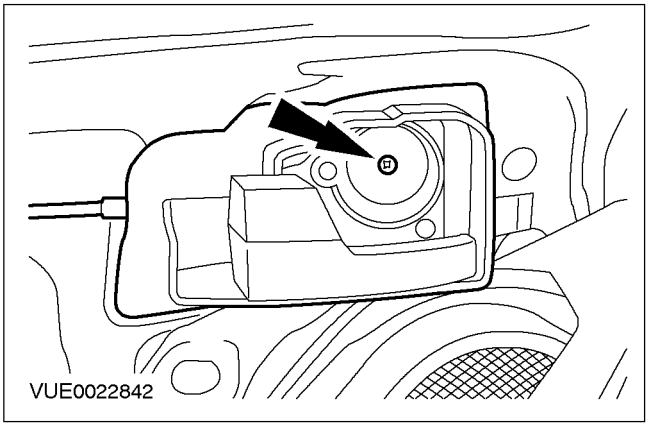
3. **Remove the front door trim panel. For additional information, refer to Section 501-05.**

4. **NOTE:** Do not touch the adhesive surface as re-bonding will be impaired.

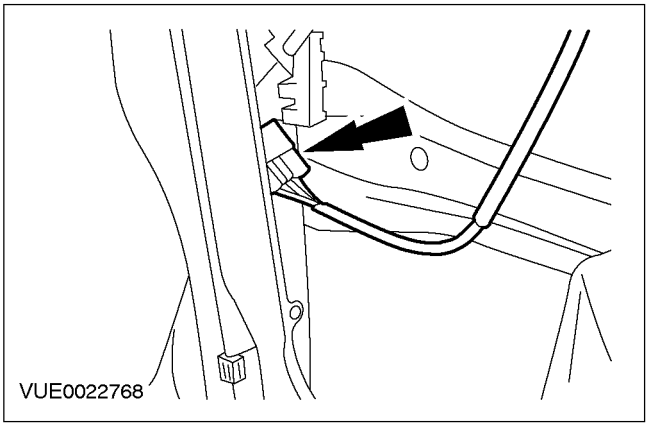
   Detach the door water shield from the front door panel.



5. **Detach the front door latch remote control from the door panel.**

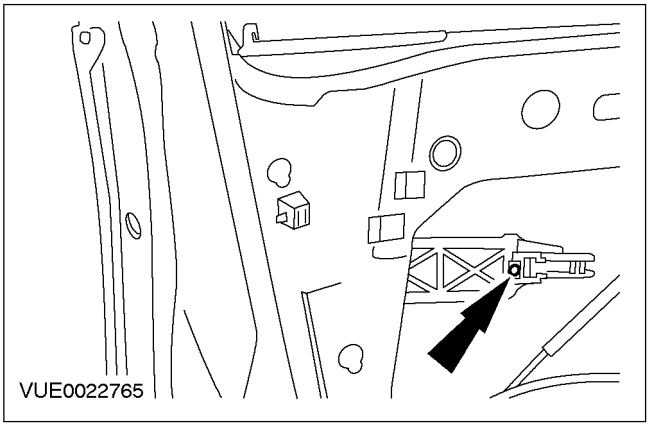


6. **Disconnect the front door lock actuator electrical connector.**



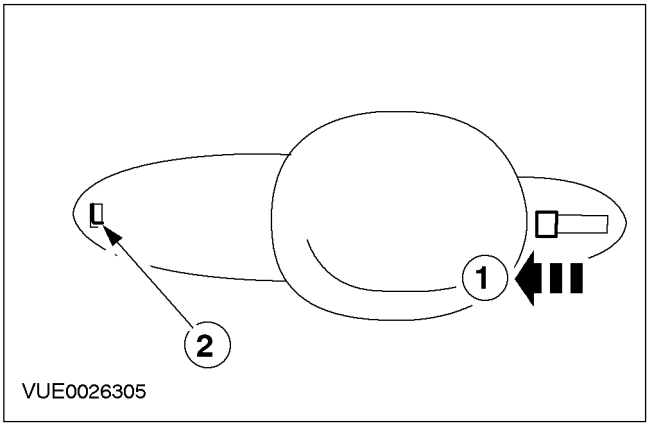
REMOVAL AND INSTALLATION (Continued)

7. Loosen the exterior front door handle reinforcement plate retaining screw.

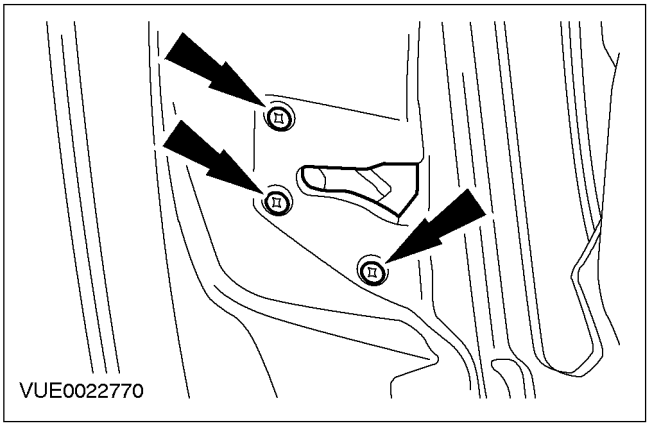


8. Detach the exterior front door handle reinforcement plate.

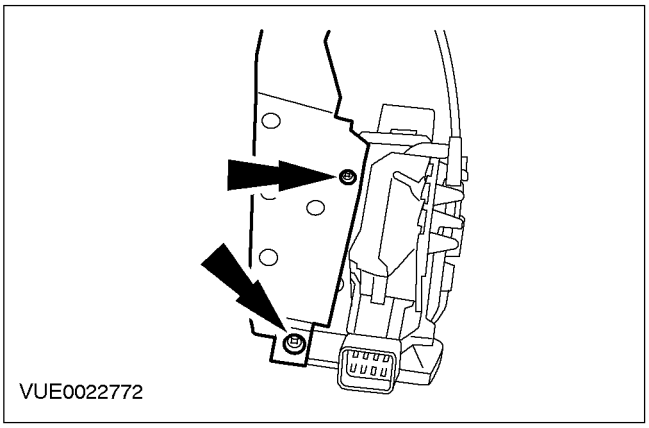
1. Slide the exterior front door handle reinforcement plate toward the front of the door panel.
2. Dislocate the exterior front door handle reinforcement plate locking tangs from the door panel.



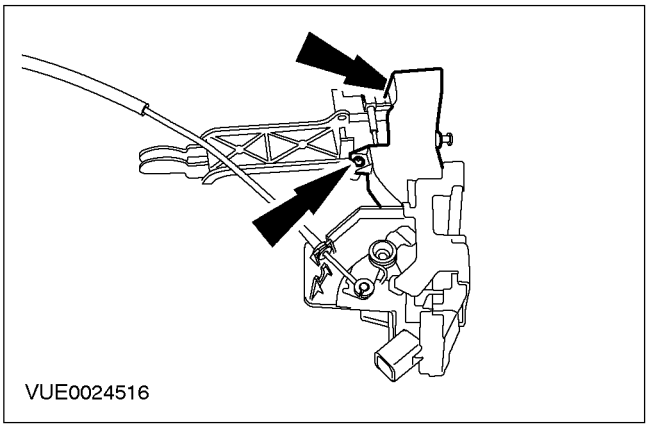
9. Remove the front door latch.



10. Remove the front door latch security shield retaining screws (driver side shown).

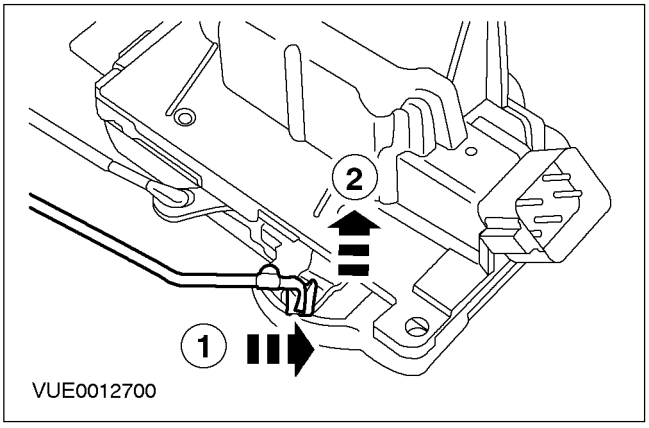


11. Remove the front door latch security shield retaining screw and remove the front door latch security shield (driver side shown).



12. Remove the driver side door lock cylinder connecting rod.

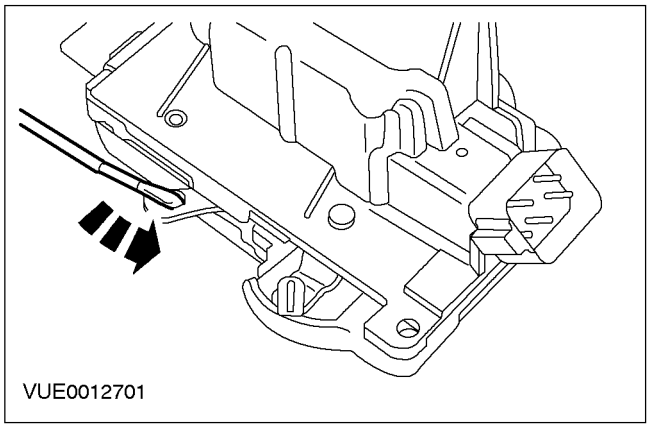
1. Rotate the clip counterclockwise to release the connecting rod.
2. Pull the connecting rod up.



REMOVAL AND INSTALLATION (Continued)

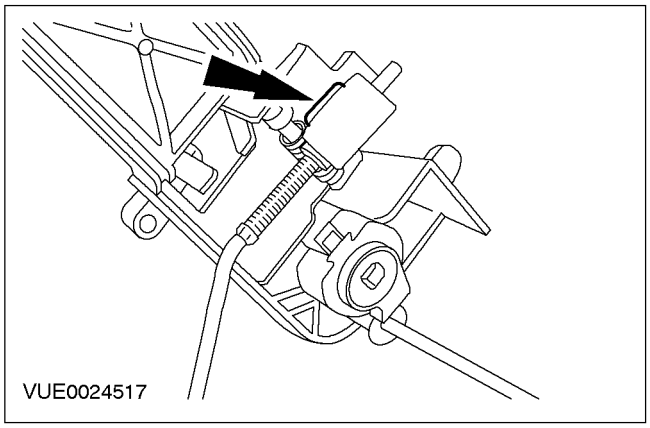
13. Remove the exterior front door handle reinforcement plate connecting rod.

- Rotate the connecting rod 90 degrees.



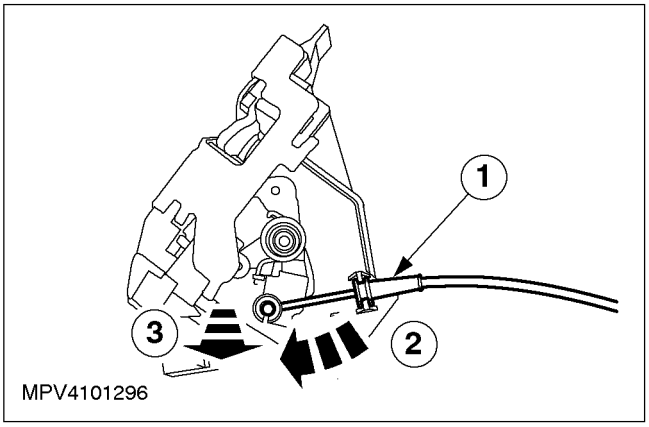
14. Remove the exterior front door handle adjustment clip from the door handle reinforcement plate.

- Discard the clip.



15. Remove the front door latch remote control cable from the front door latch.

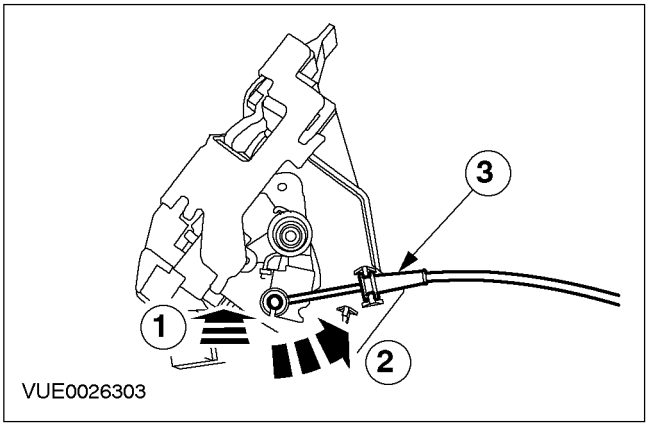
1. Detach the front door latch remote control outer cable.
2. Rotate the front door latch remote control cable clockwise.
3. Remove the front door latch.



Installation

1. Install the front door latch remote control cable onto the front door latch.

1. Attach the front door latch remote control cable to the front door latch.
2. Rotate the front door latch remote control cable counter clockwise.
3. Attach the front door latch remote control outer cable.

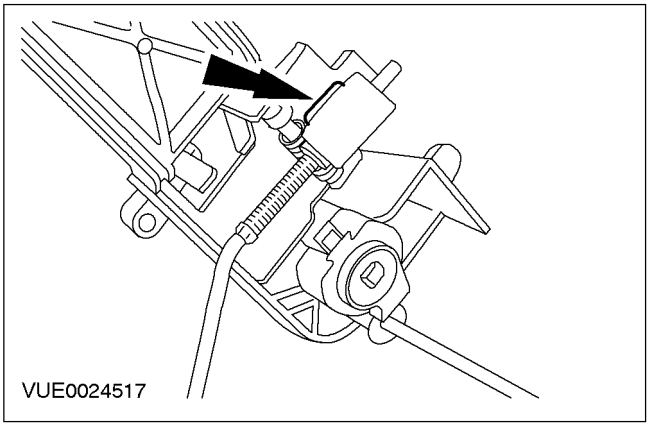


REMOVAL AND INSTALLATION (Continued)

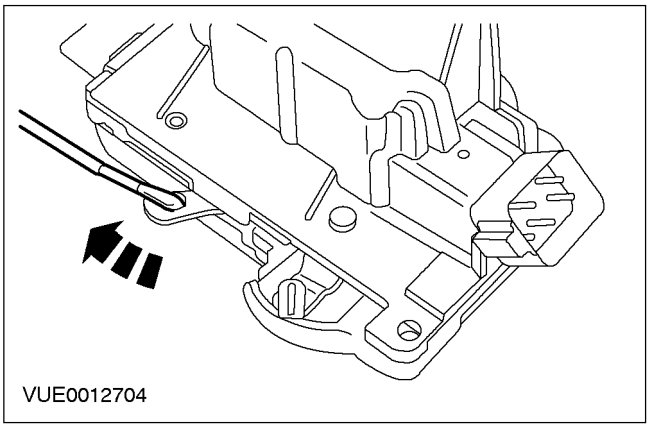
2. **NOTE:** Install a new exterior front door handle adjustment clip.

NOTE: Do not lock the adjustment clip into place at this stage.

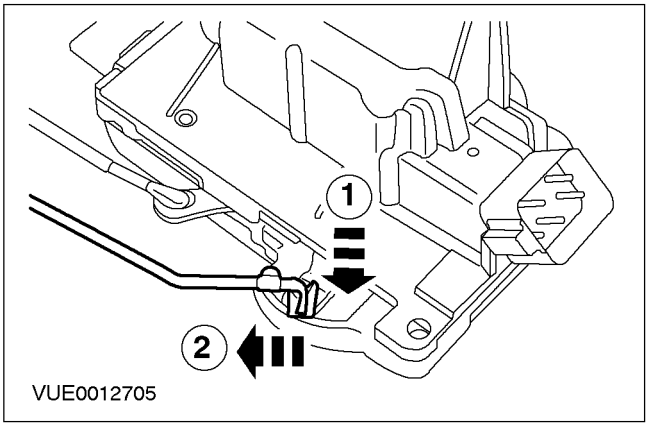
Install the exterior front door handle adjustment clip and connecting rod.



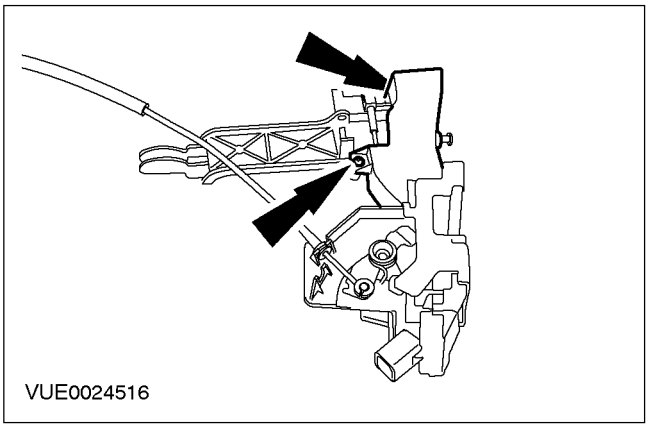
3. **Install the exterior front door handle reinforcement plate connecting rod.**



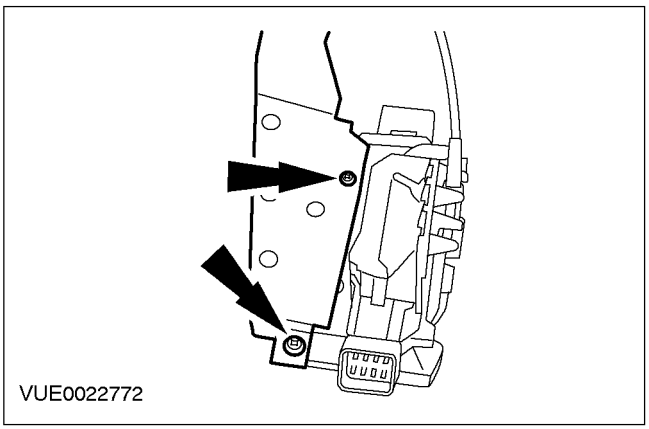
4. **Install the driver side door lock cylinder connecting rod.**
   1. Install the connecting rod.
   2. Rotate the clip to lock the connecting rod in position.



5. **Install the front door latch security shield.**



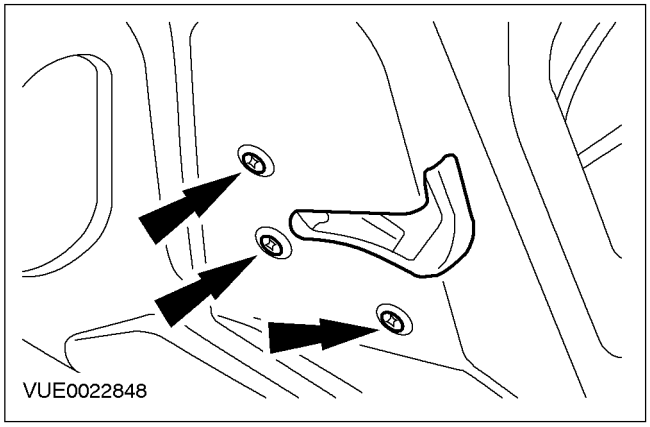
6. **Install the front door latch security shield retaining screws.**



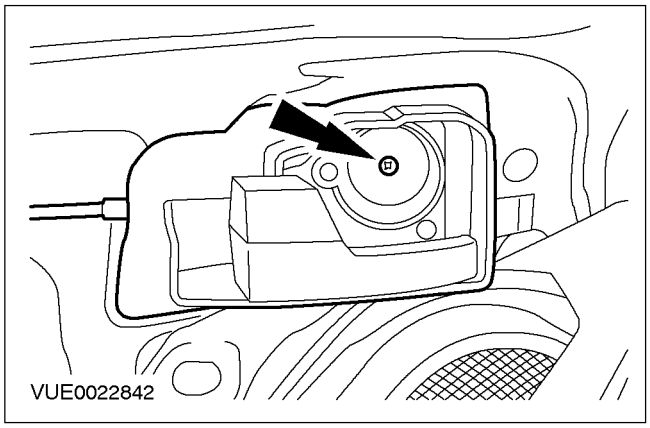
REMOVAL AND INSTALLATION (Continued)

7. **NOTE:** Do not tighten the front door latch retaining screws at this stage.

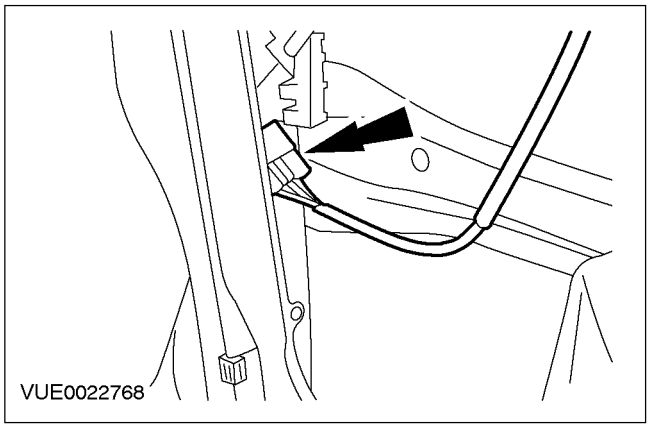
   Install the front door latch.



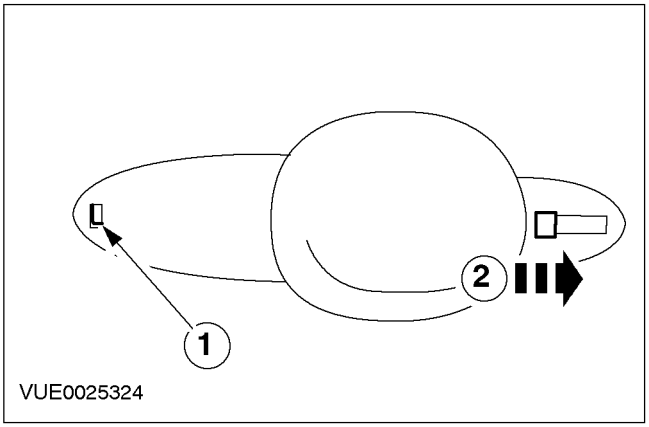
8. **Attach the front door latch remote control to the door panel.**



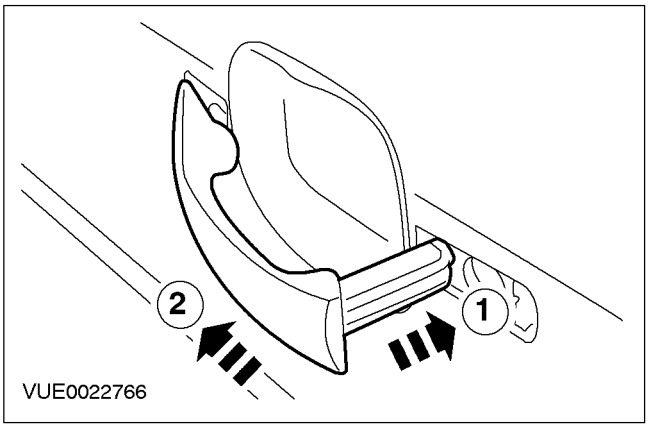
9. **Connect the front door lock actuator electrical connector.**



10. **Attach the exterior front door handle reinforcement plate.**
    1. Locate the exterior front door handle reinforcement plate locking tangs onto the door panel.
    2. Slide the exterior front door handle reinforcement plate into position.

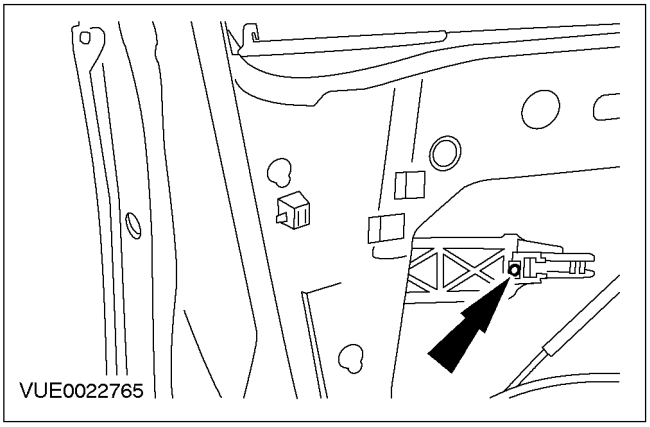


11. **Install the exterior front door handle.**
    1. Locate the exterior front door handle into the front door panel.
    2. Slide the exterior front door handle forward to install it onto the door handle reinforcement plate.

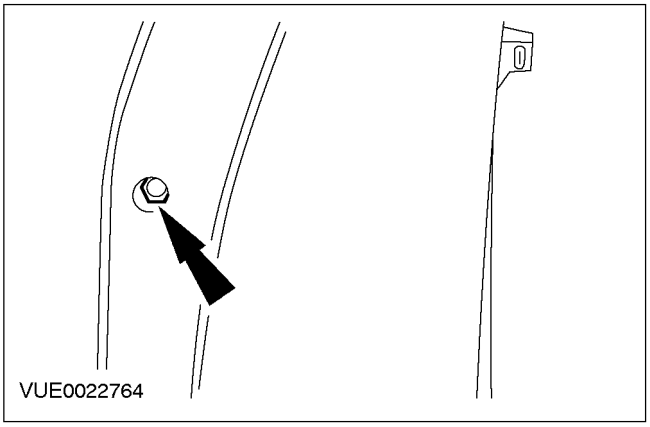


REMOVAL AND INSTALLATION (Continued)

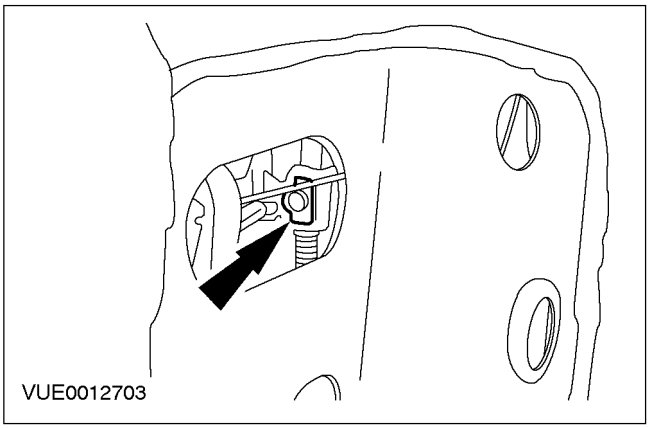
12. **Tighten the exterior front door handle retaining screw.**



13. **Install the exterior front door handle retaining screw.**

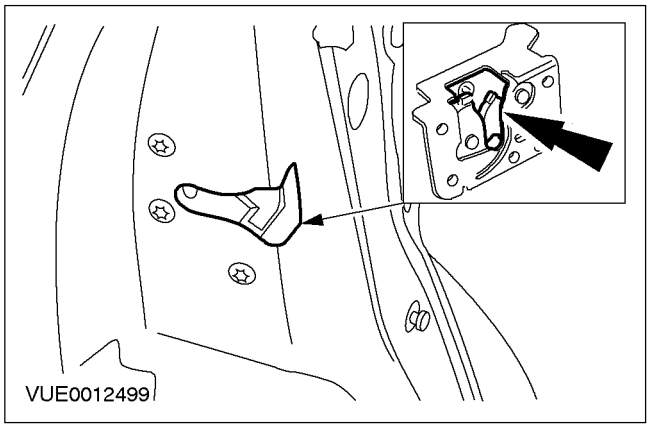


14. **Press the exterior front door handle adjustment clip to set the latch position.**

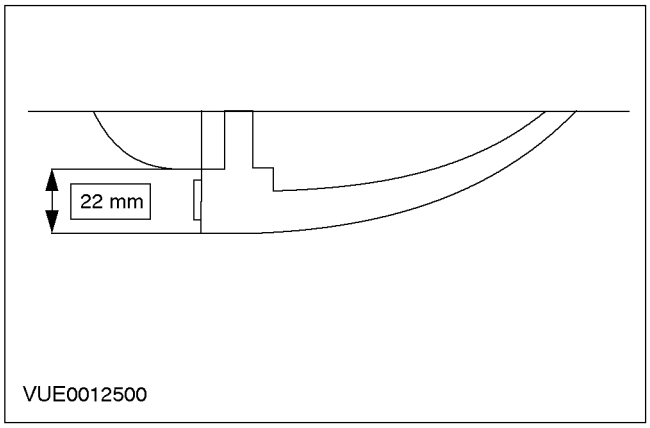


15. **NOTE:** Two audible clicks should be heard when the door latch lever is closed completely.

    Close the front door latch lever in the jaws of the door latch.



16. **Lock and unlock the front door latch using the rocker lever on the front door latch remote control handle.**
17. **Open the front door latch using the exterior front door handle. The door latch should open at approximately 75% of handle full travel (22mm). The exterior front door handle should have between 5-6 mm of travel after the front door latch has released.**

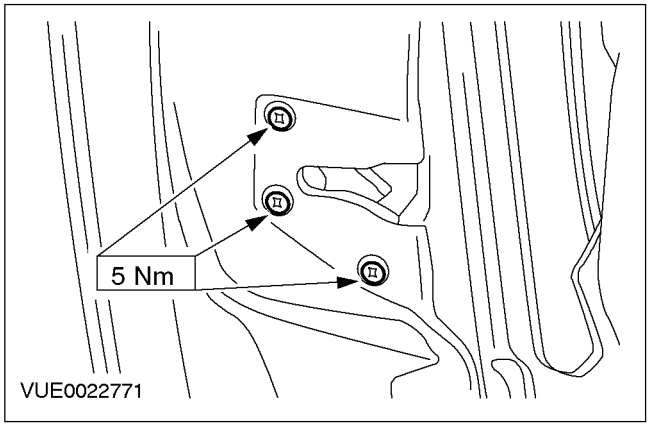


18. **NOTE:** If further adjustment of the door latch is required, a new door latch connecting rod adjustment clip must be installed.

    If the door latch does not open correctly remove the door latch and reset the exterior front door handle adjustment clip.

REMOVAL AND INSTALLATION (Continued)

19. **Tighten the front door latch retaining screws.**



20. **Attach the door water shield.**
21. **Install the front door trim panel. For additional information, refer to Section 501-05.**

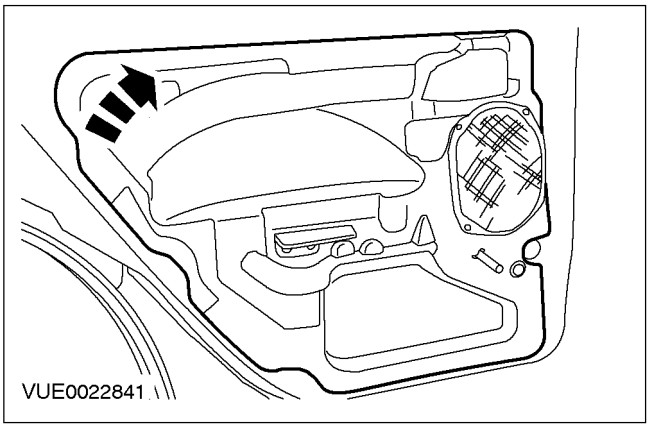
REMOVAL AND INSTALLATION

Rear Door Latch (41 352 0)

Removal

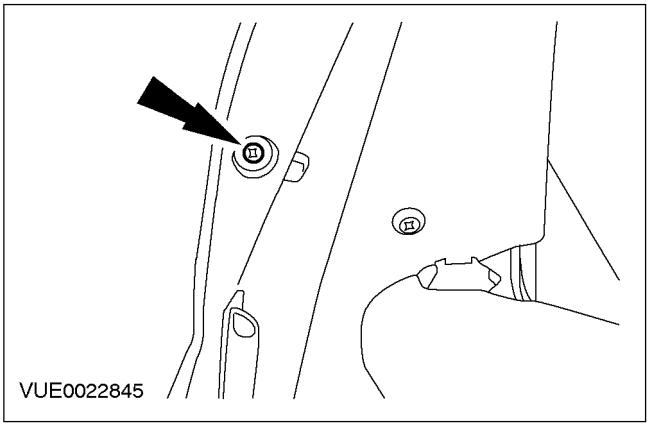
1. **Remove the rear door trim panel. For additional information, refer to Section 501-05.**
2. **NOTE:** Do not touch the adhesive surface as re-bonding will be impaired.

   Detach the door water shield from the rear door panel.

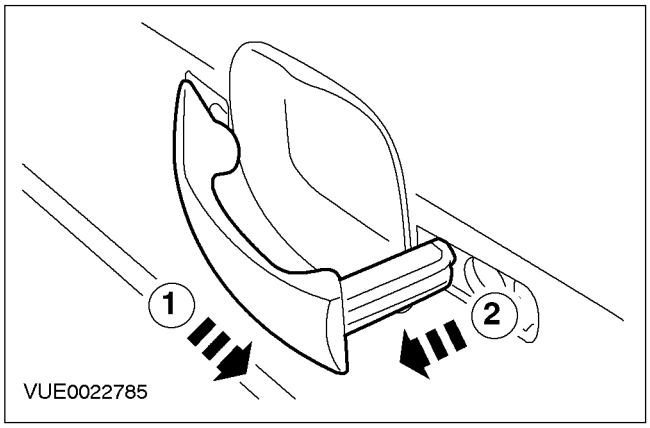


3. **NOTE:** Pull out and hold the exterior rear door handle.

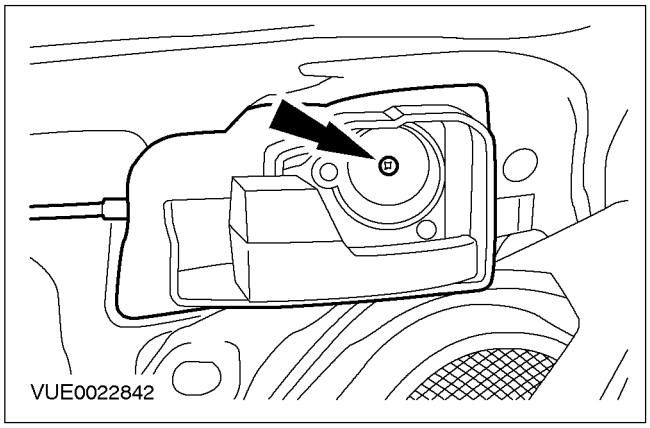
   Remove the exterior rear door handle access hole grommet and loosen the exterior rear door handle retaining screw.



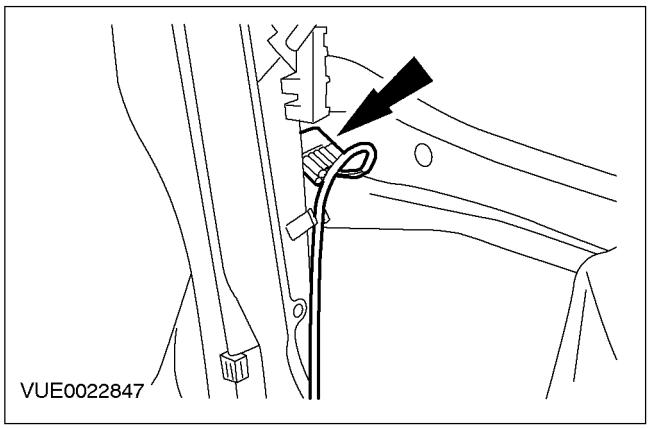
4. **Remove the exterior rear door handle.**
   1. Slide the exterior rear door handle backward to release.
   2. Pull the exterior rear door handle to remove.



5. **Detach the rear door latch remote control from the door panel.**

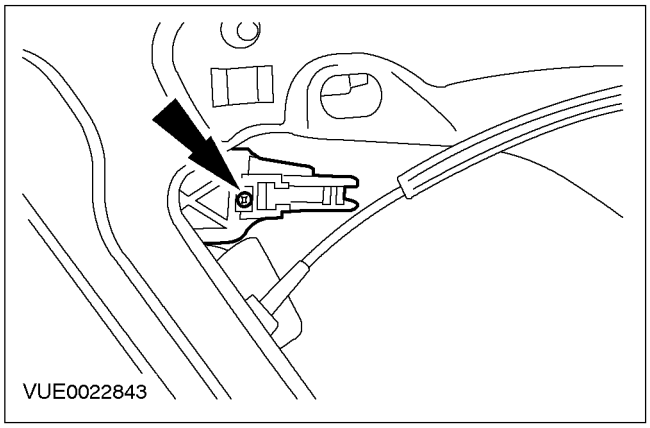


6. **Disconnect the rear door lock actuator electrical connector.**



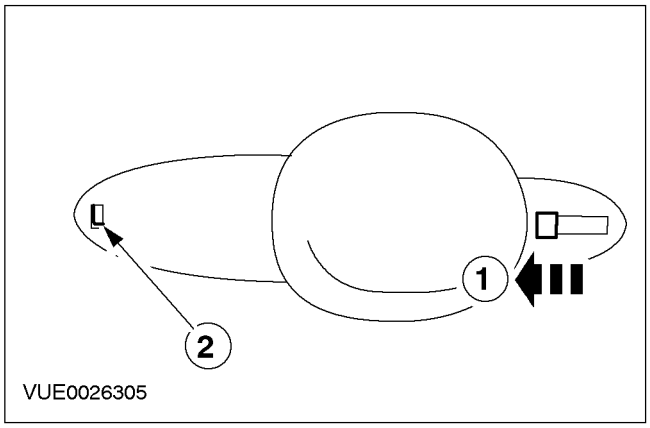
REMOVAL AND INSTALLATION (Continued)

7. Loosen the exterior rear door handle reinforcement plate retaining screw.

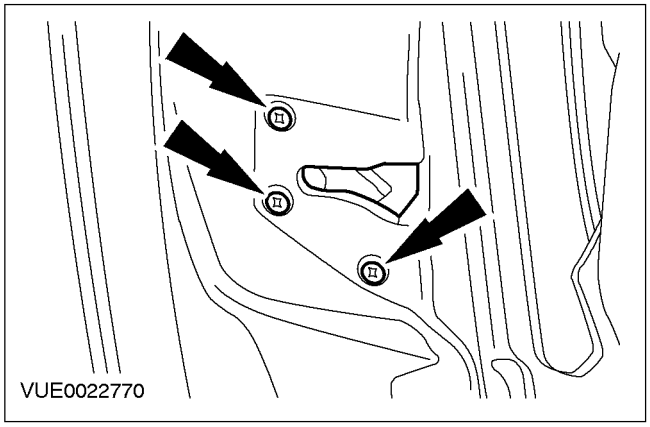


8. Detach the exterior rear door handle reinforcement plate.

1. Slide the exterior rear door handle reinforcement plate toward the front of the door panel.
2. Dislocate the exterior rear door handle reinforcement plate locking tangs from the door panel.

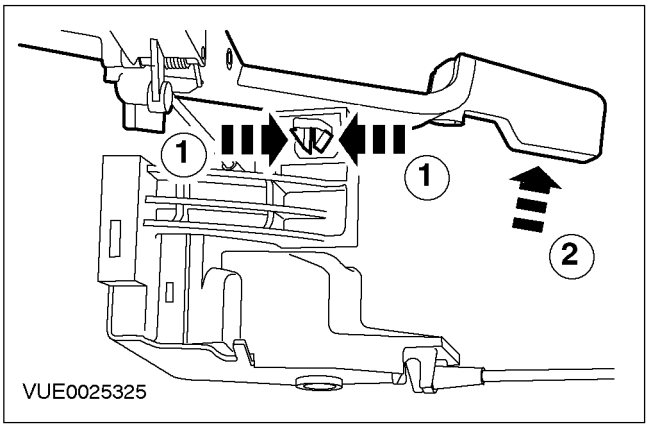


9. Remove the rear door latch.

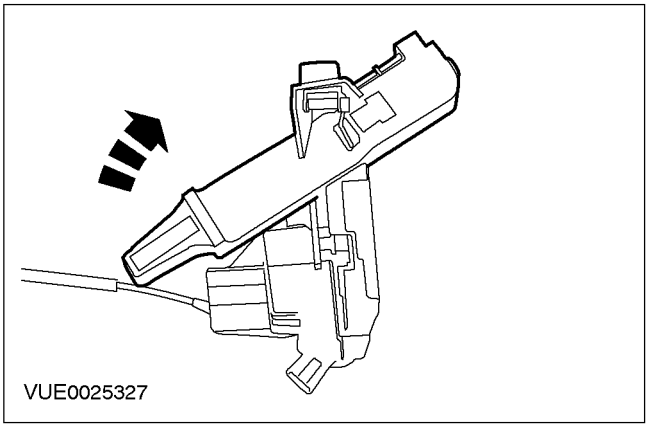


10. Detach the rear door latch from the exterior rear door handle reinforcement plate.

1. Press the clip to release.
2. Detach the door latch from the exterior rear door handle reinforcement plate.

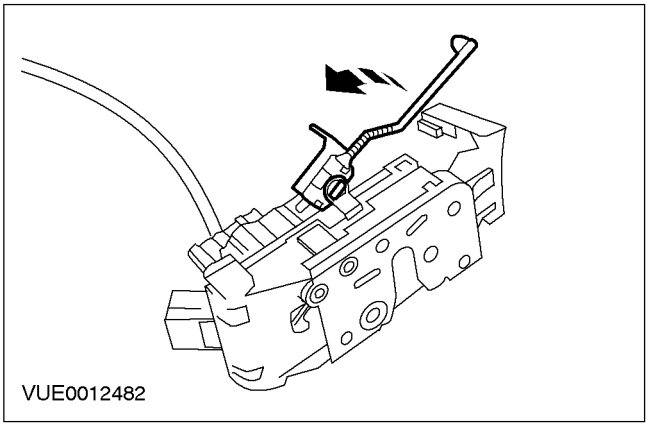


11. Remove the exterior rear door handle reinforcement plate.



12. Remove the rear door latch connecting rod.

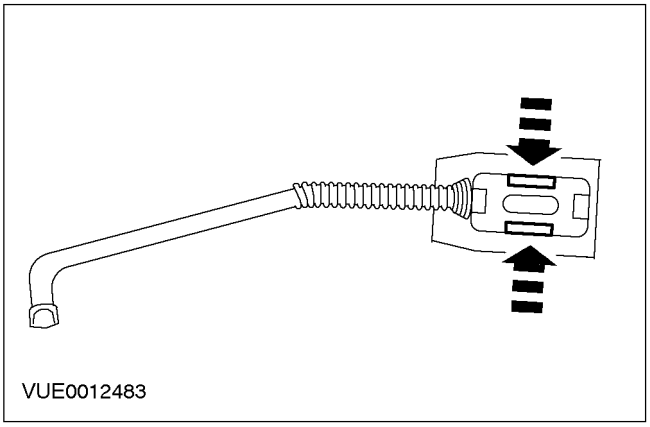
- Rotate the rear door latch connecting rod 90 degrees counterclockwise.



REMOVAL AND INSTALLATION (Continued)

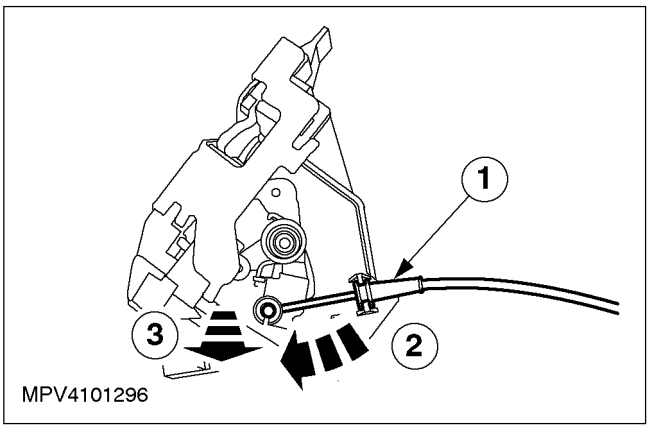
13. Release the rear door latch connecting rod adjustment clip.

- Discard the clip.



14. Remove the rear door latch

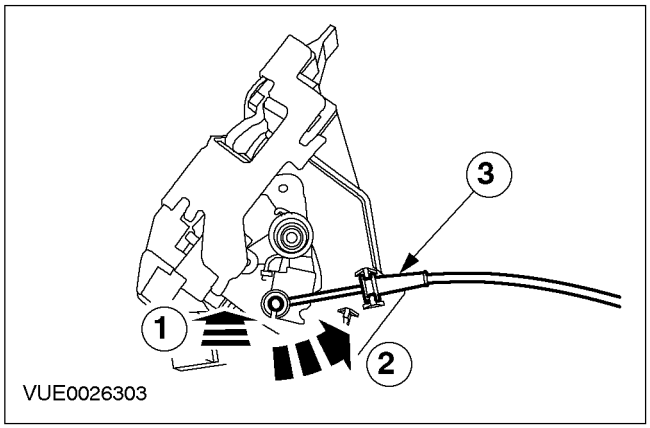
1. Detach the rear door latch remote control outer cable.
2. Rotate the rear door latch remote control clockwise.
3. Remove the rear door latch.



Installation

1. Install the rear door latch remote control cable onto the rear door latch.

1. Attach the rear door latch remote control cable to the rear door latch.
2. Rotate the rear door latch remote control cable counter clockwise.
3. Attach the rear door latch remote control outer cable.

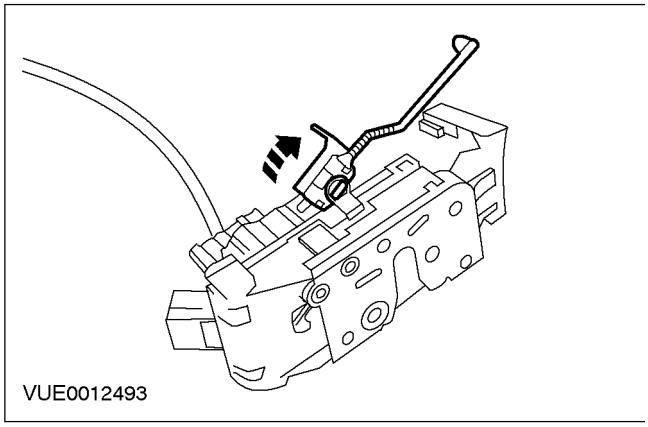


2. NOTE: Install a new exterior rear door handle adjustment clip.

NOTE: Do not lock the adjustment clip into place at this stage.

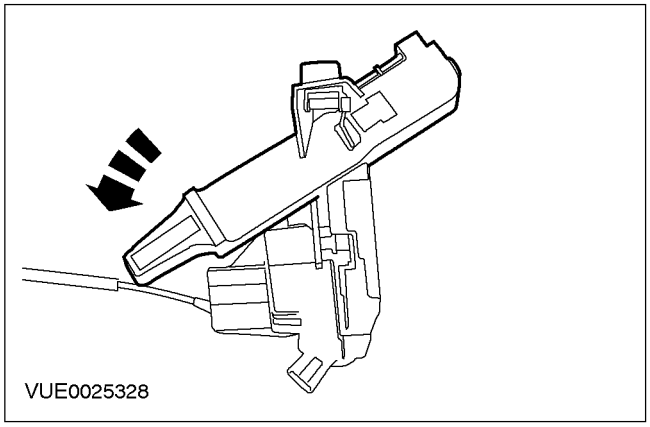
Install the rear door latch connecting rod.

- Rotate the rear door latch connecting rod 90 degrees clockwise.

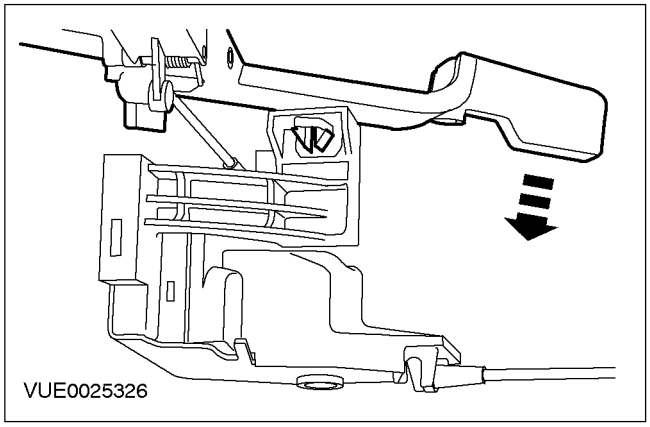


REMOVAL AND INSTALLATION (Continued)

3. Install the exterior rear door handle reinforcement plate to the connecting rod.

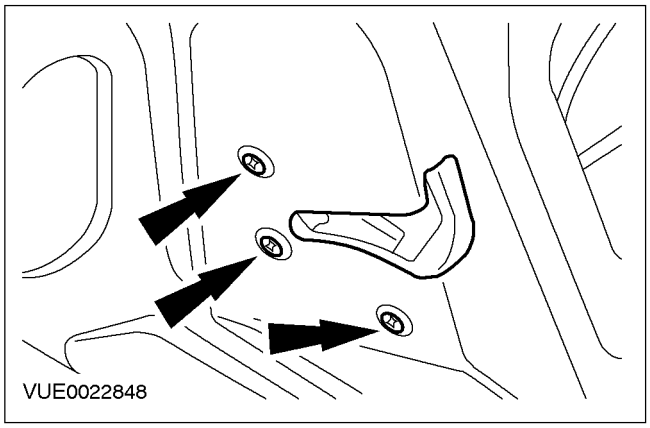


4. Install the exterior rear door handle reinforcement plate to the rear door latch.

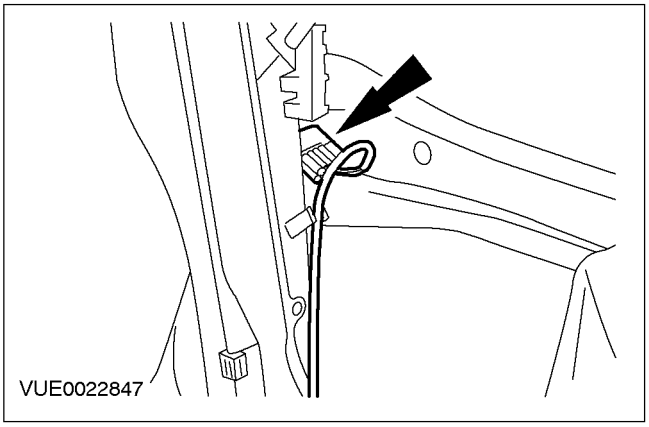


5. NOTE: Do not tighten the door screws at this stage.

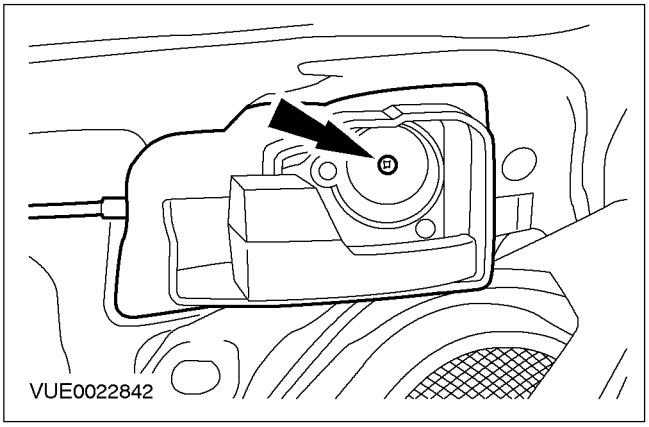
Install the rear door latch.



6. Connect the rear door lock actuator electrical connector.

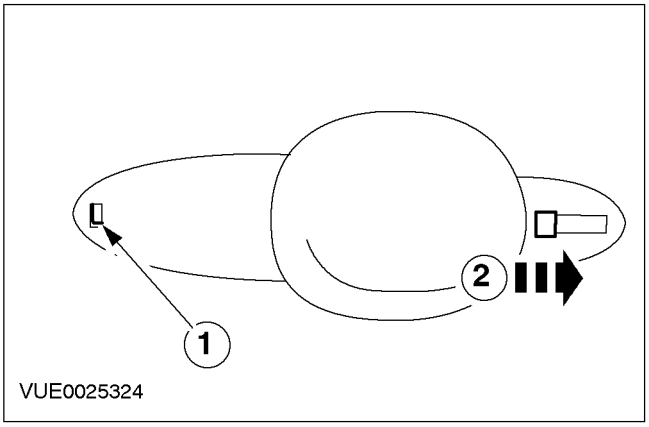


7. Attach the rear door latch remote control to the door panel.



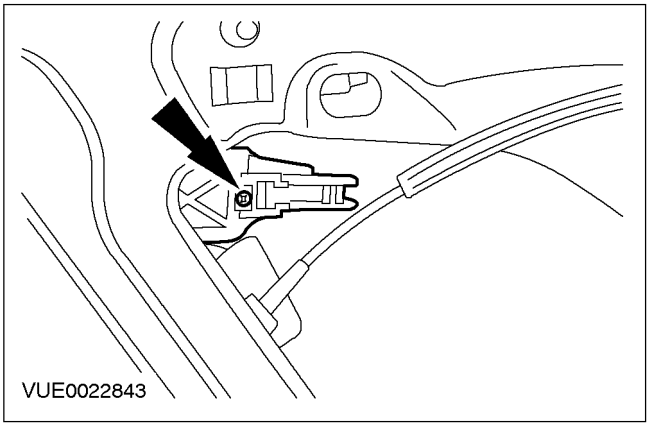
8. Install the exterior rear door handle reinforcement plate.

1. Locate the exterior rear door handle reinforcement plate locking tangs onto the door panel.
2. Slide the exterior rear door handle reinforcement plate into position.



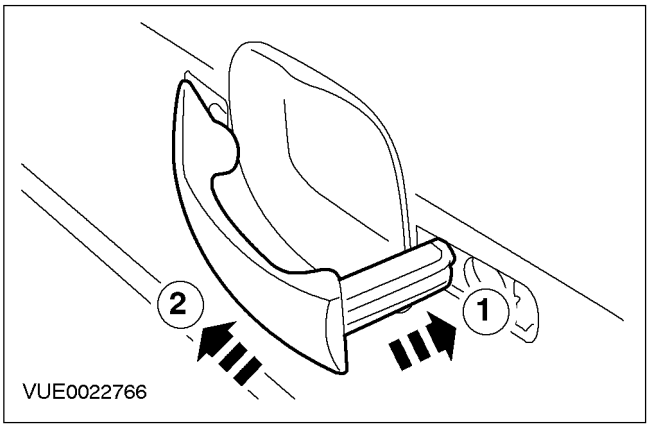
REMOVAL AND INSTALLATION (Continued)

9. Tighten the exterior rear door handle reinforcement plate retaining screw.

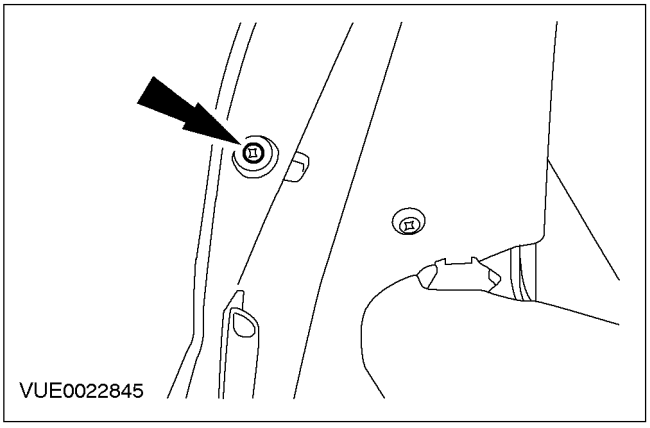


10. Install the exterior rear door handle.

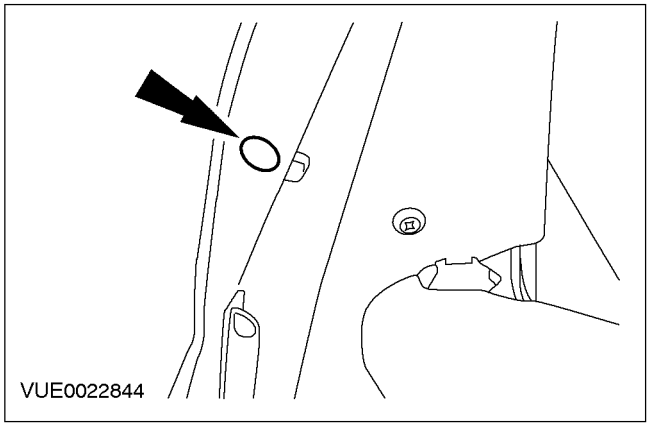
1. Install the exterior rear door handle.
2. Slide the exterior rear door handle forward to install it onto the exterior rear door handle reinforcement plate.



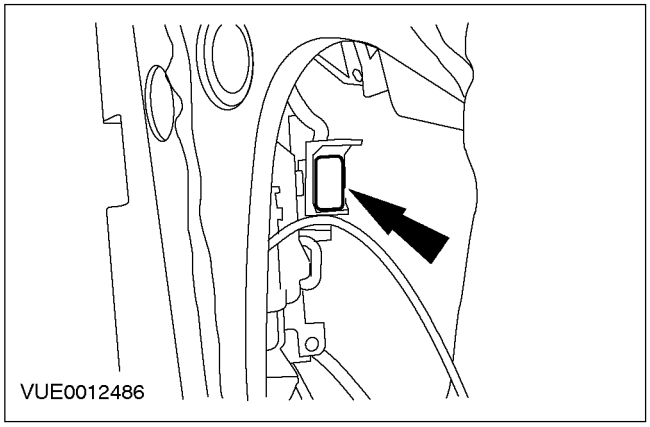
11. Install the exterior rear door handle and install the exterior rear door handle retaining screw.



12. Install the exterior rear door handle access hole grommet.

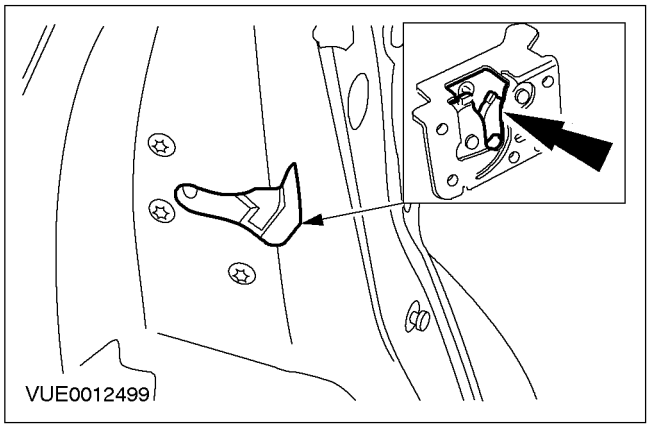


13. Press the door latch connecting rod adjustment clip to set the latch position.



14. NOTE: Two audible clicks should be heard when the door latch lever is closed completely.

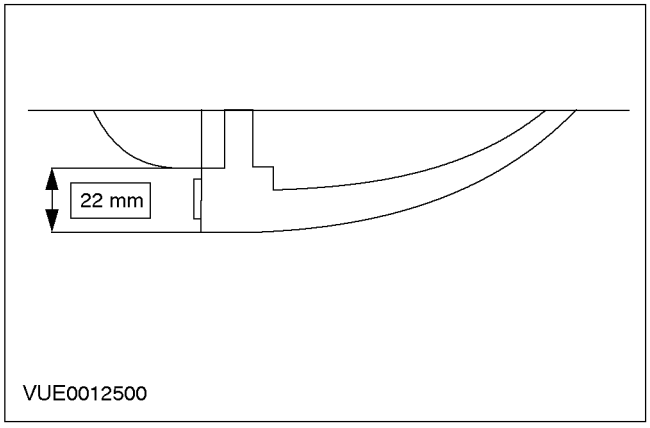
Close the door latch lever.



15. Lock and unlock the door latch using the rocker lever on the door latch remote control.

REMOVAL AND INSTALLATION (Continued)

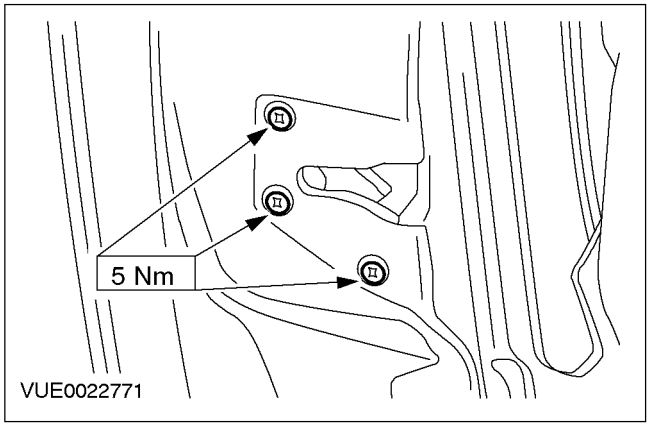
16. **Open the door latch using the exterior rear door handle. The door latch should open at approximately 75% of handle full travel (22mm). The exterior rear door handle should have between 5-6 mm of travel after the door latch has released.**



17. **NOTE:** If further adjustment of the door latch is required, a new door latch connecting rod adjustment clip must be installed.

    If the door latch does not open correctly remove the door latch and reset the door latch connecting rod adjustment clip.

18. **Tighten the door screws.**



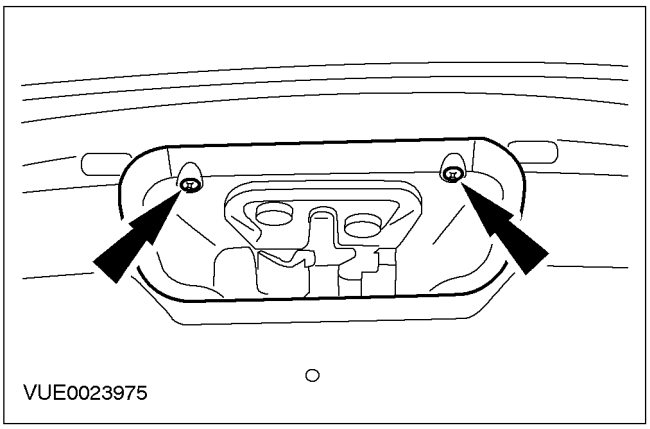
19. **Attach the door water shield.**
20. **Install the rear door trim panel. For additional information, refer to Section 501-05.**

REMOVAL AND INSTALLATION

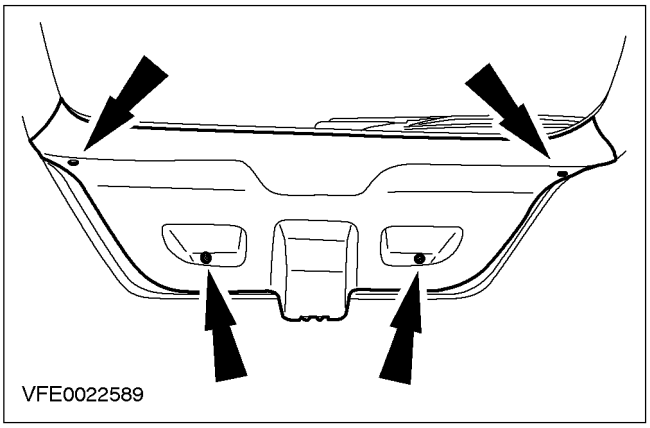
Liftgate Latch (41 666 0)

Removal

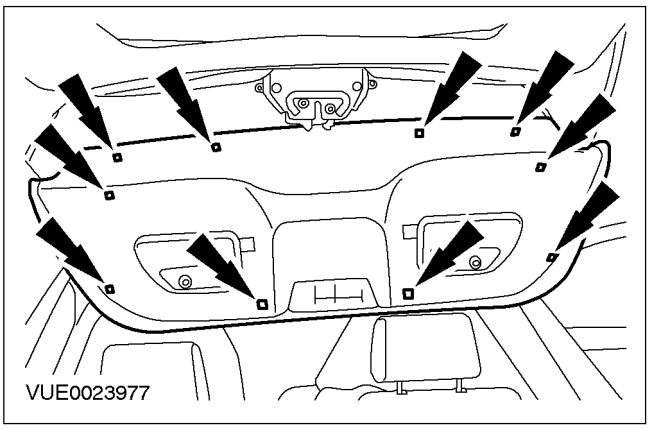
1. Remove the liftgate latch trim panel.



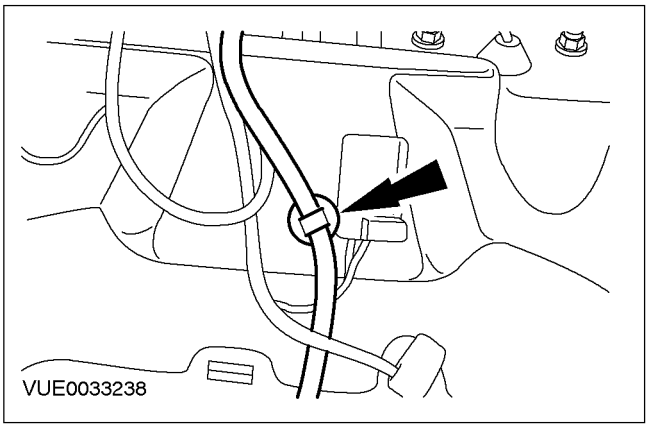
2. Remove the liftgate trim panel retaining screws.



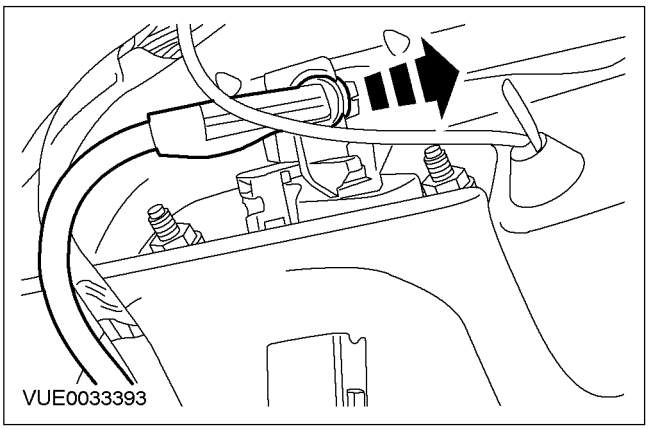
3. Remove the liftgate trim panel.



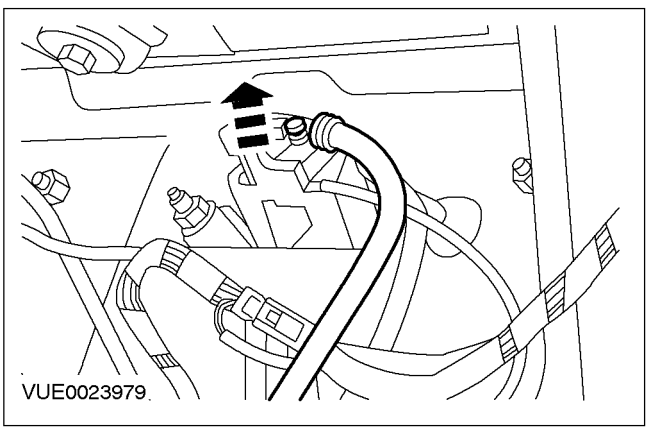
4. Detach the liftgate latch release cable from the retaining clip.



5. Detach the liftgate latch release cable from the liftgate lock cylinder retaining clip.

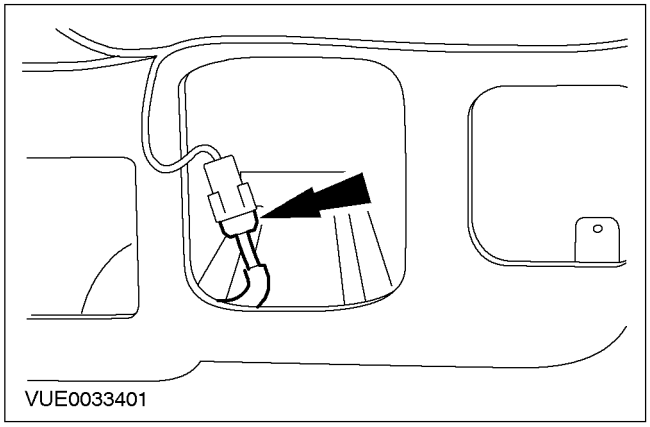


6. Detach the liftgate latch release cable from the liftgate lock cylinder.

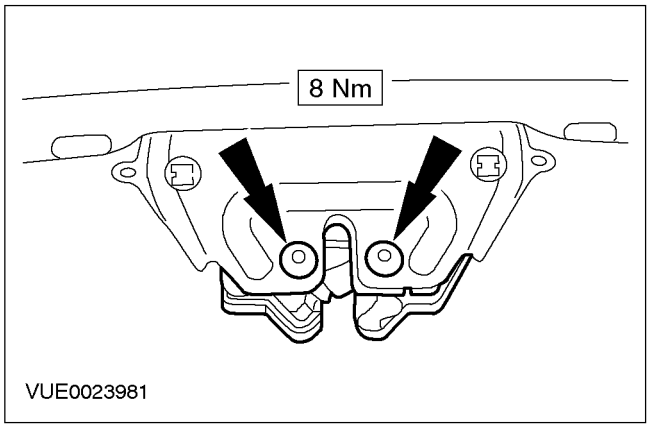


REMOVAL AND INSTALLATION (Continued)

7. Disconnect the liftgate latch electrical connector.



8. Remove the liftgate latch.



Installation

1. To install, reverse the removal procedure.

SECTION 501-16 Wipers and Washers

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

SPECIFICATIONS

Specifications 501-16-2

DIAGNOSIS AND TESTING

Wipers and Washers 501-16-3
Inspection and Verification 501-16-3
Symptom Chart 501-16-3
Pinpoint Tests 501-16-5
Component checks 501-16-38

GENERAL PROCEDURES

Windshield Wiper Blade and Pivot Arm Adjustment 501-16-40

REMOVAL AND INSTALLATION

Windshield Wiper Motor ..... (32 524 0) 501-16-41
Rear Window Wiper Motor ..... (32 530 0) 501-16-43

SPECIFICATIONS

Front Wiper Blade and Pivot Arm Adjustment (Left-hand drive vehicles)

Angle between windshield and wiper arm (driver side)	6 degrees
Angle between windshield and wiper arm (passenger side)	5 degrees

Front Wiper Blade and Pivot Arm Adjustment (Right-hand drive vehicles)

Angle between windshield and wiper arm (driver side)	-6 degrees
Angle between windshield and wiper arm (passenger side)	-5 degrees

Rear Wiper Blade and Pivot Arm Adjustment (Hatchback)

Angle between rear window and wiper arm	-6 degrees

Rear Wiper Blade and Pivot Arm Adjustment (Wagon)

Angle between rear window and wiper arm	-5.5 degrees

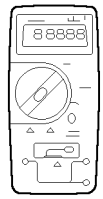
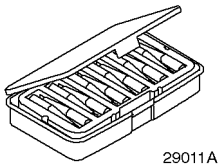
Torque Specifications

Description	Nm	lb-ft	lb-in
Windshield wiper arm retaining nut	22	16	-
Windshield wiper motor and linkage retaining bolts	8	-	71
Windshield wiper crank retaining nut	26	19	-
Windshield wiper motor retaining bolts	8	-	71
Rear window wiper arm retaining nut	14	10	-
Rear window wiper motor retaining bolts	7	-	62

DIAGNOSIS AND TESTING

Wipers and Washers

Refer to Wiring Diagrams Section 501-16 for schematic and connector information.

Special Tool(s)	
 ST1137-A	Digital multimeter 105-R0051 or a comparable device
 29011A	Terminal probe kit 29-011 A

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Check

Mechanical	Electrical
• Wiper blade(s). • Wiper arm pivot shaft. • Washer fluid reservoir • Hose(s). • Washer nozzles.	• Fuse(s). • Wiring harness. • Electrical connector(s). • Washer pump(s) • Wiper motor(s).

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern persists, verify the symptom and continue with the symptom chart

Symptom Chart

Condition	Possible Sources	Action
•Windscreen wipers are inoperative (washer system is OK)	•Fuse(s). •Circuit(s). •Central Junction Box (CJB). •Wash/wipe switch	• GO to Pinpoint Test A
•Windscreen wiper is permanently on	•Fuse(s). •Circuit(s). •Windscreen wiper relay. •Wash/wipe switch •Windscreen wiper motor. •Central Junction Box (CJB. •GEM.	• GO to Pinpoint Test B
•Fast wipe speed does not work correctly (intermittent mode OK)	•Circuit(s). •Wash/wipe switch •Windscreen wiper motor.	• GO to Pinpoint Test C
•Slow wipe speed does not work correctly (intermittent mode OK)	•Wash/wipe switch	•CHECK the wash/wipe switch according to the component check in the Wiring Diagrams, RENEW as necessary. CHECK the operation of the system .

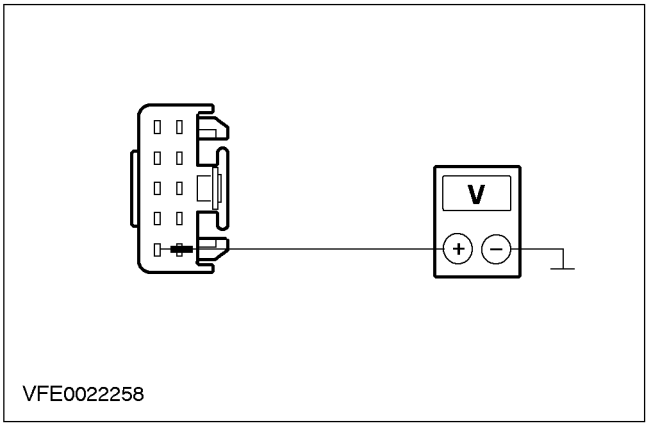
DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
•Intermittent function not working properly (fast/slow wipe OK)	•Circuit(s). •Windscreen wiper relay. •Wash/wipe switch •GEM. •Central Junction Box (CJB).	• GO to Pinpoint Test D
•Windscreen wiper park position is incorrect	•Circuit(s). •Windscreen wiper relay. •Wash/wipe switch •Windshiel wiper motor. •Central Junction Box (CJB).	• GO to Pinpoint Test E
•Windscreen wipers do not work correctly when the washer system is operated	•Circuit(s). •GEM.	•REFER to Section 419-10.
•Wash/wipe function inoperative	•Circuit(s). •Wash/wipe switch	• GO to Pinpoint Test F
•Washer pump inoperative	•Circuit(s). •Washer pump motor •Wash/wipe switch	• GO to Pinpoint Test G
•Rear window wiper is inoperative	•Circuit(s). •Rear window wiper relay. •Rear window wiper motor. •Wash/wipe switch •GEM.	• GO to Pinpoint Test H
•Rear window wiper is permanently on	•Circuit(s). •Rear window wiper relay. •Rear window wiper motor. •Wash/wipe switch •GEM.	• GO to Pinpoint Test I
•Rear wiper park position is incorrect	•Circuit(s). •Rear window wiper motor. •Central Junction Box (CJB).	• GO to Pinpoint Test J
•Rear wiper does not work correctly when the washer system is operated	•Circuit(s). •GEM.	•REFER to Section 419-10.
•Headlamp washer system does not operate correctly	•Circuit(s). •Headlamp washer relay. •Headlamp washer pump motor	• GO to Pinpoint Test K
•Headlamp washer system permanently switched on	•Circuit(s). •Headlamp washer relay.	• GO to Pinpoint Test L
•Windscreen washer nozzle heater inoperative	•Circuit(s). •Windscreen washer nozzle heater	• GO to Pinpoint Test M

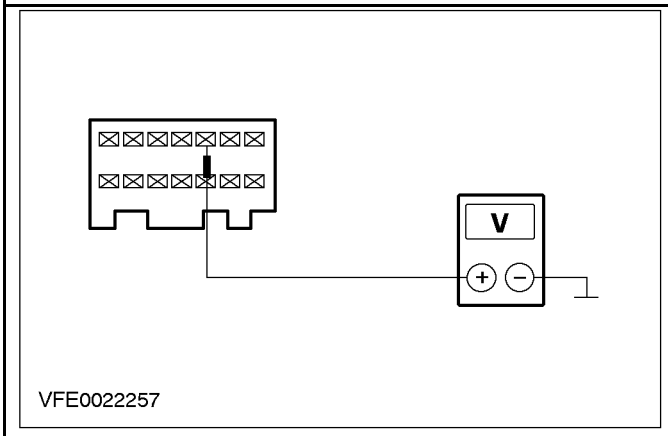
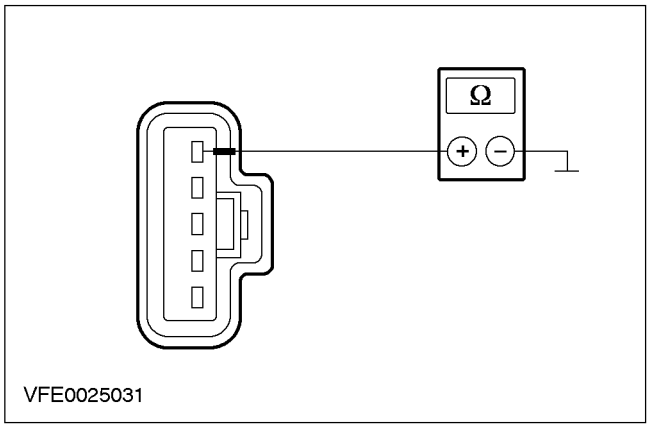
DIAGNOSIS AND TESTING (Continued)

Pinpoint Tests

PINPOINT TEST A: WINDSCREEN WIPER INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK FUSE F94 (CJB)	
	1 Key in OFF position. 2 CHECK Fuse F94 (CJB). 3 Check fuse F94 (20 A). • Is the fuse OK? → **Yes** GO to **A2** → **No** INSTALL a new fuse F94 (20 A). If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams. CHECK the operation of the system .
A2: CHECK CIRCUIT BETWEEN FUSE F94 (CJB) AND THE WASH/WIPE SWITCH	
 VFE0022258	1 Key in OFF position. 2 Connect Fuse F94 (CJB). 3 Disconnect Wash/wipe switch C530. 4 Key in ON position. 5 Measure the voltage between the wash/wipe switch, connector C530, pin 6, circuit 15-KA19 (GN/OG), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **A4** → **No** GO to **A3**
A3: CHECK THE CENTRAL JUNCTION BOX (CJB)	
	1 Key in OFF position. 2 Disconnect CJB C500. 3 Key in ON position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022257	**4** Measure the voltage between the CJB, connector C500, pin 10, circuit 15-KA19 (GN/OG), CJB side and ground. • Is battery voltage indicated? → **Yes** REPAIR the open circuit 15-KA19 (GN/OG) between the CJB and the wash/wipe switch using the Wiring Diagrams. CHECK the operation of the system. → **No** CHECK the CJB and RENEW as necessary. CHECK the operation of the system.
A4: CHECK THE GROUND CONNECTION OF THE WINDSCREEN WIPER MOTOR	
 VFE0025031	**1** Key in OFF position. **2** Disconnect Windscreen wiper motor C144. **3** Measure the resistance between windscreen wiper motor, connector C144, pin 5, circuit 31-KA8 (BK), harness side and ground. • Is the resistance less than 2 ohms? → **Yes** GO to **A5** → **No** REPAIR the open circuit 31-KA8 (BK/BU) using the Wiring Diagrams. CHECK the operation of the system.
A5: CHECK THE OPERATION OF THE WASH/WIPE SWITCH	
	1 Check the wash/wipe switch according to the component check in the Wiring Diagrams. • Is the switch OK?

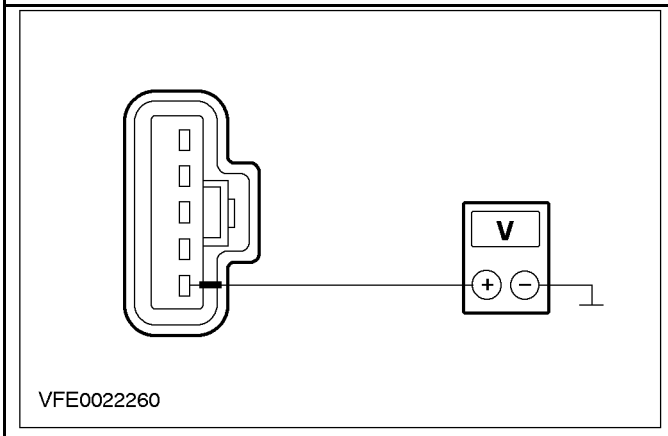
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** CHECK the windscreen wiper motor according to the component check at the end of this section, RENEW as necessary. CHECK the operation of the system. → **No** RENEW the wash/wipe switch. CHECK the operation of the system.

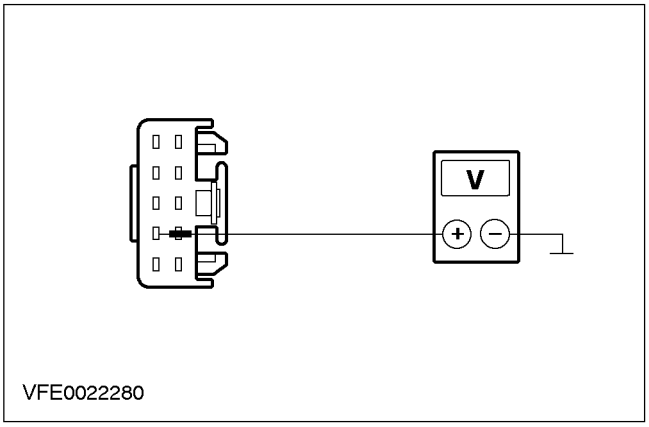
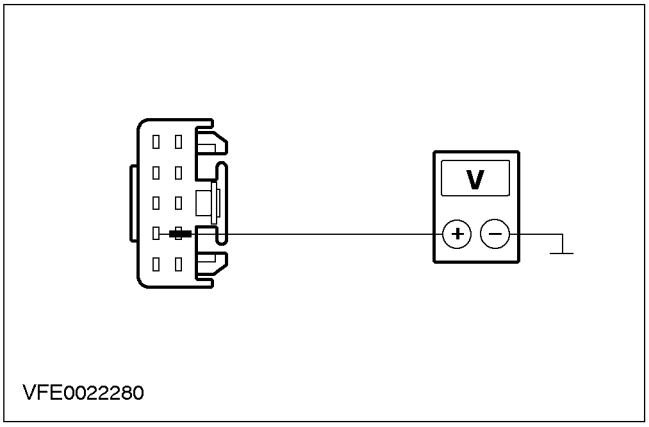
PINPOINT TEST B: WINDSCREEN WIPERS ARE PERMANENTLY SWITCHED ON

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: DETERMINE THE WINDSCREEN WIPER OPERATING SPEED	
	1 Key in ON position. 2 Switch off the WINDSCREEN WIPERS. 3 Check the wipers. • Do the windscreen wipers operate at fast speed? → **Yes** GO to **B2** → **No** GO to **B4**
B2: CHECK THE WASH/WIPE SWITCH	
	1 Key in OFF position. 2 Disconnect Wash/wipe switch C530. 3 Key in ON position. 4 Check the wipers. • Are the wipers permanently switched on? → **Yes** GO to **B3** → **No** CHECK the wash/wipe switch according to the component check in the Wiring Diagrams, RENEW as necessary. CHECK the operation of the system.
B3: CHECK CIRCUIT 32-KA11 (WH/BK) FOR SHORT TO BATTERY VOLTAGE	
	1 Key in OFF position. 2 Disconnect Windscreen wiper motor C144. 3 Key in ON position.

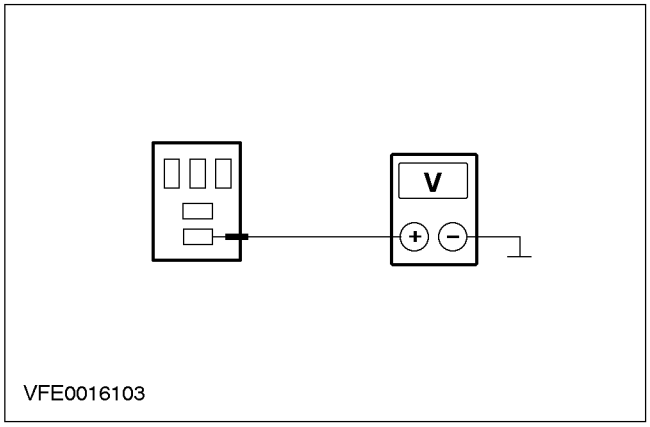
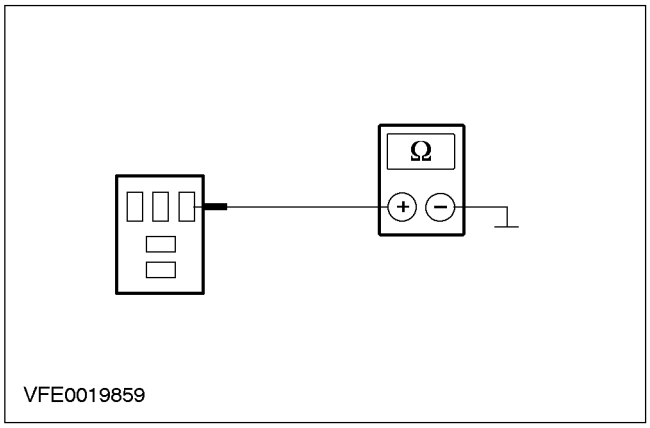
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022260	**4** Measure the voltage between windscreen wiper motor, connector C144, pin 1, circuit 32-KA11 (WH/BK) harness side and ground. • Is battery voltage indicated? → **Yes** LOCATE and REPAIR short to battery voltage in circuit 32-KA11 (WH/BK) using the Wiring Diagrams. CHECK the operation of the system. → **No** CHECK the windscreen wiper motor according to the component check at the end of this section, RENEW as necessary. CHECK the operation of the system.
B4: READ OUT THE FAULT MEMORY	
	1 Key in OFF position. **2** Connect the diagnostic tool. **3** Check the system using WDS. • Are any trouble codes (DTCs) displayed? → **Yes** RESOLVE the faults according to the WDS instructions. CLEAR the fault memory and CHECK the operation of the system. → **No** GO to **B5**
B5: CHECK THE WASH/WIPE SWITCH	
	1 Key in OFF position. **2** Disconnect Wash/wipe switch C530. **3** Key in ON position. **4** Check the wipers. • Do the windscreen wipers operate with slow speed? → **Yes** LOCATE and REPAIR the short to battery voltage in circuit 32-KA10 (WH/GN) between the wash/wipe switch and the wiper motor using the Wiring Diagrams. CHECK the operation of the system. → **No**

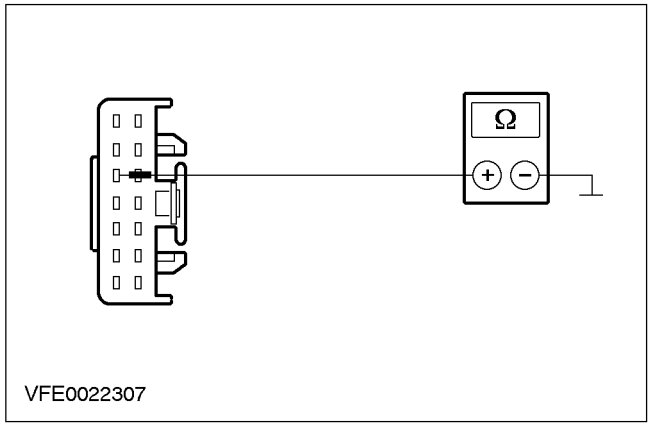
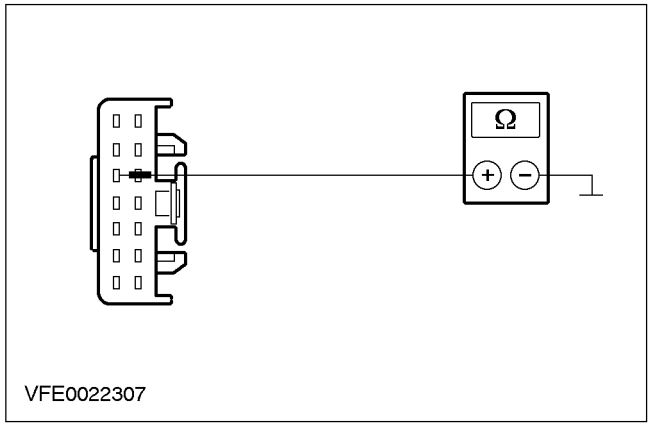
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	GO to **B6**
B6: CHECK VOLTAGE AT CIRCUIT 32-KA19 (WH/BK)	
 VFE0022280	**1** Measure the voltage between wiper switch, connector C530, pin 7, circuit 32-KA19 (WH/BK), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **B7** → **No** CHECK the wash/wipe switch according to the component check in the Wiring Diagrams, RENEW as necessary. CHECK the operation of the system.
B7: CHECK CIRCUIT 32-KA19 (WH/BK) FOR SHORT TO BATTERY VOLTAGE	
 VFE0022280	**1** Key in OFF position. **2** Disconnect Central Junction Box (CJB) C501. **3** Key in ON position. **4** Measure the voltage between the wash/wipe switch, connector C530, pin 7, circuit 32-KA19 (WH/BK), wiring harness side and ground. • Is battery voltage indicated? → **Yes** LOCATE and REPAIR short to battery voltage in circuit 32-KA19 (WH/BK) using the Wiring Diagrams. CHECK the operation of the system. → **No** GO to **B8**

DIAGNOSIS AND TESTING (Continued)

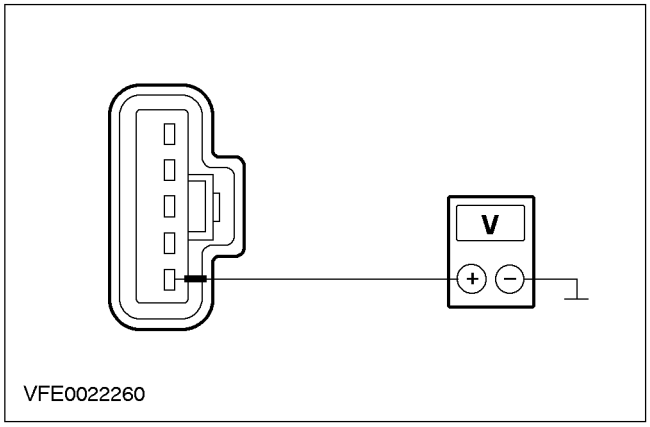
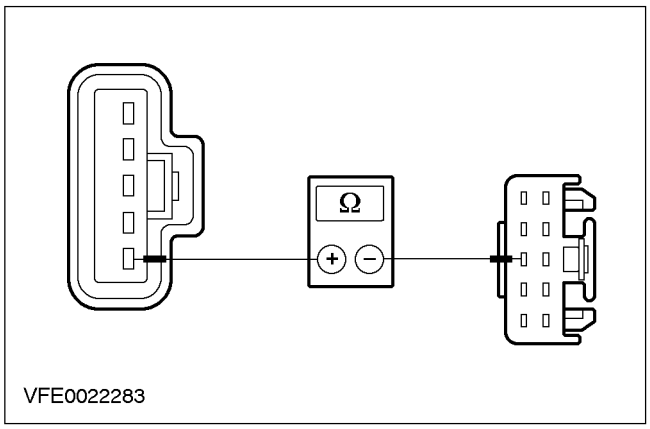
CONDITIONS	DETAILS/RESULTS/ACTIONS
B8: CHECK THE CENTRAL JUNCTION BOX (CJB).	
 VFE0016103	1 Key in OFF position. 2 Disconnect Windscreen wiper relay C917. 3 Key in ON position. 4 Measure the voltage between the windscreen wiper relay, connector C917, pin 3, CJB side and ground. • Is battery voltage indicated? → **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. → **No** GO to **B9**
B9: CHECK THE CENTRAL JUNCTION BOX (CJB) FOR A SHORT TO GROUND	
 VFE0019859	1 Key in OFF position. 2 Measure the resistance between the windscreen wiper relay, connector C917, pin 1, CJB side and ground. • Is the resistance less than 2 ohms? → **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. → **No** GO to **B10**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
B10: CHECK THE CONTROL CIRCUIT OF THE WINDSCREEN WIPER RELAY FOR SHORT TO GROUND	
 VFE0022307	**1** Measure the resistance between CJB, connector C501, pin 12, circuit 31S-KA14 (BK/GN), harness side and ground. • Is the resistance less than 2 ohms? → **Yes** GO to **B11** → **No** CHECK the wiper relay according to the component check in the Wiring Diagrams, RENEW as necessary. CHECK the operation of the system.
B11: CHECK CIRCUIT 31S-KA14 (BK/GN) FOR SHORT TO GROUND	
 VFE0022307	**1** Disconnect GEM module C430. **2** Key in ON position. **3** Measure the resistance between CJB, connector C501, pin 12, circuit 31S-KA14 (BK/GN), harness side and ground. • Is the resistance less than 2 ohms? → **Yes** LOCATE and REPAIR short to ground in circuit 31S-KA14 (BK/GN) using the Wiring Diagrams. CHECK the operation of the system. → **No** RENEW the generic electronic module (GEM) CHECK the operation of the system.

DIAGNOSIS AND TESTING (Continued)

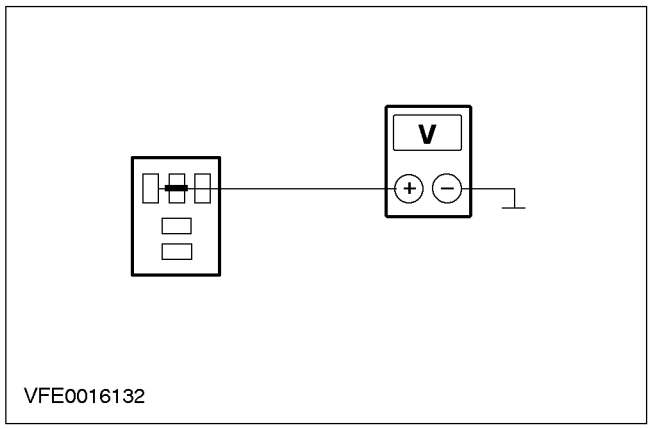
PINPOINT TEST C: FAST WIPE SPEED DOES NOT WORK CORRECTLY (INTERMITTENT MODE OK)

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK WINDSCREEN WIPER MOTOR	
 VFE0022260	1 Key in OFF position. 2 Disconnect Windscreen wiper motor C144. 3 Key in ON position. 4 Switch on the wipers at FAST SPEED. 5 Measure the voltage between windscreen wiper motor, connector C144, pin 1, circuit 32-KA11 (WH/BK), harness side and ground. • Is battery voltage indicated? → **Yes** CHECK and if necessary RENEW the windscreen wiper motor. CHECK the operation of the system. → **No** GO to **C2**
C2: CHECK CIRCUIT 32-KA11 (WH/BK)	
 VFE0022283	1 Key in OFF position. 2 Disconnect Wash/wipe switch C530. 3 Measure resistance between windscreen wiper motor, connector C144, pin 1, circuit 32-KA11 (WH/BK), wiring harness side and wash/wipe switch, connector C530, pin 8, circuit 32-KA11 (WH/BK), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** CHECK the wash/wipe switch according to the component check in the Wiring Diagrams, RENEW as necessary. CHECK the operation of the system.

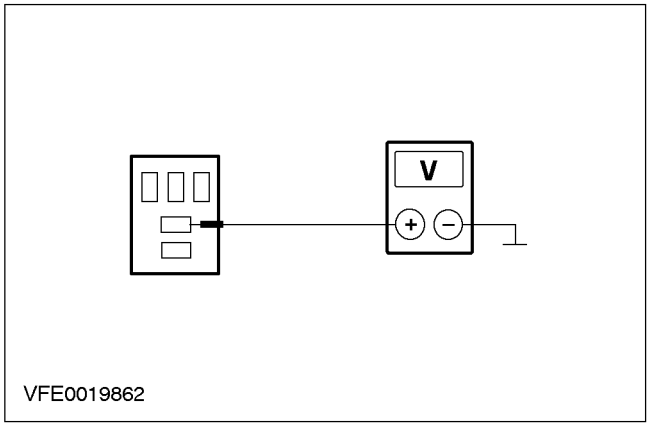
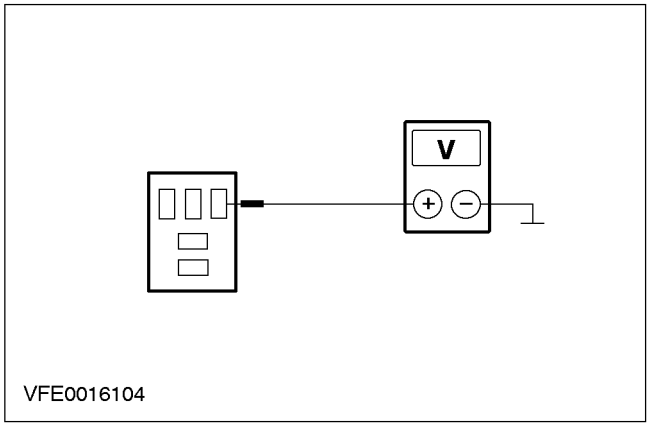
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **No** REPAIR the open circuit 32-KA11 (WH/BK) using the Wiring Diagrams. CHECK the operation of the system.

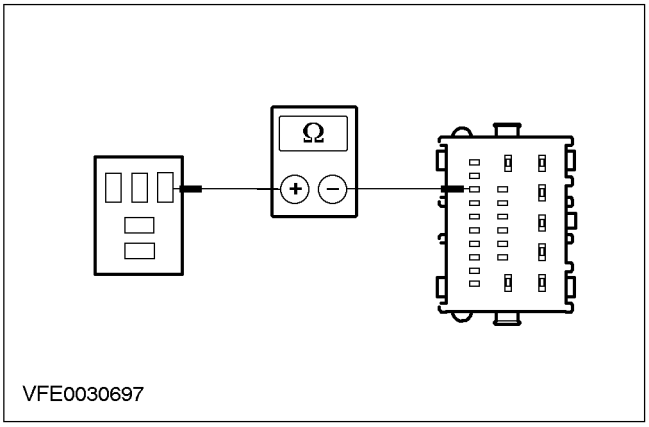
PINPOINT TEST D: INTERMITTENT FUNCTION NOT WORKING PROPERLY (FAST AND SLOW WIPE OK)

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: READ OUT THE FAULT MEMORY	
	1 Connect the diagnostic tool. 2 Check the system using WDS. • Are any trouble codes (DTCs) displayed? → **Yes** RESOLVE the faults according to the WDS instructions. CLEAR the fault memory and CHECK the operation of the system. → **No** GO to **D2**
D2: CHECK THE VOLTAGE AT THE WINDSCREEN WIPER RELAY (PIN 2)	
 VFE0016132	1 Key in OFF position. 2 Disconnect Windscreen wiper relay C917. 3 Key in OFF position. 4 Measure the voltage between the windscreen wiper relay, connector C917, pin 2, CJB side and ground. • Is battery voltage indicated? → **Yes** GO to **D3** → **No** CHECK the CJB and RENEW as necessary. CHECK the operation of the system.

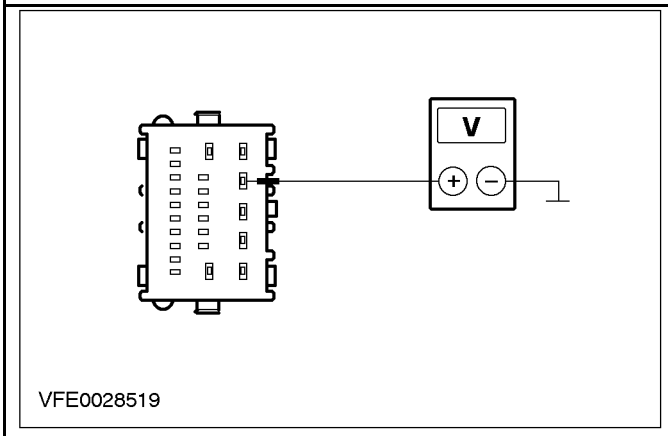
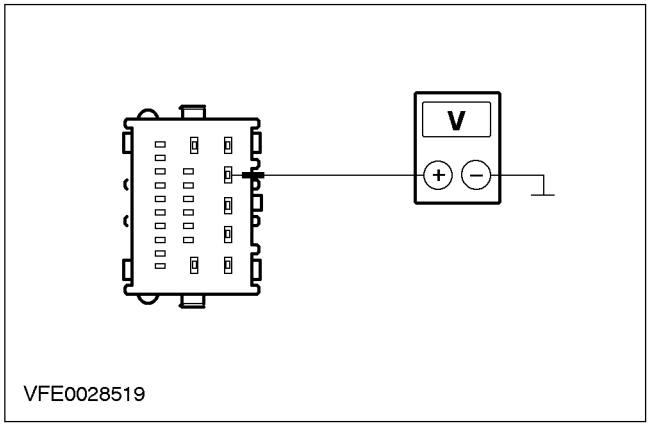
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
D3: CHECK THE VOLTAGE AT THE WINDSCREEN WIPER RELAY (PIN 5)	
	1 Measure the voltage between the windscreen wiper relay, connector C917, pin 5, CJB side and ground. • Is battery voltage indicated? → **Yes** GO to **D4** → **No** CHECK the CJB and RENEW as necessary. CHECK the operation of the system.
D4: CHECK THE CONTROL CIRCUIT OF THE WINDSCREEN WIPER RELAY FOR SHORT TO BATTERY VOLTAGE	
	1 Measure the voltage between the windscreen wiper relay, connector C917, pin 1, CJB side and ground. • Is battery voltage indicated? → **Yes** LOCATE and REPAIR the short to battery voltage in the circuit between the wiper relay and the generic electronic module (GEM) using the Wiring Diagrams, if necessary RENEW the CJB. CHECK the operation of the system. → **No** GO to **D5**
D5: CHECK THE WINDSCREEN WIPER RELAY	
	1 Check the windscreen wiper relay according to the component check in the Wiring Diagrams. • Is the relay OK?

DIAGNOSIS AND TESTING (Continued)

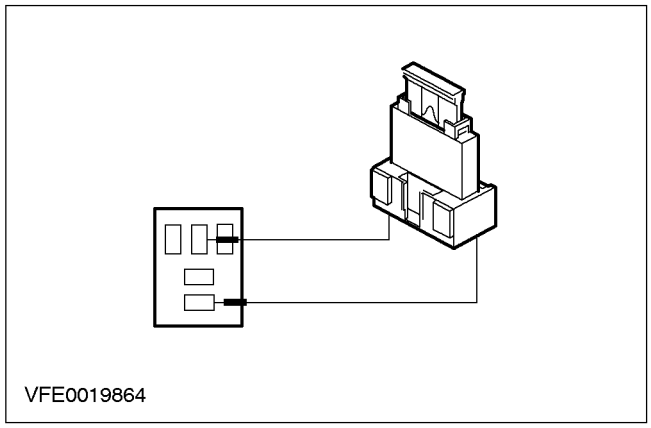
CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** GO to **D6** → **No** RENEW the wiper relay. CHECK the operation of the system.
D6: CHECK THE WASH/WIPE SWITCH	
	1 Key in OFF position. 2 Disconnect Wash/wipe switch C530. 3 Key in ON position. 4 Check the wash/wipe switch according to the component check in the Wiring Diagrams. • Is the switch OK? → **Yes** GO to **D7** → **No** RENEW the wash/wipe switch. CHECK the operation of the system.
D7: CHECK THE CONTROL CIRCUIT OF THE WINDSCREEN WIPER RELAY FOR OPEN CIRCUIT	
	1 Key in OFF position. 2 Connect Wash/wipe switch C530. 3 Disconnect GEM module C430. 4 Measure the resistance between the windscreen wiper relay, connector C917, pin 1, CJB side and the GEM, connector C430, pin 21, circuit 31S-KA14 (BK/GN), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** Intermittent mode inoperative: GO to **D8** Intermittent speed cannot be controlled (potentiometer): GO to **D9** → **No** REPAIR the open circuit between the windscreen wiper relay and the GEM using the Wiring Diagrams, if necessary RENEW the CJB. CHECK the operation of the system.
D8: CHECK CONTROL CIRCUIT FOR INTERMITTENT OPERATION	
	1 Disconnect GEM module C429. 2 Key in ON position. 3 Switch on the INTERMITTENT WIPE.

DIAGNOSIS AND TESTING (Continued)

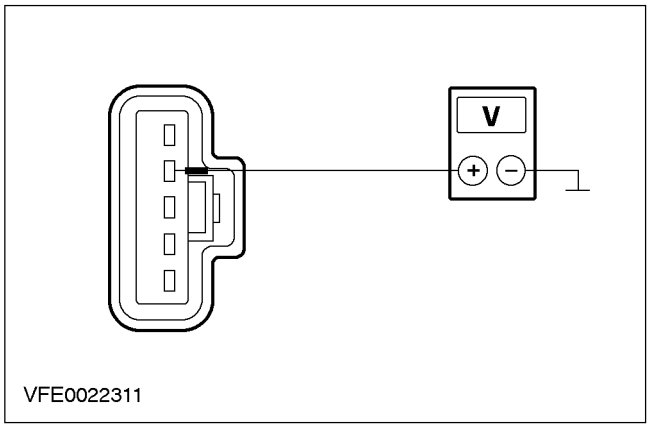
CONDITIONS	DETAILS/RESULTS/ACTIONS
	**4** Measure the voltage between the GEM, connector C429, pin 4, circuit 8-KA19 (WH/BK), wiring harness side and ground. • Does the meter display battery voltage? → **Yes** RENEW the generic electronic module (GEM) CHECK the operation of the system. → **No** REPAIR the open circuit 8-KA19 (WH/BK) between the wash/wipe switch and the GEM using the Wiring Diagrams. CHECK the operation of the system.
D9: CHECK THE CONTROL CIRCUIT FOR VARIABLE INTERMITTENT OPERATION	
	**1** Key in ON position. **2** Switch on INTERMITTENT WIPE mode and turn the variable wipe function from position 1 to position 6. **3** Measure the voltage between the GEM, connector C430, pin 4, circuit 8-KA18 (WH), wiring harness side and ground. • Is a voltage measured? → **Yes** RENEW GEM. CHECK the operation of the system. → **No** REPAIR the open circuit 8-KA18 (WH) between the wash/wipe switch and the GEM using the Wiring Diagrams. CHECK the operation of the system.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST E: WINDSCREEN WIPER PARK POSITION IS INCORRECT

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: CHECK THE WINDSCREEN WIPER RELAY	
 VFE0019864	1 Key in OFF position. 2 Disconnect Windscreen wiper relay C917. 3 Using a fused test cable (20 A) at the windscreen wiper relay, bridge connector C917, pin 3 and pin 4, CJB side. 4 Key in ON position. 5 Operate SINGLE WIPE mode. 6 Check the wipers. • Do the wipers return to the park position? → **Yes** RENEW the windscreen wiper relay. CHECK the operation of the system. → **No** GO to **E2**
E2: CHECK THE OPERATION OF WIPER INTERMITTENT MODE	
	1 Key in OFF position. 2 Connect Windscreen wiper relay C917. 3 Key in ON position. 4 Switch on the INTERMITTENT WIPE. 5 Check the wipers. • Are the wipers operating in intermittent mode? → **Yes** GO to **E4** → **No** GO to **E3**
E3: CHECK THE WASH/WIPE SWITCH	
	1 Key in OFF position. 2 Disconnect Wash/wipe switch C530. 3 Check the wash/wipe switch according to the component check in the Wiring Diagrams. • Is the switch OK? → **Yes**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR the open circuit between the windscreen wiper relay, connector C917, pin 3 and the wash/wipe switch using the Wiring Diagrams, if necessary RENEW the CJB. CHECK the operation of the system. → **No** RENEW the wash/wipe switch. CHECK the operation of the system.
E4: CHECK THE VOLTAGE AT THE WINDSCREEN WIPER MOTOR	
	1 Key in OFF position. 2 Disconnect Windscreen wiper motor C144. 3 Key in ON position. 4 Measure the voltage between windscreen wiper motor, connector C144, pin 4, circuit 15-KA9 (GN/RD), harness side and ground. • Is battery voltage indicated? → **Yes** GO to **E5** → **No** REPAIR the open circuit between fuse F94 (CJB) and the wiper motor, connector C144, pin 4, circuit 15-KA9 (GN/RD), using the Wiring Diagrams, if necessary RENEW the CJB. CHECK the operation of the system.
E5: CHECK THE WINDSCREEN WIPER MOTOR	
	1 Key in OFF position. 2 Check the windscreen wiper motor according to the component check at the end of this section. • Is the wiper motor in order? → **Yes** REPAIR the open circuit between the wiper relay, connector C917, pin 4, and the wiper motor, connector C144, pin 3, circuit 32-KA9 (WH/BU), using the Wiring Diagrams, if necessary RENEW the CJB. CHECK the operation of the system. → **No**

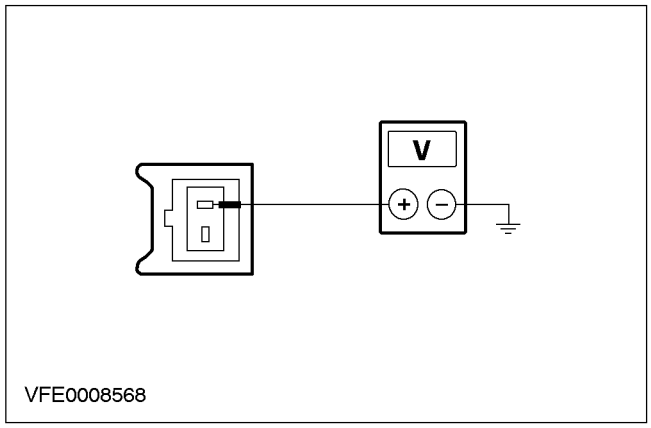
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	RENEW the wiper motor CHECK the operation of the system.

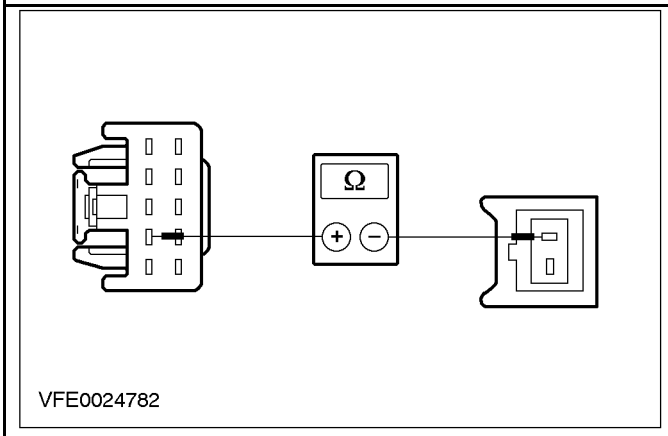
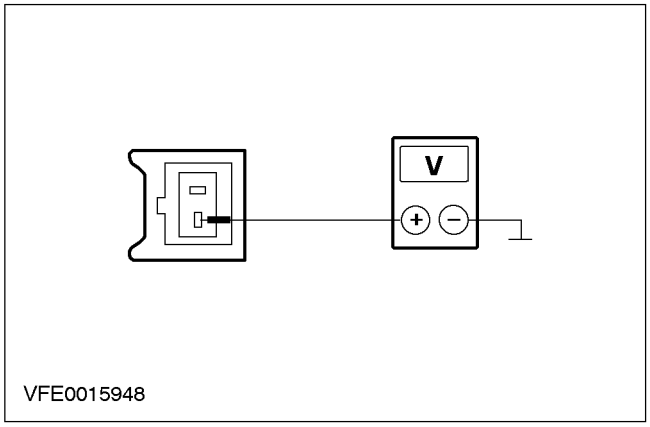
PINPOINT TEST F: WASH/WIPE FUNCTION INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1: CHECK THE WASH/WIPE SWITCH	
	1 Key in OFF position. 2 Disconnect Wash/wipe switch C530. 3 CARRY OUT a component check on the wash/wipe switch, as specified in this section. • Is the switch OK? → **Yes** REPAIR the open circuit 31-KA19 (BK) using the Wiring Diagrams. CHECK the operation of the system. → **No** RENEW the wash/wipe switch. CHECK the operation of the system.

PINPOINT TEST G: WASHER PUMP INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1: CHECK CIRCUIT 32-KA34 (WH/BK)	
 VFE0008568	1 Key in OFF position. 2 Disconnect Washer pump motor C184. 3 Key in ON position. 4 Measure the voltage between the washer pump motor, connector C184, pin 1, circuit 32-KA34 (WH/BK), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **G3** → **No** GO to **G2**
G2: CHECK CIRCUIT 32-KA34 (WH/BK)	
	1 Key in OFF position. 2 Disconnect Wash/wipe switch C530. 3 Key in ON position.

DIAGNOSIS AND TESTING (Continued)

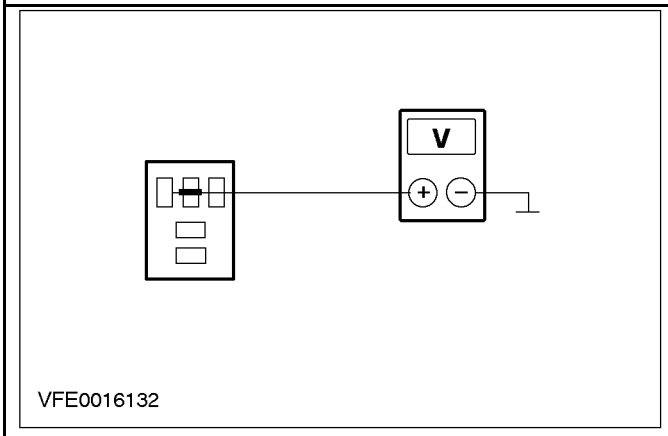
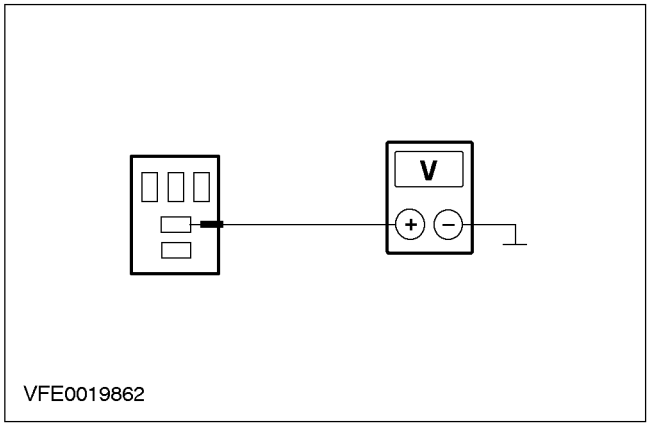
CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0024782	**4** Measure the resistance between the wash/wipe switch C530, pin 4, circuit 32-KA34 (WH/BK), wiring harness side and washer pump motor, connector C184, pin 1, circuit 32-KA34 (WH/BK), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** CHECK the wash/wipe switch according to the component check in the Wiring Diagrams, RENEW as necessary. CHECK the operation of the system. → **No** REPAIR the open circuit 32-KA34 (WH/BK) using the Wiring Diagrams. CHECK the operation of the system.
G3: CHECK CIRCUIT 33-KA34 (YE/BK)	
 VFE0015948	**1** Measure the voltage between the washer pump motor, connector C184, pin 2, circuit 33-KA34 (YE/BK), wiring harness side and ground. • Is battery voltage indicated? → **Yes** RENEW the washer pump motor. CHECK the operation of the system. → **No** REPAIR the open circuit 33-KA34 (WH/BK) or 33-KA1 (YE/RD) using the Wiring Diagrams. CHECK the operation of the system.

DIAGNOSIS AND TESTING (Continued)

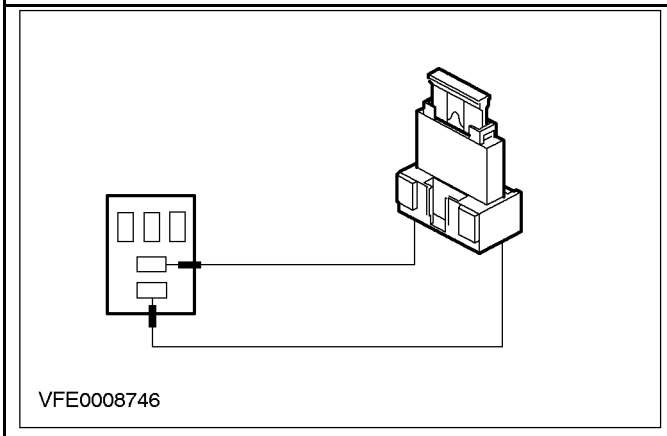
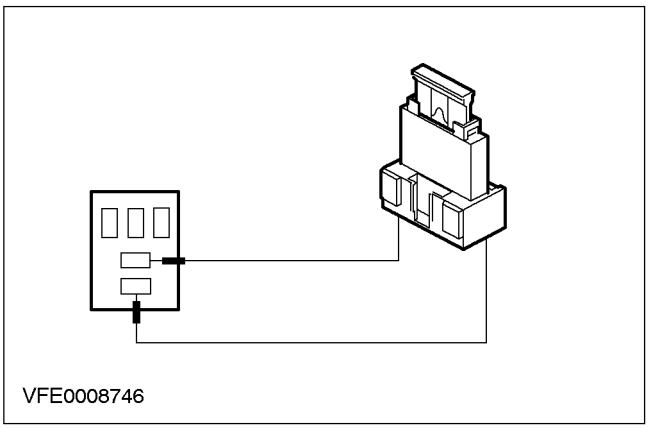
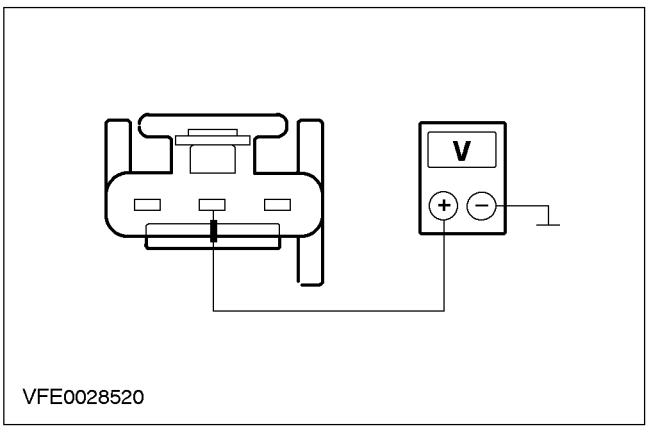
PINPOINT TEST H: REAR WINDOW WIPER IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1: CHECK FUSE F90 (CJB)	
	1 Key in OFF position. 2 CHECK Fuse F90 (CJB). 3 Check fuse F90 (15 A). • Is the fuse OK? → **Yes** GO to **H2** → **No** INSTALL a new fuse F90 (15 A). If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams. CHECK the operation of the system.
H2: CHECK THE VOLTAGE AT FUSE F90 (CJB)	
	1 Key in OFF position. 2 Connect Fuse F90 (15 A). 3 Key in ON position. 4 Measure the voltage between fuse F90 (CJB) and ground. • Is battery voltage indicated? → **Yes** GO to **H3** → **No** CHECK the CJB and RENEW as necessary. CHECK the operation of the system.
H3: READ OUT THE FAULT MEMORY	
	1 Key in OFF position. 2 Connect the diagnostic tool. 3 Check the system using WDS. • Are any trouble codes (DTCs) displayed? → **Yes** RESOLVE the faults according to the WDS instructions. CLEAR the fault memory and CHECK the operation of the system → **No** GO to **H4**
H4: CHECK VOLTAGE AT THE REAR WINDOW WIPER RELAY (PIN 2)	
	1 Key in OFF position. 2 Disconnect Rear window wiper relay C916. 3 Key in ON position.

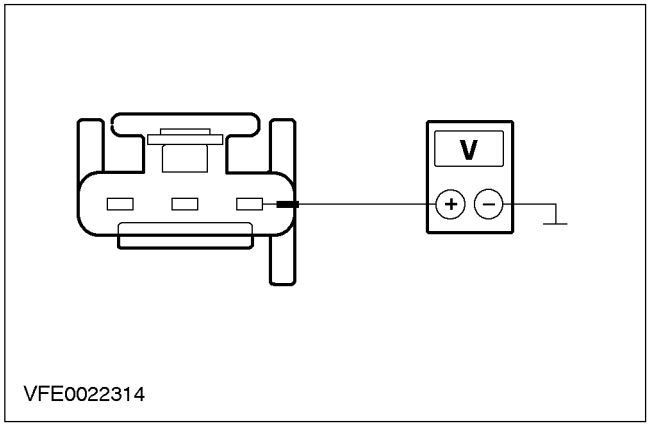
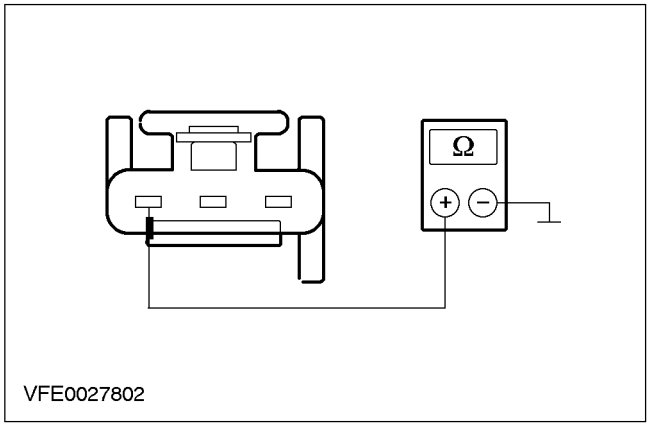
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0016132	**4** Measure the voltage between the rear wiper relay, connector C916, pin 2, CJB side and ground. • Is battery voltage indicated? → **Yes** GO to **H5** → **No** CHECK the CJB and RENEW as necessary. CHECK the operation of the system.
H5: CHECK VOLTAGE AT THE REAR WINDOW WIPER RELAY (PIN 5)	
 VFE0019862	**1** Measure the voltage between the rear wiper relay, connector C916, pin 5, CJB side and ground. • Is battery voltage indicated? → **Yes** GO to **H6** → **No** CHECK the CJB and RENEW as necessary. CHECK the operation of the system.
H6: CHECK THE OPERATING CIRCUIT OF THE REAR WIPER RELAY	
	1 Key in OFF position.

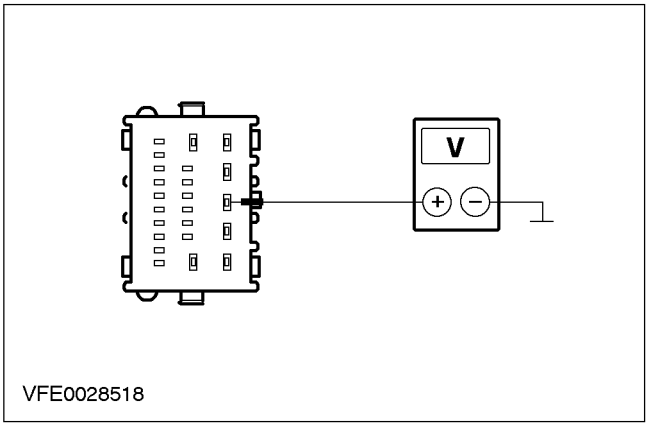
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0008746	2 Using a fused test cable (15 A) at the rear wiper relay, bridge connector C916, pin 3 and pin 5, CJB side.
	3 Key in ON position. 4 Check the wipers. • Do the rear wipers operate? → **Yes** GO to **H10** → **No** GO to **H7**
H7: CHECK THE VOLTAGE AT THE REAR WIPER MOTOR (CIRCUIT 32-KA28 WH/RD)	
 VFE0008746	1 Key in OFF position. 2 Connect Rear window wiper motor C745. 3 Using a fused test cable (15 A) at the rear wiper relay, bridge connector C916, pin 3 and pin 5, CJB side.
 VFE0028520	4 Key in ON position. 5 Measure the voltage between the rear wiper motor, connector C745, pin 2, circuit 32-KA28 (WH/RD), wiring harness side and ground.

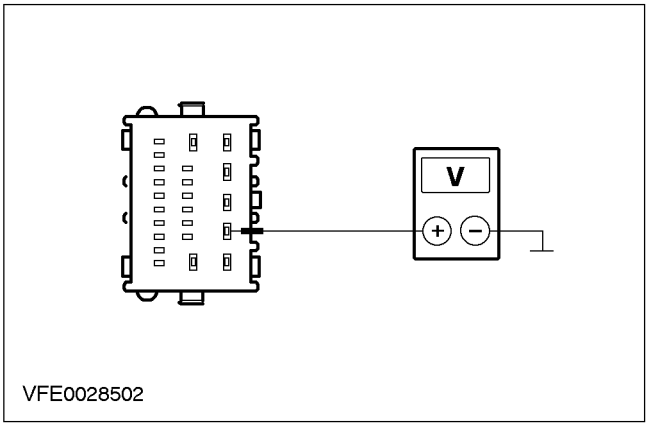
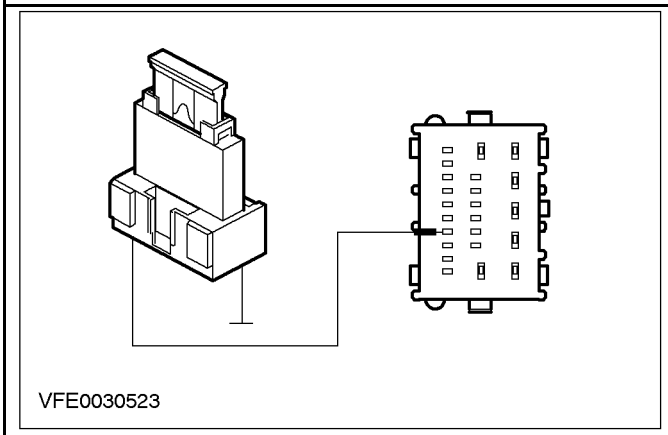
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is battery voltage indicated? → **Yes** GO to **H8** → **No** REPAIR the open circuit between the wiper relay and the wiper motor using the Wiring Diagrams, if necessary RENEW the CJB. CHECK the operation of the system.
H8: CHECK THE VOLTAGE AT THE REAR WIPER MOTOR (CIRCUIT 29-KA28 OG/BU)	
 VFE0022314	1 Measure the voltage between rear window wiper motor, connector, C745, pin 1, circuit 29-KA28 (OG/BU), harness side and ground. • Is battery voltage indicated? → **Yes** GO to **H9** → **No** REPAIR the open circuit between fuse F90 (CJB) and the wiper motor using the Wiring Diagrams, if necessary RENEW the CJB. CHECK the operation of the system.
H9: CHECK THE GROUND CONNECTION OF THE REAR WINDOW WIPER MOTOR	
 VFE0027802	1 Key in OFF position. 2 Measure the resistance between the rear window wiper motor, connector C745, pin 3, circuit 31-KA28 (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	Check the wiper motor according to the component check at the end of this section and RENEW as necessary. CHECK the operation of the system. → **No** REPAIR the open circuit between the wiper motor and solder point S518 (ground G300) using the Wiring Diagrams. CHECK the operation of the system.
H10: CHECK THE REAR WIPER RELAY	
	1 Key in OFF position. 2 Check the rear wiper relay according to the component check in the Wiring Diagrams. • Is the relay OK? → **Yes** GO to **H11** → **No** RENEW the rear wiper relay. CHECK the operation of the system.
H11: CHECK THE WASH/WIPE SWITCH	
	1 Connect Rear window wiper relay.. 2 Disconnect Wash/wipe switch C530. 3 Check the wash/wipe switch according to the component check in the Wiring Diagrams. • Is the switch OK? → **Yes** GO to **H12** → **No** RENEW the wash/wipe switch. CHECK the operation of the system.
H12: CHECK CIRCUIT 32-KA35 (WH/RD)	
	1 Connect Wash/wipe switch C530. 2 Disconnect GEM module C430. 3 Key in ON position. 4 Switch on the REAR WINDOW WIPER. 5 Measure the voltage between the GEM, connector C430, pin 3, circuit 32-KA35 (WH/RD), wiring harness side and ground. • Is battery voltage indicated?

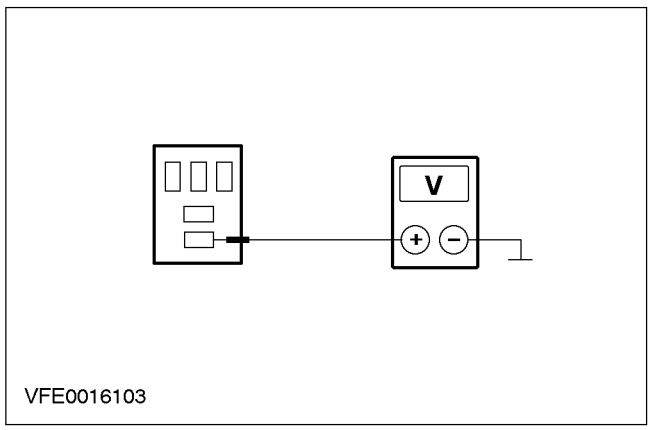
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** GO to **H13** → **No** REPAIR the open circuit 32-KA35 (WH/RD) between the wash/wipe switch and the GEM using the Wiring Diagrams. CHECK the operation of the system.
H13: CHECK CIRCUIT 32-KA6 (WH/BK)	
 VFE0028502	1 Measure the voltage between the GEM, connector C430, pin 2, circuit 32-KA6 (WH/BK), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **H14** → **No** REPAIR the open circuit 32-KA6 (WH/BK) between the wash/wipe switch and the GEM using the Wiring Diagrams. CHECK the operation of the system.
H14: CHECK THE CONTROL CIRCUIT OF THE REAR WIPER RELAY	
 VFE0030523	1 Using a fused test cable (10A) bridge between the GEM, connector C430, pin 17, circuit 31S-KA29 (BKYE), wiring harness side and ground. 2 Check the rear wiper. • Does the rear wiper operate? → **Yes** RENEW THE GEM. CHECK the operation of the system. → **No**

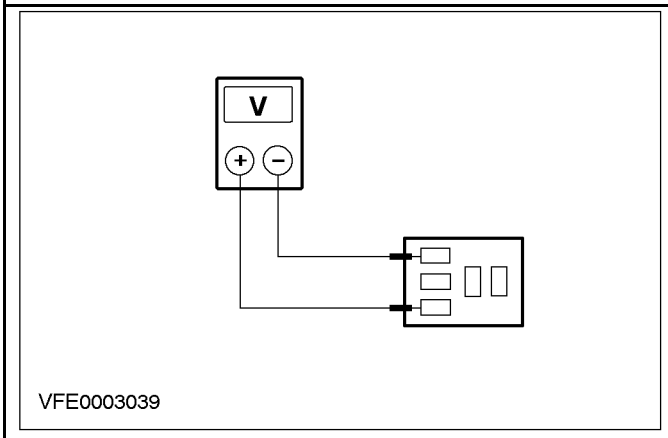
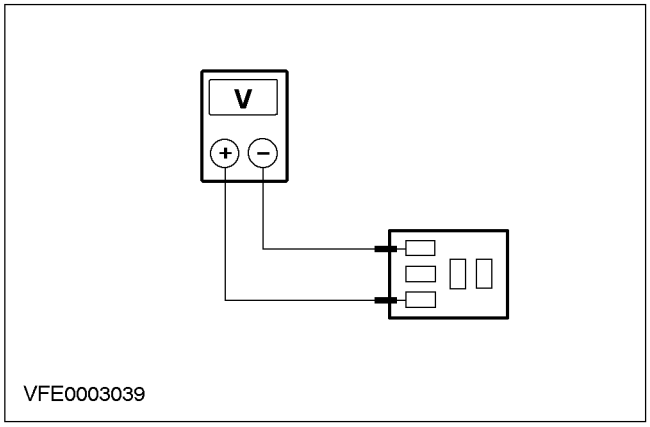
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR the open circuit 31S-KA29 (BK/YE) between the wiper relay and the GEM using the Wiring Diagrams, if necessary RENEW the CJB. CHECK the operation of the system.

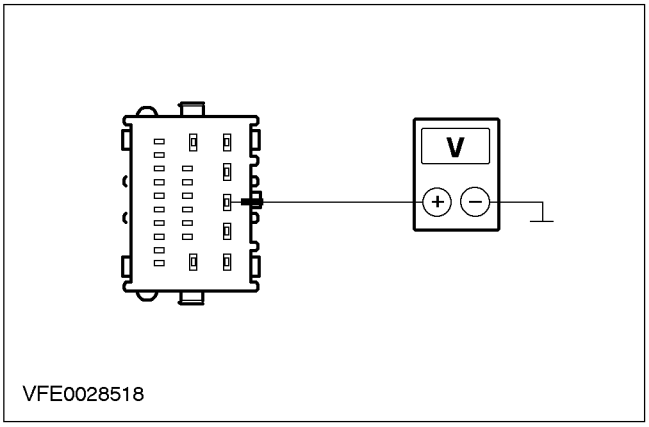
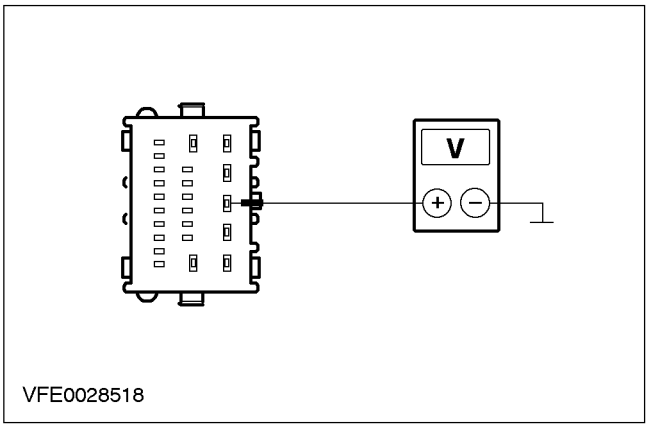
PINPOINT TEST I: REAR WINDOW WIPER IS PERMANENTLY ON

CONDITIONS	DETAILS/RESULTS/ACTIONS
I1: READ OUT THE FAULT MEMORY	
	1 Connect the diagnostic tool. 2 Check the system using WDS. • Are any trouble codes (DTCs) displayed? → **Yes** RESOLVE the faults according to the WDS instructions. CLEAR the fault memory and CHECK the operation of the system. → **No** GO to **I2**
I2: NARROW DOWN THE LOCATION OF THE SHORT TO BATTERY VOLTAGE	
	1 Key in OFF position. 2 Disconnect Rear window wiper relay C916. 3 Key in ON position. 4 Check the wipers. • Are the rear wipers operating continuously? → **Yes** GO to **I3** → **No** GO to **I4**
I3: CHECK THE OPERATING CIRCUIT OF THE REAR WIPER RELAY FOR SHORT TO BATTERY VOLTAGE	
	1 Key in OFF position. 2 Disconnect Rear window wiper motor C745. 3 Key in ON position. 4 Measure the voltage between the rear wiper relay, connector C916, pin 3, circuit 32-KA28 (WH/RD), CJB side and ground. • Is battery voltage indicated? → **Yes**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	LOCATE and REPAIR short to battery voltage in the circuit between the wiper relay and the wiper motor, if necessary, REPAIR the CJB. CHECK the operation of the system. → **No** Check the wiper motor according to the component check at the end of this section and RENEW as necessary. CHECK the operation of the system.
I4: CHECK THE CONTROL CIRCUIT OF THE WIPER RELAY FOR SHORT TO GROUND	
	**1** Measure the voltage at the rear wiper relay, connector C916, between pin 1 and pin 2, CJB side. • Is voltage displayed? → **Yes** GO to **I5** → **No** RENEW the rear wiper relay. CHECK the operation of the system.
I5: CHECK THE CONTROL CIRCUIT OF THE WIPER RELAY	
	**1** Key in OFF position. **2** Disconnect GEM module C430. **3** Measure the voltage at the rear wiper relay, connector C916, between pin 1 and pin 2, CJB side. • Is voltage displayed? → **Yes**

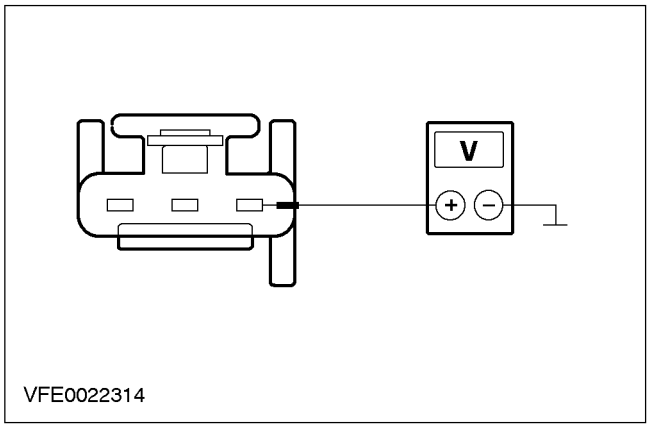
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	LOCATE and REPAIR short to ground in the circuit between the wiper relay and the GEM, if necessary, REPAIR the CJB. CHECK the operation of the system. → **No** GO to **I6**
I6: CHECK THE VOLTAGE AT THE GEM (CONTROL CIRCUIT FOR REAR WIPER)	
NOTE: Wash/wipe switch to the OFF position.	
	1 Key in ON position. 2 Measure the voltage between the GEM, connector C430, pin 3, circuit 32-KA35 (WH/RD), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **I7** → **No** RENEW the generic electronic module (GEM) CHECK the operation of the system.
I7: CHECK THE WASH/WIPE SWITCH	
	1 Key in OFF position. 2 Disconnect Wash/wipe switch C530. 3 Key in ON position. 4 Measure the voltage between the GEM, connector C430, pin 3, circuit 32-KA35 (WH/RD), wiring harness side and ground. • Is battery voltage indicated? → **Yes**

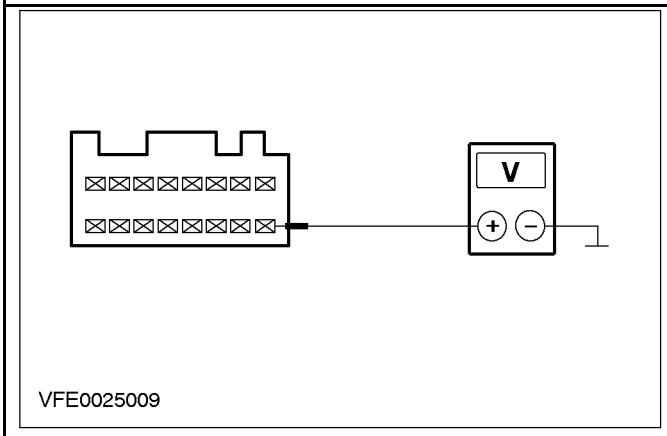
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	LOCATE and REPAIR short to battery voltage in circuit 32-KA35 (WH/RD). CHECK the operation of the system. → **No** CHECK the wash/wipe switch according to the component check in the Wiring Diagrams, RENEW as necessary. CHECK the operation of the system.

PINPOINT TEST J: REAR WIPER PARK POSITION IS INCORRECT

CONDITIONS	DETAILS/RESULTS/ACTIONS
J1: CHECK CIRCUIT 29-KA28 (OG/BU)	
	1 Key in OFF position. 2 Disconnect Rear window wiper motor C745. 3 Key in ON position. 4 Measure the voltage between the rear window wiper motor, connector, C745, pin 1, circuit 29-KA28 (OG/BU), wiring harness side and ground. • Is battery voltage indicated? → **Yes** CHECK the rear wiper motor according to the component check at the end of this section and RENEW as necessary. CHECK the operation of the system. → **No** GO to **J2**
J2: CHECK THE CENTRAL JUNCTION BOX (CJB)	
	1 Key in OFF position. 2 Disconnect Central Junction Box (CJB) C506. 3 Key in ON position.

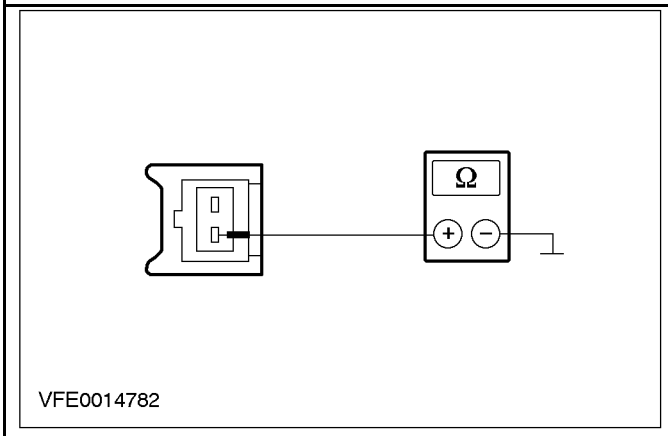
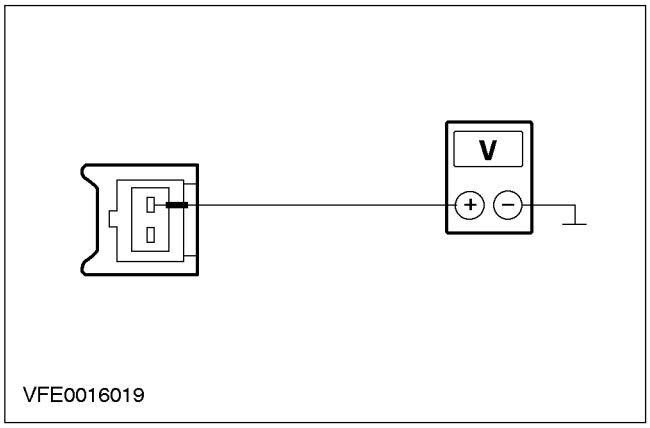
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	4 Measure the voltage between CJB, connector C506, pin 16, CJB side and ground. • Is battery voltage indicated? → **Yes** REPAIR the open circuit 29-KA28 (OG/BU) using the Wiring Diagrams. CHECK the operation of the system. → **No** CHECK the CJB and RENEW as necessary. CHECK the operation of the system.

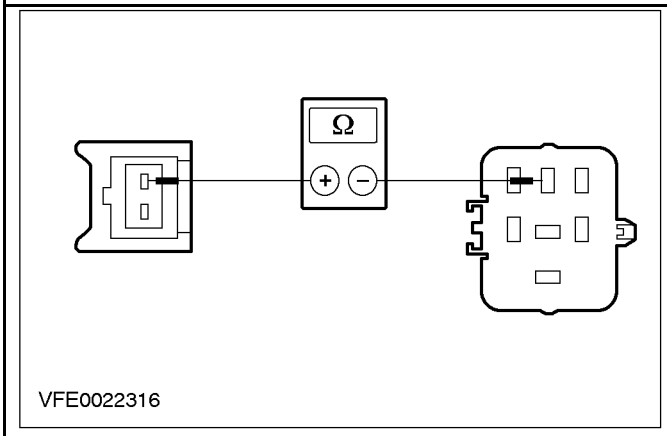
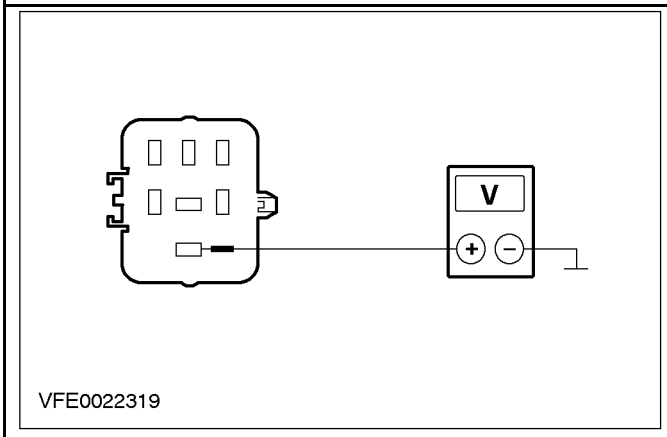
PINPOINT TEST K: HEADLAMP WASHER SYSTEM DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
K1: CHECK FUSE F22 (BJB)	
	1 Key in OFF position. 2 CHECK Fuse F22 (BJB). 3 Check fuse F22 (20 A). • Is the fuse OK? → **Yes** GO to **K2** → **No** INSTALL a new fuse F22 (20 A). If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams. CHECK the operation of the system.
K2: CHECK CIRCUIT 31-KA21 (BK)	
	1 Key in OFF position. 2 Connect Fuse F22 (BJB). 3 Disconnect Headlamp washer pump motor C145.

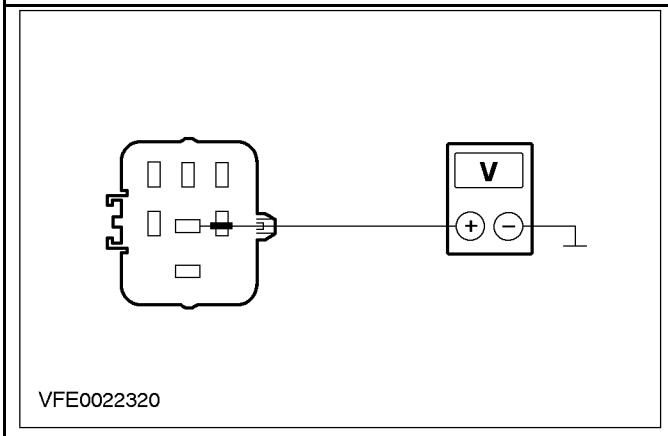
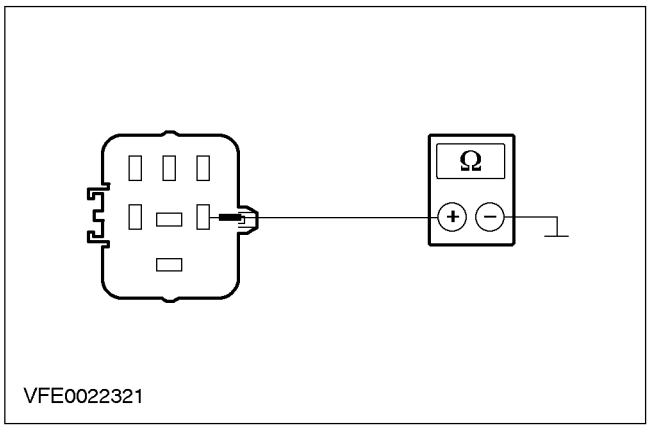
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0014782	**4** Measure the resistance between the headlamp washer pump motor, connector C145, pin 2, circuit 31-KA21 (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** GO to **K3** → **No** REPAIR the open circuit 31-KA21 (BK) using the Wiring Diagrams. CHECK the operation of the system.
K3: CHECK CIRCUIT 15S-KA21 (GN/YE)	
 VFE0016019	**1** Key in ON position. **2** Switch on the dipped beam. **3** Switch on the WINDSCREEN WASHER SYSTEM. **4** Measure the voltage between the headlamp washer pump motor, connector C145, pin 1, circuit 15S-KA21 (GN/YE), wiring harness side and ground. • Is battery voltage indicated? → **Yes** RENEW the headlamp washer pump motor. CHECK the operation of the system. → **No** GO to **K4**
K4: CHECK CIRCUIT 15S-KA21 (GN/YE)	
	1 Key in OFF position. **2** Disconnect Headlamp washer relay C439.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022316	**3** Measure the resistance between the headlamp washer pump motor, connector C145, pin 1, circuit 15S-KA21 (GN/YE), wiring harness side and the headlamp washer relay, connector C439, pin 3, circuit 15S-KA21 (GN/YE), wiring harness side. • Is the resistance less than 2 ohms? → **Yes** GO to **K5** → **No** REPAIR the open circuit 15S-KA21 (GN/YE) using the Wiring Diagrams. CHECK the operation of the system.
K5: CHECK CIRCUIT 30-KA23 (RD)	
 VFE0022319	**1** Measure the voltage between the headlamp washer relay, connector C439, pin 5, circuit 30-KA23 (RD), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **K6** → **No** REPAIR the open circuit 30-KA23 (RD) using the Wiring Diagrams. CHECK the operation of the system.
K6: CHECK CIRCUIT 15S-KA22 (GN/BU)	
	1 Key in ON position. **2** Switch on the dipped beam.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 VFE0022320	3 Measure the voltage between the headlamp washer relay, connector C439, pin 4, circuit 15S-KA22 (GN/BU), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **K7** → **No** REPAIR the open circuit 15S-KA22 (GN/BU) using the Wiring Diagrams. CHECK the operation of the system.
K7: CHECK THE GROUND CONNECTION OF THE HEADLAMP WASHER RELAY	
 VFE0022321	1 Key in OFF position. 2 Measure the resistance between the headlamp washer relay, connector C439, pin 2, circuit 31-KA22 (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** RENEW the headlamp washer relay. CHECK the operation of the system. → **No** REPAIR the open circuit 31-KA22 (BK) between the headlamp washer relay and solder point S315 (ground G104) using the Wiring Diagrams. CHECK the operation of the system.

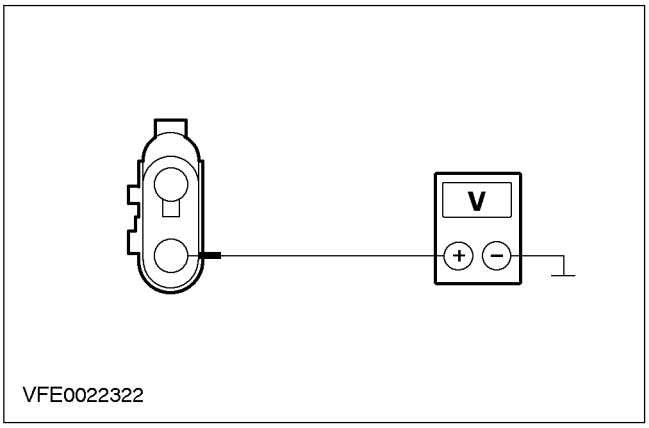
PINPOINT TEST L: HEADLAMP WASHER SYSTEM PERMANENTLY SWITCHED ON

CONDITIONS	DETAILS/RESULTS/ACTIONS
L1: CHECK THE HEADLAMP WASHER RELAY	
	1 Key in OFF position.

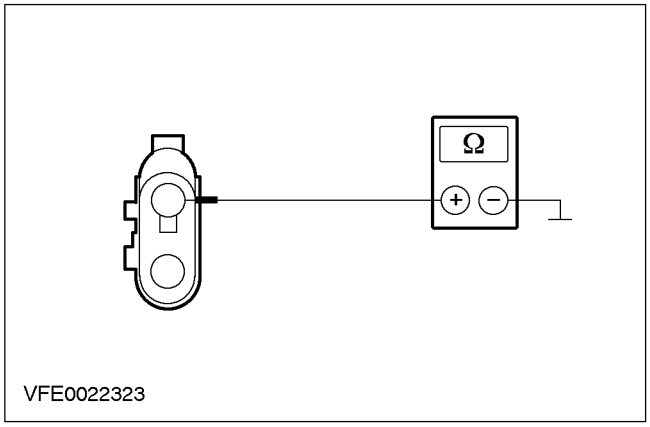
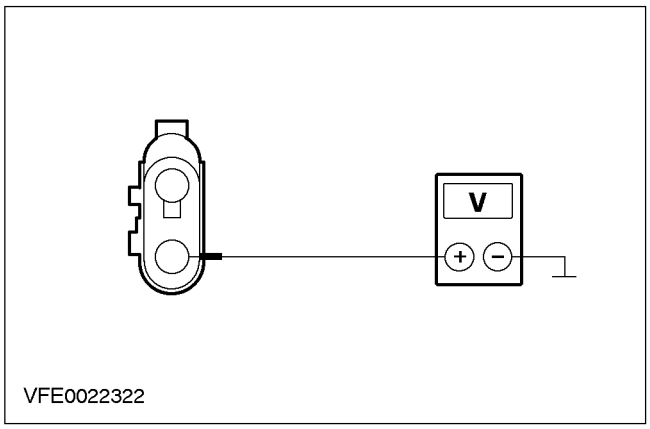
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	2 Disconnect Headlamp washer relay C439. 3 Key in ON position. 4 CHECK the headlamp washer pump. • Is the headlamp washer pump permanently switched on? → **Yes** LOCATE and REPAIR the short to battery voltage in circuit 15S-KA21 (GN/YE) using the Wiring Diagrams. CHECK the operation of the system. → **No** RENEW the headlamp washer relay. CHECK the operation of the system.

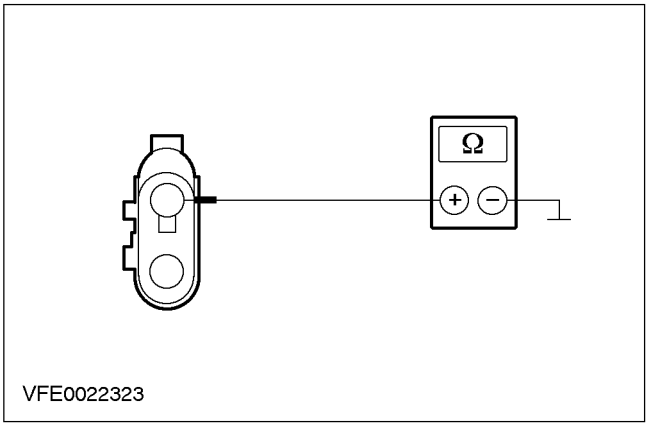
PINPOINT TEST M: WINDSCREEN WASHER NOZZLE HEATER INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
M1: CHECK THE WINDSCREEN WASHER NOZZLE HEATER	
	1 Key in ON position. 2 Determine if the windscreen washer nozzle heater is inoperative. • Is the left-hand windscreen washer nozzle heater inoperative? → **Yes** GO to **M2** → **No** The right-hand windscreen washer nozzle heater is inoperative: GO to **M4**
M2: CHECK CIRCUIT 15S-HB13 (GN/BU)	
 VFE0022322	1 Key in OFF position. 2 Disconnect Left-hand windscreen washer nozzle heater, C165. 3 Key in ON position. 4 Measure the voltage between the left-hand windscreen washer nozzle heater, connector C165, pin 2, circuit 15S-HB13 (GN/BU), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **M3** → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR the open circuit 15S-HB13 (GN/BU) using the Wiring Diagrams. CHECK the operation of the system.
M3: CHECK CIRCUIT 31-HB13 (BK)	
	1 Key in OFF position. 2 Measure the resistance between the left-hand windscreen washer nozzle heater, connector C165, pin 1, circuit 31-HB13 (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** RENEW the left-hand windscreen washer nozzle heater. CHECK the operation of the system. → **No** REPAIR the open circuit 31-HB13 (BK) using the Wiring Diagrams. CHECK the operation of the system.
M4: CHECK CIRCUIT 15S-HB26 (GN/RD)	
	1 Key in OFF position. 2 Disconnect Right-hand windscreen washer nozzle heater, C166. 3 Key in ON position. 4 Measure the voltage between the right-hand windscreen washer nozzle heater, connector C166, pin 2, circuit 15S-HB26 (GN/RD), wiring harness side and ground. • Is battery voltage indicated? → **Yes** GO to **M5** → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR the open circuit 15S-HB21 (GN/RD) using the Wiring Diagrams. CHECK the operation of the system.
M5: CHECK CIRCUIT 31-HB26 (BK)	
 VFE0022323	**1** Key in OFF position. **2** Measure the resistance between the right-hand windscreen washer nozzle heater, connector C166, pin 1, circuit 31-HB26 (BK), wiring harness side and ground. • Is the resistance less than 2 ohms? → **Yes** RENEW the right-hand windscreen washer nozzle heater. CHECK the operation of the system. → **No** REPAIR the open circuit 31-HB26 (BK) using the Wiring Diagrams. CHECK the operation of the system.

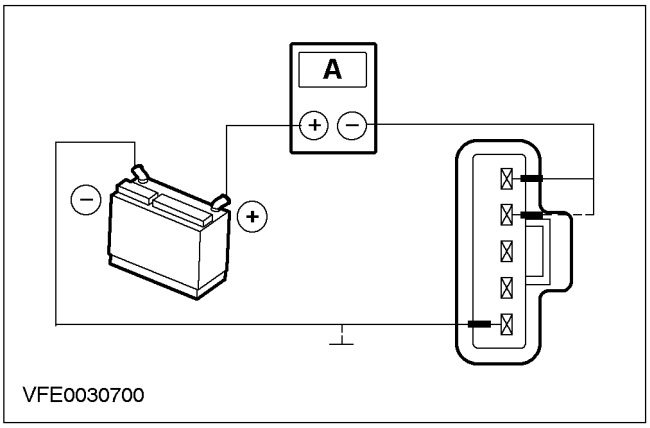
DIAGNOSIS AND TESTING

Component checks

Windscreen wiper motor.

- Switch off the ignition.
- Pull out the plugs.
- Connect the test cables as described below:
- Connect an external 12 V DC supply for a minimum current of 10 A (alternatively use a fused auxiliary cable) to the vehicle battery.

1. Check the wiper motor in the SLOW WIPE setting.



- Connect the positive terminal of the power supply to the positive terminal of the digital multimeter.
- Connect the negative terminal of the power supply to the wiper motor, pin 5, or to the housing of the wiper motor.
- Connect the negative terminal of the digital multimeter to the wiper motor, pin 2. The wiper motor runs at slow speed.

Measure the current.

Is the reading on the digital multimeter approx. 1,5 A?

If yes, GO TO 2.

If not, RENEW the wiper motor.

2. Check the wiper motor in the FAST WIPE setting (for test set-up see diagram VFE0030700).

- Connect the positive terminal of the power supply to the positive terminal of the digital multimeter.
- Connect the negative terminal of the power supply to the wiper motor, pin 5, or to the housing of the wiper motor.
- Connect the negative terminal of the digital multimeter to the wiper motor, pin 1. The wiper motor runs at fast speed.

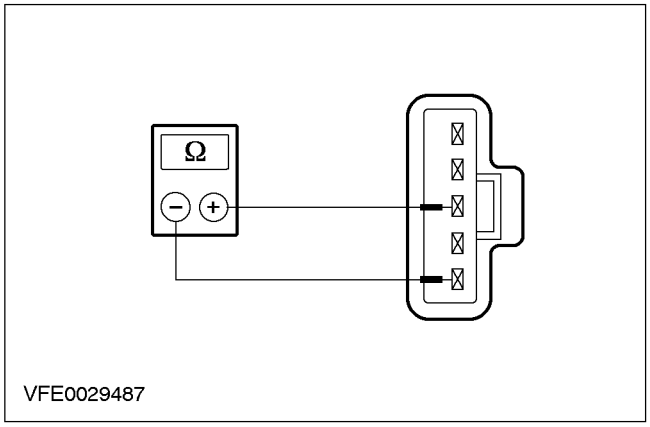
Measure the current.

Is the reading on the digital multimeter approx. 2.2 A?

If yes, GO TO 3.

If not, RENEW the wiper motor.

3. Check the wiper motor in the PARK POSITION



Measure the resistance at the wiper motor between pin 3 and pin 5 (or the housing of the wiper motor).

Is the resistance less than 2 ohms?

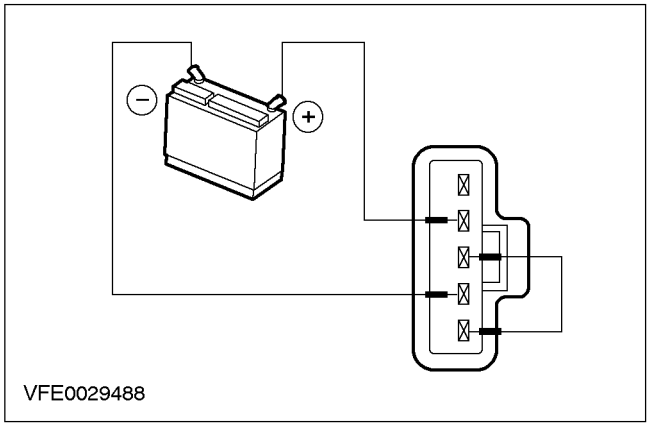
If yes, GO TO 4.

If not, GO TO 4 and REPEAT this step. (If it is still not as specified, RENEW the wiper motor.)

4. Check the park position of the wiper motor

NOTE: The wiper motor is not in the park position.

DIAGNOSIS AND TESTING (Continued)


VFE0029488

- Connect the positive terminal of the power supply to the wiper motor, pin 4.
- Connect the negative terminal of the power supply to the wiper motor, pin 2.
- Connect a bridging cable to the wiper motor between pins 3 and 5.

Check the position

Does the wiper motor return to the PARK POSITION?

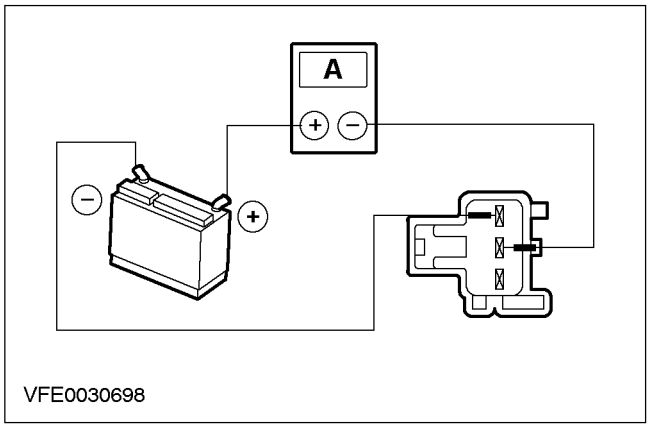
If yes, the wiper motor is OK.

If not, RENEW the wiper motor.

Rear window wiper motor.

- Switch off the ignition.
- Separate the connector.
- Connect the test cables as described below:
- Connect an external 12 V DC supply for a minimum current of 10 A (alternatively use a fused auxiliary cable) to the vehicle battery.

1. Check the wiper motor in the SLOW WIPE setting.



VFE0030698

- Connect the positive terminal of the power supply to the positive terminal of the digital multimeter.
- Connect the negative terminal of the power supply to the wiper motor, pin 3.
- Connect the negative terminal of the digital multimeter to the wiper motor, pin 2. The wiper motor runs at slow speed.

Measure the current.

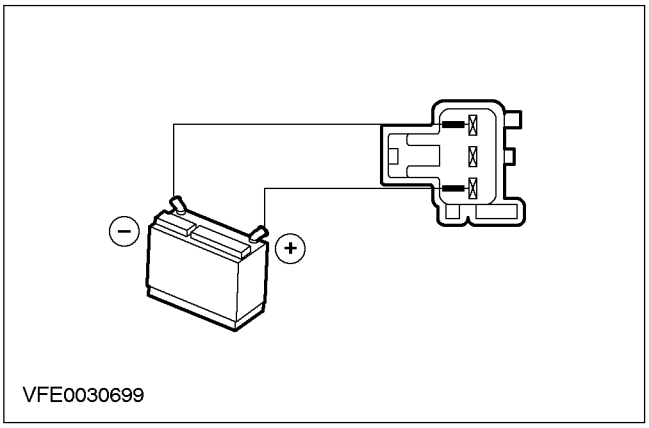
Is the reading on the digital multimeter approx. 1,5 A?

If yes, GO TO 2.

If not, RENEW the wiper motor.

2. Check the park position of the wiper motor.

NOTE: The wiper motor is not in the park position.


VFE0030699

- Connect the positive terminal of the power supply to the wiper motor, pin 1.
- Connect the negative terminal of the power supply to the wiper motor, pin 3.

Check the position

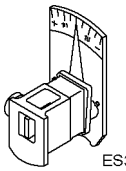
Does the wiper motor return to the PARK POSITION?

If yes, the wiper motor is OK.

If not, RENEW the wiper motor.

GENERAL PROCEDURES

Windshield Wiper Blade and Pivot Arm Adjustment

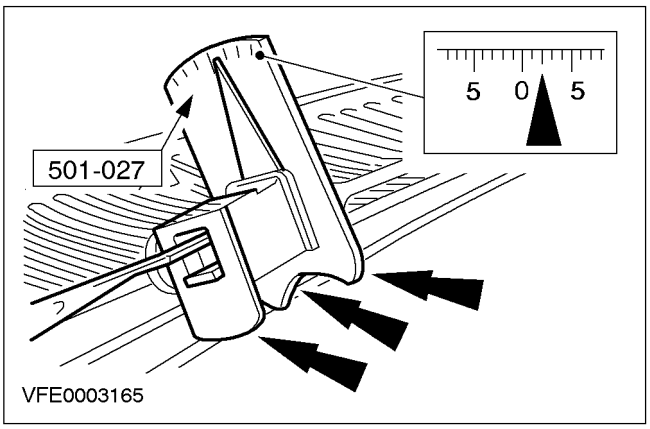
Special Tool(s)	
 ES32006	Aligner, Wiper Arm 501-027 (32-006)

Adjustment

1. **CAUTION: Make sure that the wiper motor is in the park position.**

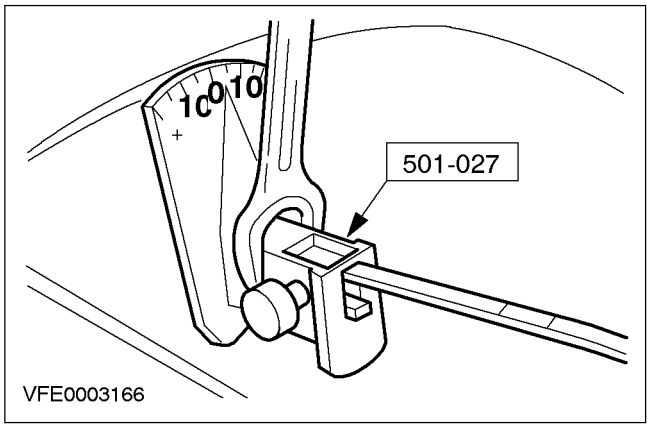
   Remove the wiper blade.
2. **Insert the wiper arm in the special tool and place the special tool on the windshield.**
3. **NOTE:** All three support points of the special tool must be in contact with the glass.

   Using the special tool, read off the angle between the wiper arm and the windshield.



4. **NOTE:** Lift the special tool away from the glass when correcting the angle, in order to prevent damage.

   Using the special tool, check and adjust the wiper arm. For additional information, refer to Specifications in this section.
   - Using an open-ended wrench on the special tool, adjust the angle.



5. **Remove the special tool.**
6. **Install the wiper blade.**

REMOVAL AND INSTALLATION

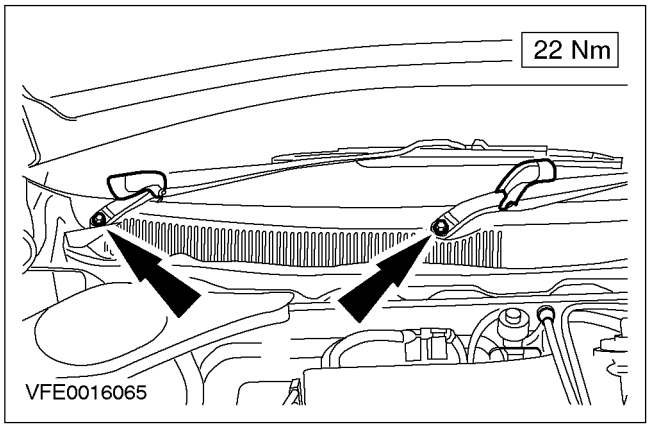
Windshield Wiper Motor (32 524 0)

Removal

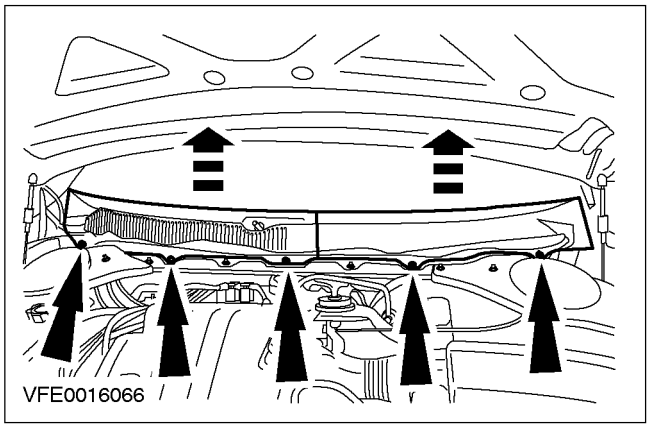
All vehicles

1. **CAUTION: Ensure that the wiper motor is in the park position.**

   Remove the windshield wiper arms.

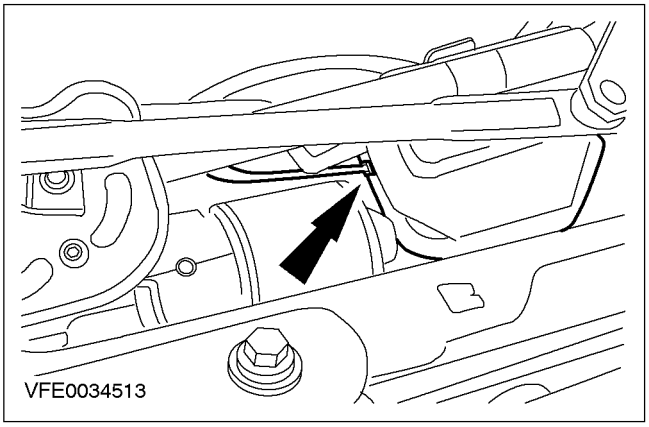


2. **Remove the cowls. .**
   - Pull the cowls from the retaining groove.



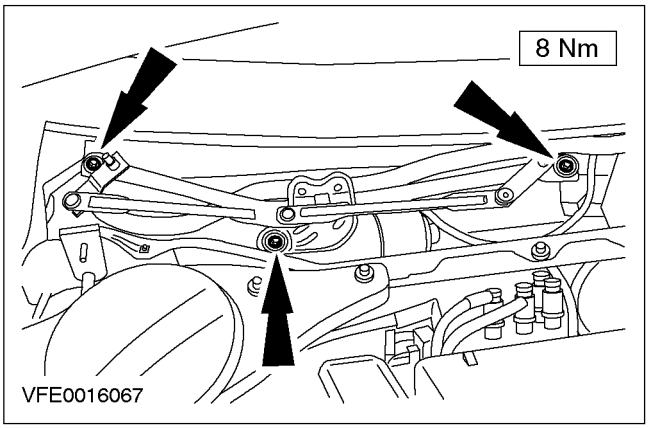
Vehicles equipped with anti-theft alarm horn with integrated battery

3. **Disconnect the anti-theft alarm horn connector.**



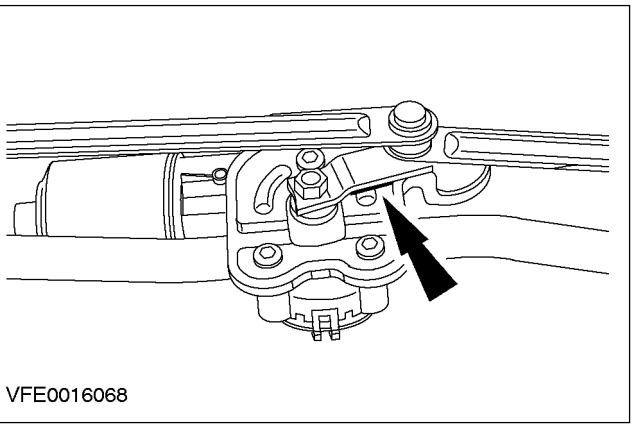
All vehicles

4. **Remove the windshield wiper motor and linkage.**
   - Disconnect the windshield wiper motor connector.

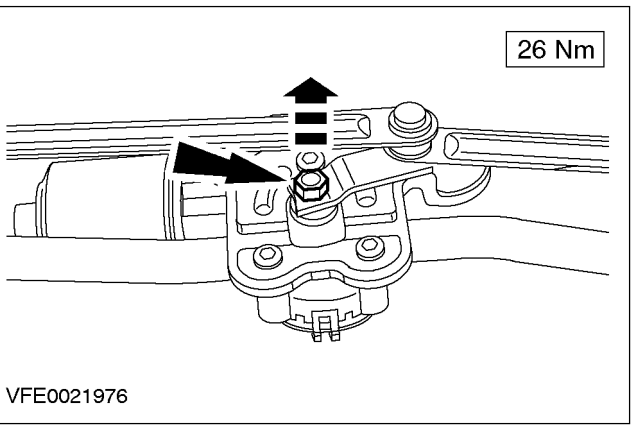


REMOVAL AND INSTALLATION (Continued)

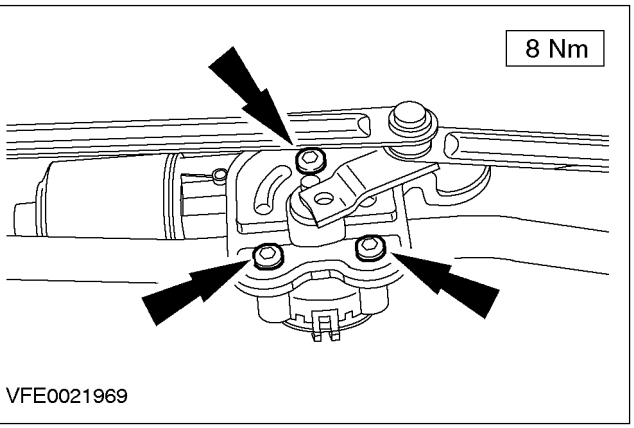
5. Mark position of the windshield wiper linkage crank arm in relation to the windshield wiper bracket.



6. Remove the nut of the windshield wiper linkage crank arm.



7. Remove the windshield wiper motor.



Installation

1. ⚠ CAUTION: Move the wiper motor to park position before installing the wiper arms.

Install the components in the reverse order.

REMOVAL AND INSTALLATION

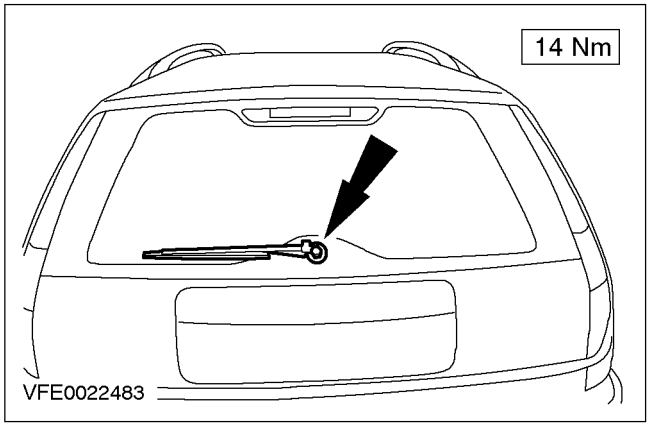
Rear Window Wiper Motor (32 530 0)

Removal

All vehicles

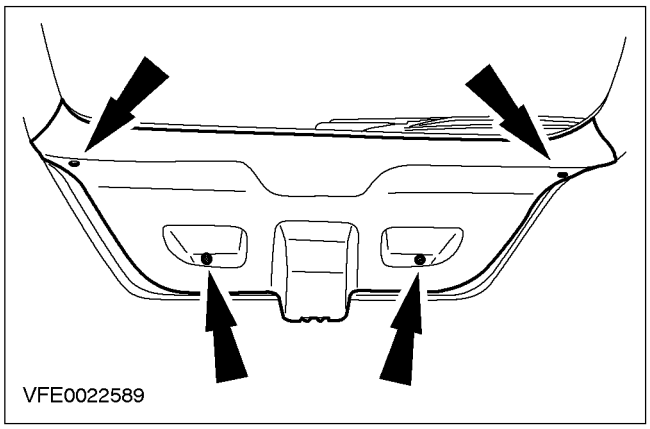
1. **NOTE:** Make sure that the rear window wiper motor is in the park position.

   Remove the rear window wiper arm (wagon shown).



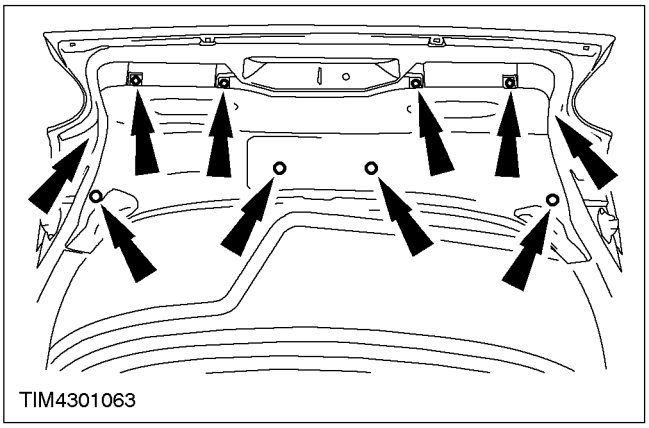
Hatchback

2. **Remove the liftgate trim panel.**



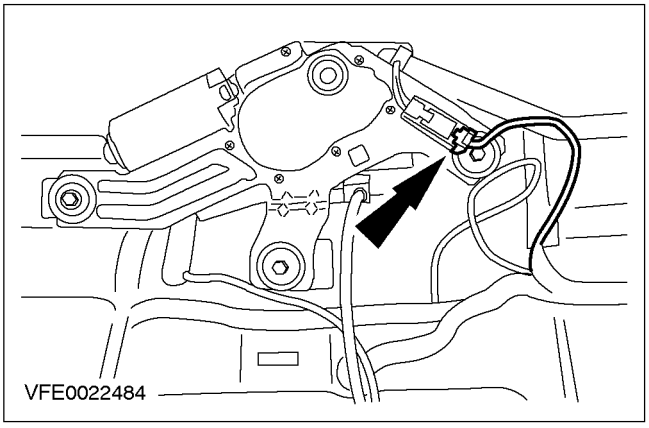
Wagon

3. **Remove the liftgate trim panel.**

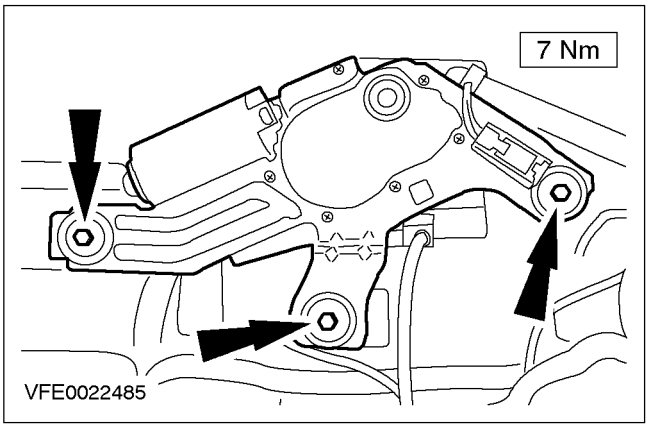


All vehicles

4. **Disconnect the rear window wiper motor electrical connector (wagon shown).**



5. **Remove the rear window wiper motor (wagon shown).**



REMOVAL AND INSTALLATION (Continued)

Installation

1. To install, reverse the removal procedure.

SECTION 501-17 Roof Opening Panel

VEHICLE APPLICATION: 2003.0 Mondeo

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REMOVAL AND INSTALLATION

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SPECIFICATIONS

Torque Specifications

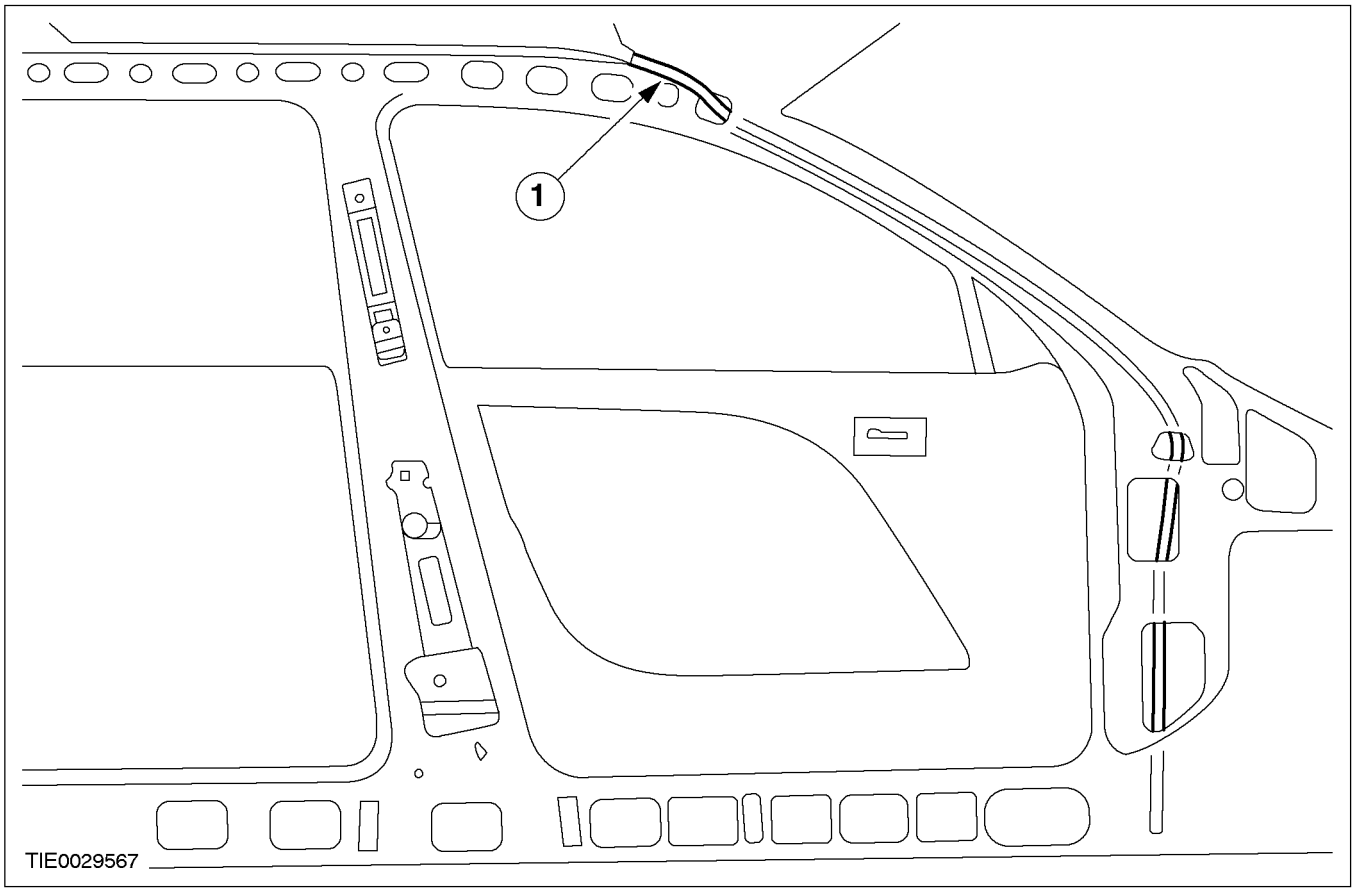
Description	Nm	lb-ft	lb-in
Roof opening panel frame retaining bolts	9	-	80
Roof opening panel motor retaining bolts	3	-	27
Roof opening panel glass retaining bolts	3	-	27

DESCRIPTION AND OPERATION

Roof Opening Panel

Front Drain Hoses

The front drain hoses are connected to the roof opening panel frame and routed to the underside of the vehicle through the A-pillar. They are removed through the opening behind the A-pillar lower trim panel. To remove the left-hand side drain hose, the inertia fuel shut-off (IFS) switch mounting bracket must be detached from the A-pillar. Both drain hoses are equipped with a rubber drain bung that automatically releases pressure and allows the drain hose to empty.



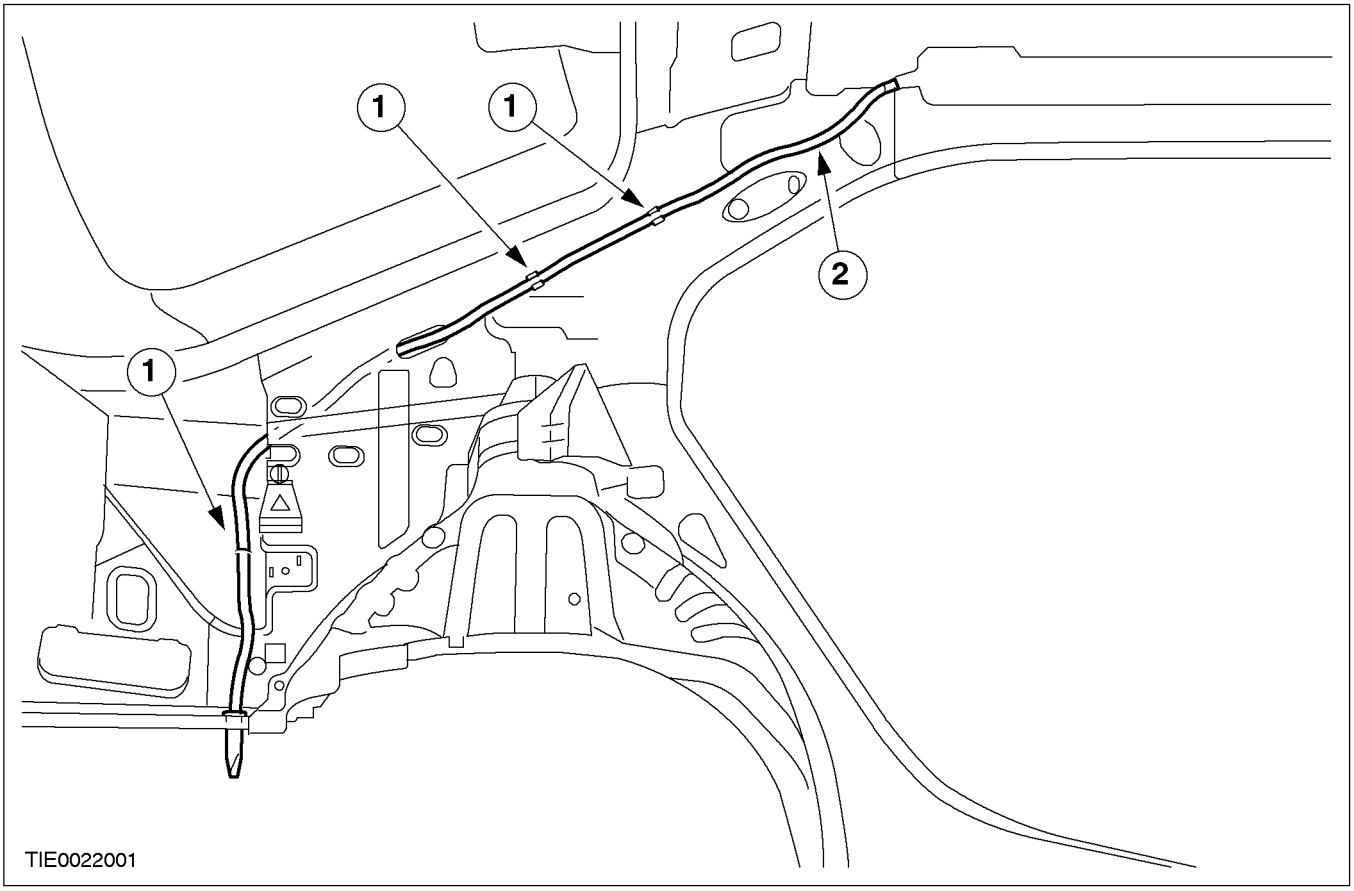
Item	Part Number	Description
1		Front drain hose

Rear Drain Hoses

The rear drain hoses are connected to the roof opening panel frame and routed to the underside of the vehicle through the C-pillar on 4-door and 5-door vehicles, and the D-pillar on the wagon. They are located by a rubber grommet at the base of the pillar. The drain hoses are secured to the vehicle by three retaining clips on 4-door and 5-door vehicles, and 6 retaining clips on the wagon. Both drain hoses are equipped with a rubber drain bung that automatically releases pressure and allows the drain hose to empty.

DESCRIPTION AND OPERATION

4-door and 5-Door

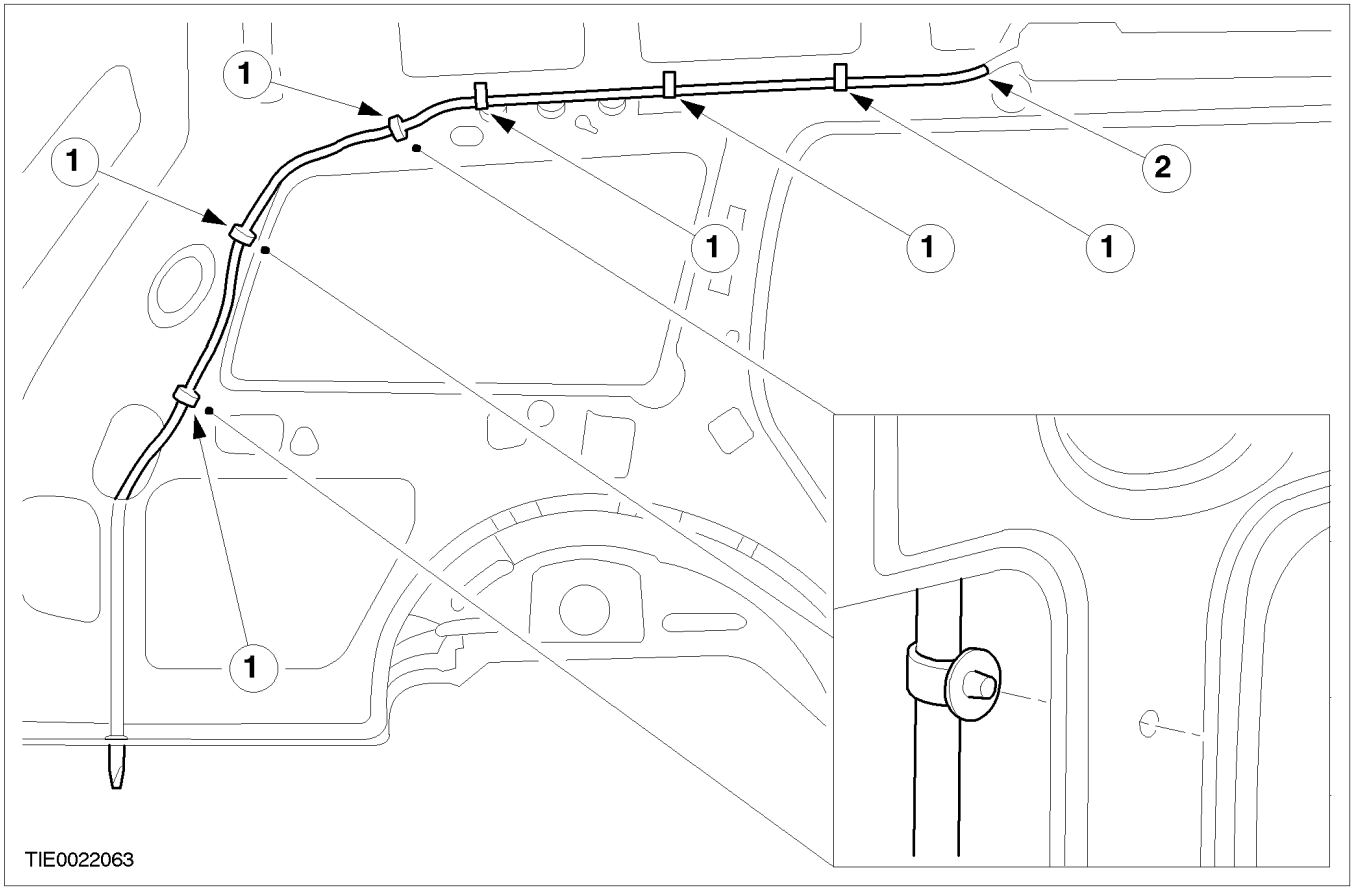


Item	Part Number	Description
1		Retaining clip

Item	Part Number	Description
2		Rear drain hose

DESCRIPTION AND OPERATION

Wagon



Item	Part Number	Description
1		Retaining clip
2		Rear drain hose

DIAGNOSIS AND TESTING

Roof Opening Panel

Refer to Wiring Diagrams Section 501-17 for schematic and connector information.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Mechanical	Electrical
Roof opening panel	Fuse(s)
Seal(s)	Electrical connector(s)
Weatherstrip	
Alignment	

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Visual Inspection Chart

Symptom Chart

Condition	Possible Sources	Action
•The roof opening panel leaks	•Drain tubes.	•CHECK the drain tubes for blockage or obstruction. CARRY OUT the Water Drainage System Check and Water Leak Corrections. REFER to Water Drainage System Check and Water Leak Corrections in this section.
•The roof opening panel rattles	•Headliner.	•CHECK the headliner for security. REFER to Section 501-05.
	•Guides and track. •Motor.	•CHECK for worn or damaged components. CARRY OUT the Roof Opening Panel Alignment. REFER to Roof Opening Panel Alignment in this section.
•The roof opening panel is noisy during operation	•Guides and track. •Motor.	•CHECK for worn or damaged components. CARRY OUT the Roof Opening Panel Alignment. REFER to Roof Opening Panel Alignment in this section.
•The roof opening panel does not open or close	•Switch.	•CARRY OUT the Roof Opening Panel Control Switch Component Test in this section.
	•Motor.	•CARRY OUT the Roof Opening Panel Motor Synchronization. REFER to Roof Opening Panel Motor Synchronization in this section.
	•Circuits.	• GO to Pinpoint Test A
•The roof opening panel shows unexpected bounce back at high speed.	•Motor. •Circuits.	• GO to Pinpoint Test B

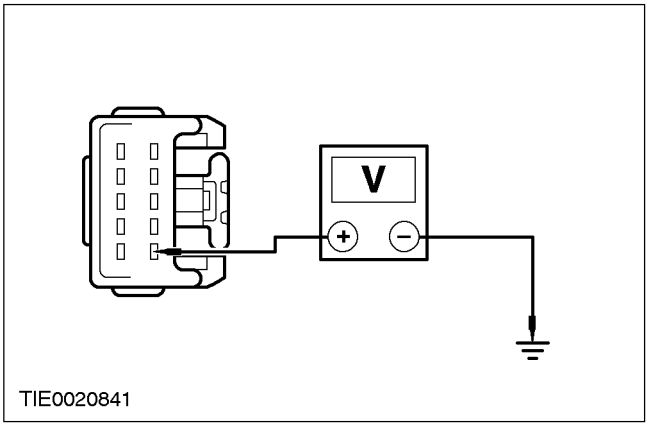
DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
•The roof opening panel does not stop in flush from any position	•Guides and track. •Motor.	•CHECK for worn or damaged components. CARRY OUT the Roof Opening Panel Alignment. REFER to Roof Opening Panel Alignment in this section.

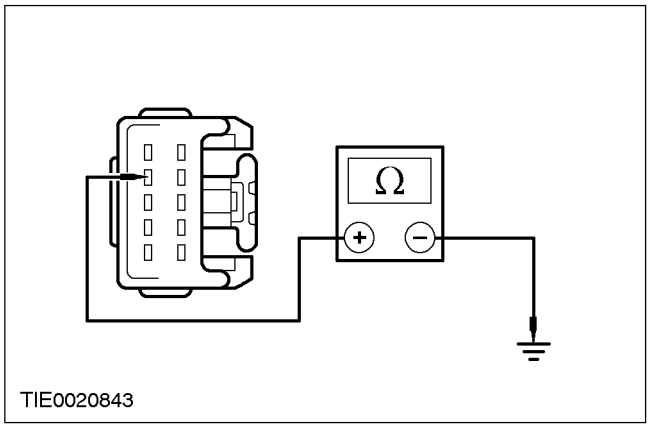
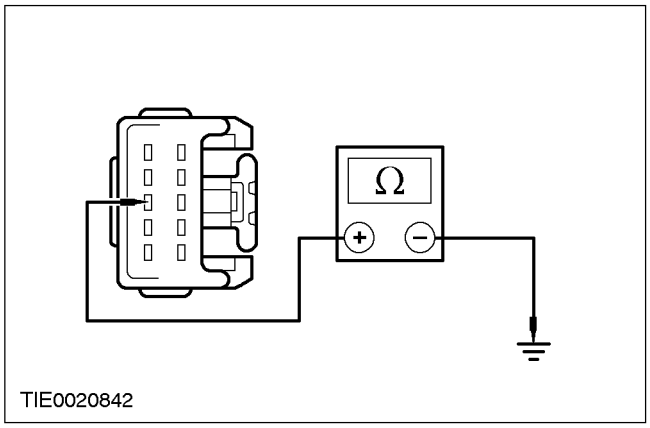
Pinpoint Tests

NOTE: Use a digital multimeter for all electrical measurements.

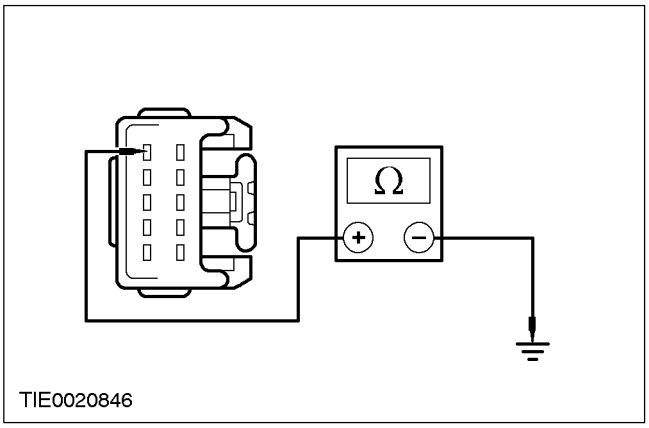
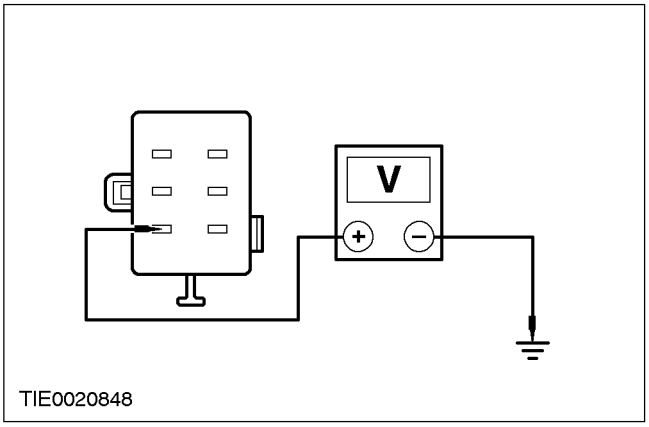
PINPOINT TEST A: THE ROOF OPENING PANEL DOES NOT OPEN OR CLOSE

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK FOR VOLTAGE TO THE ROOF OPENING PANEL CONTROL SWITCH	
	1 Key in ON position. 2 CHECK the operation of the roof opening panel control switch lamp. • Does the roof opening panel control switch lamp illuminate? → **Yes** GO to **A2** → **No** GO to **A6**
A2: CHECK THE SUPPLY VOLTAGE TO THE ROOF OPENING PANEL CONTROL UNIT, CIRCUIT 29-AG12 (OG/BK)	
	1 Key in OFF position. 2 Disconnect Fuse 73 (20A). 3 Disconnect Roof Opening Panel Control Unit C525. 4 Connect Fuse 73 (20A). 5 Measure the voltage between the roof opening panel control unit C525 pin 1, circuit 29-AG12 (OG/BK), harness side and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **A3**

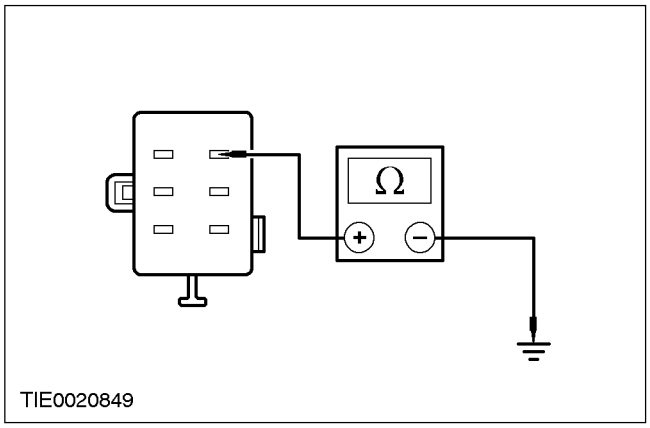
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **No** REPAIR circuit 29-AG12 (OG/BK). TEST the system for normal operation.
A3: CHECK THE ROOF OPENING PANEL CONTROL SWITCH UP/CLOSE GROUND CIRCUIT	
 TIE0020843	1 Operate the roof opening panel control switch to the UP/CLOSE position and keep it pressed. 2 Measure the resistance between the roof opening panel control unit C525 pin 9, circuit 31S-AG7A (BK/BU), harness side and ground. • Is the resistance less than 100 ohms? → **Yes** GO to **A4** → **No** REPAIR circuit 31S-AG7A (BK/BU). TEST the system for normal operation.
A4: CHECK THE ROOF OPENING PANEL CONTROL SWITCH DOWN/OPEN GROUND CIRCUIT	
 TIE0020842	1 Operate the roof opening panel control switch to the DOWN/OPEN position and keep it pressed. 2 Measure the resistance between the roof opening panel control unit C525 pin 8, circuit 31S-AG7 (BK/BU), harness side and ground. • Is the resistance less than 100 ohms? → **Yes**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	GO to **A5** → **No** REPAIR circuit 31S-AG7 (BK/BU). TEST the system for normal operation.
A5: CHECK THE ROOF OPENING PANEL CONTROL UNIT GROUND CIRCUIT	
 TIE0020846	1 Measure the resistance between the roof opening panel control unit C525 pin 10, circuit 31-AG12 (BK), harness side and ground. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new roof opening panel control unit. TEST the system for normal operation. → **No** REPAIR circuit 31-AG12 (BK). TEST the system for normal operation.
A6: CHECK THE SUPPLY VOLTAGE TO THE ROOF OPENING PANEL CONTROL SWITCH LAMP, CIRCUIT 15-AG7 (GN/BU)	
 TIE0020848	1 Key in OFF position. 2 Disconnect Roof Opening Panel Control Switch C522. 3 Key in ON position. 4 Measure the voltage between the roof opening panel control switch C522 pin 1, circuit 15-AG7 (GN/BU), harness side and ground.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is the voltage greater than 10 volts? → **Yes** GO to **A7** → **No** REPAIR circuit 15-AG7 (GN/BU). TEST the system for normal operation.
A7: CHECK THE ROOF OPENING PANEL CONTROL SWITCH GROUND CIRCUIT	
 TIE0020849	1 Key in OFF position. 2 Measure the resistance between the roof opening panel control switch C522 pin 6, circuit 31-AG7 (BK), harness side and ground. • Is the resistance less than 5 ohms? → **Yes** VERIFY the customer concern. → **No** REPAIR circuit 31-AG7 (BK). TEST the system for normal operation.

PINPOINT TEST B: THE ROOF OPENING PANEL SHOWS UNEXPECTED BOUNCE BACK AT HIGH SPEED

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK THE OPERATION OF THE MULTIFUNCTION DISPLAY	
	1 Drive the vehicle. 2 Observe the multi-function display 'Average speed' function. • Does the display operate correctly? → **Yes** GO to **B2** → **No** REFER to Section 413-01.
B2: CHECK FOR CONTINUITY BETWEEN THE POWERTRAIN CONTROL MODULE (PCM) AND THE ROOF OPENING PANEL CONTROL UNIT	
NOTE: The circuit numbers and wiring colors change at soldered joint S7.	
	1 Key in OFF position. 2 Disconnect PCM C100.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	3 Install the PCM breakout box. 4 Measure the resistance between powertrain control module C100 pin 94, circuit 8-GB8 (WH/BU), harness side and the roof opening panel motor C525 pin 6, circuit 8-GB8 (WH/BU), harness side. • Is the resistance less than 5 ohms? → **Yes** INSTALL a new roof opening panel motor. TEST the system for normal operation. → **No** REPAIR circuit 8-GB8 (WH/BU). TEST the system for normal operation.

Component Tests

Roof Opening Panel Control Switch

1. Measure the resistance between the following:

Roof Opening Panel Control Switch Position	Terminals	Measurements
Neutral	1 - 6	GO to Step 2.
Neutral	1 - 2	Greater than 10,000 ohms
Neutral	1 - 5	Greater than 10,000 ohms
Neutral	2 - 6	Greater than 10,000 ohms
Neutral	5 - 6	Greater than 10,000 ohms
Neutral	6 - 1	Greater than 10,000 ohms
Fully Up/Close	5 - 6	Less than 100 ohms
Fully Up/Close	5 - 1	Greater than 10,000 ohms
Fully Up/Close	5 - 2	Less than 100 ohms
Fully Up/Close	2 - 6	Less than 100 ohms
Fully Down/Open	2 - 6	Less than 100 ohms
Fully Down/Open	2 - 5	Less than 100 ohms
Fully Down/Open	5 - 6	Less than 100 ohms
Fully Down/Open	2 - 1	Greater than 10,000 ohms

2. Apply +12v battery positive to the roof opening panel control switch C522 pin 1, component side and 0v battery negative to the roof opening panel control switch C522 pin 6, component side. The LED should illuminate. If the LED does not illuminate install a new roof opening panel control switch.
3. If the roof opening panel control switch values are as specified, return to the Pinpoint Test. If the roof opening panel control switch values are outside the specified values, install a new roof opening panel control switch.

GENERAL PROCEDURES

Water Drainage System Check and Water Leak Corrections (41 002 0)

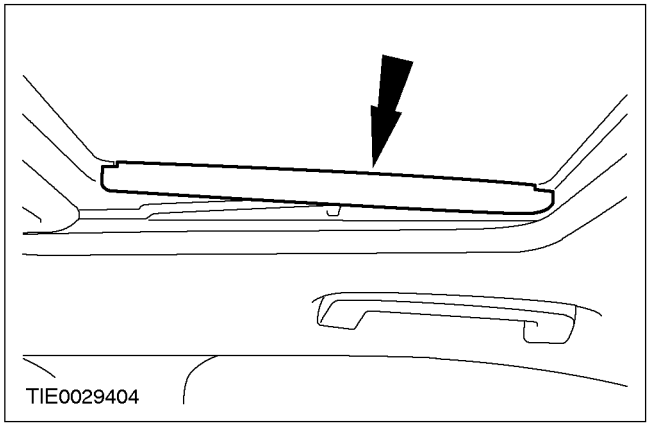
1. **If a drain hose blockage or obstruction is suspected, check the drain hoses by pouring 500 ml of water into the drain trough and checking the flow from under the vehicle rocker panels. Attempt to clear any blockage or obstruction using a drain clearing wire (nylon). If the blockage or obstruction cannot be cleared the drain hose must be removed. For additional information, refer to Drain Hose - Front / Drain Hose - Rear in this section.**
2. **If a drain hose leak is suspected the drain hose must be removed and inspected for cracks or splits. For additional information, refer to Drain Hose - Front / Drain Hose - Rear in this section.**

GENERAL PROCEDURES

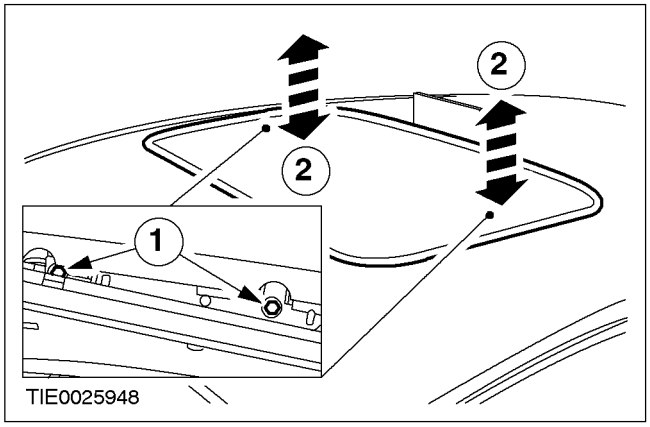
Roof Opening Panel Alignment (41 113 0)

1. **NOTE:** The roof opening panel must be in the closed position for alignment.

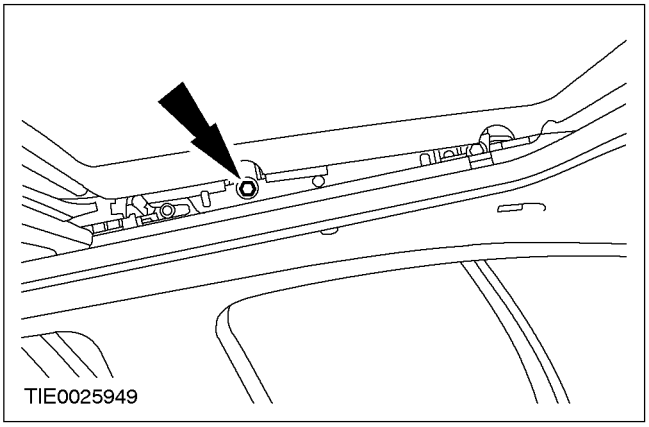
   Remove the roof opening panel guide arm covers (if equipped).



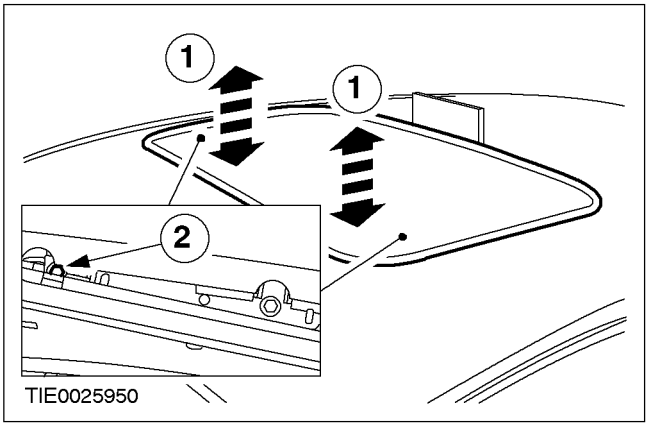
2. **Place a suitable 1.0 - 1.2 mm thick, 150 mm long plastic spacer between the rear edge of the roof opening panel glass and the roof panel opening.**
3. **Adjust the rear edge of the roof opening panel glass.**
   1. Loosen the retaining screws.
   2. Push the rear edge up or down to give the correct alignment (flush to + 1 mm).



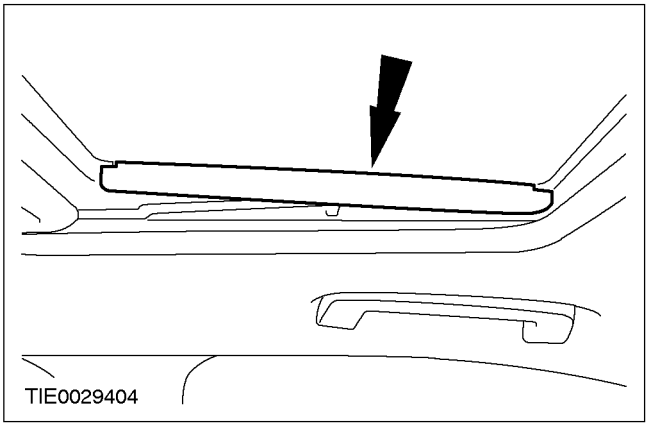
4. **Make sure that the roof opening panel glass is located centrally in the roof panel opening.**
5. **Tighten the rear retaining screws.**



6. **Adjust the front edge of the roof opening panel glass.**
   1. Push the front edge up or down to give the correct alignment (flush to -1 mm).
   2. Tighten the front retaining screws.



7. **Install the roof opening panel guide arm covers (if equipped).**



GENERAL PROCEDURES (Continued)

8. **NOTE:** Remove the plastic spacer.

   Operate the roof opening panel and check the alignment.

9. **Check the roof opening panel seal for wind noise and water leaks.**

GENERAL PROCEDURES

Roof Opening Panel Motor Initialization

Updating Roof Opening Panel Motor Initialization

WARNING: The roof opening panel anti-trap function will not operate during the updating roof opening panel motor initialization procedure. Make sure that the roof opening panel opening is free of all foreign material. Failure to follow this instruction may result in personal injury.

NOTE: This procedure should only be carried out when the roof opening panel motor has not been disconnected.

NOTE: The roof opening panel alignment must be carried out prior to carrying out roof opening panel motor initialization. For additional information, refer to Roof Opening Panel Alignment in this section.

1. **Operate the roof opening panel control switch to the up/close position until the roof opening panel is in the fully open/vent position.**
2. **Release the roof opening panel control switch.**
3. **Operate the roof opening panel control switch to the up/close position and hold for 30 seconds until there is a small movement (approximately 2 mm) and the roof opening panel motor stops.**
4. **Release the roof opening panel control switch.**
5. **Operate the roof opening panel control switch to the up/close position again within 0.5 seconds until the roof opening panel stops (one complete cycle).**

Initial Roof Opening Panel Motor Initialization

WARNING: The roof opening panel anti-trap function will not operate during the updating roof opening panel motor initialization procedure. Make sure that the roof opening panel opening is free of all foreign material. Failure to follow this instruction may result in personal injury.

NOTE: This procedure must be carried out when installing any roof opening panel motor or roof opening panel.

NOTE: The roof opening panel alignment must be carried out prior to carrying out roof opening panel motor initialization. For additional information, refer to Roof Opening Panel Alignment in this section.

1. **Operate the roof opening panel control switch to the up/close position.**
2. **Release the roof opening panel control switch.**
3. **Operate the roof opening panel control switch to the up/close position again within 0.5 seconds until the roof opening panel stops (one complete cycle).**

Erasing Roof Opening Panel Motor Initialization

NOTE: The erasing procedure is to be carried out only when the roof opening panel motor has been detached from the roof opening panel.

NOTE: This procedure must be carried out before installing a previously used roof opening panel motor.

1. **Connect the roof opening panel motor electrical connector.**
2. **Operate the roof opening panel control switch to the up/close position until the roof opening panel motor stops.**
3. **Release the roof opening panel control switch.**
4. **Operate the roof opening panel control switch again to the up/close position and hold for 30 seconds. With the roof opening panel control switch held, the roof opening panel motor will rotate in one direction.**
5. **Release the roof opening panel control switch.**
6. **Operate the roof opening panel control switch to the down/open position. If the roof opening panel motor does not rotate, the erasing procedure has been carried out successfully.**
7. **If the roof opening panel motor rotates (with the roof opening panel control switch in the down/open position), repeat the procedure.**

REMOVAL AND INSTALLATION

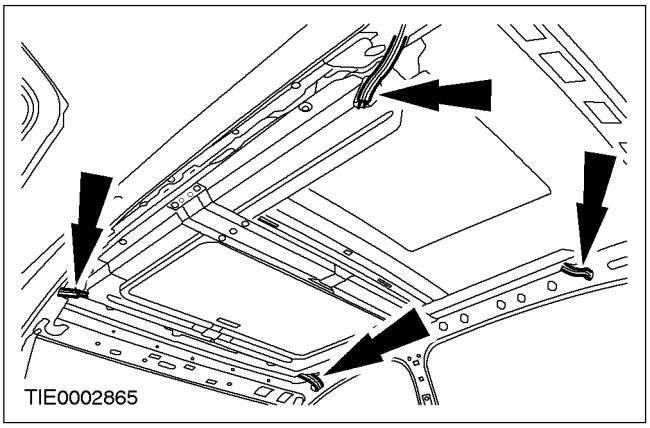
Roof Opening Panel (41 114 0)

Removal

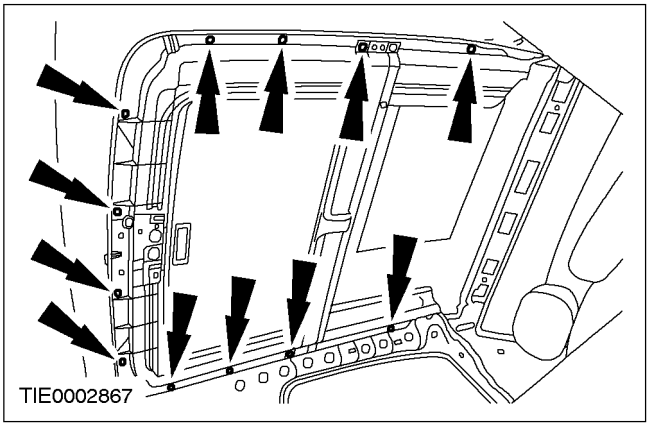
1. **NOTE:** Make sure the roof opening panel is in the closed position.

   Remove the headliner. For additional information, refer to Section 501-05.

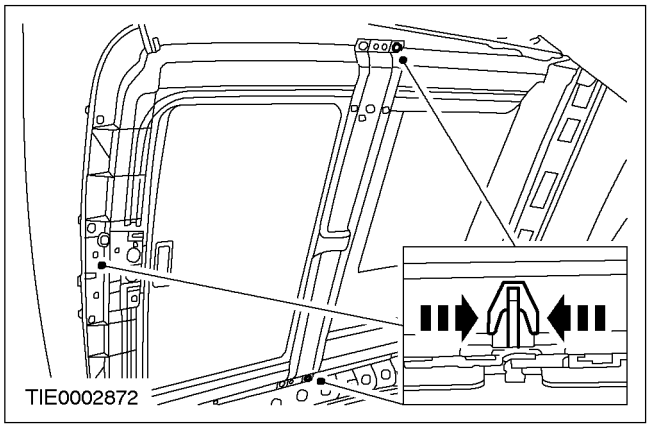
2. **Detach the drain hoses from the roof opening panel.**



3. **Detach the roof opening panel from the roof panel (12 bolts).**



4. **Remove the roof opening panel.**
   - With the aid of another technician, compress the legs of the retaining clips and lower the roof opening panel.



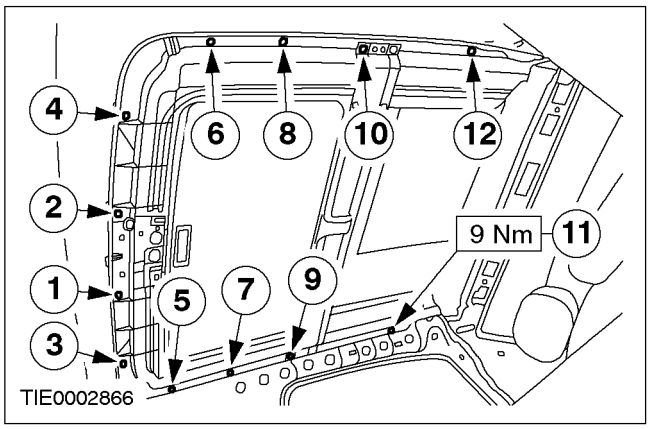
Installation

1. **NOTE:** The roof opening panel must be correctly located on the retaining clips before tightening the retaining bolts.

NOTE: Do not fully tighten the retaining bolts at this stage.

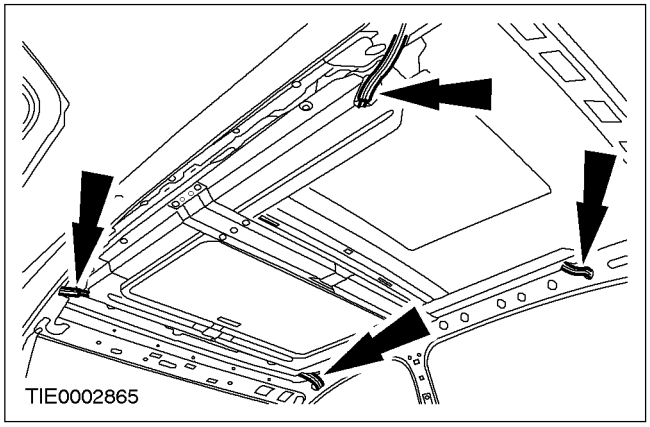
Install the roof opening panel.

2. **Tighten the retaining bolts in the sequence shown.**



REMOVAL AND INSTALLATION (Continued)

3. **Attach the drain hoses to the roof opening panel.**



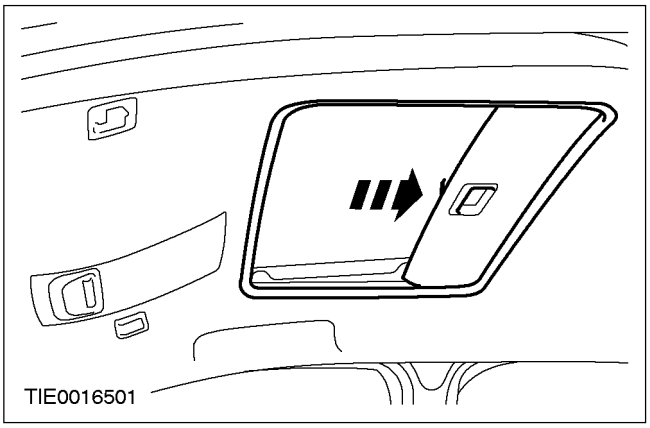
4. **Install the headliner. For additional information, refer to Section 501-05.**

REMOVAL AND INSTALLATION

Roof Opening Panel Glass

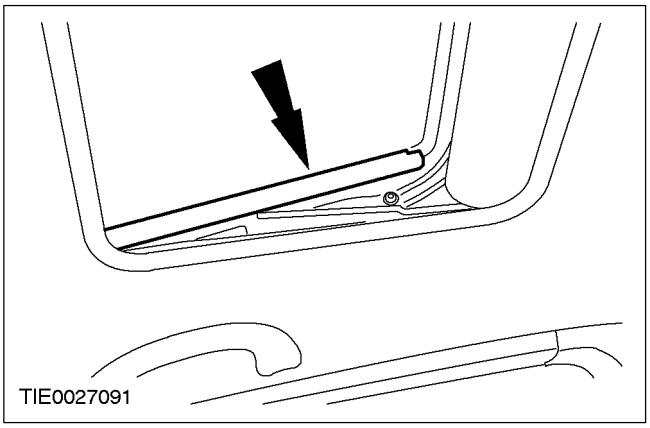
Removal

1. **Move the roof opening panel shield rearwards.**

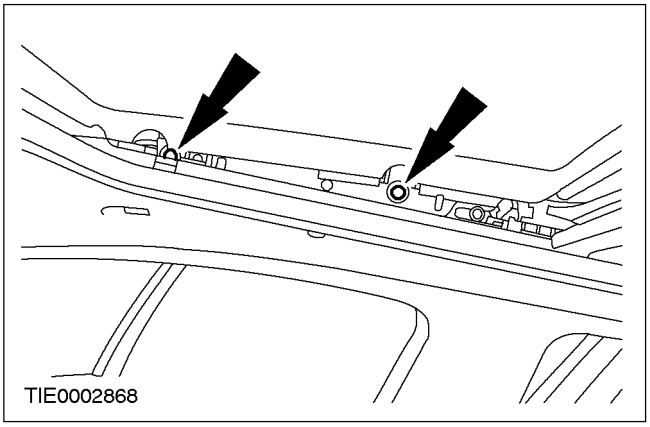


2. **NOTE:** Make sure the roof opening panel is in the vent position.

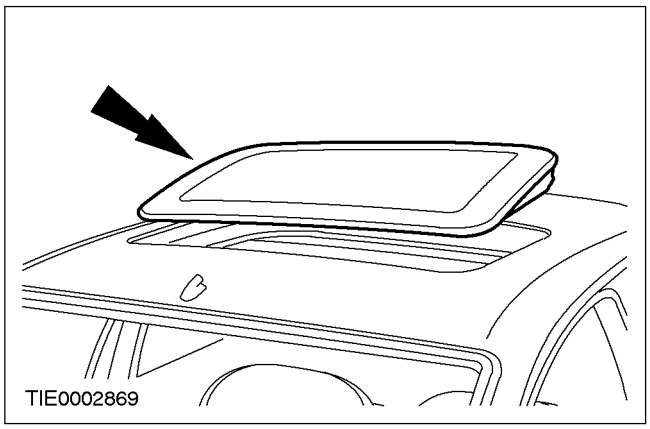
   Remove the roof opening panel guide arm covers.



3. **Remove the roof opening panel glass retaining screws on both sides.**



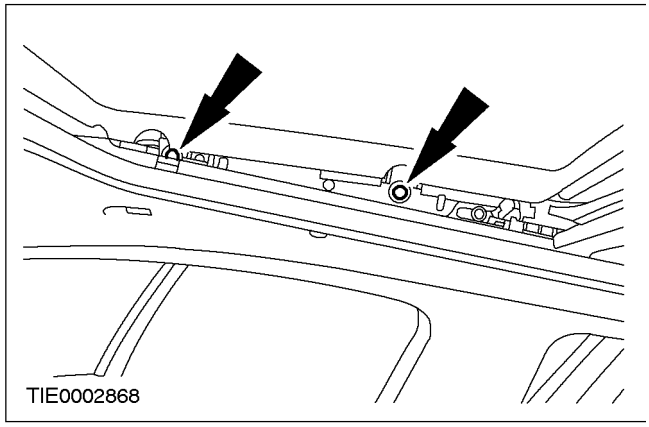
4. **Remove the roof opening panel glass.**



Installation

1. **Position the roof opening panel glass in the roof opening panel.**
2. **NOTE:** Do not fully tighten the retaining screws at this stage.

   Install the roof opening panel glass.

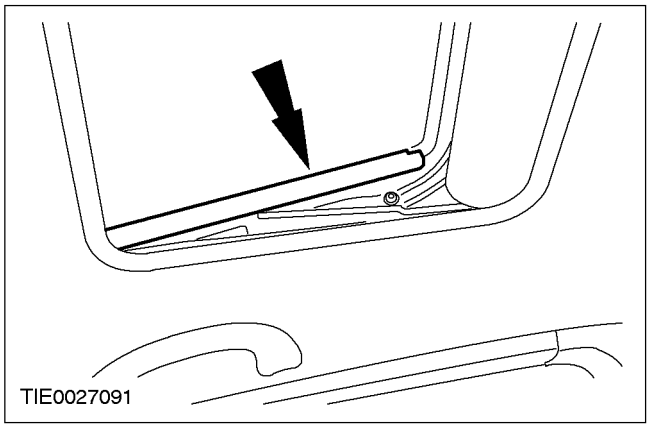


3. **Align the roof opening panel glass.** **For additional information, refer to Roof Opening Panel Alignment - in this section.**

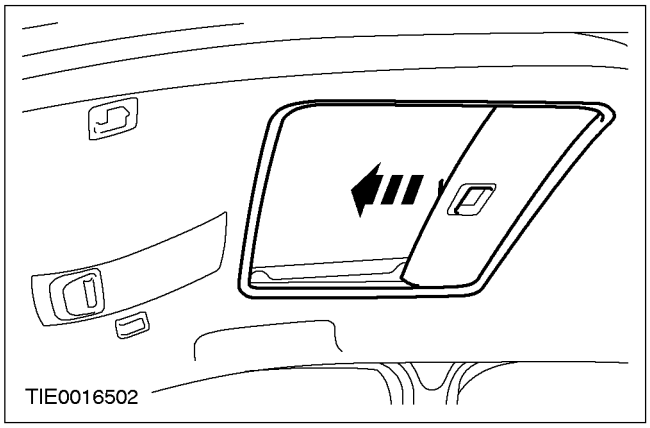
REMOVAL AND INSTALLATION (Continued)

4. **NOTE:** Make sure the roof opening panel is in the vent position.

   Install the roof opening panel guide arm covers.



5. **Move the roof opening panel shield forwards.**

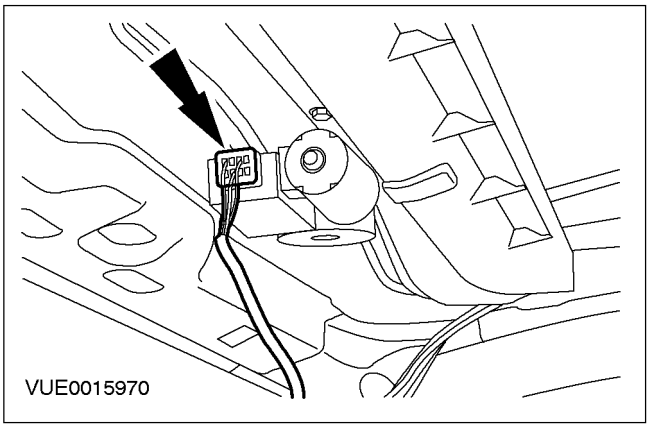


REMOVAL AND INSTALLATION

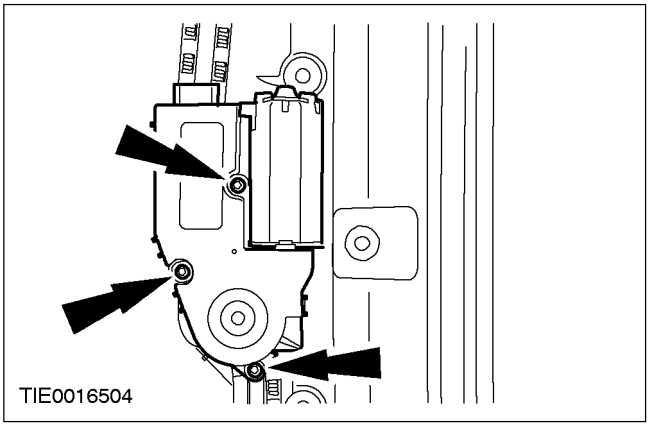
Roof Opening Panel Motor (33 786 0)

Removal

1. **Remove the overhead console. For additional information, refer to Section 501-12.**
2. **Disconnect the roof opening panel motor electrical connector (headliner shown removed for clarity).**

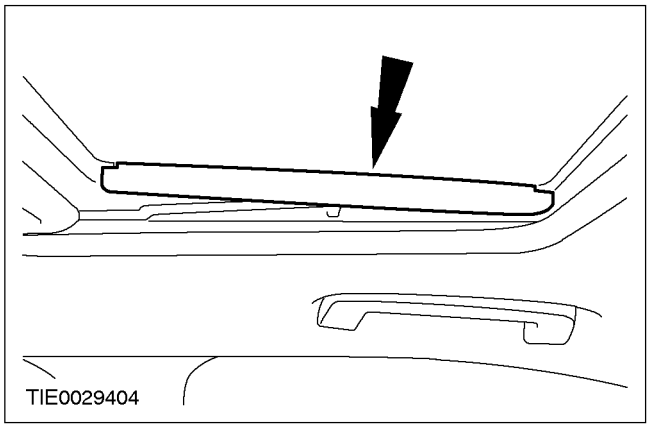


3. **Remove the roof opening panel motor.**



Installation

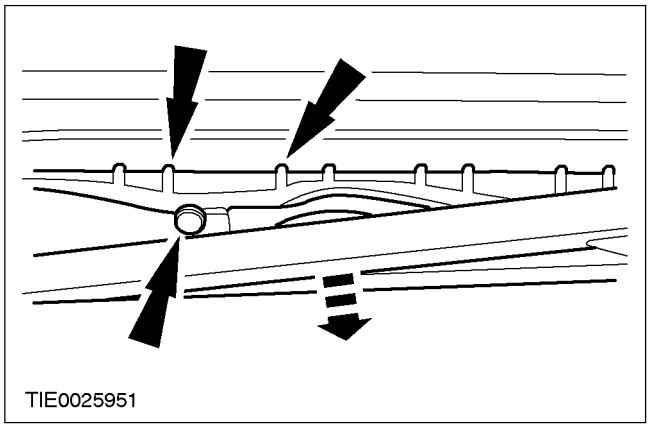
1. **Remove the roof opening panel guide arm covers.**



2. **CAUTION: The guide pins must be aligned centrally between the lugs as shown.**

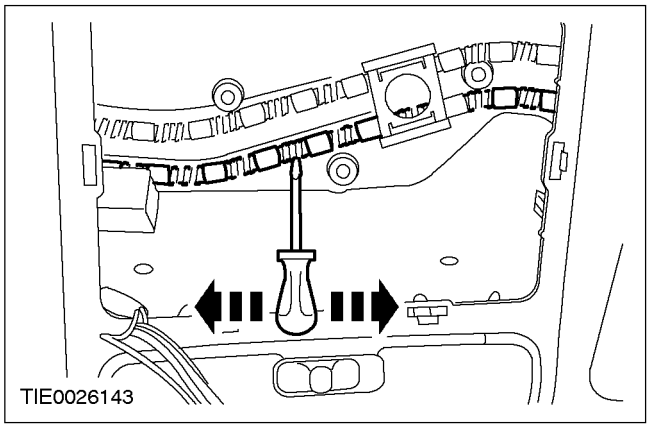
   Check the alignment of the left-hand and right-hand cable guide (left-hand side shown).

   - Depress the bar.

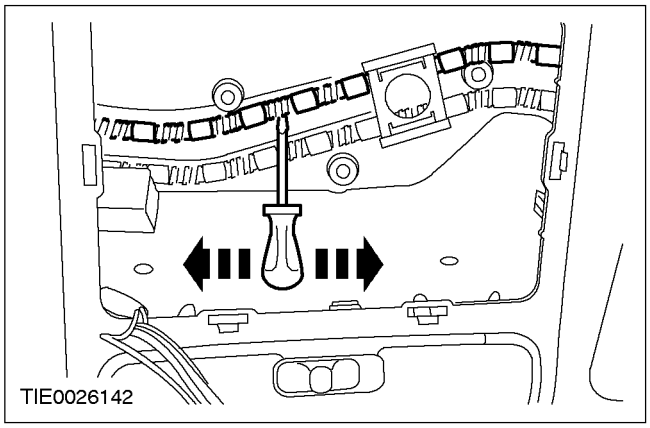


REMOVAL AND INSTALLATION (Continued)

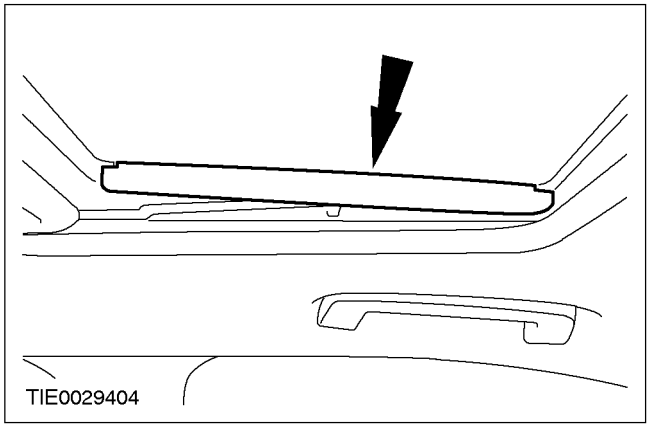
3. **Adjust the left-hand cable guide pin.**
   - Using a suitable screwdriver, move the cable in the direction required.



4. **Adjust the right-hand cable guide pin.**
   - Using a suitable screwdriver, move the cable in the direction required.



5. **Install the roof opening panel guide arm covers.**



6. **NOTE:** Support the roof opening panel motor.

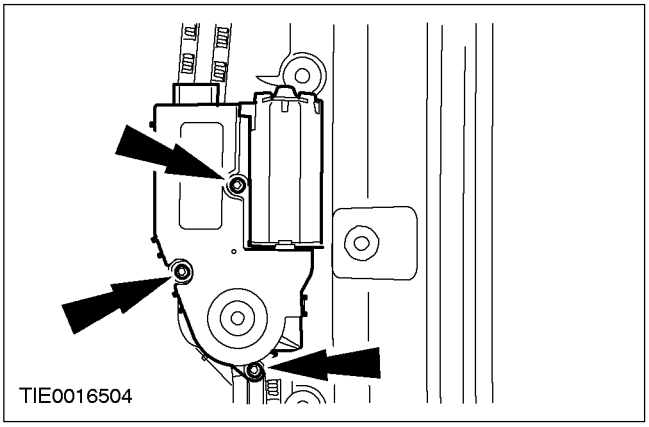
   Connect the roof opening panel motor electrical connector.

7. **Connect the battery ground cable. For additional information, refer to Section 414-01.**
8. **Connect the roof opening panel control switch electrical connector.**
9. **CAUTION: This step must be carried out if installing a previously used roof opening panel motor.**

NOTE: This step is not necessary when installing a new roof opening panel motor.

Carry out the erasing roof opening panel motor initialization procedure. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

10. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
11. **Disconnect the roof opening panel control switch electrical connector.**
12. **Install the roof opening panel motor.**



13. **Install the overhead console. For additional information, refer to Section 501-12.**
14. **Carry out the initial roof opening panel motor initialization procedure. For additional information, refer to Roof Opening Panel Motor Initialization in this section.**

SECTION 501-19 Bumpers

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS PAGE

SPECIFICATIONS

Specifications 501-19-2

REMOVAL AND INSTALLATION

Front Bumper Cover ..... (43 427 0) 501-19-3
Rear Bumper Cover — 1.8L/2.0L/2.5L/2.0L Diesel ..... (43 447 0) 501-19-5

SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Front bumper retaining bolts	15	11	–
Rear bumper bracket retaining bolts	15	11	–
Rear bumper bracket retaining nuts	15	11	–
Rear bumper to bumper bracket retaining nuts	20	15	–
Rear bumper to bumper bracket retaining bolts	20	15	–

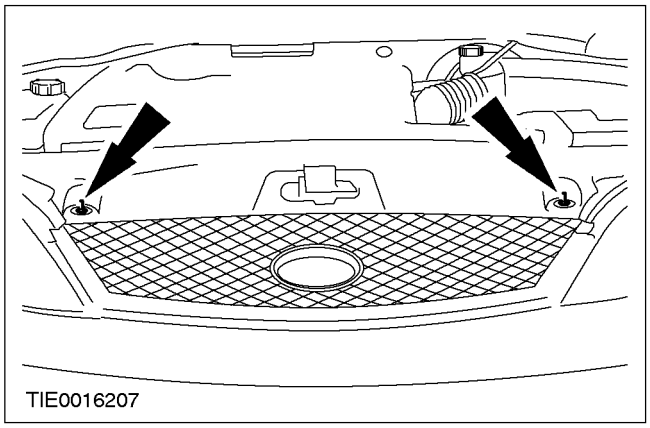
REMOVAL AND INSTALLATION

Front Bumper Cover (43 427 0)

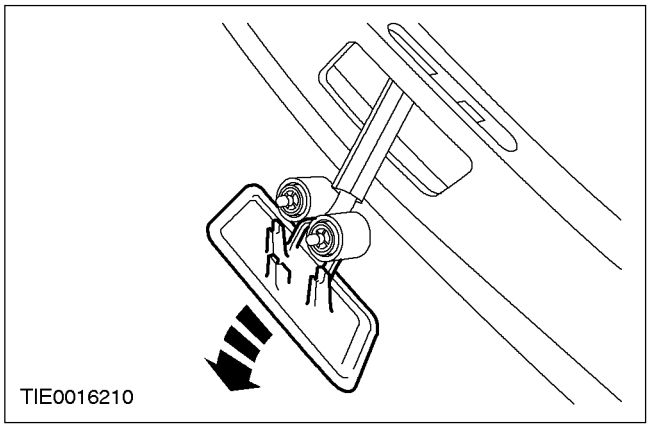
Removal

All vehicles

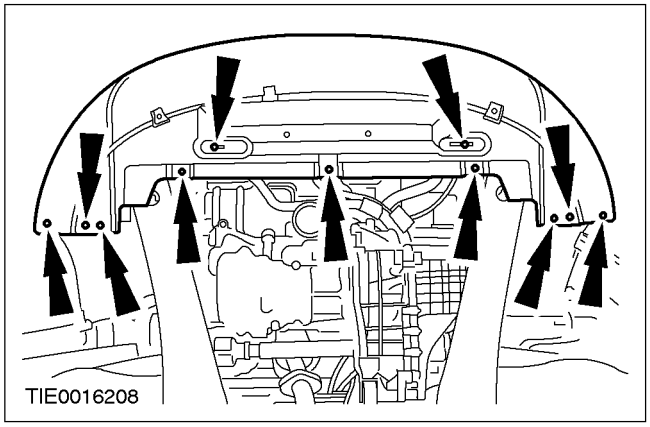
1. Remove the radiator grille.



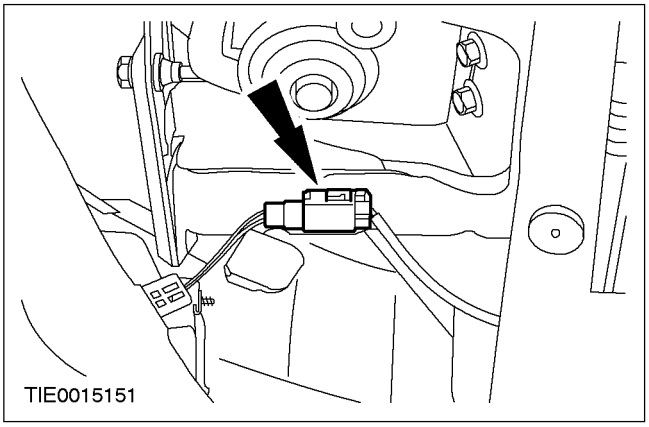
2. Remove the headlamp washer covers (if equipped).



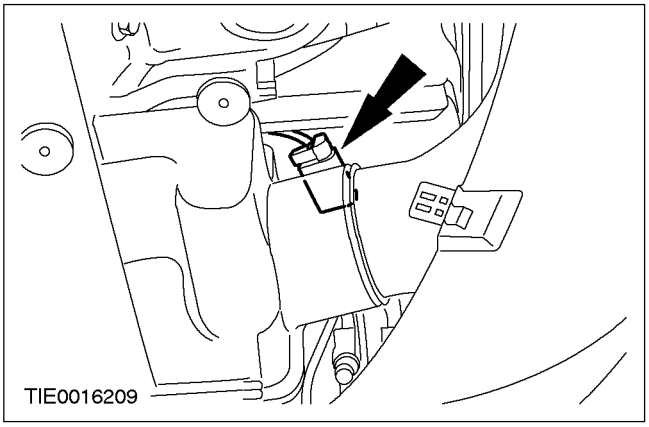
3. Remove the radiator undershield.



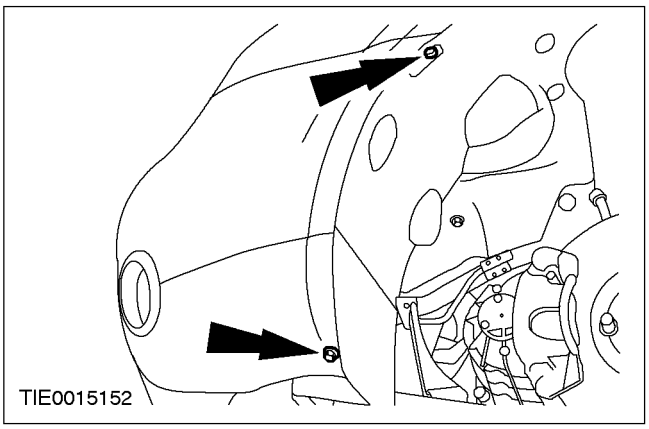
4. Disconnect the low temperature warning indicator electrical connector.



5. Disconnect the fog lamp electrical connectors (if equipped).



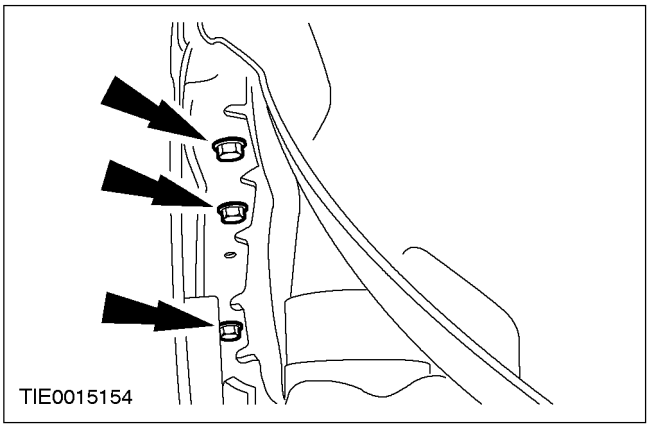
6. Detach the fender splash shield from the bumper cover on both sides.



REMOVAL AND INSTALLATION (Continued)

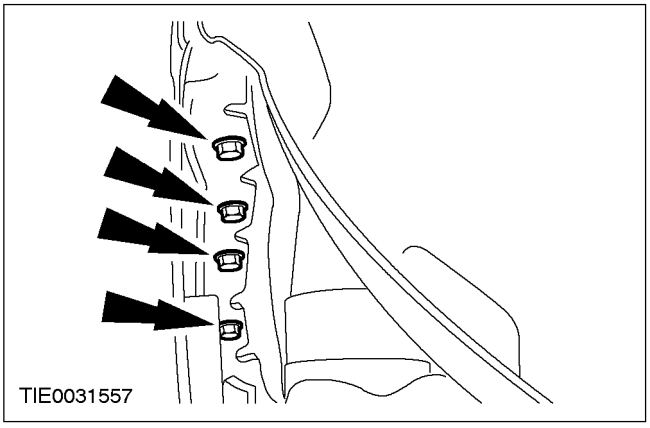
Vehicles with 1.8L, 2.0L, 2.5L or diesel engine

7. Detach the bumper cover from the fender on both sides.



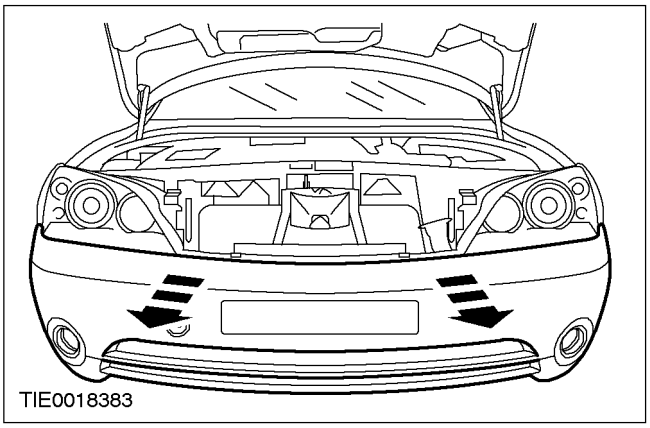
Vehicles with 3.0L engine

8. Detach the bumper cover from the fender on both sides.



All vehicles

9. Remove the bumper cover.



Installation

1. To install, reverse the removal procedure.

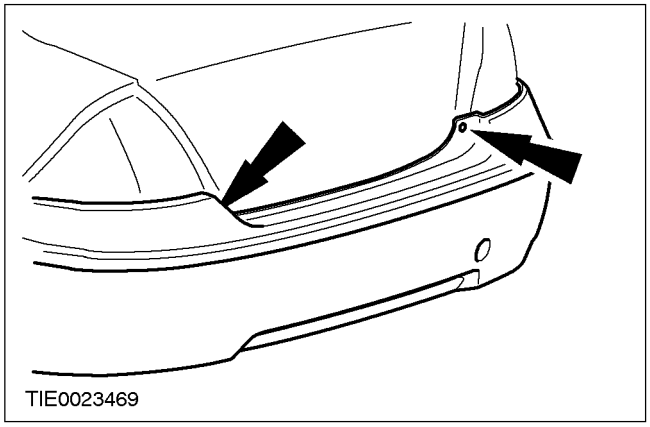
REMOVAL AND INSTALLATION

Rear Bumper Cover — 1.8L/2.0L/2.5L/2.0L Diesel (43 447 0)

Removal

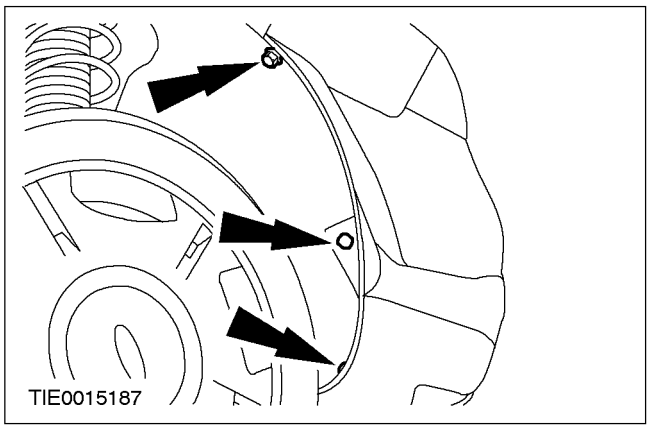
4-door

1. **Remove the bumper cover retaining screws.**

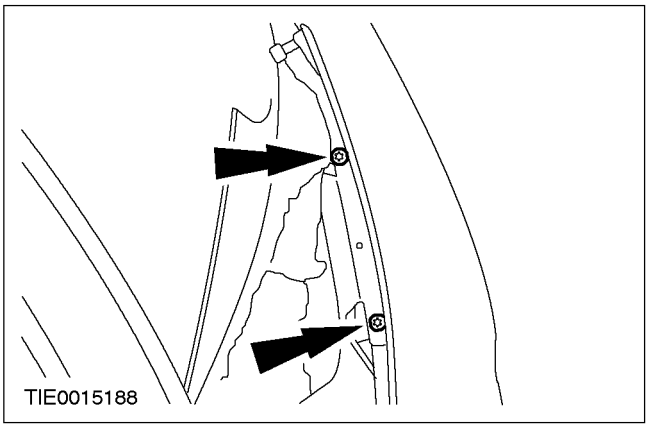

TIE0023469

All vehicles

2. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
3. **Detach the fender splash shield from the bumper cover on both sides.**

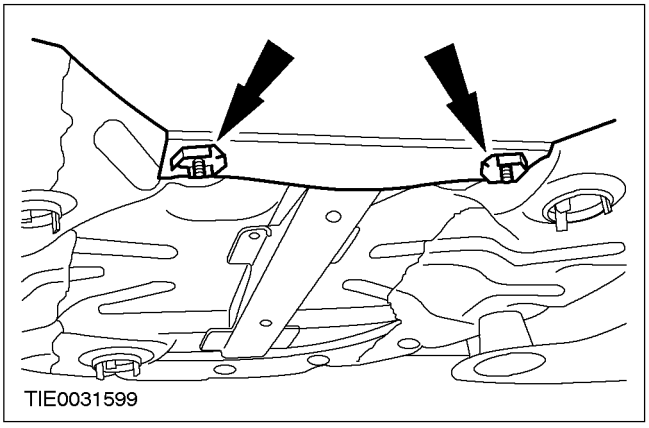

TIE0015187

4. **Detach the bumper cover from the fender on both sides.**


TIE0015188

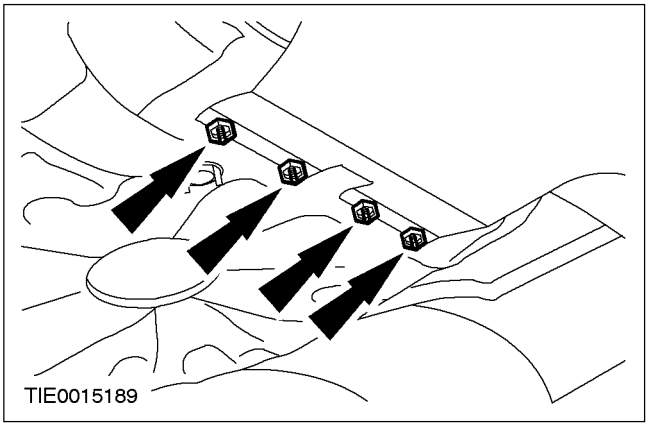
Wagon

5. **Detach the bumper cover from the spare wheel housing.**


TIE0031599

4-door and 5-door

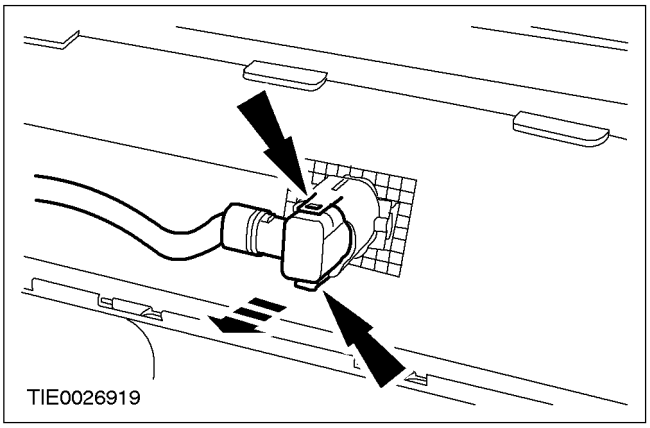
6. **Detach the bumper cover from the spare wheel housing.**


TIE0015189

REMOVAL AND INSTALLATION (Continued)

All vehicles

7. Detach the parking aid sensors from the bumper cover (if equipped).



8. Remove the bumper cover.

Installation

1. To install, reverse the removal procedure.

SECTION 501-20A Safety Belt System

VEHICLE APPLICATION: 2003.0 Mondeo

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REMOVAL AND INSTALLATION

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SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Safety belt retractor retaining bolts	38	28	–
Safety belt upper anchor retaining bolts	38	28	–
Safety belt lower anchor retaining bolts	38	28	–
Rear safety belt buckle retaining bolts	55	41	–
Safety belt shoulder height adjuster retaining bolts	25	18	–
Safety belt buckle and pretensioner retaining bolts	50	37	–

DESCRIPTION AND OPERATION

Safety Belt System

WARNING: All safety belt components including retractors, buckles, child safety seat tether brackets and attaching hardware in use during a collision must be removed and new components installed. New safety belt components should also be installed where safety belts not in use during a collision, are inspected and found to be damaged or operate incorrectly. Failure to follow these instructions may result in personal injury.



TIE0018196

WARNING: All vehicles fitted with a passenger air bag have a WARNING sticker attached to the instrument panel PROHIBITING the use of rear facing child seats in the front seating positions. Failure to follow this instruction may result in personal injury.

The safety belt system utilizes three - point lap and diagonal safety belts in all seat positions.

The front safety belt retractors incorporate a load limiting device, which allows progressive payout of additional safety belt webbing when the force exerted exceeds a predetermined limit.

The front safety belt upper anchors are connected to safety belt shoulder height adjusters mounted in the B-pillar.

The front seat safety belt buckles incorporate pretensioners and safety belt buckle switches. Both the safety belt buckle switch and the safety belt buckle pretensioner are connected to the air bag control module. The air bag control module monitors both circuits and if a fault is detected will illuminate the air bag warning indicator located in the instrument cluster. For additional information, refer to Section 501-20A / 501-20B.

The safety belt buckle pretensioners have a lower deployment threshold than that required by the air bags. Hence it is possible during a minor collision, which exceeds the deployment threshold, that only the safety belt prestensioners will deploy. However the safety belt buckle pretensioners will only deploy if the safety belt is fastened.

On vehicles equipped with a Generic Electronic Module, the safety belt system will warn the driver that the safety belt is not fastened by sounding a chime and then illuminating a warning indicator located in the instrument cluster. For additional information, refer to Diagnosis and Testing in this section.

Vehicles built 10/2001 onwards, have an additional safety belt minder. When the vehicle speed exceeds 8 km/h (5 mph) and the driver safety belt is unfastened, the safety belt minder will provide the driver with an audible and visual warning. The warning will continue for up to five minutes by sounding a chime and illuminating a warning indicator located in the instrument cluster.

The additional safety belt minder feature can be disabled. For additional information, refer to Section 413-09.

Both front seats are equipped with active head restraints, which extend forward in the event of a rear collision. For additional information, refer to Section 501-10.

Rear seat safety belt retractors and buckles are of the conventional type.

DIAGNOSIS AND TESTING

Safety Belt System

Principles of Operation

⚠ WARNING: All safety belt components including retractors, buckles, front safety belt buckle support assemblies (slider bar), child safety seat tether brackets and attaching hardware in use during a collision must be removed and new components installed. New safety belt components should also be installed where safety belts not in use during a collision, are inspected and found to be damaged or operate incorrectly. Failure to follow these instructions may result in personal injury.

The occupant restraint system utilizes three-point lap and diagonal safety belts in all seat positions.

Front seats are equipped with safety belt buckle pretensioners, which are controlled as part of the supplemental restraint system (SRS). REFER to Section 501-20A / 501-20B. The rear seat safety belt buckles are mounted directly to the floor pan underneath the rear seat cushion. The safety belt buckle attached to the driver and front passenger seat is fitted with a switch, which is connected to the SRS warning indicator in the instrument cluster by the wiring harness and the air bag control module. When the ignition is turned to the RUN position the SRS warning indicator will illuminate for 3 seconds. If the SRS, including the safety belt electrical system, is operating correctly the SRS warning indicator will be extinguished. If a fault is detected the SRS warning indicator will generate a lamp fault code (LFC).

On vehicles equipped with a Generic Electronic Module (GEM), the safety belt system will warn the driver that the safety belt is not fastened by sounding a chime and illuminating the warning indicator in the instrument cluster. If during at least the first 6 seconds after the ignition is switched to the Run or Start position, the driver safety belt is not fastened, the safety belt warning chime will sound. The chime will stop after 6 seconds or if the driver safety belt is fastened. If during the first 65 seconds after the ignition is switched to the Run or Start position, the driver safety belt is not fastened, the safety belt warning indicator will be illuminated. The warning indicator will extinguish after 60 seconds or if the driver safety belt is fastened.

The safety belt retractor, mounted within the base of the B-pillar, incorporates a torsion bar load-limiting device. The device consists of a retractor reel which is mounted onto a spindle (torsion bar) which, once the sensor has locked the retractor reel and a predetermined load is applied, twists and pays out additional webbing into the system. The deceleration force required to initiate this sequence is approximately the same as that required to initiate air bag deployment. The torsion bar load-limiting device will only react if the safety belt is in use at the time of impact.

Rear seat safety belt retractors do not use this type of retractor; they are equipped with a conventional retractor.

Emergency Locking Retractor (ELR)

The retractors in all seat positions feature ELR. The ELR is part of the safety belt system that in normal operation allows free movement of the belted occupant. In an emergency the ELR will lock, preventing webbing payout and hence forward movement of the occupant. Locking may be achieved by one of two mechanisms:

Vehicle Motion Sensor (VMS)

VMS is operated by sudden deceleration of the vehicle or excessive tilt. Once operated the VMS causes a locking pawl to be engaged, thus locking the retractor, preventing webbing payout. When the vehicle is stationary, the VMS stabilizes, causing the pawl to disengage and unlock the retractor, allowing webbing payout.

Webbing Motion Sensor (WMS)

The ELR WMS is operated by rapid acceleration of the webbing. Once operated, it causes a locking pawl to be engaged thus locking the retractor. Webbing payout is prevented in the same manner as VMS.

DIAGNOSIS AND TESTING (Continued)

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.
3.

Mechanical
Safety belt retractor Safety belt buckle and pretensioner

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Visual Inspection Chart

Symptom Chart

Condition	Possible Sources	Action
•Normal mode - occupant restraint system inoperative	•Safety belt retractor.	•CARRY OUT the Safety Belt Component Test in this section.

Component Test

Poor Retraction

If a safety belt does not retract correctly, check that the anchor covers and trim bezels are correctly installed and not rubbing against the safety belt webbing. Where necessary, check that the safety belt webbing is not rubbing at one end of the retractor cover slot and, if so, correct by loosening the retaining bolt, aligning the retractor to centralize the safety belt webbing and retighten the bolt.

These safety belts are ``dual sensitive" which means that they have:

- a vehicle motion sensor, which locks the safety belt webbing under braking, cornering, on steep hills and in adverse camber conditions.
- a webbing motion sensor, which locks when the safety belt webbing is quickly extracted.

Both systems should be fully operational and can be checked by the tests below:

Vehicle Motion Sensor Test

Either of the following two procedures may be used to check correct operation of the vehicle motion sensor. Both methods require two technicians but note that technicians of larger than normal build should not be asked to conduct these tests. This is to avoid the possibility of a fully unrolled safety belt webbing being mistaken for a correctly locked safety belt retractor.

Test Method 1 (braking)

WARNING: It is important that during this test the driver and passenger allows the safety belts to provide the restraint and do not attempt to anticipate the sudden deceleration. The steering wheel should not be used as a brace. However, both driver and passenger should prepare themselves for the possibility that the safety belt will not lock. The passenger should hold their hands in front of them, just clear of the instrument panel or front seat backrest, depending on which safety belt is being tested. Failure to follow these instructions may result in personal injury.

DIAGNOSIS AND TESTING (Continued)

- Select for this test a quiet or private stretch of road. Make sure that the road is clear and that full visibility is maintained at all times.
- Both driver and passenger should adopt a normal, comfortable seating position. Both occupants should wear the safety belts and the safety belt webbing must be correctly adjusted, with no slack.
- Proceed at a speed of 10 km/h (6 mph). Do not exceed 10 km/h (6 mph) for this test.
- Apply the foot brake sharply to stop the vehicle. If the vehicle motion sensitive lock mechanism is operating correctly, the safety belt webbing will lock and restrain the wearer.
- Conduct the test twice in each front and rear passenger seat position.
- Any safety belt retractor which does not restrain the wearer during this test must not be reused. A new safety belt must be installed.

Test Method 2 (turning circle)

This method requires a flat open area of private road, sufficient for the vehicle to be driven in a continuous circle on full steering lock.

- The driver should wear the safety belt provided and the belt webbing must be correctly adjusted, with no slack.
- The passenger should occupy a rear seat with the safety belt correctly adjusted, with no slack.
- Start the engine and, with the steering on full right-hand lock, drive the vehicle in a continuous circle at 16 km/h (10mph). Do not exceed 16 km/h (10 mph) for this test.
- When the speed is stable, the passenger should attempt to slowly extract the safety belt webbing from each safety belt retractor in turn. If the vehicle motion sensitive lock mechanism is operating correctly, it will not be possible to extract the webbing.
- Any safety belt retractor from which it is possible to extract the webbing during this test must not be used. A new safety belt must be installed.

Static Test

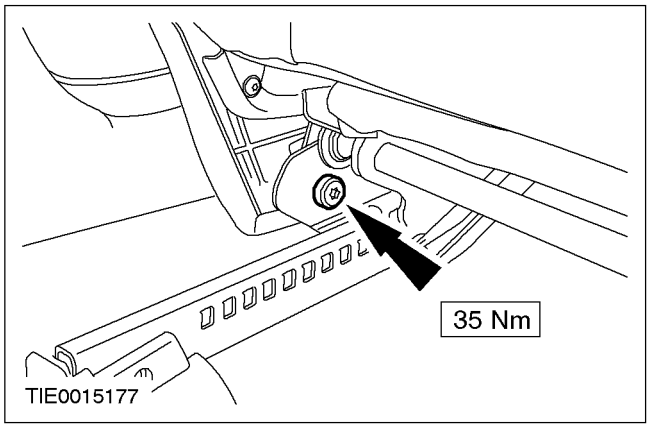
With the vehicle stationary and on level ground take firm hold of the safety belt webbing (on the tongue side of the safety belt upper anchor) and pull out quickly. The retractor should lock within 0.25 meter (10 inches), preventing further webbing payout. Any safety belt retractor from which it is possible to extract further webbing must not be used. A new safety belt must be installed.

REMOVAL AND INSTALLATION

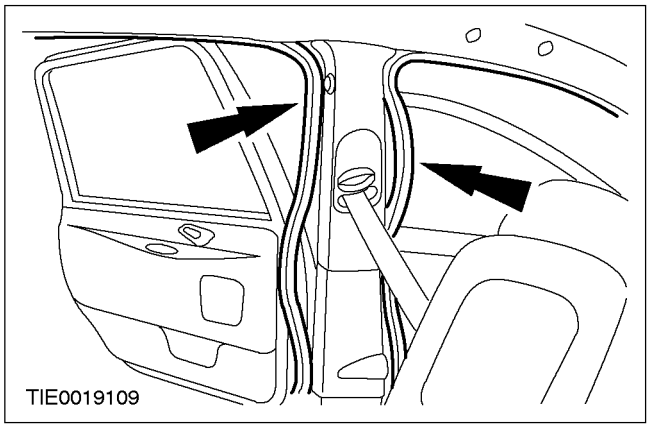
Front Safety Belt Retractor (40 222 0)

Removal

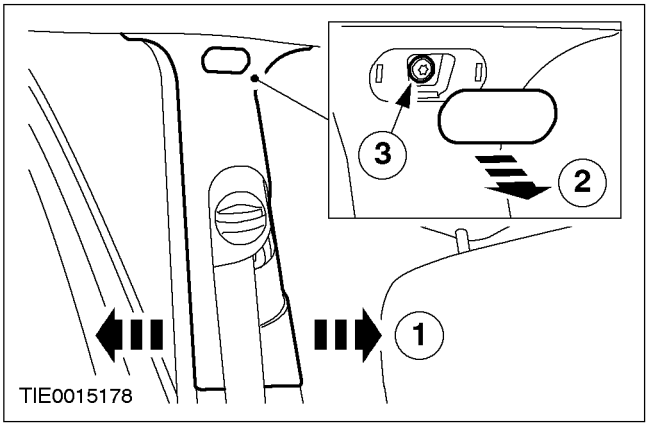
1. **Move the seat fully forwards.**
2. **Detach the safety belt lower anchor from the underside of the seat.**



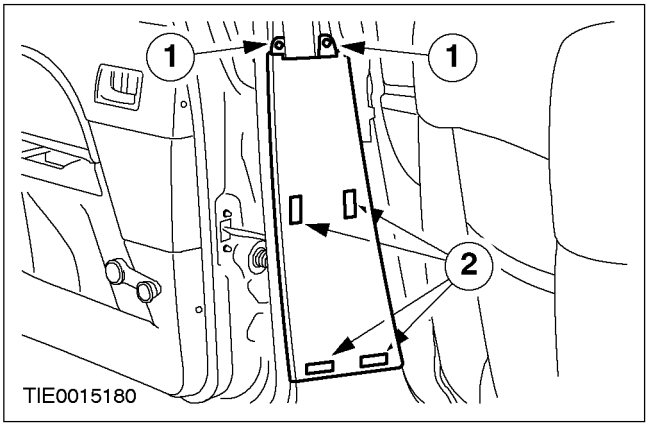
3. **Detach the door opening weatherstrips from the B-pillar.**



4. **Move the safety belt shoulder height adjuster to its lowest position.**
5. **Remove the B-pillar upper trim panel.**
   1. Detach the locating tangs from the B-pillar lower trim panel.
   2. Remove the screw cover.
   3. Remove the screw.
   - Feed the safety belt webbing through the B-pillar upper trim panel.



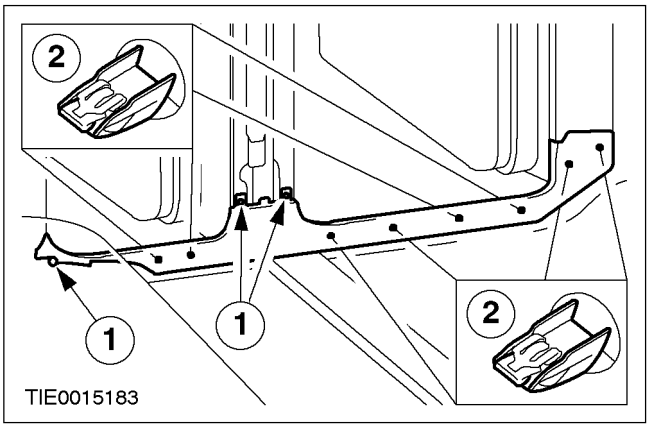
6. **Remove the B-pillar lower trim panel and reinforcement plate.**
   1. Remove the screws.
   2. Release the clips.



REMOVAL AND INSTALLATION (Continued)

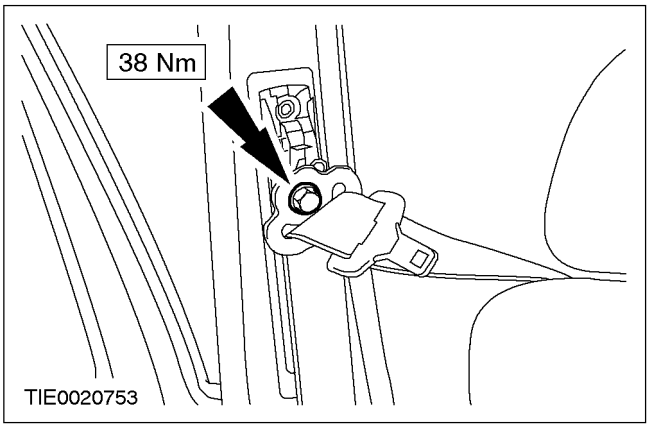
7. Remove the cowl side trim panel (front seat shown removed for clarity).

1. Remove the screws.
2. Release the clips.

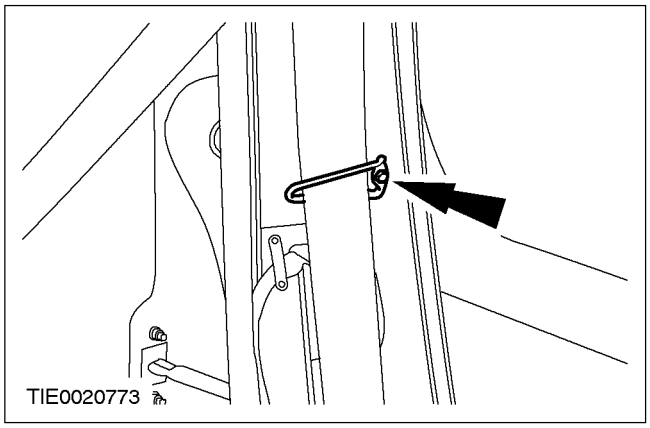


8. CAUTION: The bolt securing the safety belt anchor is held captive by a paper washer. The bolt, spacer and paper washer must remain on the safety belt anchor at all times when the safety belt is detached or removed.

Detach the safety belt upper anchor from the safety belt shoulder height adjuster.

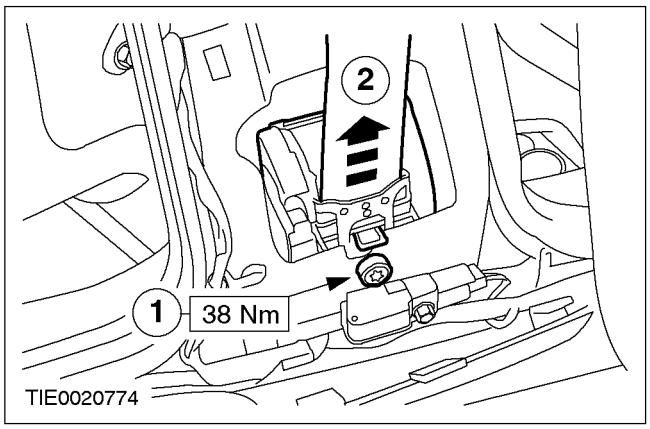


9. Detach the guide loop from the B-pillar.



10. Remove the front safety belt retractor.

1. Remove the bolt.
2. Lift the retractor to detach the locating tang.



Installation

1. CAUTION: Make sure the safety belt retractor locating tang is correctly located.

NOTE: Make sure the safety belt shoulder height adjuster locking control is correctly located on the safety belt shoulder height adjuster.

To install, reverse the removal procedure.

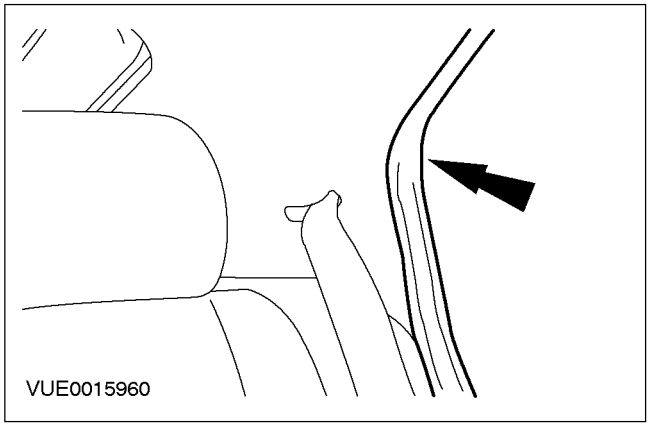
REMOVAL AND INSTALLATION

Rear Safety Belt Retractor — 4-Door/5-Door (40 248 0)

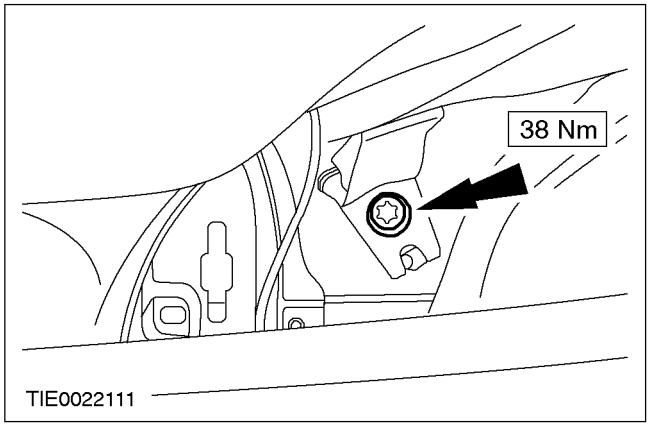
Removal

All vehicles

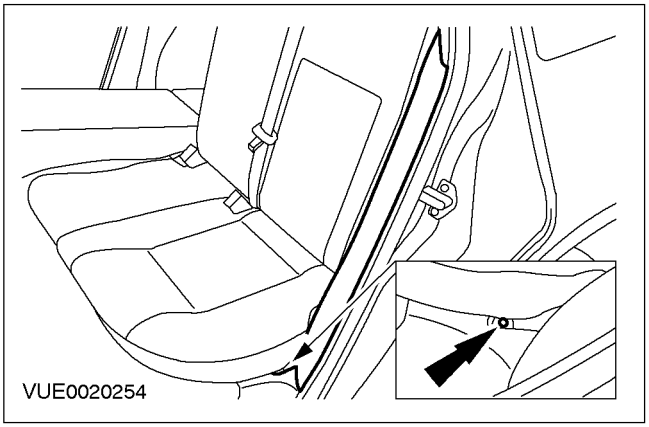
1. **Detach the rear door opening weatherstrip from the C-pillar.**



2. **Detach the rear safety belt lower anchor from the floor panel.**

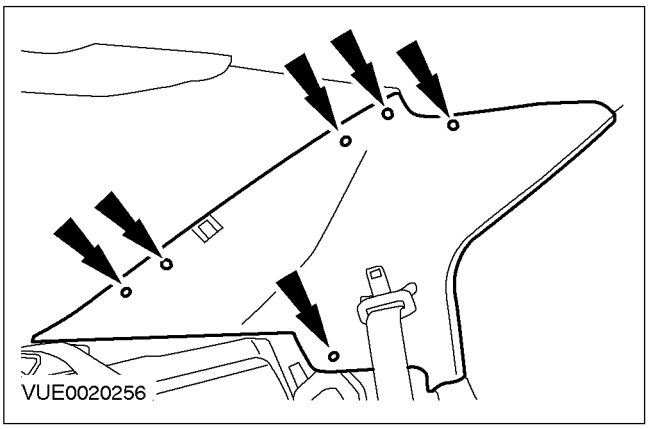


3. **Remove the C-pillar lower trim panel (vehicles with trim panel shown vehicles with seat bolster similar).**
   - Remove the C-pillar lower trim panel retaining screw.



4-door

4. **Remove the C-pillar trim panel.**
   - Feed the safety belt webbing through the C-pillar trim panel.

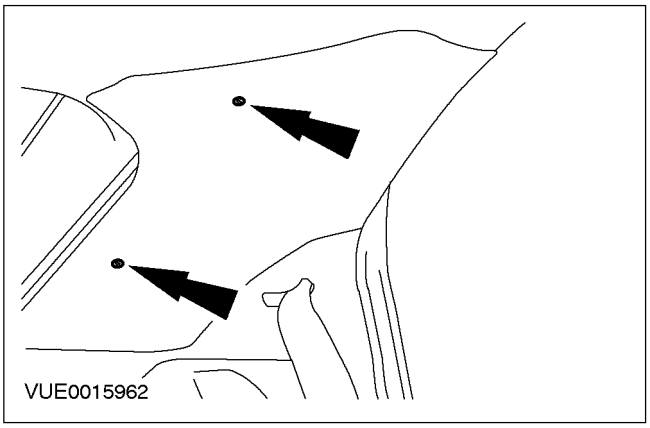


REMOVAL AND INSTALLATION (Continued)

5-door

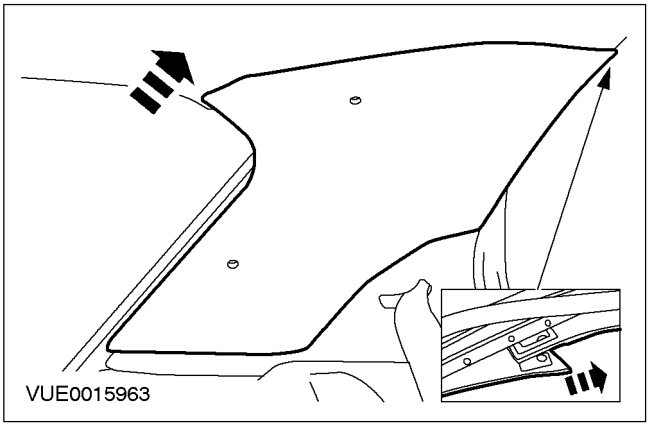
5. Remove the C-pillar upper trim panel screw.

- Remove the C-pillar trim panel blanking plug and retaining screw.



6. Remove the C-pillar upper trim panel.

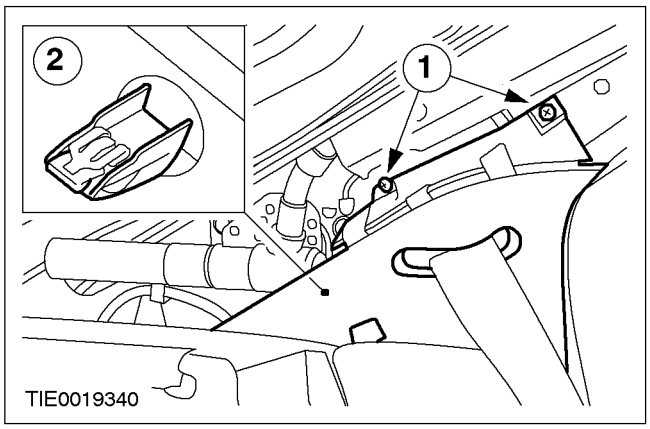
- Detach the C-pillar trim panel retaining clips and disconnect the rear window washer tube from the right-hand C-pillar trim panel.



7. Remove the C-pillar center trim panel.

1. Remove the retaining screws.
2. Detach the retaining clip.

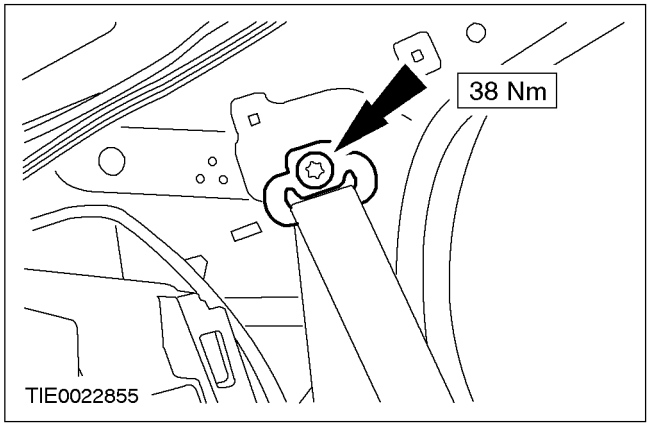
- Feed the safety belt webbing through the C-pillar center trim panel.



All vehicles

8. ⚠ CAUTION: The bolt securing the safety belt anchor is held captive by a paper washer. The bolt, spacer and paper washer must remain on the safety belt anchor at all times when the safety belt is detached or removed.

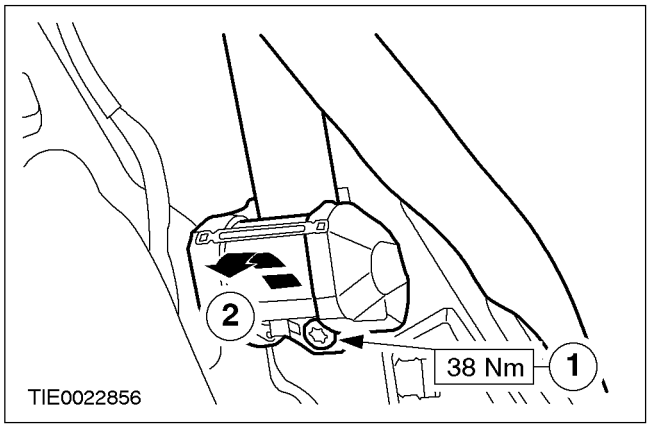
Detach the safety belt upper anchor from the C-pillar.



REMOVAL AND INSTALLATION (Continued)

9. Remove the rear safety belt retractor.

1. Remove the retaining bolt.
2. Lift the retractor to detach the locating tangs.



Installation

1. **CAUTION: Make sure the safety belt retractor locating tangs are correctly located.**

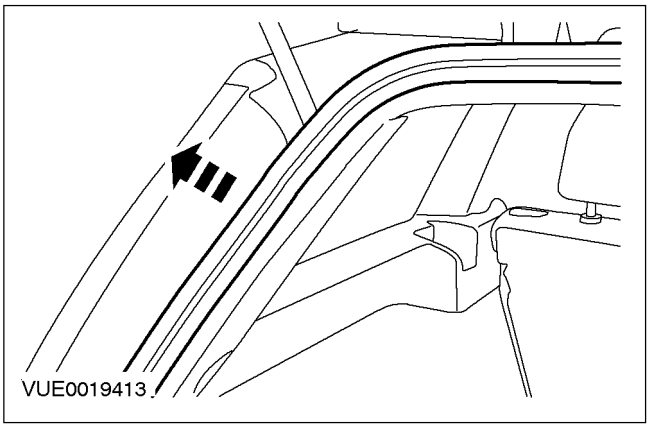
To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

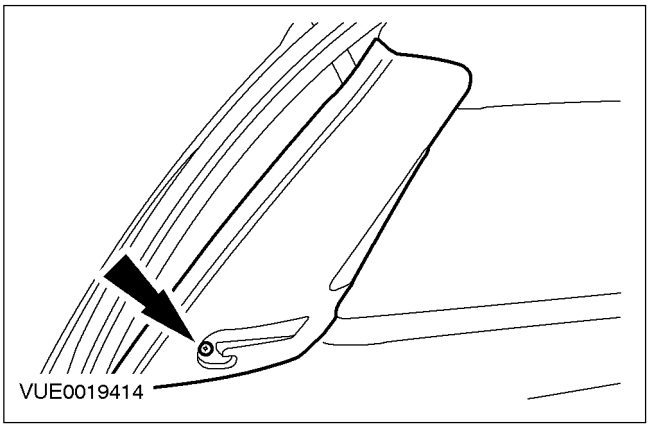
Rear Safety Belt Retractor — Wagon (40 248 0)

Removal

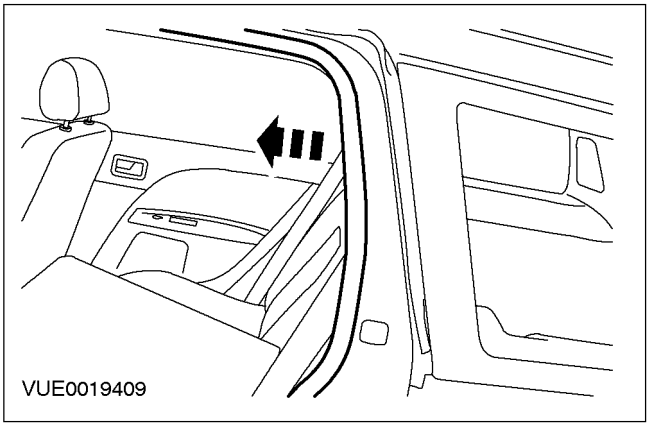
1. **Detach the liftgate opening weatherstrip from the D-pillar.**



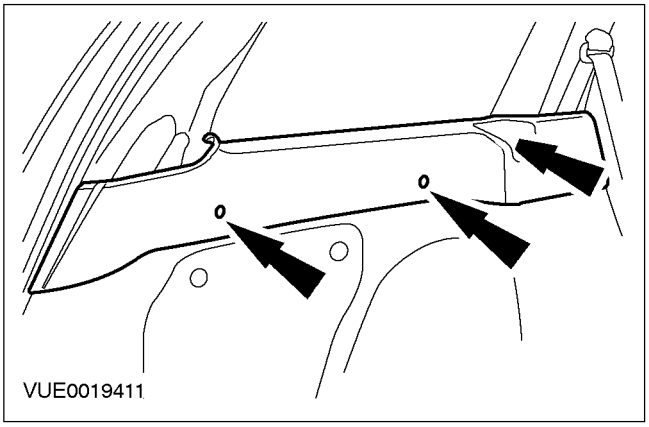
2. **Remove the D-pillar trim panel.**
   - Detach the D-pillar trim panel and disconnect the rear washer tube from the right-hand D-pillar trim panel.



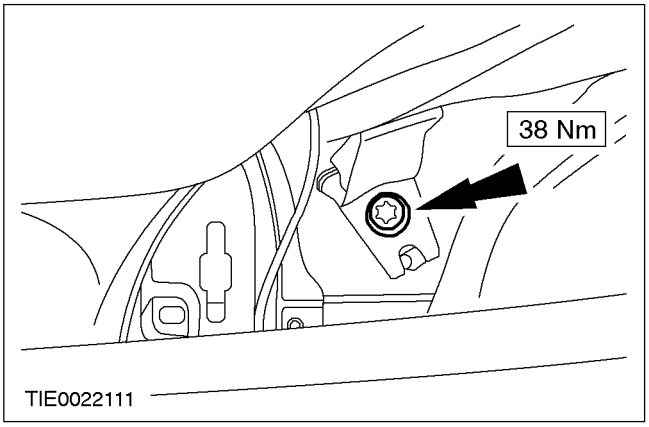
3. **Detach the rear door opening weatherstrip from the C-pillar.**



4. **Remove the load space upper trim panel.**
   - Remove the load space upper trim panel retaining screws.



5. **Detach the rear safety belt lower anchor from the floor panel.**

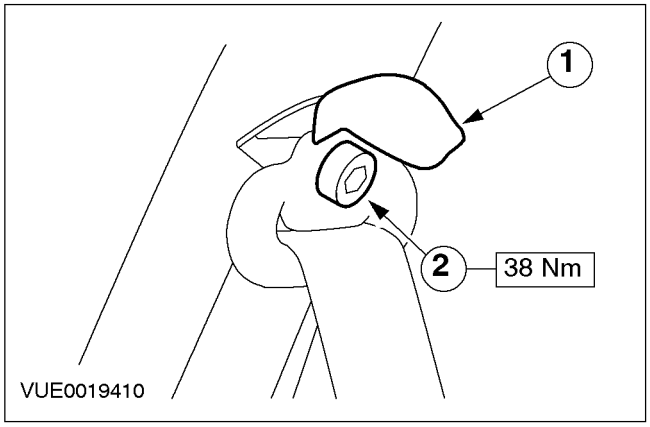


REMOVAL AND INSTALLATION (Continued)

6. **CAUTION: The bolt securing the safety belt anchor is held captive by a paper washer. The bolt, spacer and paper washer must remain on the safety belt anchor at all times when the safety belt is detached or removed.**

Detach the safety belt upper anchor from the C-pillar.

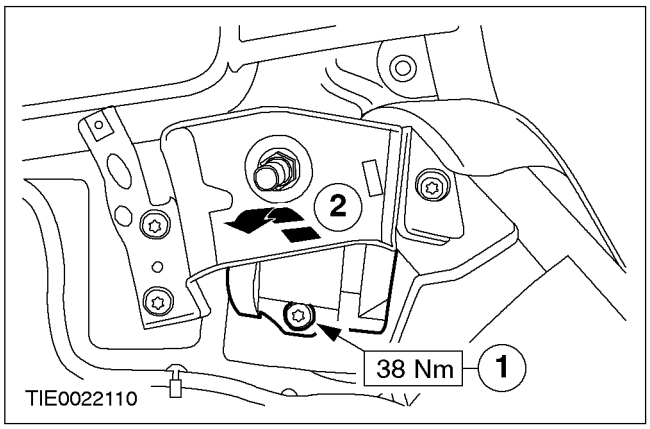
1. Detach the bolt cover.
2. Remove the retaining bolt.



7. **NOTE:** Reposition the load space trim panel carpet to access the rear safety belt retractor.

Remove the rear safety belt retractor.

1. Remove the retaining bolt.
2. Lift the retractor to detach the locating tangs.



Installation

1. **CAUTION: Make sure the safety belt retractor locating tangs are correctly located.**

To install, reverse the removal procedure.

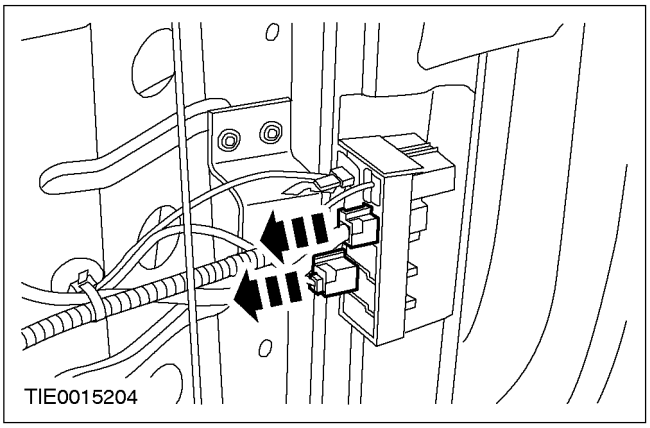
REMOVAL AND INSTALLATION

Safety Belt Buckle and Pretensioner (40 232 0)

Removal

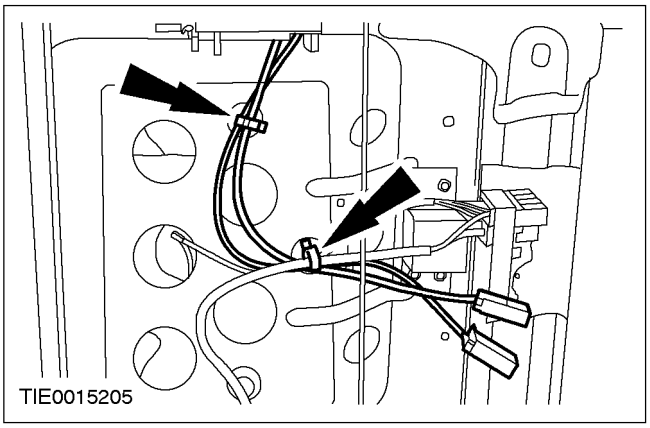
WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

1. **Remove the front seat. For additional information, refer to Section 501-10.**
2. **Disconnect the safety belt buckle switch and the safety belt buckle pretensioner electrical connectors.**

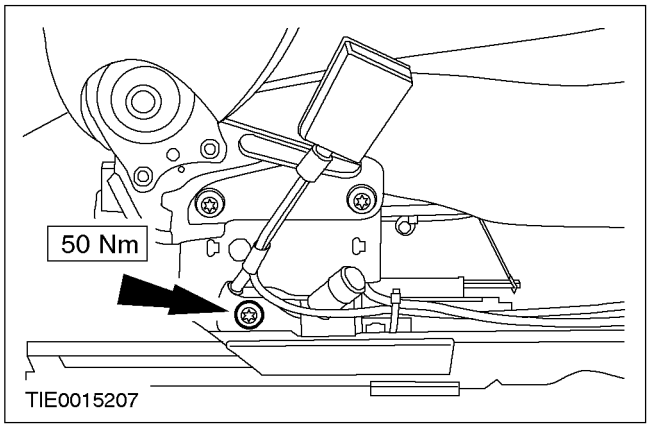


3. **CAUTION: Note the position and routing of the safety belt buckle switch and the safety belt buckle pretensioner wiring harnesses to aid assembly. An incorrectly routed wiring harness may lead to the wiring harness becoming damaged on the seat mechanism.**

   Detach the safety belt buckle switch and the safety belt buckle pretensioner wiring harnesses from the underside of the seat.



4. **Remove the safety belt buckle and pretensioner.**



Installation

1. **WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.**

   To install, reverse the removal procedure.

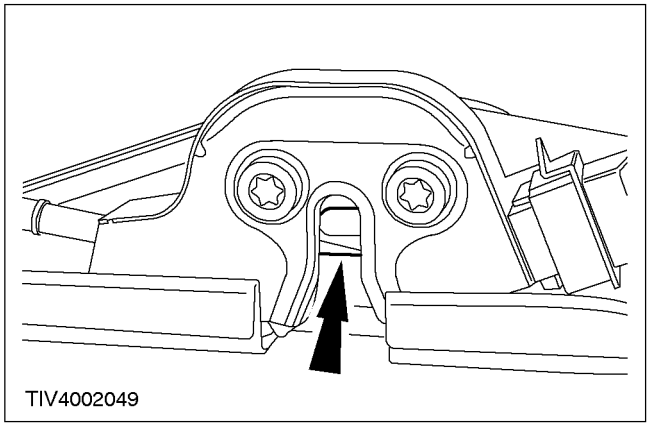
REMOVAL AND INSTALLATION

Rear Center Safety Belt Retractor — 5-Door/Wagon

General Equipment
Knife

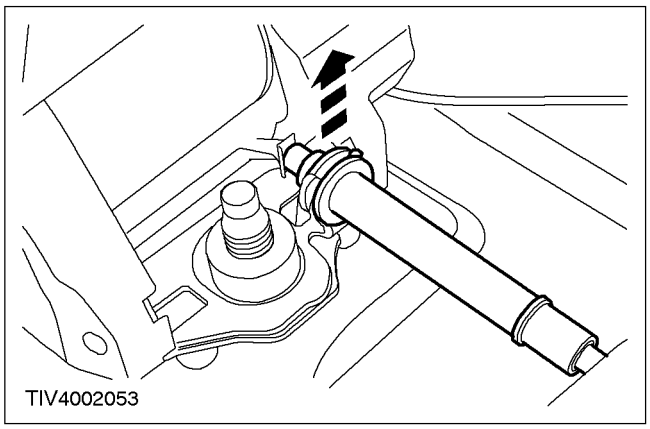
Removal

1. **Disassemble the rear seat backrest. For additional information, refer to Section 501-10.**
2. **Lock the rear seat backrest latch.**

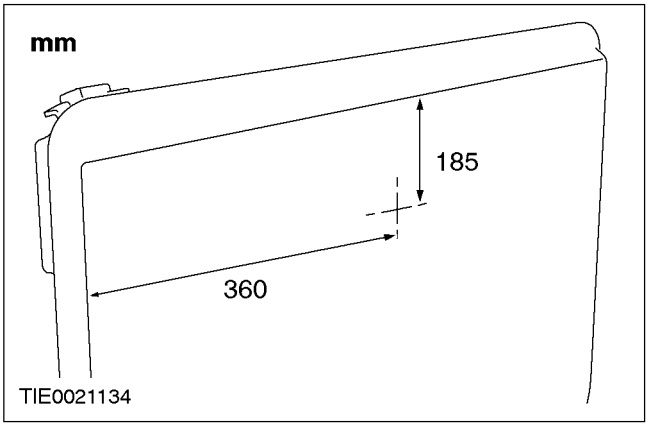


3. **NOTE:** Note the backrest latch cable position on the safety belt retractor to aid installation.

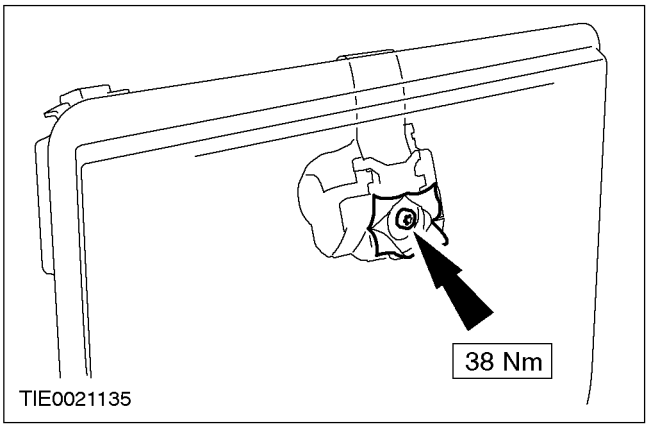
   Detach the backrest latch cable from the safety belt retractor.



4. **Using a suitable knife, cut the rear seat backrest carpet to access the safety belt retractor retaining bolt.**



5. **Remove the rear center safety belt retractor.**
   - Feed the safety belt webbing and safety belt buckle through the guide loop.



Installation

1. **CAUTION: Check the backrest latch cable routing, and the operation of the safety belt retractor and interlock before fully assembling the rear seat backrest.**

NOTE: Reinstall the self-adhesive backrest carpet to give the necessary finish.

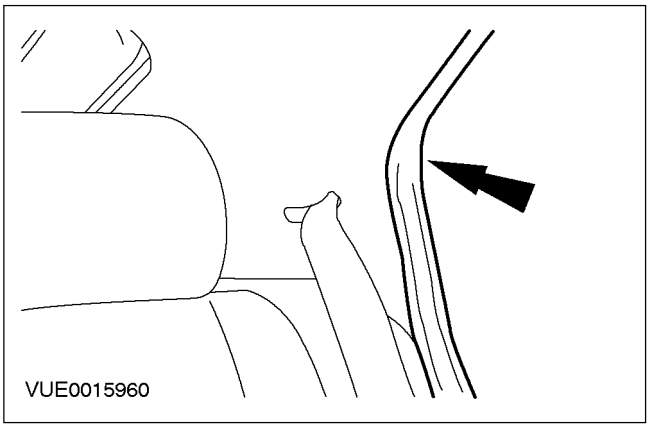
To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

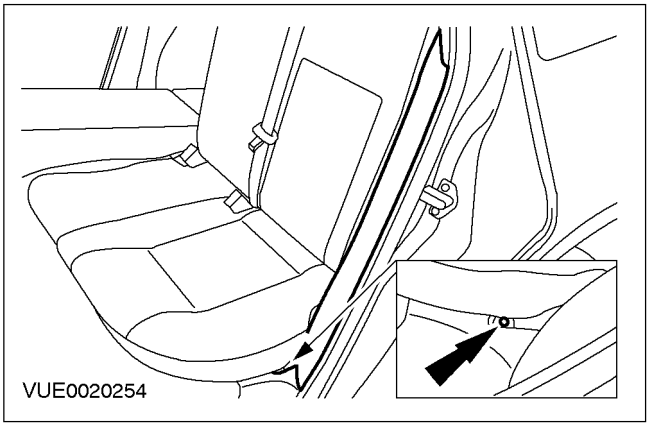
Rear Center Safety Belt Retractor — 4-Door

Removal

1. **Detach the rear door opening weatherstrip from the C-pillars.**

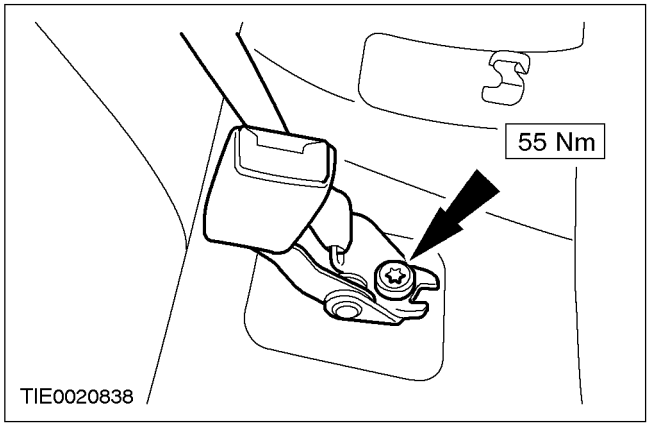


2. **Remove the C-pillar lower trim panels (vehicles with trim panel shown vehicles with seat bolster similar).**
   - Remove the C-pillar lower trim panel retaining screw.

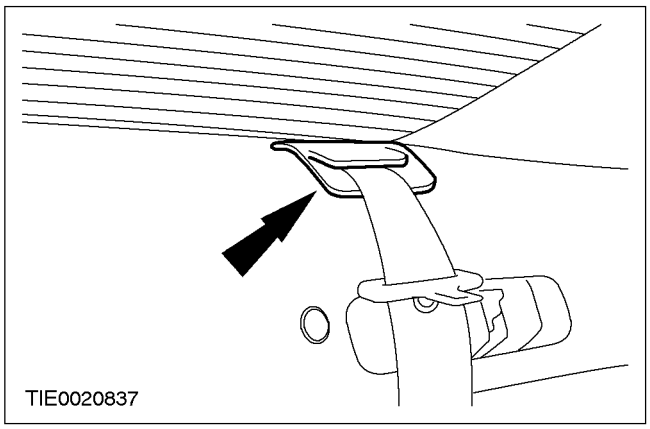


3. **Remove the rear seat cushion.**

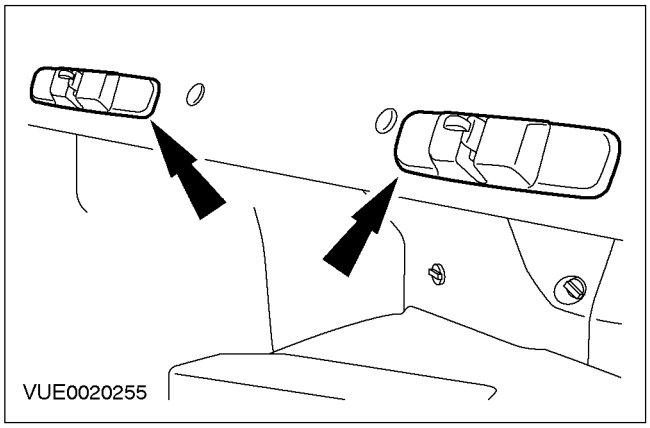
4. **Detach the center safety belt and buckle lower anchor from the floor panel.**



5. **Fold down the rear seat backrests.**
6. **Remove the center safety belt webbing trim panel.**



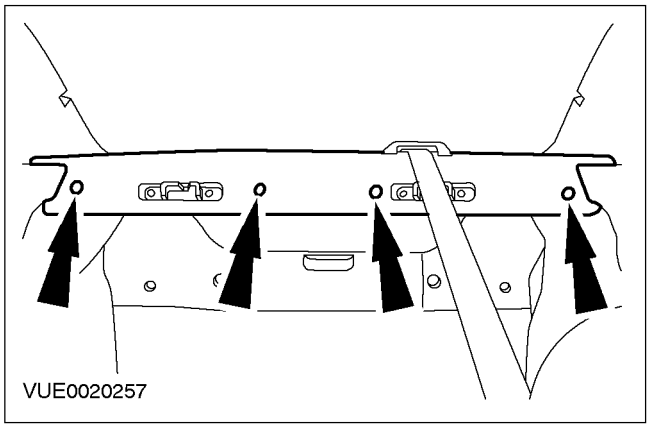
7. **Remove the rear seat backrest retaining latch trim panels.**



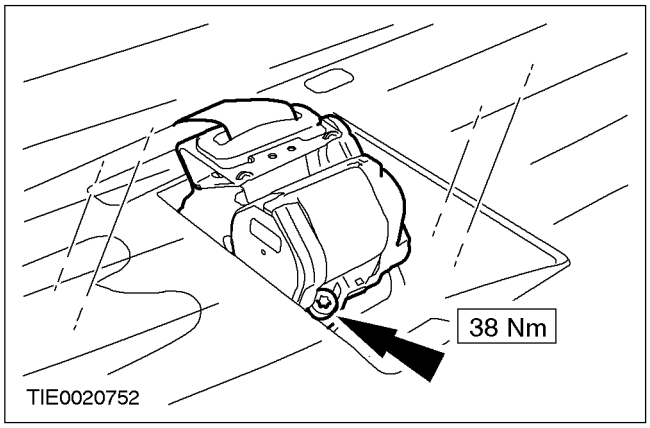
REMOVAL AND INSTALLATION (Continued)

8. Remove the parcel shelf.

- Feed the safety belt webbing through the parcel shelf.



9. Remove the rear center safety belt retractor.



Installation

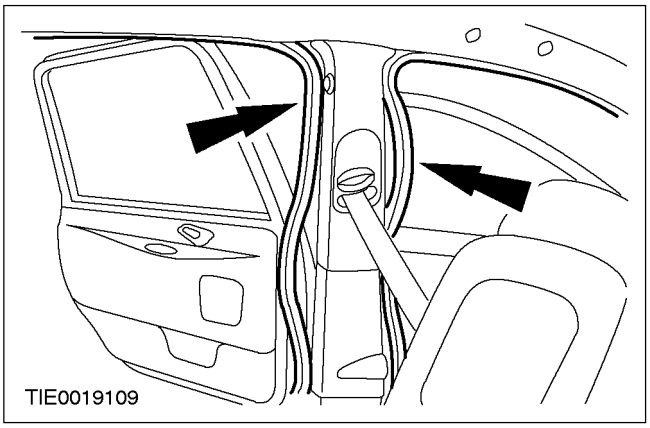
1. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

Safety Belt Shoulder Height Adjuster (40 225 0)

Removal

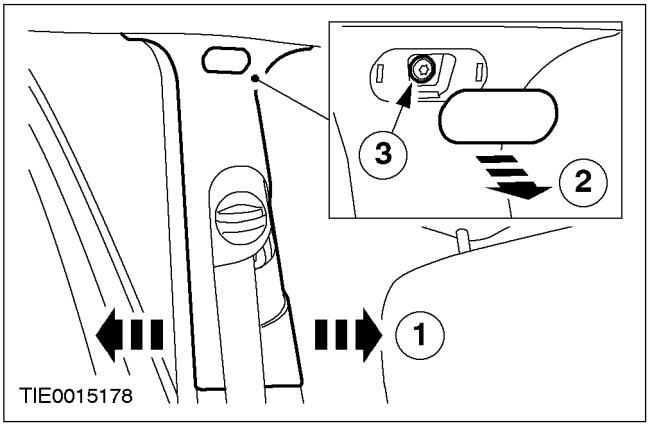
1. Detach the front and rear door opening weatherstrips from the B-pillar.



2. Move the safety belt shoulder height adjuster to its lowest position.

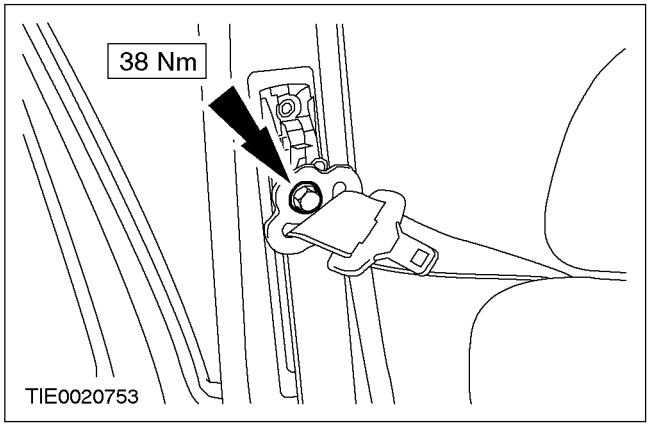
3. Detach the B-pillar upper trim panel from the B-pillar and position it to one side.

1. Detach the locating tangs from the B-pillar lower trim panel.
2. Remove the screw cover.
3. Remove the screw.



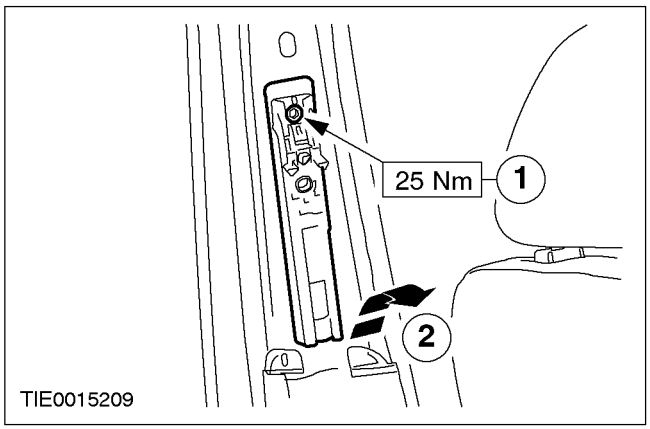
4. CAUTION: The bolt securing the safety belt anchor is held captive by a paper washer. The bolt, spacer and paper washer must remain on the safety belt anchor at all times when the safety belt is detached or removed.

Detach the safety belt upper anchor from the safety belt shoulder height adjuster.



5. Remove the safety belt shoulder height adjuster.

1. Remove the bolt.
2. Lift the adjuster to detach the locating tang.



Installation

1. NOTE: Make sure the safety belt shoulder height adjuster locking control is correctly located on the safety belt shoulder height adjuster.

To install, reverse the removal procedure.

SECTION 501-20B Supplemental Restraint System

VEHICLE APPLICATION: 2003.0 Mondeo

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SPECIFICATIONS

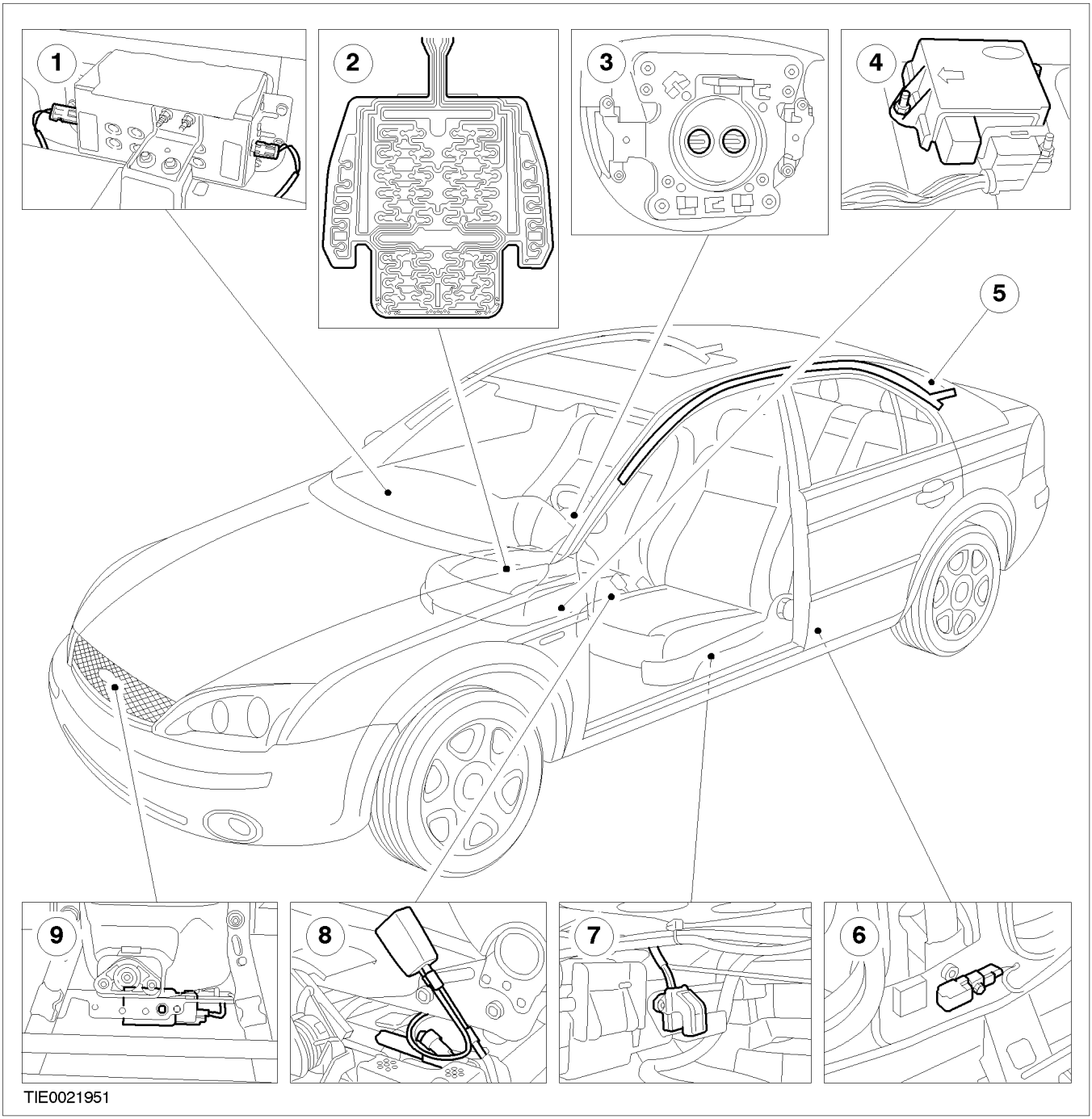
Torque Specifications

Description	Nm	lb-ft	lb-in
Driver air bag module retaining screws	5	–	44
Passenger air bag module to cross-vehicle beam retaining bolts	10	–	89
Passenger air bag module to instrument panel retaining bolts	7	–	62
Passenger air bag module deployment guide retaining nuts	4	–	35
Side air bag module retaining screws	3	–	27
Side air curtain module retaining bolts	5	–	44
Air bag control module retaining nuts	7	–	62
Crash sensor retaining bolt	8	–	71
Side impact sensor retaining bolt	7	-	62

DESCRIPTION AND OPERATION

Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

The supplemental restraint system (SRS) has been specifically designed to protect the driver and passengers from sustaining severe facial and upper body injuries in the event of a serious impact. Optimum protection can only be achieved when used in conjunction with the conventional three-point safety belts. The safety belts form an integral part of the SRS.



Item	Part Number	Description
1		Passenger air bag module

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
2		Occupant classification sensor
3		Driver air bag module
4		Air bag control module
5		Side air curtain module
6		Side impact sensor
7		Seat position sensor
8		Safety belt buckle switch 'part of the safety belt buckle and pretensioner'
9		Crash sensor

The driver, wearing the safety belt provided, should position the seat as far back as is practical, so the steering wheel can be reached with arms slightly angled, thereby leaving a gap between the steering wheel and the driver.

The passenger, wearing the safety belt provided, should not position himself or herself so that the air bag cover is in direct contact with the occupants' body.

The front air bags and safety belt buckle pretensioners will deploy in the event of a direct front impact or when the impact angle is up to 30 degrees from the left or right of the vehicle center line.

The air bag(s) and safety belt buckle pretensioners will deploy only once. In a collision in which they deployed at the first impact, the air bag(s) and safety belt pretensioners will not reduce the risk of injury in a subsequent impact.

In the event of a side impact, in which the side air bags deploy, the front air bags will still deploy in a subsequent front impact, provided that the front impact exceeds the triggering threshold.

Under certain circumstances, although the damage sustained by the vehicle may look extensive, the impact may remain below the triggering threshold of the SRS and the air bags will not deploy. In such circumstances the safety belts would provide sufficient protection for the occupants.

The visible VIN plate, which shows the air bag symbol and either X1, X2 or X4 dependent on the number of air bags fitted, is attached to the windshield edge of the instrument panel.

Vehicles equipped with side air bags can be identified by an embossed AIRBAG logo on the seat fabric adjacent to the air bag module. A label is attached to the B-pillar adjacent to the seat.



TIV9910132



TIV4003149



DTV4003021

WARNING: All vehicles fitted with the passenger air bag from the factory have a WARNING sticker attached to the instrument panel, PROHIBITING the use of rear facing child or baby seats.

The SRS consists of the following components:

DESCRIPTION AND OPERATION (Continued)

- Air bag control module with integral crash sensor
- Front two stage air bag modules
- Side air bag modules
- Side air curtain modules
- Front safety belt buckle and pretensioners (includes a safety belt buckle switch)
- Clockspring
- Crash sensor
- Side impact sensors (vehicle equipped with side air bags)
- Passenger occupant classification sensor
- Driver seat position sensor
- Air bag warning indicator
- Passenger air bag deactivation indicator

Air Bag Control Module

The air bag control module, located under the floor console, governs the operation of the whole system and performs continual system diagnostics. Information on the severity of an impact is received from the crash sensor and, in the event of a side impact, the corresponding side impact sensor.

In the event of a frontal impact, in excess of a predetermined limit, the air bag control module will evaluate the signal received from the front crash sensor against stored data and deploy the front air bag modules and the safety belt buckle pretensioners. However, the safety belt buckles will only deploy if the safety belt buckle is fastened. Variations in the deployment of the front air bag modules are dependent on the status of the driver seat position, passenger occupant classification sensor and the front safety belt buckles.

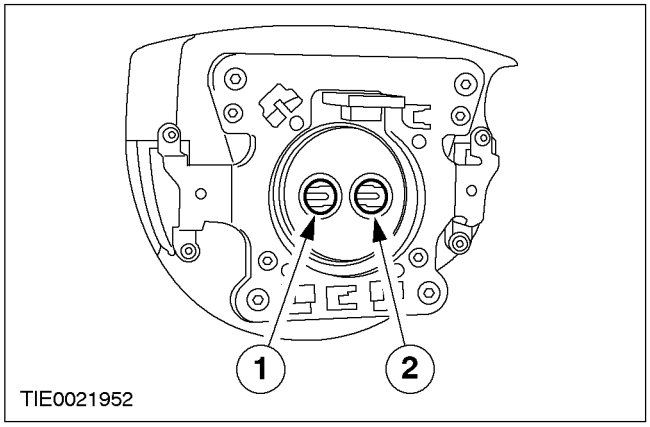
In the event of a side impact, in excess of a predetermined limit, the air bag control module will evaluate the signal received from either of the side impact sensors against stored data and deploy the corresponding side air bag module and, if equipped, the side air curtain module.

On vehicles equipped with the telematics system there is an interface with the telematics control module. In the event of an air bag deployment the telematics control module will automatically send a SOS signal.

In the event of a failure in the vehicle power supply during an accident, the air bag control module provides an auxiliary power supply, sufficient to deploy the air bag(s) for a minimum of 150 mS. The vehicle battery supply maintains the air bag control module auxiliary supply and supports all other SRS functions when the ignition is in the 'RUN' position. In the event of a fault being detected by the air bag control module the air bag warning indicator is illuminated. The behavior of the warning indicator depends on the type of fault present.

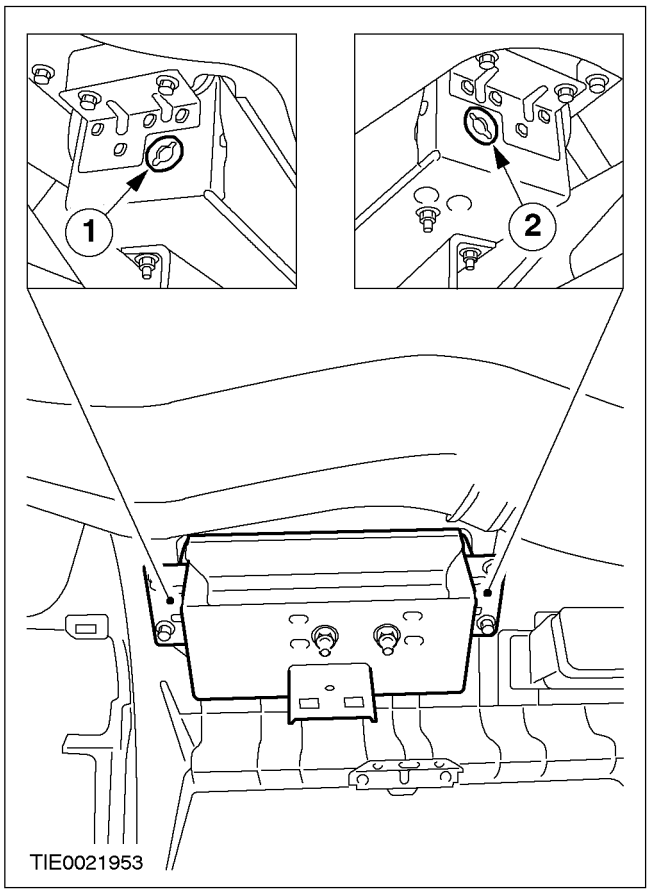
The air bag control module can be reset, using WDS, and used for up to five collisions in which the air bags deployed.

Front Two Stage Air Bag Modules.



Item	Part Number	Description
1		Driver air bag module first stage electrical connection (black electrical connector)
2		Driver air bag module second stage electrical connection (brown electrical connector)

DESCRIPTION AND OPERATION (Continued)



Item	Part Number	Description
1		Passenger air bag module first stage electrical connection (black electrical connector)
2		Passenger air bag module second stage electrical connector (brown electrical connector)

The driver air bag module is fitted to the steering wheel, the cover forming the outer surface of the steering wheel boss. The cover has invisible 'split lines' molded in its surface allowing the air bag to easily exit through the cover when the system deploys. The driver air bag has a volume of 55 liters.

A new driver air bag module and wiring harness with the air bag module electrical connectors must be installed following deployment.

The passenger air bag module is located above the glove compartment and is secured to the cross-vehicle beam and the instrument panel. The passenger air bag cover is an integral part of the instrument panel which has invisible 'split lines' to allow the passenger air bag to easily exit when the system deploys. The passenger air bag has a volume of 110 liters.

A new passenger air bag module and wiring harness with the air bag module electrical connectors must be installed following deployment.

Both the driver and passenger air bag modules contain two inflators. In the event of a frontal impact, in excess of a predetermined limit, the air bag control module will deploy the driver first stage inflator followed by the second stage inflator. The lapse time between the deployment of the first stage inflator and the second stage inflator is directly related to the accident severity and the information received by the air bag control module from the driver seat position sensor.

The air bag control module will also deploy the passenger air bag first stage inflator, provided that the passenger occupant classification sensor senses that the seat is occupied. The passenger second stage inflator will then also deploy and the lapse time between the first stage inflator deployment and the second stage inflator deployment is directly related to accident severity.

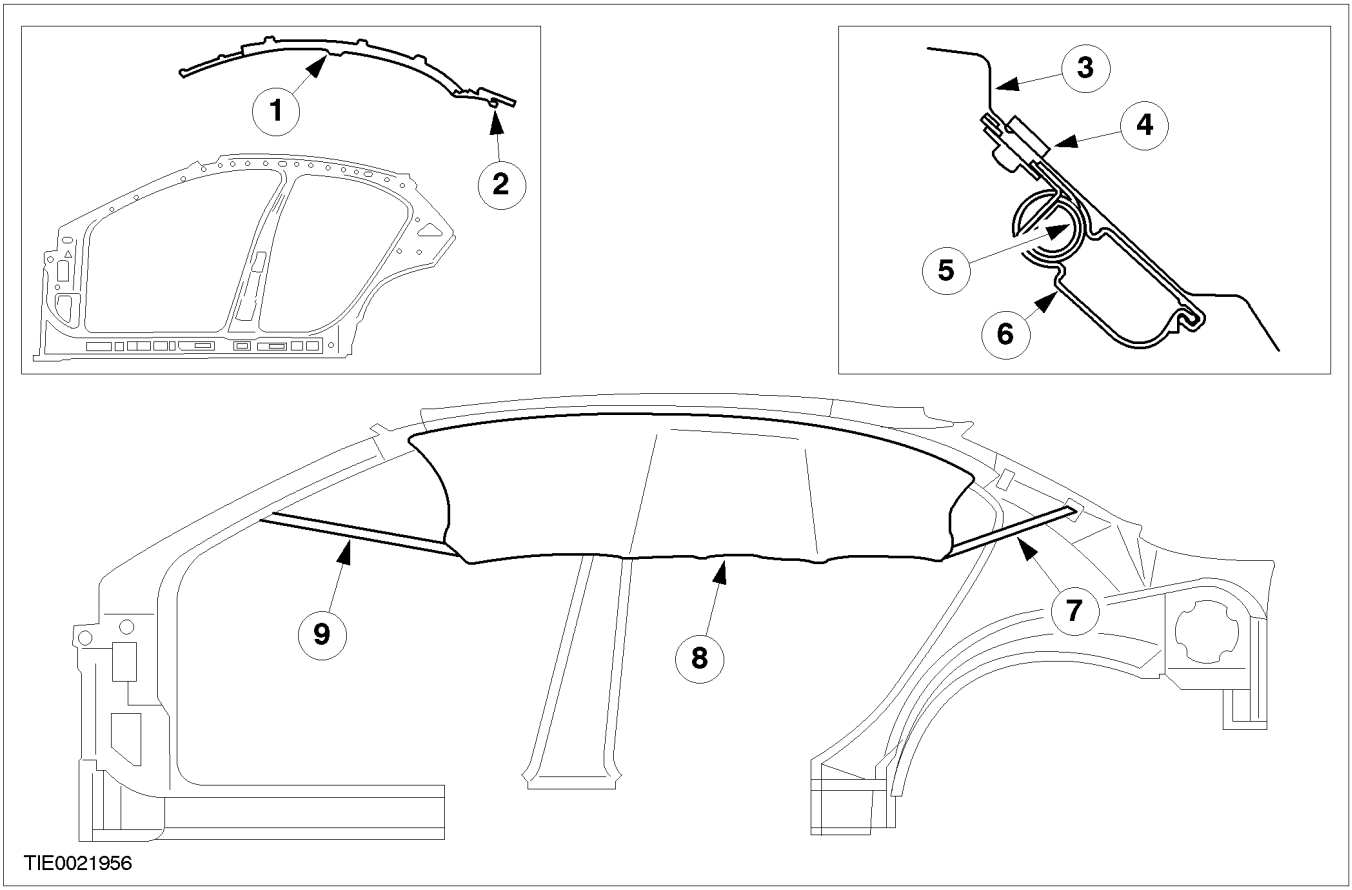
Regardless of the driver seat position or the passenger occupant classification sensor (unless the occupant classification sensor determines that the passenger seat is unoccupied) both the second stage inflators will deploy 100 mS following the first stage deployment. This 'disposal' deployment has no effect on the air bag pressure, but is a protection measure for the rescue services.

Side Air Bag Modules

The side air bag will deploy on the same side that the air bag control module received the signal from the side impact sensor. The side air bag modules, if equipped, are integrated into the front seat backrests providing an unobtrusive appearance. The unique seat cover has been designed to accommodate air bag deployment. When the side air bag is deployed the stitched seam of the seat cover adjacent to the side air bag module splits, allowing the air bag to exit the seat backrest unobstructed. Each side air bag has a volume of 11 liters.

DESCRIPTION AND OPERATION (Continued)

Side Air Curtain Modules



Item	Part Number	Description
1		Folded side air curtain module
2		Side air curtain module electrical connection
3		Roof panel
4		Side air curtain module retaining bolt
5		Side air curtain module inflator
6		Folded side air curtain
7		Side air curtain rear retaining cord
8		Unfolded side air curtain
9		Side air curtain front retaining cord

The side air curtain modules are located under the headliner between the A and C-pillar and deployed at the same time as the corresponding side air bag. If the passenger air bag is deactivated the corresponding side air bag is also deactivated, however the side air curtain will still deploy to afford protection to any corresponding rear occupant. When deployed, the side air curtain extends down to approximately shoulder height to protect both the front and rear occupants heads. Both the front and rear of the side air curtain are retained to the A and C-pillar respectively by cords.

The side air curtain inflator generates the gas needed to fill the side air curtain. It consists of a high strength steel casing filled with a solid propellant charge, an electrically activated ignitor and a cold gas bottle with pressurized gas. The ignitor is activated by a signal from the air bag control module, which ignites the propellant. The burning propellant opens the membrane of the cold gas bottle and heats the pressurized gas. The expanding gas is directed by the seal into the gas tube and emits through holes in the tube to the front and rear side air curtain chambers. The force of the occupant's heads on the side air curtain forces the gas from the front and rear

DESCRIPTION AND OPERATION (Continued)

chambers into an overflow chamber, thus producing a dampening effect. Each side air curtain has an approximate volume of 24 liters.

A new side air curtain module and wiring harness with the air curtain module electrical connectors must be installed following deployment.

Front Safety Belt Buckle and Pretensioners

The front safety belt buckles and pretensioners are seat mounted and incorporate a safety belt buckle switch. In the event of a front or side impact the air bag control module will deploy the pretensioners provided the safety belt buckles are fastened. The safety belt buckle pretensioners have a lower deployment threshold than that required by the air bags. Hence it is possible during a minor collision, which exceeds the deployment threshold, that only the safety belt pretensioners will deploy. The air bag control module receives information on the status of the safety belt buckles from a switch contained in the buckle. For additional information, refer to Section 501-20A / 501-20B.

A new safety belt buckle and pretensioner must be installed following deployment.

Air Bag and Safety Belt Pretensioners Deployment Logic

Restraint Device	Deployment Criterion	Deactivation Criterion
Driver safety belt pretensioner	Exceed the pretensioner deployment threshold Exceed the driver or front passenger side air bag deployment threshold	Driver safety belt buckle unfastened
Driver air bag	Exceed the driver air bag deployment threshold	-
Driver side air bag	Exceed the driver side air bag deployment threshold	-
Driver side air curtain	Exceed the driver side air bag deployment threshold	-
Front passenger safety belt pretensioner	Exceed the pretensioner deployment threshold Exceed the driver or front passenger side air bag deployment threshold	Passenger safety belt buckle unfastened Passenger seat not occupied
Front passenger air bag	Exceed the front passenger air bag deployment threshold	Passenger seat not occupied
Front passenger side air bag	Exceed the front passenger side air bag deployment threshold	Passenger seat not occupied
Passenger side air curtain	Exceed the front passenger side air bag deployment threshold	-

The driver and front passenger air bags have different deployment thresholds for when the safety belt buckle is fastened or unfastened. If the driver or front passenger safety belt buckle is unfastened the respective air bag deployment threshold will be lower than a fastened safety belt buckle deployment threshold.

With the driver seat in the forward position and the driver safety belt buckle fastened, the driver air bag will be deployed at the driver safety belt buckle unfastened threshold.

Safety Belt Buckle	Air Bag Deployment Threshold
Driver safety belt buckle fastened	Driver air bag will be deployed at the fastened threshold
Driver safety belt buckle unfastened	Driver air bag will be deployed at the unfastened threshold
Driver safety belt buckle fastened and the driver seat in the forward position	Driver air bag will be deployed at the unfastened threshold

DESCRIPTION AND OPERATION (Continued)

Safety Belt Buckle	Air Bag Deployment Threshold
Driver safety belt buckle unfastened and the driver seat in the forward position	Driver air bag will be deployed at the unfastened threshold
Front passenger safety belt buckle fastened	Front passenger air bag will be deployed at the fastened threshold
Front passenger safety belt buckle unfastened	Front passenger air bag will be deployed at the unfastened threshold

Depending on which front safety belt buckle(s) are fastened and the severity of the impact, there are scenarios where it is possible that only one of the two front air bags will be deployed. For example: The driver safety belt buckle unfastened, passenger safety belt buckle fastened and the impact has reached the unfastened threshold. The driver air bag will deploy but the driver safety belt pretensioner will not deploy, passenger air bag will not deploy but the passenger safety belt pretensioner will deploy.

Clockspring

The clockspring is designed to carry signals between the air bag control module and the driver air bag module. The clockspring is fitted to the steering column, and consists of fixed and moving parts connected by a coiled Mylar tape with integral conducting tracks. The Mylar tape is able to 'wind up' and 'unwind' as the steering wheel (to which the moving part is attached) is turned, maintaining electrical contact at all times between the air bag control module and the driver air bag module.

It is advisable to install a new clockspring following a driver air bag deployment.

Crash Sensor

The front crash sensor is located under the radiator grill opening panel to facilitate impact sensing along the longitudinal axis. The air bag control module processes the crash data sent by the front crash sensor against stored data, and deploys the front air bags.

The crash sensor can be reused following external examination and system self-test.

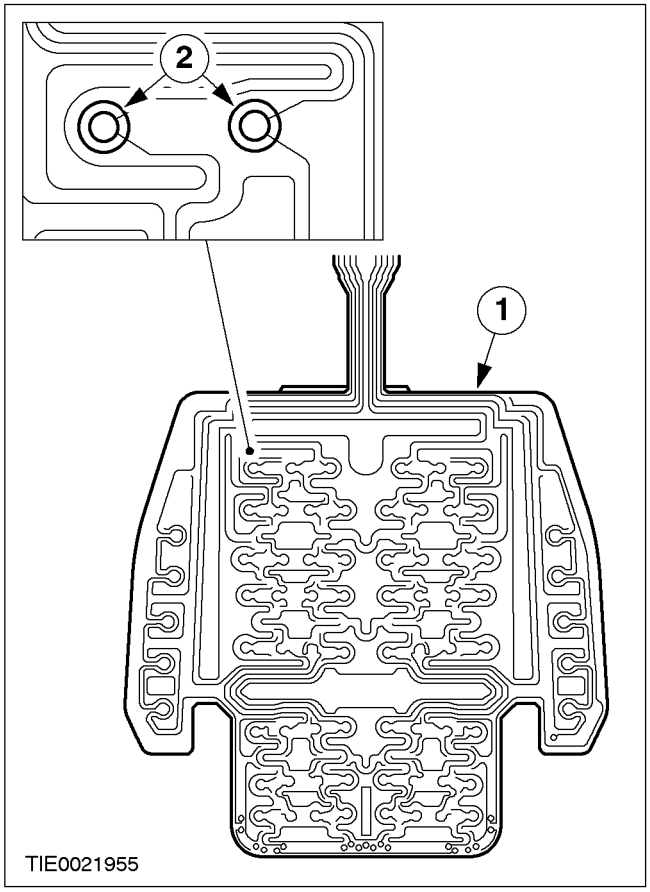
Side Impact Sensor

The side impact sensors are mounted at the base of the B-pillars to facilitate lateral impact sensing. In the event of a side impact, the air bag control module processes the crash data sent by the side impact sensor against stored data. The air bag control module will deploy the side air bag, both safety belt buckle pretensioners and, if equipped, the side air curtain on the side the deployment request was initiated.

The side impact sensors can be reused following external examination and system self-test.

Occupant Classification Sensor

NOTE: The occupant classification sensor is an integral part of the passenger seat cushion and cannot be serviced separately.



DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1		Occupant classification sensor mat
2		Seat sensors 'part of the occupant classification sensor mat'

The passenger occupant classification sensor consists of the following components:

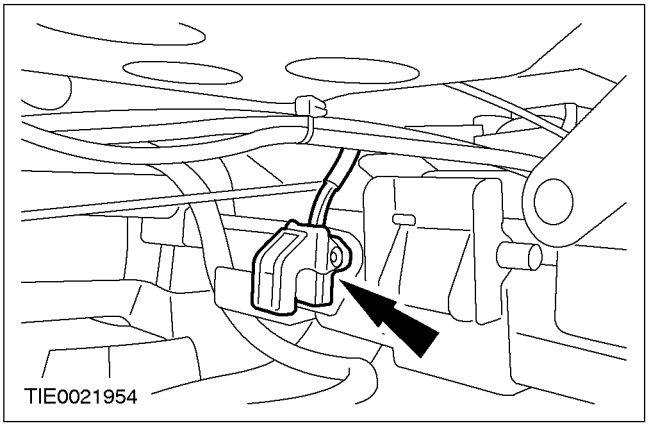
- Sensor mat with integrated pressure sensors.
- Electronic control unit
- Wiring harness

The occupant classification sensor detects, by integrated pressure sensors, the presence of a passenger or object on the seat cushion. The occupant classification sensor cannot discriminate between a passenger and an object. The electronic control unit processes the pressure information and, if the pressure exceeds a threshold, an 'Occupied Seat' state is communicated through the wiring harness to the air bag control module. If the seat is empty or occupied by a very light object an 'Empty Seat' state is transmitted to the air bag control module and the passenger air bag will be deactivated to avoid unnecessary repair costs. If the seat is empty and the safety belt is buckled the passenger air bag deactivation indicator will be illuminated.

The occupant classification sensor system is not affected by the position of the passenger seat.

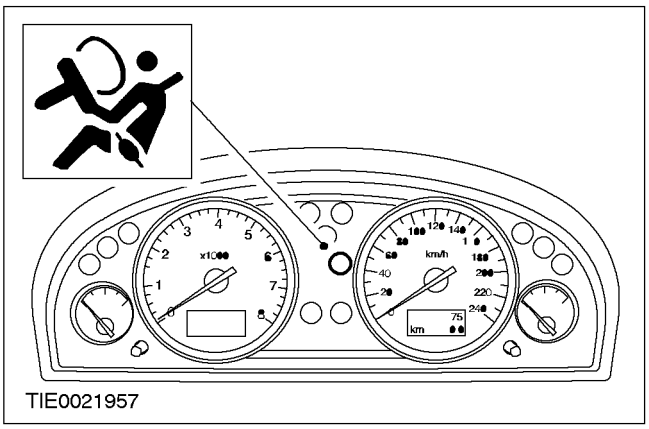
The electronic control unit monitors the occupant classification sensor and if a fault is detected will communicate the fault to the air bag control module through the corporate area network (CAN) and illuminate the air bag warning light.

Seat Position Sensor



The seat position sensor is located on the driver seat track. The seat position sensor determines the position of the driver seat, which is then communicated to the air bag control module. If the driver seat is in the forward position, the driver air bag second stage is disabled.

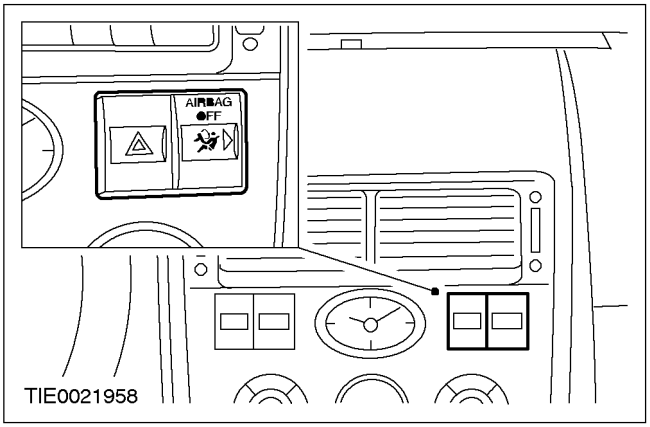
Air Bag Warning Indicator



The air bag warning indicator is located in the instrument cluster. In the event of a fault being detected by the air bag control module, the warning indicator flashes a corresponding flash code five times and then remains illuminated.

DESCRIPTION AND OPERATION (Continued)

Passenger Air Bag Deactivation (PAD) Indicator



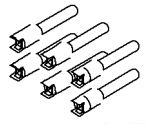
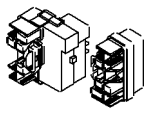
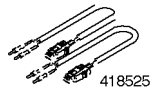
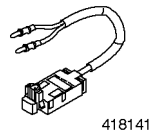
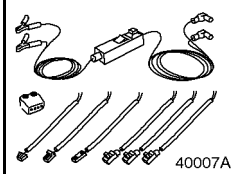
The PAD indicator is located in the instrument panel. The PAD indicator functions as follows:

- The PAD indicator performs a six second prove out when the ignition is in the RUN position, which is the same prove out time as the air bag warning indicator.
- During the ignition cycle, the PAD indicator will only illuminate if the passenger seat is empty and the front passenger safety belt buckle is fastened.

DIAGNOSIS AND TESTING

Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

Refer to Wiring Diagrams Section 501-20B for schematic and connector information.

Special Tool(s)	
 501073	Simulator, Air Bag Module 501–073 (40–016)
 501077	Simulator, Occupant Restraint Systems 501–077 (40–019)
 418525	Test and Deployment Lead, Driver; Passenger and Side Air Bag Module 418–525 (40–007–14)
 418141	Test and Deployment Lead, Side Air Curtain Module 418–141 (40–007–08)
 40007A	Test and Deployment Lead, Air Bag/Pyrotechnic Safety Belt 418–S055 (40–007A)

General Equipment
WDS

Diagnosing Customer Concerns Without Hard DTCs/LFCs

WARNING: The back up power supply must be depleted, before any work is carried out on the supplemental restraint system. Wait at least one minute after disconnecting the battery ground cable. Failure to follow this instruction may result in personal injury.

NOTE: Following the pinpoint tests when a diagnostic trouble code/lamp fault code (DTC/LFC) is not present, will result in needless replacement of air bag system components and repeat repairs.

Speak with the customer to determine if a particular set of conditions must be met in order for a fault to occur. If a LFC is reported by the customer but is not present when the vehicle comes in for repair, pinpoint test diagnostics cannot be used. Instruct the customer on how to count a LFC.

Diagnosing Customer Concerns with Hard DTCs/LFCs

WARNING: Do not use substitute air bag simulators when working on the supplemental restraint system. Use only the appropriate tool. Failure to follow this instruction may result in personal injury.

Most air bag system diagnostic procedures require the use of system deactivation and system reactivation procedures. These procedures require the air bag module(s) and safety belt buckle pretensioners to be disconnected from the SRS, thereby removing the risk of air bag deployment while diagnostics are carried out.

Air bag simulators are required to carry out diagnosis and testing of the air bag system. The simulator contains a resistor, used to simulate an air bag module connection to the system. It is not acceptable to short-circuit the air bag module connections with a 0 ohm jumper wire. If a 0 ohm jumper wire is used to short-circuit the air bag module connections, a LFC will be displayed and a DTC logged by the air bag control module.

Deactivation

WARNING: The back up power supply must be depleted, before any work is carried out on the supplemental restraint system. Wait at least one minute after disconnecting the battery ground cable. Failure to follow this instruction may result in personal injury.

DIAGNOSIS AND TESTING (Continued)

NOTE: When the passenger underseat simulator is installed on vehicles equipped with the Occupant Classification System, the passenger air bag deactivation (PAD) indicator will illuminate continuously when the ignition is turned to the RUN position, provided the seat is empty. The simulator is designed to simulate an empty seat and a fastened passenger safety belt buckle.

1. Disconnect the battery ground cable. REFER to Section 414-01.
2. Wait at least one minute for the backup power supply in the air bag control module to deplete its stored energy.

WARNING: Place the air bag module on a ground wired bench, with the trim cover facing up to avoid accidental deployment. Failure to follow this instruction may result in personal injury.

3. Remove the driver air bag module from the vehicle. REFER to Driver Air Bag Module in this section.
4. Connect the air bag simulators to the sub-harnesses in place of the driver air bag module at the top of the steering column.
5. Disconnect the passenger air bag module electrical connectors. REFER to Passenger Air Bag Module in this section.
6. Connect the air bag simulators to the wiring harnesses in place of the passenger air bag module.
7. Disconnect the both side air curtain module electrical connectors. REFER to Side Air Curtain Module-4-Door / Side Air Curtain Module-5-Door / Side Air Curtain Module-Wagon in this section.
8. Connect the air bag simulators to the wiring harnesses in place of the side air curtain modules.
9. Disconnect the driver underseat air bag electrical connector.
10. Connect the driver underseat air bag simulator to the floor harness.
11. Disconnect the passenger underseat air bag electrical connector.
12. Connect the passenger underseat air bag simulator between the floor harness electrical connector and the passenger seat harness electrical connector.
13. Connect the battery ground cable. REFER to Section 414-01.

Reactivation

WARNING: The air bag simulators must be removed and the air bag modules reconnected when reactivated to avoid non-deployment in a collision. Failure to follow this instruction may result in personal injury.

DIAGNOSIS AND TESTING (Continued)

1. Disconnect the battery ground cable. REFER to Section 414-01.
2. Wait at least one minute for the backup power supply in the air bag control module to deplete its stored energy.
3. Remove the driver air bag simulators from the sub-harness at the top of the steering column.
4. Connect and install the driver air bag module. REFER to Driver Air Bag Module in this section.
5. Remove the passenger air bag simulators from the passenger air bag module wiring harnesses.
6. Connect and install the passenger air bag module. REFER to Passenger Air Bag Module in this section.
7. Remove the side air curtain simulators from the side air curtain module wiring harnesses.
8. Connect and install the side air curtain modules. REFER to Side Air Curtain Module-4-Door / Side Air Curtain Module-5-Door / Side Air Curtain Module-Wagon in this section.
9. Remove the driver underseat air bag simulator.
10. Connect the driver underseat air bag electrical connector.
11. Remove the passenger underseat air bag simulator.
12. Connect the passenger underseat air bag electrical connector.
13. Connect the battery ground cable. REFER to Section 414-01.
14. Prove out the system.

Glossary

Air Bag Simulator

Air bag simulators are used to simulate air bag module connections to the system.

Deactivate the System

Deactivate the system means to carry out the deactivation procedure.

Prove Out the System

The air bag warning indicator will illuminate for six seconds. If a fault is detected the indicator flashes a corresponding fault code five times and then remains illuminated continuously.

Reactivate the System

Reactivate the system means to carry out the reactivation procedure.

Principles of Operation

Supplemental Restraint System (SRS) Operation

The vehicle is equipped with a DC fired sensing system.

Air bag deployment will only occur, in the event of a severe collision when the ignition key is in the RUN position.

Air Bag Control Module

The air bag control module retains full control of the whole system, providing continual system checks and full diagnostic capabilities. The non-volatile memory stores the fault codes, which are down loaded through the diagnostic link connector to WDS.

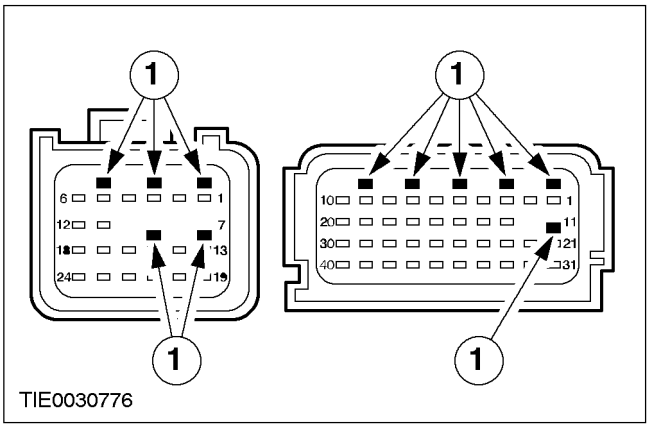
In the event of a failure in the vehicle power supply during an accident, the air bag control module provides an auxiliary power supply, sufficient to deploy the front air bag(s) for a minimum of 150mS. The auxiliary power supply is discharged by the air bag control within 60 seconds of the battery ground cable being disconnected. Thus making sure the supplemental restraint system remains operational.

The air bag control module contains a microcontroller to evaluate and process impact data. The front crash sensor discriminates frontal impacts and provides information on the severity of the impact to the air bag control module. The side impact sensors discriminates lateral impacts and provides information on the severity of the impact to the air bag control module.

The air bag control module will initiate the deployment of the appropriate air bags as soon as an impact of sufficient severity is detected.

DIAGNOSIS AND TESTING (Continued)

Air Bag Control Module Wiring Harness Connectors



Item	Part Number	Description
1	-	Connector shorting bar positions

Both air bag control module connectors have shorting bars on the harness side for air bag circuits. Pin numbers remain constant where pin positions have been removed due to the shorting bars.

Front Crash Sensor and Side Impact Sensors

Both the front crash sensor and the side impact sensors contain an acceleration sensor, filter, amplifier and an application specific integrated circuit for signal transmitting. In the event of a collision, in excess of a predetermined limit, the front crash sensor or a side impact sensor will initiate a deployment request to the air bag control module. The signal received by the air bag control module is evaluated and processed against stored data. The front crash sensor and the side impact sensors do not process the impact data.

Air Bag Warning Indicator

The air bag warning indicator is incorporated into the instrument cluster, together with the automatic detach detect (ADD) circuit. The air bag warning indicator illuminates for six seconds at key ON. If the system self-tests OK the indicator extinguishes, if a fault is detected the indicator flashes a corresponding fault code five times and then remains illuminate continuously.

The ADD circuit is designed to illuminate the air bag warning indicator continuously, if the air bag control module circuit is broken, either by loss of power or ground supply or electrical connector disconnection.

Diagnostic evaluation of the supplemental restraints system can be made through the data link connector (DLC) and WDS to establish the nature of the concern. Once the DTC is known the appropriate course of action can be selected from the Symptom Chart.

Inspection and Verification

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Electrical
- Fuse(s) - Electrical connector(s) - Circuit(s) - Wiring harness - Air bag module(s) - Bulb

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, connect the diagnostic tool to the data link connector and select the vehicle to be tested from the diagnostic tool menu.
5. Retrieve the DTCs and refer to the Symptom Chart.

DIAGNOSIS AND TESTING

Diagnostic Instructions - Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

Inspection and Verification

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical or electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, connect the diagnostic tool to the data link connector and select the vehicle to be tested from the diagnostic tool menu.
5. Retrieve the DTCs and refer to the Symptom Chart.

Visual Inspection Chart

Electrical
- Fuse(s) - Electrical connector(s) - Circuit(s) - Wiring harness - Air bag module(s) - Bulb

Symptom Chart

Condition	Possible Sources	Action
•No communication with the module	•Fuse. •DLC. •Circuit(s). •Air bag control module.	•Go to Pinpoint Test A.
•DTC B1231: Longitudinal acceleration threshold exceeded. Lamp flash code: 13	•Crash data memory full.	•Data cannot be cleared with WDS. INSTALL a new air bag control module. REFER to Air Bag Control Module in this section. REPEAT the self-test, CLEAR the DTCs.
•DTC B1342: Air bag control module is defective. Lamp flash code: 12	•Air bag control module.	•INSTALL a new air bag control module. REFER to Air Bag Control Module in this section. REPEAT the self-test, CLEAR the DTCs.
•DTC B1869: Air bag warning indicator open circuit or short to ground. Lamp flash code: continuous	•Circuit(s). •Instrument cluster. •Air bag control module.	•GO to Pinpoint Test B.
•DTC B1870: Air bag warning indicator short to battery. Lamp flash code: continuous	•Circuit. •Instrument cluster.	•GO to Pinpoint Test C.
•DTC 1884: Passenger air bag deactivation indicator inoperative. Lamp flash code: 18	•Circuit(s). •Air bag control module. •Passenger air bag deactivation indicator.	•GO to Pinpoint Test D.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
•DTC B1890: Passenger air bag deactivation indicator short to battery. Lamp flash code: 18	•Circuit(s). •Passenger air bag deactivation indicator.	•GO to Pinpoint Test E.
•DTC B1891: Air bag tone warning indicator short to battery. Lamp flash code: 53	•Air bag control module internal fault.	•INSTALL a new air bag control module. REFER to Air Bag Control Module in this section. REPEAT the self-test, CLEAR the DTCs.
•DTC B1892: Air bag tone warning indicator circuit fault. Lamp flash code: 53	•Air bag control module internal fault.	•INSTALL a new air bag control module. REFER to Air Bag Control Module in this section. REPEAT the self-test, CLEAR the DTCs.
•DTC B1921: Air bag diagnostic monitor ground circuit open. Lamp flash code: 14	•Air bag control module internal fault.	•INSTALL a new air bag control module. REFER to Air Bag Control Module in this section. REPEAT the self-test, CLEAR the DTCs.
•DTC B2290 Error value 27: Occupant Classification System module fault. Lamp flash code: 16	•Occupant classification sensor module.	•INSTALL a new passenger seat cushion. REFER to Section 501-10. REPEAT the self-test, CLEAR the DTCs.
•DTC B2290 Error value 26: Occupant Classification System communications fault. Lamp flash code: 16	•Circuit(s).	•GO to Pinpoint Test F.
•DTC B2290 Error value 25: Occupant Classification System calibration fault. Lamp flash code: 16	•Occupant classification sensor module.	•INSTALL a new passenger seat cushion. REFER to Section 501-10. REPEAT the self-test, CLEAR the DTCs.
•DTC B2290 Error value 24: Occupant Classification System sensing element fault. Lamp flash code: 16	•Occupant classification sensor.	•INSTALL a new passenger seat cushion. REFER to Section 501-10. REPEAT the self-test, CLEAR the DTCs.
•DTC B2292 Error value 31: Driver safety belt pretensioner circuit low resistance. Lamp flash code: 33	•Circuit(s). •Driver safety belt pretensioner.	•GO to Pinpoint Test G.
•DTC B2292 Error value 30: Driver safety belt pretensioner open circuit. Lamp flash code: 33	•Circuit(s). •Driver safety belt pretensioner.	•GO to Pinpoint Test H.
•DTC B2292 Error value 29: Driver safety belt pretensioner short to battery. Lamp flash code: 33	•Circuit(s).	•GO to Pinpoint Test I.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
•DTC B2292 Error value 28: Driver safety belt pretensioner short to ground. Lamp flash code: 33	•Circuit(s). •Driver safety belt pretensioner.	•GO to Pinpoint Test J.
•DTC B2292 Error value 27: Passenger safety belt pretensioner circuit low resistance. Lamp flash code: 34	•Circuit(s). •Passenger safety belt pretensioner.	•GO to Pinpoint Test K.
•DTC B2292 Error value 26: Passenger safety belt pretensioner open circuit. Lamp flash code: 34	•Circuit(s). •Passenger safety belt pretensioner.	•GO to Pinpoint Test L.
•DTC B2292 Error value 25: Passenger safety belt pretensioner short to battery. Lamp flash code: 34	•Circuit(s). •Passenger safety belt pretensioner.	•GO to Pinpoint Test M.
•DTC B2292 Error value 24: Passenger safety belt pretensioner short to ground. Lamp flash code: 34	•Circuit(s). •Passenger safety belt pretensioner.	•GO to Pinpoint Test N.
•DTC B2293 Error value 31: Driver air bag first stage short to ground. Lamp flash code: 19	•Driver air bag module. •Clockspring. •Circuit(s).	•GO to Pinpoint Test O.
•DTC B2293 Error value 30: Driver air bag first stage short to battery. Lamp flash code: 19	•Clockspring. •Circuit(s).	•GO to Pinpoint Test P.
•DTC B2293 Error value 29: Driver air bag first stage open circuit. Lamp flash code: 19	•Driver air bag module. •Clockspring. •Circuit(s).	•GO to Pinpoint Test Q.
•DTC B2293 Error value 28: Driver air bag first stage circuit low resistance. Lamp flash code: 19	•Driver air bag module. •Clockspring. •Circuit(s).	•GO to Pinpoint Test R.
•DTC B2293 Error value 27: Passenger air bag first stage short to ground. Lamp flash code: 21	•Passenger air bag module. •Circuit(s).	•GO to Pinpoint Test S.
•DTC B2293 Error value 26: Passenger air bag first stage short to battery. Lamp flash code: 21	•Circuit(s).	•GO to Pinpoint Test T.
•DTC B2293 Error value 25: Passenger air bag first stage open circuit. Lamp flash code: 21	•Passenger air bag module. •Circuit(s).	•GO to Pinpoint Test U.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
•DTC B2293 Error value 24: Passenger air bag first stage circuit low resistance. Lamp flash code: 21	•Passenger air bag module. •Circuit(s).	•GO to Pinpoint Test V.
•DTC B2293 Error value 23: Driver air bag second stage short to ground. Lamp flash code: 19	•Driver air bag module. •Clockspring. •Circuit(s).	•GO to Pinpoint Test W.
•DTC B2293 Error value 22: Driver air bag second stage short to battery. Lamp flash code: 19	•Clockspring. •Circuit(s).	•GO to Pinpoint Test X.
•DTC B2293 Error value 21: Driver air bag second stage open circuit. Lamp flash code: 19	•Driver air bag module. •Clockspring. •Circuit(s).	•GO to Pinpoint Test Y.
•DTC B2293 Error value 20: Driver air bag second stage circuit low resistance. Lamp flash code: 19	•Driver air bag module. •Clockspring. •Circuit(s).	•GO to Pinpoint Test Z.
•DTC B2293 Error value 19: Passenger air bag second stage short to ground. Lamp flash code: 21	•Passenger air bag module. •Circuit(s).	•GO to Pinpoint Test AA.
•DTC B2293 Error value 18: Passenger air bag second stage short to battery. Lamp flash code: 21	•Circuit(s).	•GO to Pinpoint Test AB.
•DTC B2293 Error value 17: Passenger air bag second stage open circuit. Lamp flash code: 21	•Passenger air bag module. •Circuit(s).	•GO to Pinpoint Test AC.
•DTC B2293 Error value 16: Passenger air bag second stage circuit low resistance. Lamp flash code: 21	•Passenger air bag module. •Circuit(s).	•GO to Pinpoint Test AD.
•DTC B2294 Error value 31: Driver side air curtain circuit short to battery. Lamp flash code: 24	•Circuit(s).	•GO to Pinpoint Test AE.
•DTC B2294 Error value 30: Driver side air curtain circuit short to ground. Lamp flash code: 24	•Driver side air curtain module. •Circuit(s).	•GO to Pinpoint Test AF.
•DTC B2294 Error value 29: Driver side air curtain circuit open circuit. Lamp flash code: 24	•Driver side air curtain module. •Circuit(s).	•GO to Pinpoint Test AG.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
•DTC B2294 Error value 28: Driver side air curtain circuit low resistance on squib. Lamp flash code: 24	•Driver side air curtain module. •Circuit(s).	•GO to Pinpoint Test AH.
•DTC B2294 Error value 27: Passenger side air curtain circuit short to battery. Lamp flash code: 25	•Circuit(s).	•GO to Pinpoint Test AI.
•DTC B2294 Error value 26: Passenger side air curtain circuit short to ground. Lamp flash code: 25	•Passenger side air curtain module. •Circuit(s).	•GO to Pinpoint Test AJ.
•DTC B2294 Error value 25: Passenger side air curtain circuit open circuit. Lamp flash code: 25	•Passenger side air curtain module. •Circuit(s).	•GO to Pinpoint Test AK.
•DTC B2294 Error value 24: Passenger side air curtain circuit low resistance on squib. Lamp flash code: 25	•Passenger side air curtain module. •Circuit(s).	•GO to Pinpoint Test AL.
•DTC B2295 Error value 31: Driver side air bag circuit short to battery. Lamp flash code: 22	•Circuit(s).	•GO to Pinpoint Test AM.
•DTC B2295 Error value 30: Driver side air bag circuit short to ground. Lamp flash code: 22	•Driver side air bag module. •Circuit(s).	•GO to Pinpoint Test AN.
•DTC B2295 Error value 29: Driver side air bag circuit open circuit. Lamp flash code: 22	•Driver side air bag module. •Circuit(s).	•GO to Pinpoint Test AO.
•DTC B2295 Error value 28: Driver side air bag circuit low resistance on squib. Lamp flash code: 22	•Driver side air bag module. •Circuit(s).	•GO to Pinpoint Test AP.
•DTC B2295 Error value 27: Passenger side air bag circuit short to battery. Lamp flash code: 23	•Circuit(s).	•GO to Pinpoint Test AQ.
•DTC B2295 Error value 26: Passenger side air bag circuit short to ground. Lamp flash code: 23	•Passenger side air bag module. •Circuit(s).	•GO to Pinpoint Test AR.
•DTC B2295 Error value 25: Passenger side air bag circuit open circuit. Lamp flash code: 23	•Passenger side air bag module. •Circuit(s).	•GO to Pinpoint Test AS.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
•DTC B2295 Error value 24: Passenger side air bag circuit low resistance on squib. Lamp flash code: 23	•Passenger side air bag module. •Circuit(s).	•GO to Pinpoint Test AT.
•DTC B2296 Error value 31: Driver side impact sensor communications fault. Lamp flash code: 43	•Circuit(s).	•GO to Pinpoint Test AU.
•DTC B2296 Error value 30: Driver side impact sensor internal fault. Lamp flash code: 43	•Driver side impact sensor.	•INSTALL a new driver side impact sensor. REFER to Side Impact Sensor in this section. REPEAT the self-test, CLEAR the DTCs.
•DTC B2296 Error value 29: Passenger side impact sensor communications fault. Lamp flash code: 44	•Circuit(s).	•GO to Pinpoint Test AV.
•DTC B2296 Error value 28: Passenger side impact sensor internal fault. Lamp flash code: 44	•Passenger side impact sensor.	•INSTALL a new passenger side impact sensor. REFER to Side Impact Sensor in this section. REPEAT the self-test, CLEAR the DTCs.
•DTC B2296 Error value 19: Crash sensor communications fault. Lamp flash code: 42	•Circuit(s).	•GO to Pinpoint Test AW.
•DTC B2296 Error value 18: Crash sensor internal fault. Lamp flash code: 42	•Crash sensor.	•INSTALL a new crash sensor. REFER to Crash Sensor in this section. REPEAT the self-test, CLEAR the DTCs.
•DTC B2434: Driver safety belt buckle switch short circuit to ground. Lamp flash code: 51	•Driver safety belt buckle switch. •Circuit(s).	•GO to Pinpoint Test AX.
•DTC B2435: Driver safety belt buckle switch resistance out of range. Lamp flash code: 51	•Driver safety belt buckle switch. •Circuit(s).	•GO to Pinpoint Test AY.
•DTC B2438: Passenger safety belt buckle switch short circuit to ground. Lamp flash code: 52	•Passenger safety belt buckle switch. •Circuit(s).	•GO to Pinpoint Test AZ.
•DTC B2439: Passenger safety belt buckle switch resistance out of range. Lamp flash code: 52	•Passenger safety belt buckle switch. •Circuit(s).	•GO to Pinpoint Test BA.
•DTC B2477: Air bag control module configuration failure. Lamp flash code: 54	•Air bag control module.	•CONFIGURE the air bag control module. REFER to Section 418-01. REPEAT the self-test, CLEAR the DTCs.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Sources	Action
•DTC B2691: Driver safety belt buckle switch open circuit or short to battery. Lamp flash code: 51	•Driver safety belt buckle switch. •Circuit(s).	•GO to Pinpoint Test BB.
•DTC B2692: Passenger safety belt buckle switch open circuit short to battery. Lamp flash code: 52	•Passenger safety belt buckle switch. •Circuit(s).	•GO to Pinpoint Test BC.
•DTC C1414: Incorrect Module Design Level. Lamp flash code: 15	•Air bag control module.	•INSTALL a new air bag control module. REFER to Air Bag Control Module in this section. REPEAT the self-test, CLEAR the DTCs.
•DTC C1947: Seat position sensor short circuit to ground or battery. Lamp flash code: 49	•Seat position sensor. •Circuit(s).	•GO to Pinpoint Test BD.
•DTC C1948: Seat position sensor resistance out of range. Lamp flash code: 49	•Seat position sensor. •Circuit(s).	•GO to Pinpoint Test BE.
•DTC C1981: Seat position sensor open circuit. Lamp flash code: 49	•Seat position sensor. •Circuit(s).	•GO to Pinpoint Test BF.
•Air bag control module disconnected or inoperative. Lamp flash code: continuous	•Air bag control module •Circuit(s).	•GO to Pinpoint Test BG.

DIAGNOSIS AND TESTING

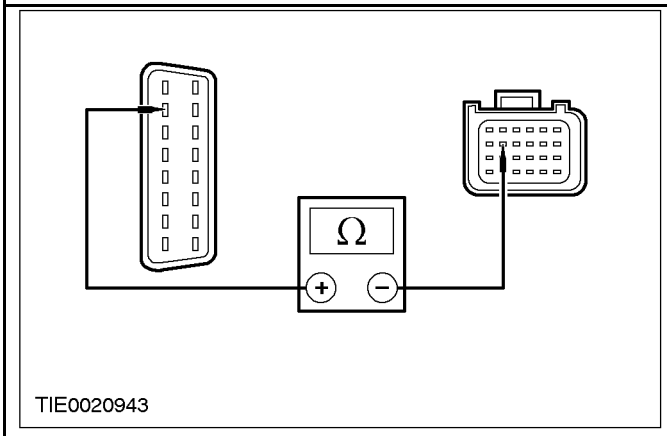
Pinpoint Tests - Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

Pinpoint Tests

PINPOINT TEST A: NO COMMUNICATION WITH THE MODULE

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
A1: CHECK THE WDS IS COMMUNICATING THROUGH THE DATA LINK CONNECTOR (DLC)	
	1 Select an alternative system to check the DLC. • Is WDS able to communicate with the selected system? → **Yes** GO to **A2** → **No** CHECK the DLC. For additional information, refer to the Wiring Diagrams.
A2: CHECK THE AIR BAG WARNING INDICATOR	
	1 Key in ON position. 2 The air bag warning indicator should illuminate when the ignition is in the ON position for six seconds and then go out. If a fault is present, the air bag warning light will then begin to flash. • Is the warning indicator operating? → **Yes** GO to **A3** → **No** CHECK the instrument cluster. For additional information, refer to the Wiring Diagrams.
A3: CHECK THE DLC CIRCUIT	
	1 Key in OFF position. 2 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 3 Disconnect Air Bag Control Module C490. 4 Measure the resistance between the DLC C418 pin 7, circuit 8-EE10 (WH/BK) and the air bag control module C490 pin 11, circuit 8-EE7 (WH/RD) harness side.

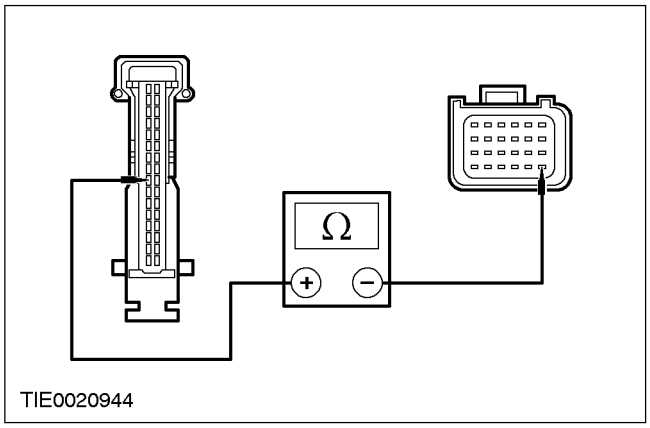
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is the resistance less than 5 ohms? → **Yes** If the air bag warning indicator is flashing, count the lamp flash code and refer to the Symptom Chart in this section. INSTALL a new air bag control module. REFER to Air Bag Control Module in this section. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuit 8-EE7 (WH/RD) or 8-EE10 (WH/BK). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

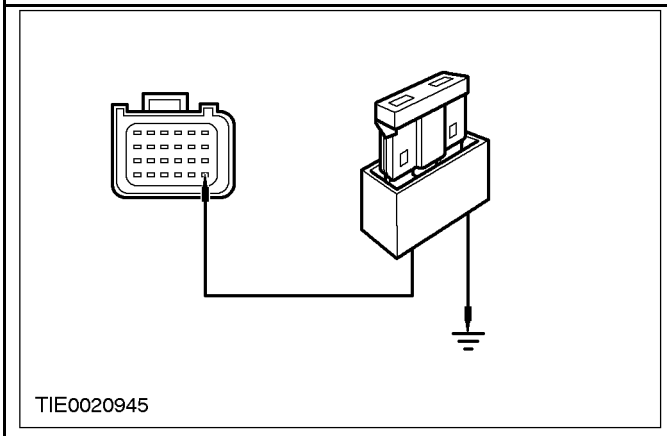
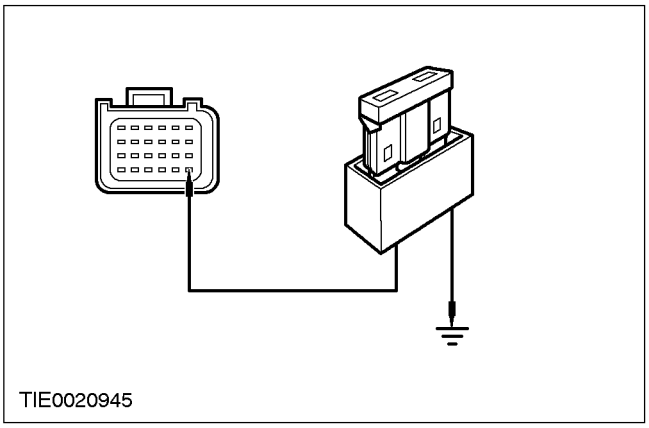
PINPOINT TEST B: DTC B1869: AIR BAG WARNING INDICATOR OPEN CIRCUIT OR SHORT TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK THE AIR BAG WARNING INDICATOR	
	1 Key in ON position. 2 Check the air bag warning indicator. • Is the air bag warning indicator illuminated continuously? → **Yes** GO to **B2** → **No** GO to **B5**
B2: CHECK THE AIR BAG WARNING INDICATOR CIRCUIT	
⚠ **WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.**	
	1 Key in OFF position.

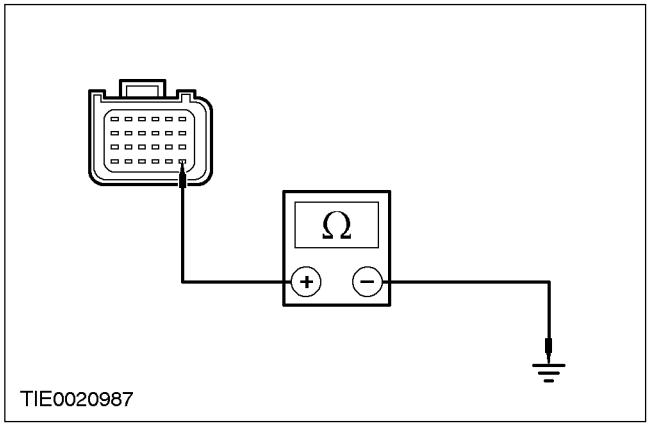
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020944	2 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 3 Disconnect Air Bag Control Module C490. 4 Disconnect Instrument Cluster C449. 5 Measure the resistance between the instrument cluster C449 pin 9, circuit 91S-JA14 (BK/GN) and the air bag control module C490 pin 19, circuit 91S-JA14 (BK/GN). • Is the resistance less than 5 ohms? → **Yes** GO to **B3** → **No** REPAIR circuit 91S-JA14 (BK/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
B3: CHECK THE AIR BAG WARNING INDICATOR FUNCTION	
	1 Connect Instrument Cluster C449. 2 Install a fused (7.5A) jumper wire between the air bag control module C490 pin 19, circuit 91S-JA14 (BK/GN) harness side and ground. - Turn the ignition to the ON position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020945	• Is the air bag warning indicator illuminated? → **Yes** INSTALL a new instrument cluster. REFER to Section 413-01. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **B4**
B4: CHECK THE AIR BAG WARNING INDICATOR FUNCTION	
 TIE0020945	1 With the fused (7.5A) jumper wire between the air bag control module C490 pin 19, circuit 91S-JA14 (BK/GN) harness side and ground. - Disconnect the fused jumper wire from the ground. • Is the air bag warning indicator illuminated? → **Yes** INSTALL a new air bag control module. REFER to Air Bag Control Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

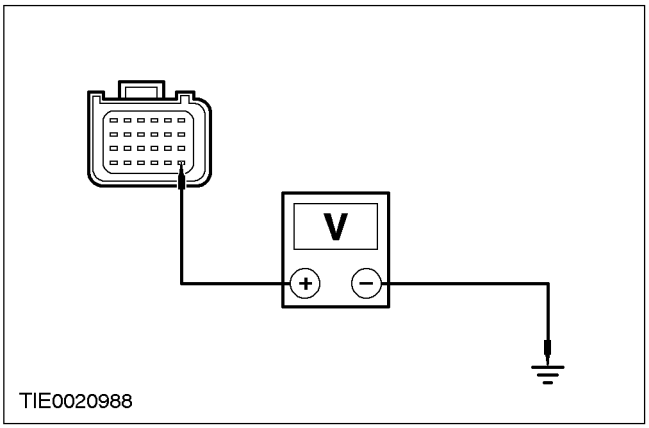
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **No** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
B5: CHECK THE INSTRUMENT CLUSTER WARNING INDICATORS	
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Check the instrument cluster warning indicators. • Are the warning indicators illuminated when the ignition is switched to the ON position? → **Yes** GO to **B6** → **No** CHECK the instrument cluster. For additional information, refer to Wiring Diagrams.
B6: CHECK THE AIR BAG WARNING INDICATOR CIRCUIT	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C490. 3 Measure the resistance between the air bag control module C490 pin 19, circuit 91S-JA14 (BK/GN) harness side and ground. • Is the resistance greater than 10,000 ohms? → **Yes**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	CHECK the air bag warning indicator LED. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuit 91S-JA14 (BK/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

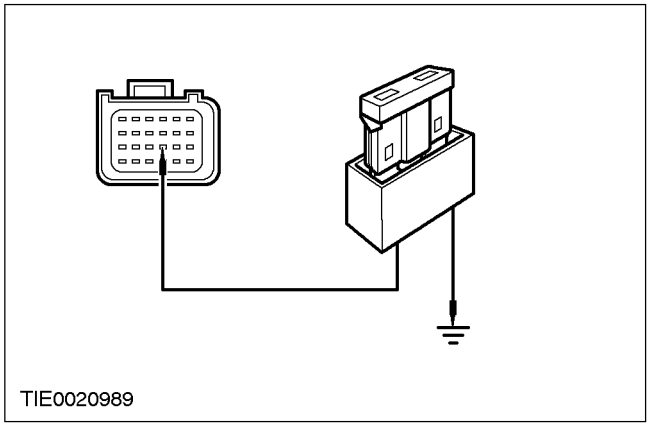
PINPOINT TEST C: DTC B1870: AIR BAG WARNING INDICATOR SHORT TO BATTERY

CONDITIONS	DETAILS/RESULTS/ACTIONS
⚠ **WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.**	
C1: CHECK THE AIR BAG WARNING INDICATOR	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Disconnect Air Bag Control Module C490. 3 Disconnect Instrument Cluster C449. 4 Key in ON position. 5 Measure the voltage between the air bag control module C490 pin 19, circuit 91S-JA14 (BK/GN) harness side and ground. • Is any voltage present? → **Yes**

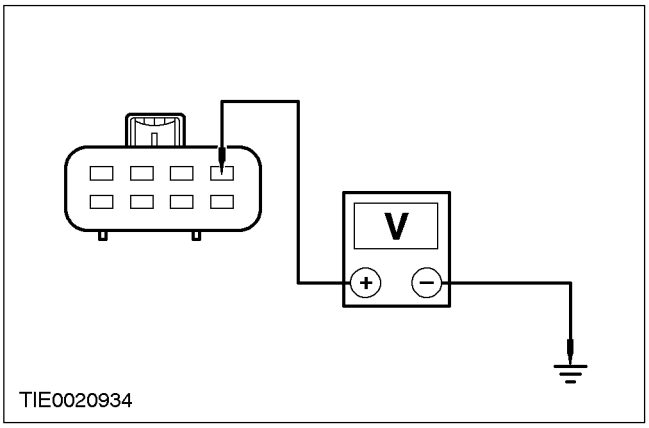
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** CHECK the instrument cluster. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

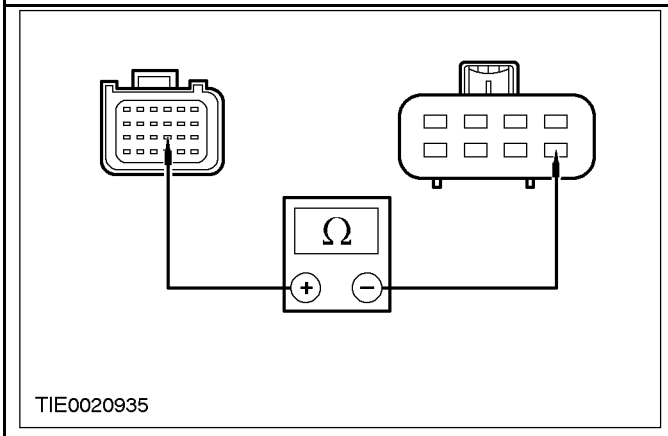
PINPOINT TEST D: DTC B1884: PASSENGER AIR BAG DEACTIVATION (PAD) INDICATOR INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
⚠ **WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.**	
D1: CHECK THE PAD INDICATOR FUNCTION	
NOTE: Using a suitable non-conducting tool, disable the shorting bar on C490 pin 15.	
 TIE0020989	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Disconnect Air Bag Control Module C490. 3 Install a fused (7.5A) jumper wire between the air bag control module C490 pin 15, circuit 91S-JA47 (BK/OG) harness side and ground. - Turn the ignition to the ON position. • Is the PAD indicator illuminated? → **Yes**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	INSTALL a new air bag control module. REFER to Air Bag Control Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **D2**
D2: CHECK THE PAD INDICATOR SUPPLY CIRCUIT	
	**1** Key in OFF position. **2** Disconnect PAD Indicator C417. **3** Key in ON position. **4** Measure the voltage between the PAD indicator C417 pin 8, circuit 15-JA47 (GN/RD) harness side and ground. • Is the voltage greater than 9 volts? → **Yes** GO to **D3** → **No** REPAIR circuit 15-JA47 (GN/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
D3: CHECK THE AIR BAG WARNING INDICATOR CIRCUIT	
	1 Key in OFF position. **2** Measure the resistance between the air bag control module C490 pin 15, circuit 91S-JA47 (BK/OG) and the PAD warning indicator C417 pin 4, circuit 91S-JA47 (BK/OG) harness side.

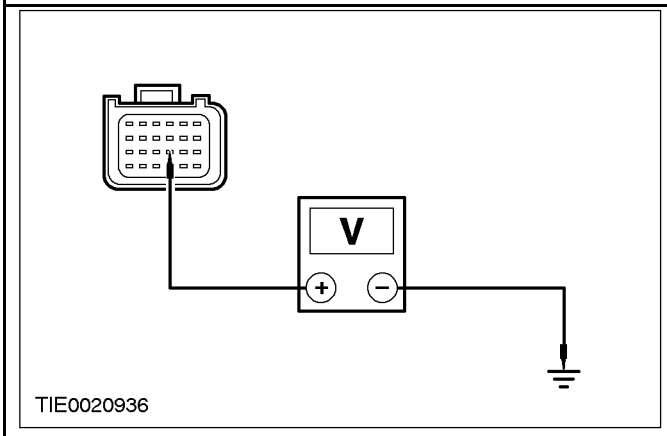
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020935	• Is the resistance less than 5 ohms? → **Yes** INSTALL a new PAD indicator. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuit 91S-JA47 (BK/OG). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

PINPOINT TEST E: DTC B1890: PASSENGER AIR BAG DEACTIVATION (PAD) INDICATOR SHORT TO BATTERY

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
E1: CHECK THE PAD INDICATOR CIRCUIT	
NOTE: Using a suitable non-conducting tool, disable the shorting bar on C490 pin 15.	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Disconnect Air Bag Control Module C490. 3 Disconnect PAD Indicator C417. 4 Key in ON position. 5 Measure the voltage between the air bag control module C490 pin 15, circuit 91S-JA47 (BK/OG) harness side and ground.

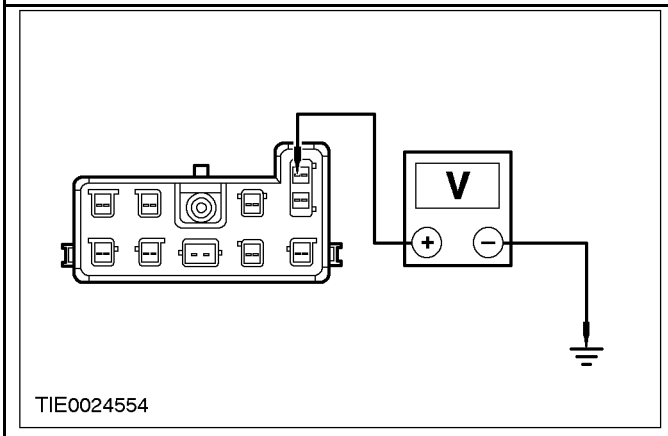
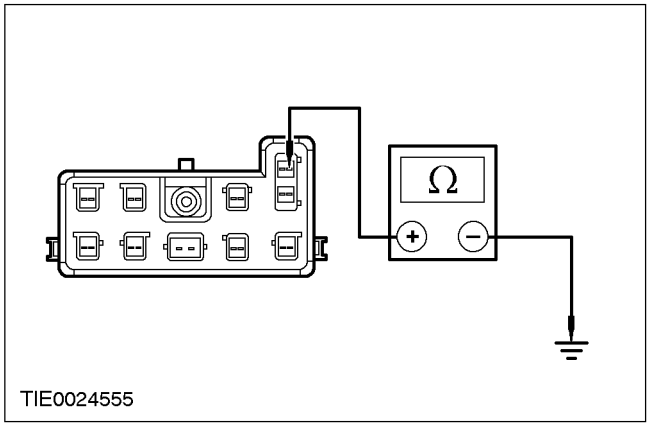
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is any voltage present? → **Yes** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new PAD indicator. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

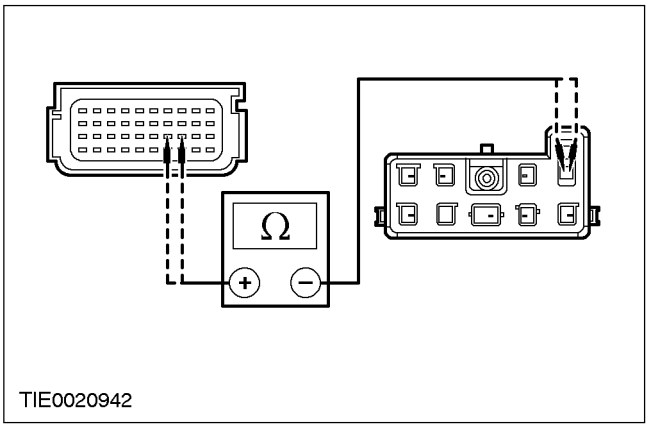
PINPOINT TEST F: DTC B2290 ERROR VALUE 26: OCCUPANT CLASSIFICATION SYSTEM COMMUNICATIONS FAULT

CONDITIONS	DETAILS/RESULTS/ACTIONS
⚠ WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
F1: CHECK THE OCCUPANT CLASSIFICATION SENSOR SUPPLY CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Disconnect Passenger Underseat Air Bag Simulator. 3 Key in ON position. 4 Measure the voltage between the occupant classification sensor C61 pin 2, circuit 15-JA52 (GN/BK) harness side and ground.

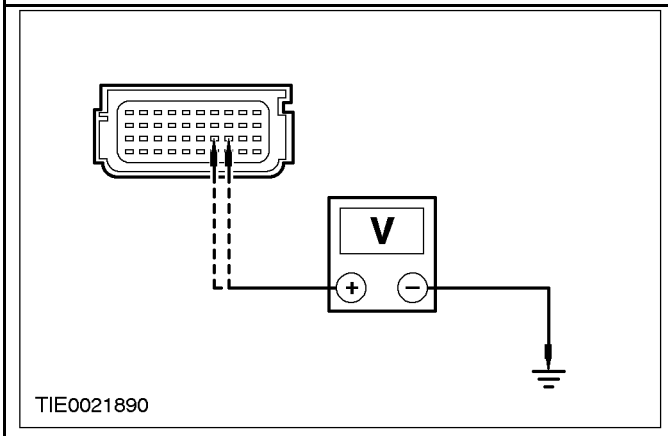
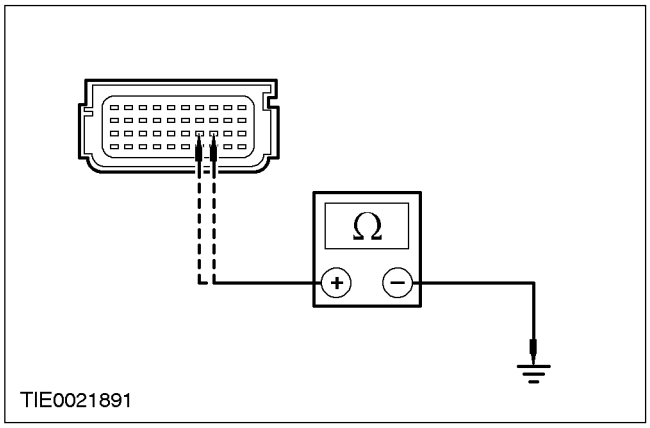
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0024554	• Is the voltage greater than 9 volts? → **Yes** GO to **F2** → **No** REPAIR circuit 15-JA52 (GN/BK). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
F2: CHECK THE OCCUPANT CLASSIFICATION SENSOR GROUND CIRCUIT	
 TIE0024555	1 Key in OFF position. 2 Measure the resistance between the occupant classification sensor C61 pin 1, circuit 91-JA52 (BK/GN) harness side and ground. • Is the resistance less than 5 ohms? → **Yes** GO to **F3** → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR circuit 91-JA52 (BK/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
F3: CHECK THE CIRCUITS BETWEEN THE OCCUPANT CLASSIFICATION SENSOR AND THE AIR BAG CONTROL MODULE FOR CONTINUITY	
 TIE0020942	1 Disconnect Air Bag Control Module. 2 Measure the resistance between: - the air bag control module C491 pin 17, circuit 8-JA52 (WH/GN) and the occupant classification sensor C61 pin 3, circuit 8-JA52 (WH/GN) harness side; and - the air bag control module C491 pin 18, circuit 9-JA52 (BN/GN) and the occupant classification sensor C61 pin 4, circuit 9-JA52 (BN/GN) harness side. • Are the resistances less than 5 ohms? → **Yes** GO to **F4** → **No** REPAIR circuit 8-JA52 (WH/GN) or circuit 9-JA52 (BN/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
F4: CHECK THE OCCUPANT CLASSIFICATION SYSTEM FOR A SHORT TO BATTERY OR IGNITION	
	1 Key in ON position. 2 Measure the voltage between: - the air bag control module C491 pin 17, circuit 8-JA52 (WH/GN) harness side and ground; and - the air bag control module C491 pin 18, circuit 9-JA52 (BN/GN) harness side and ground.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0021890	• Is any voltage present? → **Yes** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **F5**
F5: CHECK THE OCCUPANT CLASSIFICATION SYSTEM FOR A SHORT GROUND	
 TIE0021891	1 Key in OFF position. 2 Measure the resistance between: - the air bag control module C491 pin 17, circuit 8-JA52 (WH/GN) harness side and ground; and - the air bag control module C491 pin 18, circuit 9-JA52 (BN/GN) harness side and ground. • Are the resistances greater than 10,000 ohms? → **Yes**

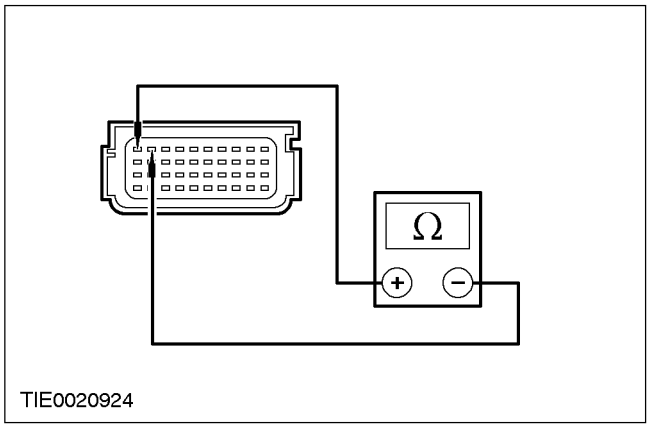
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	Install a new passenger seat cushion. REFER to Section 501-10. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

PINPOINT TEST G: DTC B2292 ERROR VALUE 31: DRIVER SAFETY BELT PRETENSIONER CIRCUIT LOW RESISTANCE

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
G1: CHECK THE DRIVER SAFETY BELT PRETENSIONER CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **G2** → **No** GO to **G3**
G2: PROVE OUT THE DRIVER SAFETY BELT PRETENSIONER	
	1 Key in OFF position. 2 Disconnect Driver Underseat Air Bag Simulator. 3 Connect Driver Underseat Air Bag Connector C60. 4 Key in ON position. 5 Carry out the self-test. • Does the system prove out correctly? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	INSTALL a new driver safety belt pretensioner. REFER to Section 501-20A / 501-20B. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
G3: CHECK THE DRIVER SAFETY BELT PRETENSIONER FOR LOW RESISTANCE	
 TIE0020924	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Driver Underseat Air Bag Simulator. 4 Measure the resistance between the air bag control module C491 pin 31, circuit 15S-JA33 (GN/BU) and pin 32, circuit 91S-JA33 (BK/BU) harness side. • Is the resistance greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 15S-JA33 (GN/BU) and 91S-JA33 (BK/BU). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

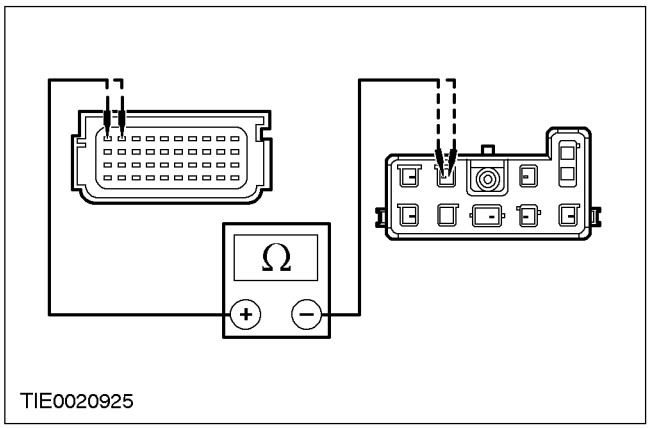
PINPOINT TEST H: DTC B2292 ERROR VALUE 30: DRIVER SAFETY BELT PRETENSIONER OPEN CIRCUIT

CONDITIONS	DETAILS/RESULTS/ACTIONS
⚠ WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1: CHECK THE DRIVER SAFETY BELT PRETENSIONER CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **H2** → **No** GO to **H3**
H2: PROVE OUT THE DRIVER SAFETY BELT PRETENSIONER	
	1 Key in OFF position. 2 Disconnect Driver Underseat Air Bag Simulator. 3 Connect Driver Underseat Air Bag Connector C60. 4 Key in ON position. 5 Carry out the self-test. • Does the system prove out correctly? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new driver safety belt pretensioner. REFER to Section 501-20A / 501-20B. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
H3: CHECK THE DRIVER SAFETY BELT PRETENSIONER FOR OPEN CIRCUIT OR HIGH RESISTANCE	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Driver Underseat Air Bag Simulator.

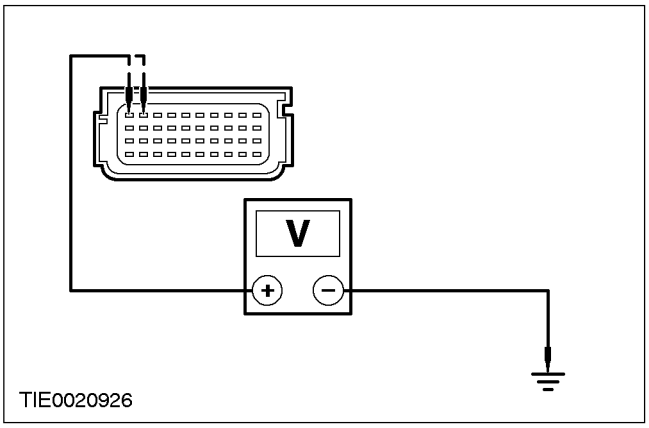
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	4 Measure the resistance between: - the air bag control module C491 pin 31, circuit 15S-JA33 (GN/BU) and the driver safety belt pretensioner C60 pin 7, circuit 15S-JA33 (GN/BU) harness side; and - the air bag control module C491 pin 32, circuit 91S-JA33 (BK/BU) and the driver safety belt pretensioner C60 pin 8, circuit 91S-JA33 (BK/BU) harness side. • Are the resistances less than 5 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 15S-JA33 (GN/BU) and 91S-JA33 (BK/BU). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

PINPOINT TEST I: DTC B2292 ERROR VALUE 29: DRIVER SAFETY BELT PRETENSIONER SHORT TO BATTERY

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
I1: CHECK THE DRIVER SAFETY BELT PRETENSIONER FOR A SHORT TO BATTERY OR IGNITION	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Disconnect Air Bag Control Module C491.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	3 Disconnect Driver Underseat Air Bag Simulator. 4 Key in ON position. 5 Measure the voltage between: - the air bag control module C491 pin 31, circuit 15S-JA33 (GN/BU) harness side and ground; and - the air bag control module C491 pin 32, 91S-JA33 (BK/BU) harness side and ground. • Is any voltage present? → **Yes** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

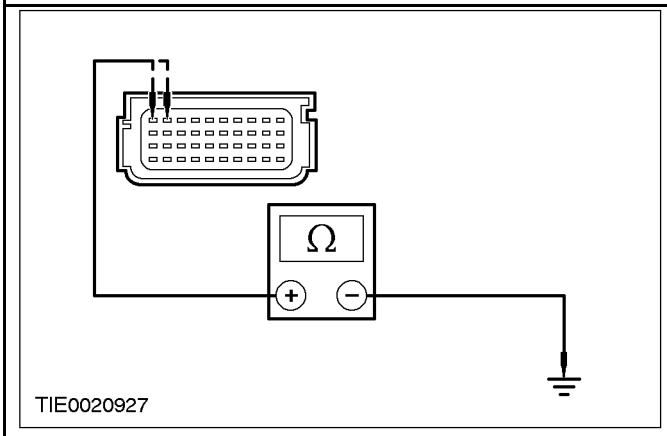
PINPOINT TEST J: DTC B2292 ERROR VALUE 28: DRIVER SAFETY BELT PRETENSIONER SHORT TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
J1: CHECK THE DRIVER SAFETY BELT PRETENSIONER CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **J2** → **No** GO to **J3**
J2: PROVE OUT THE DRIVER SAFETY BELT PRETENSIONER	
	1 Key in OFF position. 2 Disconnect Driver Underseat Air Bag Simulator. 3 Connect Driver Underseat Air Bag Connector C60. 4 Key in ON position. 5 Carry out the self-test. • Does the system prove out correctly? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new driver safety belt pretensioner. REFER to Section 501-20A / 501-20B. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
J3: CHECK THE DRIVER SAFETY BELT PRETENSIONER FOR A SHORT TO GROUND	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Driver Underseat Air Bag Simulator. 4 Measure the resistance between: - the air bag control module C491 pin 31, circuit 15S-JA33 (GN/BU) harness side and ground; and - the air bag control module C491 pin 32, 91S-JA33 (BK/BU) harness side and ground.

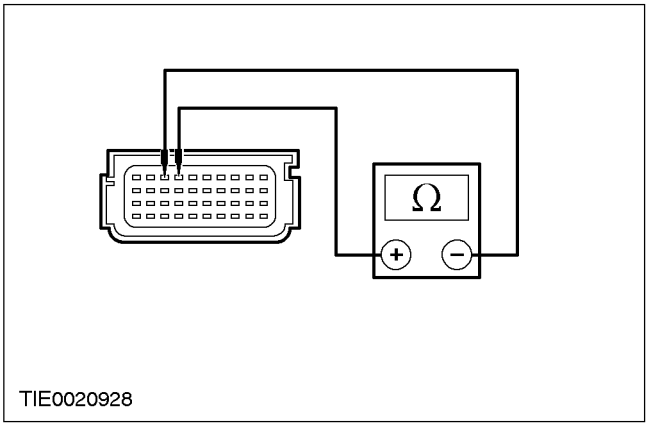
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Are the resistances greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

PINPOINT TEST K: DTC B2292 ERROR VALUE 27: PASSENGER SAFETY BELT PRETENSIONER CIRCUIT LOW RESISTANCE

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
K1: CHECK THE PASSENGER SAFETY BELT PRETENSIONER CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in OFF position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **K2** → **No** GO to **K3**
K2: PROVE OUT THE PASSENGER SAFETY BELT PRETENSIONER	
	1 Key in OFF position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	2 Disconnect Passenger Underseat Air Bag Simulator. 3 Connect Passenger Underseat Air Bag Connector C61. 4 Key in ON position. 5 Carry out the self-test. • Does the system prove out correctly? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new passenger safety belt pretensioner. REFER to Section 501-20A / 501-20B. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
K3: CHECK THE PASSENGER SAFETY BELT PRETENSIONER FOR LOW RESISTANCE	
 TIE0020928	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Passenger Underseat Air Bag Simulator. 4 Measure the resistance between the air bag control module C491 pin 33, circuit 15S-JA34 (GN/OG) and pin 34, circuit 91S-JA34 (BK/RD) harness side. • Is the resistance greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No**

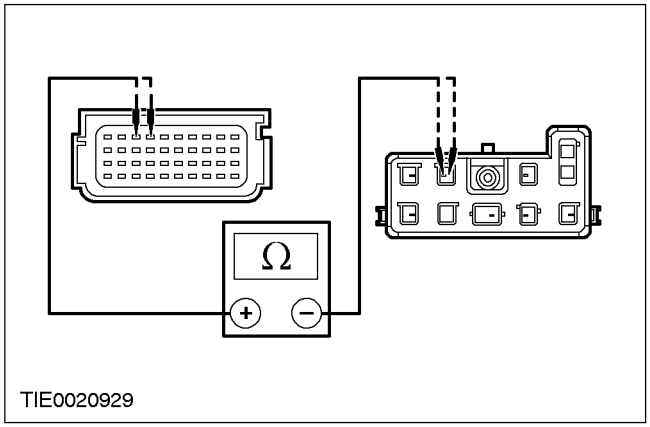
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR circuits 15S-JA34 (GN/OG) and 91S-JA34 (BK/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

PINPOINT TEST L: DTC B2292 ERROR VALUE 26: PASSENGER SAFETY BELT PRETENSIONER OPEN CIRCUIT

CONDITIONS	DETAILS/RESULTS/ACTIONS
⚠ WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
L1: CHECK THE PASSENGER SAFETY BELT PRETENSIONER CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **L2** → **No** GO to **L3**
L2: PROVE OUT THE PASSENGER SAFETY BELT PRETENSIONER	
	1 Key in OFF position. 2 Disconnect Passenger Underseat Air Bag Simulator. 3 Connect Passenger Underseat Air Bag Connector C61. 4 Key in ON position. 5 Carry out the self-test. • Does the system prove out correctly? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new passenger safety belt pretensioner. REFER to Section 501-20A / 501-20B. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

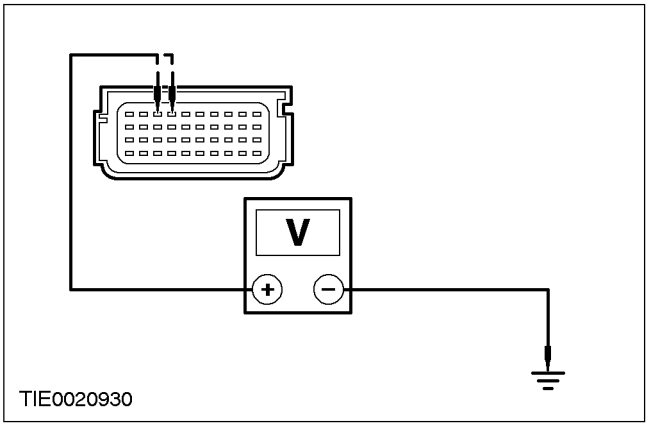
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
L3: CHECK THE PASSENGER SAFETY BELT PRETENSIONER FOR OPEN CIRCUIT OR HIGH RESISTANCE	
 TIE0020929	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Passenger Underseat Air Bag Simulator. 4 Measure the resistance between: - the air bag control module C491 pin 33, circuit 15S-JA34 (GN/OG) and the passenger safety belt pretensioner C61 pin 7, circuit 15S-JA34 (GN/OG) harness side; and - the air bag control module C491 pin 34, circuit 91S-JA34 (BK/RD) and the passenger safety belt pretensioner C61 pin 8, circuit 91S-JA34 (BK/RD) harness side. • Are the resistances less than 5 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 15S-JA34 (GN/OG) and 91S-JA34 (BK/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

PINPOINT TEST M: DTC B2292 ERROR VALUE 25: PASSENGER SAFETY BELT PRETENSIONER SHORT TO BATTERY

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	

DIAGNOSIS AND TESTING (Continued)

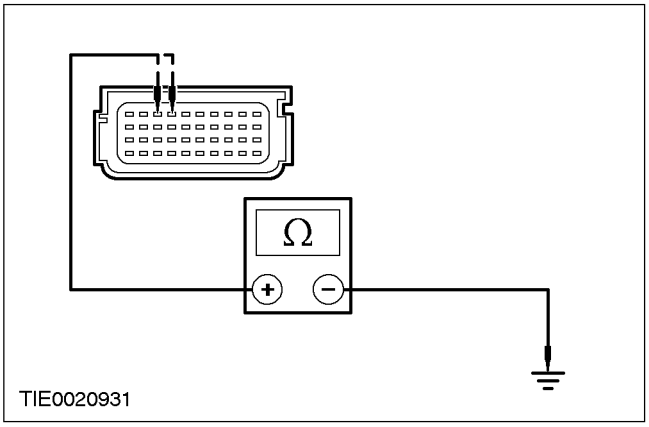
CONDITIONS	DETAILS/RESULTS/ACTIONS
M1: CHECK THE PASSENGER SAFETY BELT PRETENSIONER FOR A SHORT TO BATTERY OR IGNITION	
 TIE0020930	**1** Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. **2** Key in OFF position. **3** Disconnect Air Bag Control Module C491. **4** Disconnect Passenger Underseat Air Bag Simulator. **5** Key in ON position. **6** Measure the voltage between: - the air bag control module C491 pin 33, circuit 15S-JA34 (GN/OG) harness side and ground; and - the air bag control module C491 pin 34, 91S-JA34 (BK/RD) harness side and ground. • Is any voltage present? → **Yes** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST N: DTC B2292 ERROR VALUE 24: PASSENGER SAFETY BELT PRETENSIONER SHORT TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
N1: CHECK THE PASSENGER SAFETY BELT PRETENSIONER CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **N2** → **No** GO to **N3**
N2: PROVE OUT THE PASSENGER SAFETY BELT PRETENSIONER	
	1 Key in OFF position. 2 Disconnect Passenger Underseat Air Bag Simulator. 3 Connect Passenger Underseat Air Bag Connector C61. 4 Key in ON position. 5 Carry out the self-test. • Does the system prove out correctly? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new passenger safety belt pretensioner. REFER to Section 501-20A / 501-20B. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
N3: CHECK THE PASSENGER SAFETY BELT PRETENSIONER FOR A SHORT TO GROUND	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Passenger Underseat Air Bag Simulator.

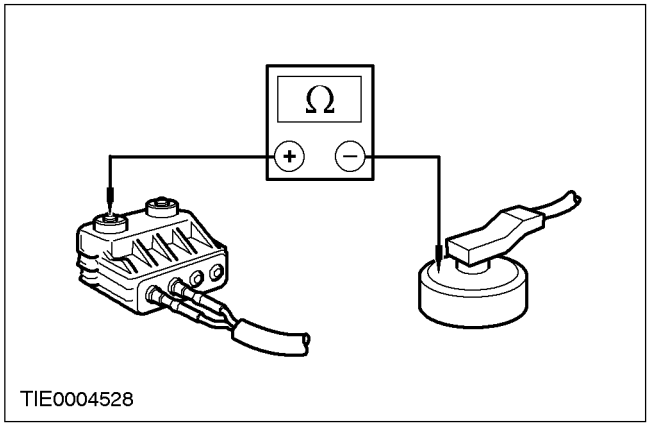
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	4 Measure the resistance between: - the air bag control module C491 pin 33, circuit 15S-JA34 (GN/OG) harness side and ground; and - the air bag control module C491 pin 34, 91S-JA34 (BK/RD) harness side and ground. • Are the resistances greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

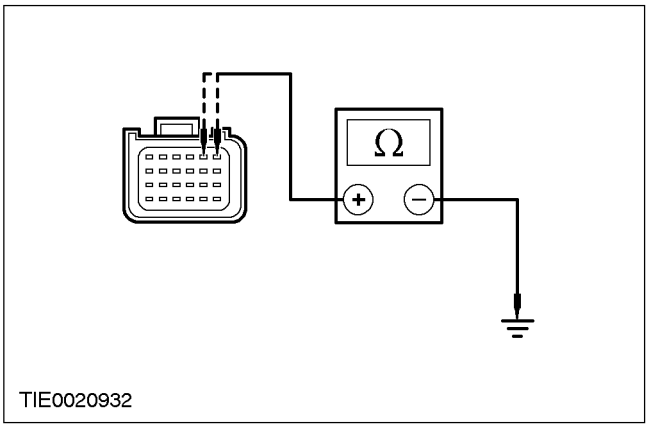
PINPOINT TEST O: DTC B2293 ERROR VALUE 31: DRIVER AIR BAG FIRST STAGE SHORT TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
⚠ **WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.**	
O1: CHECK THE DRIVER AIR BAG FIRST STAGE CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly?

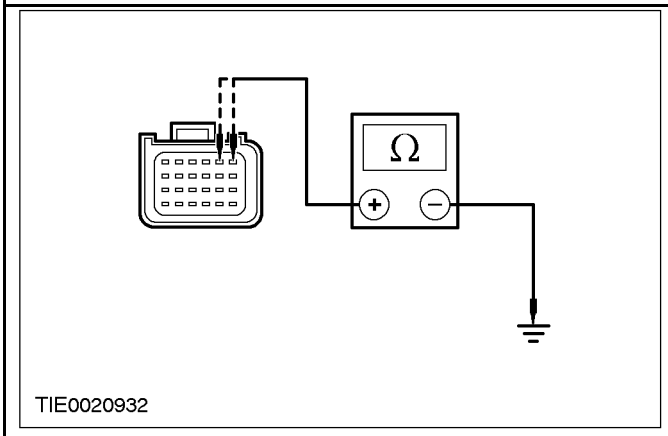
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** GO to **O2** → **No** GO to **O3**
O2: CHECK THE DRIVER AIR BAG MODULE	
WARNING: Do not proceed with the test unless using WDS. Failure to follow this instruction may result in personal injury.	
 TIE0004528	1 Connect the Test and Deployment Lead to the driver air bag module - first stage. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance between each of the terminals and the air bag module casing. 5 Connect the Test and Deployment Lead to the driver air bag module - second stage. 6 Measure the resistance between each of the terminals and the air bag module casing. • Are the resistances greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new driver air bag module. REFER to Driver Air Bag Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
O3: CHECK THE DRIVER AIR BAG FIRST STAGE WIRING HARNESS FOR A SHORT TO GROUND	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C490.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020932	3 Disconnect Driver Air Bag Module First Stage Simulator. 4 Measure the resistance between: - the air bag control module C490 pin 1, circuit 15S-JA8 (GN/RD) harness side and ground; and - the air bag control module C490 pin 2, circuit 91S- JA8 (BK/OG) harness side and ground. 5 Turn the steering wheel from lock to lock and note the resistance readings. • Are the resistances greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **O4**
O4: CHECK THE CLOCKSPRING FOR A SHORT TO GROUND	
	1 Disconnect Clockspring C413. 2 Measure the resistance between: - the air bag control module C490 pin 1, circuit 15S-JA8 (GN/RD) harness side and ground; and - the air bag control module C490 pin 2, circuit 91S- JA8 (BK/OG) harness side and ground. 3 Turn the steering wheel from lock to lock and note the resistance readings.

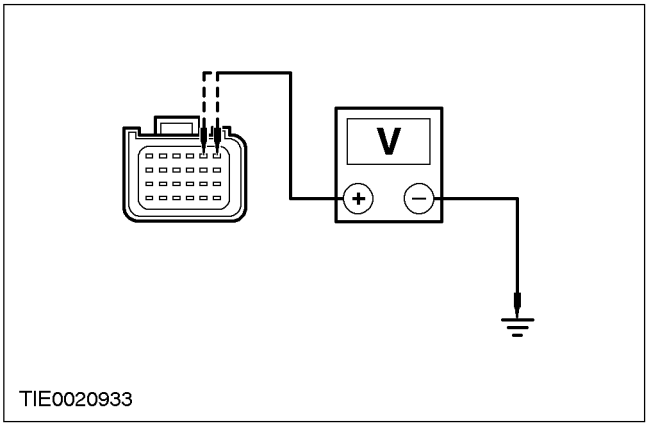
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020932	• Are the resistances greater than 10,000 ohms? → **Yes** INSTALL a new Clockspring. REFER to Clockspring in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

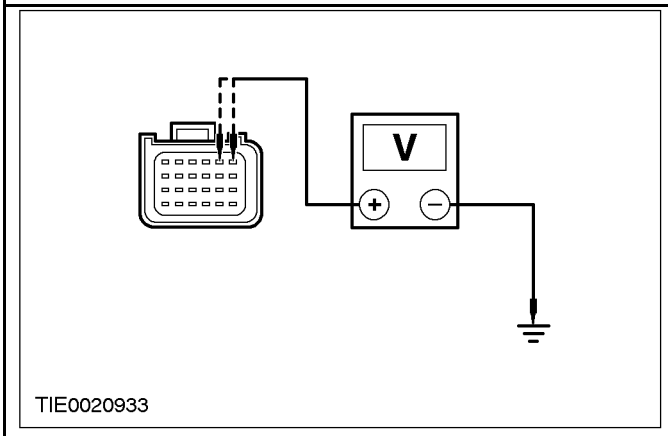
PINPOINT TEST P: DTC B2293 ERROR VALUE 30: DRIVER AIR BAG FIRST STAGE SHORT TO BATTERY

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
P1: CHECK THE DRIVER AIR BAG FIRST STAGE WIRING HARNESS FOR A SHORT TO BATTERY OR IGNITION	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Disconnect Driver Air Bag Module First Stage Simulator. 3 Disconnect Air Bag Control Module C490. 4 Key in ON position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020933	**5** Measure the voltage between: - the air bag control module C490 pin 1, circuit 15S-JA8 (GN/RD) harness side and ground; and - the air bag control module C490 pin 2, circuit 91S- JA8 (BK/OG) harness side and ground. • Is any voltage present? → **Yes** GO to **P2** → **No** CONNECT the driver air bag module first stage simulator and the air bag control module. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
P2: CHECK THE CLOCKSPRING FOR A SHORT TO BATTERY OR IGNITION	
	1 Key in OFF position. **2** Disconnect Clockspring C413. **3** Key in ON position. **4** Measure the voltage between: - the air bag control module C490 pin 1, circuit 15S-JA8 (GN/RD) harness side and ground; and - the air bag control module C490 pin 2, circuit 91S- JA8 (BK/OG) harness side and ground.

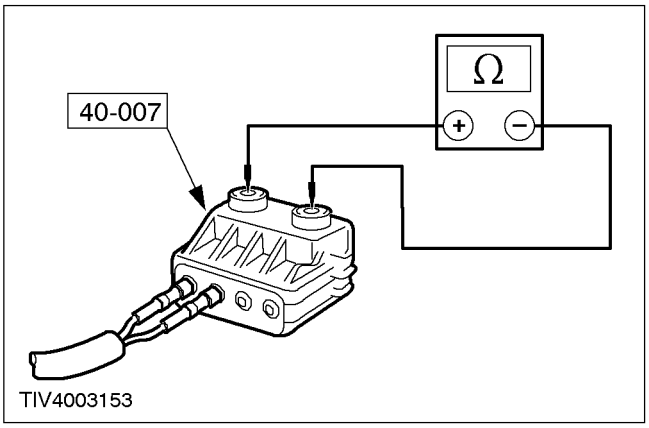
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is any voltage present? → **Yes** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new Clockspring. REFER to Clockspring in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

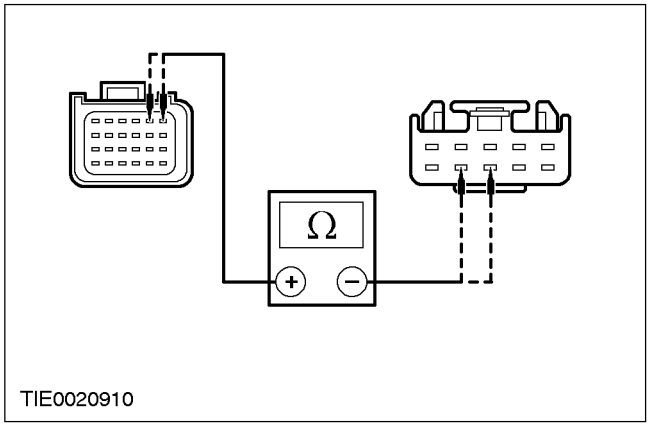
PINPOINT TEST Q: DTC B2293 ERROR VALUE 29: DRIVER AIR BAG FIRST STAGE OPEN CIRCUIT

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
Q1: CHECK THE DRIVER AIR BAG FIRST STAGE CIRCUIT RESISTANCE	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **Q2** → **No** GO to **Q3**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
Q2: CHECK THE DRIVER AIR BAG MODULE SQUIB RESISTANCE	
WARNING: Do not proceed with this test unless using WDS. Failure to follow this instruction may result in personal injury.	
 TIV4003153	1 Connect the Test and Deployment Lead to the driver air bag module - first stage. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance of the air bag module squib. 5 Connect the Test and Deployment Lead to the driver air bag module - second stage. 6 Measure the resistance of the air bag module squib. • Are the resistances between 2 and 3 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new driver air bag module. REFER to Driver Air Bag Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
Q3: CHECK THE CLOCKSPRING FOR OPEN CIRCUIT OR HIGH RESISTANCE	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C490. 3 Disconnect Clockspring C413.

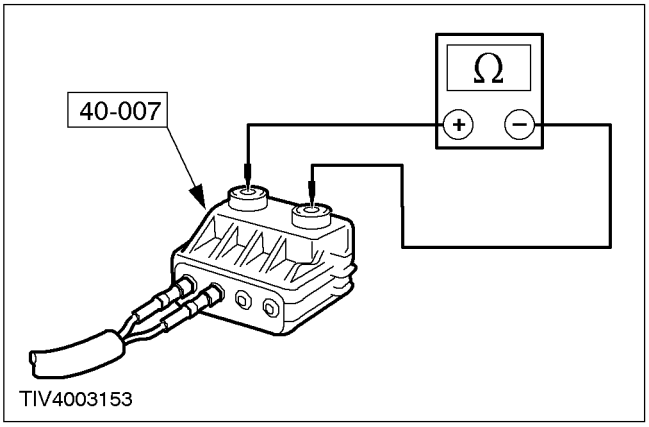
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020910	4 Measure the resistance between: - the air bag control module C490 pin 1, circuit 15S - JA8 (GN/RD) and the Clockspring C413 pin 9, circuit 15S-JA8 (GN/RD) harness side; and - the air bag control module C490 pin 2, circuit 91S-JA8 (BK/OG) and the Clockspring C413 pin 8, circuit 91S-JA8 (BK/OG) harness side. • Are the resistances less than 5 ohms? → **Yes** INSTALL a new Clockspring. REFER to Clockspring in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 15S-JA8 (GN/RD) and 91S-JA8 (BK/OG). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

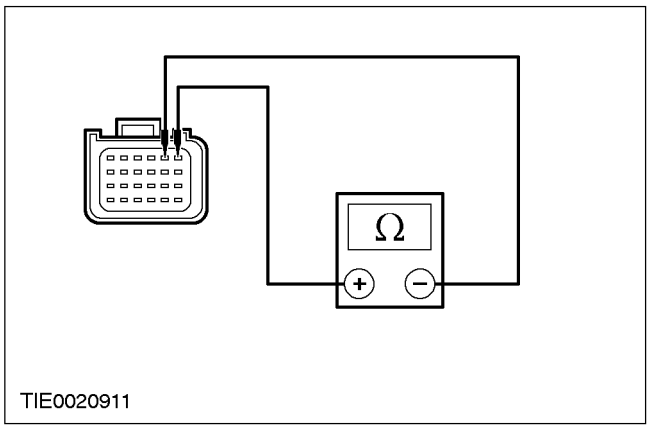
PINPOINT TEST R: DTC B2293 ERROR VALUE 28: DRIVER AIR BAG FIRST STAGE CIRCUIT LOW RESISTANCE

CONDITIONS	DETAILS/RESULTS/ACTIONS
⚠ WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
R1: CHECK THE DRIVER AIR BAG FIRST STAGE CIRCUIT RESISTANCE	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Does the system prove out correctly? → **Yes** GO to **R2** → **No** GO to **R3**
R2: CHECK THE DRIVER AIR BAG MODULE SQUIB RESISTANCE	
	1 Connect the Test and Deployment Lead to the driver air bag module - first stage. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance of the air bag module squib. 5 Connect the Test and Deployment Lead to the driver air bag module - second stage. 6 Measure the resistance of the air bag module squib. • Are the resistances between 2 and 3 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new driver air bag module. REFER to Driver Air Bag Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
R3: CHECK THE CLOCKSPRING FOR LOW RESISTANCE	
NOTE: Using a suitable non-conducting tool, disable the shorting bar on C490 pin 1.	
	1 Key in OFF position. 2 Disconnect Clockspring C413.

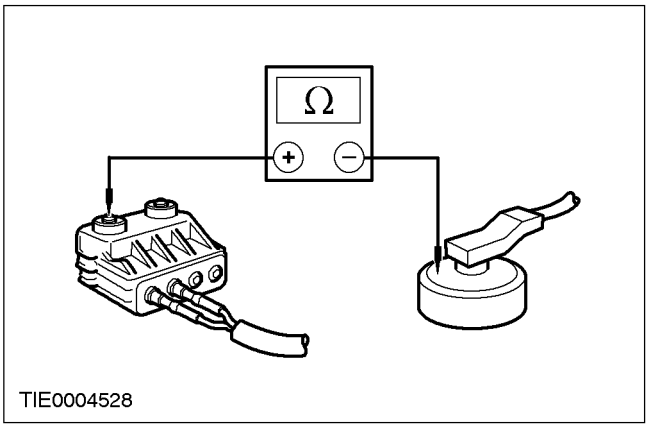
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020911	3 Disconnect Air Bag Control Module C490. 4 Measure the resistance between the air bag control module C490 pin 1, circuit 15S-JA8 (GN/RD) and pin 2, circuit 91S-JA8 (BK/OG) harness side. • Is the resistance greater than 10,000 ohms? → **Yes** INSTALL a new Clockspring. REFER to Clockspring in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 15S-JA8 (GN/RD) and 91S-JA8 (BK/OG). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

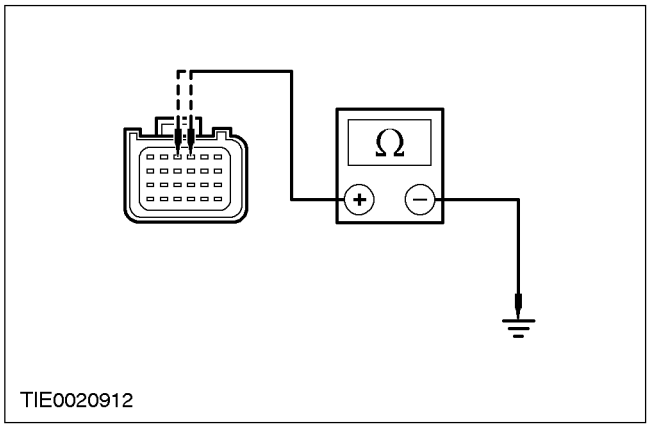
PINPOINT TEST S: DTC B2293 ERROR VALUE 27: PASSENGER AIR BAG FIRST STAGE SHORT TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
S1: CHECK THE PASSENGER AIR BAG FIRST STAGE CIRCUIT RESISTANCE	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	GO to **S2** → **No** GO to **S3**
S2: CHECK THE PASSENGER AIR BAG MODULE	
WARNING: Do not proceed with the test unless using WDS. Failure to follow this instruction may result in personal injury.	
 TIE0004528	1 Connect the Test and Deployment Lead to the passenger air bag module - first stage. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance between each of the terminals and the air bag module casing. 5 Connect the Test and Deployment Lead to the passenger air bag module - second stage. 6 Measure the resistance between each of the terminals and the air bag module casing. • Are the resistances greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new passenger air bag module. REFER to Passenger Air Bag Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
S3: CHECK THE PASSENGER AIR BAG FIRST STAGE WIRING HARNESS FOR A SHORT TO GROUND	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C490.

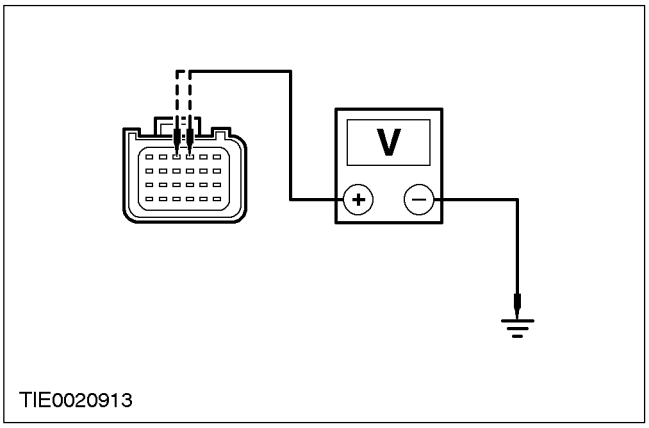
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	3 Disconnect Passenger Air Bag Module First Stage Simulator. 4 Measure the resistance between: - the air bag control module C490 pin 3, circuit 15S-JA8 (GN/YE) harness side and ground; and - the air bag control module C490 pin 4, circuit 91S- JA32 (BK/WH) harness side and ground. • Are the resistances greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

PINPOINT TEST T: DTC B2293 ERROR VALUE 26: PASSENGER AIR BAG FIRST STAGE SHORT TO BATTERY

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
T1: CHECK THE PASSENGER AIR BAG FIRST STAGE WIRING HARNESS FOR A SHORT TO BATTERY OR IGNITION	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

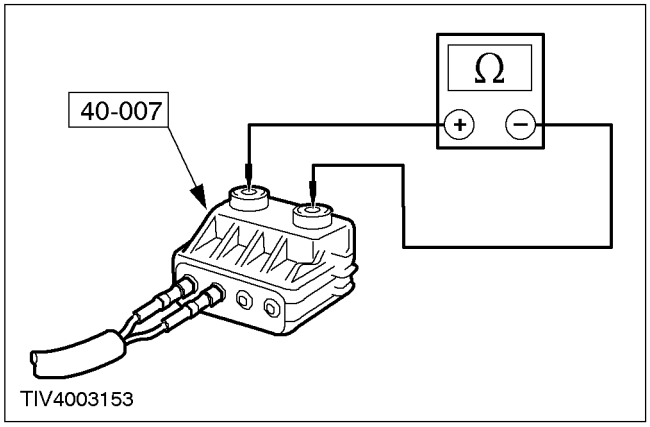
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020913	2 Disconnect Passenger Air Bag Module First Stage Simulator. 3 Disconnect Air Bag Control Module C490. 4 Key in ON position. 5 Measure the voltage between: - the air bag control module C490 pin 3, circuit 15S-JA32 (GN/YE) harness side and ground; and - the air bag control module C490 pin 4, circuit 91S- JA32 (BK/WH) harness side and ground. • Is any voltage present? → **Yes** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** CONNECT the passenger air bag module first stage simulator and the air bag control module. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

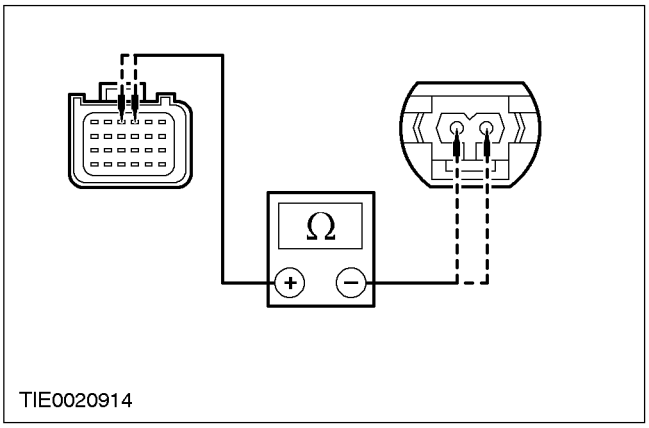
PINPOINT TEST U: DTC B2293 ERROR VALUE 25: PASSENGER AIR BAG FIRST STAGE OPEN CIRCUIT

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	

DIAGNOSIS AND TESTING (Continued)

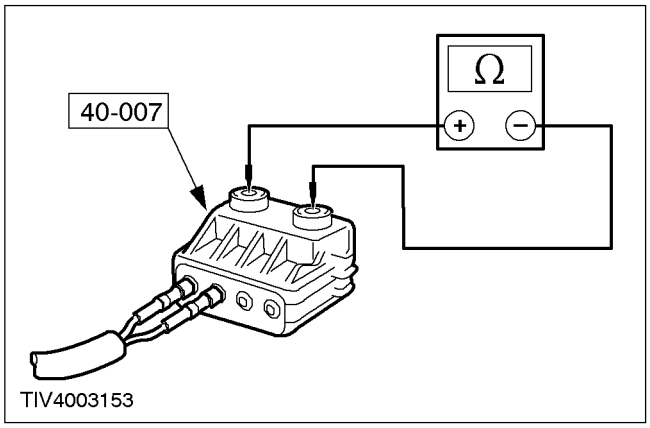
CONDITIONS	DETAILS/RESULTS/ACTIONS
U1: CHECK THE PASSENGER AIR BAG FIRST STAGE CIRCUIT RESISTANCE	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **U2** → **No** GO to **U3**
U2: CHECK THE PASSENGER AIR BAG MODULE SQUIB RESISTANCE	
WARNING: Do not proceed with this test unless using WDS. Failure to follow this instruction may result in personal injury.	
 TIV4003153	1 Connect the Test and Deployment Lead to the passenger air bag module - first stage. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance of the air bag module squib. 5 Connect the Test and Deployment Lead to the passenger air bag module - second stage. 6 Measure the resistance of the air bag module squib. • Are the resistances between 2 and 3 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No**

DIAGNOSIS AND TESTING (Continued)

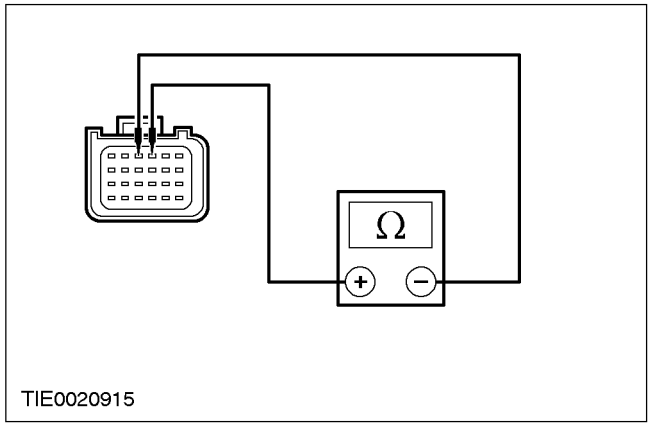
CONDITIONS	DETAILS/RESULTS/ACTIONS
	INSTALL a new passenger air bag module. REFER to Passenger Air Bag Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
U3: CHECK THE PASSENGER AIR BAG FIRST STAGE WIRING HARNESS FOR OPEN CIRCUIT OR HIGH RESISTANCE	
 TIE0020914	1 Key in OFF position. 2 Disconnect Air Bag Control Module C490. 3 Disconnect Passenger Air Bag First Stage Simulator. 4 Measure the resistance between: - the air bag control module C490 pin 3, circuit 15S-JA32 (GN/YE) and the passenger air bag module C481 pin 1, circuit 15S-JA32 (GN/YE) harness side; and - the air bag control module C490 pin 4, circuit 91S-JA32 (BK/WH) and the passenger air bag module C481 pin 2, circuit 91S-JA32 (BK/WH) harness side. • Are the resistances less than 5 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 15S-JA32 (GN/YE) and 91S-JA32 (BK/WH). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST V: DTC B2293 ERROR VALUE 24: PASSENGER AIR BAG FIRST STAGE CIRCUIT LOW RESISTANCE

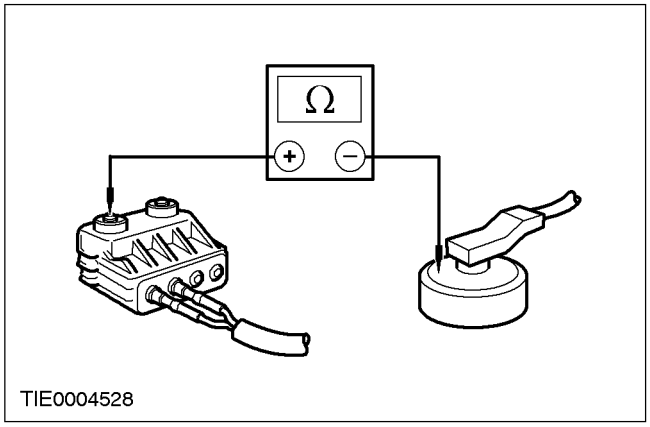
CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
V1: CHECK THE PASSENGER AIR BAG FIRST STAGE CIRCUIT RESISTANCE	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **V2** → **No** GO to **V3**
V2: CHECK THE PASSENGER AIR BAG MODULE SQUIB RESISTANCE	
	1 Connect the Test and Deployment Lead to the passenger air bag module - first stage. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance of the air bag module squib. 5 Connect the Test and Deployment Lead to the passenger air bag module - second stage. 6 Measure the resistance of the air bag module squib. • Are the resistances between 2 and 3 ohms? → **Yes**

DIAGNOSIS AND TESTING (Continued)

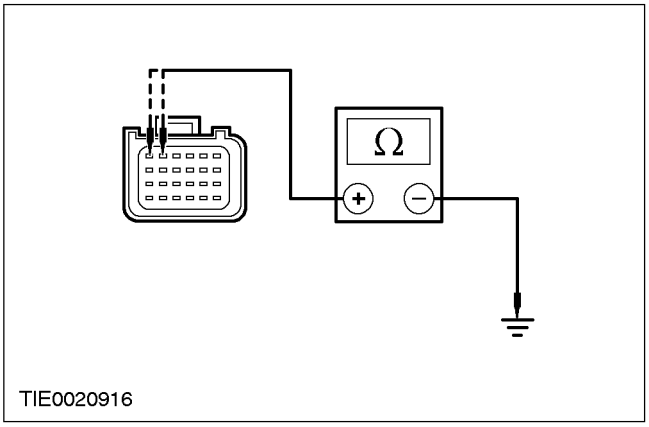
CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new passenger air bag module. REFER to Passenger Air Bag Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
V3: CHECK THE PASSENGER AIR BAG FIRST STAGE WIRING HARNESS FOR LOW RESISTANCE	
NOTE: Using a suitable non-conducting tool, disable the shorting bar on C490 pin 3.	
 TIE0020915	1 Key in OFF position. 2 Disconnect Passenger Air Bag First Stage Simulator. 3 Disconnect Air Bag Control Module C490. 4 Measure the resistance between the air bag control module C490 pin 3, circuit 15S-JA32 (GN/YE) and pin 4, circuit 91S-JA32 (BK/WH) harness side. • Is the resistance greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 15S-JA32 (GN/YE) and 91S-JA32 (BK/WH). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

DIAGNOSIS AND TESTING (Continued)

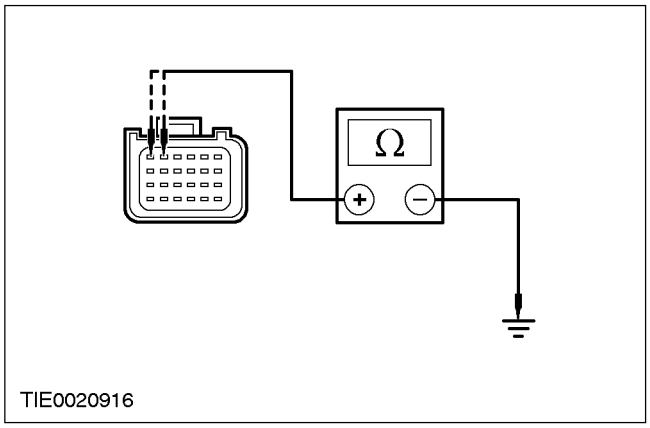
PINPOINT TEST W: DTC B2293 ERROR VALUE 23: DRIVER AIR BAG SECOND STAGE SHORT TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
W1: CHECK THE DRIVER AIR BAG SECOND STAGE CIRCUIT RESISTANCE	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **W2** → **No** GO to **W3**
W2: CHECK THE DRIVER AIR BAG MODULE	
WARNING: Do not proceed with the test unless using WDS. Failure to follow this instruction may result in personal injury.	
	1 Connect the Test and Deployment Lead to the driver air bag module - first stage. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance between each of the terminals and the air bag module casing. 5 Connect the Test and Deployment Lead to the driver air bag module - second stage. 6 Measure the resistance between each of the terminals and the air bag module casing. • Are the resistances greater than 10,000 ohms? → **Yes**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new driver air bag module. REFER to Driver Air Bag Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
W3: CHECK THE DRIVER AIR BAG SECOND STAGE WIRING HARNESS FOR A SHORT TO GROUND	
 TIE0020916	1 Key in OFF position. 2 Disconnect Air Bag Control Module C490. 3 Disconnect Driver Air Bag Module Second Stage Simulator. 4 Measure the resistance between: - the air bag control module C490 pin 5, circuit 15S-JA48 (GN/BK) harness side and ground; and - the air bag control module C490 pin 6, circuit 91S- JA8 (BK/GN) harness side and ground. 5 Turn the steering wheel from lock to lock and note the resistance readings. • Are the resistances greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **W4**
W4: CHECK THE CLOCKSPRING FOR A SHORT TO GROUND	
	1 Disconnect Clockspring C413.

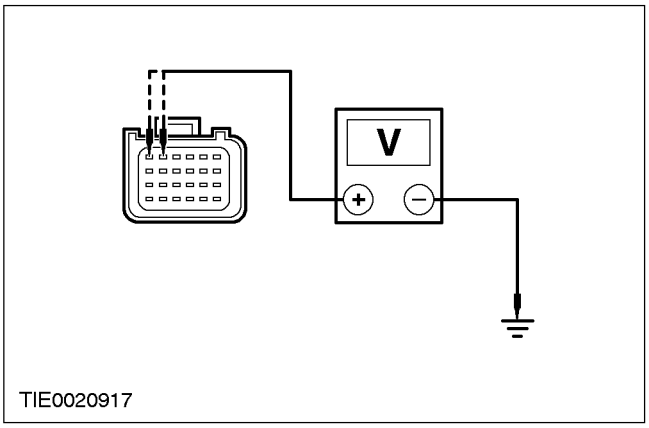
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	2 Measure the resistance between: - the air bag control module C490 pin 5, circuit 15S-JA48 (GN/BK) harness side and ground; and - the air bag control module C490 pin 6, circuit 91S- JA8 (BK/GN) harness side and ground. 3 Turn the steering wheel from lock to lock and note the resistance readings. • Are the resistances greater than 10,000 ohms? → **Yes** INSTALL a new Clockspring. REFER to Clockspring in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

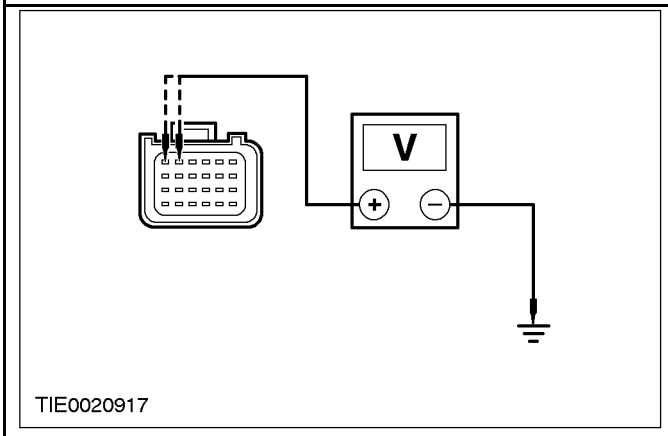
PINPOINT TEST X: DTC B2293 ERROR VALUE 22: DRIVER AIR BAG SECOND STAGE SHORT TO BATTERY

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
X1: CHECK THE DRIVER AIR BAG SECOND STAGE WIRING HARNESS FOR A SHORT TO BATTERY OR IGNITION	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020917	2 Disconnect Driver Air Bag Module Second Stage Simulator. 3 Disconnect Air Bag Control Module C490. 4 Key in ON position. 5 Measure the voltage between: - the air bag control module C490 pin 5, circuit 15S-JA48 (GN/BK) harness side and ground; and - the air bag control module C490 pin 6, circuit 91S- JA48 (BK/GN) harness side and ground. • Is any voltage present? → **Yes** GO to **X2** → **No** CONNECT the driver air bag module second stage simulator and the air bag control module. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
X2: CHECK THE CLOCKSPRING FOR A SHORT TO BATTERY OR IGNITION	
	1 Key in OFF position. 2 Disconnect Clockspring C413. 3 Key in ON position. 4 Measure the voltage between: - the air bag control module C490 pin 5, circuit 15S-JA48 (GN/BK) harness side and ground; and - the air bag control module C490 pin 6, circuit 91S- JA48 (BK/GN) harness side and ground.

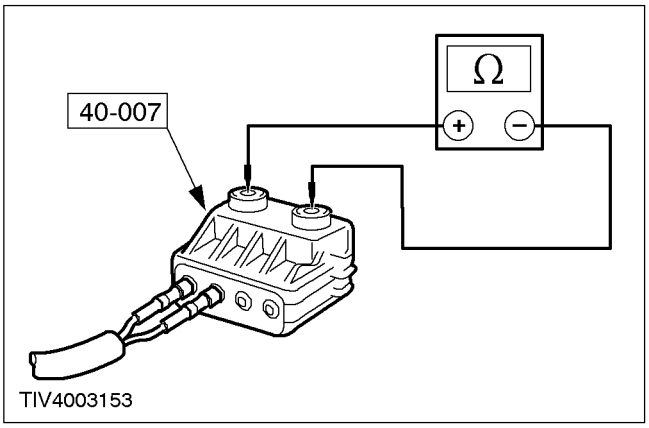
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is any voltage present? → **Yes** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new Clockspring. REFER to Clockspring in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

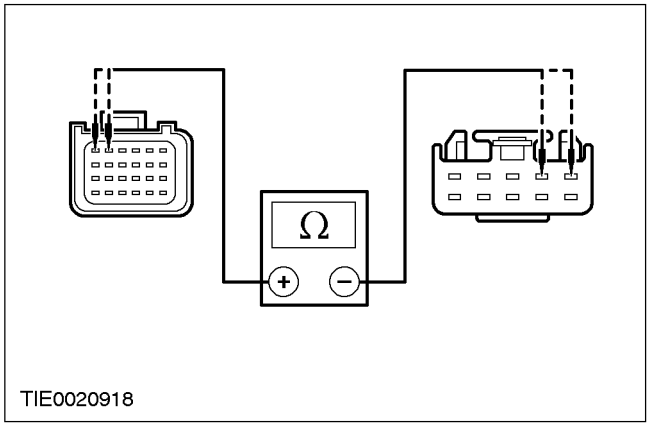
PINPOINT TEST Y: DTC B2293 ERROR VALUE 21: DRIVER AIR BAG SECOND STAGE OPEN CIRCUIT

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
Y1: CHECK THE DRIVER AIR BAG SECOND STAGE CIRCUIT RESISTANCE	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **Y2** → **No** GO to **Y3**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
Y2: CHECK THE DRIVER AIR BAG MODULE SQUIB RESISTANCE	
WARNING: Do not proceed with this test unless using WDS. Failure to follow this instruction may result in personal injury.	
 TIV4003153	1 Connect the Test and Deployment Lead to the driver air bag module - first stage. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance of the air bag module squib. 5 Connect the Test and Deployment Lead to the driver air bag module - second stage. 6 Measure the resistance of the air bag module squib. • Are the resistances between 2 and 3 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new driver air bag module. REFER to Driver Air Bag Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
Y3: CHECK THE CLOCKSPRING FOR OPEN CIRCUIT OR HIGH RESISTANCE	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C490. 3 Disconnect Clockspring C143.

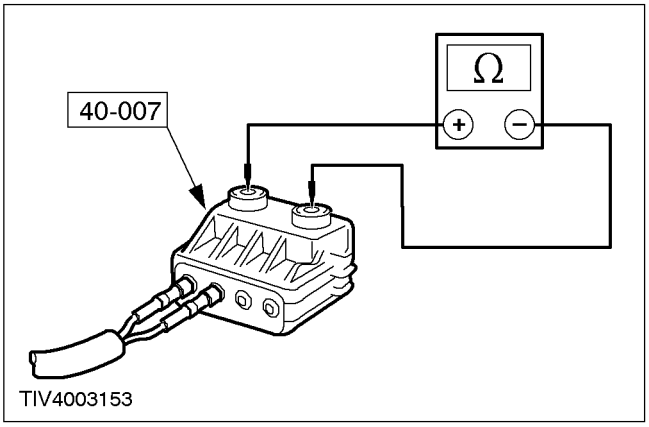
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020918	4 Measure the resistance between: - the air bag control module C490 pin 5, circuit 15S-JA48 (GN/BK) and the Clockspring C413 pin 2, circuit 15S-JA48 (GN/BK) harness side; and - the air bag control module C490 pin 6, circuit 91S-JA48 (BK/GN) and the Clockspring C413 pin 1, circuit 91S-JA48 (BK/GN) harness side. • Are the resistances less than 5 ohms? → **Yes** INSTALL a new Clockspring. REFER to Clockspring in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 15S-JA48 (GN/BK) and 91S-JA48 (BK/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

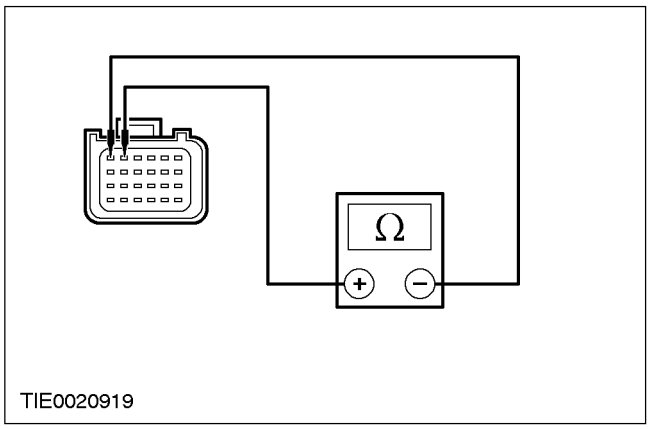
PINPOINT TEST Z: DTC B2293 ERROR VALUE 20: DRIVER AIR BAG SECOND STAGE CIRCUIT LOW RESISTANCE

CONDITIONS	DETAILS/RESULTS/ACTIONS
⚠ WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
Z1: CHECK THE DRIVER AIR BAG SECOND STAGE CIRCUIT RESISTANCE	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Does the system prove out correctly? → **Yes** GO to **Z2** → **No** GO to **Z3**
Z2: CHECK THE DRIVER AIR BAG MODULE SQUIB RESISTANCE	
	1 Connect the Test and Deployment Lead to the driver air bag module - first stage. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance of the air bag module squib. 5 Connect the Test and Deployment Lead to the driver air bag module - second stage. 6 Measure the resistance of the air bag module squib. • Are the resistances between 2 and 3 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new driver air bag module. REFER to Driver Air Bag Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
Z3: CHECK THE CLOCKSPRING FOR LOW RESISTANCE	
NOTE: Using a suitable non-conducting tool, disable the shorting bar on C490 pin 5.	
	1 Key in OFF position. 2 Disconnect Clockspring C413.

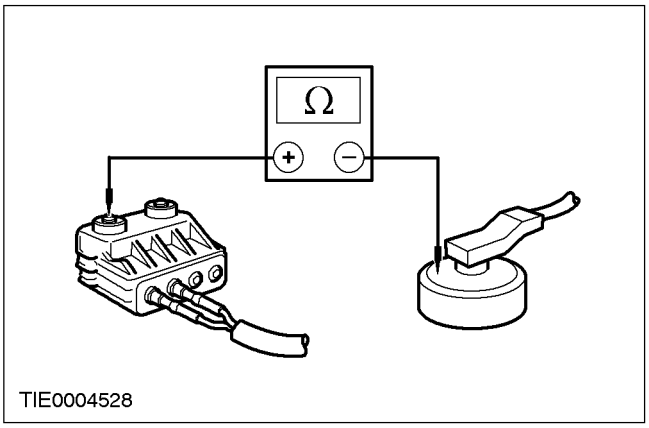
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020919	3 Disconnect Air Bag Control Module C490. 4 Measure the resistance between the air bag control module C490 pin 5, circuit 15S-JA48 (GN/BK) and pin 6, circuit 91S-JA48 (BK/GN) harness side. • Is the resistance greater than 10,000 ohms? → **Yes** INSTALL a new Clockspring. REFER to Clockspring in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 15S-JA48 (GN/BK) and 91S-JA48 (BK/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

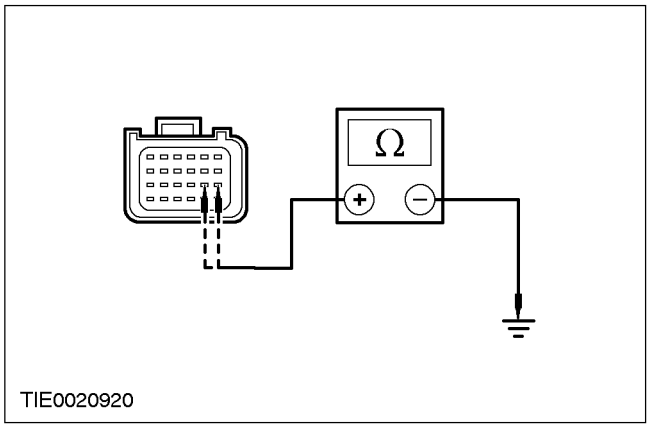
PINPOINT TEST AA: DTC B2293 ERROR VALUE 19: PASSENGER AIR BAG SECOND STAGE SHORT TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
⚠ **WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.**	
AA1: CHECK THE PASSENGER AIR BAG SECOND STAGE CIRCUIT RESISTANCE	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	GO to **AA2** → **No** GO to **AA3**
AA2: CHECK THE PASSENGER AIR BAG MODULE	
 TIE0004528	1 Connect the Test and Deployment Lead to the passenger air bag module - first stage. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance between each of the terminals and the air bag module casing. 5 Connect the Test and Deployment Lead to the passenger air bag module - second stage. 6 Measure the resistance between each of the terminals and the air bag module casing. • Are the resistances greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new passenger air bag module. REFER to Passenger Air Bag Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AA3: CHECK THE PASSENGER AIR BAG SECOND STAGE WIRING HARNESS FOR A SHORT TO GROUND	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C490. 3 Disconnect Passenger Air Bag Module Second Stage Simulator.

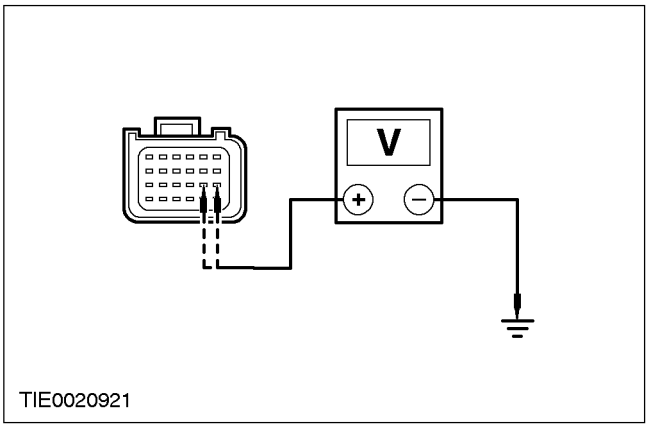
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020920	4 Measure the resistance between: - the air bag control module C490 pin 13, circuit 15S-JA31 (GN/BK) harness side and ground; and - the air bag control module C490 pin 14, circuit 91S- JA31 (BK/WH) harness side and ground. • Are the resistances greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

PINPOINT TEST AB: DTC B2293 ERROR VALUE 18: PASSENGER AIR BAG SECOND STAGE SHORT TO BATTERY

CONDITIONS	DETAILS/RESULTS/ACTIONS
⚠ WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
AB1: CHECK THE PASSENGER AIR BAG SECOND STAGE WIRING HARNESS FOR A SHORT TO BATTERY OR IGNITION	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Disconnect Passenger Air Bag Module Second Stage Simulator. 3 Disconnect Air Bag Control Module C490.

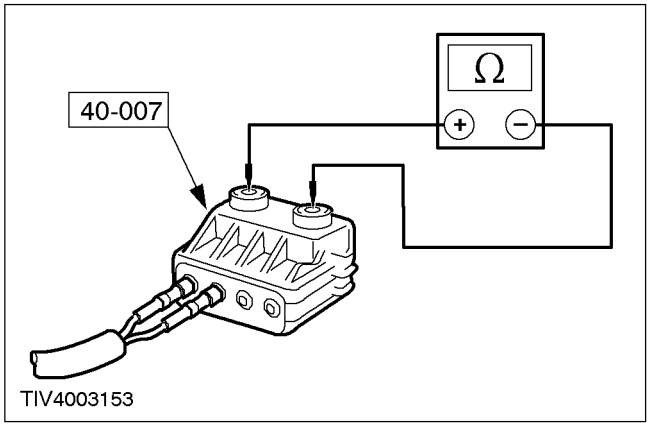
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	4 Key in ON position. 5 Measure the voltage between: - the air bag control module C490 pin 13, circuit 15S-JA31 (GN/WH) harness side and ground; and - the air bag control module C490 pin 14, circuit 91S- JA31 (BK/WH) harness side and ground. • Is any voltage present? → **Yes** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** CONNECT the passenger air bag module second stage simulator and the air bag control module. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

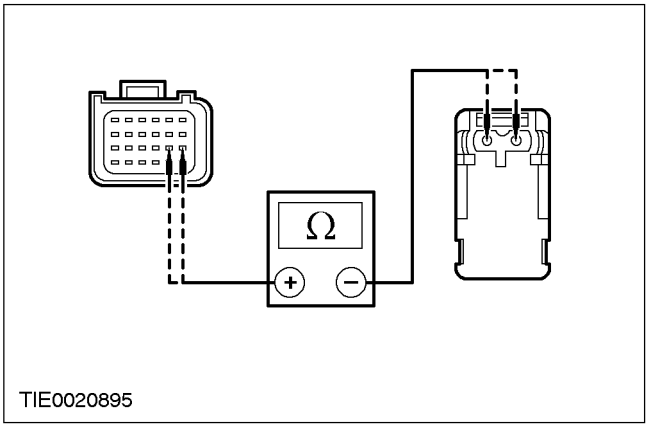
PINPOINT TEST AC: DTC B2293 ERROR VALUE 17: PASSENGER AIR BAG SECOND STAGE OPEN CIRCUIT

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
AC1: CHECK THE PASSENGER AIR BAG SECOND STAGE CIRCUIT RESISTANCE	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **AC2** → **No** GO to **AC3**
AC2: CHECK THE PASSENGER AIR BAG MODULE SQUIB RESISTANCE	
⚠ **WARNING: Do not proceed with this test unless using WDS. Failure to follow this instruction may result in personal injury.**	
 TIV4003153	1 Connect the Test and Deployment Lead to the passenger air bag module - first stage. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance of the air bag module squib. 5 Connect the Test and Deployment Lead to the passenger air bag module - second stage. 6 Measure the resistance of the air bag module squib. • Are the resistances between 2 and 3 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new passenger air bag module. REFER to Passenger Air Bag Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

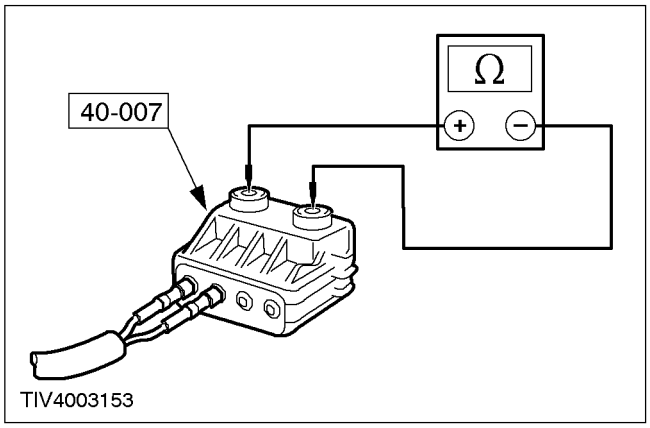
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
AC3: CHECK THE PASSENGER AIR BAG SECOND STAGE WIRING HARNESS FOR OPEN CIRCUIT OR HIGH RESISTANCE	
 TIE0020895	1 Key in OFF position. 2 Disconnect Air Bag Control Module C490. 3 Disconnect Passenger Air Bag Module Second Stage Simulator. 4 Measure the resistance between: - the air bag control module C490 pin 13, circuit 15S-JA31 (GN/WH) and the passenger air bag module C482 pin 1, circuit 15S-JA31 (GN/WH) harness side; and - the air bag control module C490 pin 14, circuit 91S-JA31 (BK/WH) and the passenger air bag module C482 pin 2, circuit 91S-JA31 (BK/WH) harness side. • Are the resistances less than 5 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 15S-JA31 (GN/WH) and 91S-JA31 (BK/WH). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

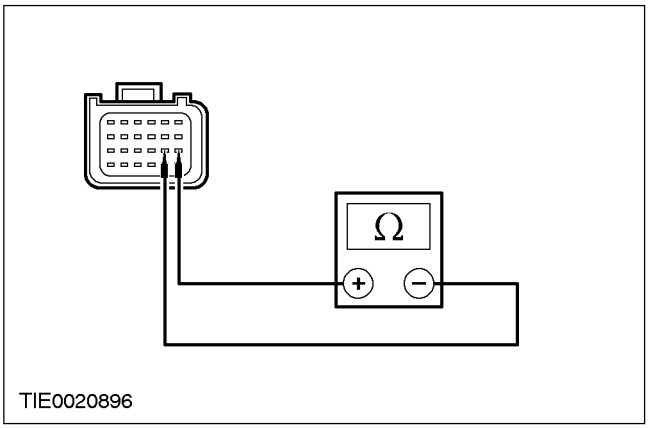
PINPOINT TEST AD: DTC B2293 ERROR VALUE 16: PASSENGER AIR BAG SECOND STAGE CIRCUIT LOW RESISTANCE

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	

DIAGNOSIS AND TESTING (Continued)

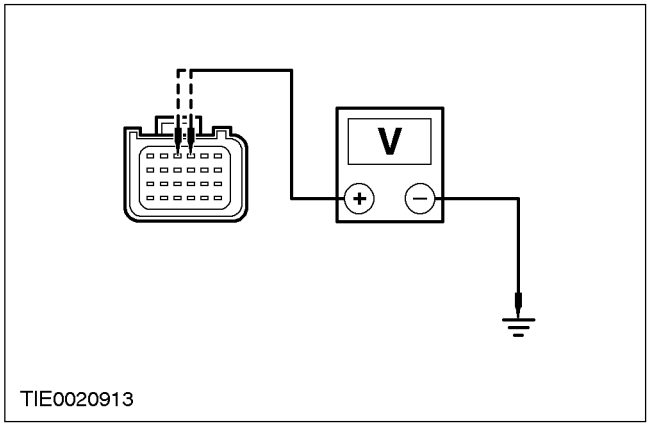
CONDITIONS	DETAILS/RESULTS/ACTIONS
AD1: CHECK THE PASSENGER AIR BAG SECOND STAGE CIRCUIT RESISTANCE	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **AD2** → **No** GO to **AD3**
AD2: CHECK THE PASSENGER AIR BAG MODULE SQUIB RESISTANCE	
	1 Connect the Test and Deployment Lead to the passenger air bag module - first stage. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance of the air bag module squib. 5 Connect the Test and Deployment Lead to the passenger air bag module - second stage. 6 Measure the resistance of the air bag module squib. • Are the resistances between 2 and 3 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	INSTALL a new passenger air bag module. REFER to Passenger Air Bag Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AD3: CHECK THE PASSENGER AIR BAG SECOND STAGE WIRING HARNESS FOR LOW RESISTANCE	
NOTE: Using a suitable non-conducting tool, disable the shorting bar on C490 pin 13.	
	1 Key in OFF position. 2 Disconnect Passenger Air Bag Module Second Stage Simulator. 3 Disconnect Air Bag Control Module C490. 4 Measure the resistance between the air bag control module C490 pin 13, circuit 15S-JA31 (GN/WH) and pin 14, circuit 91S-JA31 (BK/WH) harness side. • Is the resistance greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 15S-JA31 (GN/WH) and 91S-JA31 (BK/WH). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST AE: DTC B2294 ERROR VALUE 31: DRIVER SIDE AIR CURTAIN CIRCUIT SHORT TO BATTERY

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
AE1: CHECK THE DRIVER SIDE AIR CURTAIN WIRING HARNESS FOR A SHORT TO BATTERY OR IGNITION	
 TIE0020913	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Disconnect Driver Side Air Curtain Module Simulator. 3 Disconnect Air Bag Control Module C491. 4 Key in ON position. 5 Measure the voltage between: - the air bag control module C491 pin 3, circuit 15S-JA50 (GN/OG) harness side and ground; and - the air bag control module C491 pin 4, circuit 91S- JA50 (BK/RD) harness side and ground. • Is any voltage present? → **Yes** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No**

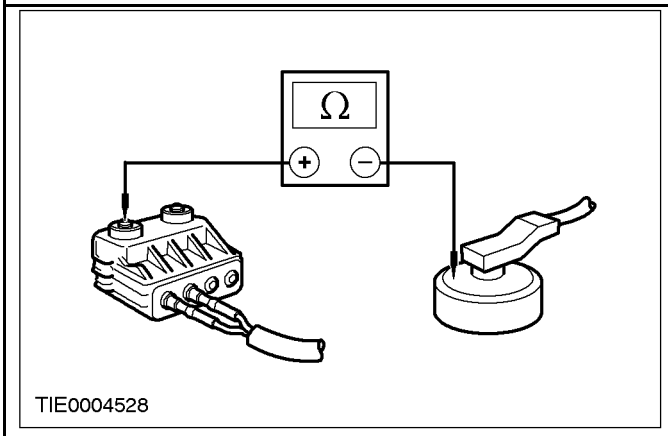
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	CONNECT the driver side air curtain module simulator and the air bag control module. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

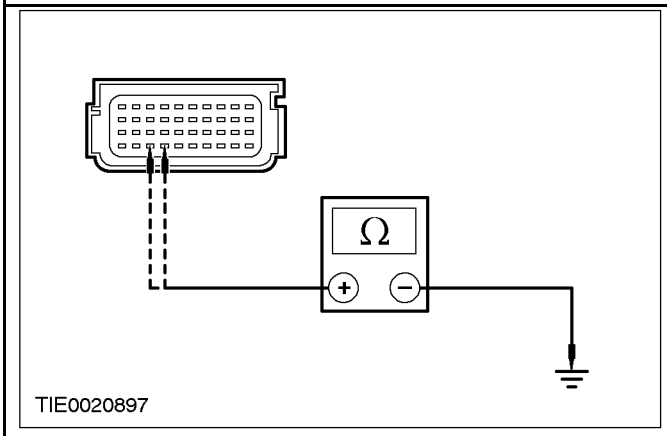
PINPOINT TEST AF: DTC B2294 ERROR VALUE 30: DRIVER SIDE AIR CURTAIN CIRCUIT SHORT TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
AF1: CHECK THE DRIVER SIDE AIR CURTAIN CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **AF2** → **No** GO to **AF3**
AF2: CHECK THE DRIVER SIDE AIR CURTAIN MODULE	
WARNING: Do not proceed with the test unless using WDS. Failure to follow this instruction may result in personal injury.	
	1 Connect the Test and Deployment Lead to the driver side air curtain module. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance between each of the terminals and the side air curtain module casing.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0004528	• Are the resistances greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new driver side air curtain module. REFER to Side Air Curtain Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AF3: CHECK THE DRIVER SIDE AIR CURTAIN WIRING HARNESS FOR A SHORT TO GROUND	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Driver Side Air Curtain Module Simulator. 4 Measure the resistance between: - the air bag control module C491 pin 3, circuit 15S-JA50 (GN/OG) harness side and ground; and - the air bag control module C491 pin 4, circuit 91S- JA50 (BK/RD) harness side and ground.

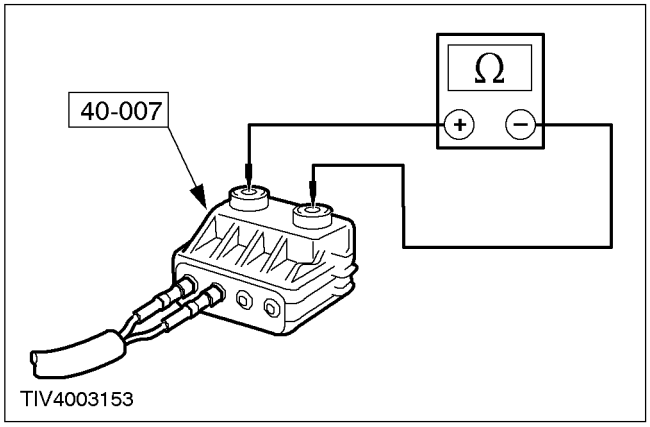
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Are the resistances greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

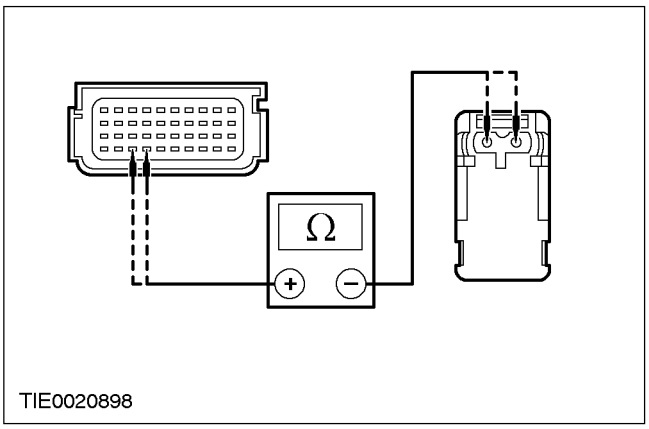
PINPOINT TEST AG: DTC B2294 ERROR VALUE 29: DRIVER SIDE AIR CURTAIN CIRCUIT OPEN CIRCUIT

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
AG1: CHECK THE DRIVER SIDE AIR CURTAIN CIRCUIT RESISTANCE	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **AG2** → **No** GO to **AG3**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
AG2: CHECK THE DRIVER SIDE AIR CURTAIN MODULE SQUIB RESISTANCE	
WARNING: Do not proceed with this test unless using WDS. Failure to follow this instruction may result in personal injury.	
 TIV4003153	1 Connect the Test and Deployment Lead to the driver side air curtain module. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance of the side air curtain module squib. • Is the resistance between 2 and 3 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new driver side air curtain module. REFER to Side Air Curtain Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AG3: CHECK THE DRIVER SIDE AIR CURTAIN WIRING HARNESS FOR OPEN CIRCUIT OR HIGH RESISTANCE	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Driver Side Air Curtain Simulator.

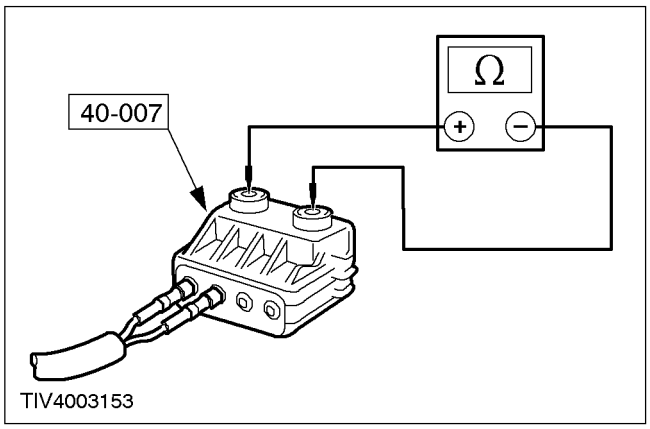
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	4 Measure the resistance between: - the air bag control module C491 pin 3, circuit 15S-JA50 (GN/OG) and the driver side air curtain module C597 pin 1, circuit 15S-JA50 (GN/OG) harness side; and - the air bag control module C491 pin 4, circuit 91S-JA50 (BK/RD) and the driver side air curtain module C597 pin 2, circuit 91S-JA50 (BK/RD) harness side. • Are the resistances less than 5 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 15S-JA50 (GN/OG) and 91S-JA50 (BK/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

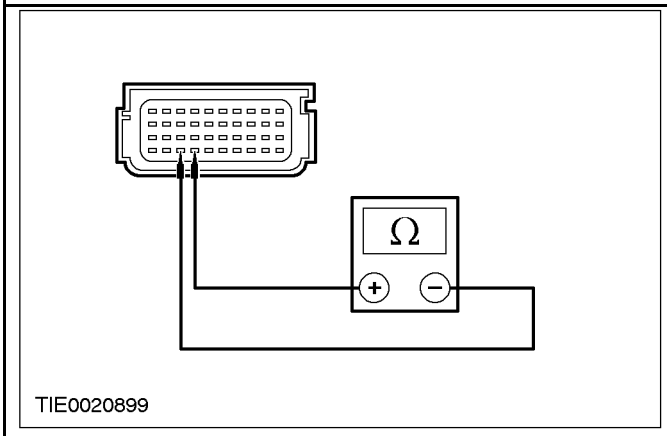
PINPOINT TEST AH: DTC B2294 ERROR VALUE 28: DRIVER SIDE AIR CURTAIN CIRCUIT LOW RESISTANCE ON SQUIB

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
AH1: CHECK THE DRIVER SIDE AIR CURTAIN MODULE CIRCUIT RESISTANCE	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Does the system prove out correctly? → **Yes** GO to **AH2** → **No** GO to **AH3**
AH2: CHECK THE DRIVER SIDE AIR CURTAIN MODULE SQUIB RESISTANCE	
	1 Connect the Test and Deployment Lead to the driver side air curtain module. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance of the side air curtain module squib. • Is the resistance between 2 and 3 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new driver side air curtain module. REFER to Side Air Curtain Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AH3: CHECK THE DRIVER SIDE AIR CURTAIN WIRING HARNESS FOR LOW RESISTANCE	
NOTE: Using a suitable non-conducting tool, disable the shorting bar on C491 pin 3.	
	1 Key in OFF position. 2 Disconnect Driver Side Air Curtain Simulator. 3 Disconnect Air Bag Control Module C491. 4 Measure the resistance between the air bag control module C491 pin 3, circuit 15S-JA50 (GN/OG) and pin 4, circuit 91S-JA50 (BK/RD) harness side.

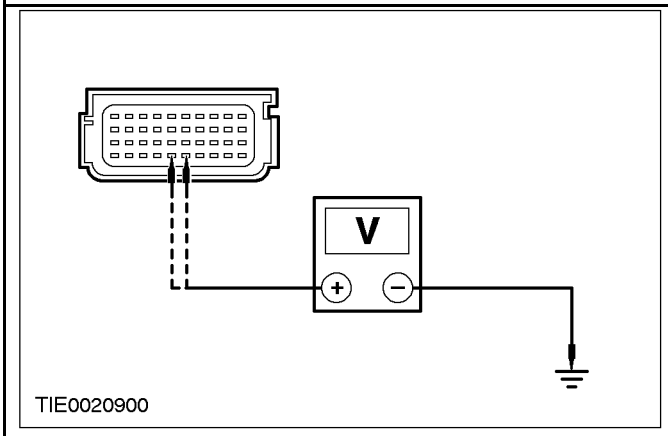
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020899	• Is the resistance greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 15S-JA50 (GN/OG) and 91S-JA50 (BK/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

PINPOINT TEST AI: DTC B2294 ERROR VALUE 27: PASSENGER SIDE AIR CURTAIN CIRCUIT SHORT TO BATTERY

CONDITIONS	DETAILS/RESULTS/ACTIONS
⚠ WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
AI1: CHECK THE PASSENGER SIDE AIR CURTAIN WIRING HARNESS FOR A SHORT TO BATTERY OR IGNITION	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Disconnect Passenger Side Air Curtain Module Simulator. 3 Disconnect Air Bag Control Module C491. 4 Key in ON position. 5 Measure the voltage between: - the air bag control module C491 pin 5, circuit 15S-JA51 (GN/BU) harness side and ground; and - the air bag control module C491 pin 6, circuit 91S- JA51 (BK/BU) harness side and ground.

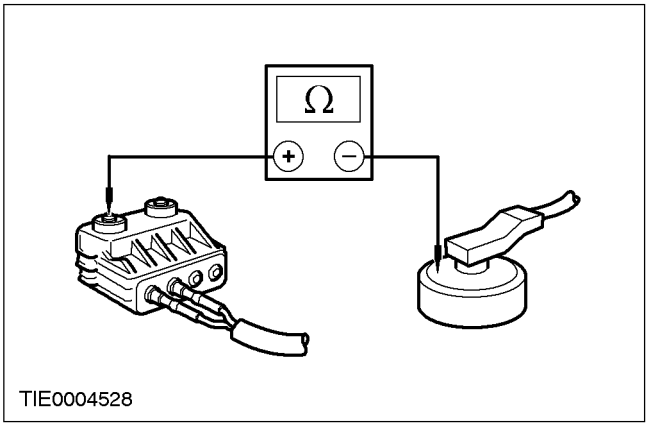
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is any voltage present? → **Yes** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** CONNECT the passenger side air curtain module simulator and the air bag control module. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

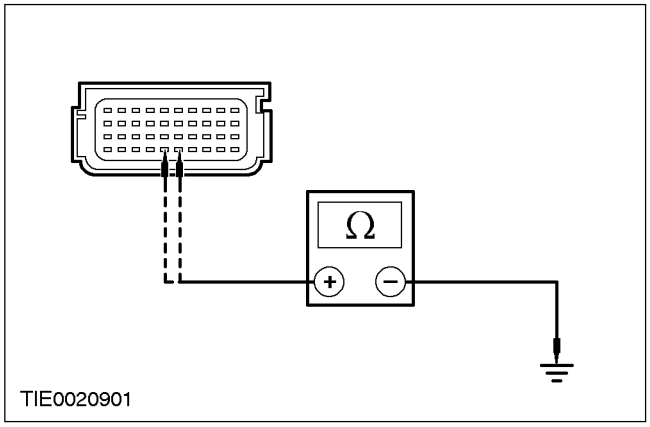
PINPOINT TEST AJ: DTC B2294 ERROR VALUE 26: PASSENGER SIDE AIR CURTAIN CIRCUIT SHORT TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
AJ1: CHECK THE PASSENGER SIDE AIR CURTAIN CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **AJ2** → **No** GO to **AJ3**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
AJ2: CHECK THE PASSENGER SIDE AIR CURTAIN MODULE	
WARNING: Do not proceed with the test unless using WDS. Failure to follow this instruction may result in personal injury.	
 TIE0004528	1 Connect the Test and Deployment Lead to the passenger side air curtain module. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance between each of the terminals and the side air curtain module casing. • Are the resistances greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new passenger side air curtain module. REFER to Side Air Curtain Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AJ3: CHECK THE PASSENGER SIDE AIR CURTAIN WIRING HARNESS FOR A SHORT TO GROUND	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Passenger Side Air Curtain Module Simulator.

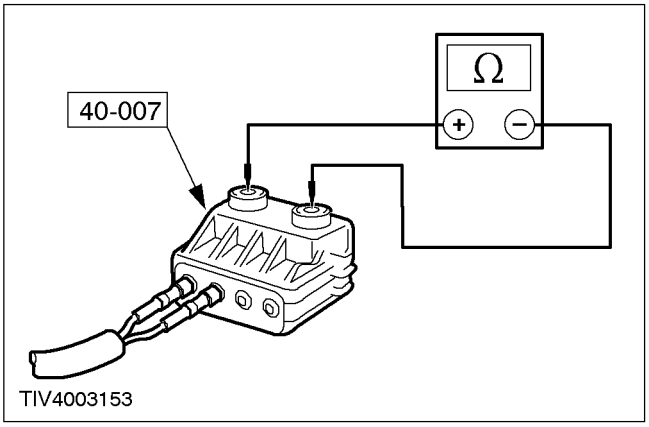
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	4 Measure the resistance between: - the air bag control module C491 pin 5, circuit 15S-JA51 (GN/BU) harness side and ground ; and - the air bag control module C491 pin 6, circuit 91S- JA51 (BK/BU) harness side and ground. • Are the resistances greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

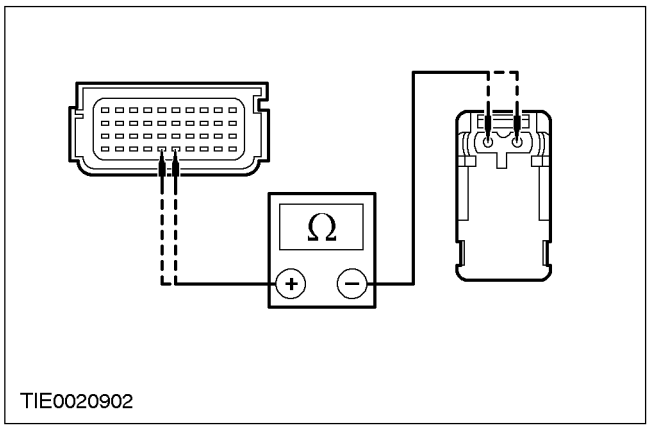
PINPOINT TEST AK: DTC B2294 ERROR VALUE 25: PASSENGER SIDE AIR CURTAIN CIRCUIT OPEN CIRCUIT

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
AK1: CHECK THE PASSENGER SIDE AIR CURTAIN CIRCUIT RESISTANCE	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly?

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** GO to **AK2** → **No** GO to **AK3**
AK2: CHECK THE PASSENGER SIDE AIR CURTAIN MODULE SQUIB RESISTANCE	
WARNING: Do not proceed with this test unless using WDS. Failure to follow this instruction may result in personal injury.	
 TIV4003153	1 Connect the Test and Deployment Lead to the passenger side air curtain module. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance of the side air curtain module squib. • Is the resistance between 2 and 3 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new passenger side air curtain module. REFER to Side Air Curtain Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AK3: CHECK THE PASSENGER SIDE AIR CURTAIN WIRING HARNESS FOR OPEN CIRCUIT OR HIGH RESISTANCE	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Passenger Side Air Curtain Module Simulator.

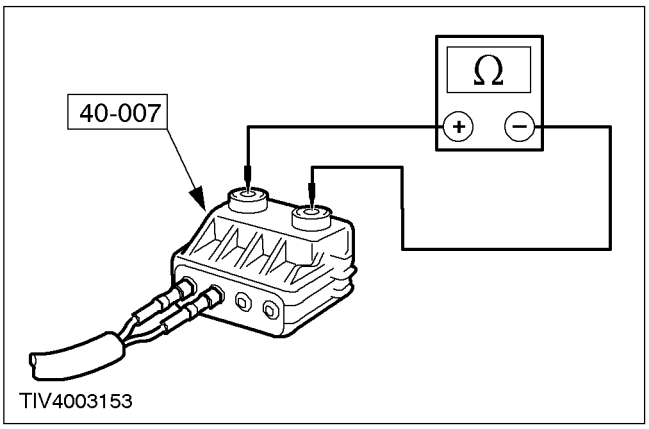
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	4 Measure the resistance between: - the air bag control module C491 pin 5, circuit 15S-JA51 (GN/BU) and the passenger side air curtain module C598 pin 1, circuit 15S-JA51 (GN/BU) harness side; and - the air bag control module C491 pin 6, circuit 91S-JA51 (BK/BU) and the passenger side air curtain module C598 pin 2, circuit 91S-JA51 (BK/BU) harness side. • Are the resistances less than 5 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 15S-JA51 (GN/BU) and 91S-JA51 (BK/BU). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

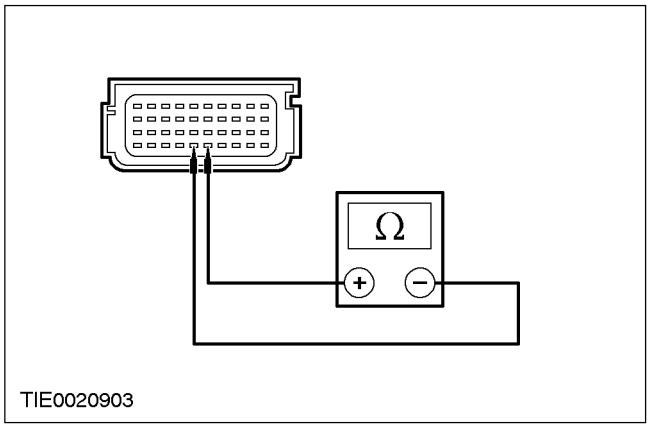
PINPOINT TEST AL: DTC B2294 ERROR VALUE 24: PASSENGER SIDE AIR CURTAIN CIRCUIT LOW RESISTANCE ON SQUIB

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
AL1: CHECK THE PASSENGER SIDE AIR CURTAIN MODULE CIRCUIT RESISTANCE	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Does the system prove out correctly? → **Yes** GO to **AL2** → **No** GO to **AL3**
AL2: CHECK THE PASSENGER SIDE AIR CURTAIN MODULE SQUIB RESISTANCE	
 TIV4003153	1 Connect the Test and Deployment Lead to the passenger side air curtain module. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance of the side air curtain module squib. • Is the resistance between 2 and 3 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new passenger side air curtain module. REFER to Side Air Curtain Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AL3: CHECK THE PASSENGER SIDE AIR CURTAIN WIRING HARNESS FOR LOW RESISTANCE	
NOTE: Using a suitable non-conducting tool, disable the shorting bar on C491 pin 5.	
	1 Key in OFF position. 2 Disconnect Passenger Side Air Curtain Module Simulator. 3 Disconnect Air Bag Control Module C491.

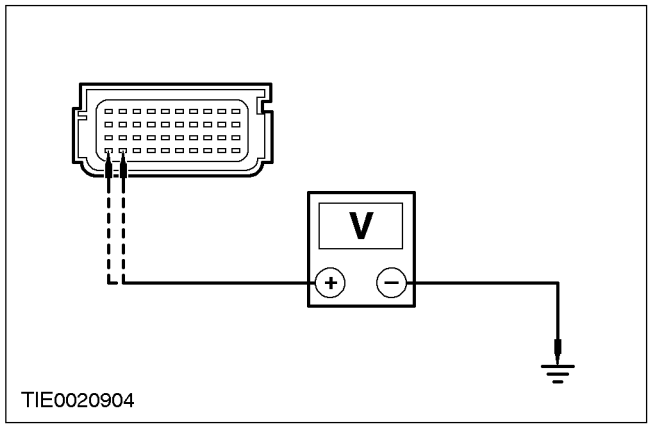
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020903	4 Measure the resistance between the air bag control module C491 pin 5, circuit 15S-JA51 (GN/BU) and pin 6, circuit 91S-JA51 (BK/BU) harness side. • Is the resistance greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 15S-JA51 (GN/BU) and 91S-JA51 (BK/BU). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

PINPOINT TEST AM: DTC B2295 ERROR VALUE 31: DRIVER SIDE AIR BAG CIRCUIT SHORT TO BATTERY

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
AM1: CHECK THE DRIVER SIDE AIR BAG CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes**

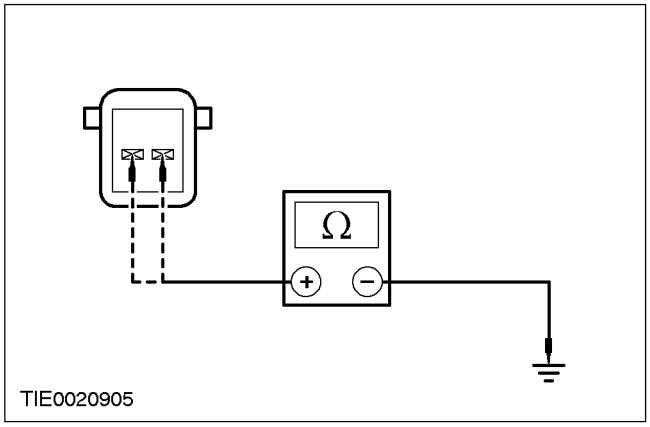
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **AM2**
AM2: CHECK THE DRIVER SIDE AIR BAG CIRCUIT FOR A SHORT TO BATTERY	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Key in ON position. 4 Measure the voltage between: - the air bag control C491 pin 1, circuit 15S-JA37 (GN/BK) harness side and ground; and - the air bag control module C491 pin 2, circuit 91S-JA37 (BK/GN) harness side and ground. • Is any voltage present? → **Yes** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

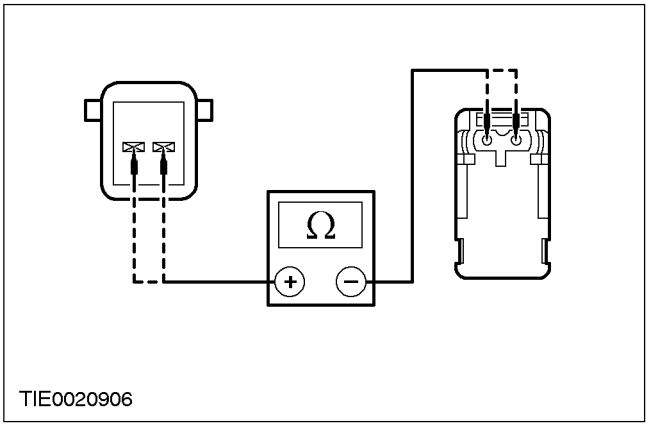
PINPOINT TEST AN: DTC B2295 ERROR VALUE 30: DRIVER SIDE AIR BAG CIRCUIT SHORT TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	

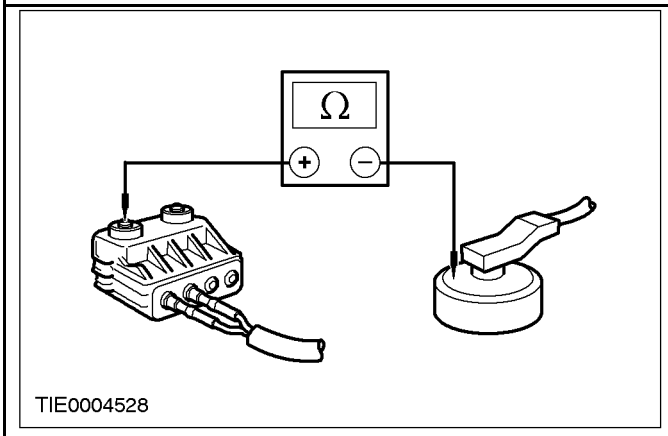
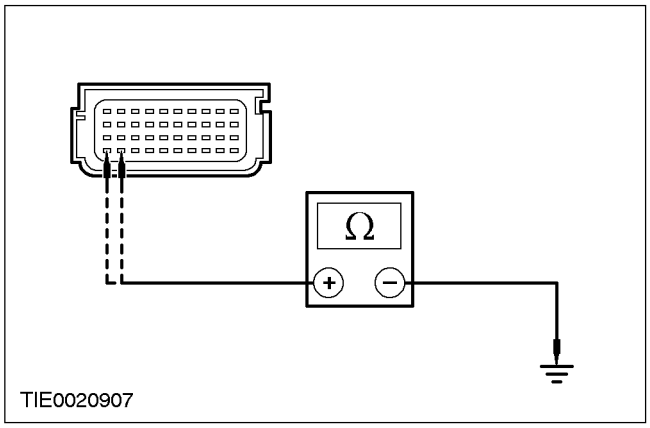
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
AN1: CHECK THE DRIVER SIDE AIR BAG CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **AN2** → **No** GO to **AN5**
AN2: CHECK THE DRIVER SIDE AIR BAG CIRCUIT FOR A SHORT TO GROUND	
	1 Key in OFF position. 2 Measure the resistance between: - the driver side air bag module underseat connector C60b pin 1, circuit 15S-JA37 (GN/BK) component side and ground; and - the driver side air bag module underseat connector C60b pin 2, circuit 91S-JA37 (BK/GN) component side and ground. • Are the resistances greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **AN3**
AN3: CHECK THE DRIVER SIDE AIR BAG WIRING SUB-HARNESS FOR HIGH RESISTANCE	
	1 Disassemble the front seat backrest to access the side air bag module electrical connector. REFER to Side Air Bag Module in this section. 2 Disconnect Driver Side Air Bag Module C217.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020906	**3** Measure the resistance between: - the driver side air bag module underseat connector C60b pin 1, circuit 15S-JA37 (GN/BK) component side and the seat frame; and - the driver side air bag module underseat connector C60b pin 2, circuit 91S-JA37 (BK/GN) component side and the seat frame. • Are the resistances greater than 10,000 ohms? → **Yes** GO to **AN4** → **No** REPAIR circuits 15S-JA37 (GN/BK) and 91S-JA37 (BK/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AN4: CHECK THE DRIVER SIDE AIR BAG MODULE	
WARNING: Do not proceed with the test unless using WDS. Failure to follow this instruction may result in personal injury.	
	1 Connect the Test and Deployment Lead to the driver side air bag module. **2** Select DMM specific on WDS. **3** Connect the Test and Deployment Lead to WDS. **4** Measure the resistance between each of the terminals and the side air bag module casing.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0004528	• Are the resistances greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new driver side air bag module. REFER to Side Air Bag Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AN5: CHECK THE DRIVER SIDE AIR BAG CIRCUIT FOR A SHORT TO GROUND	
 TIE0020907	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Driver Underseat Air Bag Simulator. 4 Measure the resistance between: - the air bag control C491 pin 1, circuit 15S-JA37 (GN/BK) harness side and ground; and - the air bag control module C491 pin 2, circuit 91S-JA37 (BK/GN) harness side and ground.

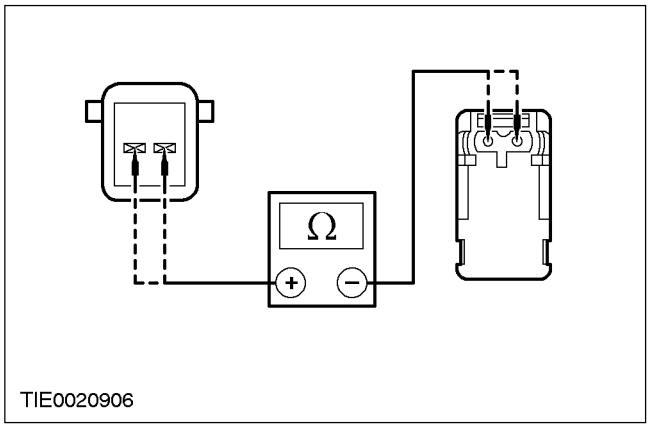
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Are the resistances greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

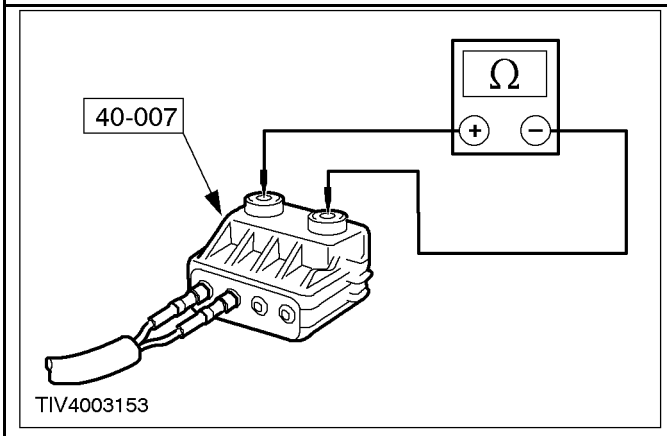
PINPOINT TEST AO: DTC B2295 ERROR VALUE 29: DRIVER SIDE AIR BAG CIRCUIT OPEN CIRCUIT

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
AO1: CHECK THE DRIVER SIDE AIR BAG CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **AO2** → **No** GO to **AO4**
AO2: CHECK THE DRIVER SIDE AIR BAG WIRING SUB-HARNESS FOR OPEN CIRCUIT OR HIGH RESISTANCE	
	1 Key in OFF position. 2 Disassemble the front seat backrest to access the side air bag module electrical connector. REFER to Side Air Bag Module in this section. 3 Disconnect Driver Side Air Bag Module C217.

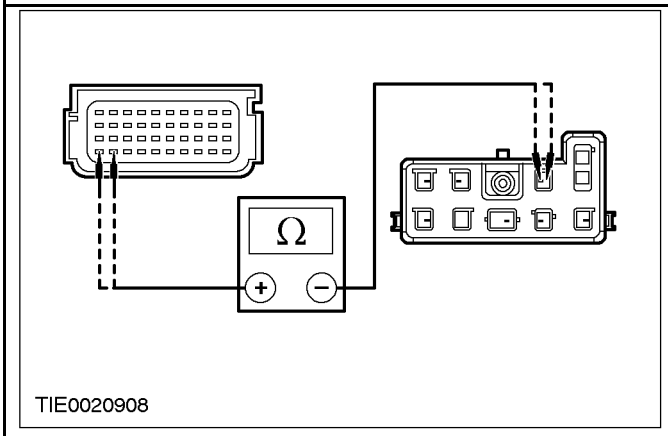
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020906	**4** Measure the resistance between: - the driver side air bag module underseat connector C60b pin 1, circuit 15S-JA37 (GN/BK) and the driver air bag module C217 pin 1, circuit 15S-JA37 (GN/BK) harness side; and - the driver side air bag module underseat connector C60b pin 2, circuit 91S-JA37 (BK/GN) and the driver air bag module C217 pin 2, circuit 91S-JA37 (BK/GN) harness side. • Are the resistances less than 5 ohms? → **Yes** GO to **AO3** → **No** REPAIR circuits 15S-JA37 (GN/BK) and 91S-JA37 (BK/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AO3: CHECK THE DRIVER SIDE AIR BAG MODULE SQUIB RESISTANCE	
⚠ **WARNING: Do not proceed with this test unless using WDS. Failure to follow this instruction may result in personal injury.**	
	1 Connect the Test and Deployment Lead to the driver side air bag module. **2** Select DMM specific on WDS. **3** Connect the Test and Deployment Lead to WDS. **4** Measure the resistance of the air bag module squib.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Are the resistances between 2 and 3 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new driver side air bag module. REFER to Side Air Bag Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AO4: CHECK THE DRIVER SIDE AIR BAG WIRING HARNESS FOR OPEN CIRCUIT OR HIGH RESISTANCE	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Driver Underseat Air Bag Simulator. 4 Measure the resistance between: - the air bag control module C491 pin 1, circuit 15S-JA37 (GN/BK) and the driver side air bag module underseat connector C60 pin 5, circuit 15S-JA37 (GN/BK) harness side; and - the air bag control module C491 pin 2, circuit 91S-JA37 (BK/GN) and the driver side air bag module underseat connector C60 pin 6, circuit 91S-JA37 (BK/GN) harness side.

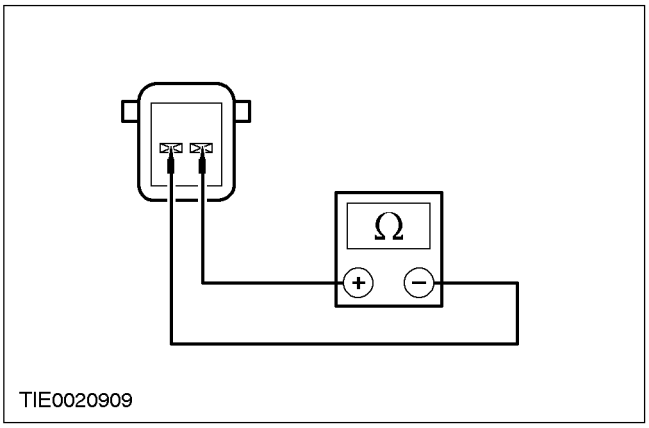
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020908	• Are the resistances less than 5 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 15S-JA37 (GN/BK) and 91S-JA37 (BK/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

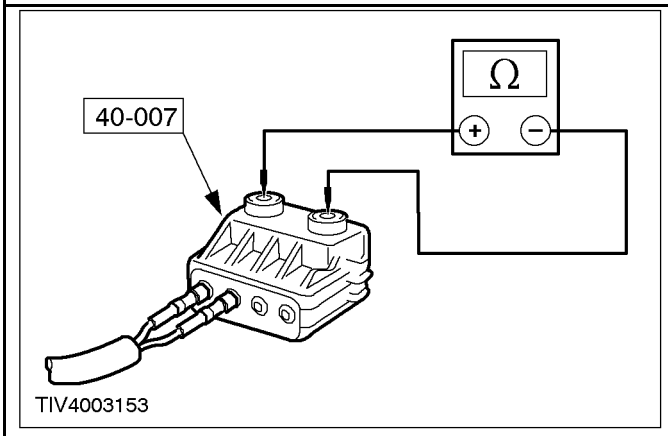
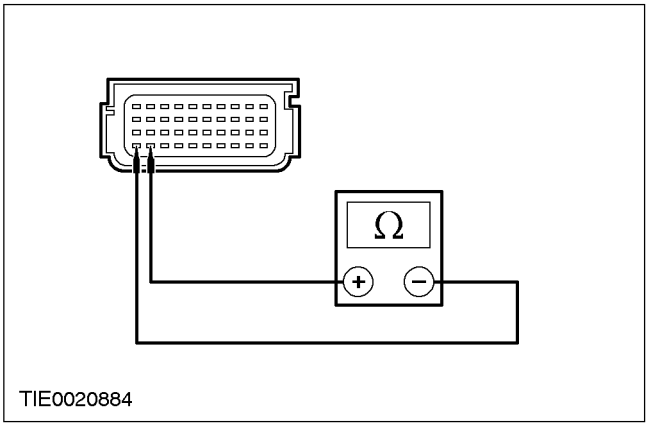
PINPOINT TEST AP: DTC B2295 ERROR VALUE 28: DRIVER SIDE AIR BAG CIRCUIT LOW RESISTANCE ON SQUIB

CONDITIONS	DETAILS/RESULTS/ACTIONS
⚠ **WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.**	
AP1: CHECK THE DRIVER SIDE AIR BAG CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **AP2** → **No** GO to **AP4**
AP2: CHECK THE DRIVER SIDE AIR BAG WIRING SUB-HARNESS FOR LOW RESISTANCE	
	1 Key in OFF position.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020909	2 Disassemble the front seat backrest to access the side air bag module electrical connector. REFER to Side Air Bag Module in this section. 3 Disconnect Air Bag Control Module C491. 4 Disconnect Driver Side Air Bag Module C217. 5 Measure the resistance between: - the driver side air bag module underseat connector C60b pin 1, circuit 15S-JA37 (GN/BK) and pin 2, circuit 91S-JA37 (BK/GN) harness side. • Is the resistance greater than 10,000 ohms? → **Yes** GO to **AP3** → **No** REPAIR circuits 15S-JA37 (GN/BK) and 91S-JA37 (BK/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AP3: CHECK THE DRIVER SIDE AIR BAG MODULE SQUIB RESISTANCE	
WARNING: Do not proceed with this test unless using WDS. Failure to follow this instruction may result in personal injury.	
	1 Connect the Test and Deployment Lead to the driver side air bag module. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance of the air bag module squib.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIV4003153	• Are the resistances between 2 and 3 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new driver side air bag module. REFER to Side Air Bag Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AP4: CHECK THE DRIVER SIDE AIR BAG CIRCUIT FOR LOW RESISTANCE	
NOTE: Using a suitable non-conducting tool, disable the shorting bar on C491 pin 1.	
 TIE0020884	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Driver Underseat Air Bag Simulator. 4 Measure the resistance between the air bag control module C491 pin 1, circuit 15S-JA37 (GN/BK) and pin 2, circuit 91S-JA37 (BK/GN) harness side.

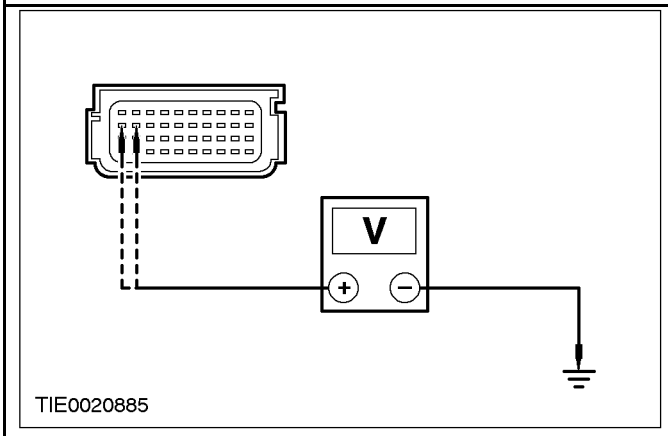
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is the resistance greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 15S-JA37 (GN/BK) and 91S-JA37 (BK/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

PINPOINT TEST AQ: DTC B2295 ERROR VALUE 27: PASSENGER SIDE AIR BAG CIRCUIT SHORT TO BATTERY

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
AQ1: CHECK THE PASSENGER SIDE AIR BAG CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **AQ2**
AQ2: CHECK THE PASSENGER SIDE AIR BAG CIRCUIT FOR A SHORT TO BATTERY	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Key in ON position. 4 Measure the voltage between: - the air bag control C491 pin 21, circuit 15S-JA38 (GN/OG) harness side and ground; and - the air bag control module C491 pin 22, circuit 91S-JA38 (BK/RD) harness side and ground.

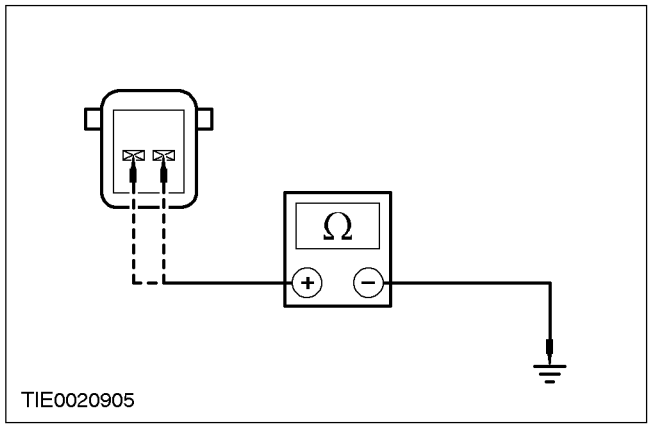
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is any voltage present? → **Yes** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

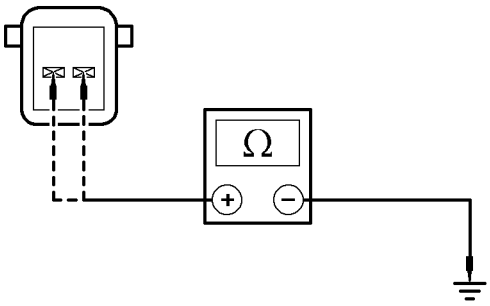
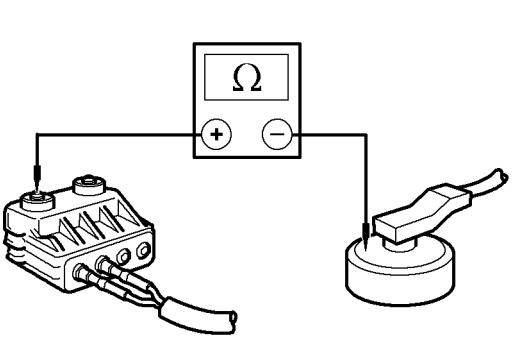
PINPOINT TEST AR: DTC B2295 ERROR VALUE 26: PASSENGER SIDE AIR BAG CIRCUIT SHORT TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
AR1: CHECK THE PASSENGER SIDE AIR BAG CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **AR2** → **No** GO to **AR5**
AR2: CHECK THE PASSENGER SIDE AIR BAG CIRCUIT FOR A SHORT TO GROUND	
	1 Key in OFF position.

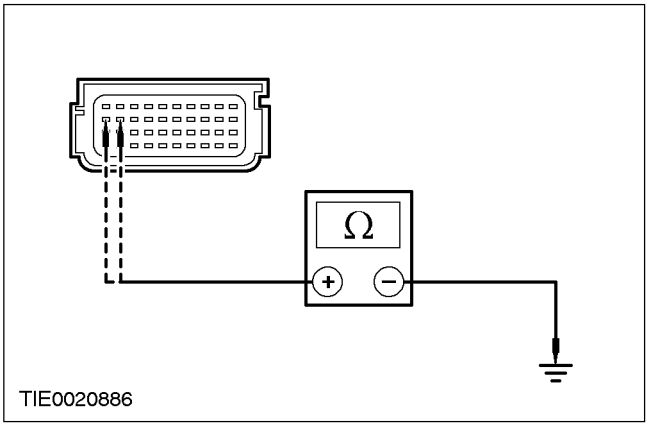
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	**2** Measure the resistance between: - the passenger side air bag module underseat connector C61b pin 1, circuit 15S-JA38 (GN/OG) component side and ground; and - the passenger side air bag module underseat connector C61b pin 2, circuit 91S-JA38 (BK/RD) component side and ground. • Are the resistances greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **AR3**
AR3: CHECK THE PASSENGER SIDE AIR BAG WIRING SUB-HARNESS FOR HIGH RESISTANCE	
	1 Disassemble the front seat backrest to access the side air bag module electrical connector. REFER to Side Air Bag Module in this section. **2** Disconnect Passenger Side Air Bag Module C218. **3** Measure the resistance between: - the passenger side air bag module underseat connector C61b pin 1, circuit 15S-JA38 (GN/OG) component side and the seat frame; and - the passenger side air bag module underseat connector C61b pin 2, circuit 91S-JA38 (BK/RD) component side and the seat frame.

DIAGNOSIS AND TESTING (Continued)

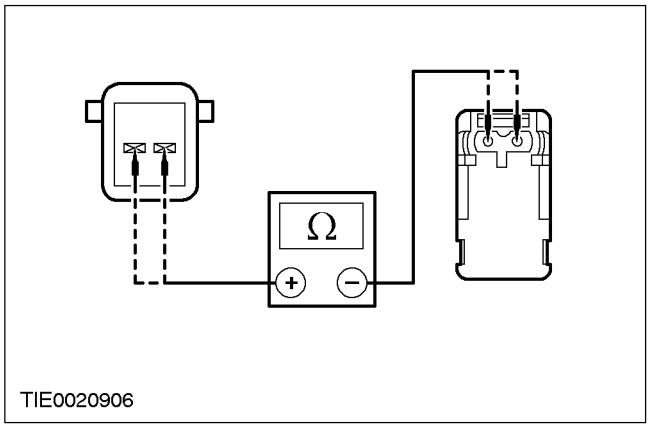
CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020905	• Are the resistances less than 5 ohms? → **Yes** GO to **AR4** → **No** REPAIR circuits 15S-JA38 (GN/OG) and 91S-JA38 (BK/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AR4: CHECK THE PASSENGER SIDE AIR BAG MODULE	
⚠ **WARNING: Do not proceed with the test unless using WDS. Failure to follow this instruction may result in personal injury.**	
 TIE0004528	1 Connect the Test and Deployment Lead to the passenger side air bag module. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance between each of the terminals and the side air bag module casing. • Are the resistances greater than 10,000 ohms? → **Yes**

DIAGNOSIS AND TESTING (Continued)

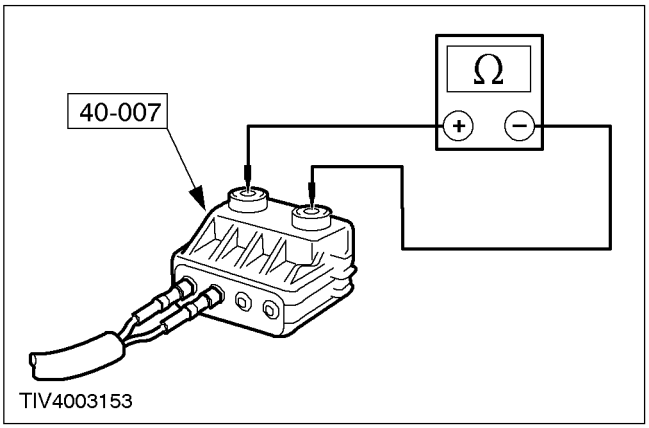
CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new passenger side air bag module. REFER to Side Air Bag Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AR5: CHECK THE PASSENGER SIDE AIR BAG CIRCUIT FOR A SHORT TO GROUND	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Passenger Underseat Air Bag Simulator. 4 Measure the resistance between: - the air bag control C491 pin 21, circuit 15S-JA38 (GN/OG) harness side and ground; and - the air bag control module C491 pin 22, circuit 91S-JA38 (BK/RD) harness side and ground. • Are the resistances greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

DIAGNOSIS AND TESTING (Continued)

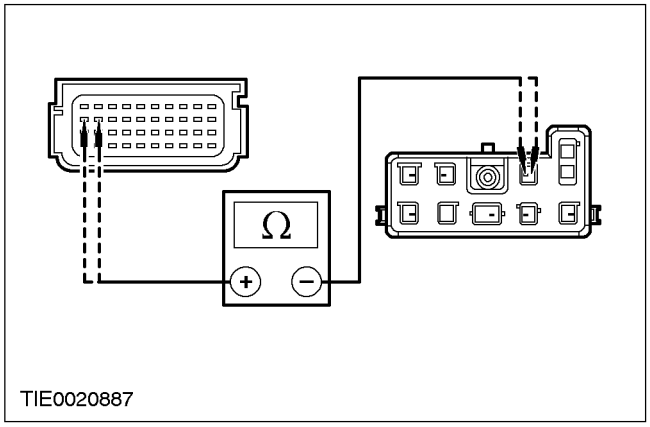
PINPOINT TEST AS: DTC B2295 ERROR VALUE 25: PASSENGER SIDE AIR BAG CIRCUIT OPEN CIRCUIT

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
AS1: CHECK THE PASSENGER SIDE AIR BAG CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **AS2** → **No** GO to **AS4**
AS2: CHECK THE PASSENGER SIDE AIR BAG WIRING SUB-HARNESS FOR OPEN CIRCUIT OR HIGH RESISTANCE	
	1 Key in OFF position. 2 Disassemble the front seat backrest to access the side air bag module electrical connector. REFER to Side Air Bag Module in this section. 3 Disconnect Passenger Side Air Bag Module C218. 4 Measure the resistance between: - the passenger side air bag module underseat connector C61b pin 1, circuit 15S-JA38 (GN/OG) and the passenger air bag module C218 pin 1, circuit 15S-JA38 (GN/OG) harness side; and - the passenger side air bag module underseat connector C61b pin 2, circuit 91S-JA38 (BK/RD) and the passenger air bag module C218 pin 2, circuit 91S-JA38 (BK/RD) harness side.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Are the resistances less than 5 ohms? → **Yes** GO to **AS3** → **No** REPAIR circuits 15S-JA38 (GN/OG) and 91S-JA38 (BK/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AS3: CHECK THE PASSENGER SIDE AIR BAG MODULE SQUIB RESISTANCE	
WARNING: Do not proceed with this test unless using WDS. Failure to follow this instruction may result in personal injury.	
	1 Connect the Test and Deployment Lead to the passenger side air bag module. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance of the air bag module squib. • Is the resistance between 2 and 3 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new passenger side air bag module. REFER to Side Air Bag Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

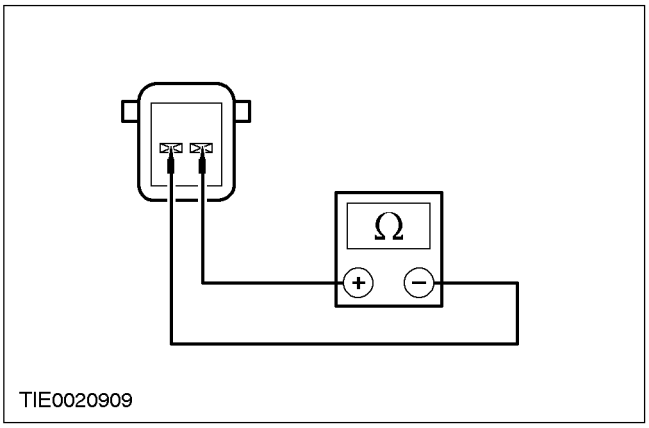
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
AS4: CHECK THE PASSENGER SIDE AIR BAG WIRING HARNESS FOR OPEN CIRCUIT OR HIGH RESISTANCE	
 TIE0020887	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Passenger Underseat Air Bag Simulator. 4 Measure the resistance between: - the air bag control module C491 pin 21, circuit 15S-JA38 (GN/OG) and the passenger side air bag module underseat connector C61 pin 5, circuit 15S-JA38 (GN/OG) harness side; and - the air bag control module C491 pin 22, circuit 91S-JA38 (BK/RD) and the passenger side air bag module underseat connector C61 pin 6, circuit 91S-JA38 (BK/RD) harness side. • Are the resistances less than 5 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 15S-JA38 (GN/OG) and 91S-JA38 (BK/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

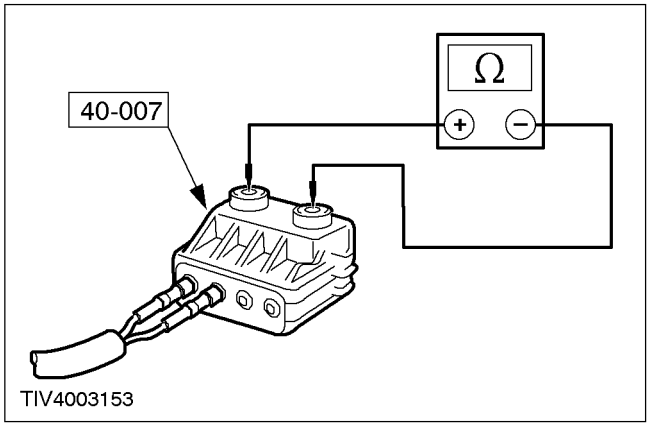
PINPOINT TEST AT: DTC B2295 ERROR VALUE 24: PASSENGER SIDE AIR BAG CIRCUIT LOW RESISTANCE ON SQUIB

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	

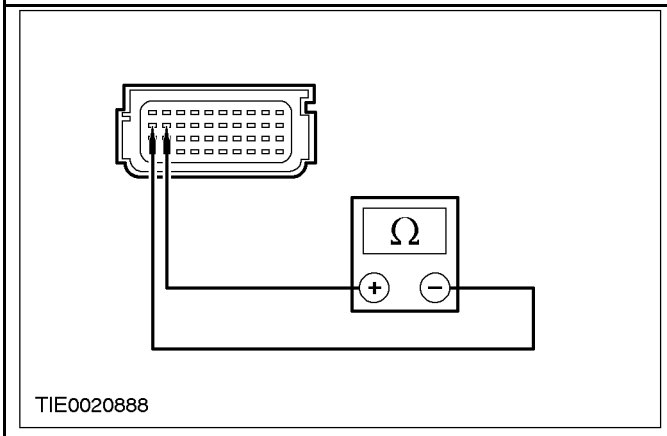
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
AT1: CHECK THE PASSENGER SIDE AIR BAG CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** GO to **AT2** → **No** GO to **AT4**
AT2: CHECK THE PASSENGER SIDE AIR BAG WIRING SUB-HARNESS FOR LOW RESISTANCE	
 TIE0020909	1 Key in OFF position. 2 Disassemble the front seat backrest to access the side air bag module electrical connector. REFER to Side Air Bag Module in this section. 3 Disconnect Air Bag Control Module C491. 4 Disconnect Passenger Side Air Bag Module C218. 5 Measure the resistance between: - the passenger side air bag module underseat connector C61b pin 1, circuit 15S-JA38 (GN/OG) and pin 2, circuit 91S-JA38 (BK/RD) harness side. • Is the resistance greater than 10,000 ohms? → **Yes** GO to **AT3** → **No** REPAIR circuits 15S-JA38 (GN/OG) and 91S-JA38 (BK/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
AT3: CHECK THE PASSENGER SIDE AIR BAG MODULE SQUIB RESISTANCE	
WARNING: Do not proceed with this test unless using WDS. Failure to follow this instruction may result in personal injury.	
 TIV4003153	1 Connect the Test and Deployment Lead to the passenger side air bag module. 2 Select DMM specific on WDS. 3 Connect the Test and Deployment Lead to WDS. 4 Measure the resistance of the air bag module squib. • Is the resistance between 2 and 3 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new passenger side air bag module. REFER to Side Air Bag Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AT4: CHECK THE PASSENGER SIDE AIR BAG CIRCUIT FOR LOW RESISTANCE	
NOTE: Using a suitable non-conducting tool, disable the shorting bar on C491 pin 21.	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Passenger Underseat Air Bag Simulator. 4 Measure the resistance between the air bag control module C491 pin 21, circuit 15S-JA38 (GN/OG) and pin 22, circuit 91S-JA38 (BK/RD) harness side.

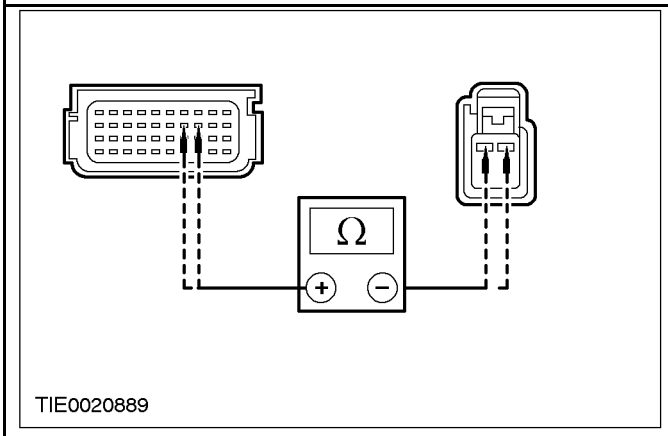
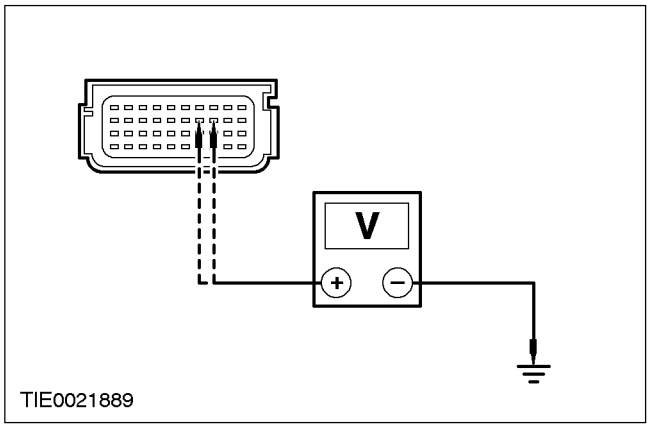
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020888	• Is the resistance greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 15S-JA38 (GN-OG) and 91S-JA38 (BK/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

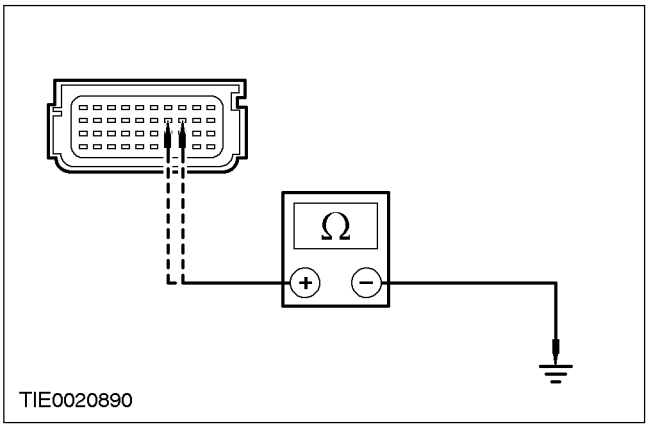
PINPOINT TEST AU: DTC B2296 ERROR VALUE 31: DRIVER SIDE IMPACT SENSOR COMMUNICATIONS FAULT

CONDITIONS	DETAILS/RESULTS/ACTIONS
⚠ **WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.**	
AU1: CHECK THE DRIVER SIDE IMPACT SENSOR CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Disconnect Driver Side Impact Sensor C453. 3 Disconnect Air Bag Control Module C491. 4 Measure the resistance between: - the air bag control module C491 pin 27, circuit 8-JA39 (WH) and the driver side impact sensor C453 pin 1, circuit 8-JA39 (WH) harness side; and - the air bag control module C491 pin 28, circuit 9-JA39 (BN) and the driver side impact sensor C453 pin 2, circuit 9-JA39 (BN) harness side.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020889	• Are the resistances less than 5 ohms? → **Yes** GO to **AU2** → **No** REPAIR circuits 8-JA39 (WH) and 9-JA39 (BN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AU2: CHECK THE DRIVER SIDE IMPACT SENSOR FOR A SHORT CIRCUIT TO BATTERY	
 TIE0021889	1 Measure the voltage between: - the air bag control module C491 pin 27, circuit 8-JA39 (WH) harness side and ground; and - the air bag control module C491 pin 28, circuit 9-JA39 (BN) harness side and ground. • Is any voltage present? → **Yes**

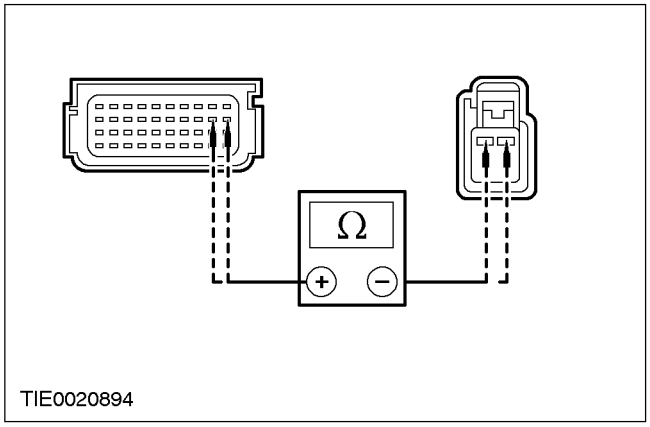
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **AU3**
AU3: CHECK THE DRIVER SIDE IMPACT SENSOR FOR A SHORT CIRCUIT TO GROUND	
	1 Measure the resistance between: - the air bag control module C491 pin 27, circuit 8-JA39 (WH) harness side and ground; and - the air bag control module C491 pin 28, circuit 9-JA39 (BN) harness side and ground. • Are the resistance greater than 10,000 Ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

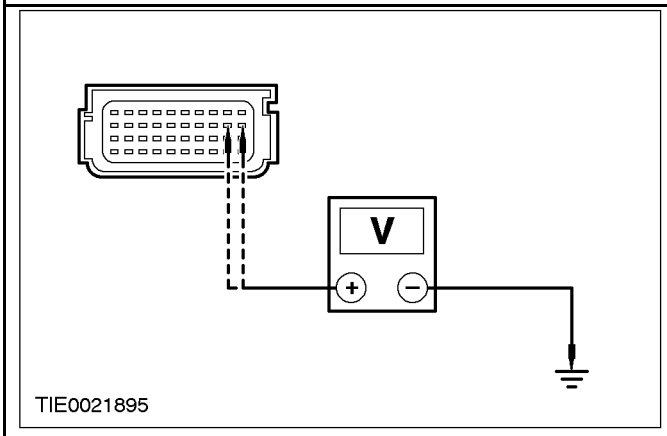
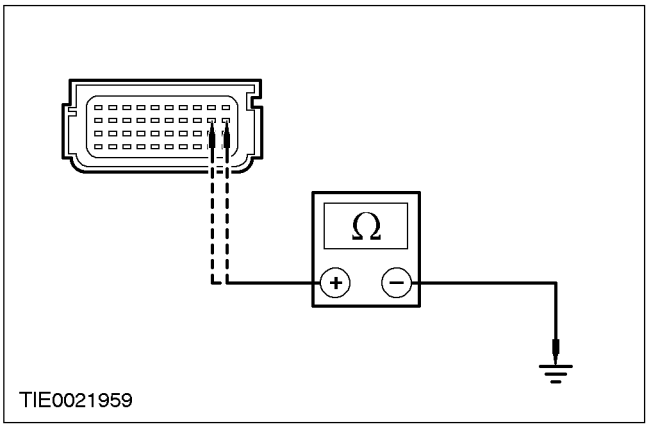
PINPOINT TEST AV: DTC B2296 ERROR VALUE 29: PASSENGER SIDE IMPACT SENSOR COMMUNICATIONS FAULT

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
AV1: CHECK THE PASSENGER SIDE IMPACT SENSOR CIRCUIT	
 TIE0020894	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Disconnect Passenger Side Impact Sensor C495. 3 Disconnect Air Bag Control Module C491. 4 Measure the resistance between: - the air bag control module C491 pin 29, circuit 8-JA40 (WH/VT) and the passenger side impact sensor C495 pin 1, circuit 8-JA40 (WH/VT) harness side; and - the air bag control module C491 pin 30, circuit 9-JA40 (BN/WH) and the passenger side impact sensor C495 pin 2, circuit 9-JA40 (BN/WH) harness side. • Are the resistances less than 5 ohms? → **Yes** GO to **AV2** → **No** REPAIR circuits 8-JA40 (WH/VT) and 9-JA40 (BN/WH). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AV2: CHECK THE PASSENGER SIDE IMPACT SENSOR FOR A SHORT CIRCUIT TO BATTERY	
	1 Key in ON position. 2 Measure the voltage between: - the air bag control module C491 pin 29, circuit 8-JA40 (WH/VT) harness side and ground; and - the air bag control module C491 pin 30, circuit 9-JA40 (BN/WH) harness side and ground.

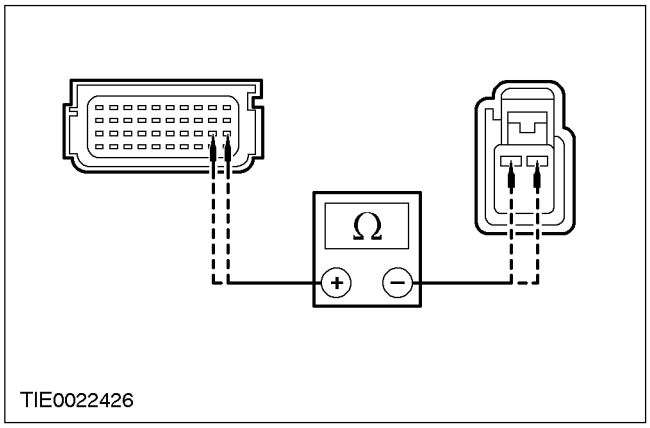
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Is any voltage present? → **Yes** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **AV3**
AV3: CHECK THE PASSENGER SIDE IMPACT SENSOR FOR A SHORT CIRCUIT TO GROUND	
	1 Key in OFF position. 2 Measure the resistance between: - the air bag control module C491 pin 29, circuit 8-JA40 (WH/VT) harness side and ground; and - the air bag control module C491 pin 30, circuit 9-JA40 (BN/WH) harness side and ground. • Are the resistance greater than 10,000 Ohms? → **Yes**

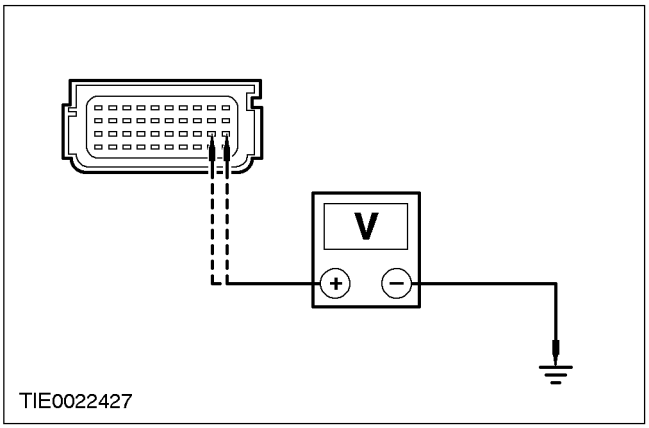
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

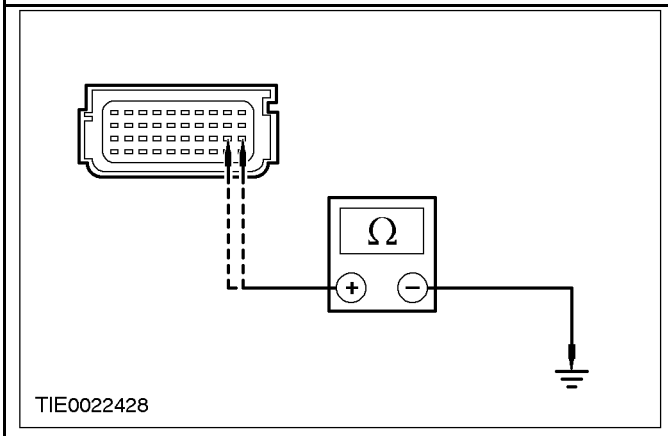
PINPOINT TEST AW: DTC B2296 ERROR VALUE 19: CRASH SENSOR COMMUNICATIONS FAULT

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
AW1: CHECK THE CRASH SENSOR CIRCUIT	
 TIE0022426	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Disconnect Crash Sensor C496. 3 Disconnect Air Bag Control Module C491. 4 Measure the resistance between: - the air bag control module C491 pin 19, circuit 8-JA49 (WH) and the crash sensor C496 pin 1, circuit 8-JA49 (WH) harness side; and - the air bag control module C491 pin 20, circuit 9-JA49 (BN) and the crash sensor C496 pin 2, circuit 9-JA49 (BN) harness side. • Are the resistances less than 5 ohms? → **Yes** GO to **AW2**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **No** REPAIR circuits 8-JA49 (WH) and 9-JA49 (BN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AW2: CHECK THE CRASH SENSOR FOR A SHORT CIRCUIT TO BATTERY	
	1 Key in ON position. 2 Measure the voltage between: - the air bag control module C491 pin 19, circuit 8-JA49 (WH) harness side and ground; and - the air bag control module C491 pin 20, circuit 9-JA49 (BN) harness side and ground. • Is any voltage present? → **Yes** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **AW3**
AW3: CHECK THE CRASH SENSOR FOR A SHORT CIRCUIT TO GROUND	
	1 Key in OFF position. 2 Measure the resistance between: - the air bag control module C491 pin 19, circuit 8-JA49 (WH) harness side and ground; and - the air bag control module C491 pin 20, circuit 9-JA49 (BN) harness side and ground.

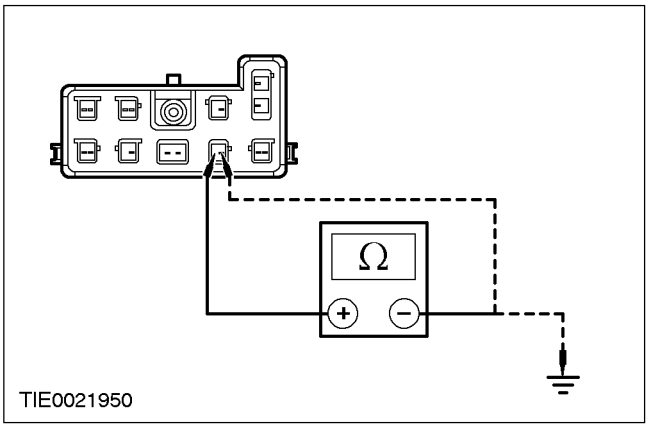
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Are the resistance greater than 10,000 Ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

PINPOINT TEST AX: DTC B2434: DRIVER SAFETY BELT BUCKLE SWITCH SHORT TO GROUND

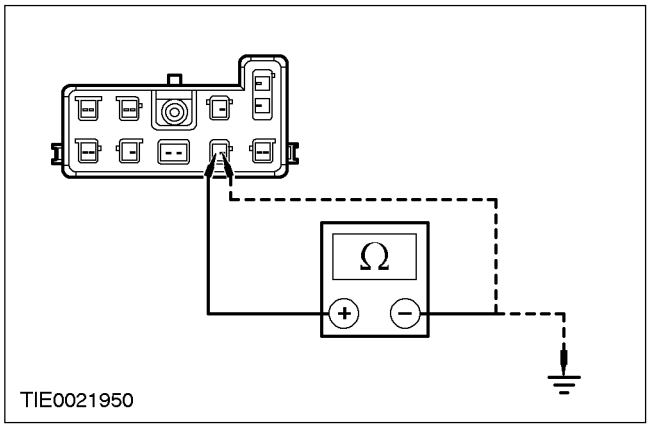
CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
AX1: CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes**

DIAGNOSIS AND TESTING (Continued)

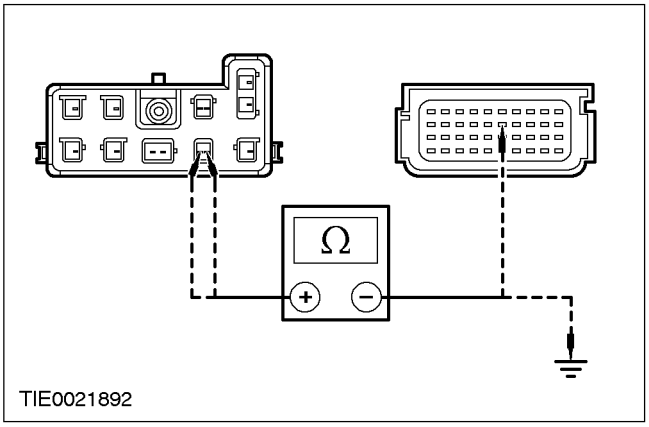
CONDITIONS	DETAILS/RESULTS/ACTIONS
	INSTALL a new driver safety belt buckle and pretensioner. REFER to Section 501-20A / 501-20B. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **AX2**
AX2: CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH CIRCUIT FOR A SHORT TO GROUND	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Driver Underseat Air Bag Simulator. 4 Measure the resistance between: - the driver safety belt buckle switch C60 pin 13, circuit 91-GE52A (BK/RD) and pin 14, circuit 91S-GE52A (BK/RD) harness side. - the driver safety belt buckle switch C60 pin 14, circuit 91S-GE52A (BK/RD) harness side and ground. • Are the resistances greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuit 91-GE52A (BK/RD) and 91S-GE52A (BK/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST AY: DTC B2435: DRIVER SAFETY BELT BUCKLE SWITCH RESISTANCE OUT OF RANGE

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
AY1: CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** INSTALL a new driver safety belt buckle and pretensioner. REFER to Section 501-20A / 501-20B. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **AY2**
AY2: CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH CIRCUIT FOR LOW RESISTANCE	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Driver Underseat Air Bag Simulator. 4 Measure the resistance between: - the driver safety belt buckle switch C60 pin 13, circuit 91-GE52A (BK/RD) and pin 14, circuit 91S-GE52A (BK/RD) harness side; and - the driver safety belt buckle switch C60 pin 14, circuit 91S-GE52A (BK/RD) harness side and ground.

DIAGNOSIS AND TESTING (Continued)

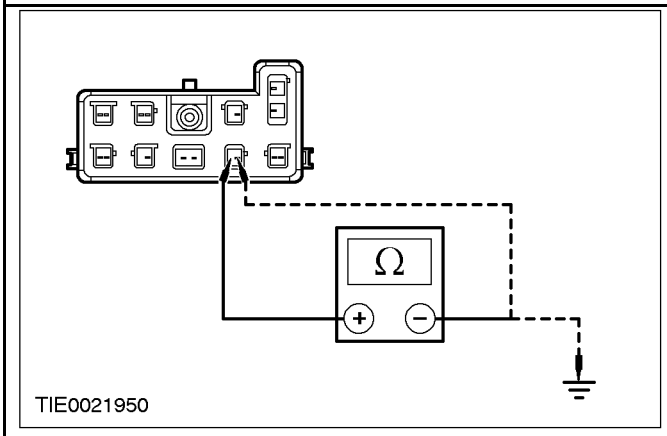
CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Are the resistances greater than 10,000 ohms? → **Yes** GO to **AY3** → **No** REPAIR circuit 91-GE52A (BK/RD) and 91S-GE52A (BK/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
AY3: CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH CIRCUIT FOR HIGH RESISTANCE	
 TIE0021892	1 Key in OFF position. 2 Disconnect Driver Underseat Air Bag Simulator. 3 Measure the resistance between: - the driver safety belt buckle switch C60 pin 14, circuit 91S-GE52A (BK/RD) and the air bag control module C491 pin 25, circuit 91S-GE52A (BK/RD) harness side; and - the driver safety belt buckle switch C60 pin 13, circuit 91-GE52A (BK/RD) harness side and ground. • Are the resistances less than 5 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** INSTALL a new air bag wiring harness. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST AZ: DTC B2438: PASSENGER SAFETY BELT BUCKLE SWITCH SHORT TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
AZ1: CHECK THE PASSENGER SAFETY BELT BUCKLE SWITCH CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** INSTALL a new passenger safety belt buckle and pretensioner. REFER to Section 501-20A / 501-20B. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **AZ2**
AZ2: CHECK THE PASSENGER SAFETY BELT BUCKLE SWITCH CIRCUIT FOR A SHORT TO GROUND	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Passenger Underseat Air Bag Simulator. 4 Measure the resistance between: - the passenger safety belt buckle switch C61 pin 13, circuit 91-GE52B (BK/RD) and pin 14, circuit 91S-GE52B (BK/RD) harness side; and - the passenger safety belt buckle switch C60 pin 14, circuit 91S-GE52B (BK/RD) harness side and ground.

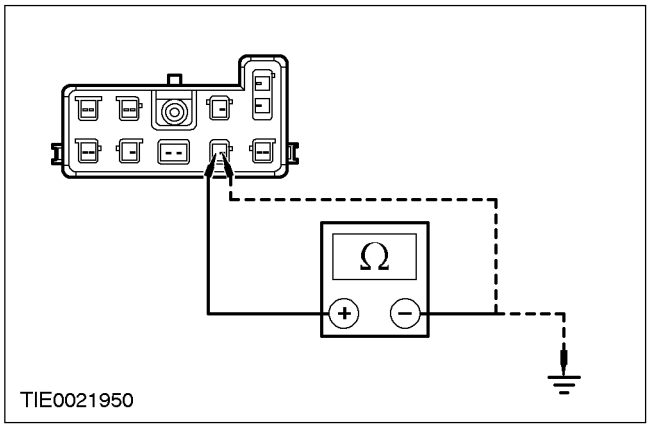
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Are the resistances greater than 10,000 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 91-GE52B (BK/RD) and 91S-GE52B (BK/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

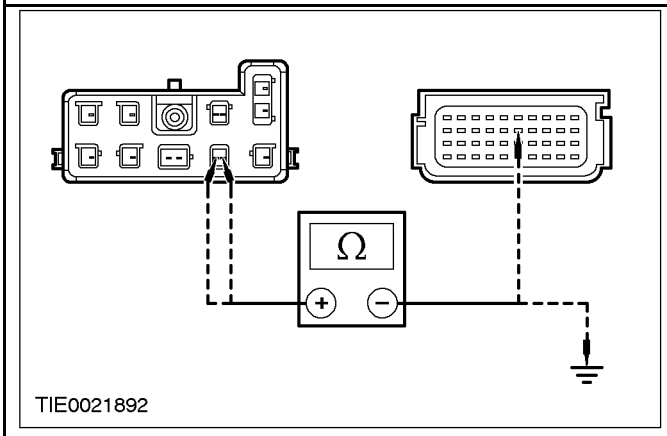
PINPOINT TEST BA: DTC B2439: PASSENGER SAFETY BELT BUCKLE SWITCH RESISTANCE OUT OF RANGE

CONDITIONS	DETAILS/RESULTS/ACTIONS
⚠ **WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.**	
BA1: CHECK THE PASSENGER SAFETY BELT BUCKLE SWITCH CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** INSTALL a new passenger safety belt buckle and pretensioner. REFER to Section 501-20A / 501-20B. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	GO to **BA2**
BA2: CHECK THE PASSENGER SAFETY BELT BUCKLE SWITCH CIRCUIT FOR LOW RESISTANCE	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Passenger Underseat Air Bag Simulator. 4 Measure the resistance between: - the passenger safety belt buckle switch C61 pin 13, circuit 91-GE52B (BK/RD) and pin 14, circuit 91S-GE52B (BK/RD) harness side; and - the passenger safety belt buckle switch C61 pin 14, circuit 91S-GE52B (BK/RD) harness side and ground. • Are the resistances greater than 10,000 ohms? → **Yes** GO to **BA3** → **No** REPAIR circuits 91-GE52B (BK/RD) and 91S-GE52B (BK/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
BA3: CHECK THE PASSENGER SAFETY BELT BUCKLE SWITCH CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect Passenger Underseat Air Bag Simulator. 2 Measure the resistance between: - the passenger safety belt buckle switch C61 pin 14, circuit 91S-GE52B (BK/RD) and the air bag control module C491 pin 26, circuit 91S-GE52B (BK/RD) harness side; and - the passenger safety belt buckle switch C61 pin 13, circuit 91-GE52B (BK/RD) harness side and ground.

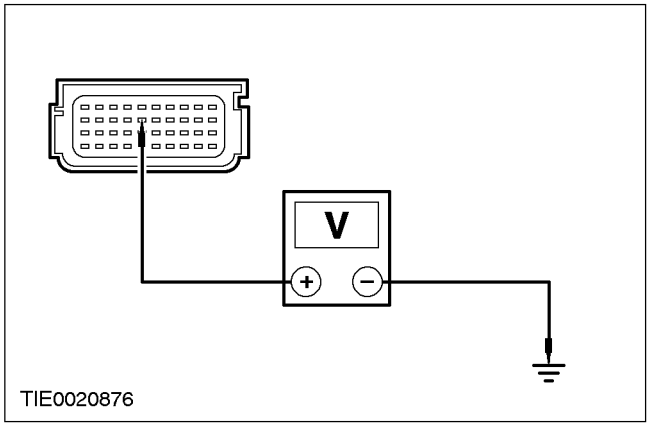
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Are the resistances less than 5 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 91S-GE52B (BK/RD) and 91-GE52B (BK/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

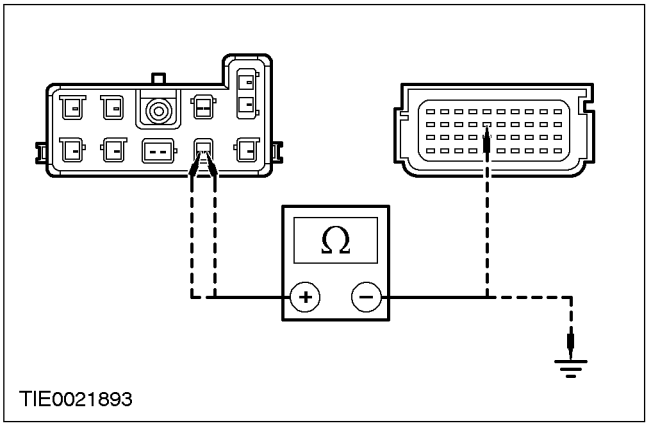
PINPOINT TEST BB: DTC B2691: DRIVER SAFETY BELT BUCKLE SWITCH OPEN CIRCUIT OR SHORT TO BATTERY

CONDITIONS	DETAILS/RESULTS/ACTIONS
BB1: CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH CIRCUIT	
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	INSTALL a new driver safety belt buckle and pretensioner. REFER to Section 501-20A / 501-20B. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **BB2**
BB2: CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH CIRCUIT FOR A SHORT TO BATTERY	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Key in ON position. 4 Measure the voltage between the air bag control module C491 pin 25, circuit 91S-GE52A (BK/RD) harness side and ground. • Is any voltage present? → **Yes** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **BB3**
BB3: CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH CIRCUIT FOR AN OPEN CIRCUIT	
	1 Key in OFF position. 2 Disconnect Driver Underseat Air Bag Simulator.

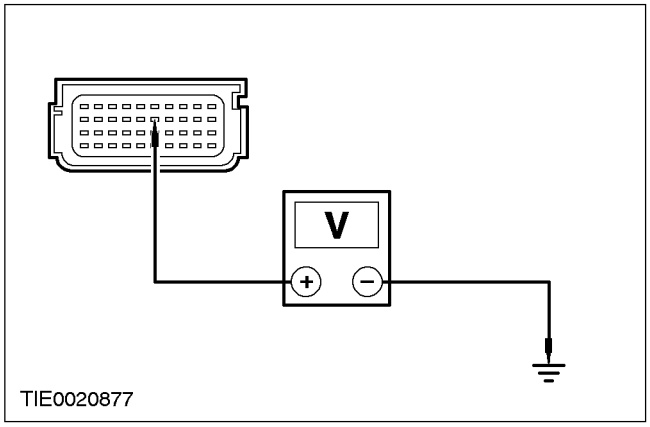
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0021893	3 Measure the resistance between: - the driver safety belt buckle switch C60 pin 14, circuit 91S-GE52A (BK/RD) and the air bag control module C491 pin 25, circuit 91S-GE52A (BK/RD) harness side; and - the driver safety belt buckle switch C60 pin 13, circuit 91-GE52A (BK/RD) harness side and ground. • Are the resistances less than 5 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 91S-GE52A (BK/RD) and 91-GE52A (BK/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

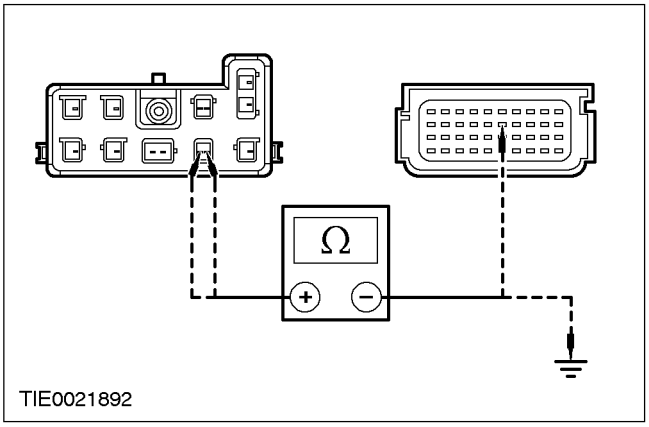
PINPOINT TEST BC: DTC B2692: PASSENGER SAFETY BELT BUCKLE SWITCH OPEN CIRCUIT OR SHORT TO BATTERY

CONDITIONS	DETAILS/RESULTS/ACTIONS
BC1: CHECK THE PASSENGER SAFETY BELT BUCKLE SWITCH CIRCUIT	
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	• Does the system prove out correctly? → **Yes** INSTALL a new passenger safety belt buckle and pretensioner. REFER to Section 501-20A / 501-20B. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **BC2**
BC2: CHECK THE PASSENGER SAFETY BELT BUCKLE SWITCH CIRCUIT FOR A SHORT TO BATTERY	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Key in ON position. 4 Measure the voltage between the air bag control module C491 pin 26, circuit 91S-GE52B (BK/RD) harness side and ground. • Is any voltage present? → **Yes** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **BC3**
BC3: CHECK THE PASSENGER SAFETY BELT BUCKLE SWITCH CIRCUIT FOR AN OPEN CIRCUIT	
	1 Key in OFF position. 2 Disconnect Passenger Underseat Air Bag Simulator.

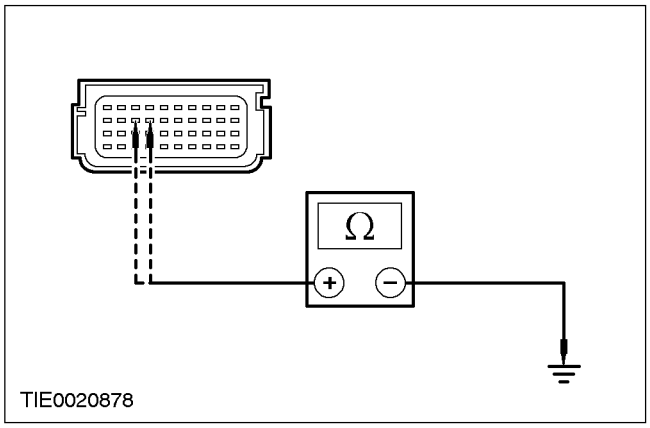
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0021892	3 Measure the resistance between: - the passenger safety belt buckle switch C61 pin 14, circuit 91S-GE52B (BK/RD) and the air bag control module C491 pin 26, circuit 91S-GE52B (BK/RD) harness side; and - the passenger safety belt buckle switch C61 pin 13, circuit 91-GE52B (BK/RD) harness side and ground. • Are the resistances less than 5 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 91S-GE52B (BK/RD) and 91-GE52B (BK/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

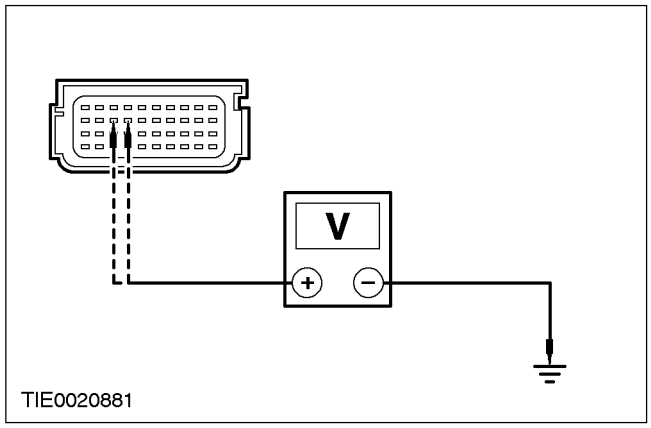
PINPOINT TEST BD: DTC C1947: SEAT POSITION SENSOR SHORT TO GROUND OR BATTERY

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
BD1: CHECK THE SEAT POSITION SENSOR CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly?

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** INSTALL a new seat position sensor. REFER to Section 501-10. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **BD2**
BD2: CHECK THE SEAT POSITION SENSOR FOR A SHORT TO GROUND	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Driver Underseat Air Bag Simulator. 4 Measure the resistance between: - the air bag control module C491 pin 23, circuit 8-JA53 (WH/RD) harness side and ground; and - the air bag control module C491 pin 24, circuit 9-JA53 (BN/RD) harness side and ground. • Are the resistances greater than 10,000 ohms? → **Yes** GO to **BD3** → **No** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
BD3: CHECK THE SEAT POSITION SENSOR FOR A SHORT TO BATTERY	
	1 Key in ON position.

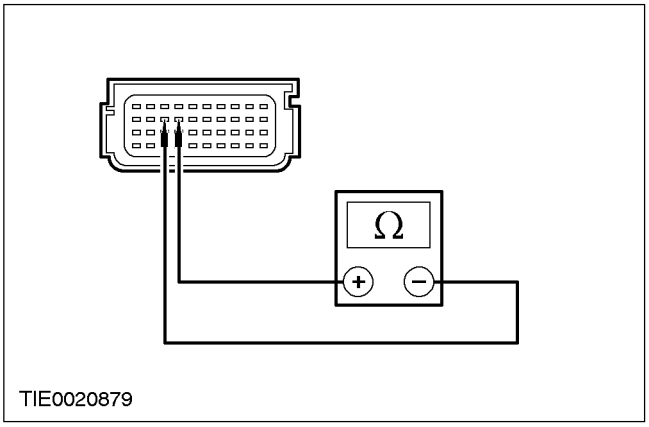
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	2 Measure the voltage between: - the air bag control module C491 pin 23, circuit 8-JA53 (WH/RD) harness side and ground; and - the air bag control module C491 pin 24, circuit 9-JA53 (BN/RD) harness side and ground. • Is any voltage present → **Yes** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

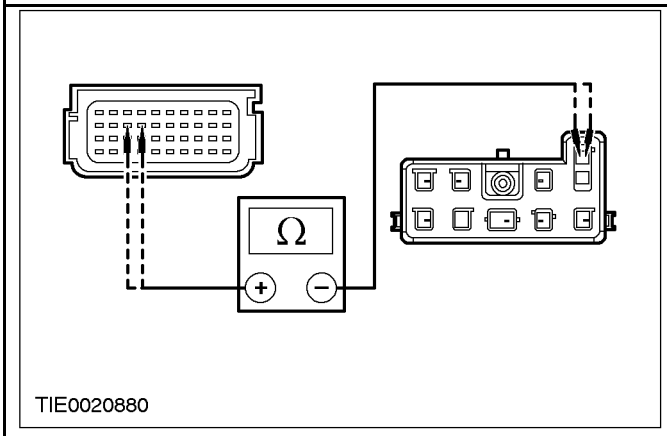
PINPOINT TEST BE: DTC C1948: SEAT POSITION SENSOR RESISTANCE OUT OF RANGE

CONDITIONS	DETAILS/RESULTS/ACTIONS
⚠ **WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.**	
BE1: CHECK THE SEAT POSITION SENSOR CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly?

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	→ **Yes** INSTALL a new seat position sensor. REFER to Section 501-10. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **BE2**
BE2: CHECK THE SEAT POSITION SENSOR CIRCUIT FOR LOW RESISTANCE	
 TIE0020879	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Disconnect Driver Underseat Air Bag Simulator. 4 Measure the resistance between: - the air bag control module C491 pin 23, circuit 8-JA53 (WH/RD) and pin 24, circuit 9-JA53 (BN/RD) harness side. • Is the resistance greater than 10,000 ohms? → **Yes** GO to **BE3** → **No** REPAIR circuits 8-JA53 (WH/RD) and 9-JA53 (BN/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
BE3: CHECK THE SEAT POSITION SENSOR CIRCUIT FOR HIGH RESISTANCE	
	1 Measure the resistance between: - the air bag control module C491 pin 23, circuit 8-JA53 (WH/RD) and the seat position sensor C60 pin 2, circuit 8-JA53 (WH/RD) harness side; and - the air bag control module C491 pin 24, circuit 9-JA53 (BN/RD) and the seat position sensor C60 pin 1, circuit 9-JA53 (BN/RD) harness side.

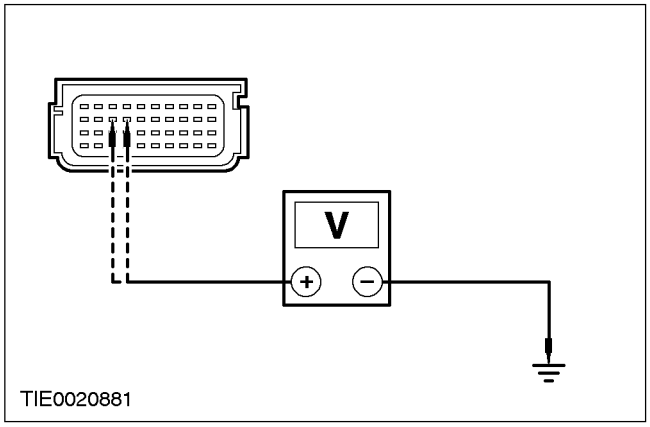
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020880	• Are the resistances less than 5 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 8-JA53 (WH/RD) and 9-JA53 (BN/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

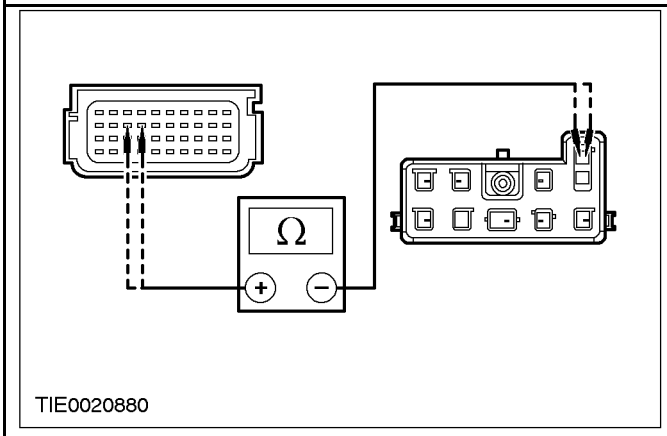
PINPOINT TEST BF: DTC C1981: SEAT POSITION SENSOR OPEN CIRCUIT

CONDITIONS	DETAILS/RESULTS/ACTIONS
WARNING: Wait at least one minute after disconnecting the battery ground cable before disconnecting any supplemental restraint system electrical connector. Failure to follow this instruction may result in personal injury.	
BF1: CHECK THE SEAT POSITION SENSOR CIRCUIT	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Key in ON position. 3 Carry out the self-test with the simulators installed. • Does the system prove out correctly? → **Yes** INSTALL a new seat position sensor. REFER to Section 501-10. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	GO to **BF2**
BF2: CHECK THE SEAT POSITION SENSOR CIRCUIT FOR A SHORT TO BATTERY	
	1 Key in OFF position. 2 Disconnect Air Bag Control Module C491. 3 Key in ON position. 4 Measure the voltage between: - the air bag control module C491 pin 23, circuit 8-JA53 (WH/RD) harness side and ground; and - the air bag control module C491 pin 24, circuit 9-JA53 (BN/RD) harness side and ground. • Is any voltage present? → **Yes** REPAIR the air bag wiring harness. For additional information, refer to the Wiring Diagrams. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** GO to **BF3**
BF3: CHECK THE SEAT POSITION SENSOR CIRCUIT FOR AN OPEN CIRCUIT	
	1 Key in OFF position. 2 Disconnect Driver Underseat Air Bag Simulator. 3 Measure the resistance between: - the air bag control module C491 pin 23, circuit 8-JA53 (WH/RD) and the seat position sensor C60 pin 2, circuit 8-JA53 (WH/RD) harness side; and - the air bag control module C491 pin 24, circuit 9-JA53 (BN/RD) and the seat position sensor C60 pin 1, circuit 9-JA53 (BN/RD) harness side.

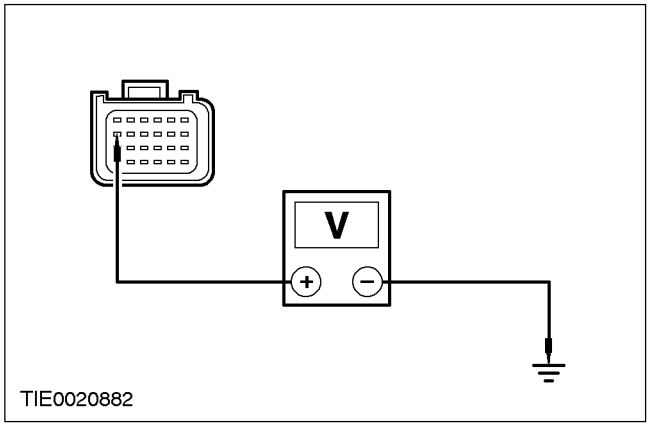
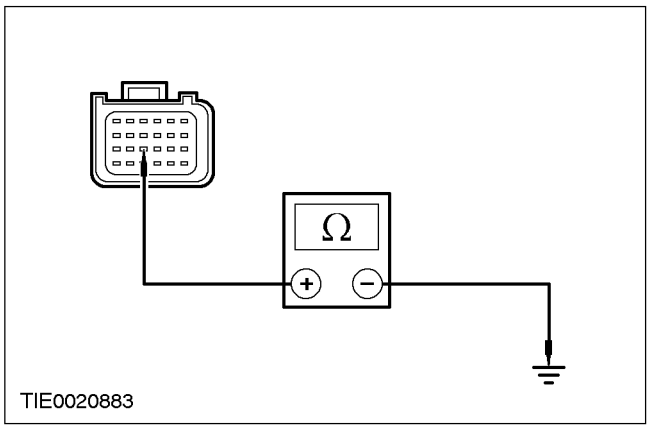
DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
 TIE0020880	• Are the resistances less than 5 ohms? → **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuits 8-JA53 (WH/RD) and 9-JA53 (BN/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

PINPOINT TEST BG: AIR BAG CONTROL MODULE DISCONNECTED OR INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
BG1: CHECK THE AIR BAG CONTROL MODULE ELECTRICAL CONNECTORS	
	1 Deactivate the supplemental restraint system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. 2 Check the air bag control module electrical connectors. • Are the air bag control module electrical connectors fully connected with the red locking tabs engaged? → **Yes** GO to **BG2** → **No** CONNECT the air bag control module electrical connectors and engage the red locking tabs. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
BG2: CHECK THE IGNITION SUPPLY CIRCUIT FOR AN OPEN CIRCUIT	
	1 Disconnect Air Bag Control Module C490. 2 Key in ON position. 3 Measure the voltage between the air bag control module C490 pin 12, circuit 15-JA10 (GN/OG) harness side and ground. • Is the voltage between 9 and 16 volts? → **Yes** GO to **BG3** → **No** REPAIR circuit 15-JA10 (GN/OG). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.
BG3: CHECK THE AIR BAG CONTROL MODULE GROUND CIRCUIT	
	1 Key in OFF position. 2 Measure the resistance between the air bag control module C490 pin 16, circuit 91-JA10 (BK/RD) harness side and ground. • Is the resistance less than 5 ohms? → **Yes**

DIAGNOSIS AND TESTING (Continued)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	INSTALL a new air bag control module. REFER to Air Bag Control Module in this section. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section. → **No** REPAIR circuit 91-JA10 (BK/RD). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

GENERAL PROCEDURES

Deployed Air Bag Disposal

WARNING: After deployment, the air bag module surface may contain deposits of sodium hydroxide, a product of the gas generate combustion, that is irritating to the skin. Use protective gloves when handling any deployed air bag module. Failure to follow this instruction may result in personal injury.

1. **Remove the deployed air bag module(s). For additional information, refer to the relevant procedure in this section.**
2. **Seal the deployed air bag module(s) in the packaging from the new air bag module(s) or a suitable polythene bag, and then dispose of in accordance with local contaminated waste regulations.**

GENERAL PROCEDURES

Unserviceable Air Bag Disposal

1. **WARNING: To minimise the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.**

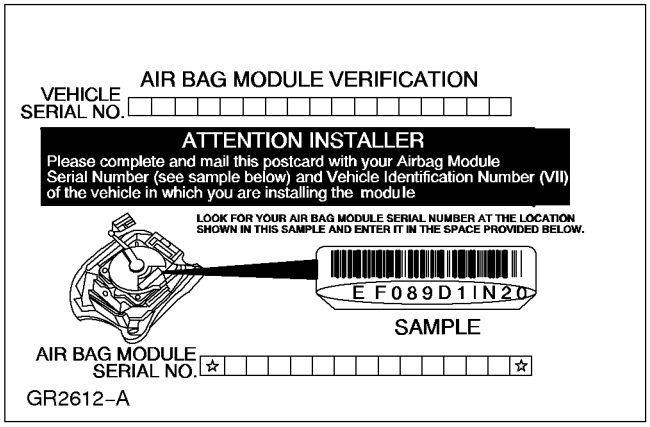
WARNING: To prevent premature deployment, live air bag modules must only be placed on work benches which have been ground bonded. Failure to follow this instruction may result in personal injury.

NOTE: All unserviceable air bag modules have been placed on the Mandatory Return List. All discolored or damaged air bag modules should be treated the same as any unserviceable live air bag module being returned.

Remove the unserviceable air bag module. For additional information, refer to the relevant procedure in this section.

NOTE: A prepaid, return postcard is provided with the new air bag module. The new air bag module serial number and the vehicle identification number (VIN) must be recorded on the air bag module verification card.

2. **Before installing the air bag module, record the necessary information. Return the air bag module verification card to Ford Motor Company (driver air bag module verification card shown).**

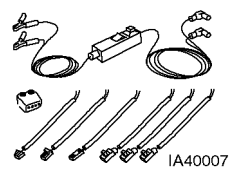


3. **WARNING: Under no circumstances is an unserviceable air bag module(s) to be returned through the local mailing system. Failure to follow this instruction may result in personal injury.**

Seal the unserviceable air bag module(s) in the packaging from the new air bag module(s) and return to the Exchange Plan Center, as appointed through the local National Sales Company.

GENERAL PROCEDURES

Scrapped Vehicle Undeployed Air Bag Disposal

Special Tool(s)	
 IA40007	Test and Deployment Lead, Air Bag/Pyrotechnic Safety Belt 418-S055 (40-007A)

General Equipment
12 volt battery

All vehicles

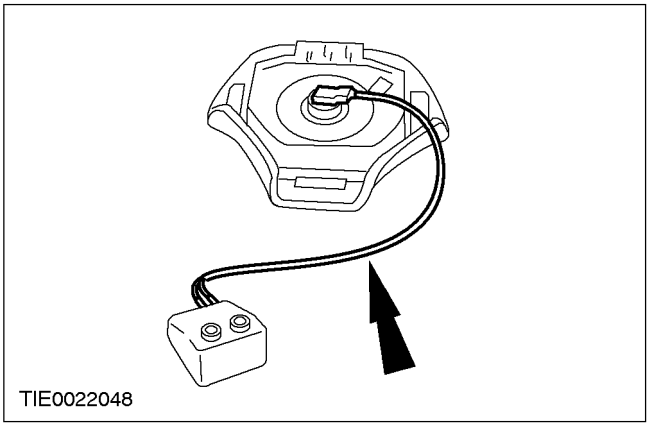
WARNING: To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded. Failure to follow this instruction may result in personal injury.

1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Remove the air bag module(s) to be deployed. For additional information, refer to the relevant procedure(s) in this section.**

Single stage air bag modules

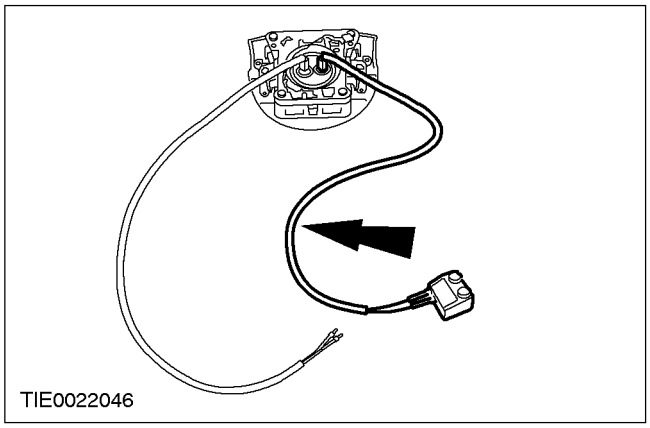
3. **Connect the test lead to the air bag module and the adapter (driver air bag module shown).**



Two stage air bag modules

4. **CAUTION: Do not connect both test leads to the adapter. Both air bag module inflators must be deployed separately.**

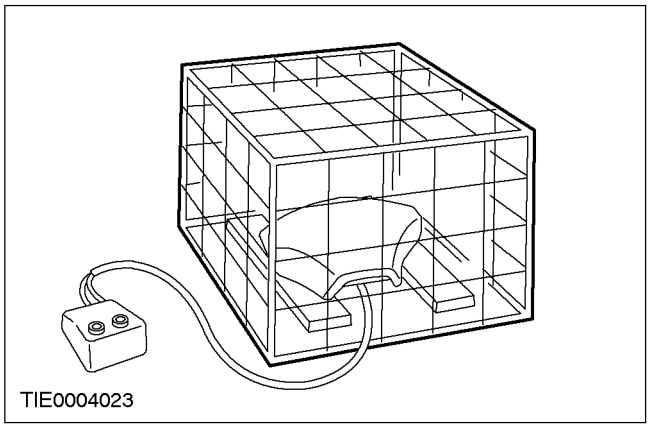
   Connect two test leads to the air bag module and the other end of one of the test leads to the adapter (driver air bag module shown).



All air bag modules

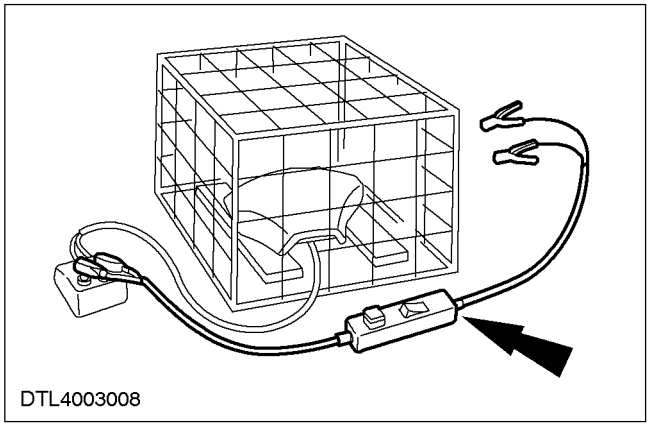
5. **CAUTION: To protect the test lead electrical connector(s) from damage during deployment, raise the air bag module off the ground on two wooden blocks.**

   Place the air bag module inside a suitable rigid wire cage with the air bag module cover uppermost.



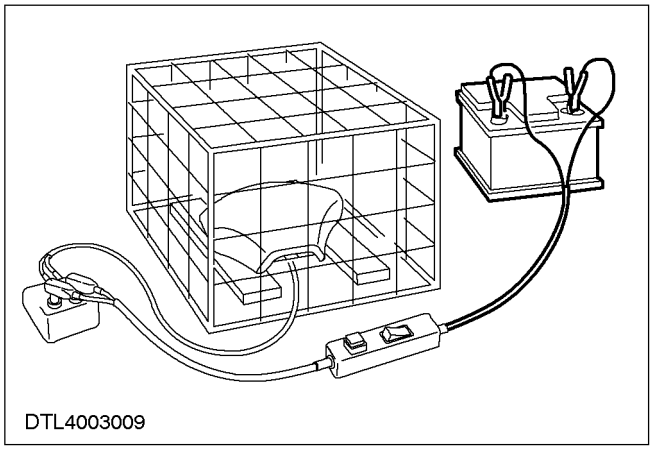
GENERAL PROCEDURES (Continued)

6. Connect the deployment lead to the adapter.


DTL4003008

7. WARNING: Before proceeding make sure that all personnel in the vicinity are aware that a loud noise (bang) is about to occur. Do not let anybody approach closer than six meters. Failure to follow this instruction may result in personal injury.

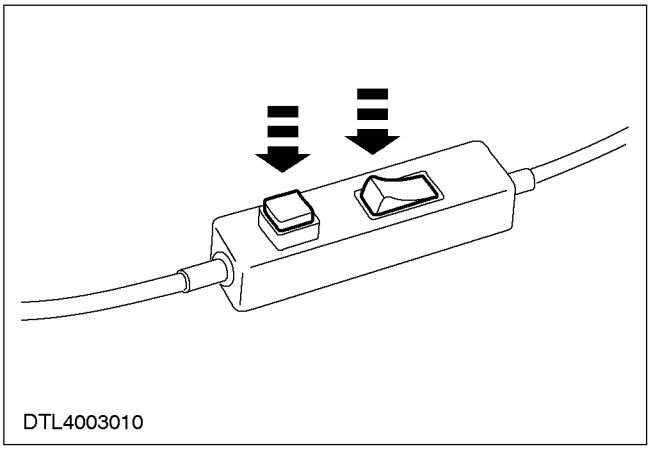
Move as far away as possible from the air bag module and connect the deployment lead to the battery.


DTL4003009

8. CAUTION: The air bag module should not be handled immediately following deployment as the air bag module will be very hot.

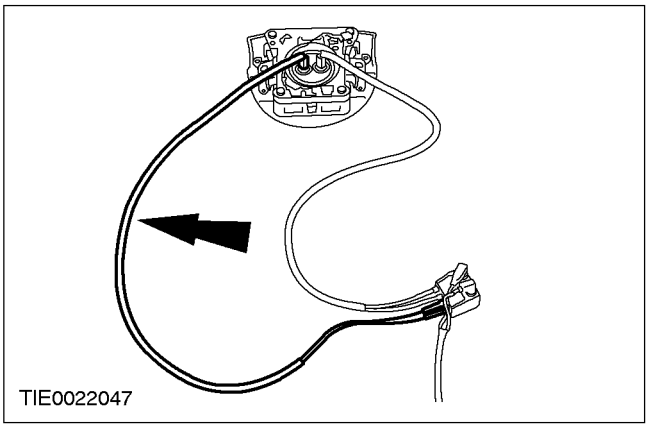
CAUTION: After deployment, the air bag module surface may contain deposits of sodium hydroxide, a product of the gas generate combustion, that is irritating to the skin. Use protective gloves when handling any deployed air bag module.

Depress both switches to deploy the air bag.


DTL4003010

Two stage air bag modules

9. Connect the second test lead to the adapter.


TIE0022047

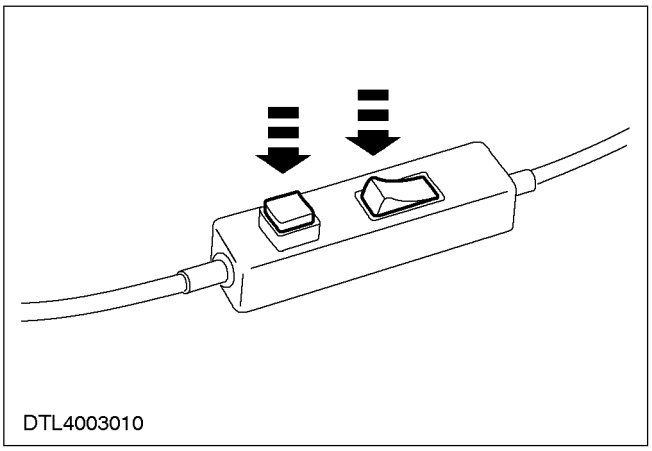
GENERAL PROCEDURES (Continued)

10. **WARNING: Before proceeding make sure that all personnel in the vicinity are aware that a loud noise (bang) is about to occur. Do not let anybody approach closer than six meters. Failure to follow this instruction may result in personal injury.**

CAUTION: The air bag module should not be handled immediately following deployment as the air bag module will be very hot.

CAUTION: After deployment, the air bag module surface may contain deposits of sodium hydroxide, a product of the gas generate combustion, that is irritating to the skin. Use protective gloves when handling any deployed air bag module.

Depress both switches to deploy the air bag.

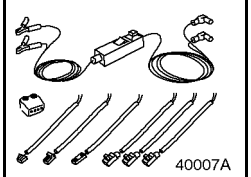

DTL4003010

All air bag modules

11. **Deployed air bag module(s) should be sealed in a suitable bag and then disposed of in accordance with local contaminated waste regulations.**

GENERAL PROCEDURES

Safety Belt Pretensioner Disposal

Special Tool(s)	
 40007A	Test and Deployment Lead, Air Bag/Pyrotechnic Safety Belt 418-S055 (40-007A)

General Equipment
12v Battery

Deploy

WARNING: To avoid accidental deployment, the air bag control module backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

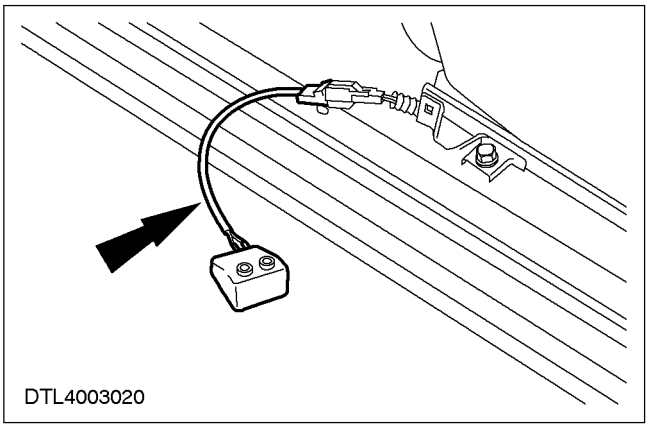
WARNING: Before deploying the air bag module or safety belt pretensioner, make sure that all personnel in the vicinity are aware that a loud noise (bang) is about to occur. Do not let anybody approach closer than six meters. Failure to follow this instruction may result in personal injury.

WARNING: The air bag module or the safety belt pretensioner should not be handled immediately following deployment as the air bag module or safety belt pretensioner will be very hot. Failure to follow this instruction may result in personal injury.

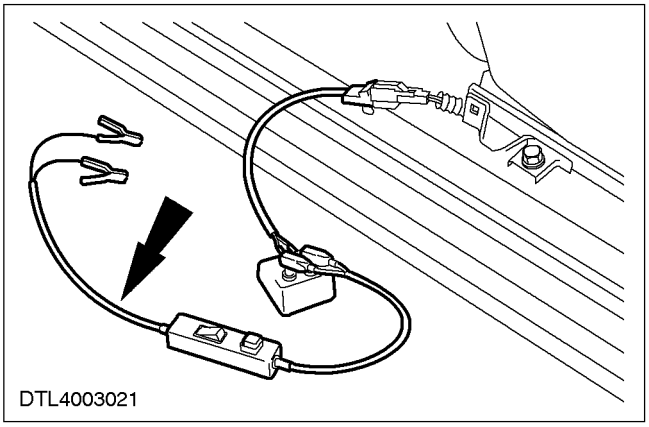
1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **NOTE:** Certain vehicles require the removal of the front seat to access the safety belt pretensioner electrical connector.

   Remove the front seat (if necessary). For additional information, refer to Section 501-10.
3. **Detach the safety belt pretensioner electrical connector from the front seat.**
4. **Install the front seat (if necessary). For additional information, refer to Section 501-10.**
5. **CAUTION: Make sure the seat mounting bolts are installed.**

   Connect the deployment lead to the safety belt pretensioner electrical connector.

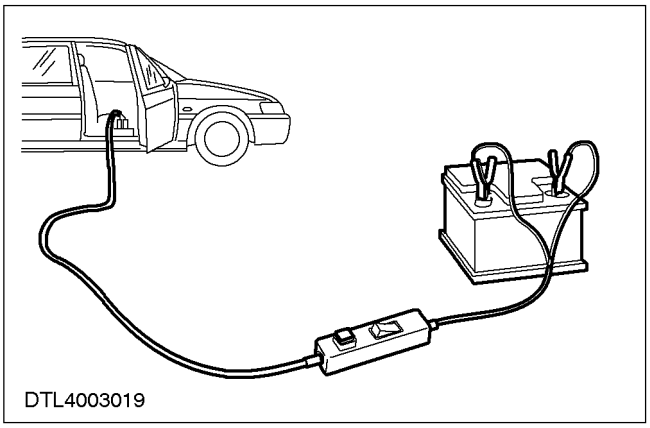

DTL4003020

6. **Connect the deployment lead to the adapter lead.**

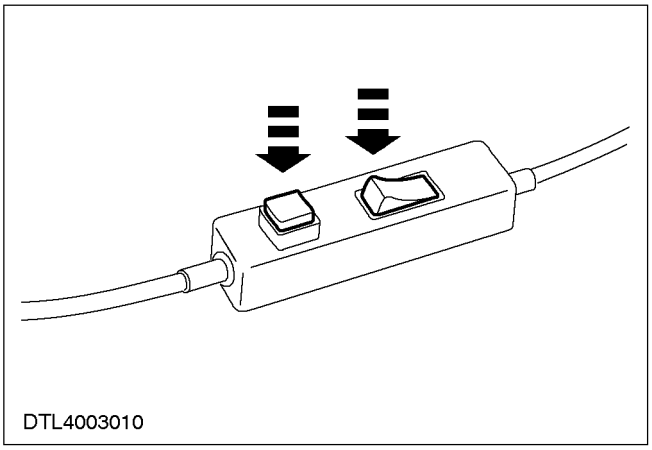

DTL4003021

GENERAL PROCEDURES (Continued)

7. Move as far away as possible from the vehicle and connect the deployment lead to the battery.



8. Depress both switches to deploy the safety belt pretensioner.



9. Remove the safety belt buckle and pretensioner. For additional information, refer to Safety Belt Buckle and Pretensioner in this section.

10. Deployed air bag module(s) and safety belt pretensioners should be sealed in suitable bags and then disposed of in accordance with local contaminated waste regulations.

11. ⚠ WARNING: Under no circumstances is an unserviceable air bag module or safety belt buckle pretensioner to be returned through the local mailing system. Failure to follow this instruction may result in personal injury.

NOTE: All unserviceable air bag modules have been placed on the Mandatory Return List. All discolored or damaged air bag modules should be treated the same as any unserviceable live air bag module being returned.

If an air bag module or safety belt buckle pretensioner fails to deploy, seal the unserviceable air bag module or safety belt buckle pretensioner in suitable packaging and return to the Exchange Plan Center, as appointed through the local National Sales Company.

REMOVAL AND INSTALLATION

Side Impact Sensor (40 699 0)

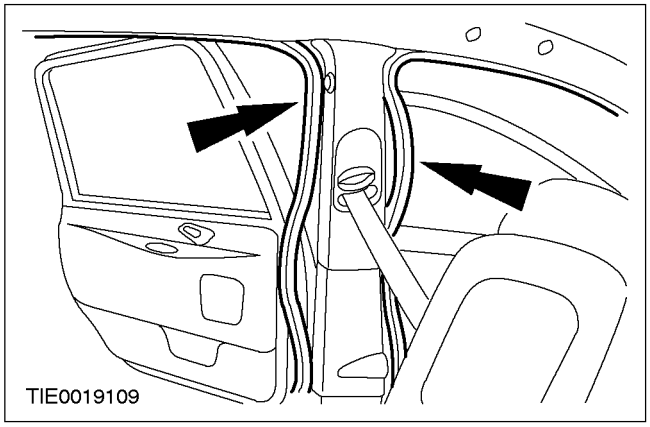
Removal

WARNING: To avoid accidental deployment, the air bag control module backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

WARNING: To minimize the possibility of premature deployment, do not use radio key code savers when working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.

WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

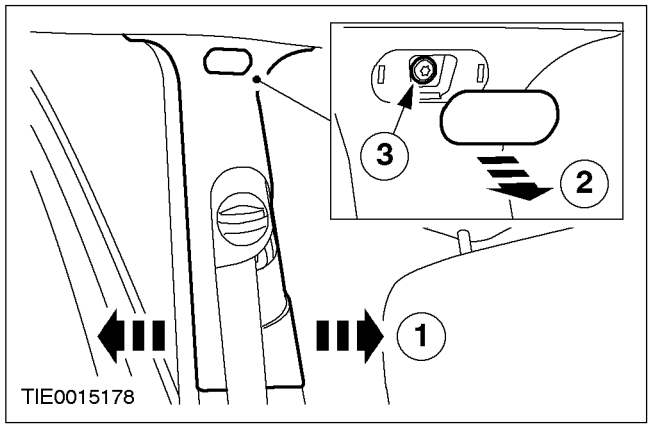
1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Detach the weatherstrips from the B-pillar.**



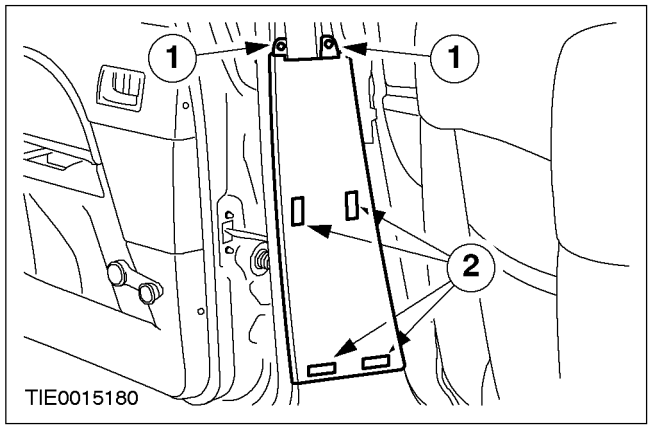
3. **NOTE:** To aid installation, set the safety belt shoulder height adjuster to its lowest position.

   Detach the B-pillar upper trim panel from the B-pillar and position to one side.

   1. Detach the locating tangs from the B-pillar lower trim panel.
   2. Remove the screw cover.
   3. Remove the retaining screw.



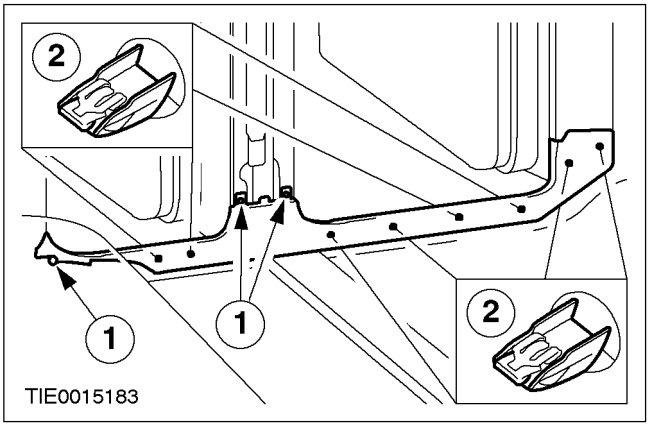
4. **Remove the B-pillar lower trim panel.**
   1. Remove the retaining screws.
   2. Detach the retaining clips.



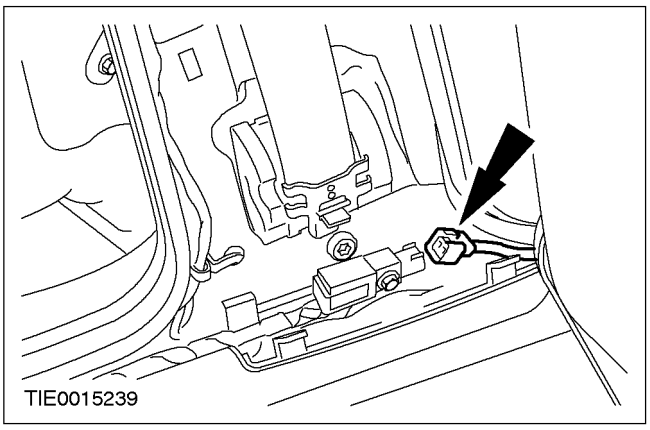
REMOVAL AND INSTALLATION (Continued)

5. Remove the cowl side trim panel.

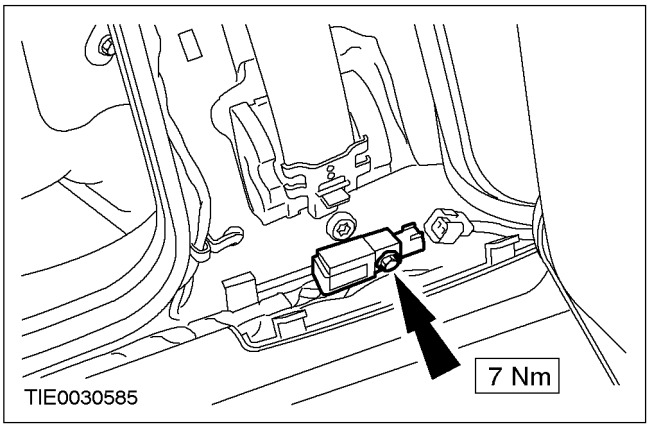
1. Remove the retaining screws.
2. Detach the retaining clips.



6. Disconnect the side impact sensor electrical connector.



7. Remove the side impact sensor.



Installation

WARNING: Make sure the side impact sensor locating tangs are correctly located into the B-pillar. Failure to follow this instruction may result in personal injury.

WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

CAUTION: Make sure the safety belt shoulder height adjuster is set to the lowest position. Make sure the B-pillar upper trim panel is correctly located on the safety belt shoulder height adjuster.

1. **To install, reverse the removal procedure.**
2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

REMOVAL AND INSTALLATION

Crash Sensor

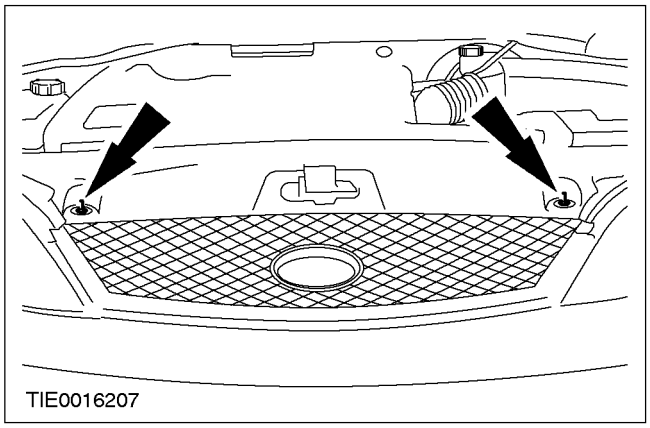
Removal

WARNING: To avoid accidental deployment, the air bag control module backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

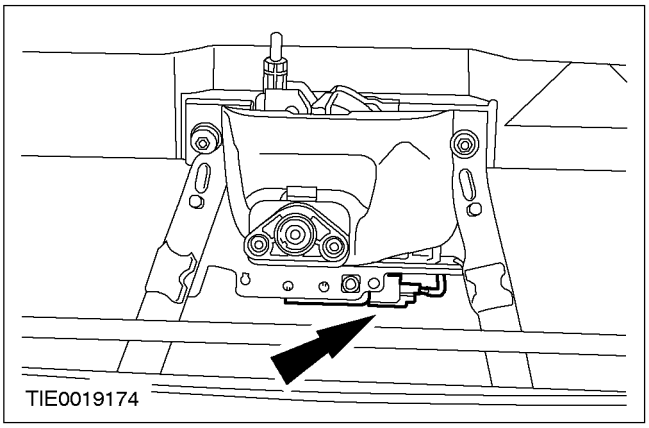
WARNING: To minimize the possibility of premature deployment, do not use radio key code savers when working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.

WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

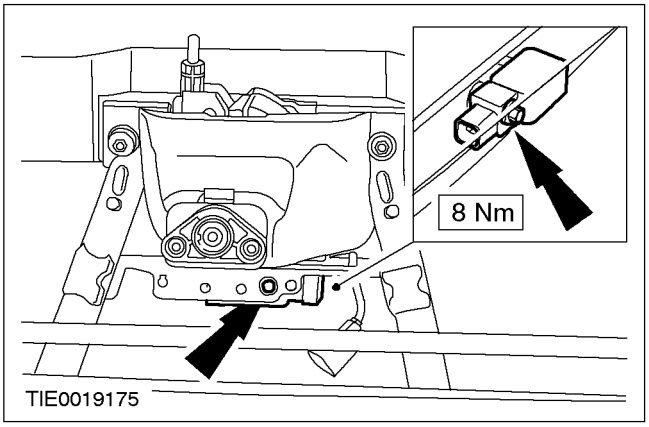
1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Remove the radiator grille.**


TIE0016207

3. **Disconnect the crash sensor electrical connector.**


TIE0019174

4. **Remove the crash sensor.**



TIE0019175

Installation

WARNING: Make sure the crash sensor locating tang is correctly located in the grill opening reinforcement panel bracket. Failure to follow this instruction may result in personal injury.

WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

1. **To install, reverse the removal procedure.**
2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

REMOVAL AND INSTALLATION

Air Bag Control Module (33 650 0)

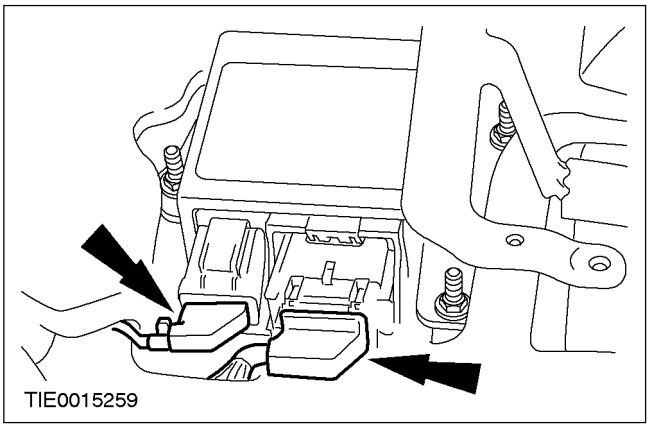
Removal

WARNING: To avoid accidental deployment, the air bag control module backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

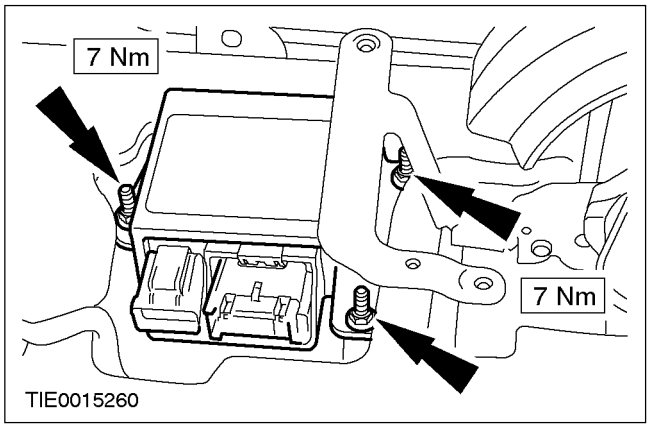
WARNING: To minimize the possibility of premature deployment, do not use radio key code savers when working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.

WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Remove the floor console. For additional information, refer to Section 501-12.**
3. **Disconnect the air bag control module electrical connectors.**


TIE0015259

4. **Remove the air bag control module.**



TIE0015260

Installation

WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

1. **To install, reverse the removal procedure.**
2. **WARNING: New air bag control modules must be configured following installation. Failure to follow this instruction may result in personal injury.**

   If installing a new air bag control module, configure the air bag control module using WDS.
3. **Initialize the door window motors. For additional information, refer to Section 501-11.**

REMOVAL AND INSTALLATION

Driver Air Bag Module (40 700 0)

Removal

WARNING: To avoid accidental deployment the air bag control module backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

WARNING: Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of premature deployment, do not use radio key code savers when working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.

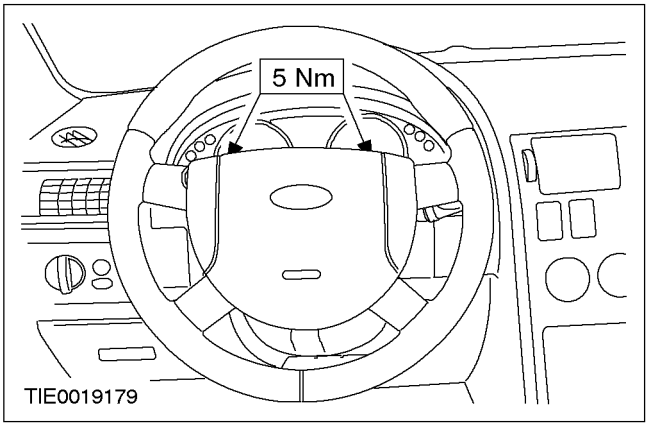
WARNING: To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.

WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

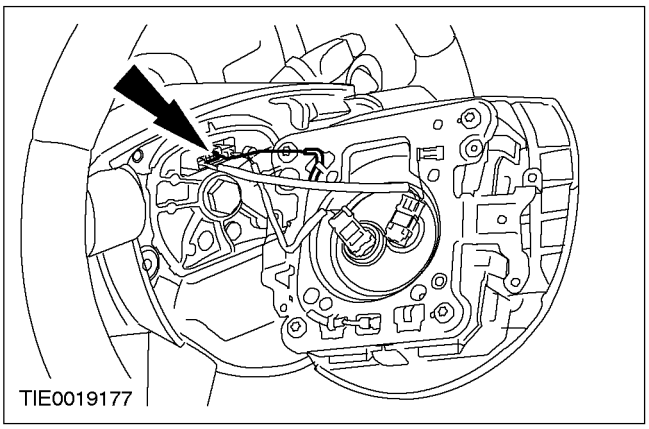
WARNING: Painting over the driver air bag module trim cover or instrument panel could lead to deterioration of the trim cover and air bags. Do not for any reason attempt to paint discolored or damaged air bag module trim covers or instrument panel. Install a new component. Failure to follow this instruction may result in personal injury.

1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **NOTE:** Turn the steering wheel to access the air bag module retaining screws.

   Detach the driver air bag module from the steering wheel.



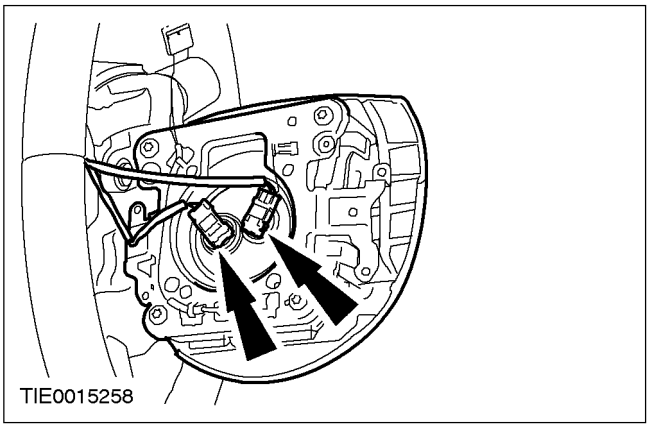
3. **Disconnect the horn switch electrical connector.**



REMOVAL AND INSTALLATION (Continued)

4. Remove the driver air bag module.

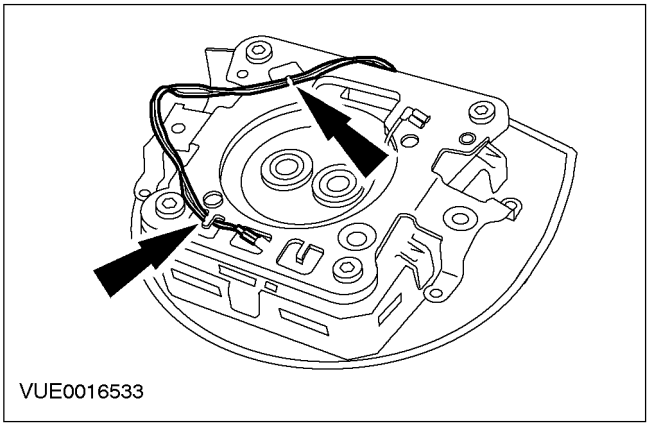
- Disconnect the driver air bag module electrical connectors.



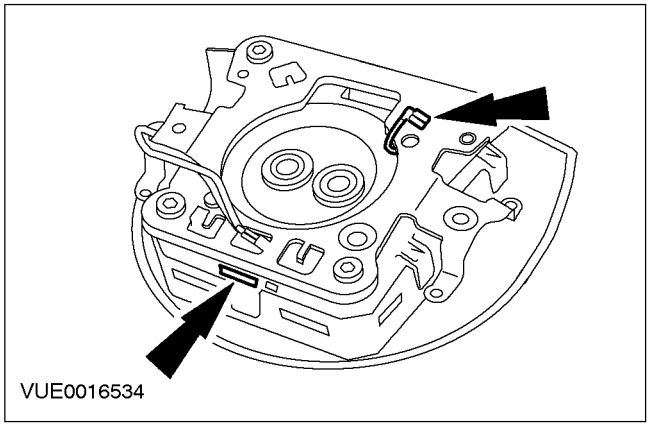
5. WARNING: The driver air bag module should only be inverted long enough for the horn switch contact plate to be removed. Handle with extreme care making sure that, if for any reason this procedure is interrupted, the driver air bag module is turned the correct way up, with the trim cover side uppermost. Failure to follow these instructions may result in personal injury.

NOTE: If a new driver air bag module is being installed, the horn switch must be removed from the existing driver air bag module.

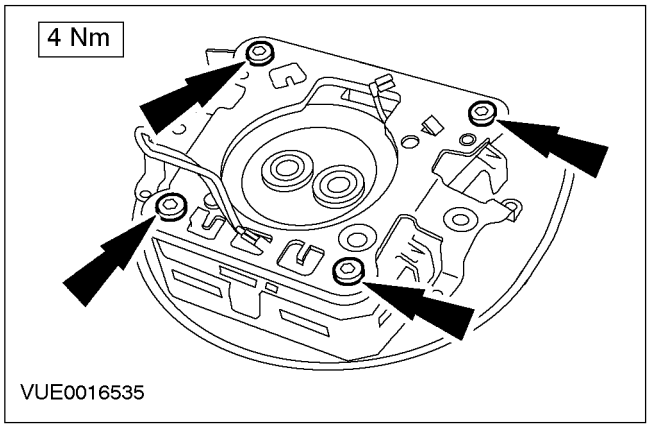
Detach the horn switch wiring harness from the horn switch.



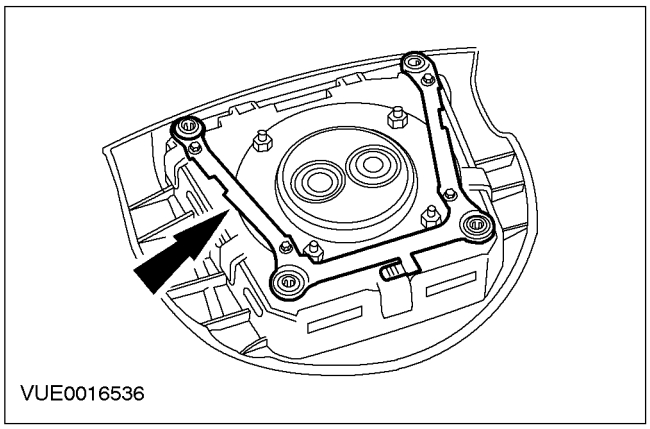
6. Disconnect the horn switch electrical connectors.



7. Remove the horn switch.



8. Remove the horn switch contact plate from the driver air bag module.



REMOVAL AND INSTALLATION (Continued)

Installation

WARNING: Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.

WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

WARNING: Painting over the driver air bag module trim cover or instrument panel could lead to deterioration of the trim cover and air bags. Do not for any reason attempt to paint discolored or damaged air bag module trim covers or instrument panel. Install a new component. Failure to follow this instruction may result in personal injury.

WARNING: The driver air bag module should only be inverted long enough for the horn switch contact plate to be installed. Handle with extreme care making sure that, if for any reason this procedure is interrupted, the driver air bag module is turned the correct way up, with the trim cover side uppermost. Failure to follow these instructions may result in personal injury.

1. **To install, reverse the removal procedure.**
2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

REMOVAL AND INSTALLATION

Passenger Air Bag Module (40 701 0)

Removal

WARNING: To avoid accidental deployment the air bag control module backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

WARNING: Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of premature deployment, do not use radio key code savers when working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.

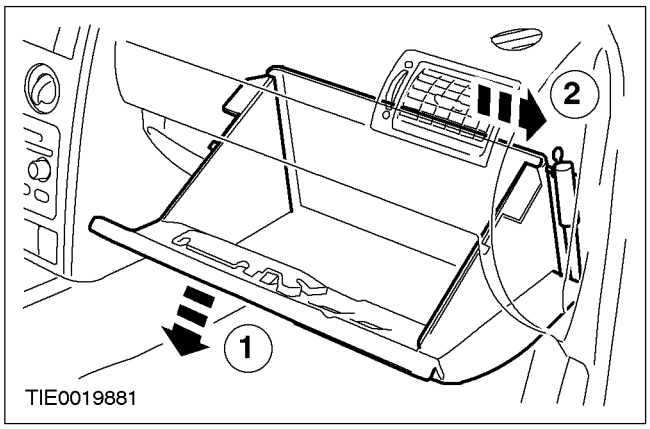
WARNING: To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.

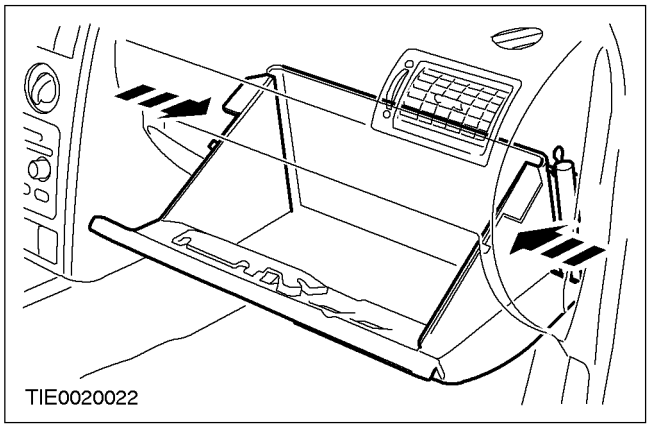
WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

WARNING: Painting over the driver air bag module trim cover or instrument panel could lead to deterioration of the trim cover and air bags. Do not for any reason attempt to paint discolored or damaged air bag module trim covers or instrument panel. Install a new component. Failure to follow this instruction may result in injury.

1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Detach the damper from the glove compartment.**
   1. Open the glove compartment to access the damper.
   2. Push the top of the damper away from the glove compartment.



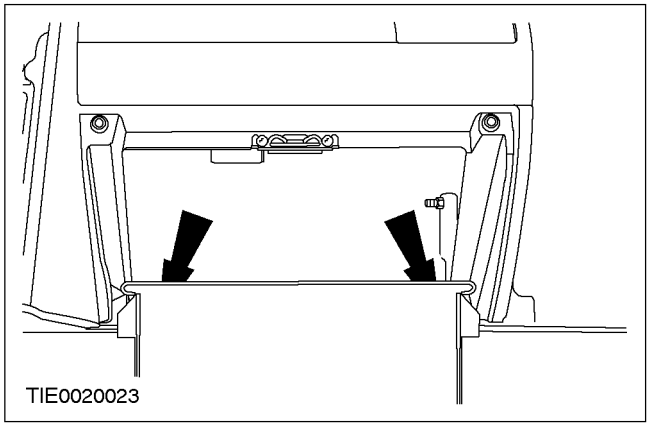
3. **Fully open the glove compartment.**
   - Press the sides of the glove compartment towards the center to release the glove compartment stops.



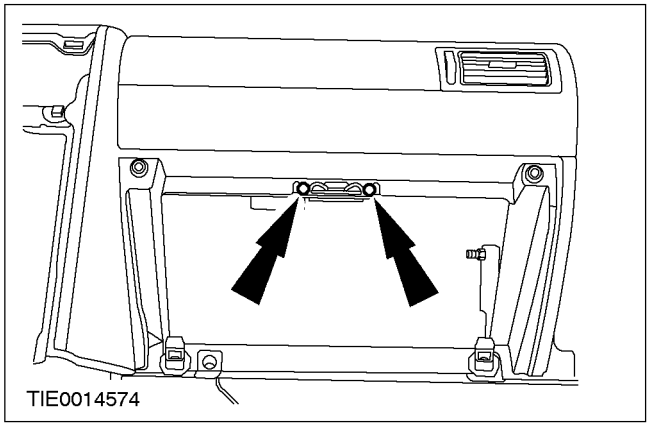
REMOVAL AND INSTALLATION (Continued)

4. Remove the glove compartment.

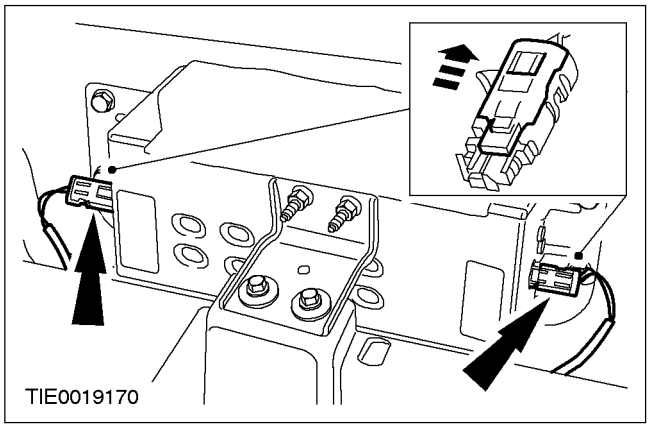
- Detach the hinges.



5. Detach the glove compartment latch from the instrument panel and position to one side.



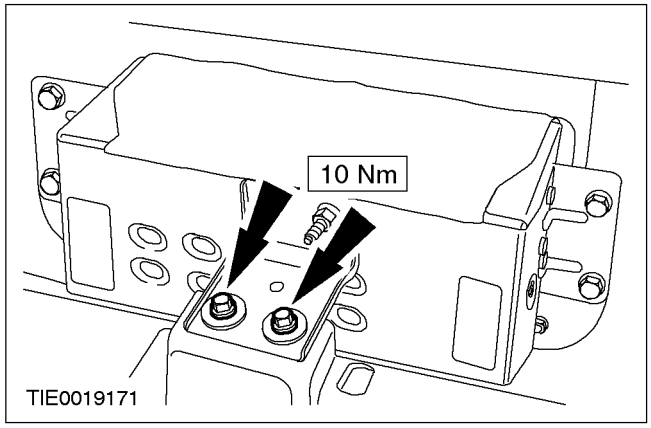
6. Disconnect the passenger air bag module electrical connectors.



7. CAUTION: The passenger air bag module retaining bolts must only be used three times.

NOTE: After removal, stamp the passenger air bag module retaining bolts with a center punch to indicate usage.

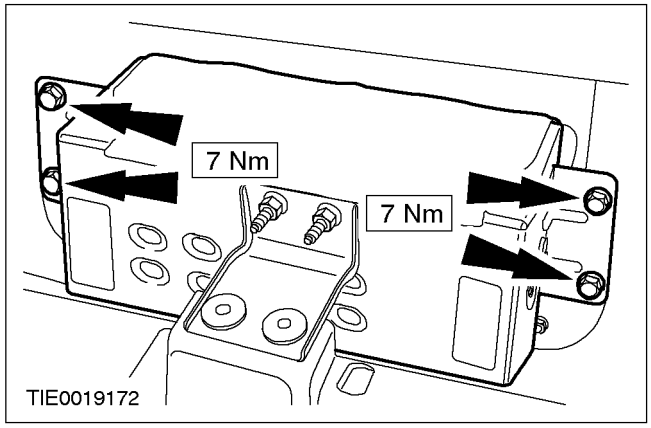
Detach the passenger air bag module from the cross-vehicle beam.



8. CAUTION: The passenger air bag module retaining bolts must only be used three times.

NOTE: After removal, stamp the passenger air bag module retaining bolts with a center punch to indicate usage.

Remove the passenger air bag module.



Installation

WARNING: Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.

REMOVAL AND INSTALLATION (Continued)

WARNING: To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.

WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

WARNING: Painting over the driver air bag module trim cover or instrument panel could lead to deterioration of the trim cover and air bags. Do not for any reason attempt to paint discolored or damaged air bag module trim covers or instrument panel. Install a new component. Failure to follow this instruction may result in injury.

1. **CAUTION: If a new passenger air bag module is being installed, always use the new nuts and bolts contained in the service kit.**

   To install, reverse the removal procedure.

2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

REMOVAL AND INSTALLATION

Side Air Bag Module (40 698 0)

Removal

WARNING: Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.

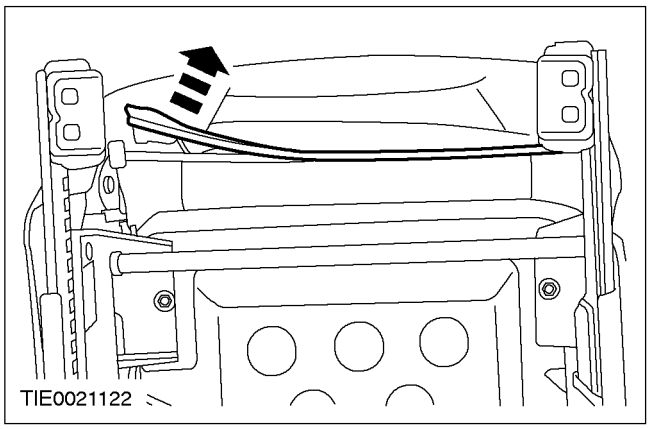
WARNING: To minimize the possibility of premature deployment, do not use radio key code savers when working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.

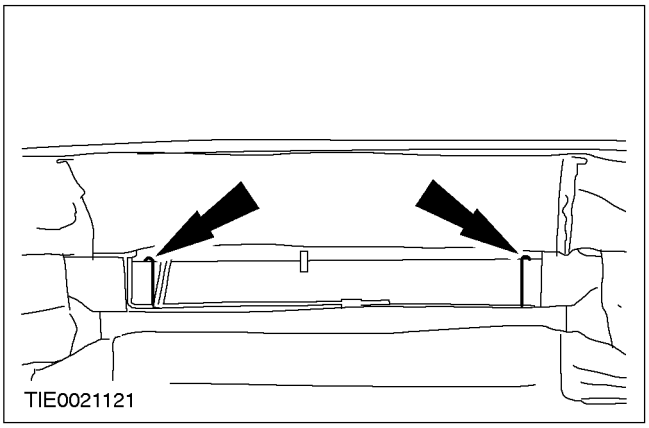
WARNING: To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.

WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

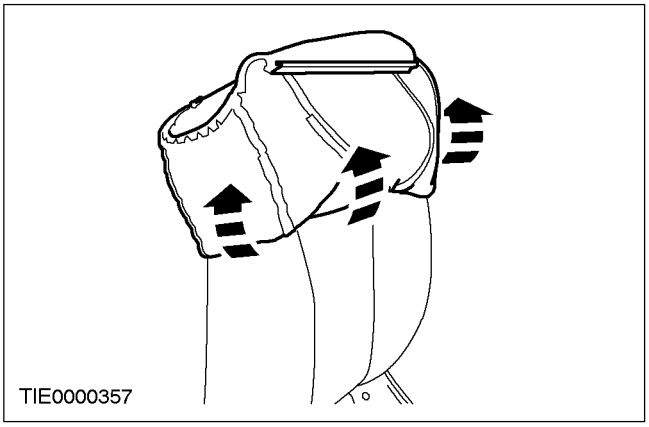
1. **Remove the front seat. For additional information, refer to Section 501-10.**
2. **Detach the backrest cover from the underside of the seat.**
   - Detach the retaining strip.



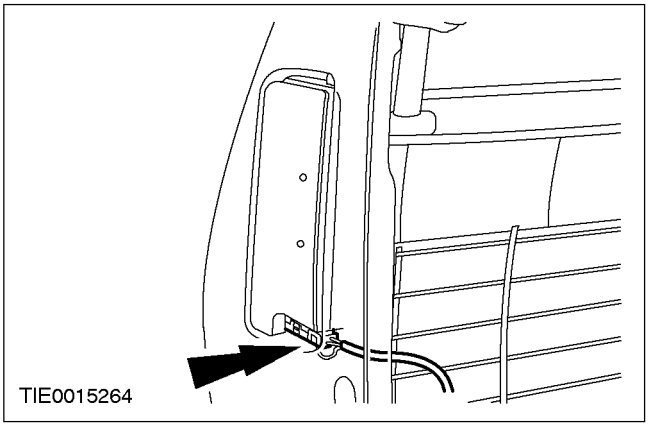
3. **Detach the backrest cover tensioning cords from the backrest.**



4. **Roll the backrest cover up the backrest to access the side air bag module.**



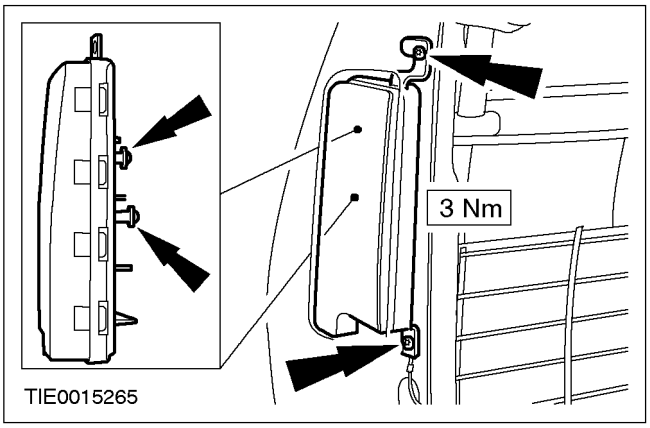
5. **Disconnect the side air bag module electrical connector.**



REMOVAL AND INSTALLATION (Continued)

6. NOTE: Note the position of the ground cable attached to the side air bag module lower retaining screw and the locating tangs on the rear of the side air bag module to aid installation.

Remove the side air bag module.



Installation

1. WARNING: Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of premature deployment, do not use radio key code savers when working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.

WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

WARNING: Make sure the front seat backrest cover tensioning cords are correctly installed and that the cover is correctly aligned to the backrest frame. An incorrectly installed backrest cover may impair deployment of the side air bag. Failure to follow this instruction may result in personal injury.

To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

Side Air Curtain Module — 4-Door

Removal

WARNING: To avoid accidental deployment, the air bag control module backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

WARNING: Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of premature deployment, do not use radio key code savers when working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.

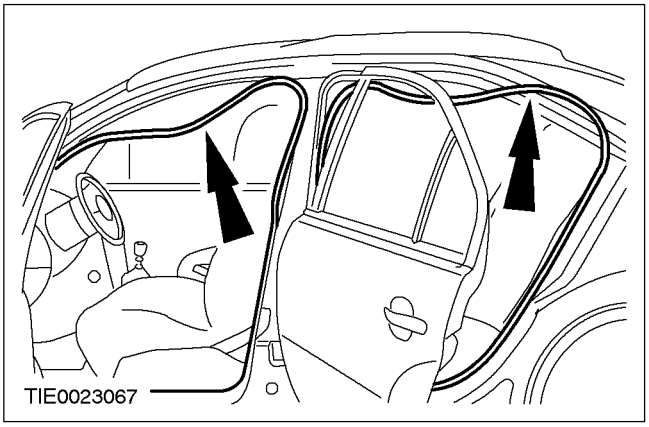
WARNING: To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.

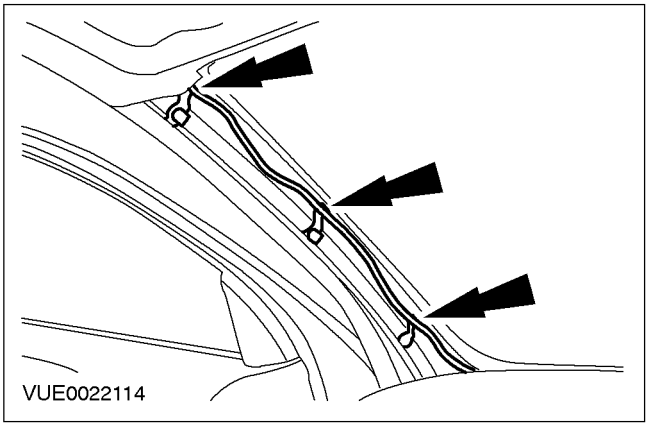
WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

All vehicles

1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Detach the front and rear door opening weatherstrips from around the upper part of the door openings.**

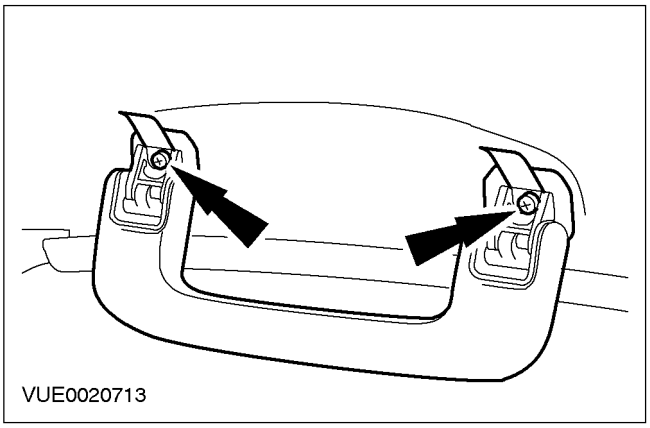


3. **Remove the A-pillar trim panel. For additional information, refer to Section 501-05.**
4. **Detach the headliner wiring harness from the left-hand A-pillar or the rear window washer tube from the right-hand A-pillar as necessary (left-hand A-pillar shown).**



REMOVAL AND INSTALLATION (Continued)

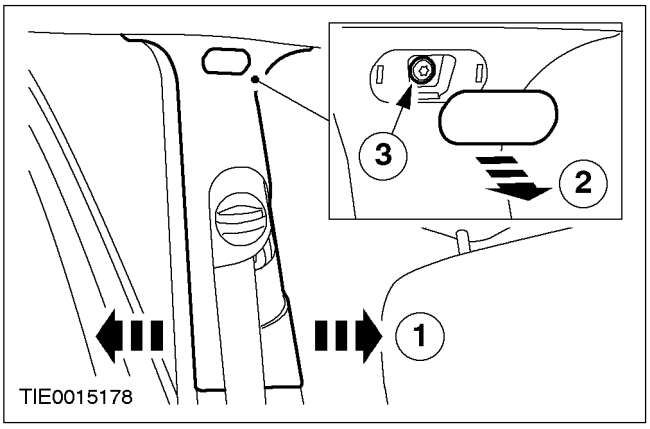
5. Lever open the covers to expose the screws and remove the passenger assist handles.



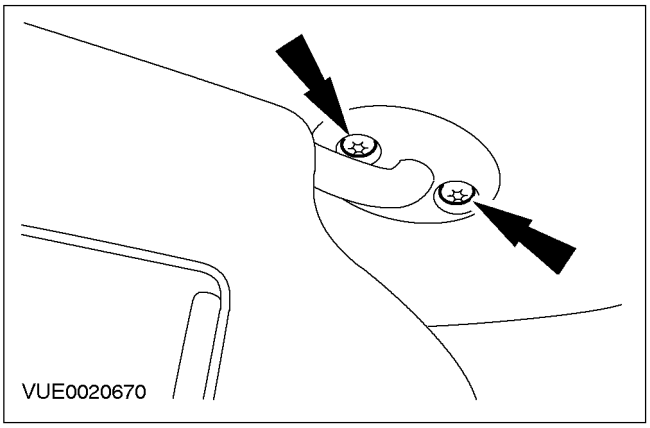
6. Move the front safety belt shoulder height adjuster to its lowest position.

7. Detach the B-pillar upper trim panel from the B-pillar and position it to one side.

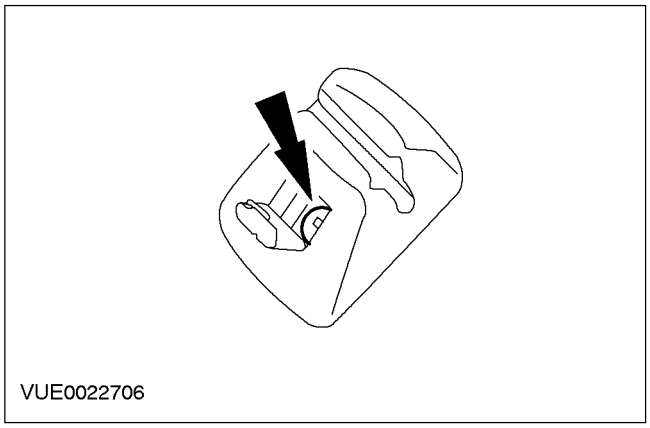
1. Detach the locating tangs from the B-pillar lower trim panel.
2. Remove the screw cover.
3. Remove the screw.



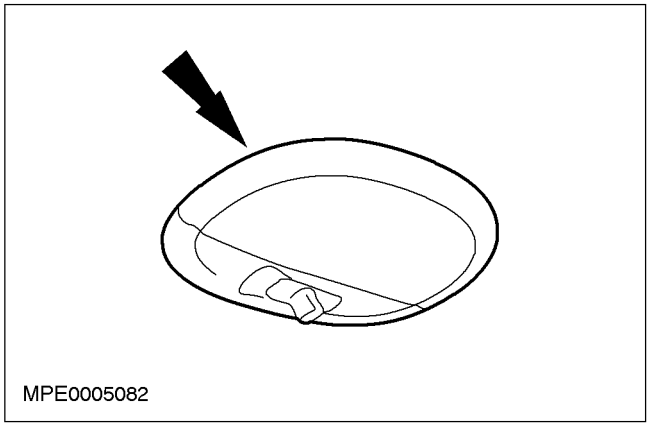
8. Remove the sun visor.



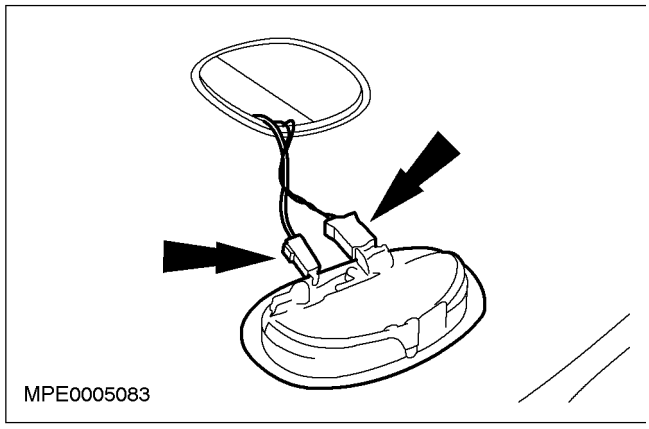
9. Lever open the cover to expose the screw and remove the sun visor retaining clip.



10. Detach the rear interior lamp from the headliner (if equipped).



11. Disconnect the electrical connectors and remove the rear interior lamp (if equipped).

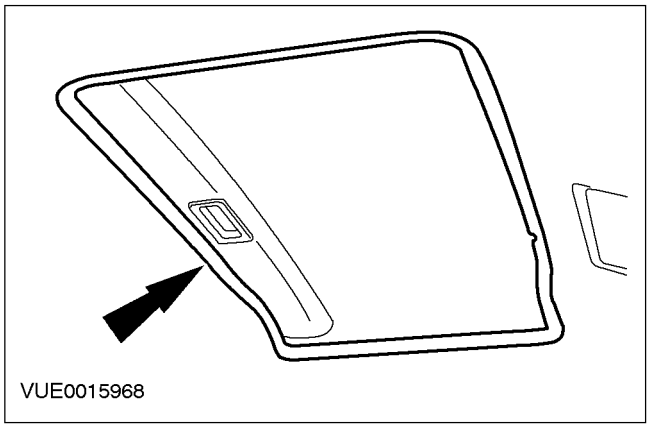


12. Pull down on the rear interior lamp opening to detach the headliner spacer adhesive fixing from the roof panel.

REMOVAL AND INSTALLATION (Continued)

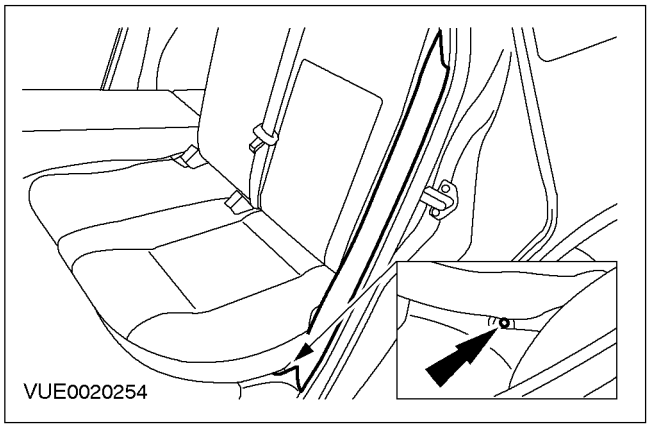
Vehicles with roof opening panel

13. **Remove the roof opening panel weatherstrip.**

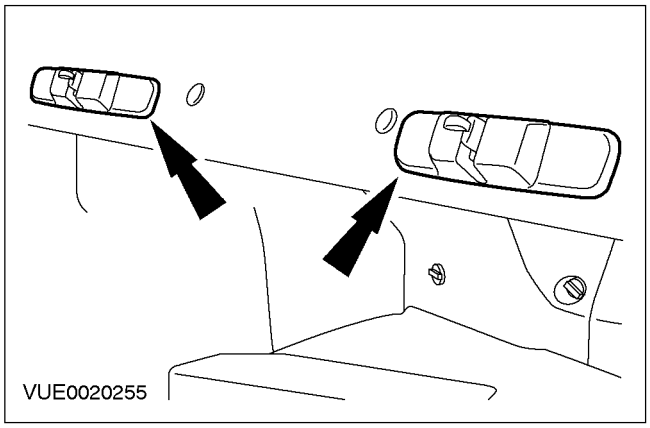


All vehicles

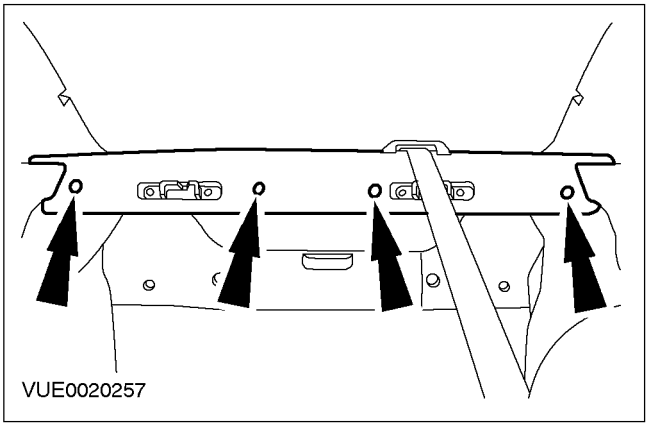
14. **Remove the C-pillar lower trim panel (vehicles with trim panel shown vehicles with seat bolster similar).**
    - Remove the C-pillar lower trim panel retaining screws.



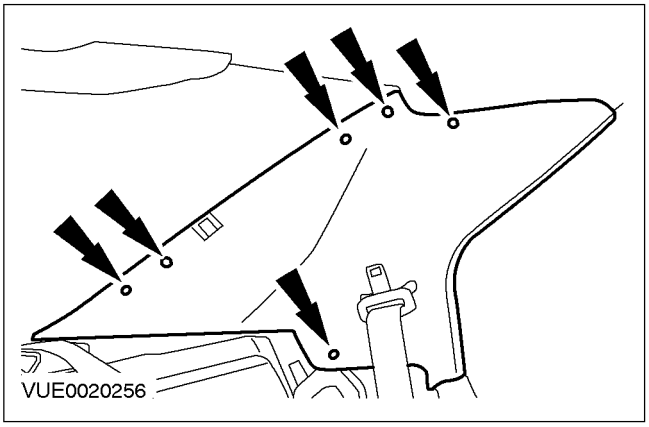
15. **Fold down the rear seat backrests.**
16. **Remove the rear seat backrest latch covers.**



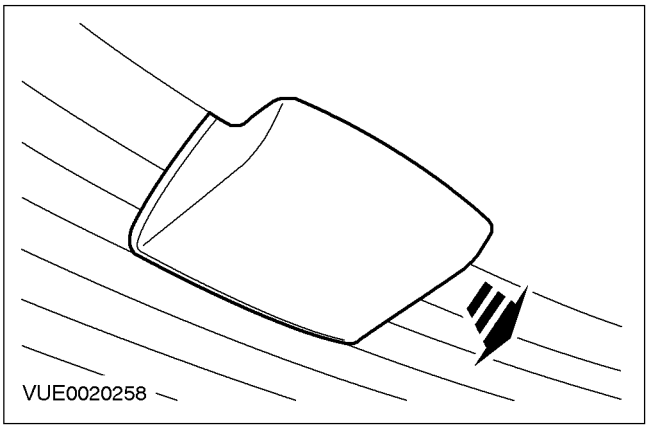
17. **Remove the parcel shelf retaining clips and pull the parcel shelf forward.**



18. **Detach the C-pillar trim panel and position it to one side.**

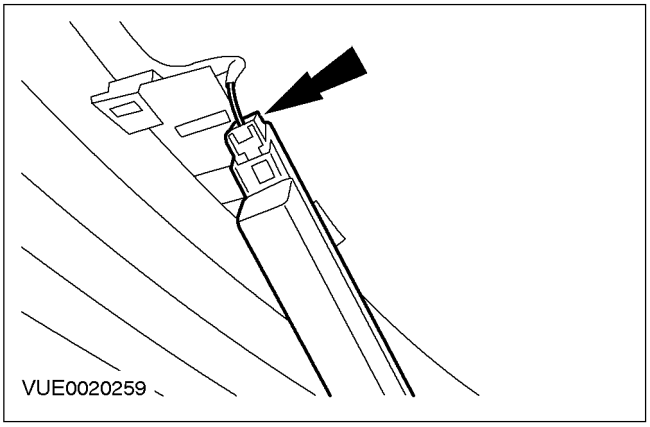


19. **Remove the high mounted stoplamp cover.**



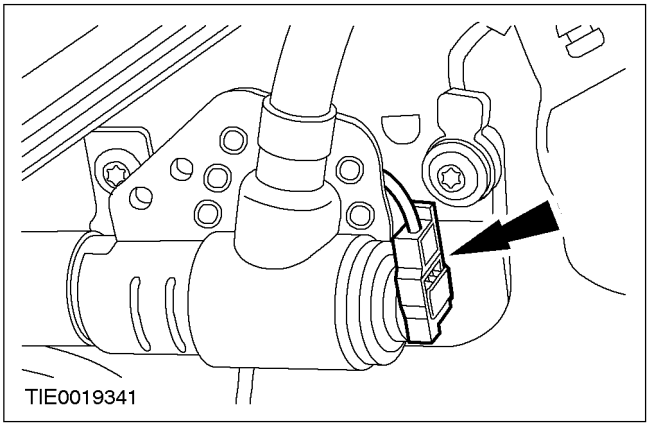
REMOVAL AND INSTALLATION (Continued)

20. Disconnect the electrical connector and remove the high mounted stoplamp.



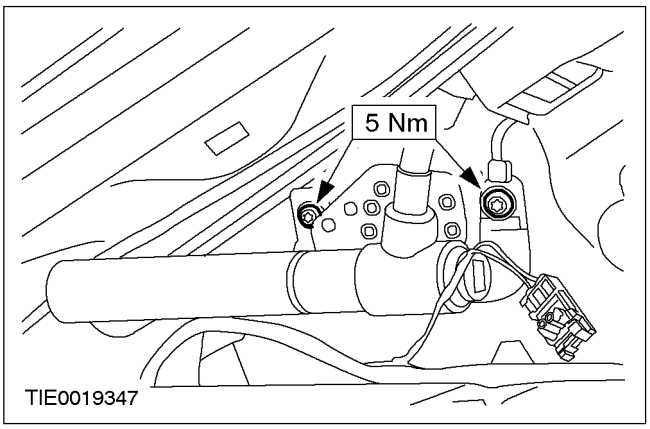
21. Lower the headliner and rest it on the front seat backrest head restraint.

22. Disconnect the side air curtain module electrical connector.



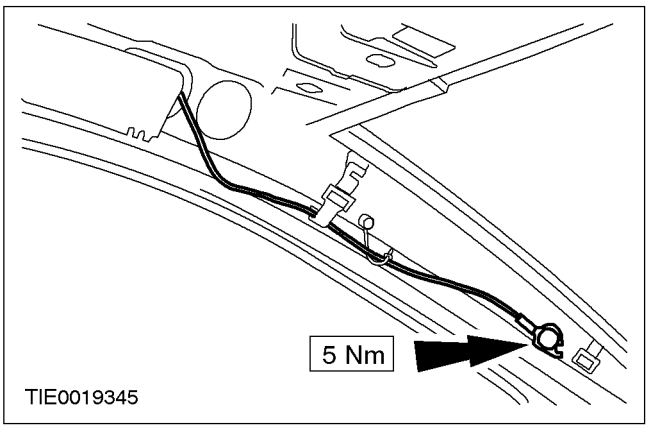
23. NOTE: Note the routing of the retaining cord, to aid installation.

Remove the side air curtain module rear retaining bolts.



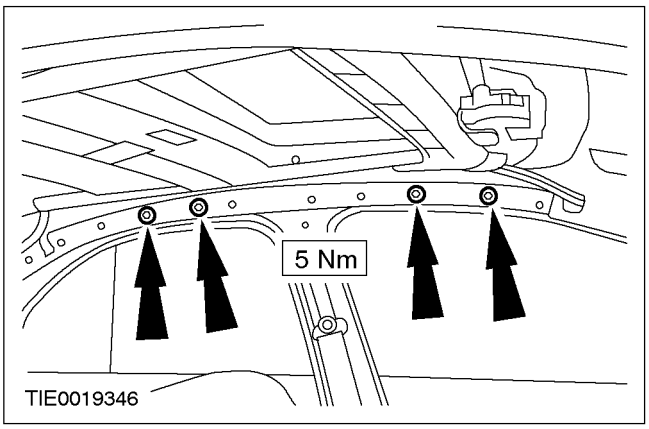
24. NOTE: Note the routing of the retaining cord, to aid installation.

Remove the side air curtain module front retaining bolts (headliner shown removed for clarity).



25. NOTE: Note the position of the locating tangs, to aid installation.

Remove the side air curtain module (headliner shown removed for clarity).



Installation

WARNING: Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.

REMOVAL AND INSTALLATION (Continued)

WARNING: To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.

WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

NOTE: Make sure the front safety belt shoulder height adjuster locking control is correctly located on the safety belt shoulder height adjuster.

1. **To install, reverse the removal procedure.**
2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

REMOVAL AND INSTALLATION

Side Air Curtain Module — 5-Door

Removal

WARNING: To avoid accidental deployment, the air bag control module backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

WARNING: Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of premature deployment, do not use radio key code savers when working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.

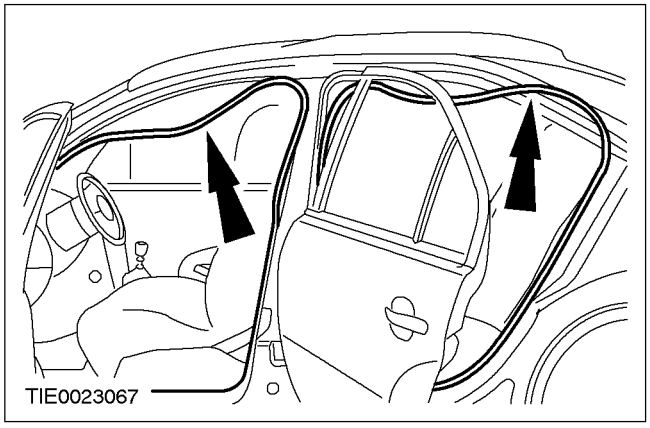
WARNING: To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.

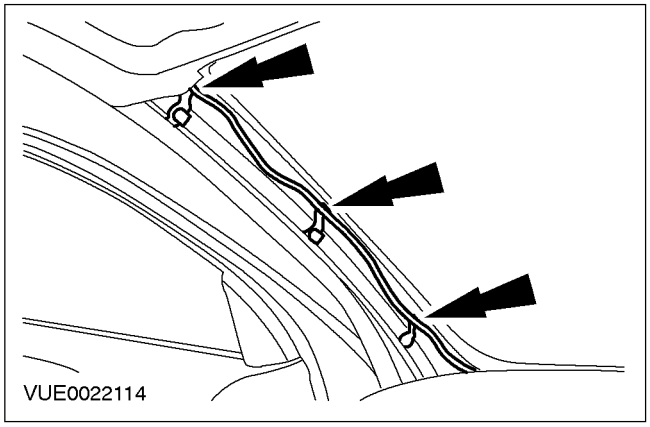
WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

All vehicles

1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Detach the front and rear door opening weatherstrips from around the upper part of the door openings.**

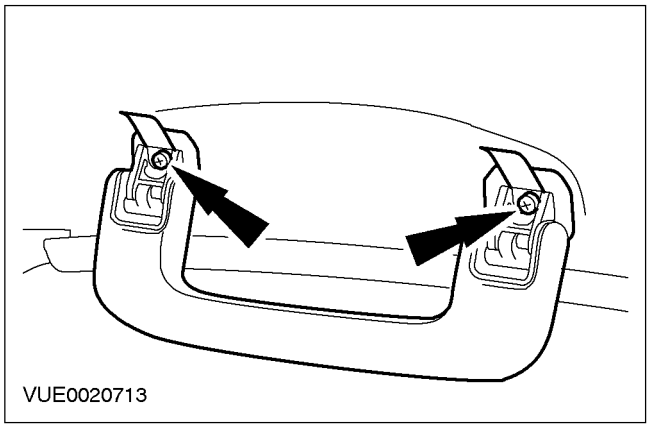


3. **Remove the A-pillar trim panel. For additional information, refer to Section 501-05.**
4. **Detach the headliner wiring harness from the left-hand A-pillar or the rear window washer tube from the right-hand A-pillar as necessary (left-hand A-pillar shown).**



REMOVAL AND INSTALLATION (Continued)

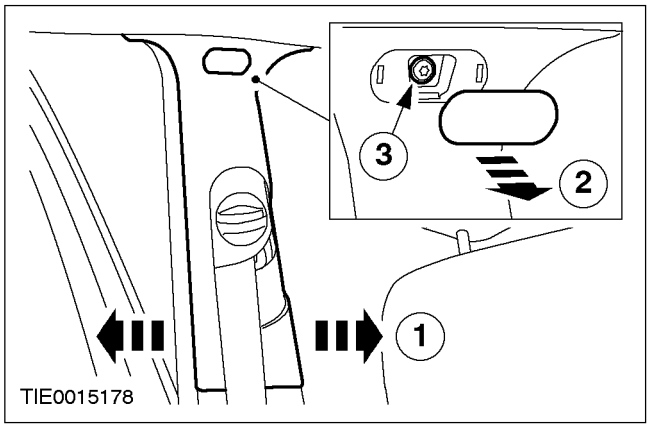
5. Lever open the covers to expose the screws and remove the passenger assist handles.



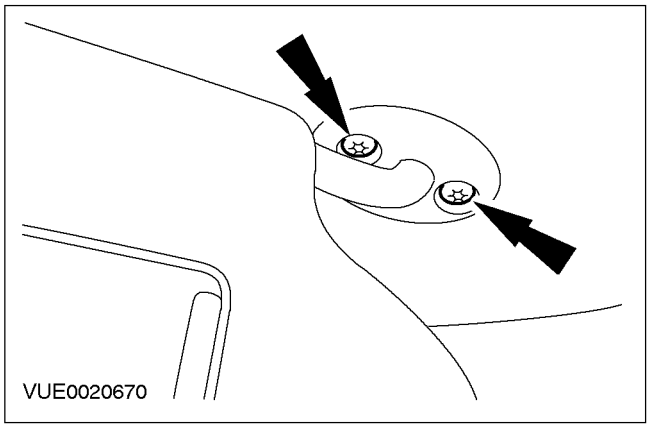
6. Move the front safety belt shoulder height adjuster to its lowest position.

7. Detach the B-pillar upper trim panel from the B-pillar and position it to one side.

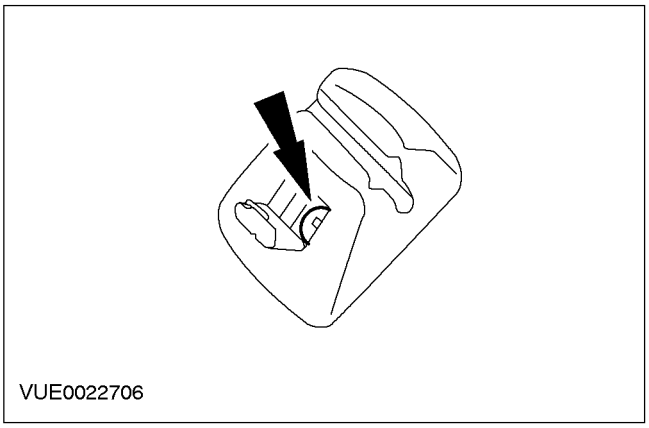
1. Detach the locating tangs from the B-pillar lower trim panel.
2. Remove the screw cover.
3. Remove the screw.



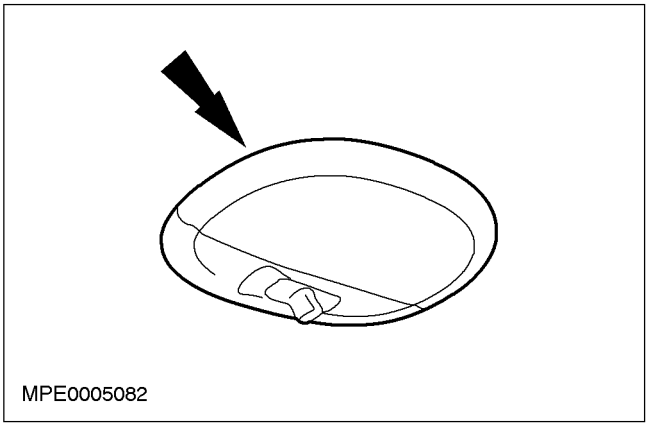
8. Remove the sun visor.



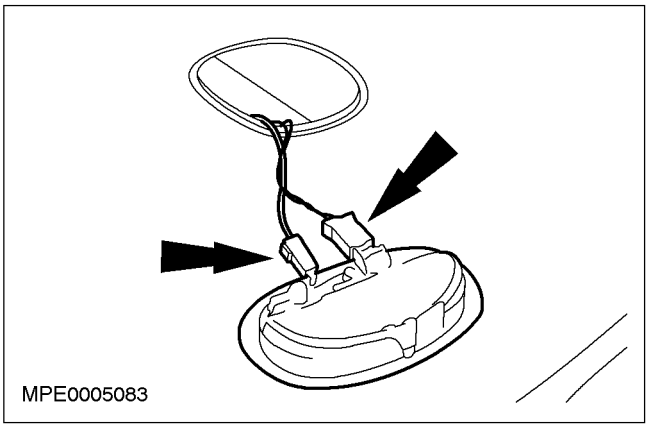
9. Lever open the cover to expose the screw and remove the sun visor retaining clip.



10. Detach the rear interior lamp from the headliner (if equipped).



11. Disconnect the electrical connectors and remove the rear interior lamp (if equipped).

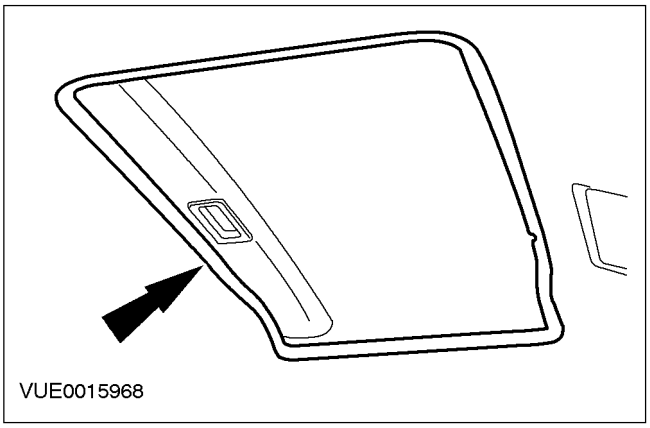


12. Pull down on the rear interior lamp opening to detach the headliner spacer adhesive fixing from the roof panel.

REMOVAL AND INSTALLATION (Continued)

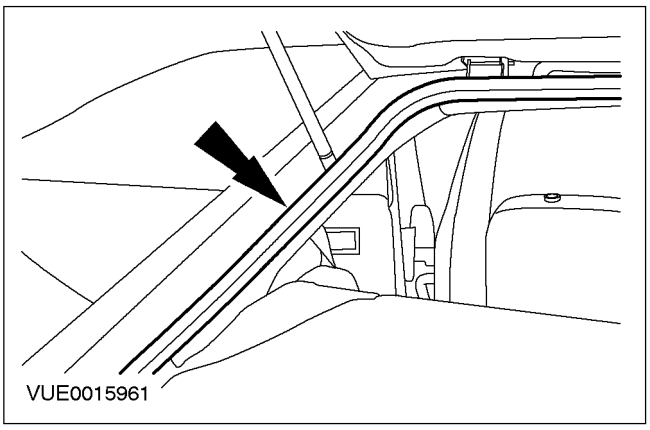
Vehicles with roof opening panel

13. Remove the roof opening panel weatherstrip.



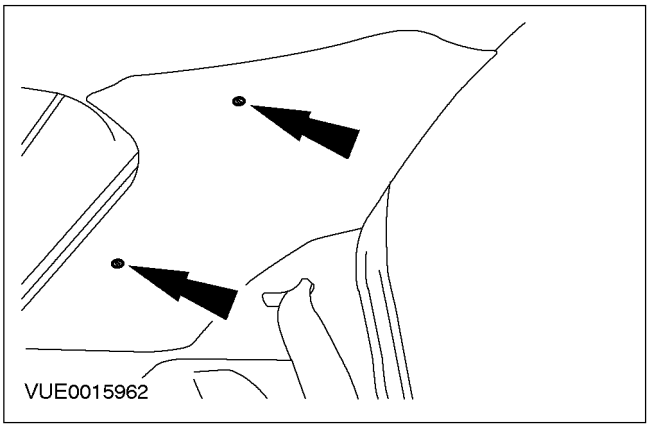
All vehicles

14. Detach the liftgate opening weatherstrip from the C-pillar.



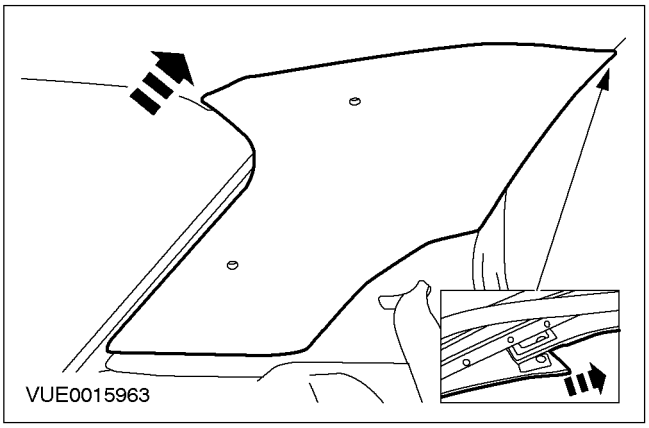
15. Remove the C-pillar upper trim panel retaining screws.

- Remove the C-pillar upper trim panel blanking plugs and retaining screws.



16. Remove the C-pillar upper trim panel.

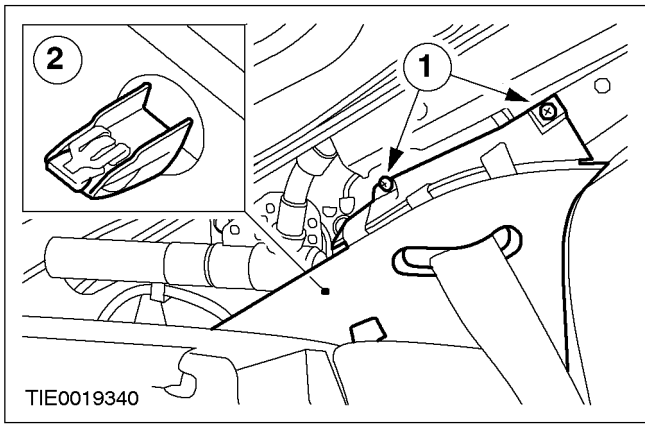
- Detach the C-pillar upper trim panel retaining clips and disconnect the rear window washer tube from the right-hand C-pillar trim panel as necessary.



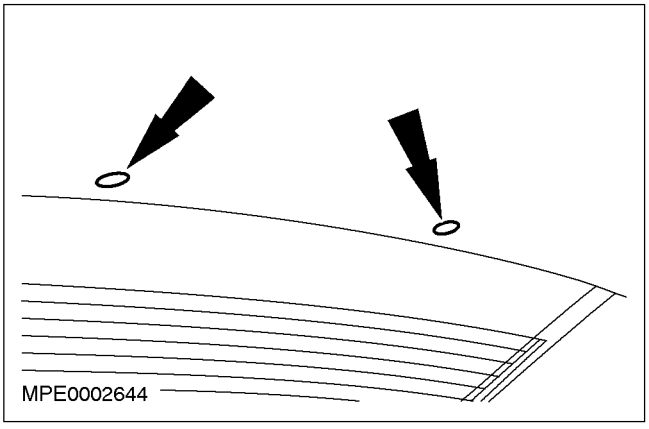
17. Remove the rear seat backrest outer head restraint.

18. Detach the C-pillar center trim panel and position it to one side.

1. Remove the screws.
2. Release the clip.

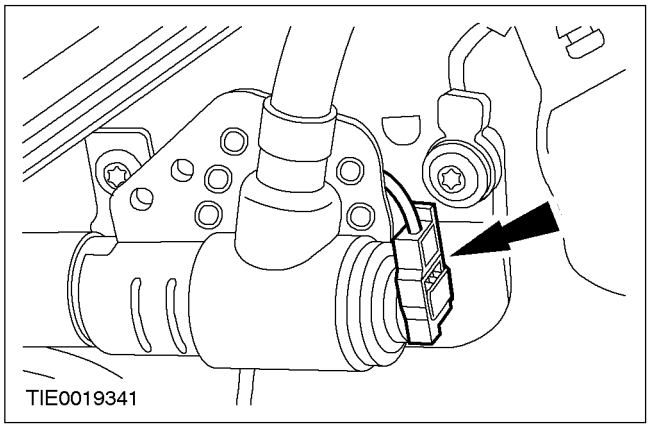


19. Remove the headliner retaining clips.



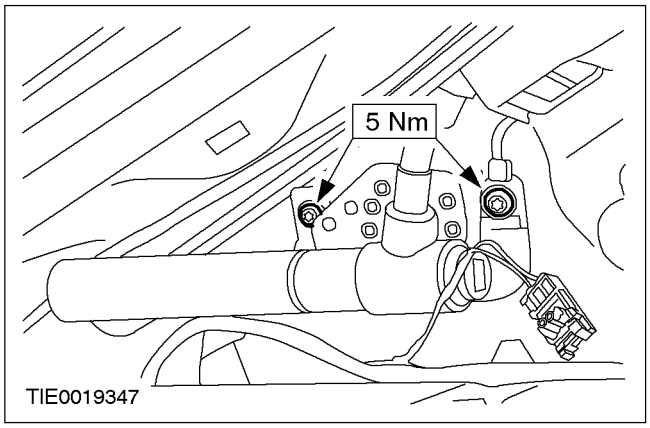
REMOVAL AND INSTALLATION (Continued)

20. **Lower the headliner and rest it on the front seat backrest head restraint.**
21. **Disconnect the side air curtain module electrical connector.**



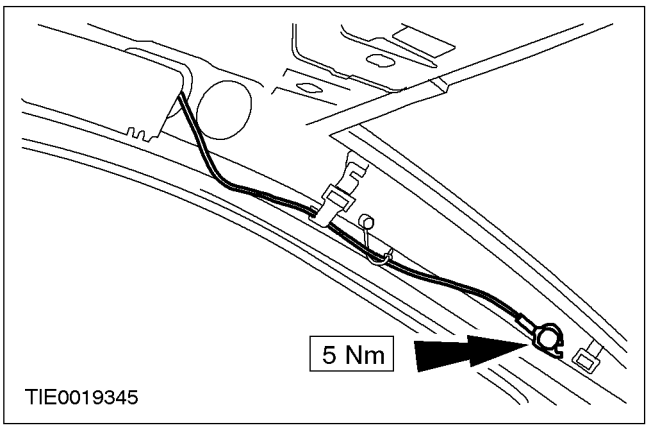
22. **NOTE:** Note the routing of the retaining cord to aid installation.

    Remove the side air curtain module rear retaining bolts.



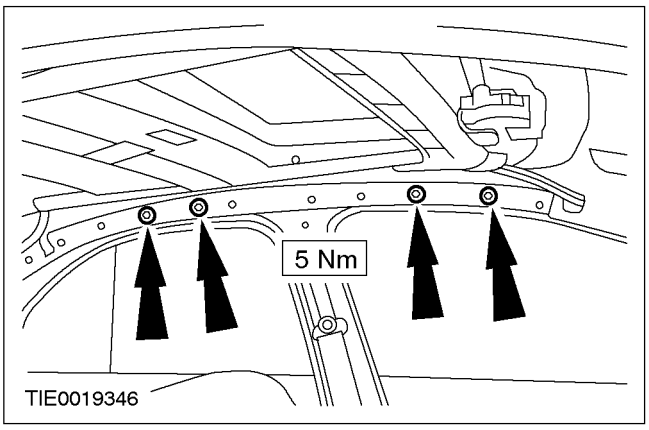
23. **NOTE:** Note the routing of the retaining cord to aid installation.

    Remove the side air curtain module front retaining bolt (headliner shown removed for clarity).



24. **NOTE:** Note the position of the locating tangs to aid installation.

    Remove the side air curtain module (headliner shown removed for clarity).



Installation

WARNING: Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.

REMOVAL AND INSTALLATION (Continued)

WARNING: To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.

WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

NOTE: Make sure the front safety belt shoulder height adjuster locking control is correctly located on the safety belt shoulder height adjuster.

1. **To install, reverse the removal procedure.**
2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

REMOVAL AND INSTALLATION

Side Air Curtain Module — Wagon

Removal

WARNING: To avoid accidental deployment, the air bag control module backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

WARNING: Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of premature deployment, do not use radio key code savers when working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.

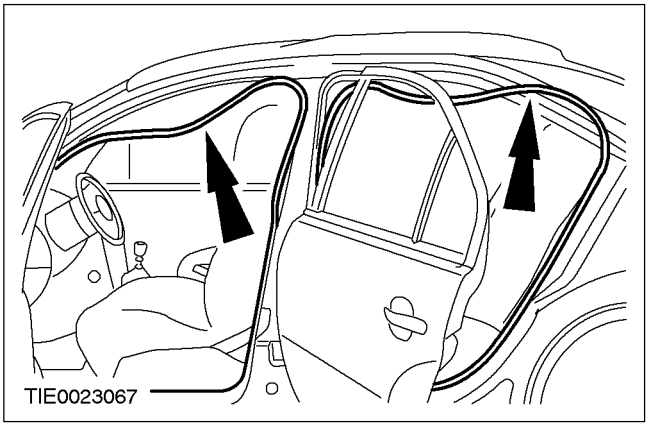
WARNING: To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.

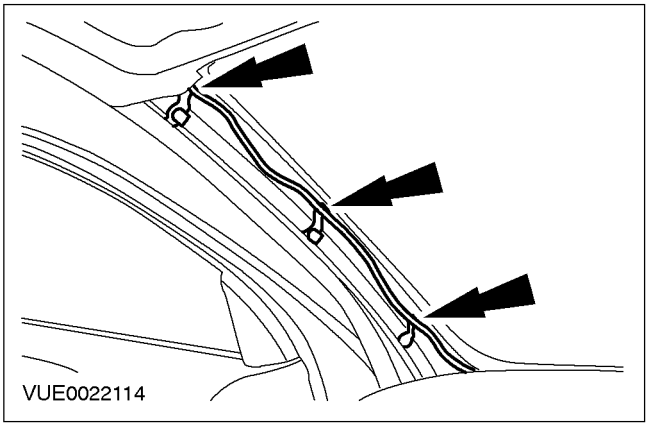
WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

All vehicles

1. **Disconnect the battery ground cable. For additional information, refer to Section 414-01.**
2. **Detach the front and rear door opening weatherstrips from around the upper part of the door openings.**

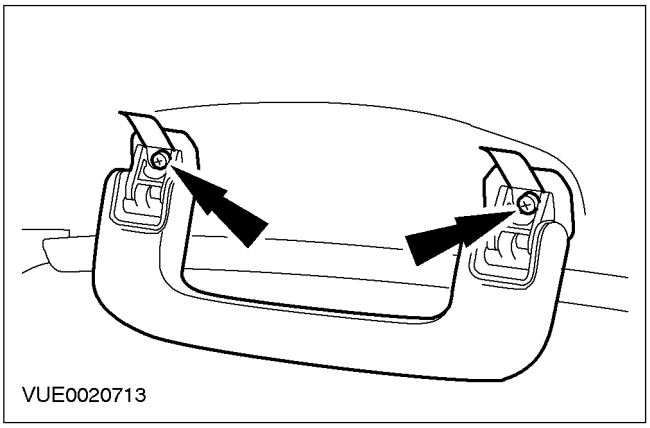


3. **Remove the A-pillar trim panel. For additional information, refer to Section 501-05.**
4. **Detach the headliner wiring harness from the left-hand A-pillar or the rear window washer tube from the right-hand A-pillar as necessary (left-hand A-pillar shown).**



REMOVAL AND INSTALLATION (Continued)

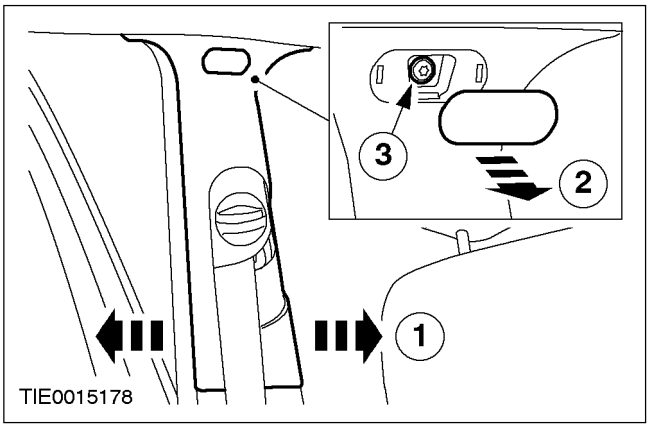
5. Lever open the covers to expose the screws and remove the passenger assist handles.



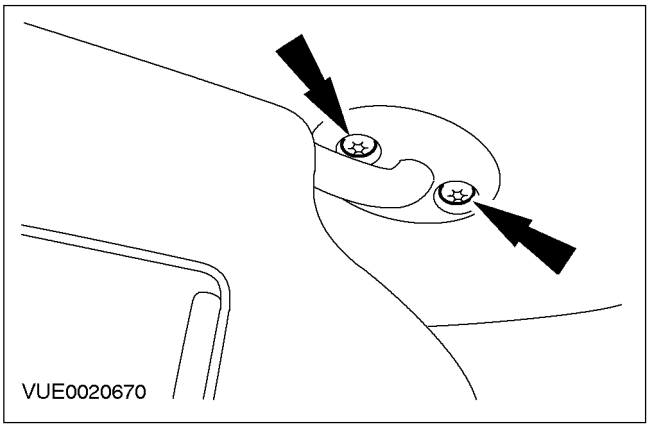
6. Move the front safety belt shoulder height adjuster to its lowest position.

7. Detach the B-pillar upper trim panel from the B-pillar and position it to one side.

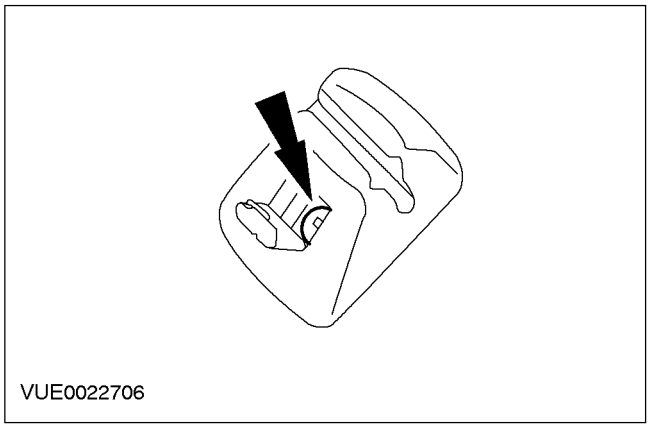
1. Detach the locating tangs from the B-pillar lower trim panel.
2. Remove the screw cover.
3. Remove the screw.



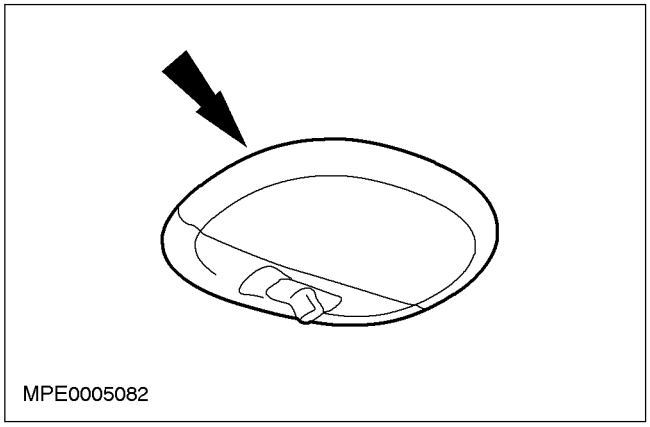
8. Remove the sun visor.



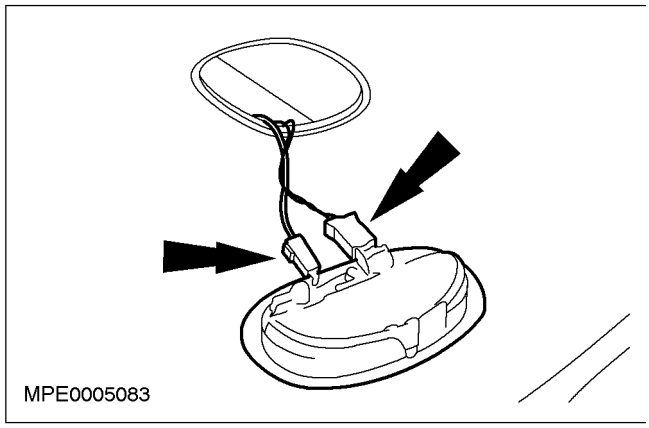
9. Lever open the cover to expose the screw and remove the sun visor retaining clip.



10. Detach the rear interior lamp from the headliner (if equipped).



11. Disconnect the electrical connectors and remove the rear interior lamp (if equipped).

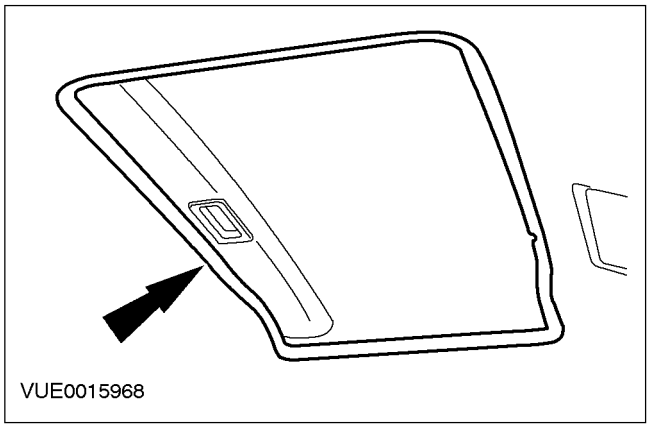


12. Pull down on the rear interior lamp opening to detach the headliner spacer adhesive fixing from the roof panel.

REMOVAL AND INSTALLATION (Continued)

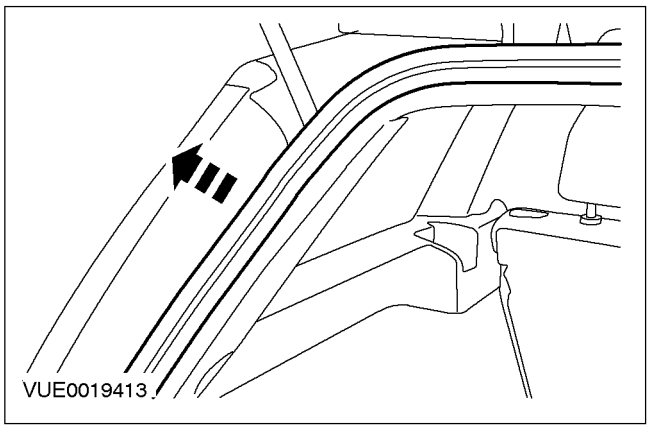
Vehicles with roof opening panel

13. Remove the roof opening panel weatherstrip.



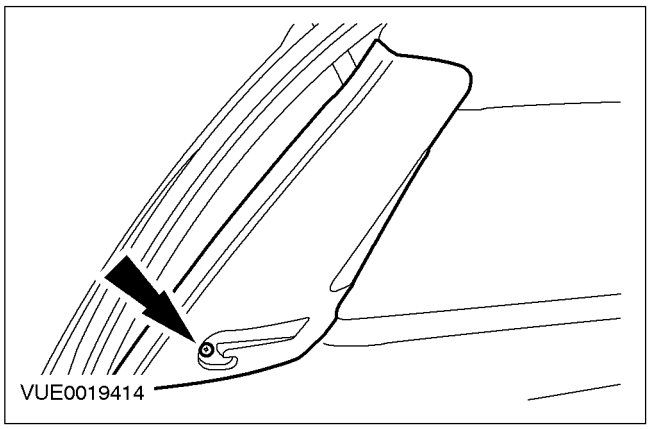
All vehicles

14. Detach the liftgate opening weatherstrip from the D-pillar.



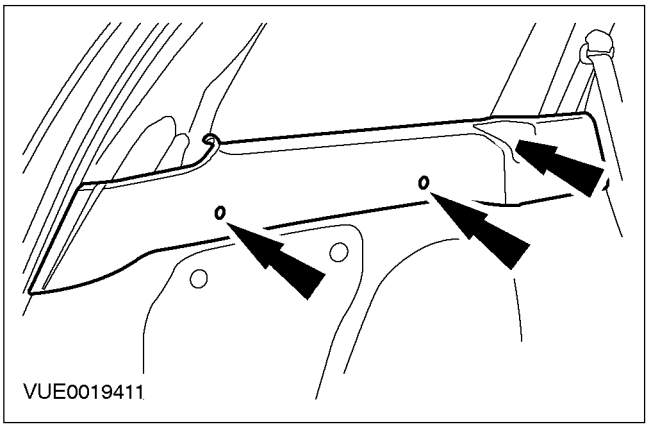
15. Remove the D-pillar trim panel retaining screw and remove the D-pillar trim panel.

- Detach the D-pillar trim panel retaining clips and disconnect the rear window washer tube from the right-hand D-pillar trim panel as necessary.



16. Remove the load space upper trim panel.

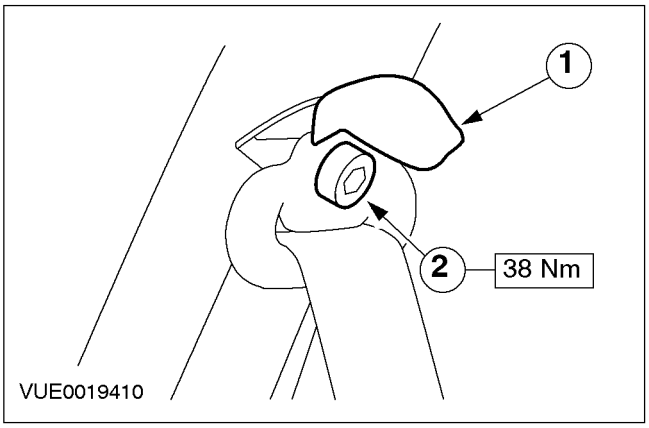
- Remove the load space upper trim panel retaining screws.



17. ⚠ CAUTION: The bolt securing the safety belt anchor is held captive by a paper washer. The bolt, spacer and paper washer must remain on the safety belt anchor at all times when the safety belt is detached or removed.

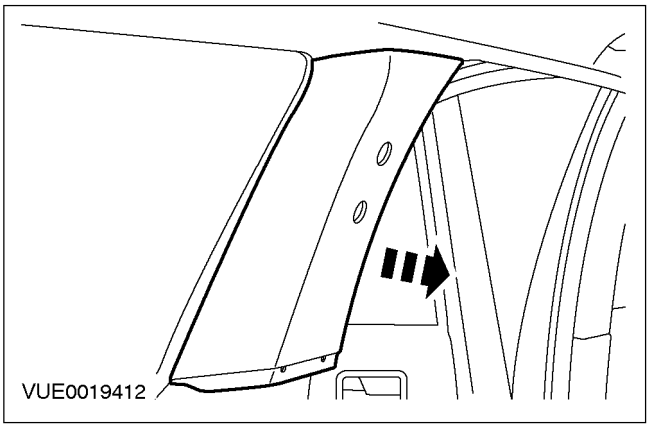
Detach the safety belt upper anchor from the C-pillar.

1. Detach the bolt cover.
2. Remove the bolt.

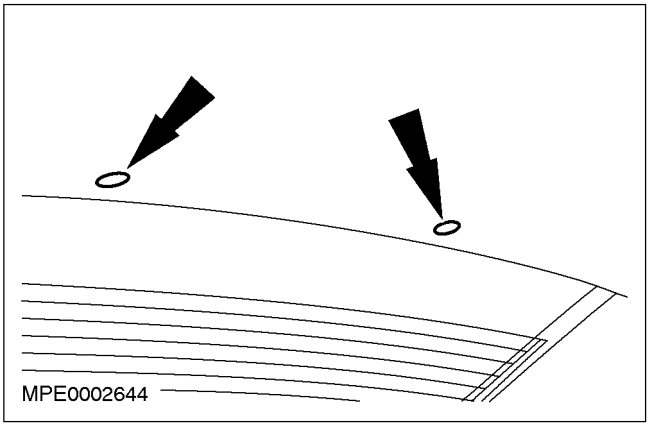


REMOVAL AND INSTALLATION (Continued)

18. Remove the C-pillar trim panel.

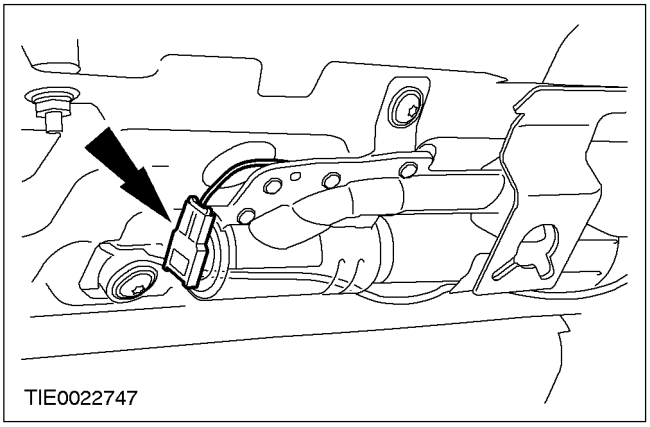


19. Remove the headliner retaining clips.



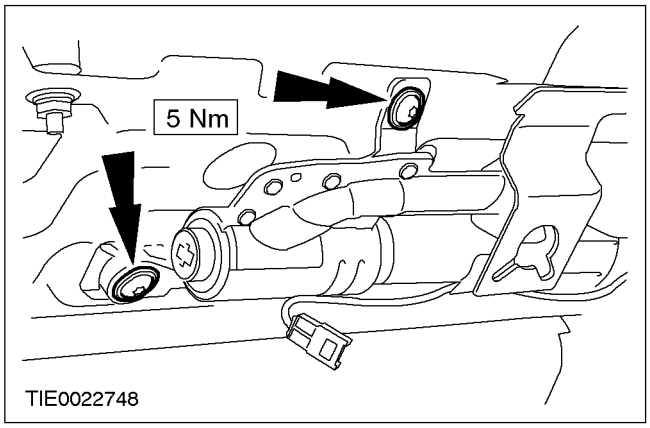
20. Lower the headliner and rest it on the front seat backrest head restraint.

21. Disconnect the side air curtain module electrical connector.



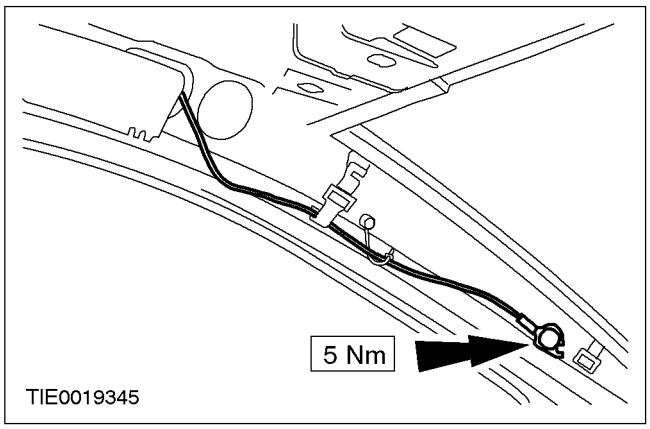
22. NOTE: Note the routing of the retaining cord to aid installation.

Remove the side air curtain module rear retaining bolts.



23. NOTE: Note the routing of the retaining cord to aid installation.

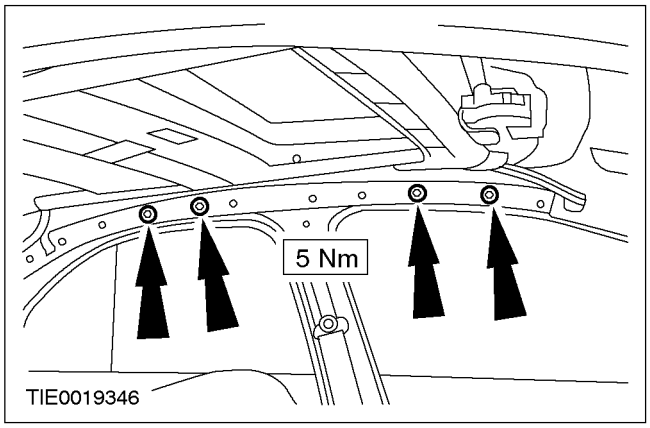
Remove the side air curtain module front retaining bolt (headliner shown removed for clarity).



REMOVAL AND INSTALLATION (Continued)

24. NOTE: Note the position of the locating tangs to aid installation.

Remove the side air curtain module (headliner shown removed for clarity).



Installation

WARNING: Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.

WARNING: To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.

WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

NOTE: Make sure the front safety belt shoulder height adjuster locking control is correctly located on the safety belt shoulder height adjuster

1. **To install, reverse the removal procedure.**
2. **Initialize the door window motors. For additional information, refer to Section 501-11.**

REMOVAL AND INSTALLATION

Clockspring

Removal

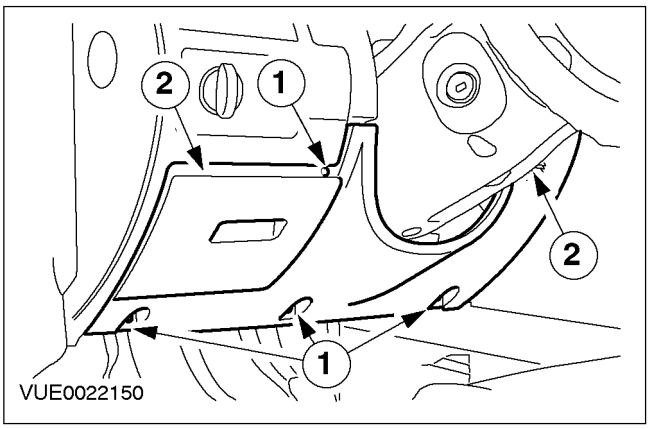
WARNING: To avoid accidental deployment, the air bag control module backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instruction may result in personal injury.

WARNING: To minimize the possibility of premature deployment, do not use radio key code savers when working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.

WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

1. Remove the instrument panel lower panel.

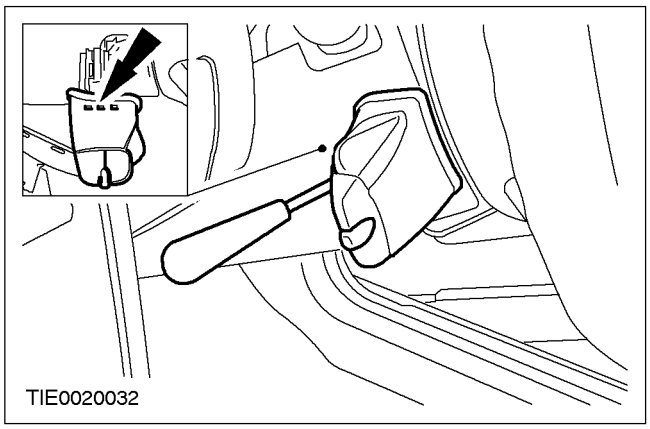
1. Remove the screws.
2. Release the clips.



2. Remove the steering wheel. For additional information, refer to Section 211-04.

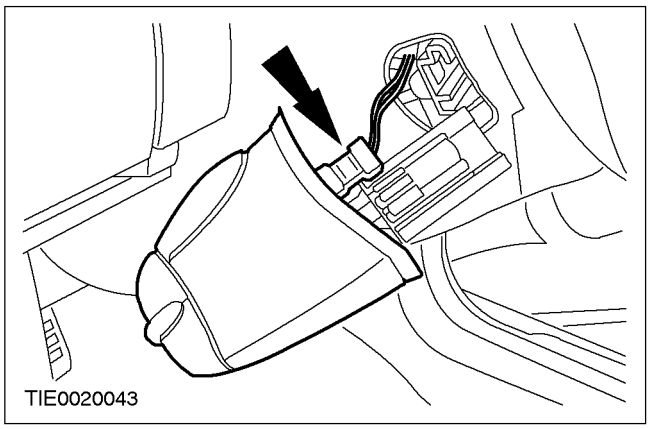
3. Detach the audio control switch from the steering column lower shroud (if equipped).

- Using a thin bladed screwdriver, release the locking tang.



4. Remove the audio control switch (if equipped).

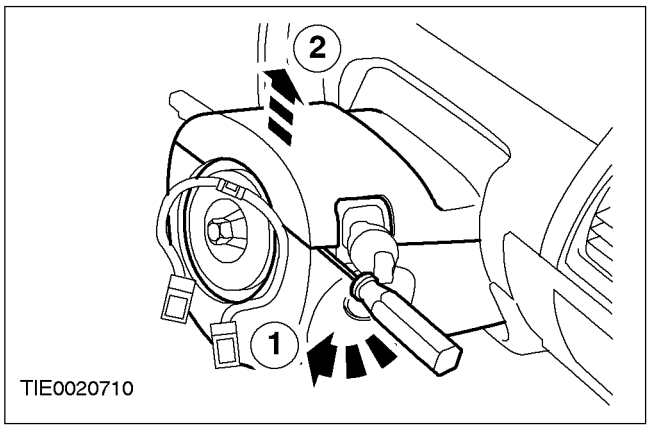
- Disconnect the electrical connector.



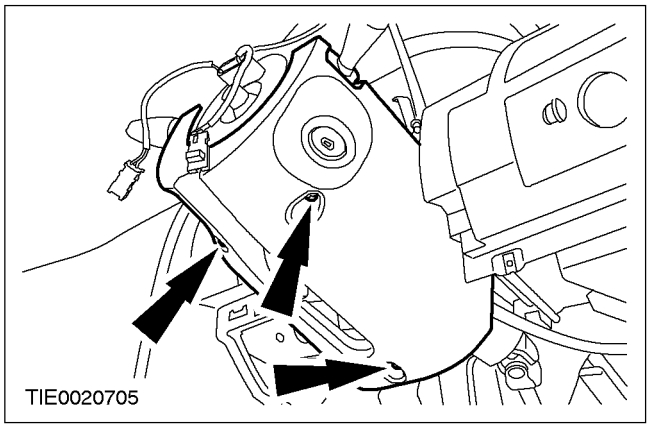
REMOVAL AND INSTALLATION (Continued)

5. Detach the steering column upper shroud from the lower shroud.

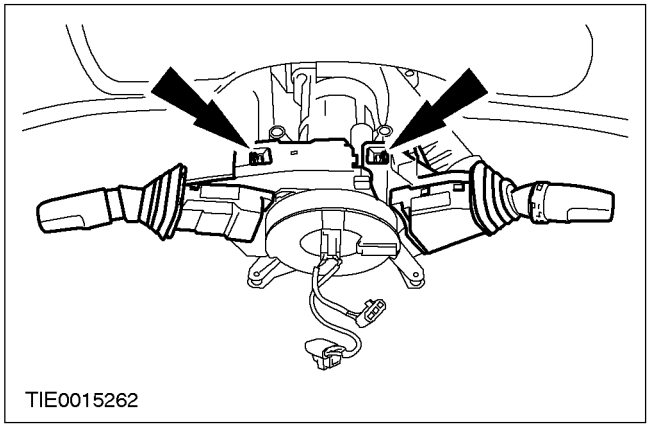
1. Using a thin bladed screwdriver, release the two clips (one each side).
2. Detach the shroud.



6. Remove the steering column lower shroud.

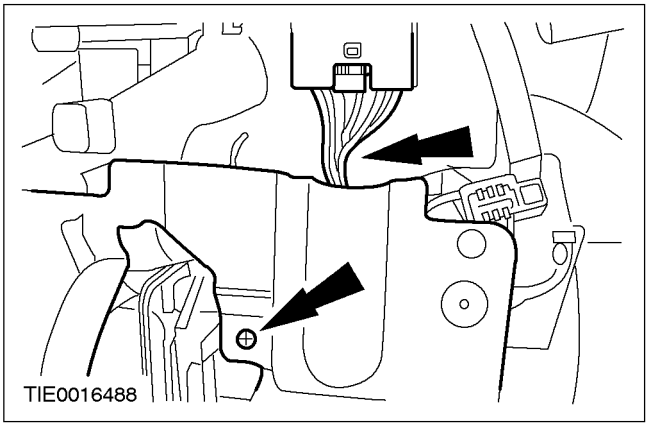


7. Detach the multifunction switches from the clockspring and position them to one side.

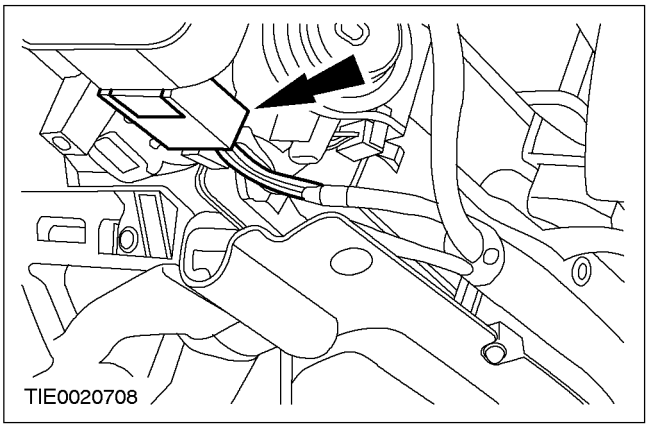


8. NOTE: Note the routing of the clockspring wiring harness to aid installation.

Detach the spreader plate from the steering column and position it to one side.

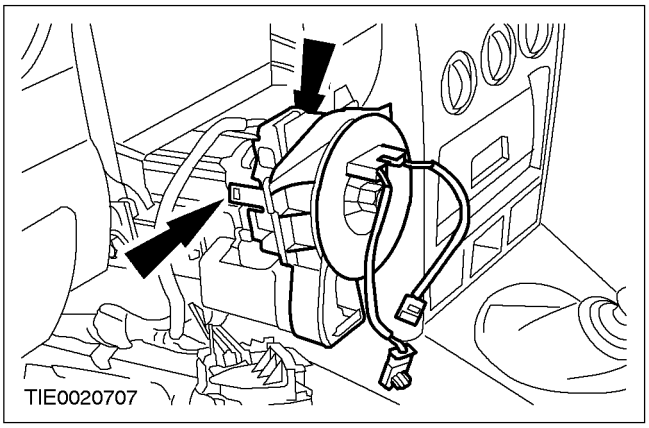


9. Disconnect the clockspring electrical connector.



10. Remove the clockspring.

- Release the locking tangs from the steering column.



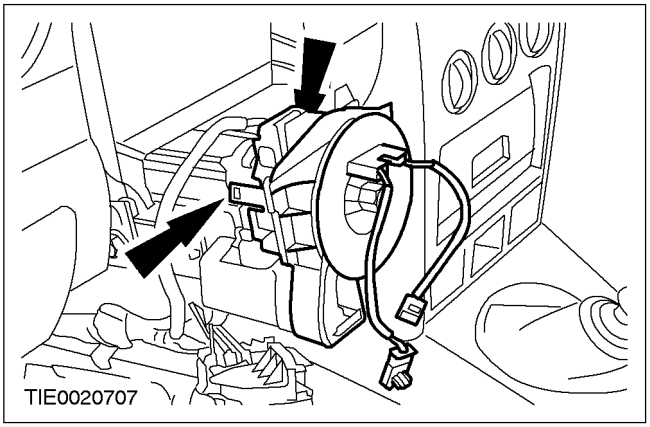
REMOVAL AND INSTALLATION (Continued)

Installation

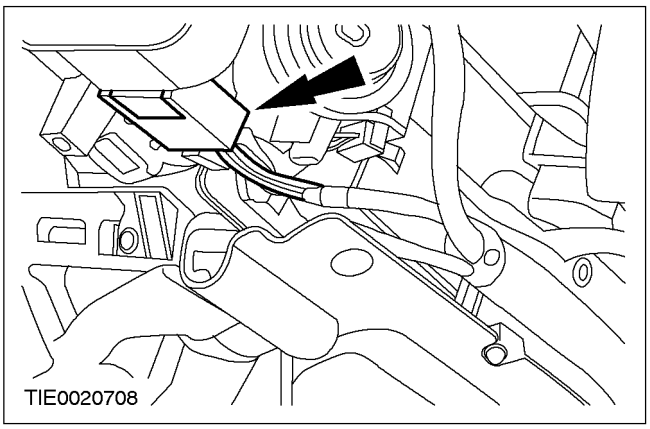
WARNING: Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

1. Install the clockspring.

- Make sure the retaining tangs lock into position on the steering column.

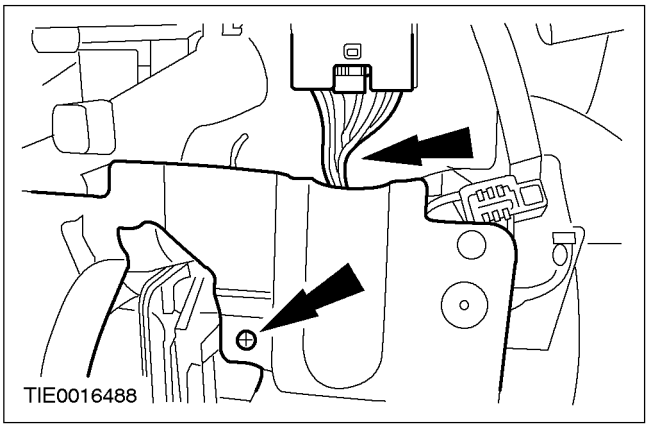


2. Connect the clockspring electrical connector.

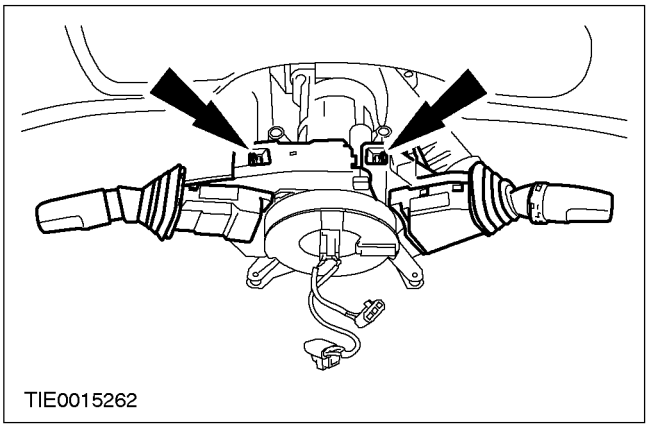


3. CAUTION: Make sure that the clockspring wiring harness is routed down the spreader plate depression and, following the installation of the spreader plate, that the clockspring electrical connector is fully connected.

Attach the spreader plate to the steering column.

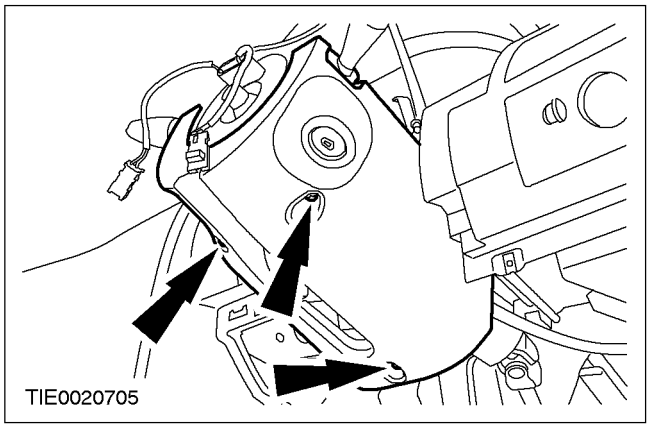


4. Attach the multifunction switches to the clockspring.



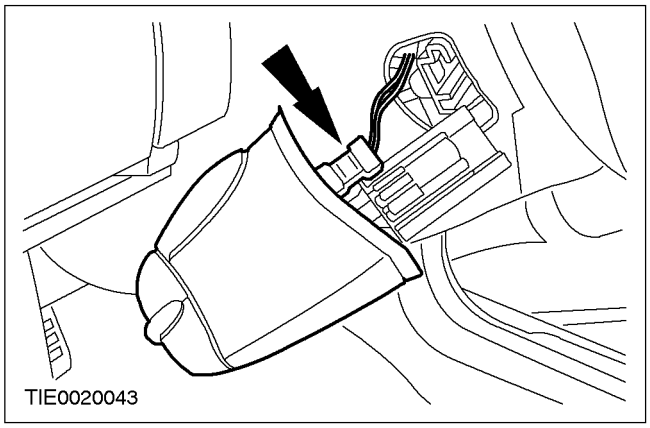
REMOVAL AND INSTALLATION (Continued)

5. Install the steering column lower shroud.



6. Install the audio control switch (if equipped).

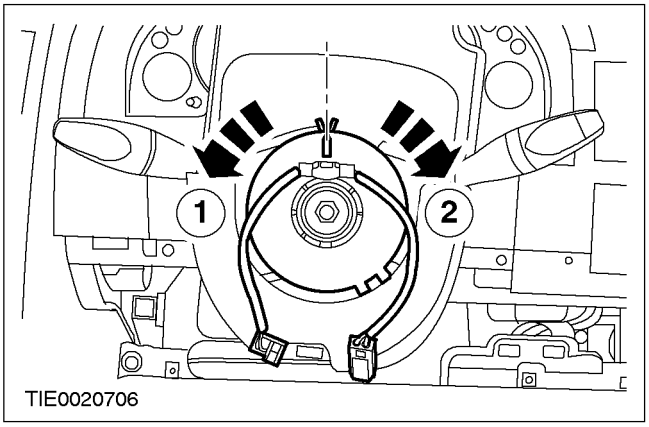
- Connect the electrical connector.



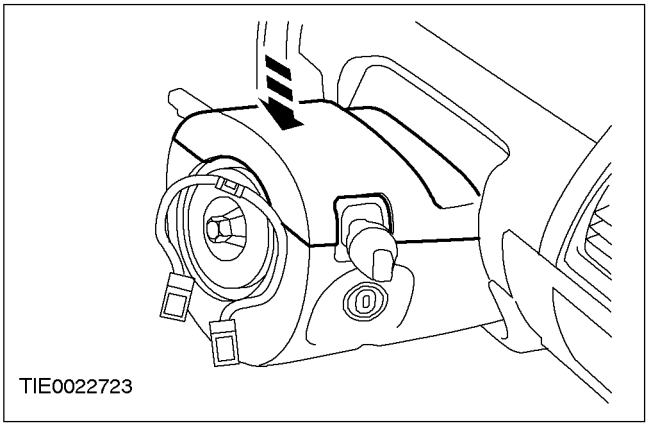
7. WARNING: Incorrect centralization may result in premature component failure. If in doubt when centralizing the clockspring, repeat the centralizing procedure. Failure to follow this instruction may result in personal injury.

Centralize the clockspring.

1. Turn the clockspring in a counterclockwise direction until resistance is felt (approximately two and one half turns from the central position).
2. Turn the clockspring in a clockwise direction, until the arrow marked on the rotor of the clockspring aligns with the raised 'V' section at the 12 o'clock position on the outer cover of the clockspring (approximately two and one half turns).



8. Attach the steering column upper shroud to the lower shroud.

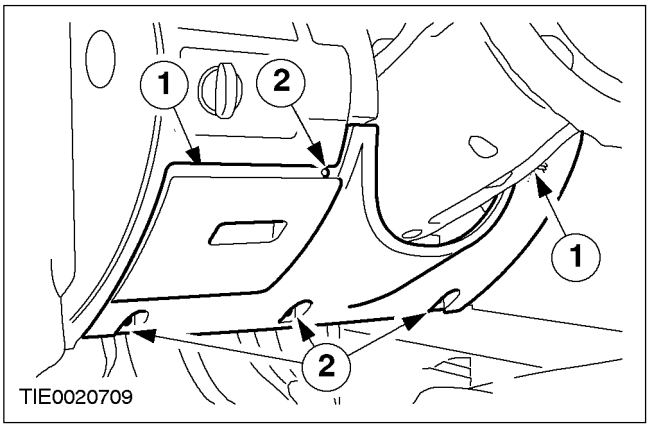


REMOVAL AND INSTALLATION (Continued)

9. **CAUTION: If there is any break between centralizing the clockspring and installing the steering wheel, or the vehicle is left unattended by the technician, the centralizing procedure MUST be repeated.**

   Install the steering wheel. For additional information, refer to Section 211-04.

10. **Install the instrument panel lower panel.**
    1. Install the clips.
    2. Install the screws.



REMOVAL AND INSTALLATION

Occupant Classification Sensor

Removal

1. **NOTE:** The occupant classification sensor is an integral part of the passenger seat cushion and cannot be serviced separately. If the occupant classification sensor is found to be unserviceable, following the correct diagnosis and testing, a new passenger seat cushion must be installed.

   Remove the passenger seat cushion. For additional information, refer to Section 501-10.

Installation

1. **To install, reverse the removal procedure.**

SECTION 502-00 Uni-Body, Subframe and Mounting System

VEHICLE APPLICATION: 2003.0 Mondeo

CONTENTS **PAGE**

SPECIFICATIONS

Specifications 502-00-2

REMOVAL AND INSTALLATION

Subframe..... 502-00-3

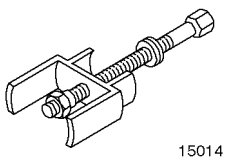
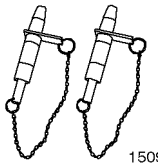
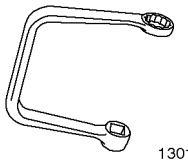
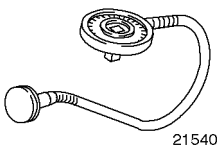
SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Lower arm front retaining bolts 1. Stage	80	59	-
2. Stage	60 Degrees	60 Degrees	60 Degrees
Lower arm rear retaining bolts 1. Stage	90	66	-
2. Stage	60 Degrees	60 Degree	60 Degree
Stabilizer bar to the subframe	48	35	-
Steering gear to the subframe	130	96	-
Rear subframe retaining bolts	142	105	-
Subframe bracket to the body	10	-	89
Front subframe retaining bolts	142	105	-
Lower arm ball joint pinch bolt to the wheel knuckle	83	61	-
Engine support insulator to the subframe	80	59	-
Engine support insulator to the engine	80	59	-
Stabilizer connecting link to the suspension strut	48	35	-
Radiator support bracket retaining bolts to the sub-frame	25	18	-
Engine undershield retaining bolts	10	-	89
Hose bracket to the subframe	10	-	89

REMOVAL AND INSTALLATION

Subframe

Special Tool(s)	
 15014	Remover/Installer, Rear Suspension Bushing 205-050 (15-014)
 15097A	Alignment Pins, Subframe 205-316 (15-097A)
 13013	Wrench, Steering Gear 211-270 (13-028)
 21540	Angle Gauge, Bolt Tightening 303-174 (21-540)

General Equipment
Transmission jack
Wooden blocks

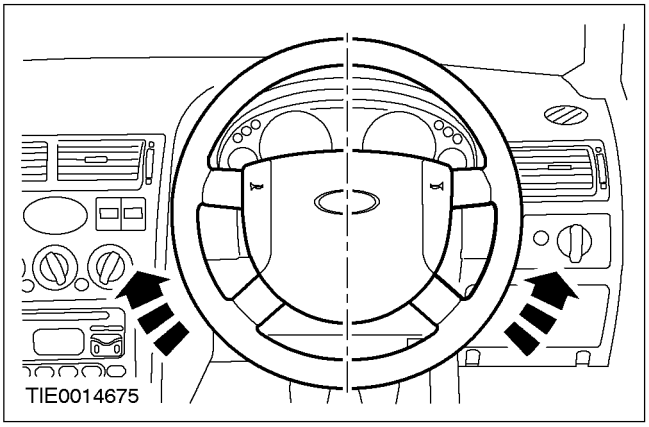
Name	Specification
Washer	E830 819 571

Removal

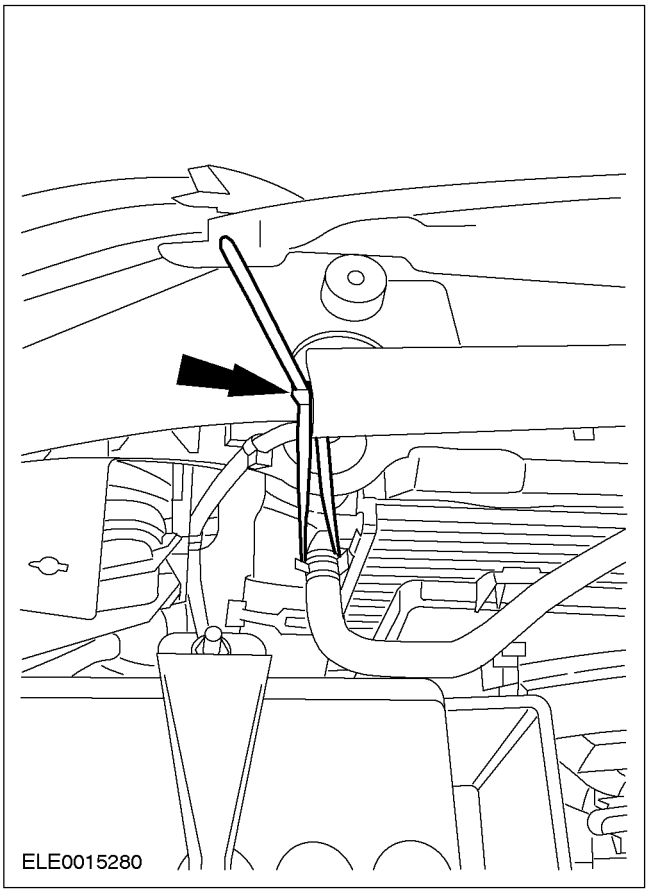
All vehicles

1. **NOTE:** Make sure the road wheels are in the straight ahead position.

   Centralize the steering.

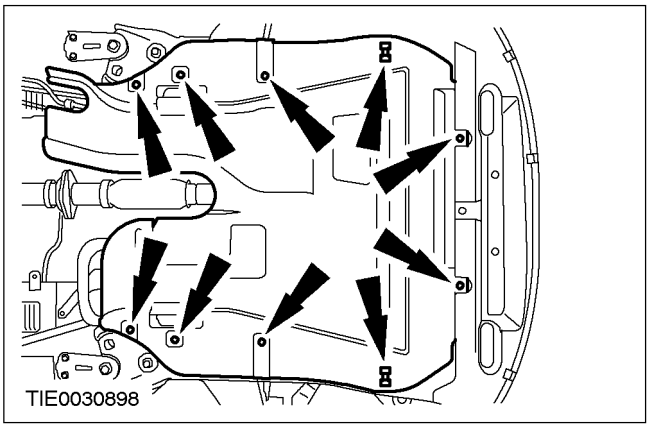


2. **Using cable ties, support the radiator on both sides.**

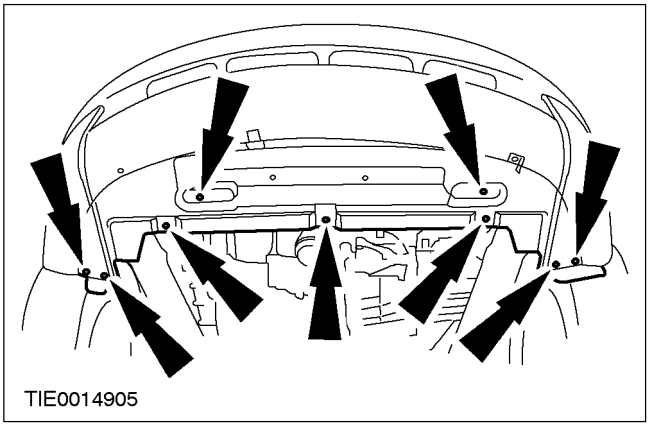


REMOVAL AND INSTALLATION (Continued)

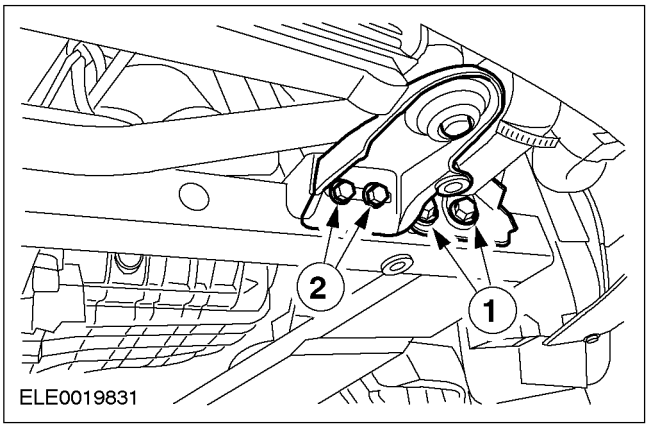
3. **Raise and support the vehicle. For additional information, refer to Section 100-02.**
4. **Remove the front wheels and tires. For additional information, refer to Section 204-04.**
5. **Remove the engine undershield (if equipped).**


TIE0030898

6. **Remove the splash shield.**


TIE0014905

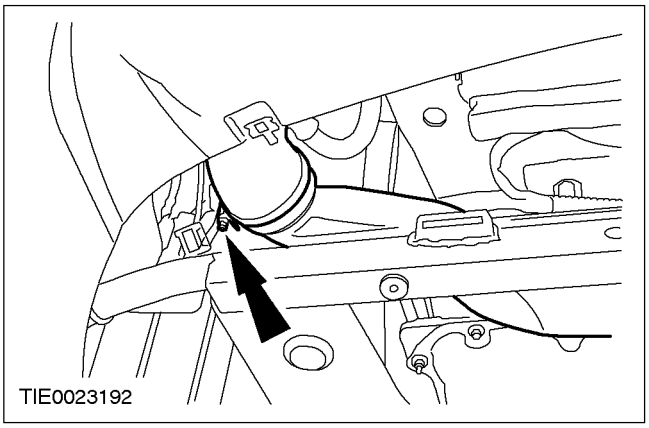
7. **Remove the radiator support bracket on both sides.**
   1. Remove the hose bracket (if equipped).
   2. Remove the radiator support bracket.



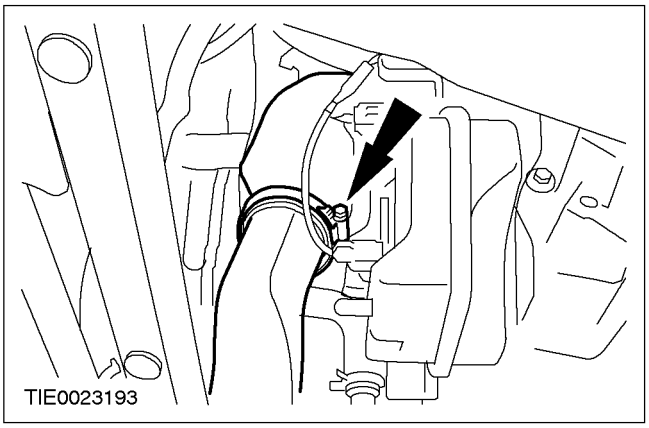
ELE0019831

Vehicles with diesel engine

8. **Remove the air intake hose.**


TIE0023192

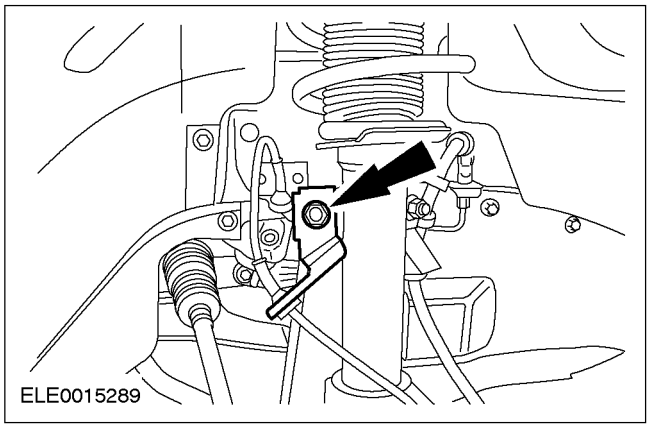
9. **Remove the turbocharger outlet hose.**


TIE0023193

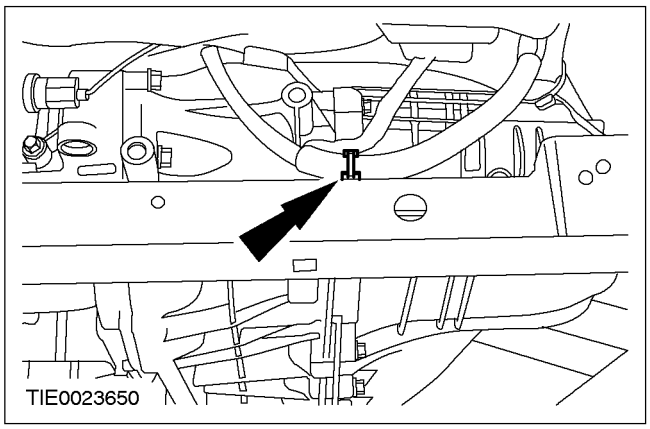
REMOVAL AND INSTALLATION (Continued)

All vehicles

10. **Detach the stabilizer bar connecting link from the suspension strut on both sides.**

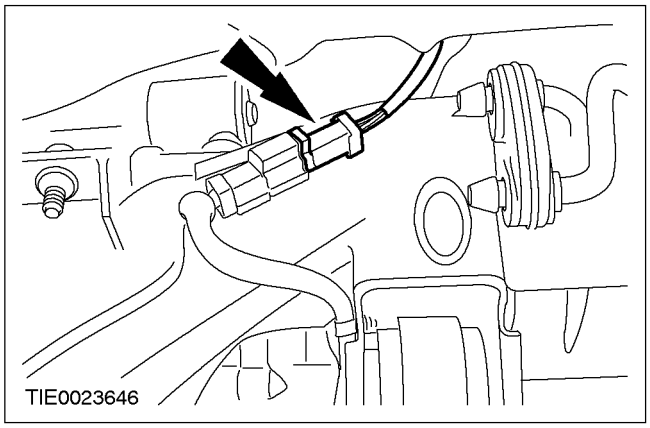


11. **Detach the radiator cooling fan wiring harness from the subframe.**

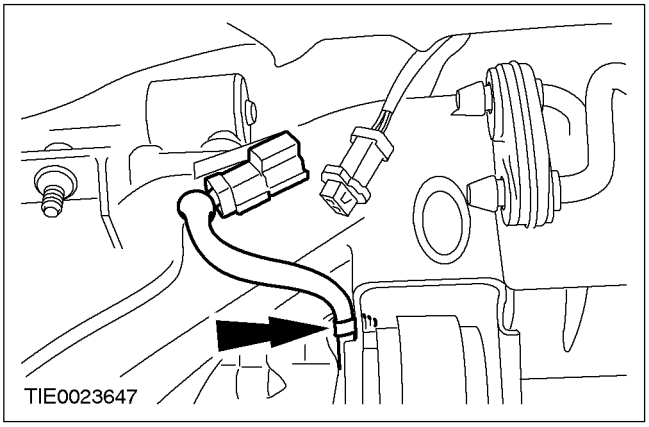


All except vehicles with diesel engine

12. **Disconnect the catalyst monitor sensor electrical connector.**



13. **Detach the catalyst monitor sensor wiring harness from the subframe.**



Vehicles with 1.8L, 2.0L or diesel engine

14. **Remove the exhaust flexible pipe. For additional information, refer to Section 309-00.**

Vehicles with 2.5L engine

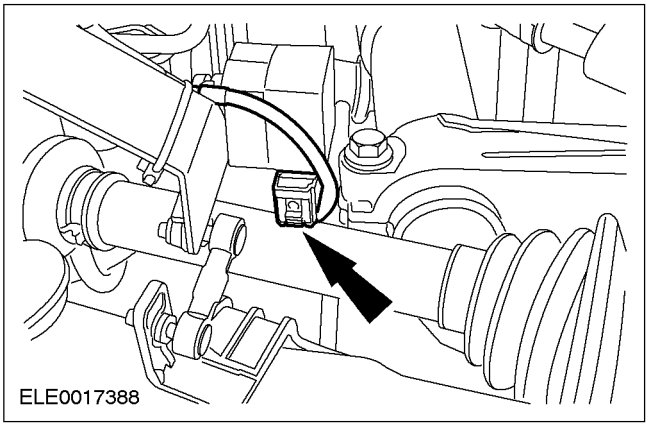
15. **Remove the dual converter Y-pipe. For additional information, refer to Section 309-00.**

Vehicles with 3.0L engine

16. **Remove the catalytic converters. For additional information, refer to Section 309-00.**

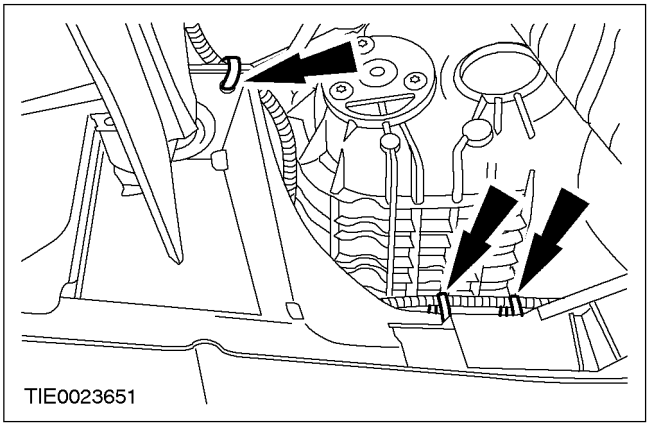
Vehicles with xenon headlamps

17. **Disconnect the headlamp leveling sensor electrical connector.**



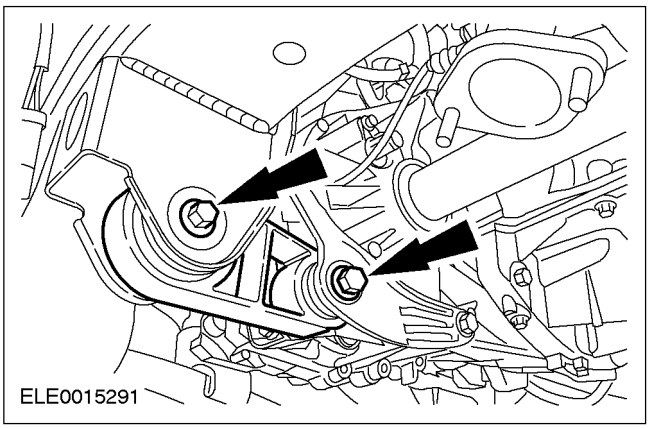
REMOVAL AND INSTALLATION (Continued)

18. **Detach the headlamp leveling sensor wiring harness from the subframe.**

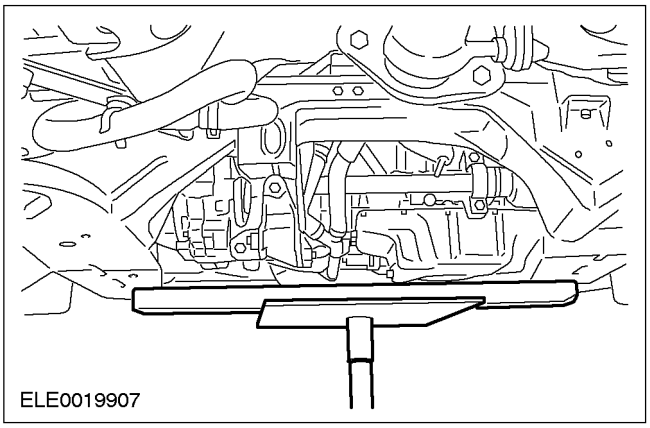


All Vehicles

19. **Remove the engine rear support insulator.**

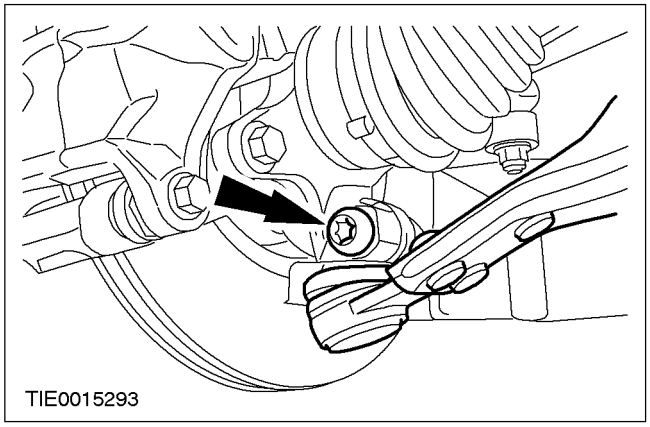


20. **Using two suitable wooden blocks and suitable transmission jack, support the subframe.**

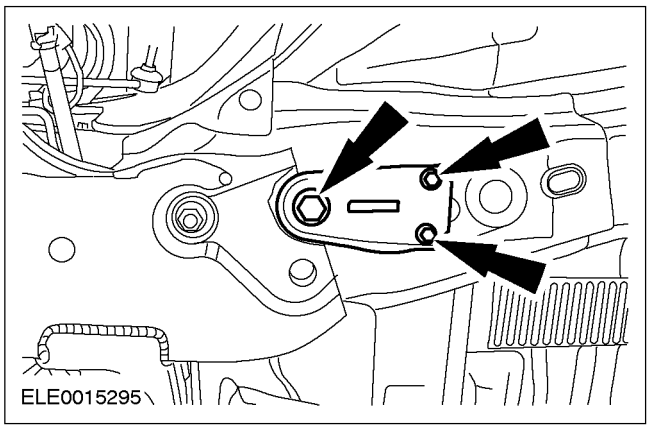


21. **CAUTION: Do not pull down the lower arm, to prevent the lower arm hydro-bushing from damage.**

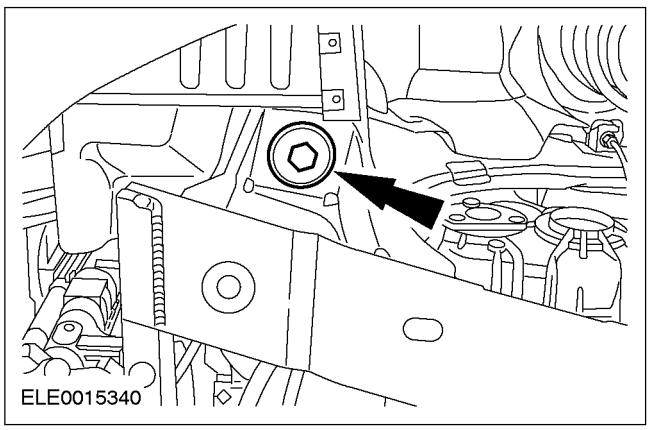
Remove the lower arm ball joint retaining nut and bolt.



22. **Remove the subframe rear retaining bolts and the subframe bracket retaining bolts on both sides.**



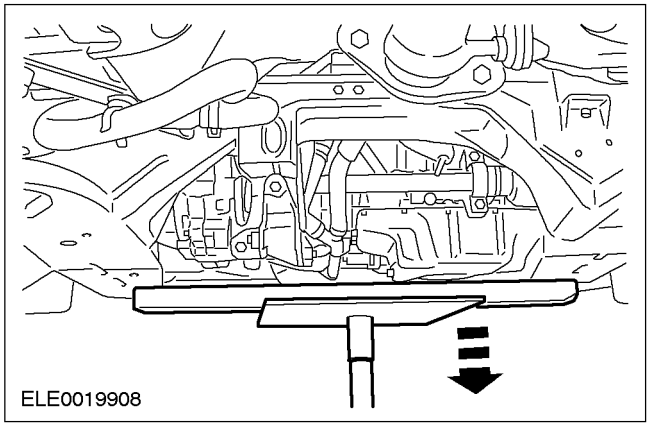
23. **Remove the subframe front retaining bolts on both sides.**



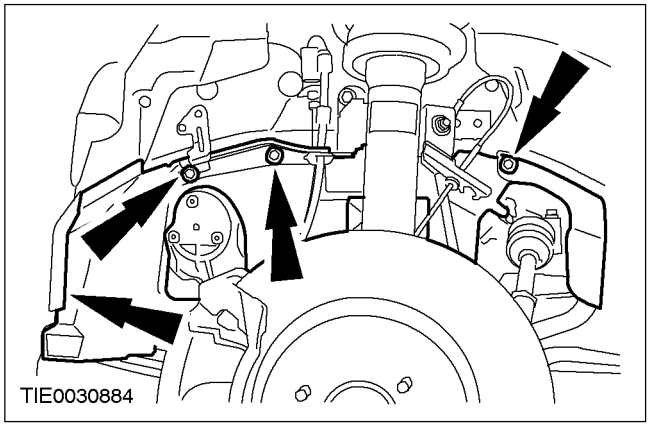
REMOVAL AND INSTALLATION (Continued)

24. ⚠ CAUTION: Lower the subframe uniformly, to prevent the lower arm hydro-bushing from damage.

Using the transmission jack, lower the subframe approximately 150 mm.

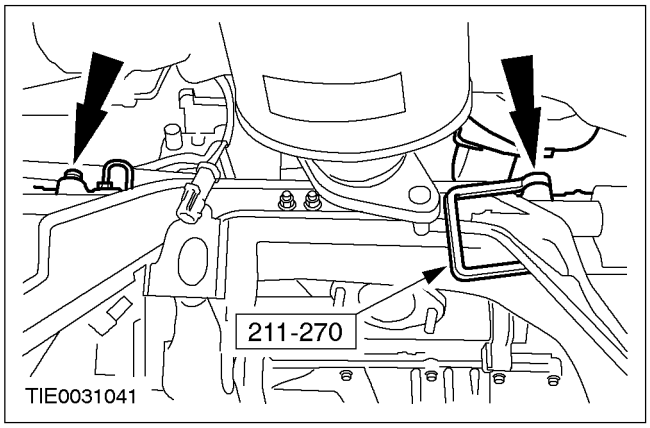


25. Remove the splash shield on both sides.



26. Using the special tool, detach the steering gear from the subframe.

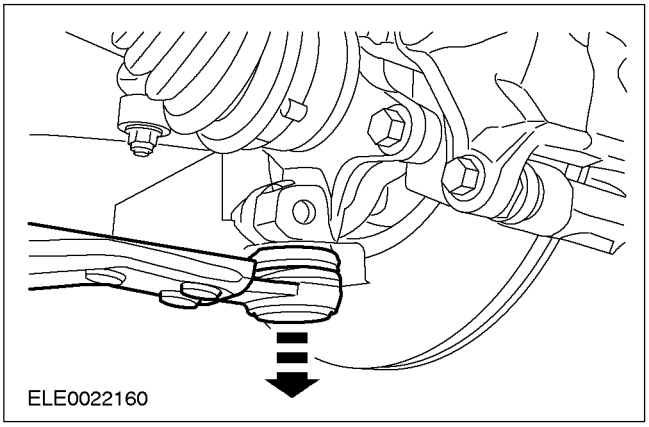
- Support the steering gear, using cable ties.



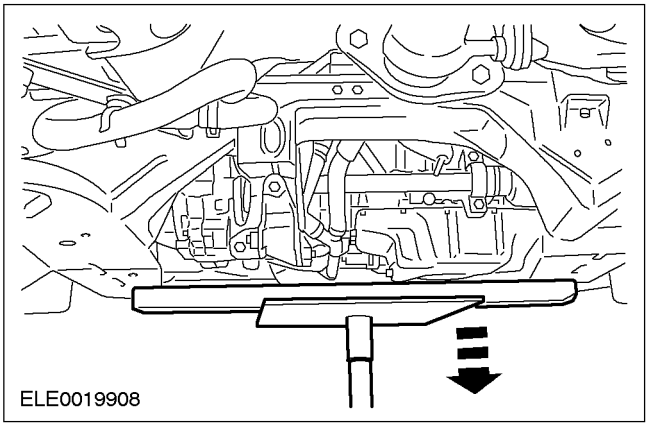
27. ⚠ CAUTION: Protect the ball joint seal using a soft cloth to prevent damage.

Detach the lower arm ball joint from the wheel knuckle.

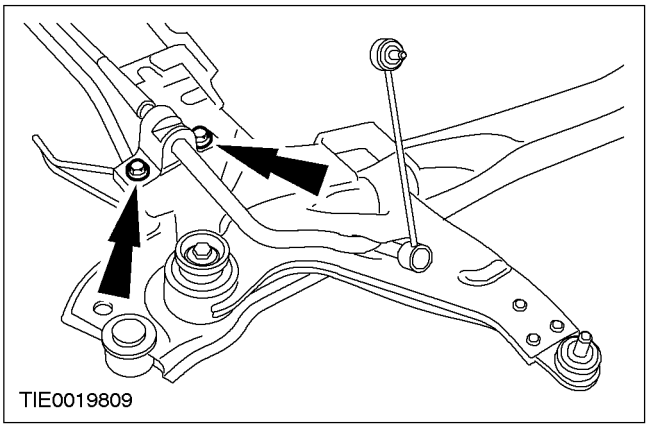
- Remove the heat shield.



28. Using the transmission jack, lower the subframe uniformly.

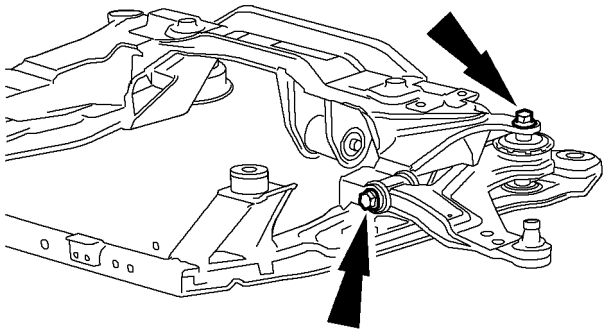


29. Remove the stabilizer bar (two bolts each side).

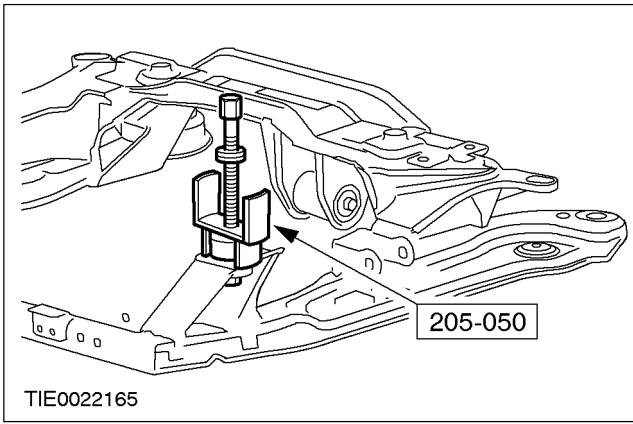


REMOVAL AND INSTALLATION (Continued)

30. Remove the lower arms (two bolts each side).


TIE0019810

31. Using the special tool, remove the sub-frame bushings.



TIE0022165

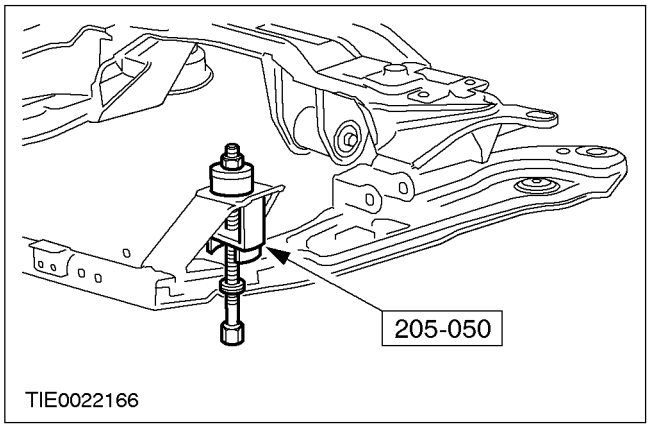
Installation

All vehicles

1. NOTE: Use new bushings.

NOTE: Make sure correct orientation of bushings. Slot on inner core of bushing has to point to vehicle longitudinal axis.

Using the special tool, install the subframe bushings.



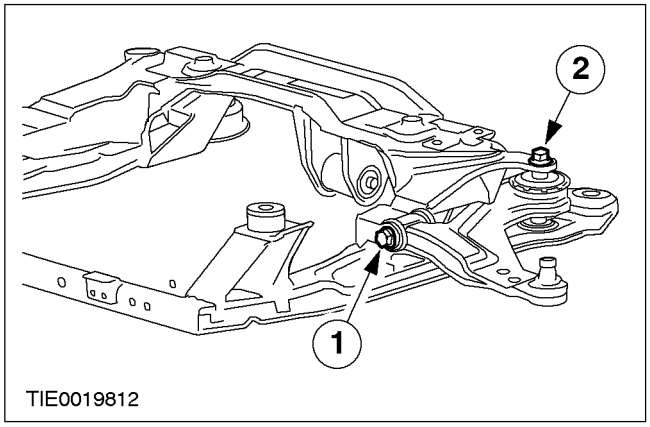
TIE0022166

2. NOTE: Use new bolts and nuts.

Install the lower arms.

1. Install the lower arm front retaining bolt in two stages.
- Stage 1: 80 Nm.
- Stage 2: 60 degrees.

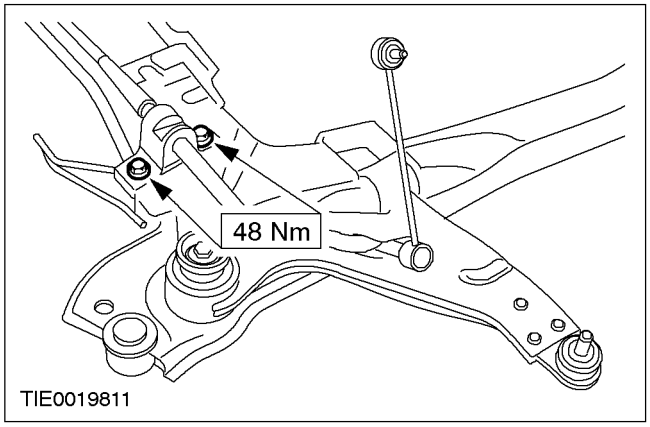
2. Install the lower arm rear retaining bolt in two stages.
- Stage 1: 90 Nm.
- Stage 2: 60 degrees.



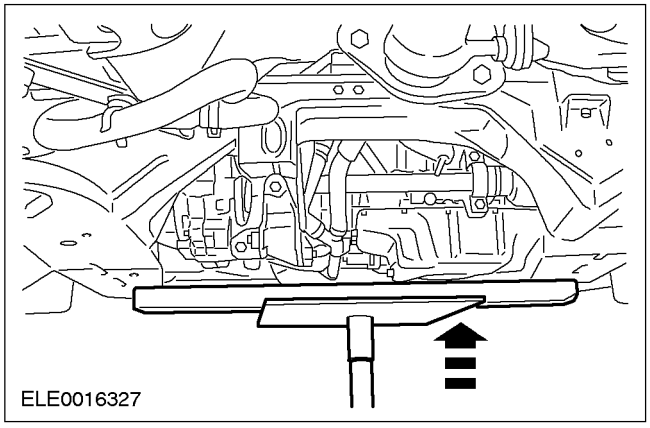
TIE0019812

REMOVAL AND INSTALLATION (Continued)

3. Install the stabilizer bar (two bolts each side).



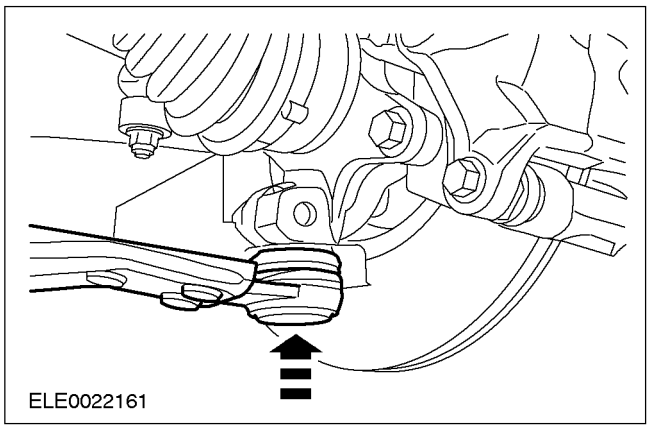
4. Using the transmission jack, position the subframe and lift it towards the body until the distance of the subframe to body is approximately 150 mm.



5. CAUTION: Make sure the heat shield is installed to prevent damage to the ball joint.

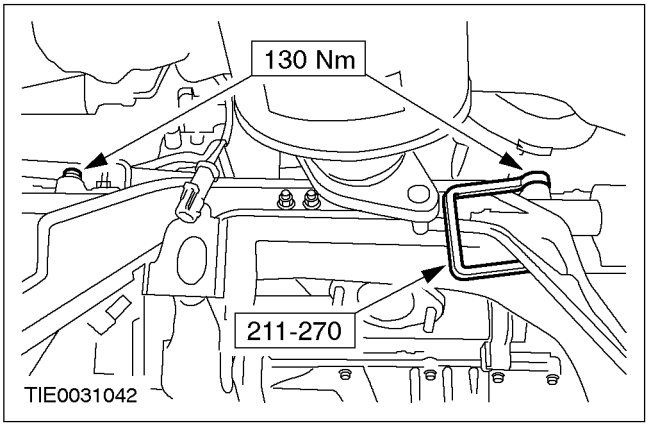
Attach the lower arm to the wheel knuckle on both sides.

- Install the heat shield.

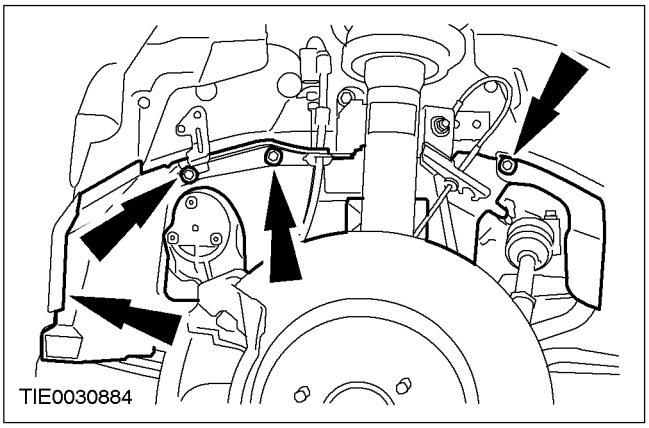


6. Using the special tool, attach the steering gear to the subframe.

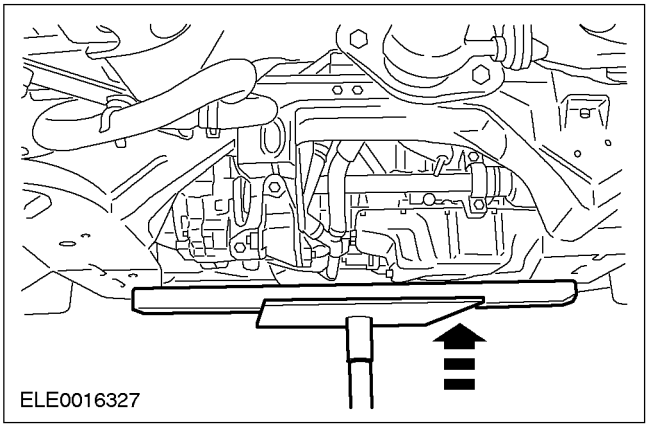
- Remove the cable ties.



7. Install the splash shield on both sides.



8. Using the transmission jack, position the subframe.



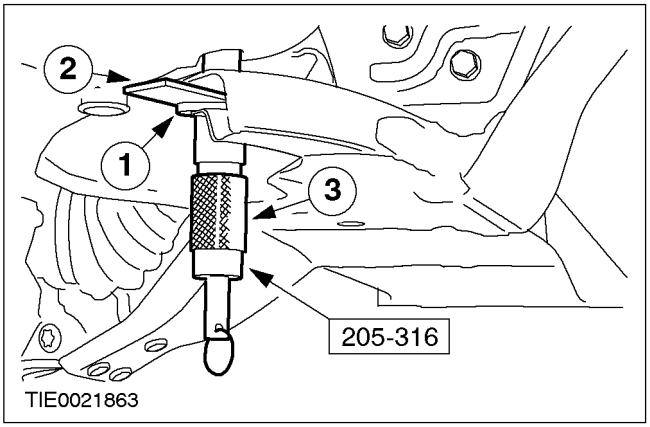
9. Using the special tools and a suitable washer, align the subframe.

1. Insert the washer, with inside diameter 22 mm, outside diameter 44 mm and height 5

REMOVAL AND INSTALLATION (Continued)

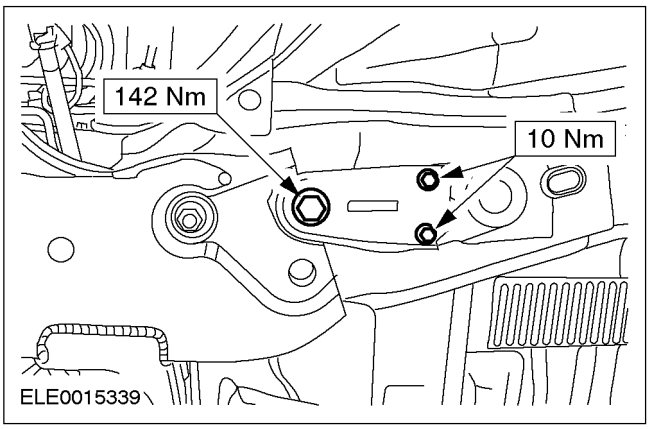
mm, into the subframe above the lower alignment hole.

2. Insert the alignment pin through the subframe alignment holes and the washer.
3. Slide the locking plates on top of the washer and into the groove of the tool and tighten the alignment pin sleeve.



10. **CAUTION: While tightening the subframe retaining bolts, make sure the subframe does not move.**

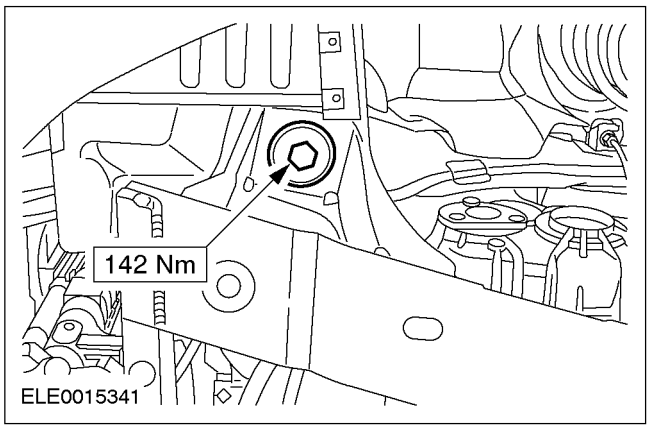
Install the subframe rear retaining bolts and the subframe bracket retaining bolts on both sides.



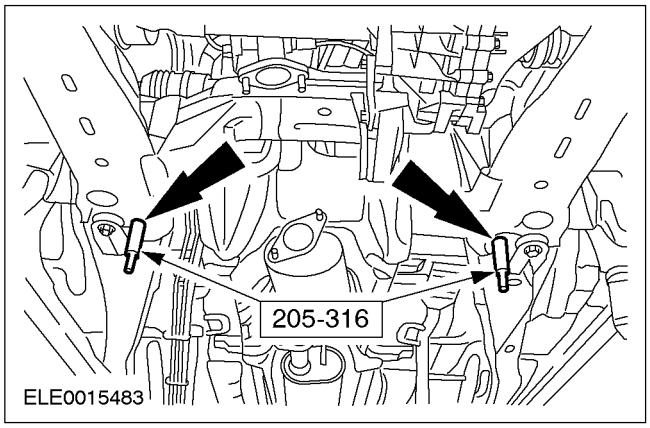
11. **CAUTION: While tightening the subframe retaining bolts, make sure the subframe does not move.**

Install the subframe front retaining bolts.

- Lower and remove the transmission jack.

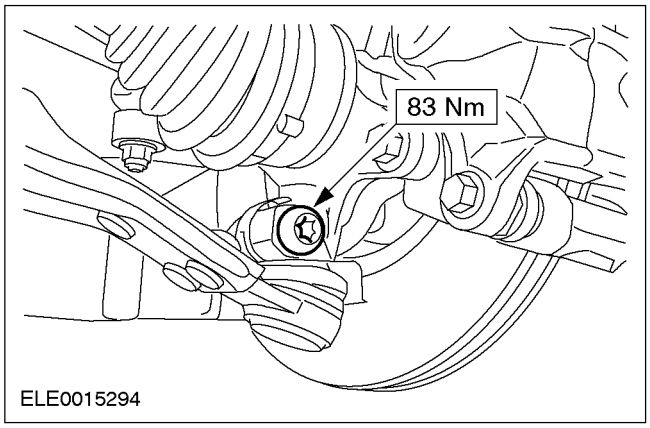


12. **Remove the special tools.**



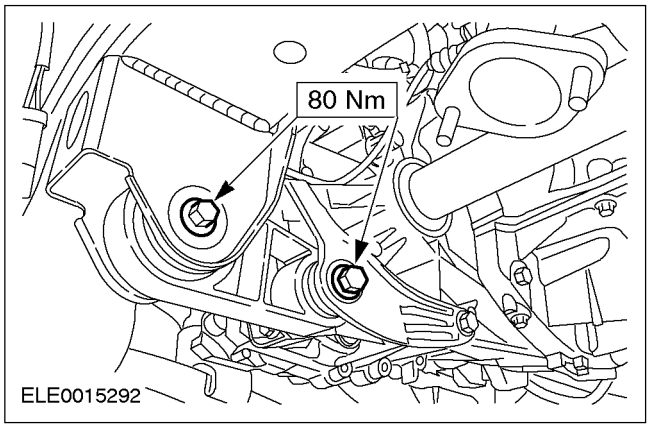
13. **NOTE:** The lower arm pinch bolt must be installed from the rear.

Install the lower arm ball joint pinch bolt on both sides.



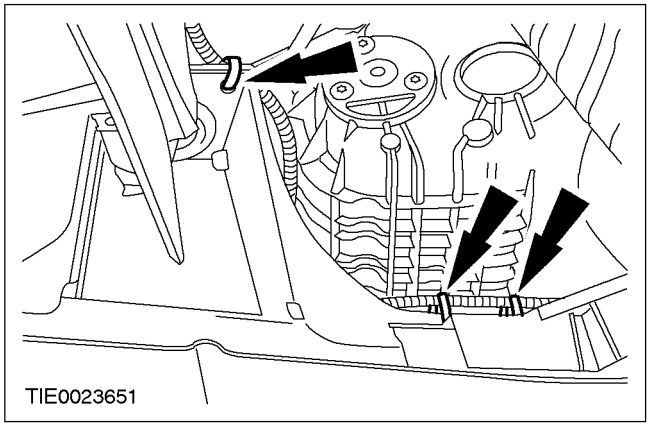
REMOVAL AND INSTALLATION (Continued)

14. **Install the engine rear support insulator.**

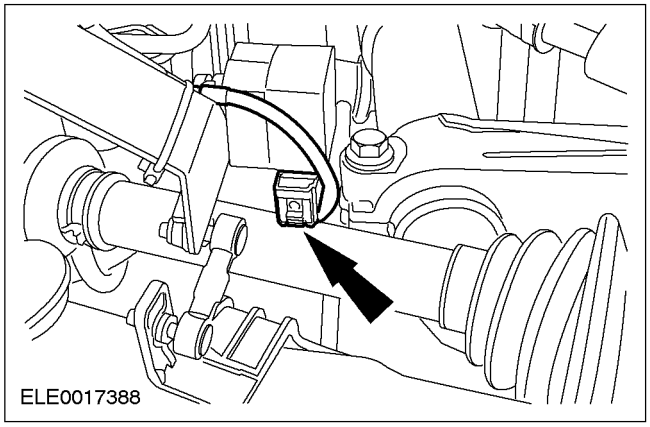


Vehicles with xenon headlamps

15. **Attach the headlamp leveling sensor wiring harness to the subframe.**



16. **Connect the headlamp leveling sensor electrical connector.**



Vehicles with 1.8L, 2.0L or diesel engine

17. **Install the exhaust flexible pipe. For additional information, refer to Section 309-00.**

Vehicles with 2.5L engine

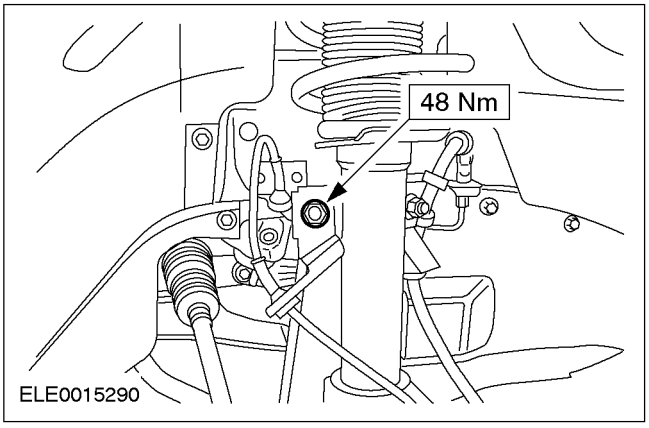
18. **Install the dual converter Y-pipe. For additional information, refer to Section 309-00.**

Vehicles with 3.0L engine

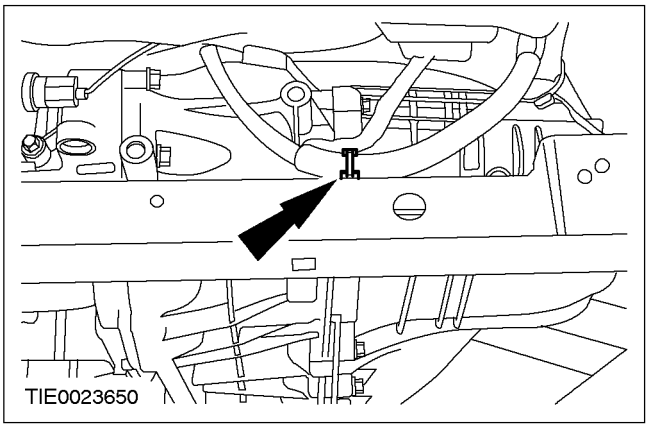
19. **Install the catalytic converters. For additional information, refer to Section 309-00.**

All Vehicles

20. **Install the stabilizer bar connecting link to the suspension strut on both sides.**



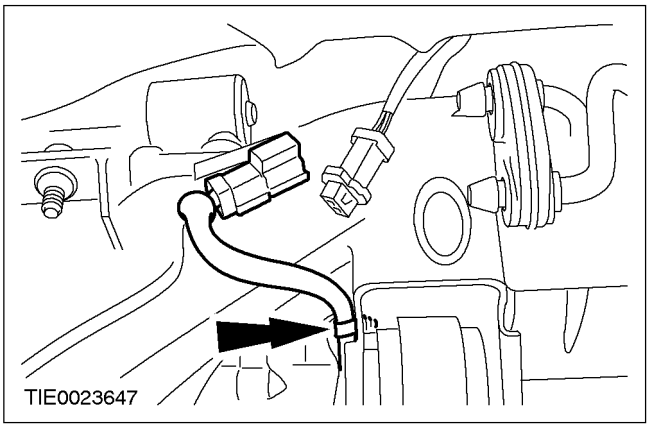
21. **Attach the radiator cooling fan wiring harness to the subframe.**



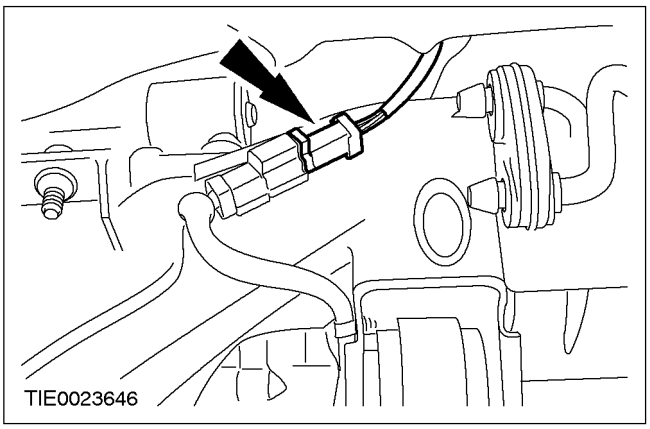
REMOVAL AND INSTALLATION (Continued)

All except vehicles with diesel engine

22. Attach the catalyst monitor sensor wiring harness to the subframe.

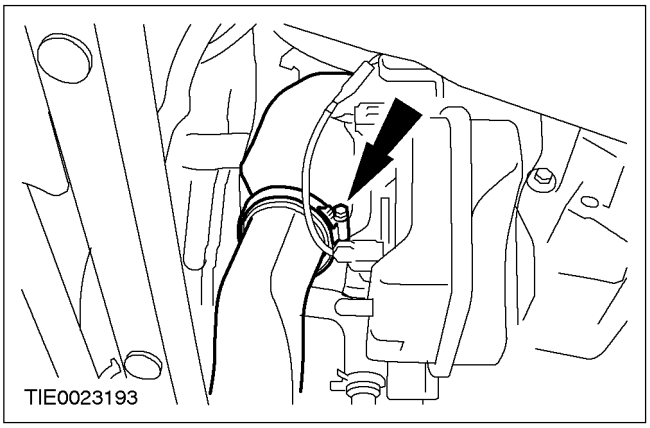


23. Connect the catalyst monitor sensor electrical connector.

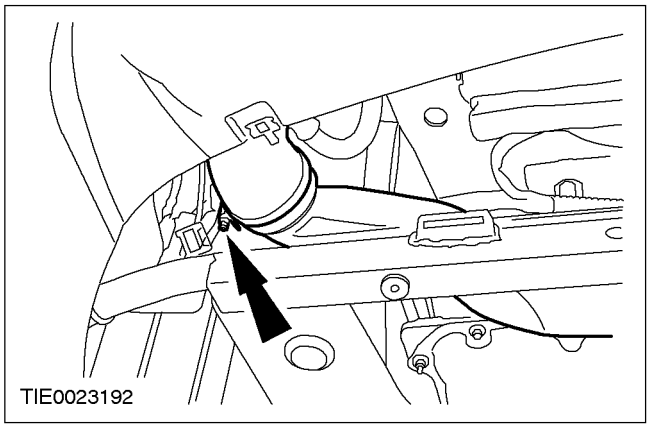


Vehicles with diesel engine

24. Install the turbocharger outlet hose.



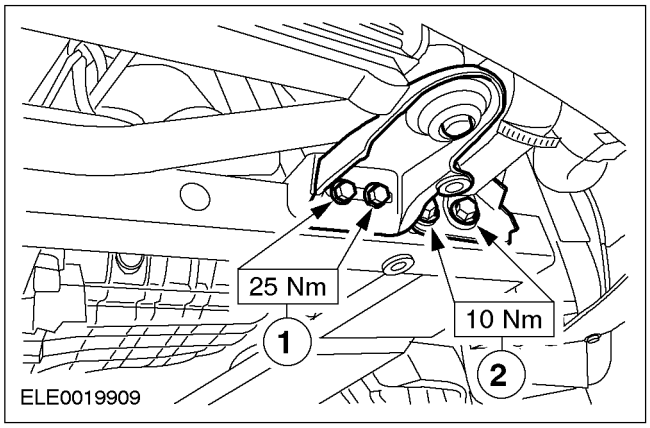
25. Install the air intake hose.



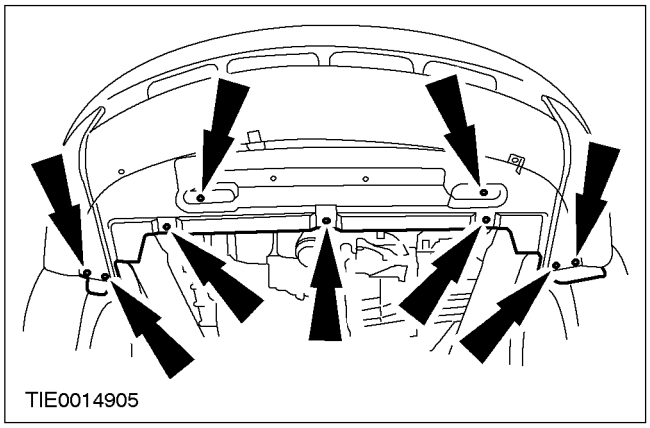
All vehicles

26. Install the radiator support brackets on both sides.

1. Install the radiator support brackets.
2. Install the hose bracket (if equipped).

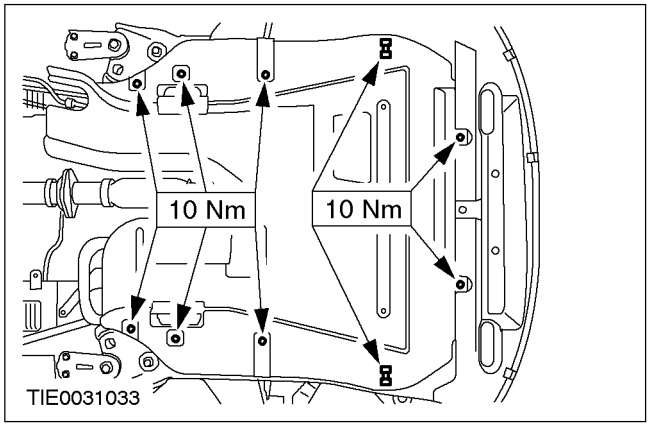


27. Install the splash shield.

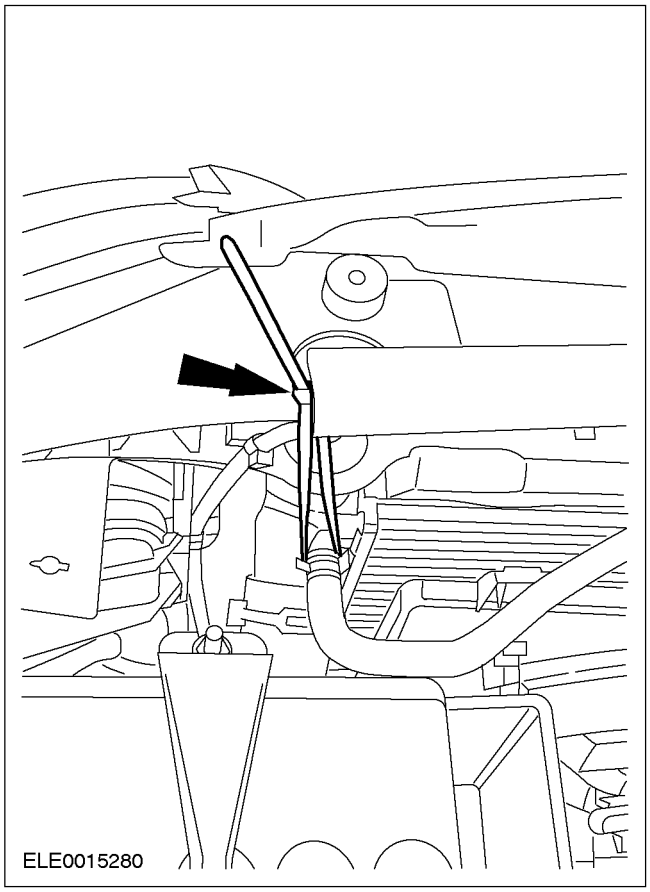


REMOVAL AND INSTALLATION (Continued)

28. **Install the engine undershield (if equipped).**



29. **Install the wheels and tires. For additional information, refer to Section 414-01.**
30. **Lower the vehicle.**
31. **Remove the cable ties.**



32. **Check the toe setting and adjust as necessary. For additional information, refer to Section 204-00.**