WORKSHOP MANUAL

Spider

1989 EDITION



DIREZIONE ASSISTENZA

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Alfa Romeo

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FOREWORD

This manual is intended for use by workshops belonging to the ALFA ROMEO Service Organization. It contains all necessary instructions for tune up, repair and overhaul of the mechanical units with which the ALFA ROMEO cars are equipped. It includes procedures concerning removal and installation, disassembly and assembly, checks and inspections as well as instructions for effective trouble-shooting.

All operations are extensively illustrated so that the part or unit involved, as well as the proper tool to be used, are easily identified.

All data, figures, and technical specifications herein contained are up to date at time of publication. Any subsequent change in values or technical specifications occurring between reprints, will be included in the Technical Bulletins issued by the Service Department as changes take place.

The manufacturer reserves the right to make - at any time and without notice - all those changes that it deems necessary to improve the vehicle or arising out of manufacturing or commercial requirements. It further advises that not all models mentioned in this manual will be available in all countries.

HOW TO USE THE MANUAL

This manual is designed as a guide for personnel assigned to provide effective service to the mechanical units concerned. The instructions herein contained are in general common to all different models of the same group; when they are meant for one particular model, it is previously indicated with a specific detailed reference to be found in the CONTENTS and in the text.

All instructions given for the purpose of restoring faulty components to proper working conditions, do not necessarily reflect manufacturer's directives as regards service, but they must just the same be complied with. Furthermore, since most given instructions concern complete disassembly of components, they should be followed in their entirety only when it is strictly necessary.

For easier consultation of the manual, read the CONTENTS carefully.

The manual contains a SERVICE DATA AND SPECIFICATIONS chapter to be complied with when tuning up and repairing the vehicle. The specifications have been subdivided into four different items: Technical Data, General Specifications, Inspections and Adjustments, and Tightening Torques.

The manual also contains a TROUBLE DIAGNOSIS AND CORRECTIONS chapter where likely causes of trouble, as well as the relevant recommended corrective action, are listed.

The manual contains a list of SPECIAL SERVICE TOOLS designed to allow quick, accurate and safe repairs.

Measurements given in this manual are expressed in the International System of Units (SI) as well as in the metric system and in the yard/pound system.

Captions CAUTION and WARNING emphasize steps that must be followed with extreme care to avoid personal injury and/or damage to the vehicle or part of it.

Remember to keep the manual up-to-date with the data supplied by the "Technical Bulletin" periodically issued by the Service Department.

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Disassembly and assembly operations should be always carried out using proper tools (general-purpose as well as special service tools) since makeshift tools will damage the parts involved.

To loosen tight fitting cast iron parts, just lightly strike them with a lead or aluminium hammer; use a wooden or plastic mallet to loosen light alloy parts.
Separate one by one the parts making up each unit and partially tighten nuts onto relevant studs or screws.

On disassembly, check if parts that should be marked do in fact have the relevant number or reference stamped on it. Any previously replaced part is found to be not properly marked, it should be stamped accordingly.

Before washing, clean all parts with a brush and cloth removing most dirt (thus avoiding needless dirtying of the washing fluid); then wash them with detergent or special compound. Remove any residual dirt with a jet of compressed air. Dry all parts immediately after washing to prevent them from rusting.

Thoroughly wash parts that have been ground or lapped and blow them with a jet of compressed air to remove all residues.

On assembly, clean all parts (especially those that have been ground) with a jet of compressed air or a clean brush.
On assembly also suitably lubricate parts (except self-lubricating bushes) to prevent seizure during their running-in period. To apply lubricant, use a clean brush as well as clean oil keeping them away from dust and dirt at all times and using them only for this special purpose.

Suitably protect with adhesive tape or clean cloths all engine parts that after disassembly show orifices or drilling which are likely to let in dust or foreign matter.

On assembly, replace all gaskets, seal rings, spring washers and lock rings in addition to all worn or damaged parts.

IMPORTANT NOTICE

When replacing units or parts thereof, be sure to use only original spare parts to ensure interchangeability as well as proper performance.

When ordering, remember to show the part number taken from the Spare Parts Catalogue or from the microfiches.
Service quality varies according to procedures used, personnel skill, and available tools and parts.

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UNIT 00

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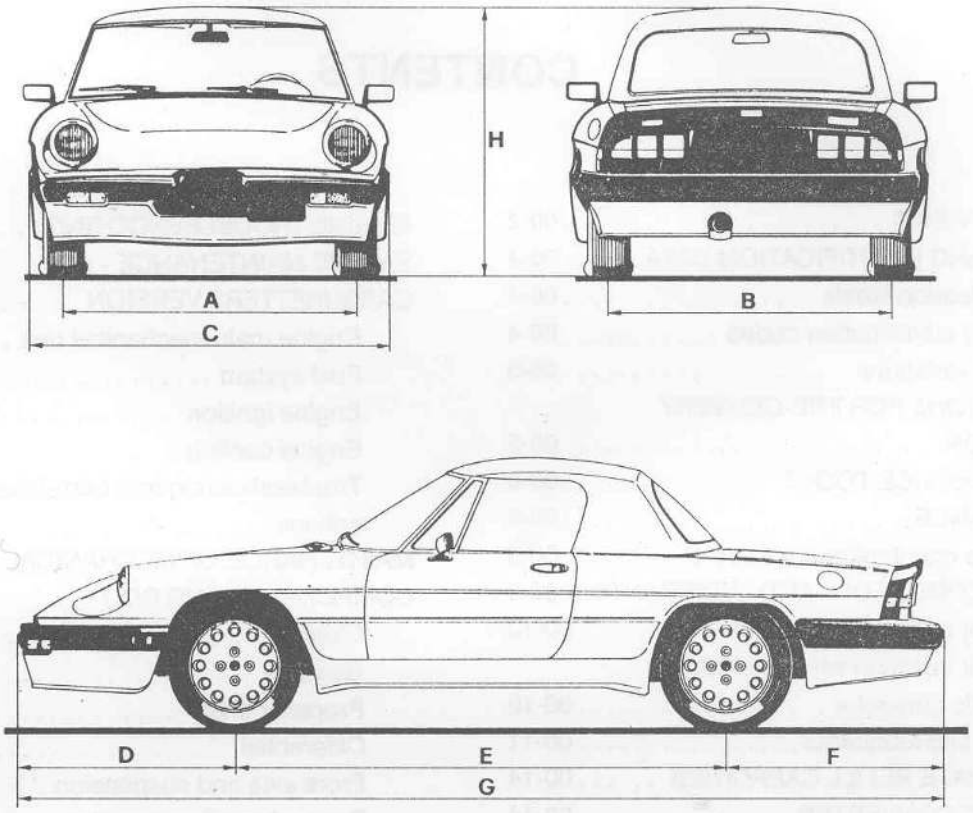
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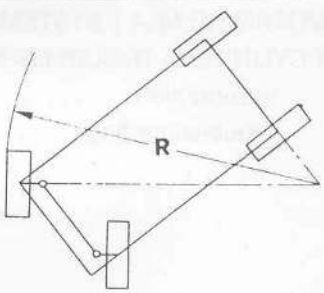
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GENERAL VIEWS



DIMENSIONS [mm (in)]

Model \ Dimensions	A	B	C	D	E	F	G	H max.	R	
Spider	1324 (1) (52.1) 1340 (2) (52.7)	1274 (1) (50.2) 1290 (2) (50.8)	1630 (64.2)	990 (39)	2250 (88.6)	1030 (40.2)	4270 (168.1)	1290 (50.8)	5100 (200.8)	

(1) With rims 5 1/2J × 14"

(2) With rims 6J × 15"

R = Radius of the circumference described in correspondence with ground, from outer rim of the outer front wheel when in full steering lock conditions.

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WEIGHTS AND LOADS

Weights and loads \ Model		Spider / Spider 2.0	Spider 1.6
Payload	kg (lb)	1110	1070
Max. towing gross weight	kg (lb)	800 (1764)	
Seating capacity		2	

WHEELS AND TYRES

Wheels and tyres \ Model		Spider	Spider 2.0	Spider 1.6
Rims		6Jx15"	$5^1/_2$Jx14"	$5^1/_2$Jx14"
Tyres		195/60R15"86H	185/70R14"86H	185/70R14"86H
Inflation pressures (1) [Kg/cm^2 (p.s.i.)]	F	1.9 (27)	1.8 (26)	1.8 (26)
	R	2.0 (28.4)	1.8 (26)	1.8 (26)

(1) Pressure measured on cold tires

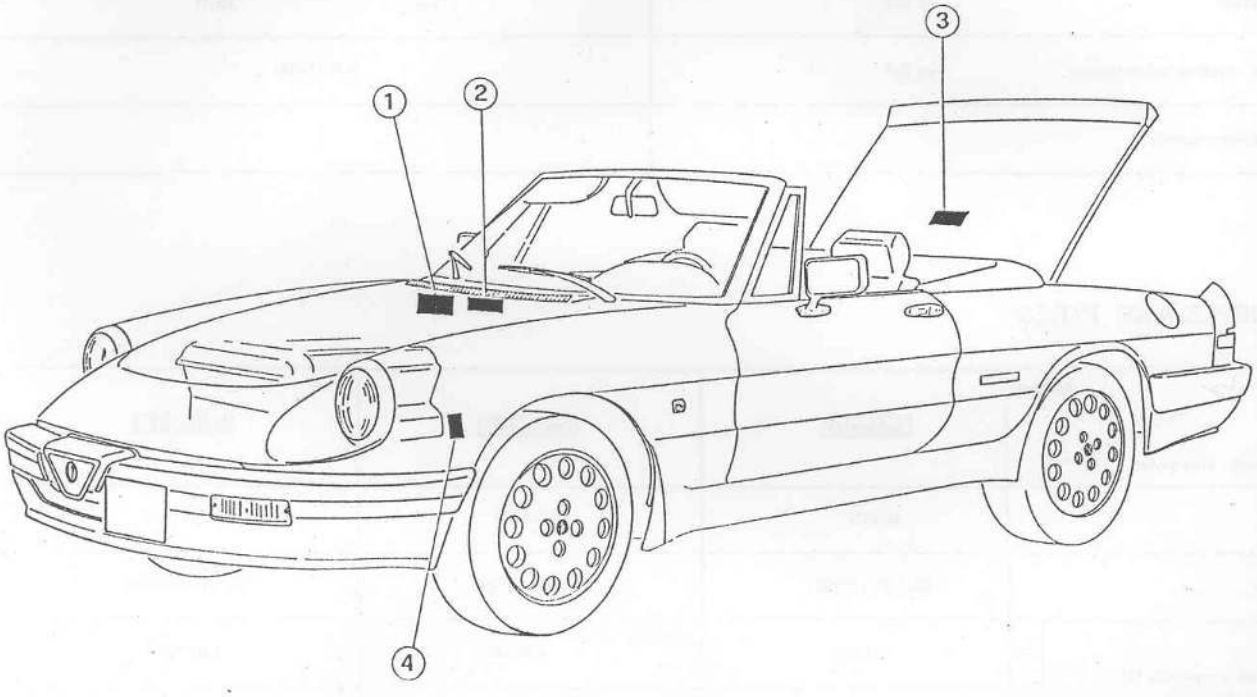
F = Front
R = Rear

WARNING:
Wheel nuts tightened to a torque of 98 N·m (10 kg·m)

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SERVICE AND IDENTIFICATION DATA

IDENTIFICATION LABELS



1 Label on scuttle (bodywork no. label)
2 Identification label (identification no. and type approval no.)
3 Paint label
4 Engine number label (rear left hand side of engine base)

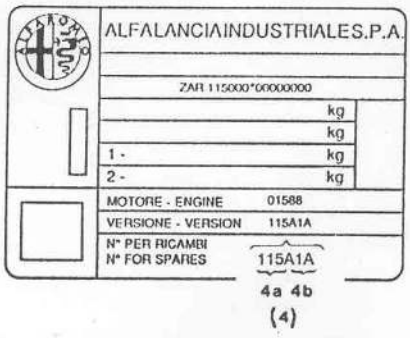
VEHICLE IDENTIFICATION CODES

A) Chassis numbering

It is composed of groups of numbers and/or reference identifications:

ZAR (1) 115.000 (2a)(2b) (2) ★ 060.00001 (3)

(1) Manufacturer identification characters.
(2) Number of "Type and version approved".
It is composed of six figures, subdivided as follows:
(2a) Base type number: is assigned to each vehicle having a common design project (ex. **115 series** Spider).
(2b) Type variant number: identifies the variations withing the base type.
(3) Serial number is progressively assigned at factory



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(4) Version number (on identification label).
It is composed of five figures, subdivided as follows:

(4a) Basic type code: is assigned to all vehicles having a common design project (ex. **115 series** Spider).

(4b) Type variant number: identifies, within the base type, those vehicles that differ because of some variant that alters their features (ex. 115.A2 Spider 1.6).

B) Engine numbering

015.88 000.001
(1) (2)

(1) Type number

(2) Engine serial number: is progressively assigned at factory.

MODEL VARIATIONS

Model		Spider		
Variations		1.6	2.0	
Body		2-door convertible		
Drive		L.	L.	L.
Basic type and version		115.A2	115.A1A	115.A1A
Version	-on scuttle	115.000	115.000	115.000
Chassis serial number	-on scuttle	060.00001	060.00001	060.00001
Engine number	-on left rear side of engine block	015.63 from 000.001	015.88 from 000.001	015.88 from 000.001

INSTRUCTIONS FOR PRE-DELIVERY INSPECTION

This chapter lists and describes the pre-delivery operations required for the Spider vehicles. The operation description does not refer to each version, but gives general information concerning the parts for which inspection is required.
As regards the technical specifications related to each operation, and the lubricant products (and similar), refer to the "Technical Data and Specifications" present in each section.

CAUTION:
Pre-delivery inspection of a new vehicle, prior to customer delivery, consists in carrying out all checking operations and tests hereafter described in order to detect and thus eliminate any damage or malfunction.
It goes without saying, however, that when Dealer personnel picks up the vehicle, he should perform a visual check in order to:

a. Make sure that vehicle is in normal driving conditions, especially as regards level of fluids and controls in general.

b. Detect any dents or scratches on body or other damage to the vehicle interior (upholstery).

c. Make sure nothing is missing, especially factory supplied accessories, spare tire and any parts that are to be fitted on vehicle as pre-delivery completion.

If, as a consequence of the checks, topping up is required, proceed accordingly; this operation is to be considered as part of pre-delivery inspection. In the event of interventions (malfunctions) different from those indicated, carry out the adjustment according to the current technical and administrative procedures.
As each operation is being carried out, the relevant card must be filled out and then filled together with the sold vehicle's other documents.

OPERATIONS IN THE ENGINE COMPARTMENT

Coolant

— On cold engine, check the header tank level. Top up if necessary with the prescribed liquid, up to the max level.

Engine oil

— Check that level is up to the "MAX" mark on the dipstick (carry out this operation after having parked the vehicle on an even surface, and after the engine has been off for a few minutes). If required, top up with specified oil.

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Brake and clutch fluid

— Check that the leve in the tank is up to the "MAX" nark on the tank. If required, top up with specified fluid remembering that tins must be sealed and opened only wheen ready to use.
Be sure to perform this operation with utmost care and cleanliness.

Windscreen washer liquid

— Check that the related tank is full. Top up, if necessary, with appropriate solution.

OPERATIONS ON VEHICLE OUTER SIDE AND IN THE PASSENGER COMPARTMENT

Exterior cleaning

— If required, dewax the vehicle using suitable products and procedures; wash the vehicle's exterior with a solution of water and shampoo, rinse it thoroughly and dry it.
Finish up cleaning by removing any stubborn spots by means of suitable compounds.

Paint

— Visually and throughly check all painted sufrfaces and remove accidental or manufacturing flaws, if any.

Exterior moldings and fittings

— Visually check all vehicle's outside parts; bumpers, moldings, grills, headlight rims, letters and emblems making sure they are securely fitted, and have no spots or dents.

Doors and hoods

— Visually check all weatherstrips for tight fit and make sure they are not damaged, out of shape or dirty.
— See if doors and bonnets are aligned and centered with relevant openings.

Factory issued accessory equipped

— Check if following items are in their proper place in the vehicle; tool kit, spare tire, jack, Instruction Book and Service Book.

Locks, hinges windows

— Check proper working condition of all door locks (close, lock, open from inside and outside).
Check in the same manner also closure of bonnet and boot.
— Check door and bonnet hinges for smooth noiseless operation.
— Check if windows can be opened and closed all the way without sticking and noiselessly.

Interior finishings

— Verify all upholsteries (carpets, panels etc...) removing any stains or scratches.

Seats, seat belt and accessory equipment

— Inspect seats checking if they slide freely on tracks without sticking and noiselessly. Also check proper working condition of seat and head-rest adjusting devices.
— Check inside and outside rearview mirrors making sure they swing easily and stay firmly in place when set; also check snap switch on mirror for day/night driving.
— Check if seat belts and relevant retractors are in good working condition.
— Check maneuverability of sunvisors, ashtrays, glove compartment and any other accessory.

Heating and ventilation

— Verify correct functioning of heater controls and air inlet lids and lowers (opening and closing).
— Verify that electric fan operates correctly at the various speeds.

Lights, indicators, electric accessory equipment

— With the ignition key set to "MAR", check whether lights outside and inside the vehicle, as well as the related warning lamps, illuminate; front and rear side lights, number plate lights, direction and hazard lights, stop lights high/low beams, headlight flashing, reverse light, engine and luggage compartment lights, passenger compartment light (through manual control, and on doors) and the related switch off timer, front and rear spot lights, cluster lights and related adjustment rheostat, glove compartment light.
— Check whether the following warning lamps illuminate; alternator, fuel reserve, engine oil pressure, choke on □, brake fluid level, handbrake on, heated rear window on, engine temperature.
— Verify proper functioning of horns, cigar lighters, power window controls, and front seats electric controls.

□ Spider 1.6

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Windscreen wash/wipe and headlight washer

- After having installed the wiper blades, check whether windscreen wiper works properly at the different speeds, as well as intermittently.
- Operate the windscreen washer and verify that spray nozzle jet is uniform and correct directed towards window upper part.

Tire pressure

- Check tire pressure and, if required, restore to specified values. Use higher p.s.i. for the spare wheel.

Tightening of wheel nuts or screws

- Using a wrench, check that nuts or screws of wheels are completely tightened. Verify also that nuts are appropriate for the type of vehicle and rim, as indicated in the Spare Parts Catalogue.

OPERATIONS ON VEHICLE LOWER PART

Gearbox and differential oil

- Remove filler plug and check that the lubricant level reaches the lower rim of the related hole. Top up if necessary with the prescribed oil and re-fit filler plug.

□ Spider 1.6

System tighness

- Visually check for leaks or leak traces in the following systems: fuel, brakes, clutch, engine cooling.
  Check for oil leaks from engine, gearbox and differential.

FUNCTIONAL TESTS

Engine controls

- Verify that the pedal accelerator control operates without sticking and, with the pedal at the end of travel, the throttle valve is fully open.

Engine controls □

- Verify that the starter control operates without stricking along the whole travel and that, when the related knob is pushed down, the related device is completely disengaged from carburetter.

Engine start-up and functioning

- Verify that engine starts correctly.
  With hot engine, verify steady functioning of the engine at the prescribed idle r.p.m.

Instruments

- With engine running, verify correct functioning of al electrically operated instruments: rev counter, speedometer, oil pressure, gauge, water thermometer, fuel level gauge, clock.

Brake clutch and speed gear controls

- With engine running, push the brake pedal and check that, afte rthe initial empty stroke, it stops without elasticity.
  Check also proper functionin of hand brake lever.
- With engine running, push the clutch pedal and check that all speeds can be shifted without sticking or noise.

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SPECIAL SERVICE TOOLS

Special service tools play a very important role in a vehicle's maintenance since they are essential to ensure accurate, reliable and quick service. To this effect, it must be remembered that times taken relevant to the various maintenance operations are computed assuming that said special tools are being used.

All special service tools, made expressly on the Manufacturer's design, needed for overhauling, maintenance and repair of models are listed and illustrated in this manual.

The identification number is determined by the relevant ordering part number and consists of a letter followed by a five figure number according to the following schedule:

A.0.0000 Special Service Tool
C.0.0000 Tester
U.0.0000 Reamer

Order of the listed tools by the authorized workshop, must be performed according to the usual systems already followed by each Service - net.

MAINTENANCE

Maintenance operations consists in checking and restoring proper working condition of some parts of the vehicle wich are most likely to become worn or out-of-adjustment as a consequence of the vehicle's normal use.

A list of the various operations to be performed at differents intervals, as shown in the chart that follows, is included in the coupons of the Service Book which accompanies each vehicle.

Coupons will have to be stamped by the Service Organisation Agency to show that specified maintenance operations have been carried out.

Just as for pre-delivery inspection, should topping up or change of fluids and lubricants - as described in the text - become necessary, they will be considered as part of maintenance operations. In case damages or malfunctions other than those listed are encountered, they will be taken care of repaired or adjusted according to current technical and administrative procedures.

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VEHICLE MAINTENANCE SCHEDULE

Operations to be performed at the stated kilometres	km x 1000									
	20	40	60	80	100	120	140	160	180	200
Replace engine oil and oil filter (in any case every year): check oil system for leaks	●	●	●	●	●	●	●	●	●	●
Check valve clearance. Check timing belt or chain tension	●	●	●	●	●	●	●	●	●	●
Check drive belt of alternator	●	●	●	●	●	●	●	●	●	●
Replace air filter element		●		●		●		●		●
Check air filter element	●		●		●		●		●	
Clear spark arrester of exhaust gas blow - by (Spider 1.6)		●		●		●		●		●
Replace fuel filter element (injection)				●				●		
Check idle speed (Spider 1.6) Check exhaust emissions (cars with catalyst only)	●	●	●	●	●	●	●	●	●	●
Replace exhaust gas oxygen sensor (λ probe) (cars with catalyst only)					●					●
Check ignition timing (Spider 1.6)	●	●	●	●	●	●	●	●	●	●
Replace spark plugs	●	●	●	●	●	●	●	●	●	●
Replace antifreeze mixture (in any case every two years)			●			●			●	
Check clutch/brake fluid level (in any case, replace every year)	●	●	●	●	●	●	●	●	●	●
Check level of steering box oil	●	●	●	●	●	●	●	●	●	●
Replace gearbox and differential oil		●		●		●		●		●
Check gearbox and differential oil level	●		●		●		●		●	
Grease propeller shaft slip yoke	●	●	●	●	●	●	●	●	●	●
Check protective boots of front suspension components	●	●	●	●	●	●	●	●	●	●
Check brake system pipe seating	●	●	●	●	●	●	●	●	●	●
Check disc brake pads	●	●	●	●	●	●	●	●	●	●
Check rear brake drum linings		●		●		●		●		●
Check hand brake travel	●	●	●	●	●	●	●	●	●	●
Check electrical connections of engine compartment (conditions and positioning of connectors and caps)		●		●		●		●		●
Lubricate door & lid hinges; grease lid latches	●	●	●	●	●	●	●	●	●	●
Test vehicle	●	●	●	●	●	●	●	●	●	●

List of work to be done after the first 900 mi. (1,500 km) and not later than 1,500 mi. (2,500 km) and during the guarantee period.

1 Replace engine oil and oil filter and check the tightness of the oil system.
2 Check and if necessary adjust the tension of the alternator and water pump drive belt.
3 Tighten cylinder head screws/nuts.
4 Check tightness of fuel system. Check the evaporative circuit (if fitted).
5 Check the tightness of the air intake system downstream from the air flow gauge (fuel injection models only).
6 Check exhaust emissions (vehicles with catalyst only).
7 Check idle running r.p.m. and advance sparking (Spider 1.6).
8 Check and if necessary adjust accelerator linkage.
9 Check the level of the antifreeze mixture and the tightness of the cooling system.
10 Check protective boots of front suspension components
11 Check tightness of hydraulic brake system.
12 Check level of brake and clutch fluid.
13 Check the travel of the hand brake.
14 Check level of liquid and proper functioning of windscreen washer/wiper.
15 Check level of steering box oil.
16 Test vehicle.

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RECOMMENDED FUEL AND LUBRICANTS

FUEL FOR CARBURETTERS VERSION

To ensure proper engine operation use fuel with Octane rating ≥ 95 RON (Research Octane Number).

FUEL FOR INJECTION VERSIONS WITH CATALYTIC CONVERTER

To ensure proper engine operation and catalytic converter long life, use unleaded fuel with Octane rating 91 thru 95 RON (research Octane Number).

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Type	Application	Classification	Name				Notes
			AGIP	IP	SHELL	Other	
OIL	Engine - 01	SAE 10W/50 ASTM SE API SF	Sint 2000 10W40	Sintiax 10W40	Super Plus Motor Oil SAE 15W50		Ambient temperature −18 to 40°C (−0.4 to 104°F)
	Gearbox - 13	SAE 80W/90 API GL-5	Rotra SX 75W90	Pontiax HDS 75W90	Spirax HD 80W90		Ambient temperature −40 to 150°C (−40 to 302°F)
	Differential - 17	SAE 80W/90 API GL-5	Rotra SX 75W90	Pontiax HDS 75W90	Spirax HD 80W90		Ambient temperature −40 to 150°C (−40 to 302°F)
	Front suspension - 21	SAE 80W/90 API GL-5	Rotra SX 75W90	Pontiax HDS 75W90	Spirax HD 80W90		Ambient temperature −40 to 150°C (−40 to 302°F)
	Steering box/wheel - 23	SAE 80W/90 API GL-5	Rotra SX 75W90	Pontiax HDS 75W90	Spirax HD 80W90		
	Air conditioner - 80					SUNISO 4G SUNISO 5DS	
GREASE	Engine - 01					UNION CARBIDE CHEMICALS COMPANY: Ucon lubricant 50 HB -5100	
						MILLOIL: Lubricant for elastomer seals	
						ISECO: Std. No. 3671-69841	
						SIPAL AREXONS: Carbo silicon for valves	
						ISECO: Molykote BR2	
						ISECO: Molykote A	
	Engine - Fuel system - 04	N.L.G.I. No. 1	Grease 15				Basic Substance: Al - Ca
						ISECO: Molykote Paste G	
						ISECO: Molykote Longterm No. 2	
						REINACH: E10 TAC	

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Type	Application	Classification	Name				Notes
			AGIP	IP	SHELL	Other	
GREASE	Engine ignition - 05					REINACH: E10 TAC	
	Engine cooling system - 07					Antiseize R. GORI: Never Seez	
	Clutch - 12	N.L.G.I. No. 3	Grease 33 FD	Autogrease FD			Basic Substance Bentonite Polythene
						ISECO: Molykote BR2	
	Gearbox - 13					ISECO: Molykote BR2	
	Transmission - 15	N.L.G.I. No. 1	Grease 15	Autogrease MP	Retinax A		Basic Substance Al - Ca
	Differential - 17					ISECO: Molykote BR2	
	Front suspension - 21	N.L.G.I. No. 3	Grease 33 FD	Autogrease FD			Basic Substance Bentonite Polythene
						ISECO: Molykote BR2	
						ISECO: Ergon Rubber Grease No. 3	
						SPCA: Spagraph	
						REINACH: Sferul B2AR	
						Antiseize compound R. GORI: Never Seez	
						NOVO: Calypsol AE 63	
	Front and rear brakes - 22					ATE: Bremszylinder Paste	
						ISECO: Molykote Longterm No. 2	
	Steering box/wheel - 23		Grease 33 FD				

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Type	Application	Classification	Name				Notes
			AGIP	IP	SHELL	Other	
GREASE	Rear suspension - 25					SPCA: Spagraph	
						ISECO: Ergon Rubber Grease No. 3	
						REINACH: Sferul B2AR	
						Antiseize Compound R. GORI: Never Seez	
						ISECO: Molykote Pasta G	
	Wheels and tyres - 28					UNION CARBIDE CHEMICALS COMPANY: Ucon lubricant 50 HB - 5100	
						MILLOIL: Lubricant for elastomer seals	
	Air Conditioner - 80					UNION CARBIDE CHEMICALS COMPANY: Ucon lubricant 50 HB - 5100	
						MILLOIL: Lubricant for elastomer seals	
FLUID	Engine cooling - 07		Antifreeze	Antifreeze	Antifreeze		Ethylene Glycol (concentrated) Std. No. 3681 - 69956
							Antifreeze (ready for use) Std. No. 3681 - 69958
	Brakes - Clutch - 22 - 12		Brake Fluid Super HD	Auto Fluid FR		ALFA ROMEO Brake Fluid	
						ATE "S"	
	Air conditioner - 80					Freon 12	

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SAE VISCOSITY

Measurement Unit	°C (°F)	Motor Oil	Gearbox - Differential Oil
		SAE 10W50	SAE 80W90
Cps	−40 (−40)	—	150000
Cst	−20 (−4) 40 (104) 50 (122) 100 (212)	2600 165 110 19	— 118 — 14.3 to 15.3

APPROXIMATE REFILL CAPACITIES

Fuel tank	l (gals)	46 (12.2)
Fuel reserve	l (gals)	6 thru 7 (1.5 thru 1.8)
Engine oil sump — Quantity for oil change	kg (l; lb)	5.9 (6.6; 13)
Gearbox	kg (l; lb)	1.65 (1.85; 3.6)
Differential	kg (l; lb)	1.25 (1.4; 2.8)
Steering	kg (l; lb)	0.12 (0.13; 0.26)
Coolant	l (gals)	8.5 (2.25)
Camshaft support sumps (*)	kg (l; lb)	0.415 (0.465; 0.915)

(*) Replacement to be carried out only in the case of disassembly

CATALYTIC CONVERTER

TEMPERATURE OF THE CATALYTIC CONVERTER

Excessive temperature in the catalytic converter during driving can cause damage to the alumina monolith thereby lowering its conversion efficiency as well as cause damage to the container and to the vehicle or possibly cause fire hazard. Engine malfunctions that can cause catalytic converter overtemperature are:

- Spark plug fouling at one or more cylinders.
- Defective electric fuel pump or fuel filter clogged (too low fuel pressure).
- Defective injector(s).
- Air filter element very dirty.
- Engine accelerator control linkage out of setting.
- Engine and related devices not set to Factory specifications.
- Leaks at the exhaust pipe upstream of the exh sensor.
- Faulty pressure regulator.
- Too low a battery voltage (or defective charging circuit).

Driving methods that can cause catalyst overtemperature are:

- Use of wrong gears.
- Too low level in the fuel tank.
- Engine overloading for prolonged time e.g. when racing the engine, pulling trailers or climbing long hills or grades.
- Driving or coasting with the ignition turned off.

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PRECAUTIONS TO BE TAKEN IN CATALYTIC EQUIPPED MODELS

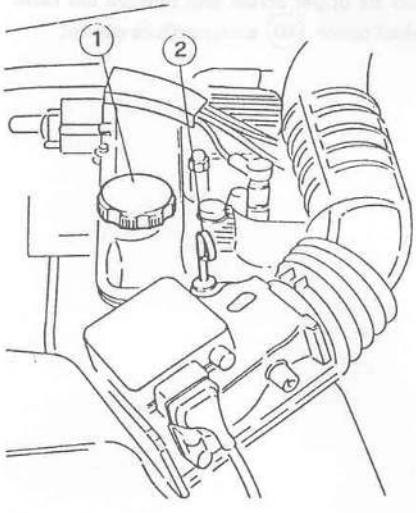
1. Use only unleaded gasoline.
2. Avoid the fuel tank from becoming empty.
3. Do not ever operate the engine with a spark plug lead disconnected and do not ever ground spark plug.
4. Don't exceed overloading the engine for prolonged periods. Be careful when pulling trailers or when climbing long hills or grades.
5. Avoid turning off ignition while driving in any conditions or coasting. Vehicle must be stopped before shutdown.
6. Avoid parking over or in vicinity of combustible materials such as: dry grass, spilled fuel, dry leaves, rubbish, etc.
7. Cylinder compression checking must be made after having removed the fuse protecting the fuel pump in order to avoid injecting fuel.
8. Do not tamper with any component of the emission control system.
9. Do not discard spent catalytic converter in with flammable refuse.
10. Have maintenance operations performed as prescribed in the Owner's Operational Manual. The perfect maintenance of the engine is the main factor for the life of the catalytic converter.

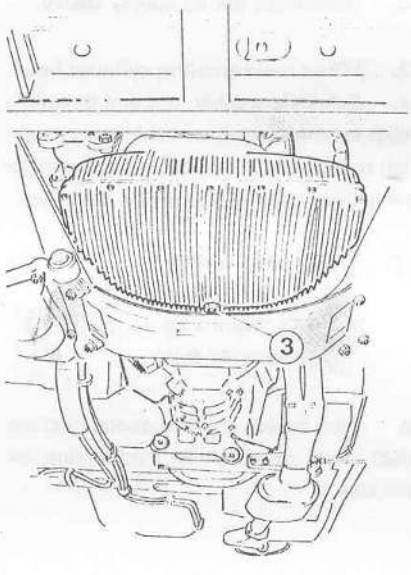
ENGINE MAINTENANCE - INJECTION VERSION

ENGINE MAIN MECHANICAL UNIT

REPLACEMENT OF ENGINE OIL AND OIL FILTER — CHECK OF LUBRICATION SYSTEM TIGHTNESS

1. On hot engine, remove the oil filler plug and the oil sump plug, draining oil completely (wait **15 minutes** at least).

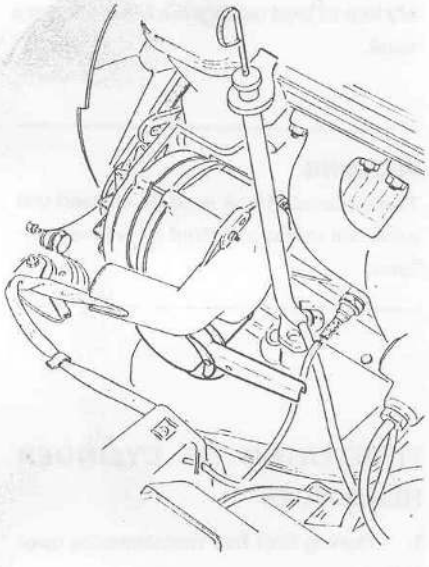




1 Oil filler plug
2 Oil dipstick
3 Oil drain plug

- **A milky oil indicates the presence of coolant leaks in the oil. Identify the cause and take corrective measures.**
- **An oil with extremely low viscosity, indicates dilution with fuel.**

2. Release oil filter, then remove it using appropriate wrench.



3. When engine oil is completely drained, clean the drain plug and tighten it on sump, together with the related gasket.
4. Moisten the oil filter gasket and tighten thoroughly.
5. Refill engine with the type and quantity of oil prescribed.

ENGINE OIL

Type:
AGIP Sint 2000 10W40
IP Sintiax 10W40
SHELL Super Plus
Motor Oil 15W50

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Quantity (1)	6 kg - 6.6 l (13 lb)
Circuit capacity	6.37 kg - 7.16 l (14 lb)
Cylinder head support sumps (2)	415 g (0.91 lb)
Filter capacity	0.5 kg 0.56 l (1.1 lb)

(1) Quantity required for complete oil change
(2) Refilling to be carried out for each support sump when disassembling

6. Check oil level by means of the dipstick.
7. Re-insert filler plug and start the engine, letting it idle for about 2 minutes.
8. Check for lubricant leaks. If necessary, replace or tighten any item with poor oil seal.
9. Switch off the engine and wait for a few minutes.
10. Remove the dipstick and clean it; insert the dipstick again, remove it, and verify that oil level reaches the MAX reference mark.

WARNING:
The oil level check is to be carried out with the vehicle parked on a level surface.

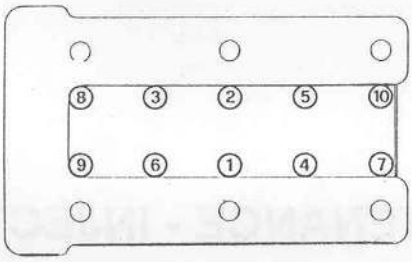
TIGHTENING OF CYLINDER HEAD NUTS

1. During first free maintenance operation.

a. Remove the air supply sleeve.

b. On cold engine, loosen nuts by one turn, one at a time, according to the order indicated, moisten the surfaces between washer and nut with oil; tighten to the prescribed torque.

(T) : Tightening torques
82 thru 88 N·m
(8.4 thru 9 kg·m)
(60 thru 65 ft·lb)



c. Reconnect the air supply sleeve.

2. When reassembling cylinder head.

a. Lubricate washer, nut and threading with engine oil and, on cold engine, tighten nuts to the prescribed torque, tightening them gradually in proper sequence.

(T) : Tightening torque
74 thru 82 N·m
(7.5 thru 8.4 kg·m)
(55 thru 60 ft·lb)

b. After having covered about 1000 km (620 miles) operate, with cold engine, as per step 1.

CHECK AND ADJUSTMENT OF VALVE CLEARANCE

The following operations are to be carried out on cold engine.

1. Removal of the camshaft cover.

a. Disconnect the battery.

b. Unoosen the clamp (4), remove the connector (7) from the air flow sensor, unhook the clips (8) and remove the air filter cover (9) with the relevant air intake duct (6).

c. Disconnect the oil vapor breather hose (14) from the camshaft cover.

d. Disconnect the by-pass hose (3) for idle r.p.m. adjuster and the oil vapor return hose 1 from the sleeve (13).

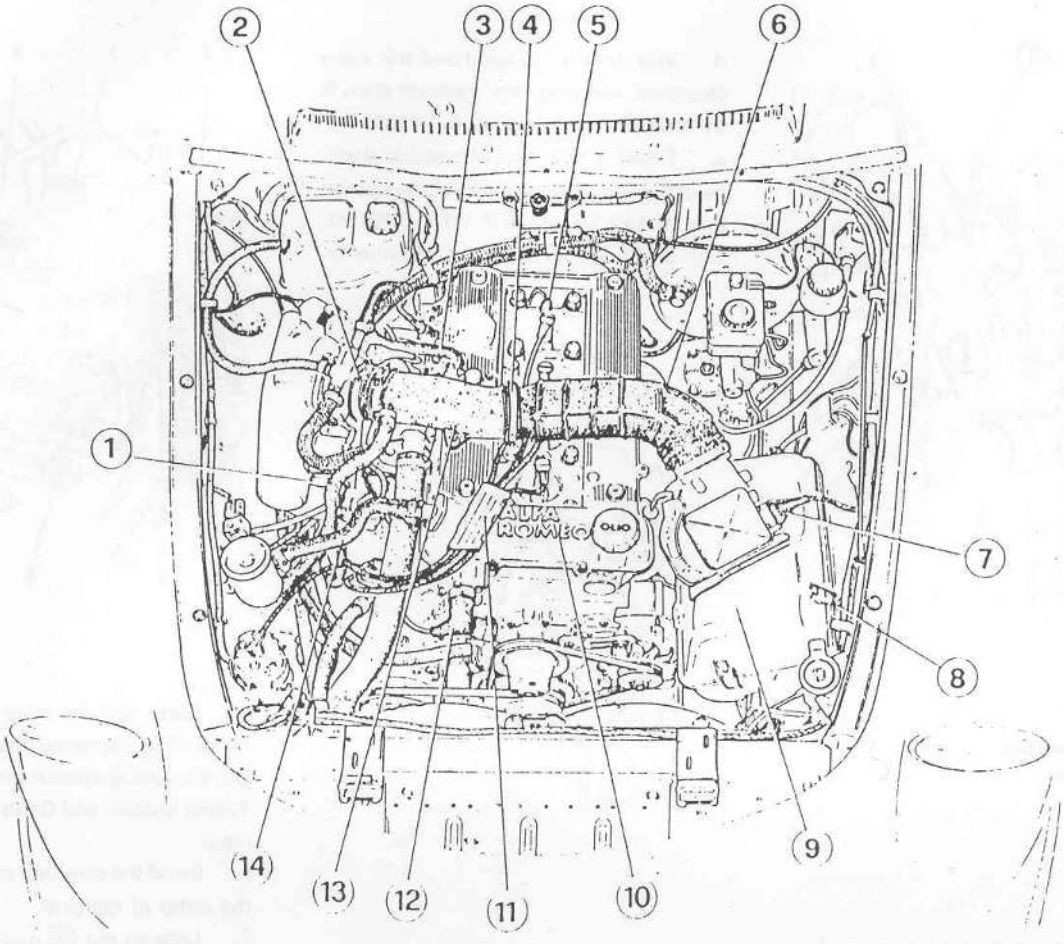
e. Unloosen the clamp (2) and remove the sleeve (13) by unscewing the relevant fixing screws.

f. Disconnect the spark plug cables and remove the cable retainer (11).

g. Disconnect the electromagnet of the timing variator (12).

h. Unscrew the two front fixing bolts, the fixing bolt of the engine oil dipstick guide, the six upper screw and remove the camshalf cover (10) along with its gasket.

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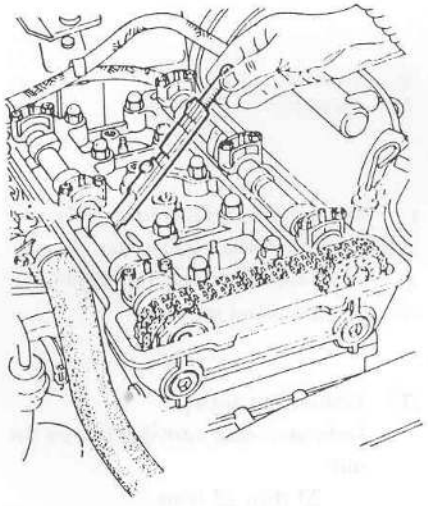


1 Oil vapor return hose
2 Clamp
3 By-pass hose for idle r.p.m.
4 Clamp
5 Coolant maximum temperature warning light sensor (for cluster)
6 Intake duct
7 Air flow sensor connector
8 Clips fixing air filter cover
9 Air filter cover
10 Camshaft cover
11 Spark plug cable retainers
12 Timing variator electromagnet
13 Sleeve
14 Oil vapor breather hose

2. Clean the spark plug seats, remove spark plugs and plug the holes to prevent foreign matter from entering.

3. On cold engine and by means of feeler gauge, check that the clearance between the cam resting radius and cups crown, is within the prescribed values.

Valve clearance (on cold engine)
Intake:
0.400 thru 0.450 mm
(0.0157 thru 0.0177 in)
Exhaust:
0.450 thru 0.500 mm
(0.0177 thru 0.0197 in)

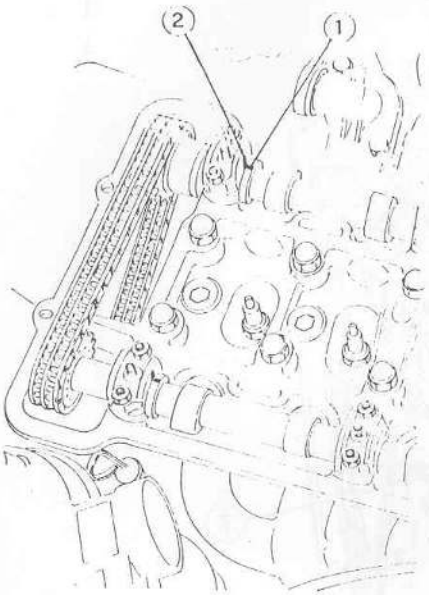


4. If the clearance is not within the prescribed values, carry out the adjustment operating as follows.

a. Rotate crankshaft until the notches (1) on camshaft are aligned with the notches (2) present on the related caps.

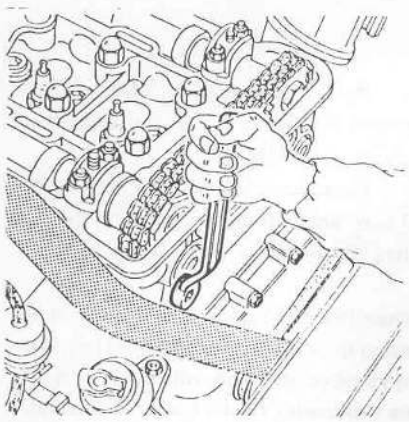
When in this position, the alignment between fixed index and notch on front pulley must correspond, with cylinder n. 1 in the expansion stroke (cams outwards).

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1 Camshaft notches
2 Cap notches

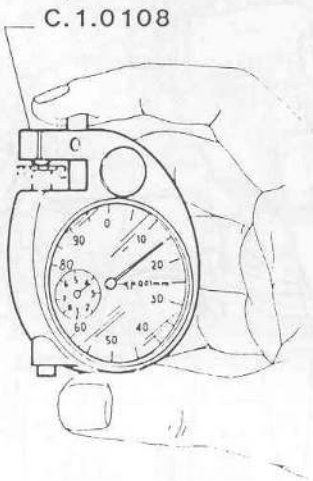
b. Release the chain tightener securing screw, compress the chain downwards so as to overcome the tension load of chain tightener spring; lock chain tightener in this position.

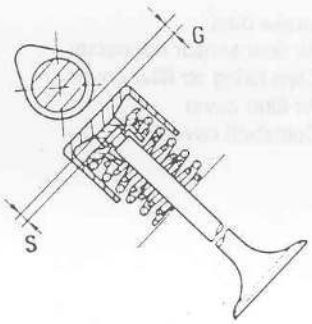


c. Remove camshaft caps, taking care not to move the chain with respect to gears; remove the complete camshaft and the chain, then rest them on the central part of head.

d. Withdraw valve bowl and the valve clearance adjusting cap; measure shim S by means of feeler gauge C.1.0108.

e. Select a new cap of suitable thickness; caps are available with thickness within 1.3 thru 3.5 mm (0.051 thru 0.138 in), with 0.025 mm (0.00098 in) increments.



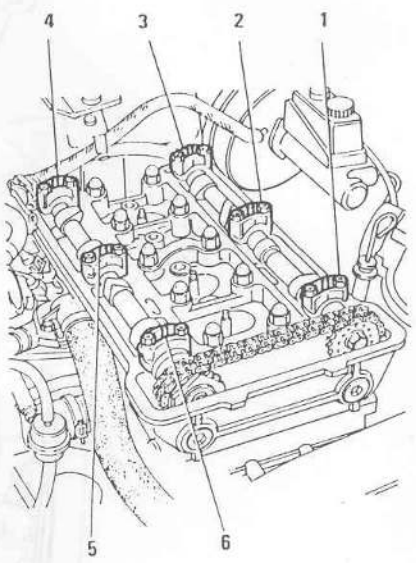


G: Valve clearance
S: Adjusting cap thickness

f. Refit valve bowl (after lubricating with engine oil), camshaft and chain.

g. Install caps on camshaft following the numbering marked on them.

(T) **Tightening torque**
Nuts securing camshaft caps (in oil)
20 thru 22 N·m
(2 thru 2.25 kg·m)
(15 thru 16 ft·lb)



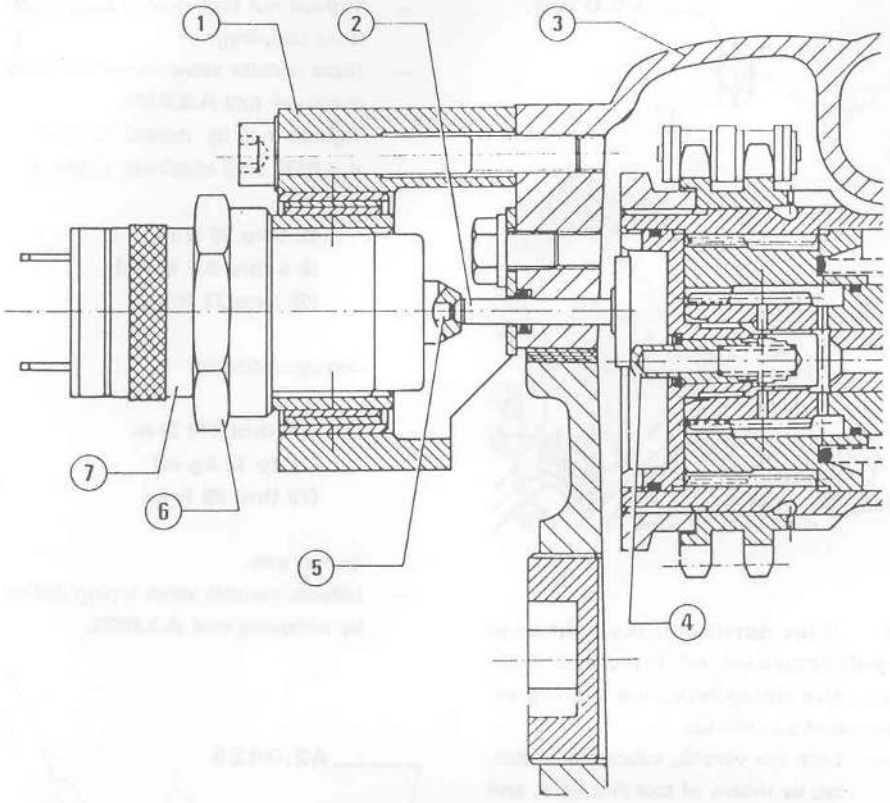
5. Carry out the chain tensioning, recheck valve clearance, then proceed to adjust the timing system (refer to: Check of Timing System and Control Chain Tensioning).

6. Install the camshaft cover by reversing the order of removal.

7. Loosen nut ⑥ and unscrew electromagnet ⑦ by a few turns so as to allow insertion of tool C.6.0203 via the upper hole ⑧ of the carrier between the movable core ⑤ and the pushrod ②.

8. Screw the electromagnet ⑦ until the pushrod ② reaches end of travel, tighten the nut ⑥ and remove tool C.6.0203.

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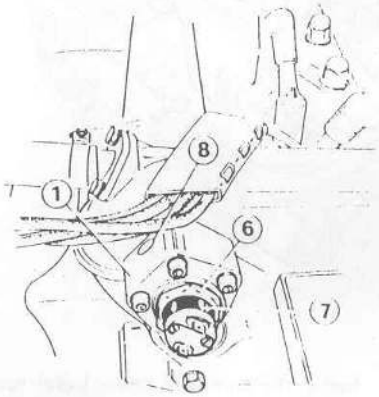
9. Install all items by reversing the order of removal.

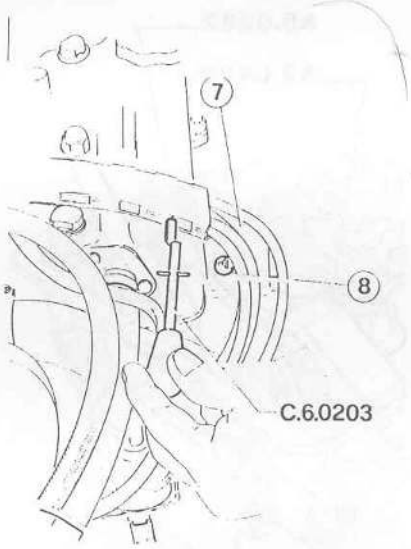
WARNING:
Take the utmost care when positioning the rear seal rings interposed between head and valve cover.

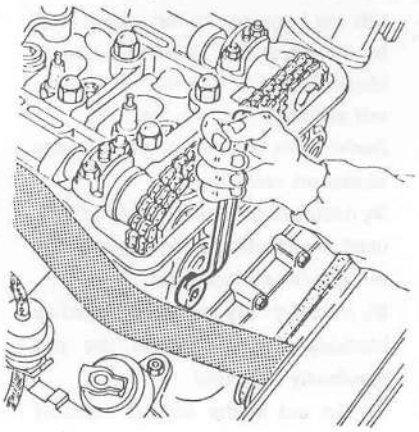
CHECK OF TIMING CHAIN TENSIONING

1. **Check of timing chain tensioning.**
a. Remove the camshaft cover operating as described in: "Check and Adjustment of Valve Clearance - step 1".
b. Loosen the chain tightener securing screw.
c. Engage the 5th speed, move vehicle forwards and backwards and, keeping chain stretched, lock the chain tightener securing screw.
d. Install the camshaft cover and the surrounding components by reversing the order of removal.

WARNING:
Take the utmost care when positioning the rear seal rings interposed between head and valve cover.







1 Variable valve timing device support
2 Pushrod
3 Timing system cover
4 Control valve
5 Movable core
6 Nut securing electromagnet
7 Electromagnet
8 Upper support hole

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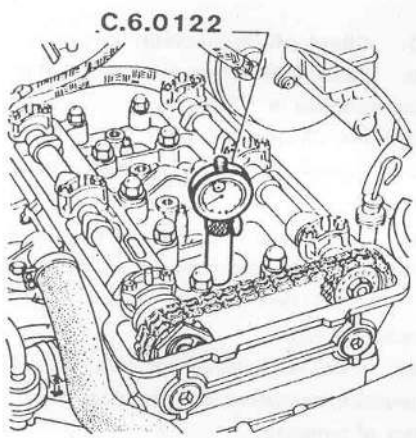
2. **Adjustment of timing system.**

Check is to be carried out with valve clearance to the prescribed torque and timing chain normally tensioned.

a. Remove the camshaft cover (refer to: Check and Adjustment of Valve Clearance - step 1.).

b. Clean the spark plug seat of first cylinder, remove the spark plug and insert tool **C.6.0122**, fitted with comparator, into the spark plug support hole.

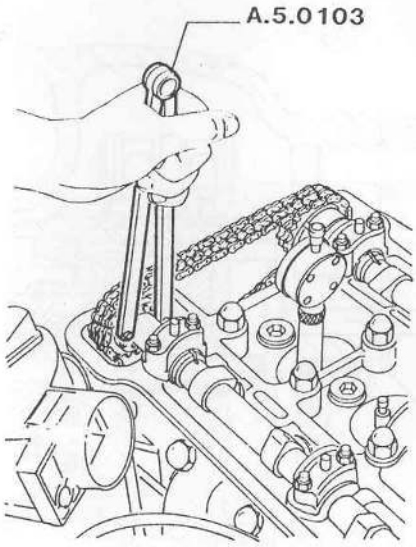
c. Engage the 5th speed and move vehicle forward and backward until the comparator needle stops oscillating (piston n. 1 at T.D.C., with valves closed).



d. Make sure that, when the cams of cylinder n. 1 are outwards, the notches on camshaft pins are aligned with those on caps.

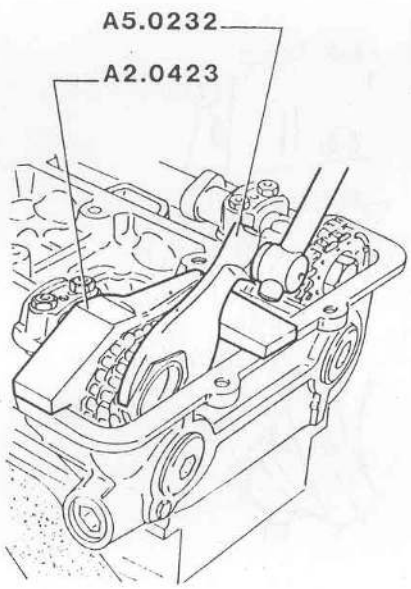
e. If the notches on left camshaft (exhaust valves) are not aligned, proceed as follows.

- Lift the edge of the nut clamp and, by means of tool **A.5.0103** used as blocking device, loosen the retaining nut securing gear to camshaft.
- Remove the bolt securing gear to the sleeve on camshaft.
- By means of the same tool **A.5.0103**, used as a blocking device, tighten the nut previously loosened.
- By means of the same tool, used as blocking device, tighten the nut previously loosened.
- Fit the nut in the aligned holes of gears and tighten it.
- Bend the clamp on nut.



f. If the notches of the right camshaft (intake valves), fitted with variable valve timing device are not aligned, proceed as follows.

- Lock the variable valve timing device, by means of tool **A.2.0423**, and loosen the securing nut by means of wrench **A.5.0232**, not further than **1/8 turn**.



Release camshaft (or remove tool **A.2.0423**).

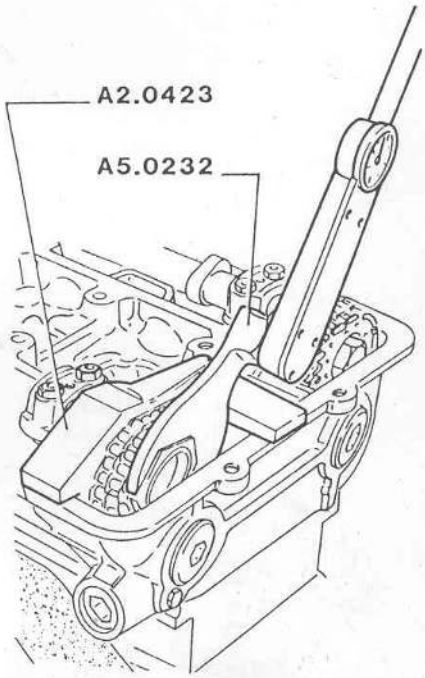
- Loosen the nut further so that gear is completely disengaged from front coupling.
- Rotate camshaft until the reference notches are aligned.
- Tighten nut until gear is blocked on front coupling.
- Block variable valve timing device by means of tool **A.2.0423**.
- Tighten nut by means of wrench **A.5.0232** until obtaining torque of:

  88 thru 96 N·m
  (8.8 thru 9.6 kg·m)
  (65 thru 71 ft·lb)

  corresponding to:

  108 thru 118 N·m
  (11 to 12 kg·m)
  (79 thru 88 ft·lb)

  on nut axis.
- Release variable valve timing device by removing tool **A.2.0423**.



g. Install the camshaft cover (refer to: Check and Adjustment of Valve Clearance).

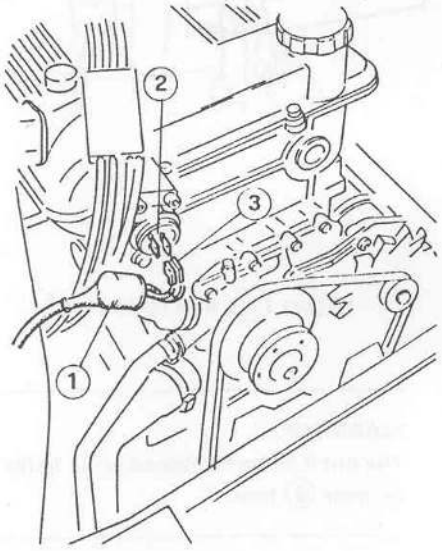
h. Install all items by reversing the order of removal. Take care to reconnect the two ground wires on the auxiliary air device securing screws, replacing the related washers.

WARNING:
Take the utmost care when positioning the rear seal rings interposed between head and valve cover.

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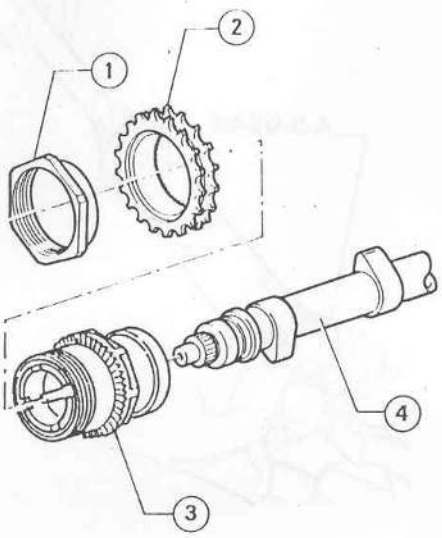
CHECKING AND RESTORING THE VARIABLE VALVE TIMING DEVICE FUNCTIONING

1. Start the engine and run it at the idle r.p.m.
2. Withdraw the plug (1), detach the electromagnet connectors (3) and connect the 12V supply (battery) to pins of electromagnet itself; in these conditions, the engine should go off or, however, run unevenly.



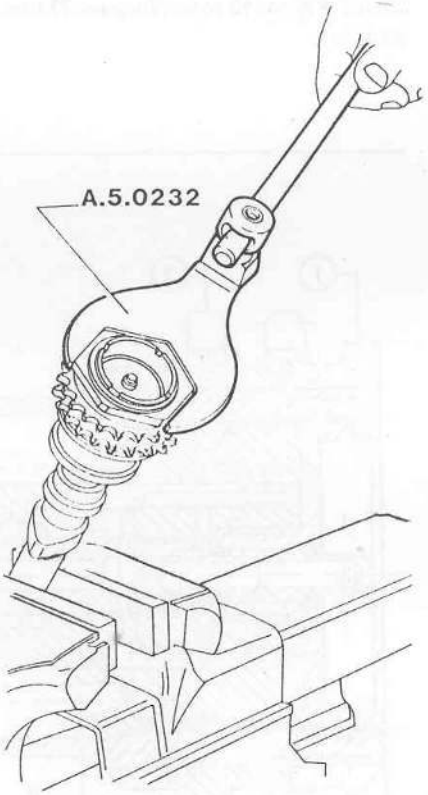
1 Plug
2 Variable valve timing device
3 Connectors

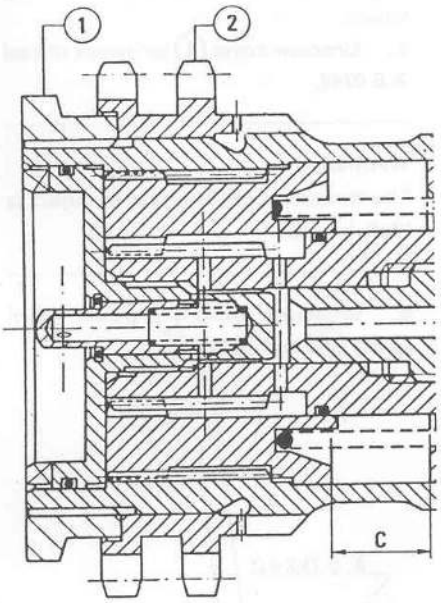
3. If so, the variable valve timing device operation is to be considered as regular. If not so, proceed as follows.
4. Remove the camshaft with variable valve timing device, from cylinder head.
a. Remove the camshaft cover as described in: "Check and Adjustment of Valve Clearance", step 1.
b. Disassemble the right-hand camshaft, operating as described in: "Check and Adjustment of Valve Clearance - step 4".
5. Remove the variable valve timing device from camshaft, by operating as follows.



1 Nut
2 Timing system chain
3 Variable valve timing device
4 Camshaft

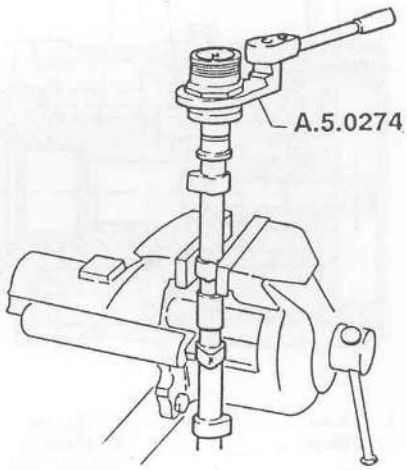
a. Clamp camshaft on a vice fitted with jaws and, by means of wrench A.5.0232, unscrew nut (1), then remove gear (2).





1 Nut
2 Timing system gear

b. Always with camshaft clamped on a vice, and by means of wrench A.5.0274, unscrew the complete variable valve timing device from camshaft.



c. Move the control valve inwards, blow compressed air in the main duct and verify that variable valve timing device rotates. If required, disassemble the variable valve timing device.

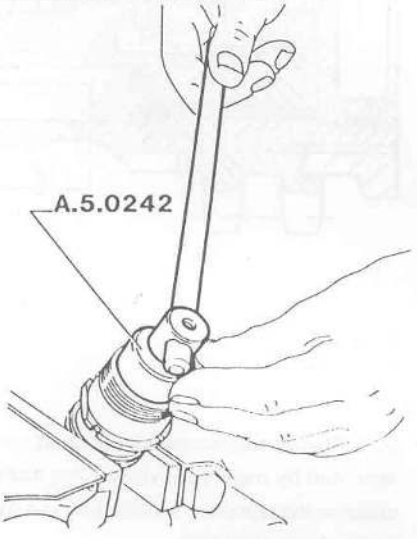
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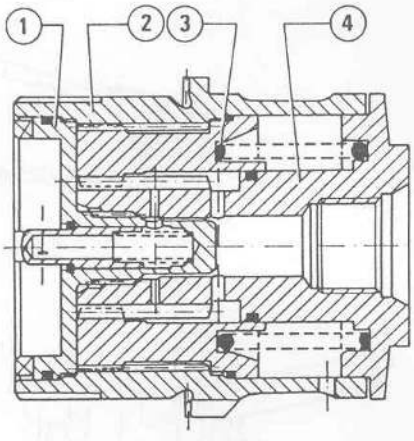
6. Disassemble the variable valve timing device.

a. Unscrew cover (1) by means of tool A.5.0242.

WARNING:
The threading of the cover in object is "left-handed".

b. Withdraw sleeve (2), piston return spring (3), and piston (4).





1 Cover
2 Sleeve
3 Spring
4 Piston

7. Check variable valve timing device.

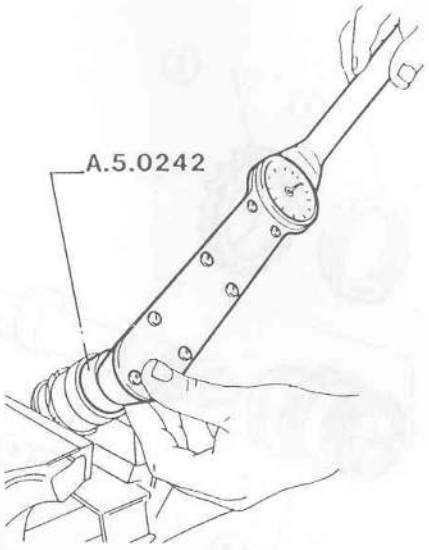
a. Check that oil passage is not clogged.

b. Check efficiency of oil seal rings.

8. Reassemble the variable valve timing device.

a. Reassemble it installing piston and return spring.

b. Screw the left-handed threading cover and tighten it with the tool A.5.0242 to the prescribed torque (59 N·m; 6 kg·m; 43 ft·lb) by means of tool A.5.0242.



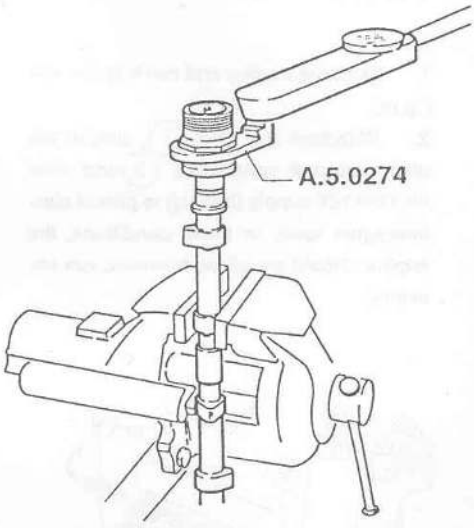
9. Install variable valve timing device on camshaft.

a. Lay a coat of **Loctite sealing compound** on camshaft threading.

WARNING:
Take care to prevent the sealing compound from obstructing the oil ducts.

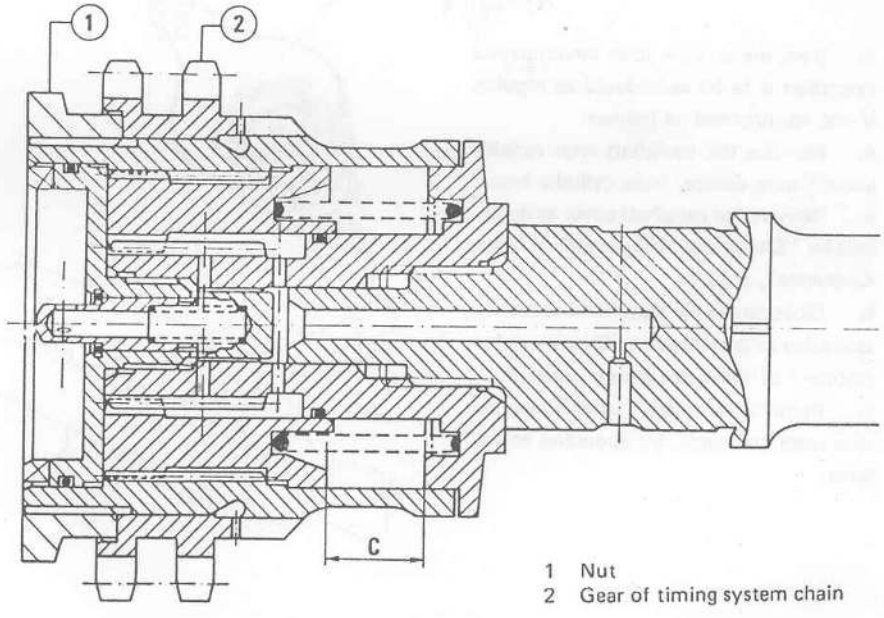
b. By means of wrench A.5.0274, screw the variable valve timing device on shaft and tighten to the prescribed torque (98 thru 118 N·m; 10 thru 12 kg·m; 72 thru 88 ft·lb).

Wait for about 6 hours before installing shaft on cylinder heads.



c. Fit gear (2), then tighten nut (1).

WARNING:
The nut is to be tightened so as to leave gear (2) free.



1 Nut
2 Gear of timing system chain

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10. Install camshaft, on head.

a. Install the camshaft, complete with variable valve timing device, on head, operating as described in: Check and Adjustment of Valve Clearance.

b. Stretch the timing system control chain (refer to: Check of Timing System and Control Chain Tensioning); then tighten the gear until the coupling is tightly packed.

c. Lock variable valve timing device by means of tool **A.2.0423**, tightening the nut to the prescribed torque.

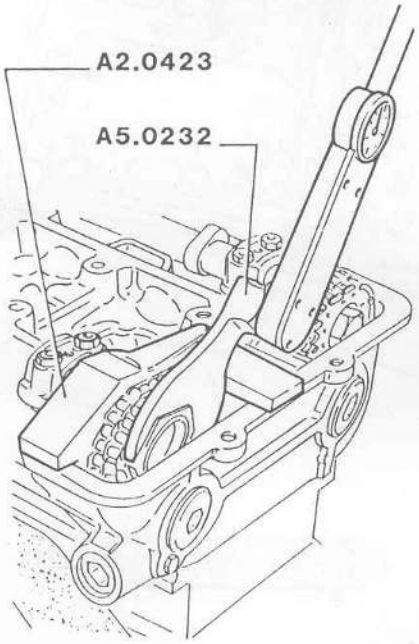
86 thru 94 N·m
(8.8 thru 9.6 kg·m)
(65 thru 74 ft·lb)

making use of wrench **A.5.0232** corresponding to:

108 thru 118 N·m
(11 thru 12 kg·m)
(79 thru 88 ft·lb)

on nut axis.

With the valve closed, the piston, under the oil pressure, performs the stroke C = 9.5 thru 9.9 mm (0.37 thru 0.39 in) due to the helicoidal coupling, thus causing the camshaft to rotate clockwise by 11°30' thru 11°52' approx.



11. Install the camshaft cover.

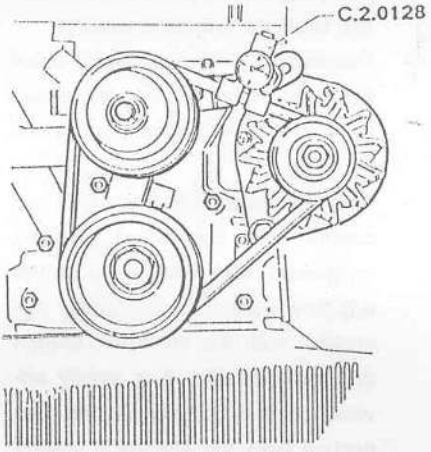
a. To carry out this operation, (refer to: Check and Adjustment of Valve Clearance).

CHECKING GOOD CONDITIONS, REPLACING AND ADJUSTING DRIVE BELT OF ALTERNATOR.

1. Tensioning adjustment.

Using tool **C.2.0128** check that belt tension is at prescribed value; if not adjust tensioning.

Alternator drive belt tension
On assembly:
400 thru 450 N
(41 thru 46 kg;
90 thru 101 lb)
Minimum value (cold):
250 N (25 kg; 55 lb)
Re-tensioning (cold):
300 thru 350N
(31 thru 36 kg;
68 thru 79 lb)



To adjust the tensioning, unscrew nuts (1) and (2) on the adjusting arm, then loosen bolt (3).

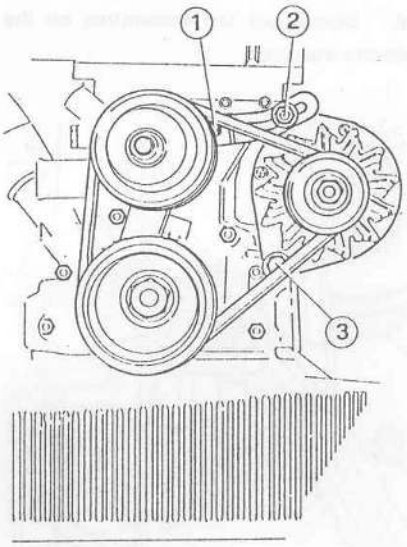
Move the alternator away, so as to increase the belt tensioning, and tighten nut (2); re-check the belt tensioning, then tighten bolt (3) and nut (1).

2. Belt replacement.

Loosen nuts (1) and (2), and bolt (3). Move the alternator inward, then remove the worn belt.

Fit the new belt on the three pulleys and move alternator until the belt tensioning required is obtained.

Tighten nut (2) thoroughly and check the tensioning; tighten bolt (3) and nut (1).



1 Nut
2 Nut
3 Bolt

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CHECK OF CYLINDER COMPRESSION

When checking poor engine performance because power is not up to normal, it is advisable to test cylinder compression using the relevant tester.

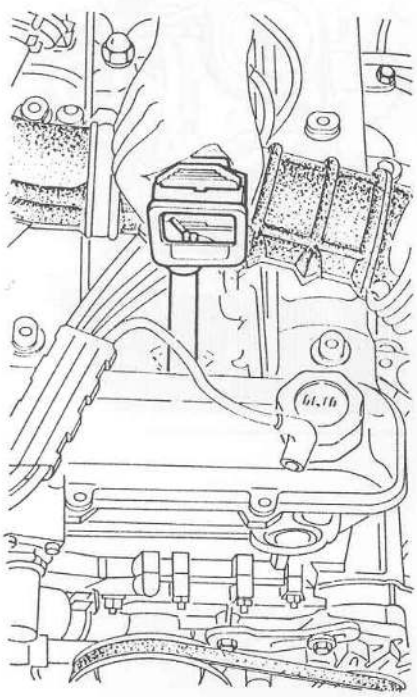
The check is to be carried out as follows:

a. Start the engine and warm it up to the normal running temperature.

b. Remove spark plugs.

c. Detach the coil supply cable (+ 15).

d. Disconnect the connectors on the electro-injectors.



e. Apply the compression tester in the seat of a spark plug.

f. Crank the engine briefly, keeping the accelerator pedal fully pressed.

g. Check for leaks from tester union.

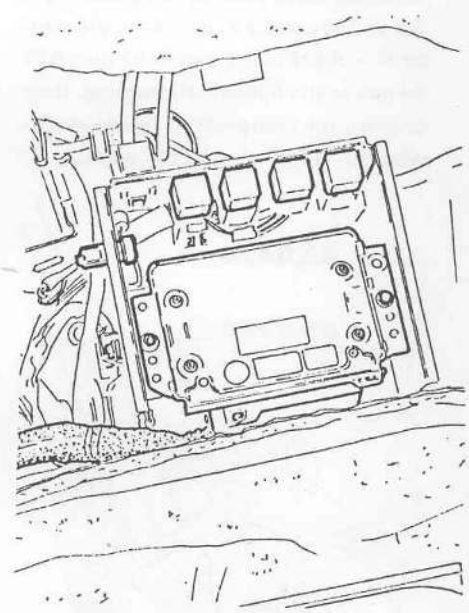
If the difference between the pressure values measured in the cylinder is not remarkable, all cylinders can be considered in the same conditions.

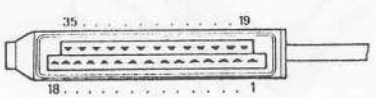
On the contrary, identify the cause starting from the check of valve tightness or, if necessary, from the check of the piston rings or pistons.

FUEL SYSTEM

GENERAL MAIN INFORMATION

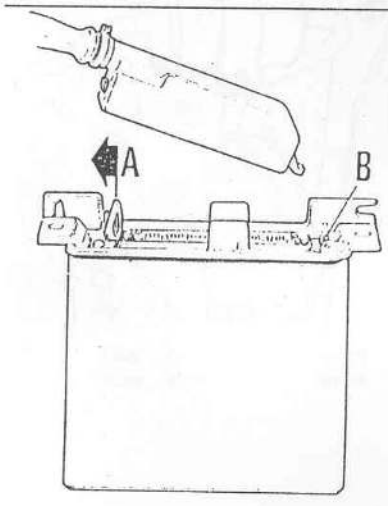
- **Never disconnect the battery when the engine has been started or the contact has been energized (ignition key in "Mar" position); otherwise severe and irreversible damages to the electric and electronic components of the system control unit may occur**
- Before starting the engine, make sure that the battery terminals are correctly fastened
- Never start the enigne by using a rapid charge power supply
- Completely disconnect the battery from the system before recharging
- Do not start the engine in case of electrical connections interrupted or components removed from their seats
- Do not ground any high/low voltage parts and do not break any connection while the engine is running
- Remove the electronic control unit if the vehicle shall be furnace-painted at temperatures higher than 80 °C (176 °F)
- Always disconnect the electronic control unit, should an ancillary equipment be installed. Check the ancillary equipment for proper operation with the electronic control unit disconnected. It is strictly advised not to shunt any electric connection from the electronic control unit harness
- Before intervening on the various system components, verify the absence of unplugged connectors, unfastened clamps and cut or clogged hoses
- Never connect or disconnect the plug from the electronic control unit leads with ignition on
- Never ground high/low voltage cables for test purposes
- Make sure that shielded wire connectors are properly plugged
- Verify the ignition system and spark plug efficiency and check that the timing cover is not wet or cracked. Make sure that the cables between coil and distributor and distributor and spark plugs are properly connected and that the insulation does not show traces of burning or abrasion
- Before replacing any fuse, remove the ignition key; should a fuse repeatedly blow, troubleshoot the shorted circuit; never replace a fuse with a piece of cable.
  The blown fuse must be replaced by another one having the same amperage





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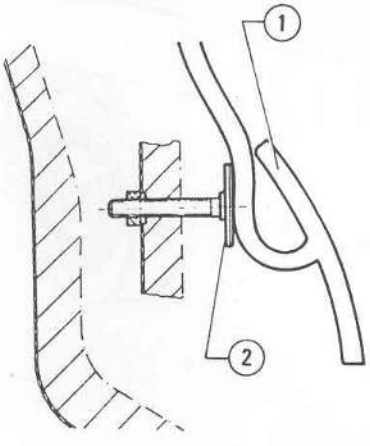
WARNING:
To disconnect the female connector from the electronic control unit, push the stop toward the direction of arrow A, withdraw the connector upward and release it from area B.
To link the connectors, engage them at area B and apply pressure at A paying attention not to damage the pins.



CHECK AND ADJUSTMENT OF ACCELERATOR CONTROL

1. Control system check.
Check that the rods which form the control system can move freely.

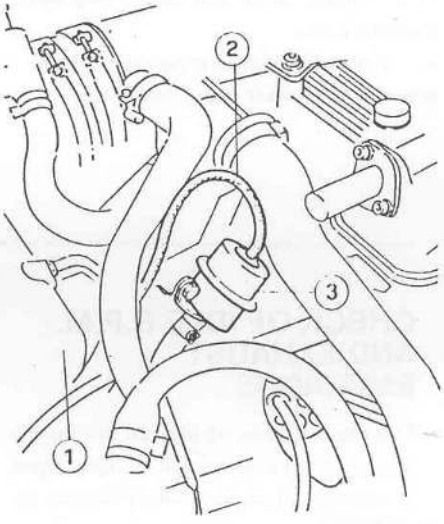
2. Throttle valve max opening check.
a. Check that, with the accelerator pedal (1) fully pressed, up or down the corresponding throttle valve opening position, minimum or maximum, is achieved.
b. If necessary, adjust by operating on the end-of-travel screw (2) and the joints of the control rods.



1 Accelerator pedal
2 End-of-travel screw

CHECK OF FUEL SYSTEM PRESSURE AND SYSTEM TIGHTNESS

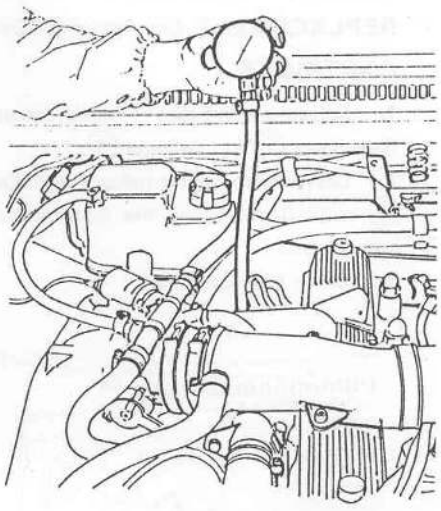
1. Check of fuel supply pressure.
Carry out the check operating as follows:
a. Disconnect the hose for fuel delivery to electroinjector fuel inlet manifold.
b. Connect a pressure gauge, through a union tee, at the ends of the inlet line previously disconnected.
c. Detach the hose (2) connecting pressure regulator (3) to plenum chamber (1). All this to prevent that any unevenness in the engine rotation can cause incorrect reading.



1 Plenum chamber
2 Hose
3 Pressure regulator

d. Run the engine to the idle r.p.m. and check that the fuel pressure value is that prescribed.

Fuel pressure:
284.3 thru 323.6 kPa
(2.8 thru 3.2 bar;
2.9 thru 3.3 kg/cm²;
41.2 thru 46.9 p.s.i.)



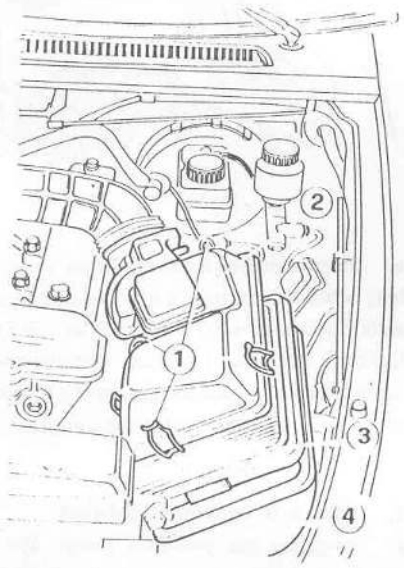
e. Reconnect the hose to plenum chamber, when at the minimum, the pressure shall decrease by **50 kPa (0.5 bar; 0.51 kg/cm²; 7.25 p.s.i.)** approx., and then increase when the throttle valve opens. If not so, check for leaks in the vacuum hose.

2. Check of system tightness.
a. Keeping the pressure gauge connected, and with engine idling, throttle the delivery hose immediately after pressure regulator, and verify that pressure increases up to **400 kPa (4 bar; 4.08 kg/cm²; 58 p.s.i.)** (prevent pressure from exceeding this value).
b. When **400 kPa (4 bar; 4.08 kg/cm²; 58 p.s.i.)** pressure are obtained, check for leaks in the unions and piping of fuel supply.
c. If the fuel pressure does not reach **400 kPa (4 bar; 4.08 kg/cm²; 58 p.s.i.)** and no leaks are present, check filter and/or the fuel pump functioning.

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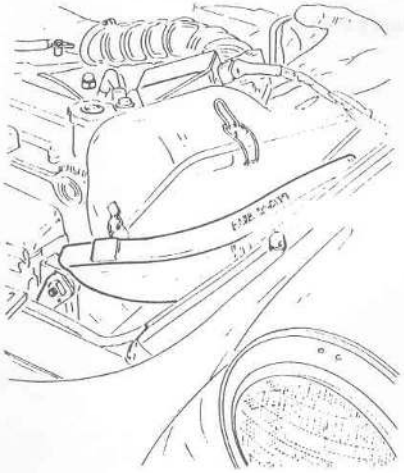
CHECK, CLEANING AND REPLACEMENT OF AIR FILTER CARTRIDGE

1. Release the five clips (1) which secure filter cover (2) to container (4).
2. Lift cover enough to remove cartridge (3) without damaging the surrounding components.
3. Clean filter container.



1 Clips
2 Cover
3 Cartridge
4 Container

4. Clean the cartridge thoroughly blowing low pressure compressed air from cartridge upper side.
5. Insert the cartridge into container, positioning with the metal grid upward, as shown in the figure.



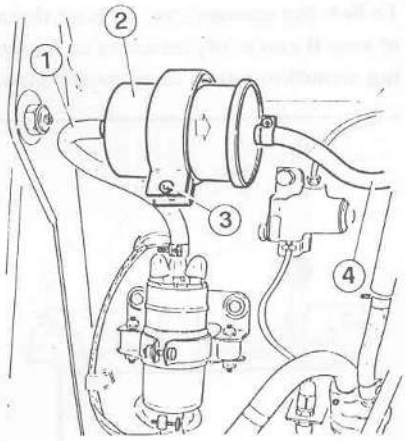
Replace the cartridge periodically (refer to: Vehicle Maintenance Schedule).

CHECK OF AIR SUPPLY SYSTEM TIGHTNESS AFTER AIR FLOW GAUGE

1. Run the engine to idle r.p.m..
2. Brush a soapy solution on the connection points of the ducts after the air flow gauge.
3. Verify that the solution is not sucked in the ducts, since this could vary the engine r.p.m..
4. If not so, tighten the clamps on ducts and check for their good condition.

FUEL FILTER REPLACEMENT

1. Working from under the car, throttle hoses (1) and (4), loosen the clips and disconnect the hoses from the filter.
2. Unscrew the bolt (3) and remove the filter (2).

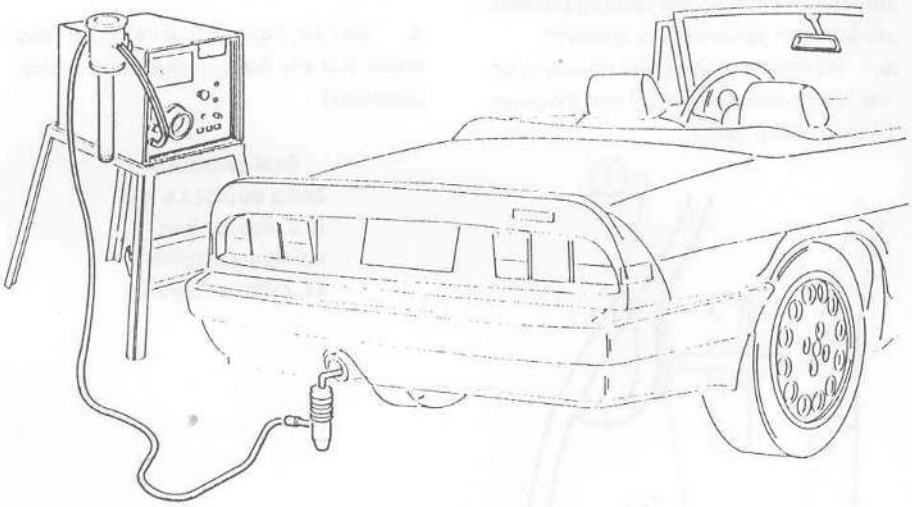


1 Pipe
2 Filter
3 Bolt
4 Pipe

CHECK OF IDLE R.P.M. AND EXHAUST EMISSIONS

This check is to be carried out with engine at normal running temperature, speed gear to neutral, and all the ancillary devices excluded.

Idle r.p.m.
750 ÷ 850 r.p.m.
CO ≤ 0,5%
HC ≤ 100 p.p.m.

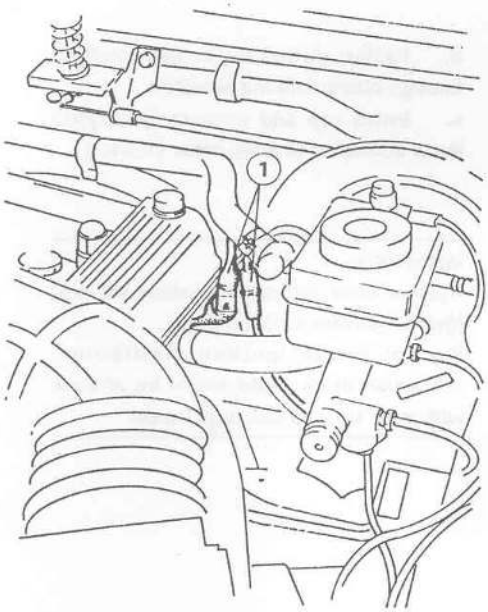


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Idle emissions on Bosch Motronic System are currently adjusted by acting on a potentiometer inside the air flow sensor.
This is carried out by means of a screw positioned in a hole in the sensor casing.
On vehicles equipped with Lambda sensor and catalytic converter an additional circuit in the electronic unit makes it inoperative in any position of its working range. The A/F ratio is corrected automatically by the Lambda sensor to a stoichiometric value. This correction is stored in a memory and made effective even in the case the sensor is removed from its housing in the exhaust pipe.
There is no way to adjust the engine because this is made automatically by the electronic system.
Therefore no seal is provided on this system.
If the illustrated check value doesn't range within the prescribed limits, it is necessary to accomplish the diagnostic procedure through specific instrumentation.

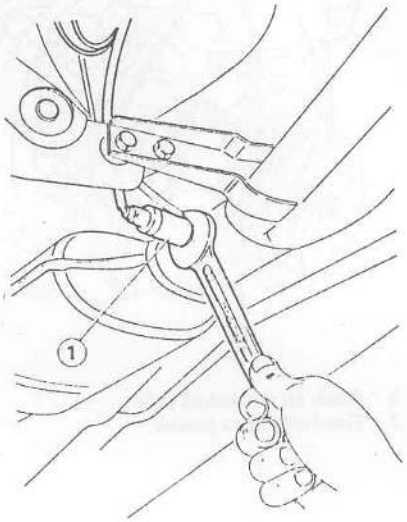
REPLACEMENT OF THE LAMBDA SENSOR FOR EXHAUST GAS ANALYSIS

1. Working in the engine compartment, disconnect the lambda sensor connector and the heating resistance connector.



1 Connections

2. Working under the car, unscrew and remove the lambda sensor (1) and associated electrical wiring.



1 Lambda sensor

3. Apply specified grease to the threading of the new sensor.

Grease:
R. GORI Never seez
BOSCH 5.964.080.105

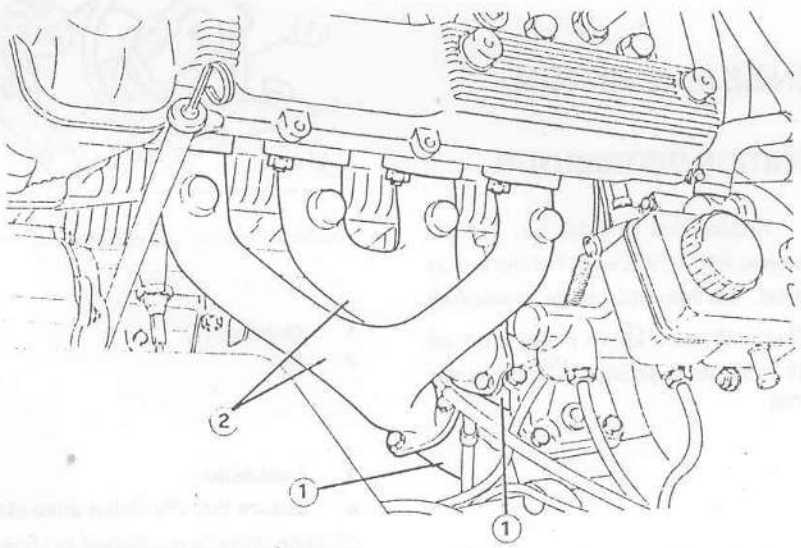
4. Screw on the sensor and associated washer, tightening appropriately.
5. Reconnect the two electrical connectors in the engine compartment.

CATALYTIC CONVERTER

In order to reduce emissions, there is a catalytic converter in the exhaust system. It is made of an alumina monolith coated with an active material of noble metals in a special steel container for high temperature resistance. The system converts the HC, CO and NOx in the exhaust into water and CO_2, which are not harmful.
The catalyst is efficient within a certain temperature range. At low temperature there is no catalytic conversion. High temperature can cause deformation on the metal container and deterioration of the alumina, with a subsequent loss of efficiency of the catalyst itself.
High temperatures can be caused by an excessive quantity of unburned fuel going through the alumina, owing either to excessive loads on the engine or maladjustment of the engine.

Replacement

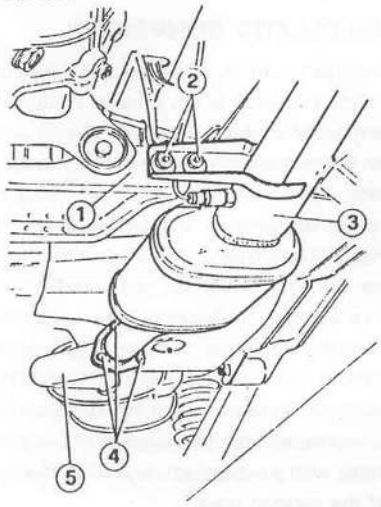
1. Remove the lambda sensor from the exhaust pipe.
2. Unscrew the six bolts fixing the exhaust pipes (1) to the exhaust manifolds (2).



1 Exhaust pipes
2 Exhaust manifolds

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3. Unscrew the two bolts ② securing the exhaust pipe ③ to the gearbox carrier cross member ①.
4. Unscrew the three bolts ④ securing the front exhaust pipe ③ to the rear part ⑤.



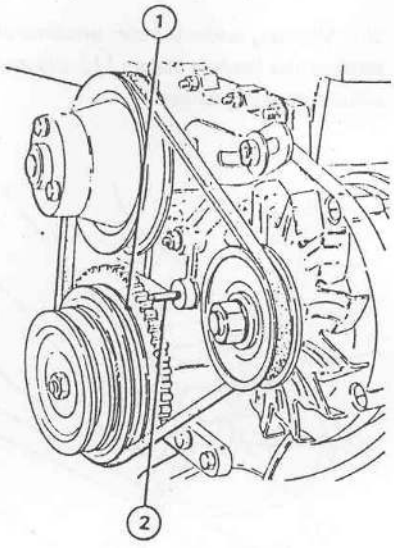
1 Cross member
2 Bolts
3 Exhaust pipe
4 Bolts
5 Rear part

5. Remove the front exhaust pipe with the catalytic converter.
6. Reassemble the new part in reverse order of removal.

ENGINE IGNITION

IGNITION DISTRIBUTOR

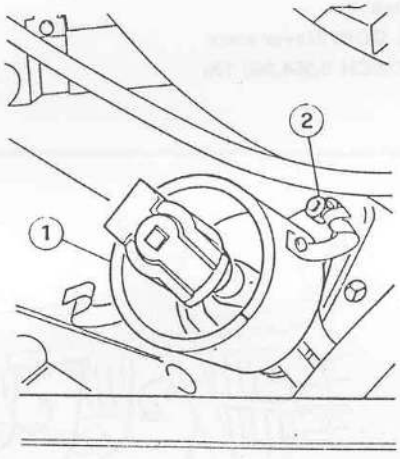
1. Ensure that cylinder No. 1 is on compression stroke, i.e. with both valves closed. To this end, rotate crankshaft pulley until notch ① on pulley lines up with reference pointer ② on water pump.



1 Notch on crankshaft pulley
2 Fixed reference pointer

2. Removal

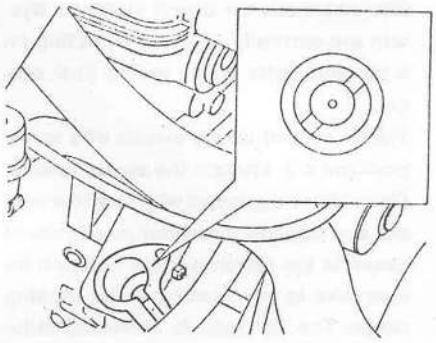
a. Remove the two protecting shells from distributor.
b. Disconnect spark plug and ignition coil wires from distributor cap.
c. Release to two clips and remove distributor cap.
d. Unscrew nut (2) and remove distributor assembly.



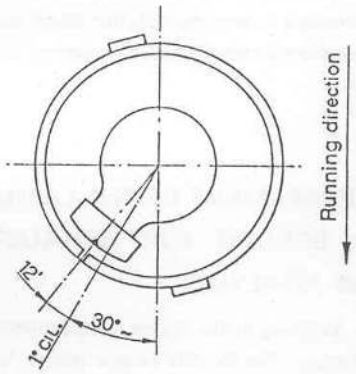
1 Distributor
2 Nut

3. Installation

a. Ensure that distributor drive slot on oil pump spigot is positioned as shown in the following figure.



b. Fit distributor to front cover: have the distrubutor drive coupling key fit the oil pump shaft coupling slot.
c. Position distributor correctly, rotating until notch on edge body lines up with rotor centerline, as shown in the following figure.



d. Fasten distributor in this position through clamp and nut provided.
e. Install cap and connect spark plug leads according to firing order (1-3-4-2)

WARNING:
System does not need or allow for any ignition advance adjustment.
Do not rotate ignition distributor, otherwise firing order might be altered with very serious consequences.

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ENGINE COOLING SYSTEM

ANTIFREEZE MIXTURE LEVEL CHECK AND COOLING SYSTEM TIGHTNESS CHECK

1. Cooling system check

a. Check that the coolant level in the filler tank is between MAX and MIN reference points.
b. Check for sleeve and hose integrity; they must not be damaged or leak.
c. Check the filler tank cap; springs, gaskets and valves must be fully efficient.
d. Check the operation of the electric fans.

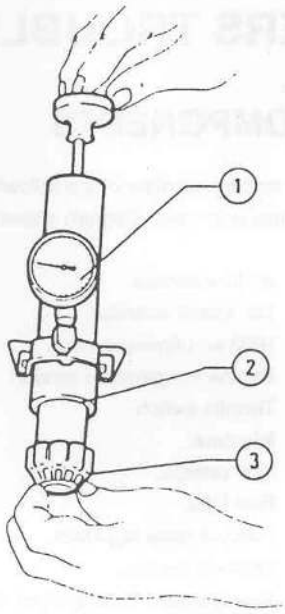
- Detach the two cables of the thermal switch on the radiator and short circuit them.
- Turn the ignition key and chek that the electric fan start.

e. Check the radiator by referring to Unit 07 - ENGINE COOLING SYSTEM.
f. Should it be necessary to add a remarkable quantity of coolant, locate and eliminate any leakage from the engine cooling system.

2. Pressurized cap tightness check

a. Apply the pressurized cap to the instrument equipped with the suitable union ②.
b. Apply pressure and check that the relief valve opens at the specified pressure setting.

Cap pressure relief valve setting
100 kPa
(1 bar; 1.02 Kg/cm²; 14.29 p.s.i.)

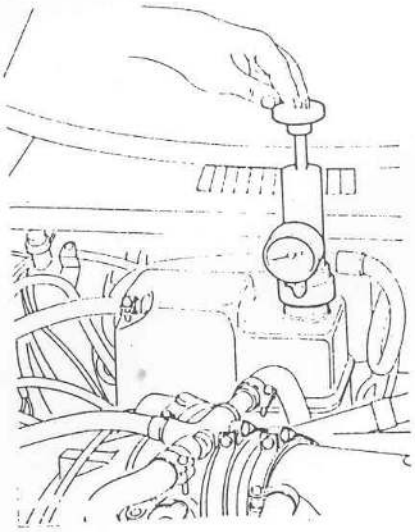


1 Instrument
2 Union
3 Cap

3. Cooling system tightness check

a. Unscrew the pressurized cap from the filler tank.
b. Apply the instrument for the cooling system tightness check to the tank filler neck.
c. Apply pressure to the circuit and check on the instrument that pressure remains at the specified value.

Cooling system check pressure
150 kPa
(1.5 bar; 1.53 Kg/cm²; 21.43 p.s.i.)



4. Cooling system refilling

After having drained the cooling circuit, refill it with coolant, quality and quantity being as follows:

External Minimum Temperature °C [°F]	- 25 [- 13]	- 35 [- 31]
Antifreeze Liquid . l (gals)	2.8 (0.77)	4.25 (1.12)
Diluting distilled water l (gals)	5.7 (1.48)	4.25 (1.12)
Antifreeze mixture l (gals)	8.5 (2.25)	—

To increase the antifreeze protection from -25° C (-13° F) to -35° C (-31° F) without draining the whole cooling system, replace 2 liters of coolant mixture with as many liters of concentrated antifreeze.

WARNING:
These products may damage paint. Avoid contact with painted parts.

Refilling is to be carried out through the tank filler neck by acting as follows:

a. Set the heater control lever to "fully open" position.
b. Fill up the system till reaching the maximum level mark on the filler tank.
c. Start the engine and let it reach the running temperature, so that the thermostat opens and vents the air still contained in the system.
d. With cold engine top up the coolant till reaching the maximum level mark on the filler tank.
e. Refit the cap on the filler tank.

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MOTRONIC ML4.1 SYSTEM 4 CYLINDERS TROUBLESHOOTING

INTRODUCTION

The motronic ML4.1 combines the ignition and fuel injection systems into a single electronically controlled unit.
This results in optimal engine performance and fuel consumption.
The fact that the injection and ignition system have been combined into a single unit means that both systems can use the same signals which of course makes the system much less complex.
The motronic ML4.1 performs the following main functions:

- Regulates injection times.
- Regulation spark avance.
- Controls engine cold-start.
- Controls enrichment when accelerating.
- Cuts out fuel when decelerating.
- Controls idle speed.
- Limits maximum number of revolutions.
- Commands valve timing variator.

COMPONENTS

The system consists of the following main components (see diagram shown in Unit 04):

- Air flow sensor.
- Idle speed actuator.
- RPM and timing sensor.
- Engine temperature sensor.
- Throttle switch.
- Injectors.
- Fuel pumps.
- Fuel filter.
- Fuel pressure regulator.
- Lambda sensor.
- Fuel vapour flow control solenoid valve.
- Timing variator.

TROUBLESHOOTING PROCEDURE

To locate possible faults in the Motronic ML4.1 system, the procedure using the flashing code can be performed (see publication PA424500000000 - Trouble Diagnostic Procedure for Motronic ML4.1 Systems Using Flanshing Lamp Codes or the Alfa Tester **C.1.0160,** provided with the appropriate program cartridge, can beused.
These two procedures allow to identify the failures that the Motronic Control Unit is able to detect by means of a self-diagnosis process.
To check the wiring and signals from the Motronic contro unit, it is convenient to carry out the following diagnosis procedure which uses the equipment designed by Alfa Romeo Service.

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TROUBLESHOOTING

NOTE:

This troubleshooting procedure mainly deals with the electric/electronic diagnosis of the system and the relevant sensors and actuators. Should the faulty condition persist at the end of the tests, it is necessary to check the main mechanical components, such as valves, cylinders, coupling, seals, intake ducts, etc.

DIAGNOSTIC PROCEDURE

CAUTION:

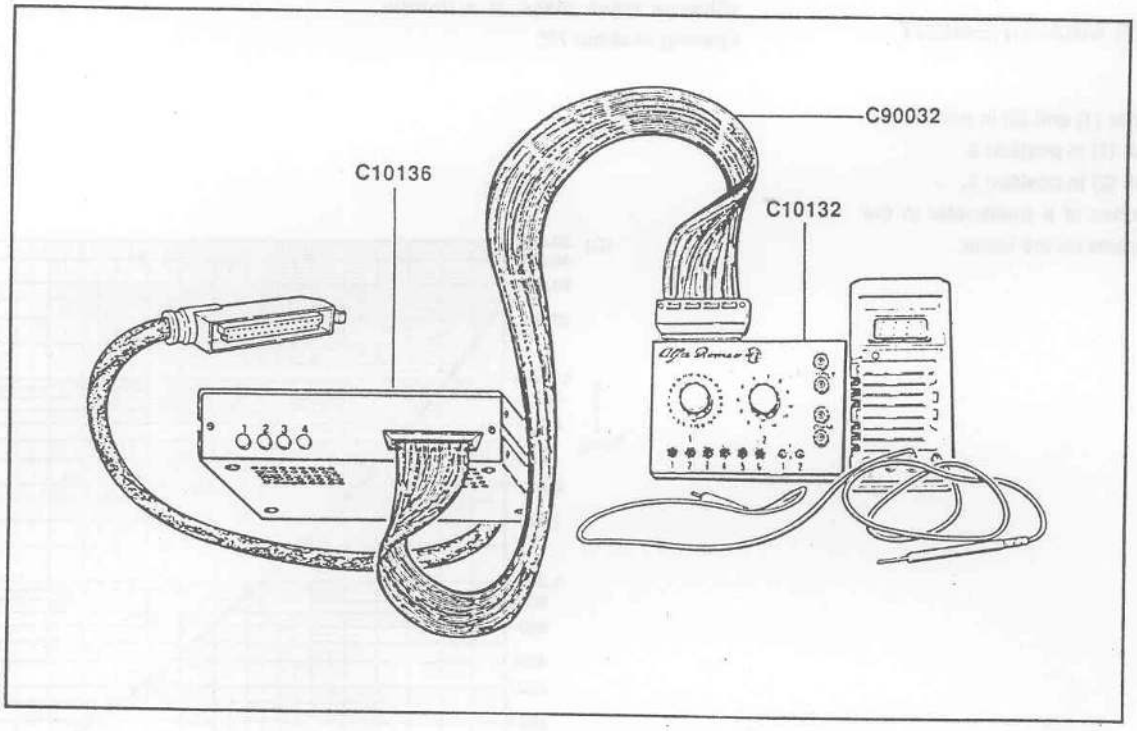
If the vehicle fails to pass one of the diagnostic tests listed below, the cause of the problem must be identified by performing the troubleshooting procedure.

PRELIMINARY OPERATIONS

- Remove the ignition key.
- Disconnect the negative battery terminal.
- Disconnect the connector from the Motronic electronic control unit.
- Connect the connector, vehicle wiring side, to the corresponding connector on interface **C10136.**

DO NOT CONNECT THE CONTROL UNIT

- Select the ML4.1 engine version (4 cylinders) by pressing key No. 3 on interface **C.1.0136.**
- Connect the interface to the multi-purpose tester **C.1.0132** with cable **C.9.0032.**
- Reconnect the negative battery terminal.
- Disconnect the fuel pump relay.



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PRELIMINARY TEST

CHECK ON CONNECTION PIN 8 CONTROL UNIT (ANTITHEFT FUNCTION)

- Set the multimeter to 20 V F.S.
- Turn the ignition key to RUN position.
- Insert multimeter probes between control unit connector pin 8 and ground.
- Multimeter shoud read 0 V (no voltage).

PRELIMINARY TEST

CHECK FOR GROUND ON CONTROL UNIT CONNECTOR PINS 16 AND 19

- Remove ignition key.
- Multimeter set to 200 Ohm FS.
- Selector (1) in position 3.
- Multimeter reading: less than 10 Ohm.
- Selector (1) in position 4.
- Multimeter reading: less than 10 Ohm.

OHMMETER MEASUREMENT SET-UP

- Set selector (1) and (2) in position 1.
- Set switch (1) in position 2.
- Set switch (2) in position 1.
- Insert probes of a multimeter in the "OHM" sokets on the tester.

TEST No. 1

CHECK ON MINIMUM THROTTLE OPENING MICROSWITCH - WIRING CONNECTOR PIN 2

- Selector (2) in position 1.
- Multimeter set to 200 Ohm FS.
- Multimeter reading: less than 10 Ohm.
- Press accelerator pedal gently and read infinite resistance on the multimeter.

TEST No. 2

CHECK ON MAXIMUM THROTTLE OPENING MICROSWITCH - WIRING CONNECETOR PIN 3

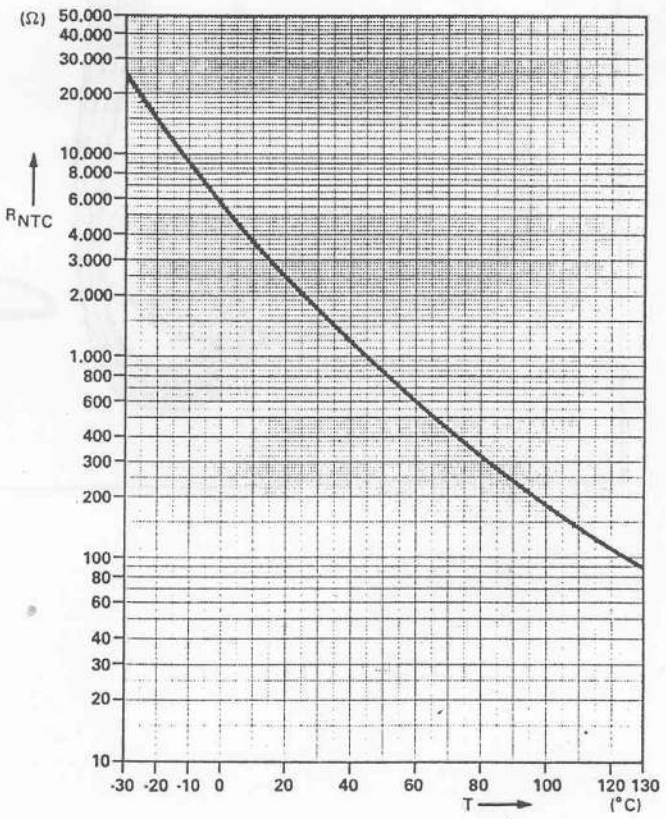
- Selector (2) in position 2.
- Multimeter set to 200 Ohm FS.
- Multimeter reading: infinite resistance.
- Press accelerator pedal completely and read a value less than 10 Ohm on the multimeter.
  (Change takes place at a throttle opening of about 72°.

TEST No. 3

CHECK ON ENGINE TEMPERATURE SENSOR WIRING CONNECTOR PIN 13

- Selector (2) in position 3.
- Multimeter set to 20 kOhm FS.
- The multimeter reading depends on engine temperature.

-10°C = 9 kOhm
0°C = 6 kOhm
+10°C = 3.8 kOhm
+15°C = 3 kOhm
+20°C = 2.5 kOhm
+25°C = 2.1 kOhm
+30°C = 1.7 kOhm
+40°C = 1.2 kOhm
+60°C = 600 Ohm
+80°C = 330 Ohm



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TEST No. 4

CHECK ON AIR TEMPERATURE SENSOR WIRING CONNECTOR PIN 22 (PIN 6 GROUNDED THROUGH C10136)

- Selector (2) in position 4.
- Multimeter set to 20 kOhm FS.
- Multimeter reading: infinite resistance.
- Press pushbutton (3); multimeter reading will depend on engine temperature (see curve illustrated for test No.3).
- **Disconnect negative battery terminal.**
- **Insert interface connector in electronic control unit connector.**
- **Reconnect negative battery terminal.**

TEST No. 5

CHECK ON SHIELDED CABLES GROUND - CONTROL UNIT CONNECTOR PIN 23

- Selector (2) in position 5.
- Multimeter set to 200 Ohms F.S.
- Multimeter reading: less than 10 Ohm.

VOLTMETER MEASUREMENT SET-UP

- Set selectors (1) and (2) in position 1.
- Set switch (1) in position 2.
- Set switch (2) in position 1.
- Measure battery voltage directly on the battery terminals with key in RUN position, and take note of the reading.
- Remove inition key.
- Insert probes of a multimeter in the "VOLT" sockets on the tester.

TEST No. 6

CHECK ON DIRECT +12V TO MOTRONIC CONTROL UNIT (PIN 18)

- Remove ignition key.
- Multimeter set to 20 V FS.
- Selector (1) in position 1.
- Multimeter reading: battery voltage noted earlier ± 50 mV.

TEST No. 7

CHECK ON KEY-OPERATED +12 V - CONTROL UNIT CONNECTOR PIN 35

- Multimeter set to 20 V FS.
- Selector (1) in position 2.
- With key removed read 0 V (no voltage).
  With key in RUN position, read battery voltage noted earlier ± 50 mV.

Turn ignition key to "RUN" position.

TEST No. 8

CHECK ON GROUND - CONTROL UNIT CONNECTOR PIN 16 AND 19

- Key in RUN position.
- Multimeter set to 200 mV FS.
- Selector (1) in position 3 (pin 16).
- Multimeter voltage reading: less than 30 mV.
- Selector (1) in position 4 (pin 19).
- Multimeter voltage reading: less than 30 mV.

NOTE:
The read value may be just higher if the long version of C.9.0032 cable is used.

TEST No. 9

CHECK ON AIR FLOW SENSOR SUPPLY - CONTROL UNIT CONNECTOR PIN 9

- Key in RUN position.
- Multimeter set to 20 V FS.
- Selector (1) in position 6.
- Multimeter reading: between 4.5 V and 5.5 V.

TEST No. 10

CHECK ON AIR FLOW SENSOR POTENTIOMETER CONTROL UNIT CONNECTOR PIN 7

- Key in RUN position.
- Multimeter set to 20 V FS.
- Selector (1) in position 7.
- Multimeter reading: between 100 mV and 300 mV.
- Manually operate air flow sensor throttle valve and check that the voltage increases until it is equal to or greater than 4.2 V without intermediate breaks.

TEST No. 11

CHECK ON IDLE SPEED ACTUATOR SUPPLY AND WIRING

- Key in RUN position.
- Multimeter set to 20 V FS.
- Selector (1) in position 5.
- Multimeter voltage reading: between 4 V and 12 V.
- Momentarily disconnect connector on idle speed actuator and check that voltage drops to approx. 0 V (no voltage).

Reconnect fuel pump relay (with key in RUN position, the relay may remain enabled or enable/disable alternately click).

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TEST No. 12
TEST TO BE PERFORMED ONLY ON AN ENGINE WHICH WILL NOT START

NOTE:
Make sure the preliminary test has been carried out (Connection check of control unit pin 8).

TEST No. 12.1

INDUCTIVE SENSOR TEST - CONTROL UNIT CONNECTOR PIN 25

- Multimeter set to 20 V FS.
  Set for alternating current readings
- Selector (1) in position 18.
- Try to start: multimeter reading should exceed 1.5 V.

Reset multimeter for direct current readings

TEST No. 12.2

CHECK ON INJECTION DURATION

- Multimeter set to 2 V FS.
- Selector (1) in position 14.
- Switch (1) in position 1.
- Switch (2) in position 1.
- Try extended starting: multimeter voltage reading between 200 mV and 1 V (from 2 to 10 msec).

TEST No. 12.3

CHECK ON INJECTOR CURRENT

- Multimeter set to 2 V FS.
- Selector (1) in position 13.
- Switch (2) in position 1.
- Try extended starting: multimeter voltage reading between 300 mV and 400 mV.

TEST No. 12.4

CHECK ON COIL CONTROL - CONTROL UNIT CONNECTOR PIN 1

- Multimeter set to 2 V FS.
- Selector (1) in position 15.
- Switch (1) in position 2.
- Try extended starting: multimeter voltage reading corresponds to rpm while starting

(e.g: 20 mV = 200 rpm
30 mV = 300 rpm)

TEST No. 12.5

CHECK ON FUEL SUPPLY SYSTEM

- Connect a pressure gauge to the fuel distribution pipe.
- Turn the key to RUN position.
- Press pushbutton No. 4 on the tester and check that the fuel reaches a pressure equal to or greater than 2.8 bar.

NOTE:
The pump may already be rotating at this point.

TEST TO BE PERFORMED IF THE ENGINE STARTS

TEST No. 13

CHECK INDUCTIVE SENSOR POSITIVE HALF-WAVE

- Start engine.
- Multimeter set to 20 V FS.
- Selector (1) in position 11.
- Check that the value read on the multimeter during idling is approx. 100 mV.
- Accelerate and check that the reading increases.

TEST No. 14

CHECK ON INDUCTIVE SENSOR NEGATIVE HALF-WAVE

- Start engine.
- Multimeter set to 20 V FS.
- Selector (1) in position 12.
- Proceed as for test No. 13, and check that the reading is the same as or greater than the previsous value.

TEST No. 15

CHECK ON INJECTOR CURRENT

- Start engine.
- Multimeter set to 2 V FS.
- Selector (1) in position 13.
- Switch (1) in position 1.
- Switch (2) in position 1.
- Accelerate with short sharp bursts, and check that maximum multimeter readings range from 410 mV to 490 mV (with engine temperature above +50°C).

NOTE:
The reading is given in millivolts corresponding to the injector current.
(e.g.: 200 mV = 2A
300 mV = 3 A
400 mV = 4 A).

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TEST No.16

CHECK ON INJECTION DURATION

- Start engine.
- Multimeter set to 2 V FS.
- Selector (1) in position 14.
- Switch (1) in position 1.
- Switch (2) in position 1.
- With engine at normal running temperature and idle speed, multimeter voltage reading may vary between 150 mV and 300 mV which is equivalent to 1.5 to 3 msec injection time.

NOTE:
Injection lasts longer if the engine is cold or the external temperature is very low.

- Check acceleration enrichment, acceleration in short sharp bursts and making sure that the multimeter reading tends to increase.
- If the engine has reached, or almost reached its normal running conditions, press pushbutton No. 5 (cold engine simulation) on the tester and check cold enrichment over a longer injection period.
- If the external temperature is higher than 10°C, press pushbutton No. 6 (cold air simulation) on the tester and check that the multimeter reading increases slightly.

TEST No. 17

CHECK ON COIL A CONTROL (PIN 1)

- Start engine.
- Multimeter set to 2 V FS.
- Selector (1) in position 15.
- Switch (1) in position 2.
- Multimeter reading corresponds to the engine rpm (COIL A TEST)

(e.g.: 800 rpm = 55 mV
1000 rpm = 70 mV
3000 rpm = 200 mV
4000 rpm = 270 mV
5000 rpm = 340 mV)

TEST No. 18

CHECK ON SPARK ADVANCE

- Start engine.
- Multimeter set to 2 V FS.
- Selector (1) in position 17.
- Switch (1) in position 2.
- With engine at normal running temperature and idle speed, multimeter reading may vary between 70 mV and 130 mV corresponding to a spark advance of 7-13 degrees.
- Accelerate to 2000 rpm and check that spark advance increases.

TEST No. 19

CHECK ON IDLE SPEED ACTUATOR OPERATION

- With engine at idle, momentarily disconnect the actuator connector and check that engine rpm increases.
- Reconnect connector and check idle speed again.

TEST No. 20

CHECK ON CONTROL UNIT FUNCTIONS

- With engine idling between 1000 and 1500 rpm, press pushbutton 2 on the tester. Check that the valve timing variator functions (rpm should drop momentarily).
- With engine running at approx. 2000 rpm, press pushbutton No. 1 (throttle closed) and check fuel is cut off, which is indicated by a drop in rpm followed by increases and decreases (hunting).

TEST No. 21

SPECIAL TESTS FOR VEHICLES FITTED - WITH LAMBDA SENSOR

TEST No. 21.1

LAMBDA SENSOR CHECK - CONTROL UNIT PIN 24

- Insert the multimeter probes in the "VOLT" sockets of the tester.
- Multimeter set to 2 V F.S.
- Selector (1) in position 22.
- Start the engine and make it reach the running temperature, the multimeter reading must be ranging within 100 mV and 1 V.

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TEST No. 21.2

CHECK ON SOLENOID VALVE CONTROLLING THE FUEL VAPOUR FLOW - CONTROL UNIT PIN 34

- Multimeter set to 20 V F.S.
- Insert the multimeter probes directly on the solenoid valve pins.
- Start the engine and make il reach the running temperature, shortly and repeatedly speed up; verify on the multimeter the presence of a +12 V (at each acceleration).

TEST No. 21.3

CHECK ON THE POWER SUPPLY OF THE LAMBDA SENSOR PRE-HEATING RESISTOR

- Multimeter set to 20 V F.S.
- Start the engine
- Insert the multimeter probes directly on the lambda sensor pre-heating resistor pins.
- Read a value +12 V on the multimeter.
- With the resistor connector unplugged, verify a resistance value on the pins (multimeter set to 200 Ohm F.S.) ranging within 3 Ohm and 20 Ohm.

TROUBLESHOOTING PROCEDURE

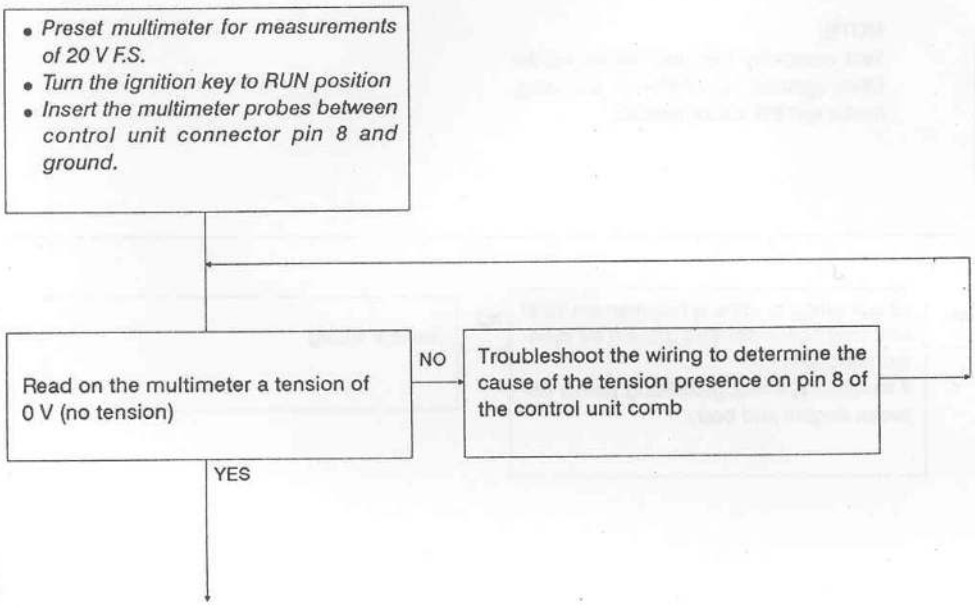
CAUTION:
When troubleshooting, keep to the order of procedure laid down in the operating sequences to prevent incorrect adjustments or faulty components affecting the results of subsequent tests.

PRELIMINARY OPERATIONS

- Remove ignition key.
- Disconnect negative battery terminal.
- Disconnect connector from Motronic electronic control unit
- Connect connector wiring side to corresponding connector on interface **C.1.0136.**
  DO NOT CONNECT CONTROL UNIT
- Press pushbutton No.3 on interface **C.1.0136** to select ML4.1 engine version (4 cylinders).
- Connect interface to multi-purpose tester **C.1.0132** with cable **C.9.0032.**
- Reconnect negative battery terminal.
- Disconnect fuel pump relay.

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PRELIMINARY TEST - CONNECTOR CHECK OF THE CONTROL UNIT PIN 8 (ANTITHEFT FUNCTION)

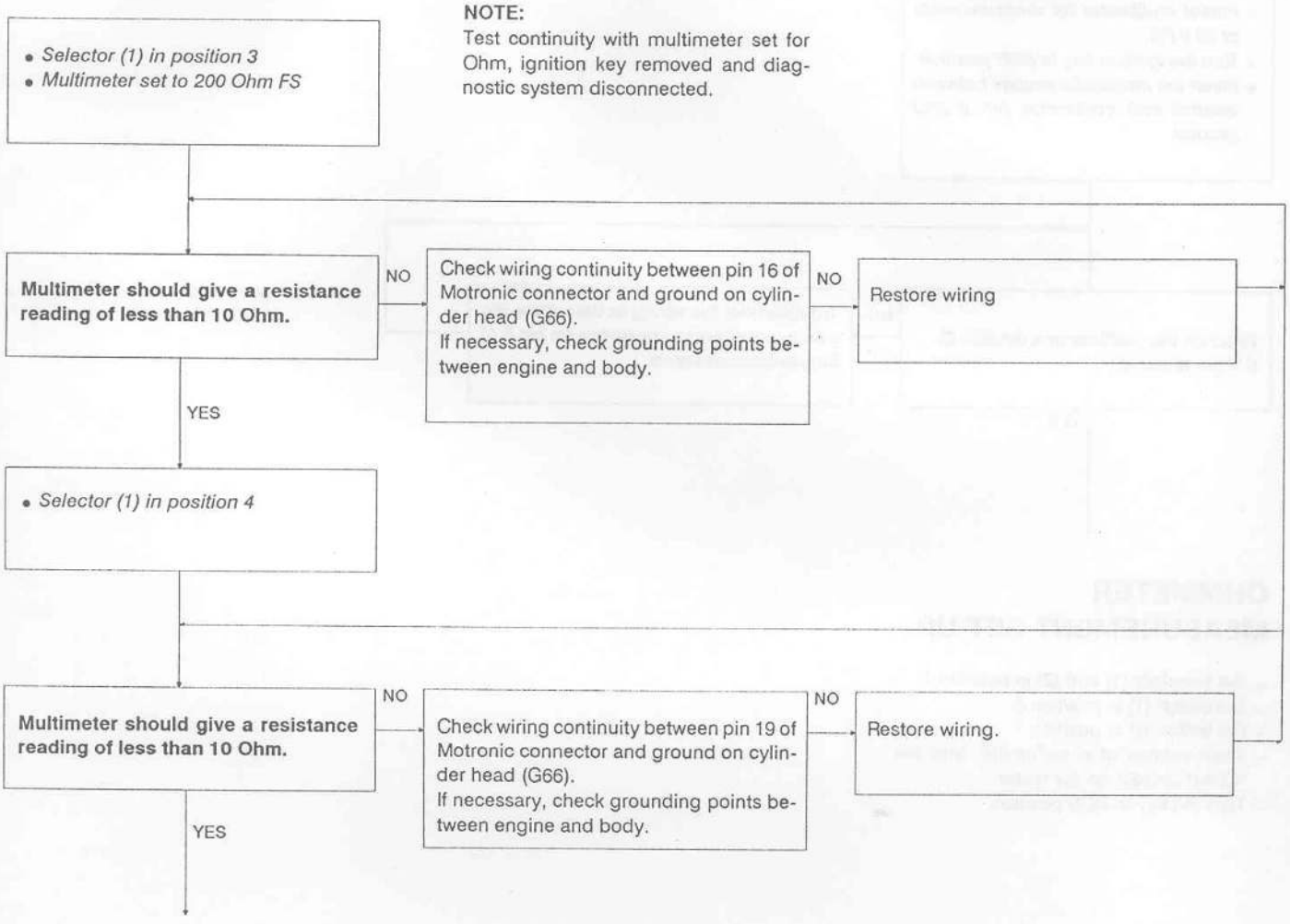


OHMMETER MEASUREMENT SET-UP

- Set selectors (1) and (2) in position 1.
- Set switch (1) in position 2.
- Set switch (2) in position 1.
- Insert probes of a multimeter into the "OHM" sockets on the tester
- Turn the key to RUN position

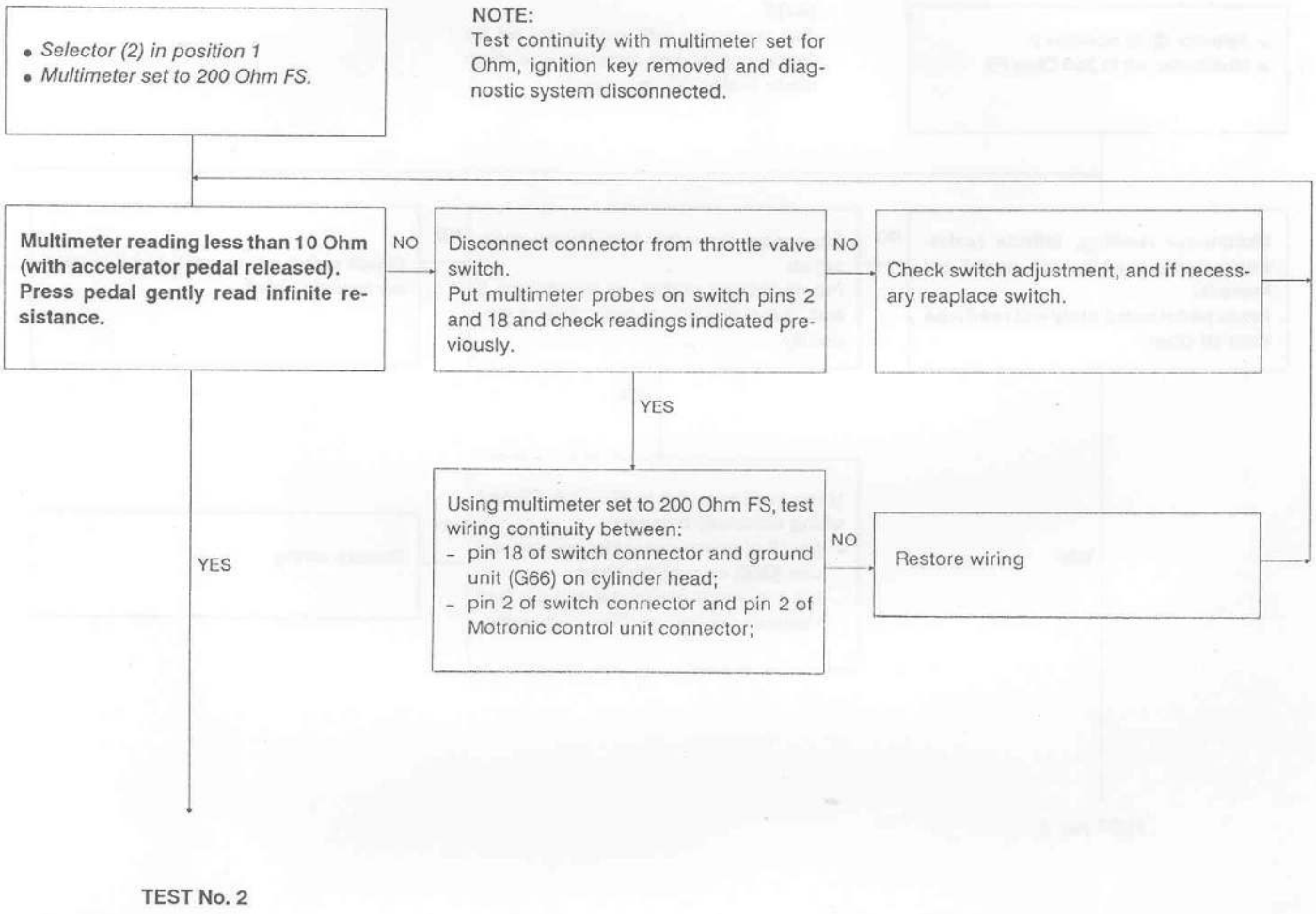
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PRELIMINARY TEST - CHECK FOR GROUND ON MOTRONIC CONTROL UNIT CONNECTOR PINS 16 AND 19



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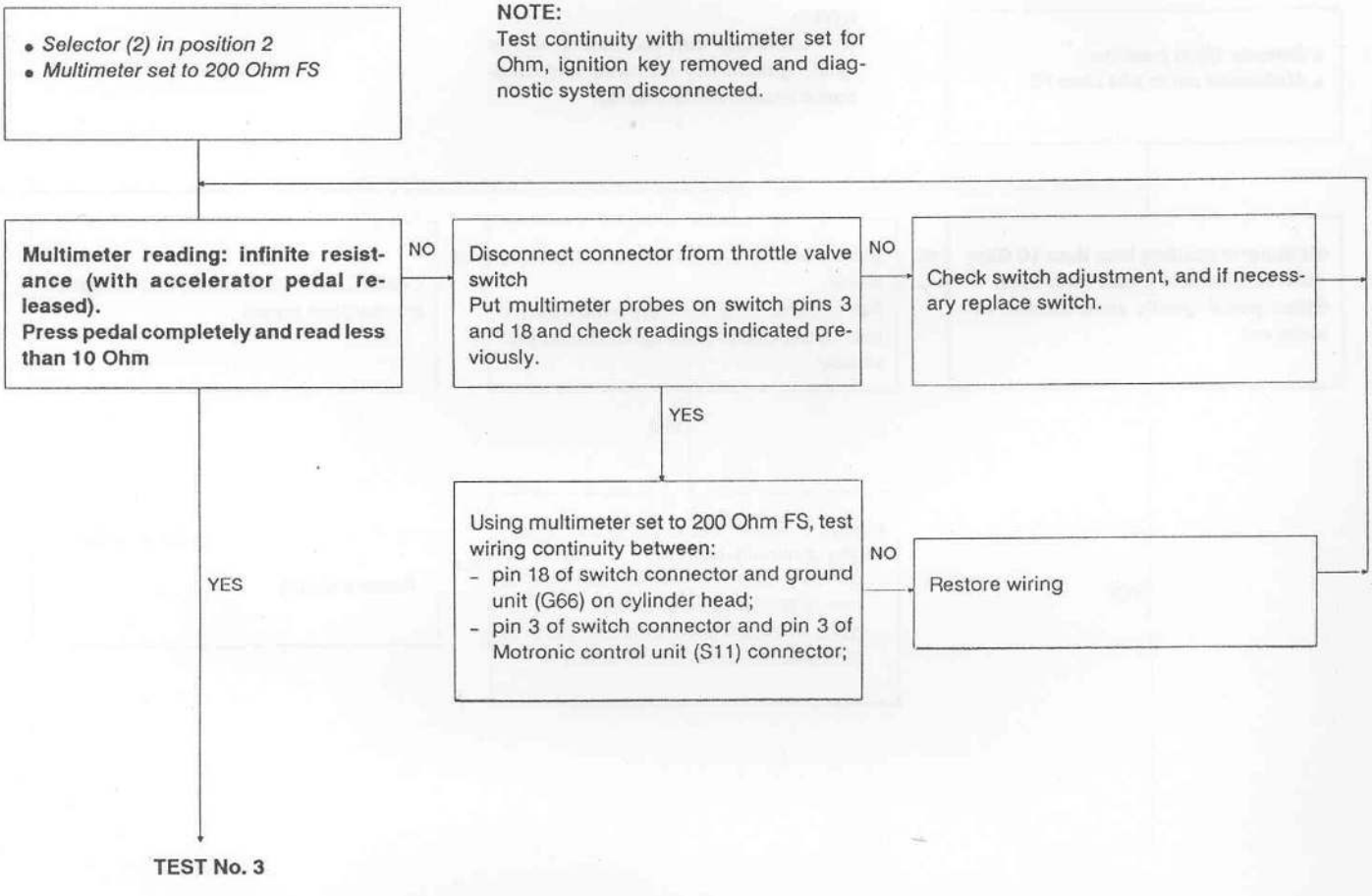
TEST No. 1 - CHECK ON MINIMUM THROTTLE OPENING MICROSWITCH



TEST No. 2

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TEST No. 2 - CHECK ON MAXIMUM THROTTLE OPENING MICROSWITCH



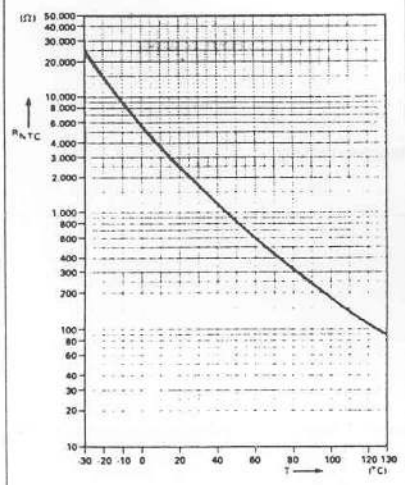
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TEST No. 3 - CHECK ON ENGINE TEMPERATURE SENSOR

- *Selector (2) in position 3*
- *Multimeter set to 20 kOhm FS*

NOTE:
Test continuity with multimeter set for Ohm, ignition key removed and diagnostic system disconnected.

Multimeter resistance reading depends on engine temperature as illustrated by the curve.



NO

Test wiring continuity between:
- pin 13 of Motronic control unit connector and connector of engine temperature sensor (brown wire)
- sensor connector and ground unit (G66) on cylinder head (black wire).

NO

Restore wiring

YES

Replace engine temperature sensor

YES

TEST No. 4

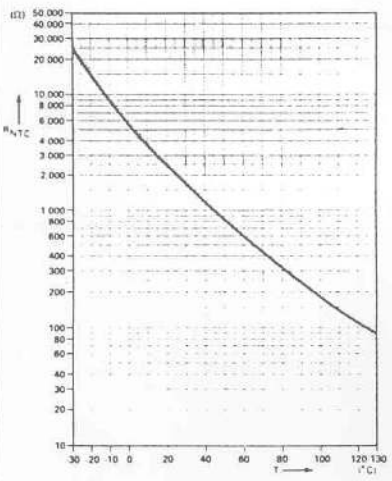
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TEST No. 4 - CHECK ON AIR TEMPERATURE SENSOR

- *Selector (2) in position 4*
- *Multimeter set to 20 kOhm FS*

NOTE:
Test continuity with multimeter set for Ohm, ignition key removed and diagnostic system disconnected.

Multimeter reading: infinite resistance.
Press pushbutton (3): multimeter resistance reading depends on temperature of air as illustrated by the curve.



NO → Check air flow sensor resistance between pins 5 and 4 (value depends on temperature of air as illustrated by the curve in the previous step).

NO → Replace air flow sensor

YES

Check wiring continuity between:
- pin 4 of air flow sensor connector and pin 6 of Motronic control unit connector
- pin 5 of air flow sensor connector and pin 22 of Motronic control unit connector

NO → Restore wiring

YES

Replace air flow sensor

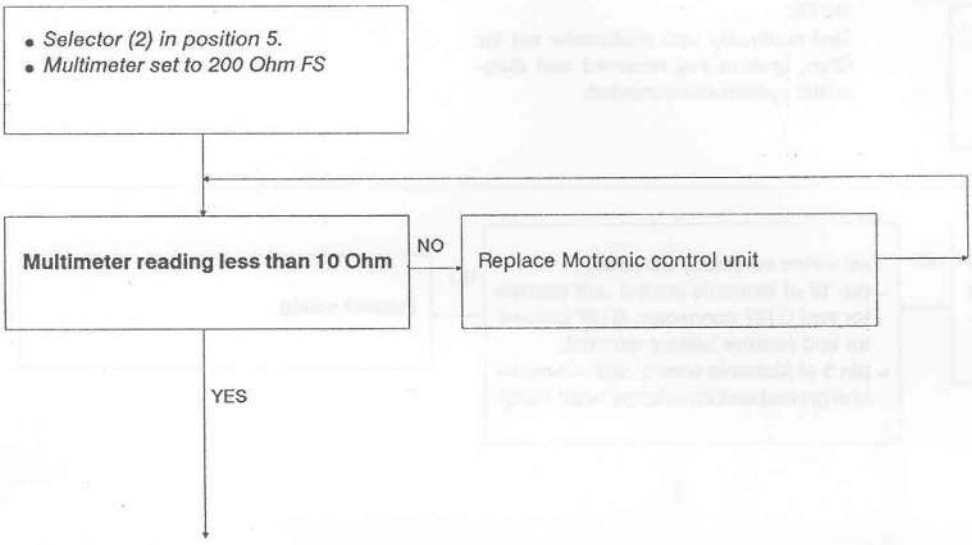
YES

- *Disconnect negative battery terminal*
- *Insert interface connector in electronic control unit connector*
- *Reconnect negative battery terminal*

TEST No. 5

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TEST No. 5 - CHECK ON SHIELDED CABLES GROUND



VOLTMETER MEASUREMENT SET-UP

- Set selector (1) and (2) in position 1.
- Set switch (1) in position 2.
- Set switch (2) in position 1.
- Measure battery voltage directly on the battery terminals with key in RUN position, and take note of the reading.
- Remove ignition key.
- Insert probes of a multimeter in the "VOLT" sockets on the tester.

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TEST No. 6 - CHECK ON DIRECT + 12V MOTRONIC CONTROL UNIT (PIN 18)

- *Ignition key removed*
- *Multimeter set to 20 V FS*
- *Selector (1) in position 1*

NOTE:
Test continuity with multimeter set for Ohm, ignition key removed and diagnostic system disconnected.

Multimeter reading: battery voltage corresponding to the value measured directly on the battery terminals (± 50 mV).

NO →

Test wiring continuity between:
- pin 18 of Motronic control unit connector and G137 connector; G137 connector and positive battery terminal.
- pin 5 of Motronic control unit connector and ground unit on cylinder head (G66).

NO →

Restore wiring

YES ↓

TEST No. 7

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TEST No. 7 - CHECK ON KEY-OPERATED +12 V (MAIN RELAY)

- *Selector (1) in position 2*
- *Multimeter set to 20 V FS*

NOTE:
Test continuity with multimeter set for Ohm, ignition key removed and diagnostic system disconnected.

With ignition key removed, multimeter should read 0 V (no voltage)
With key in RUN position, multimeter gives battery voltage reading corresponding to value measured directly on battery terminal (±50 mV)

NO → With key in RUN position, check for key-operated +12 V (battery voltage) on pin 2 of body side wiring connector (G133b)
NO → Test vehicle wiring (e.g.: between pin 2 of connector (G133b) and fusebox, connection between fusebox and ignition switch, ignition switch functioning).

YES

With key in RUN position, check for key operated +12 V (battery voltage) on pin 15 of ignition coil.
NO → Restore wiring continuity between pin 2 of connector G133b and pin 15 of ignition coil

YES

Remove auxiliary relay and with key in RUN position, check for +12 V (battery voltage) on pin 86 in socket.
NO → Restore wiring continuity between pin 15 of ignition coil and connector of auxiliary relay

YES

Using multimeter set for 200 Ohm FS check wiring continuity between pin 85 of auxiliary relay socket and ground on cylinder head (G66).
NO → Restore wiring between pin 85 of auxiliary relay and pin 85 of relay with diode socket; pin 85 of relay with diode socket and ground cylinder head (G66).

YES

With key inserted, check for +12 V (battery voltage) on pin 30 in auxiliary relay socket.
NO → Restore wiring between positive battery terminal, G137 connector and pin 30 of auxiliary realy socket.

YES

Reinsert auxiliary relay and check for +12 V (battery voltage) on the two pins 87 of the realy.
NO → Replace auxiliary relay

YES

Check for +12 V (battery voltage) on pin 30 of fuel pump relay
NO → Restore wiring

YES

Check for +12 V (battery voltage) on pin 86 of relay with diode.
NO → Restore wiring

YES

Check for +12 V (battery voltage) on pin 30 of relay with diode
NO → Restore wiring between pin 30 of relay with diode and G137 connector and between G137 connector and battery.

YES

Check for +12 V (battery voltage) on both pins 87 of relay with diode.
NO → Replace relay with diode

YES

Check for +12 V (battery voltage) on pin 35 of Motronic control unit connector
NO → Restore wiring

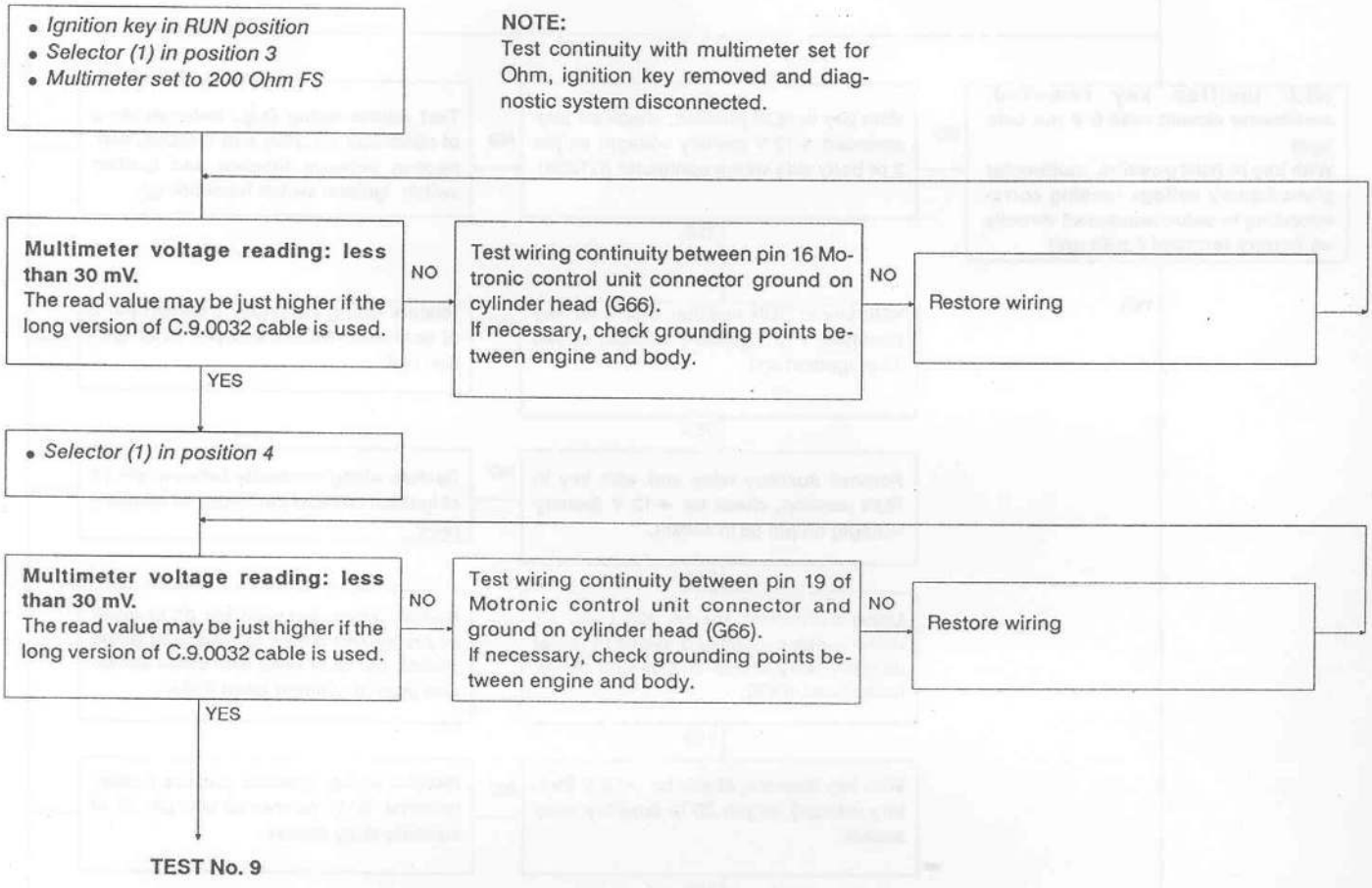
YES

- *TURN IGNITION KEY TO "RUN" POSITION*

TEST No. 8

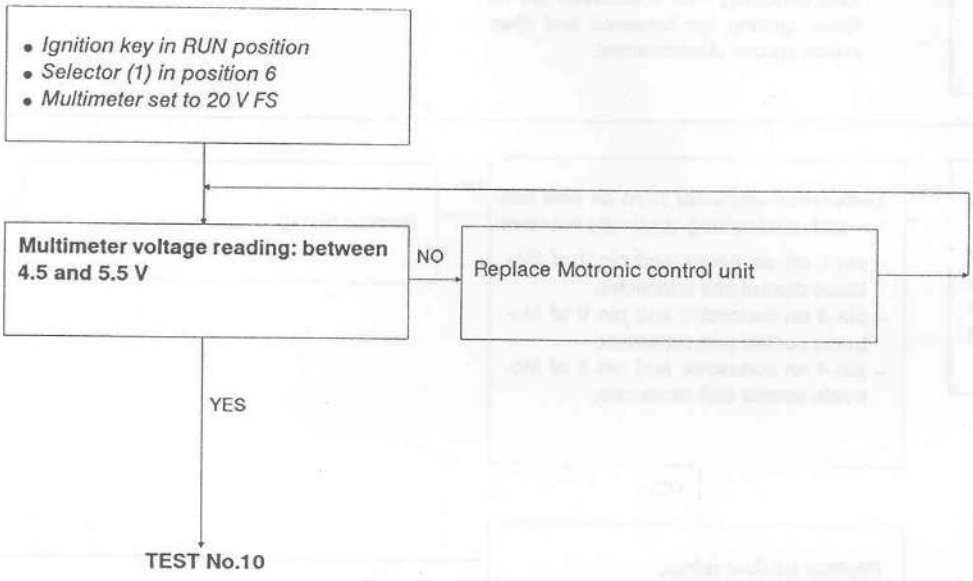
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TEST No. 8 - CHECK ON GROUND - MOTRONIC CONTROL UNIT CONNECTOR PINS 16 AND 19



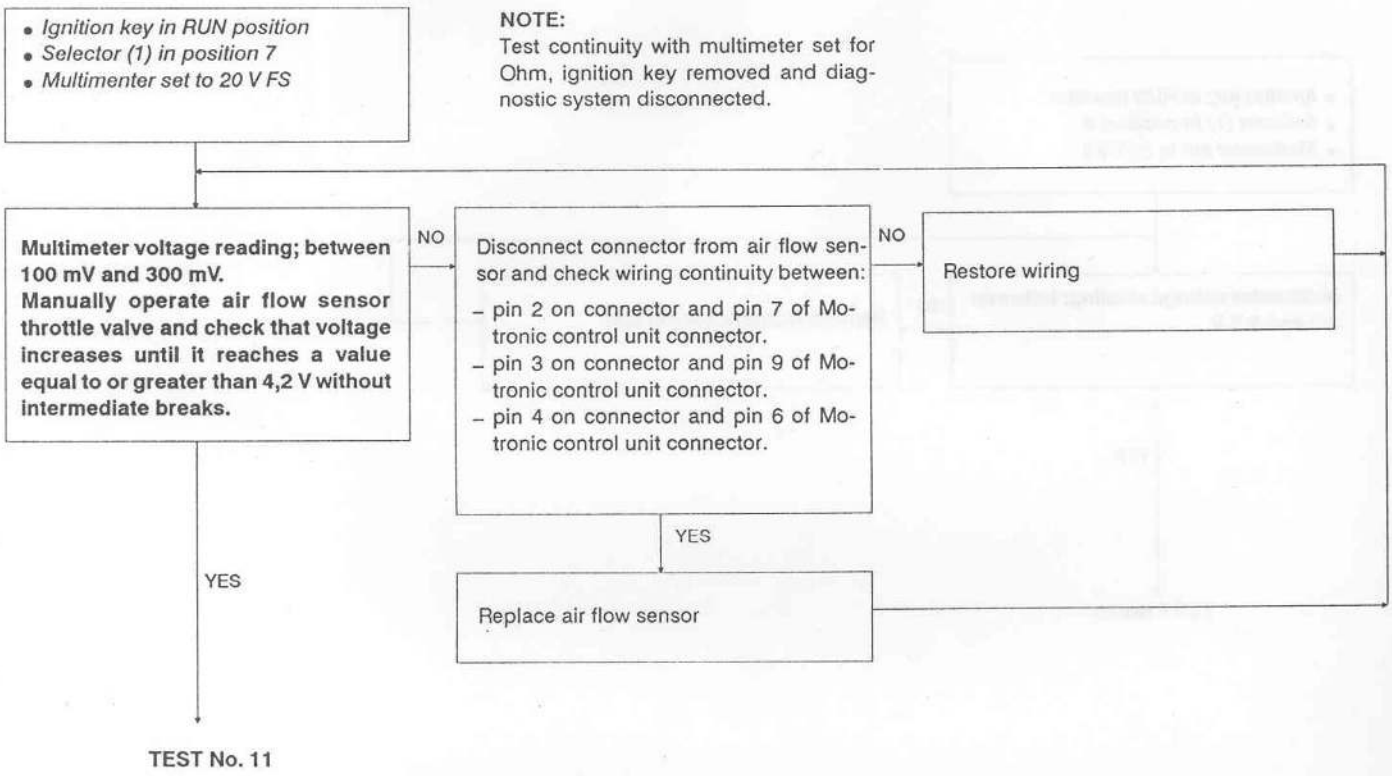
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TEST No. 9 - CHECK ON AIR FLOW SENSOR SUPPLY



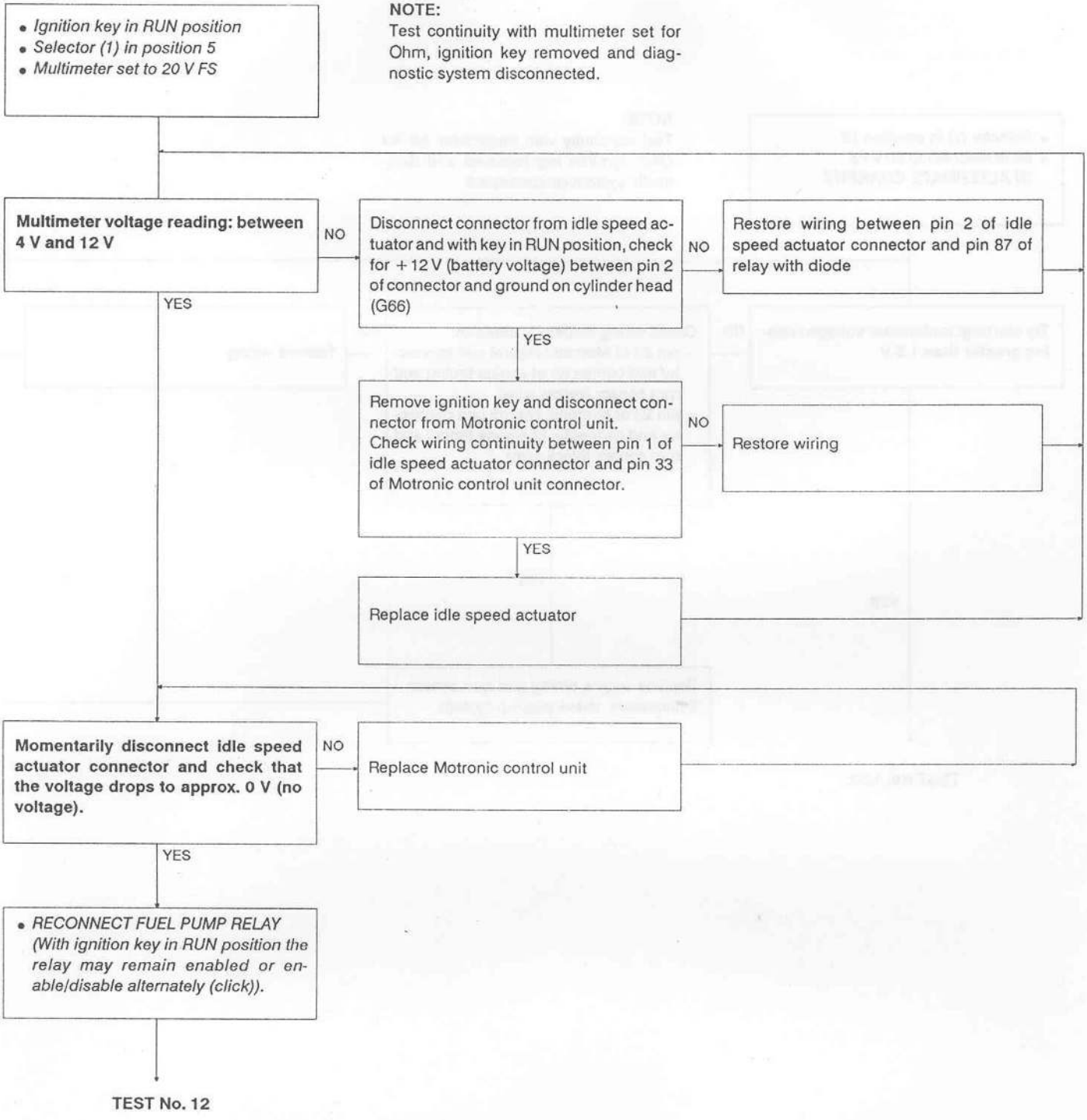
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TEST No. 10 - CHECK ON AIR FLOW SENSOR POTENTIOMETER



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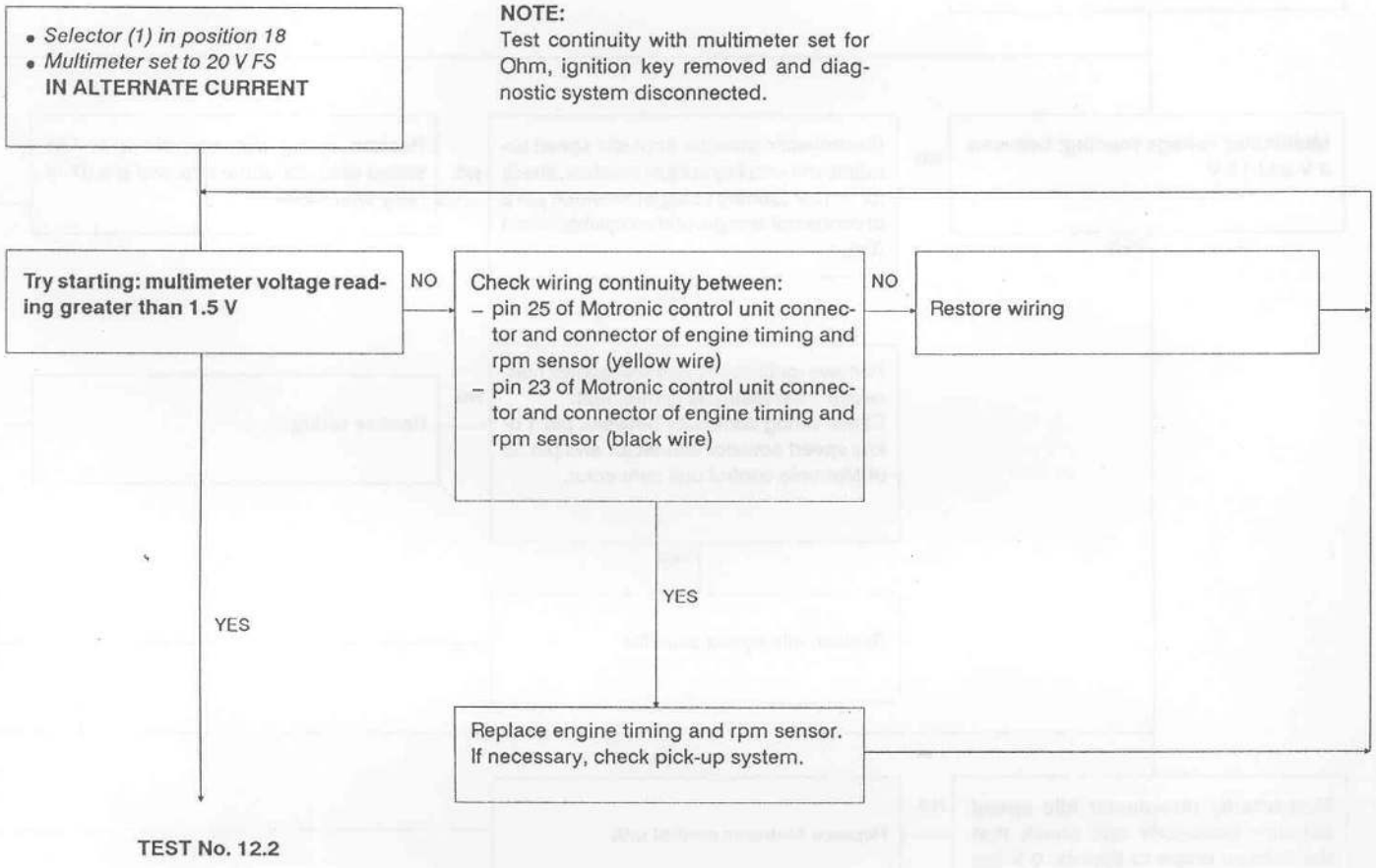
TEST No. 12 - CHECK ON IDLE SPEED ACTUATOR SUPPLY AND WIRING



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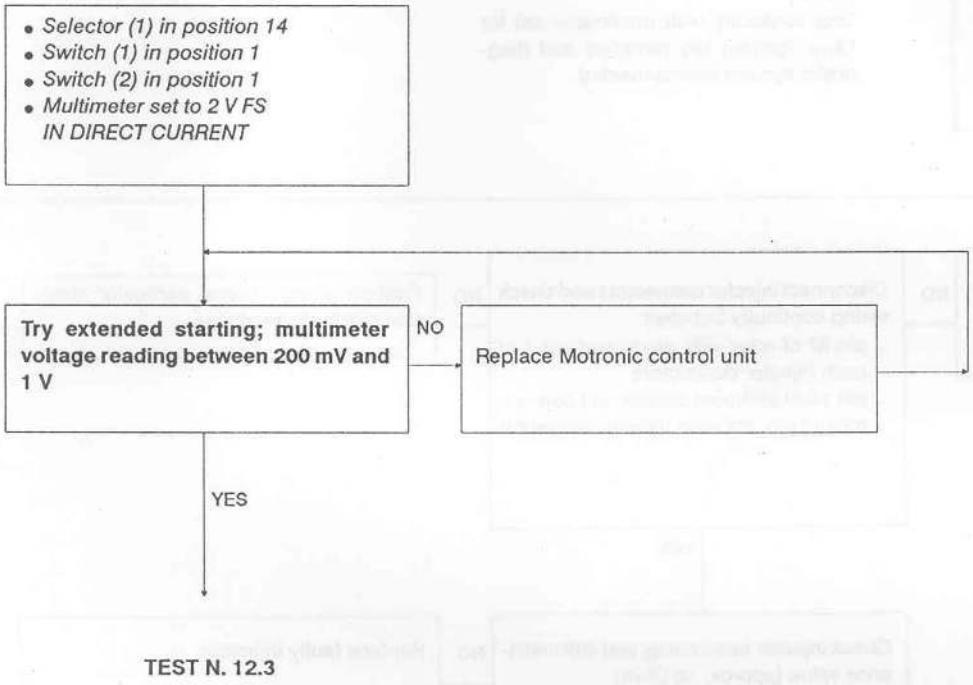
TEST No. 12 - TEST TO BE PERFORMED ONLY ON AN ENGINE WHICH WILL NOT START
NOTE: Make sure the preliminary test has been carried out (connection check of control unit pin 8).

TEST No. 12.1 - INDUCTIVE SENSOR TEST



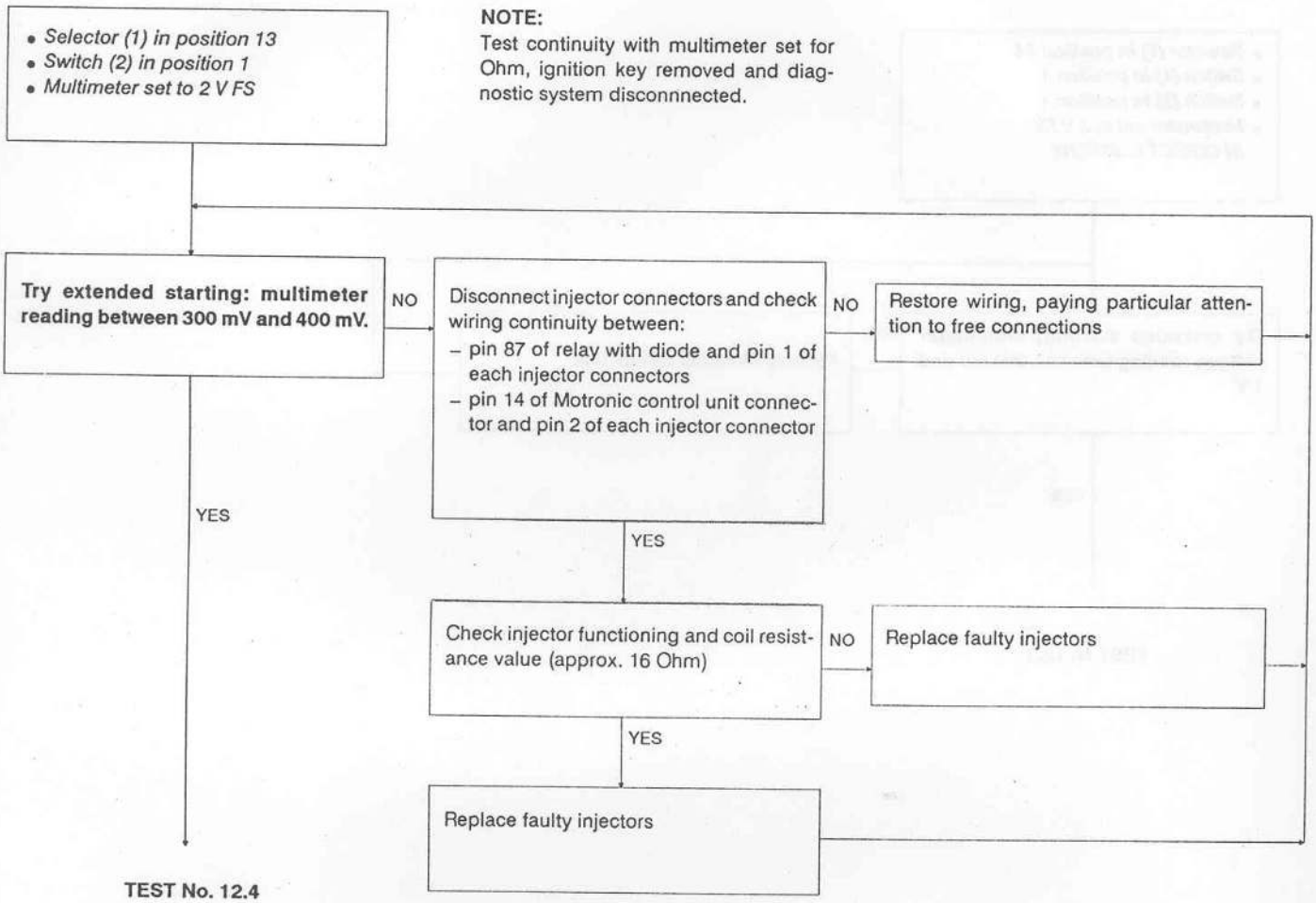
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TEST No. 12.2 - CHECK ON INJECTION DURATION



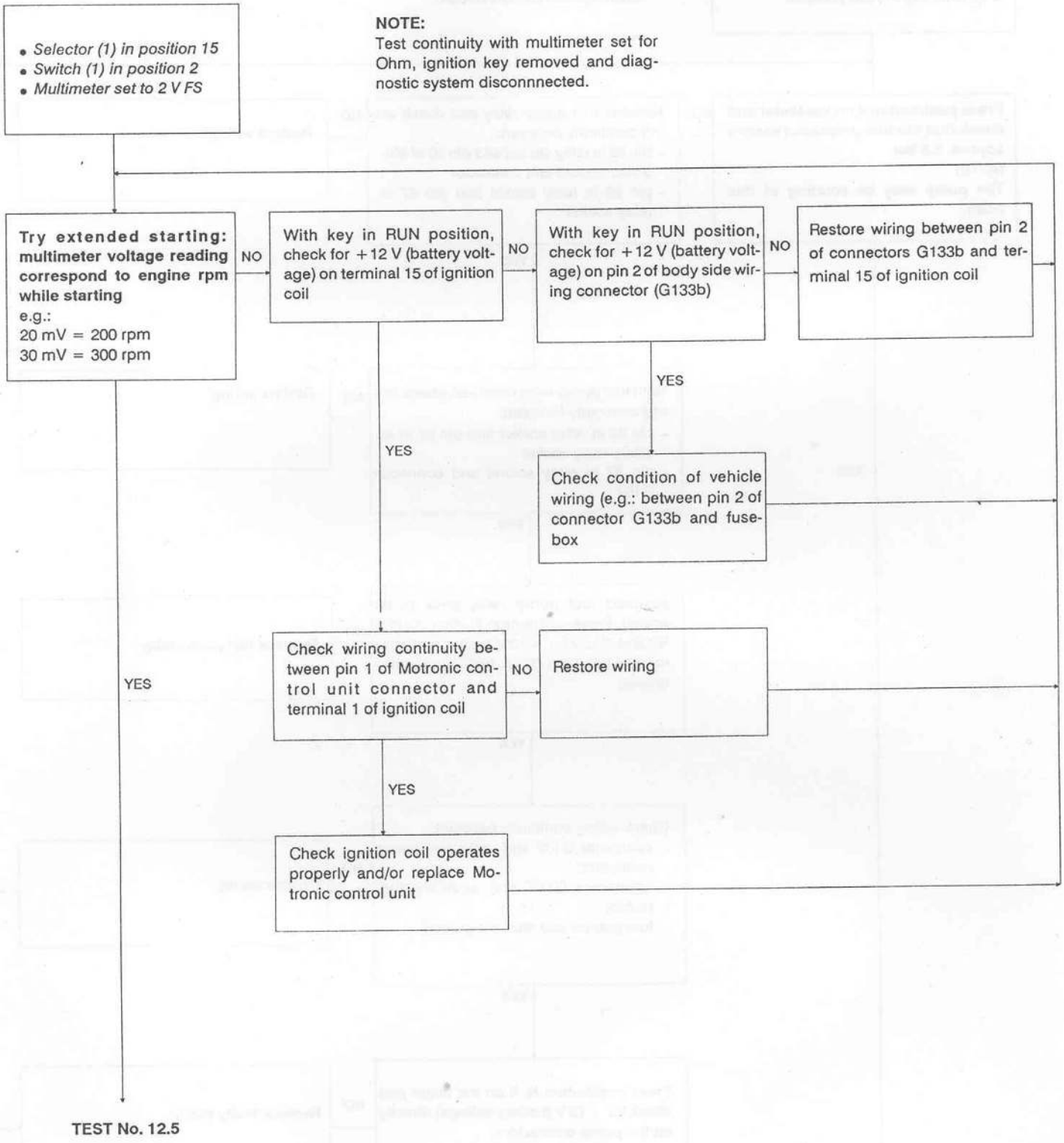
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TEST No. 12.3 - CHECK ON INJECTION CURRENT



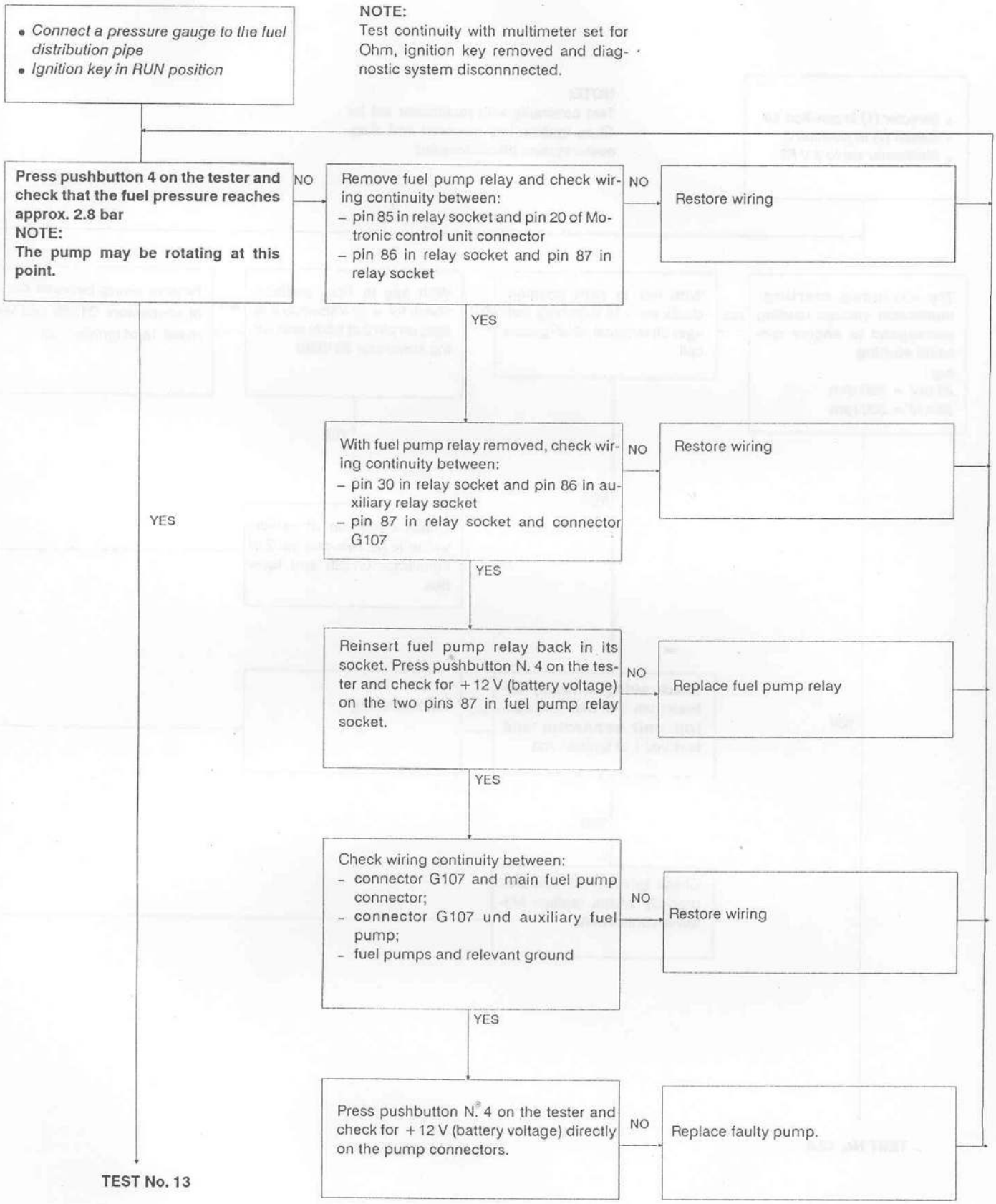
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TEST No. 12.4 - CHECK ON COIL CONTROL



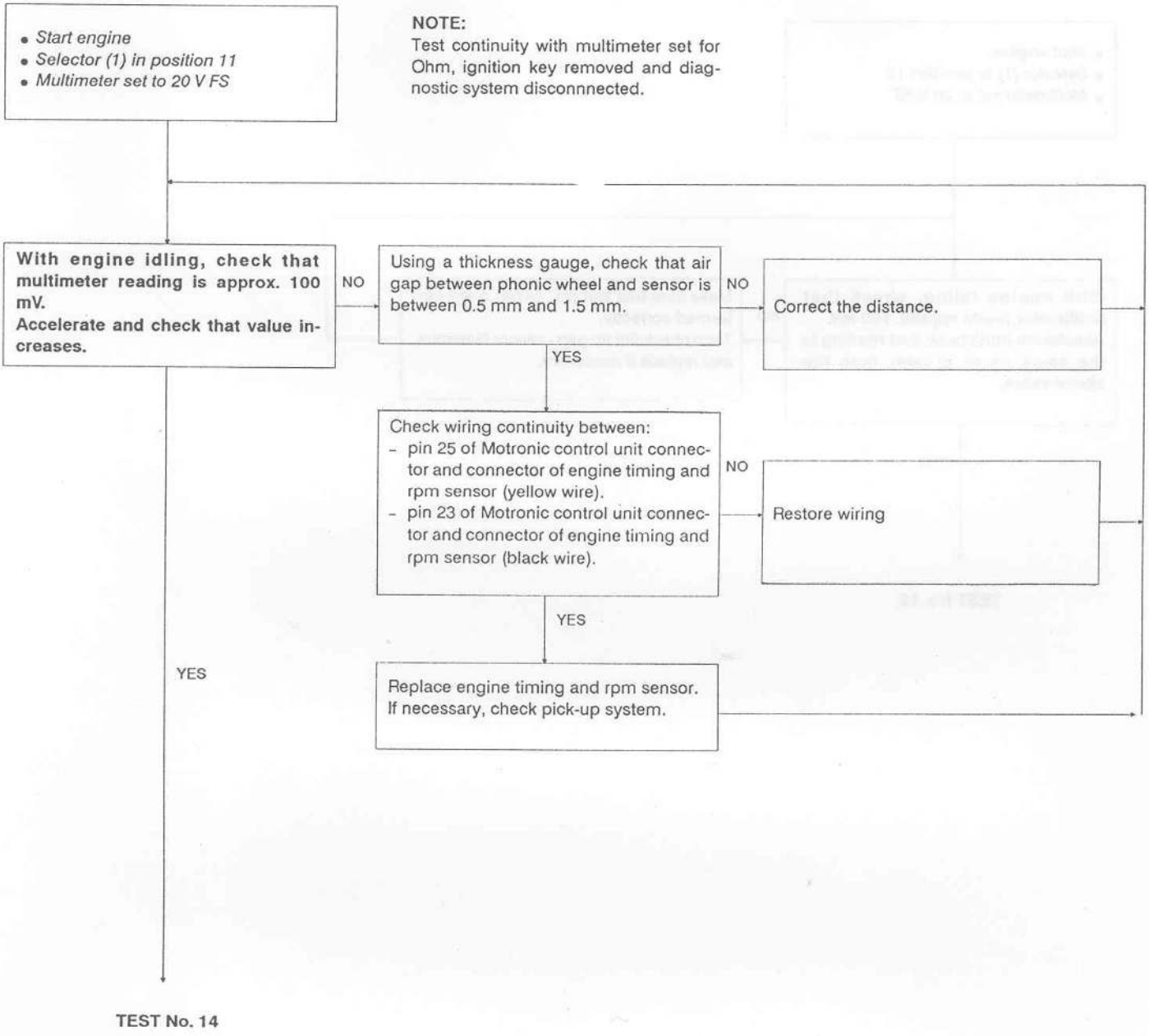
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TEST No. 12.5 - CHECK ON FUEL SUPPLY SYSTEM



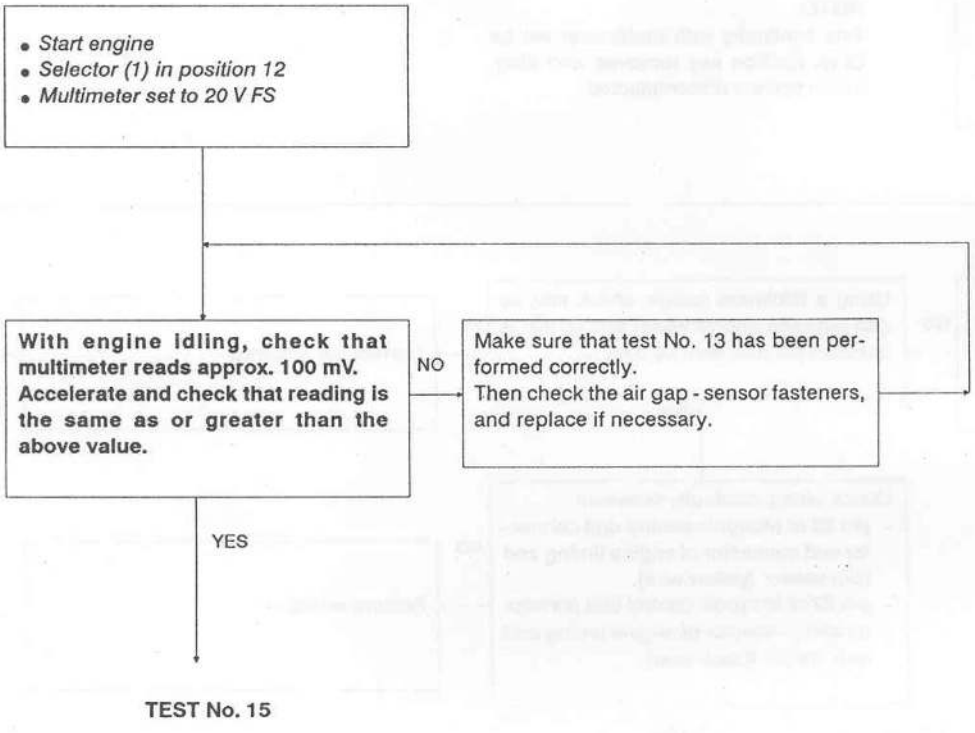
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TESTS TO BE PERFORMED IF THE ENGINE STARTS
TEST No. 13 - CHECK ON INDUCTIVE SENSOR POSITIVE HALF-WAVE



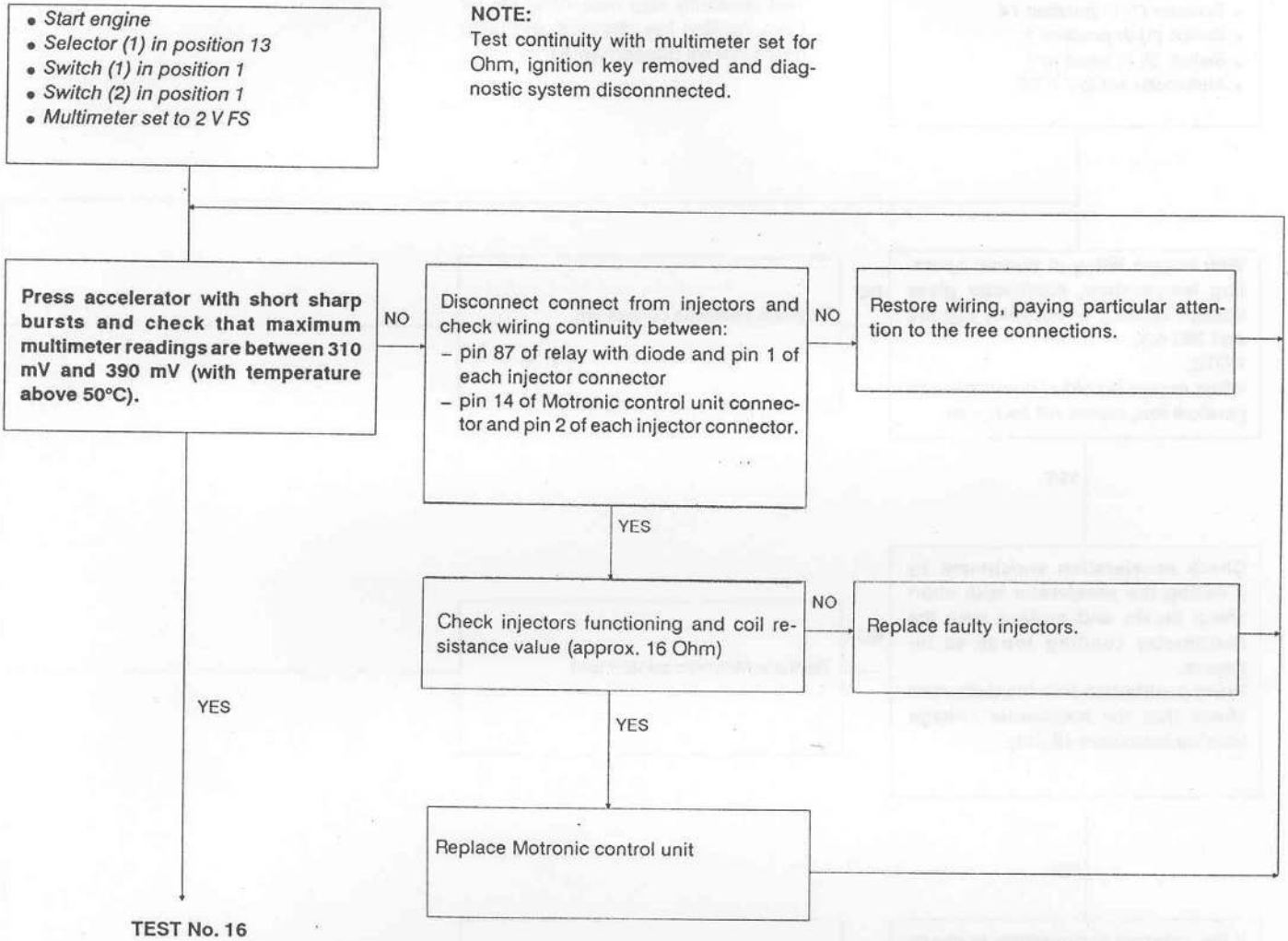
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TEST No. 14 - CHECK ON INDUCTIVE SENSOR NEGATIVE HALF- WAVE



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TEST No. 15 - CHECK ON INJECTOR CURRENT



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TEST No. 16 - CHECK ON INJECTION DURATION

- *Start engine*
- *Selector (1) in position 14*
- *Switch (1) in position 1*
- *Switch (2) in position 1*
- *Multimeter set to 2 V FS*

NOTE:
Test continuity with multimeter set for Ohm, ignition key removed and diagnostic system disconnnected.

With engine idling at normal operating temperature, multimeter gives voltage reading of between 150 mV and 300 mV.
NOTE:
When engine is cold and outside temperature low; values will be higher.

NO → Replace Motronic control uni

YES

Check acceleration enrichment by pressing the accelerator with short sharp bursts and making sure the multimeter reading tends to increase.
Press pushbutton 5 on the tester and check that the multimeter voltage reading increases slightly.

NO → Replace Motronic control unit

YES

If the external temperature is above 10°C, press pushbutton 6 on the tester and check that the multimeter voltage reading increases slightly.

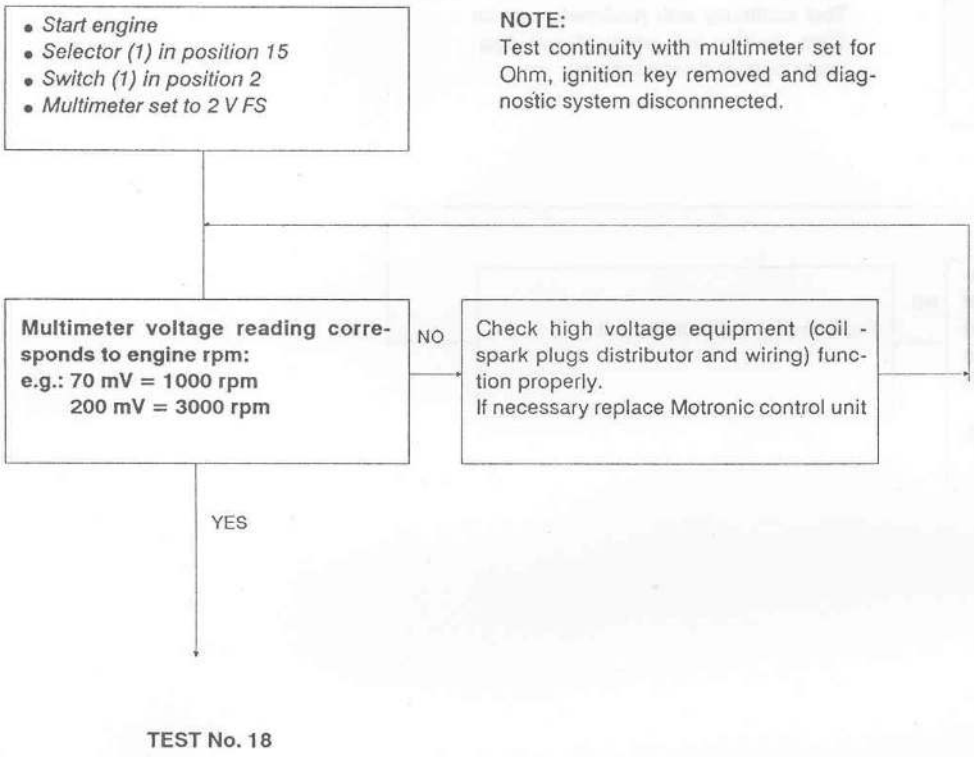
NO → Replace Motronic control unit

YES

TEST No. 17

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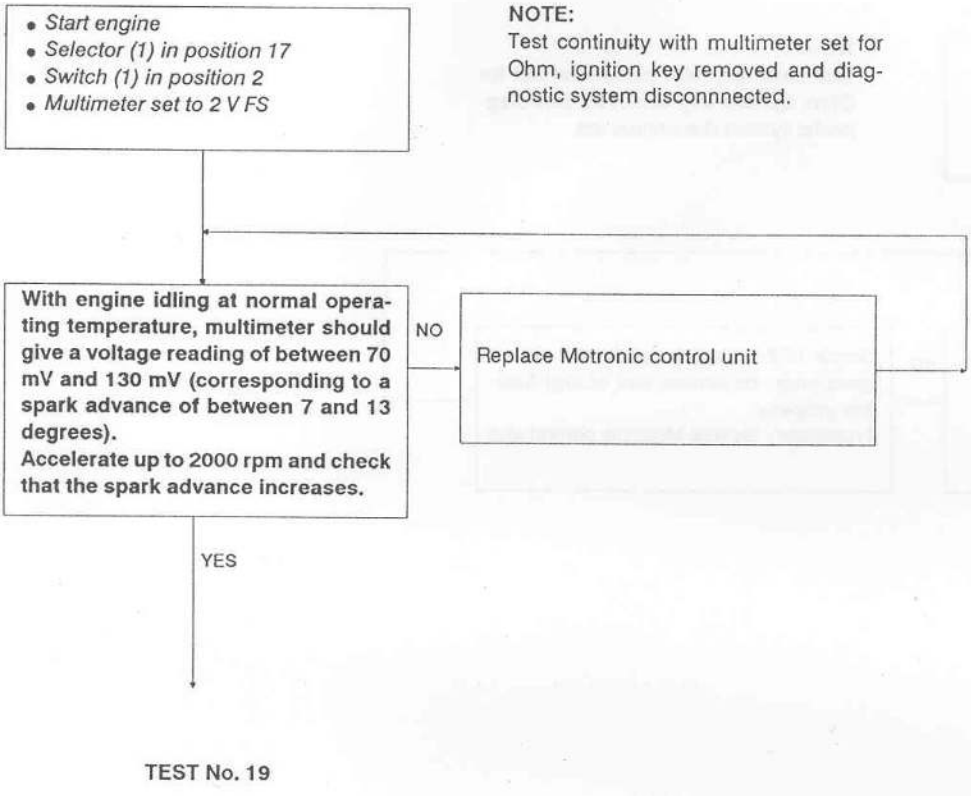
TEST No. 17 - CHECK ON COIL CONTROL



TEST No. 18

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TEST No. 18 - CHECK ON SPARK ADVANCE



TEST No. 19

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TEST No. 19 - CHECK ON IDLE SPEED ACTUATOR OPERATION

With engine idling, momentarily disconnect the connector of idle speed actuator and check that rpm increases.
NOTE:
In the event of hunting check with flow meter.
Reconnect connector and check that engine idles correctly.

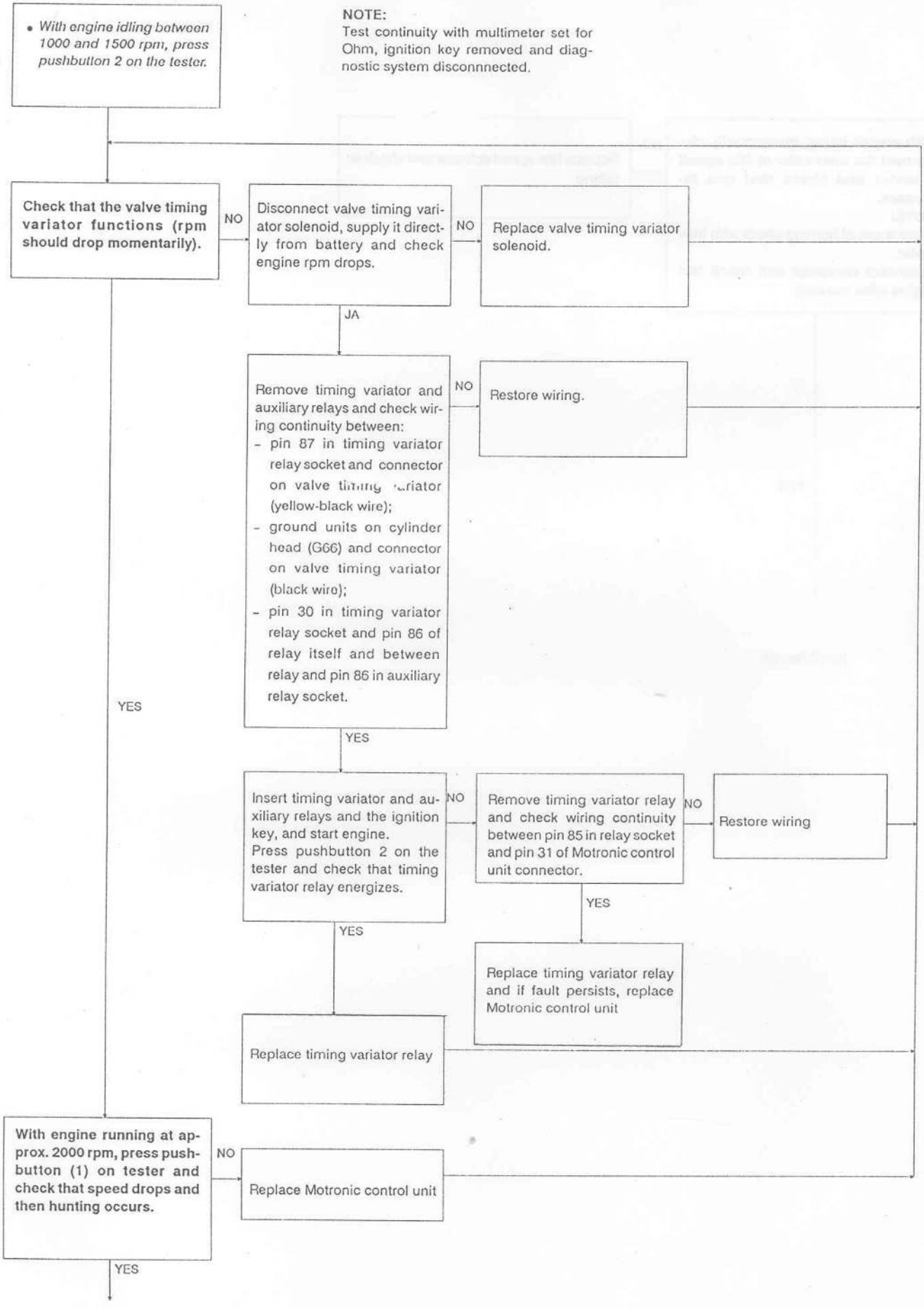
NO → Replace idle speed actuator and check air tubing

YES ↓

TEST No. 20

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TEST No. 20 - CHECK ON CONTROL UNIT FUNCTIONS



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TEST No. 21 - SPECIAL TESTS FOR VEHICLES FITTED WITH LAMBDA SENSOR

TEST No. 21.1 - LAMBDA SENSOR CHECK - CONTROL UNIT PIN 24

- *Insert the multimeter probes in the "VOLT" sockets of the tester*
- *Multimeter set to 2 V FS*
- *Selector (1) in position 22*

NOTE:
Test continuity with multimeter set for Ohm, ignition key removed and diagnostic system disconnnected.

Start the engine and make it reach the running temperature, the multimeter reading must be ranging within 100 mV and 1 V.

NO

With the wiring-side control unit comb disconnected and the lambda sensor connector unplugged, check the continuity between control comb pin 24 and lambda sensor wiring-side connector.

NO

Restore the wiring

YES

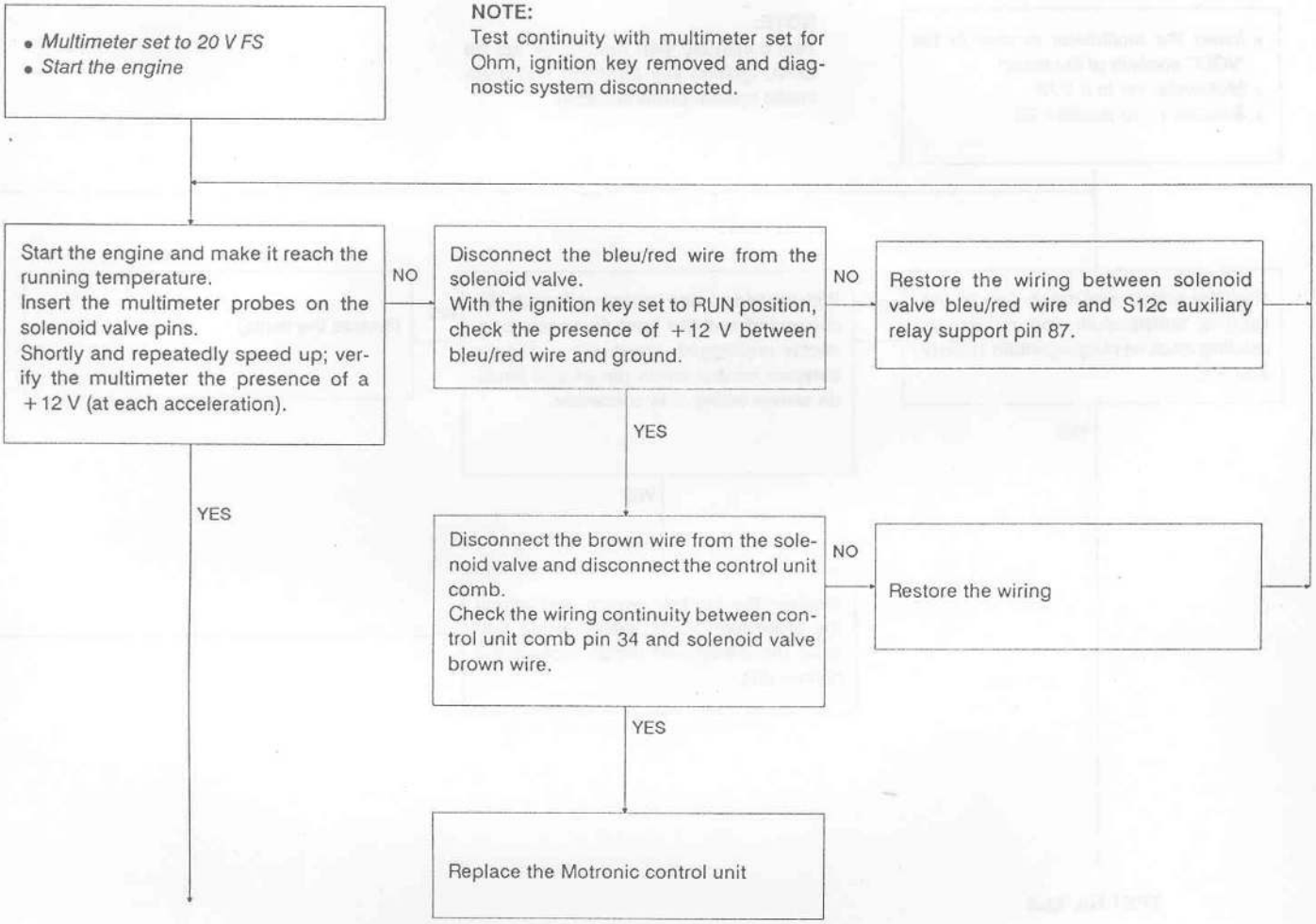
Replace the lambda sensor and repeat the procedure, if the tension value outgoes the prescribed limits, replace the control unit.

YES

TEST No. 21.2

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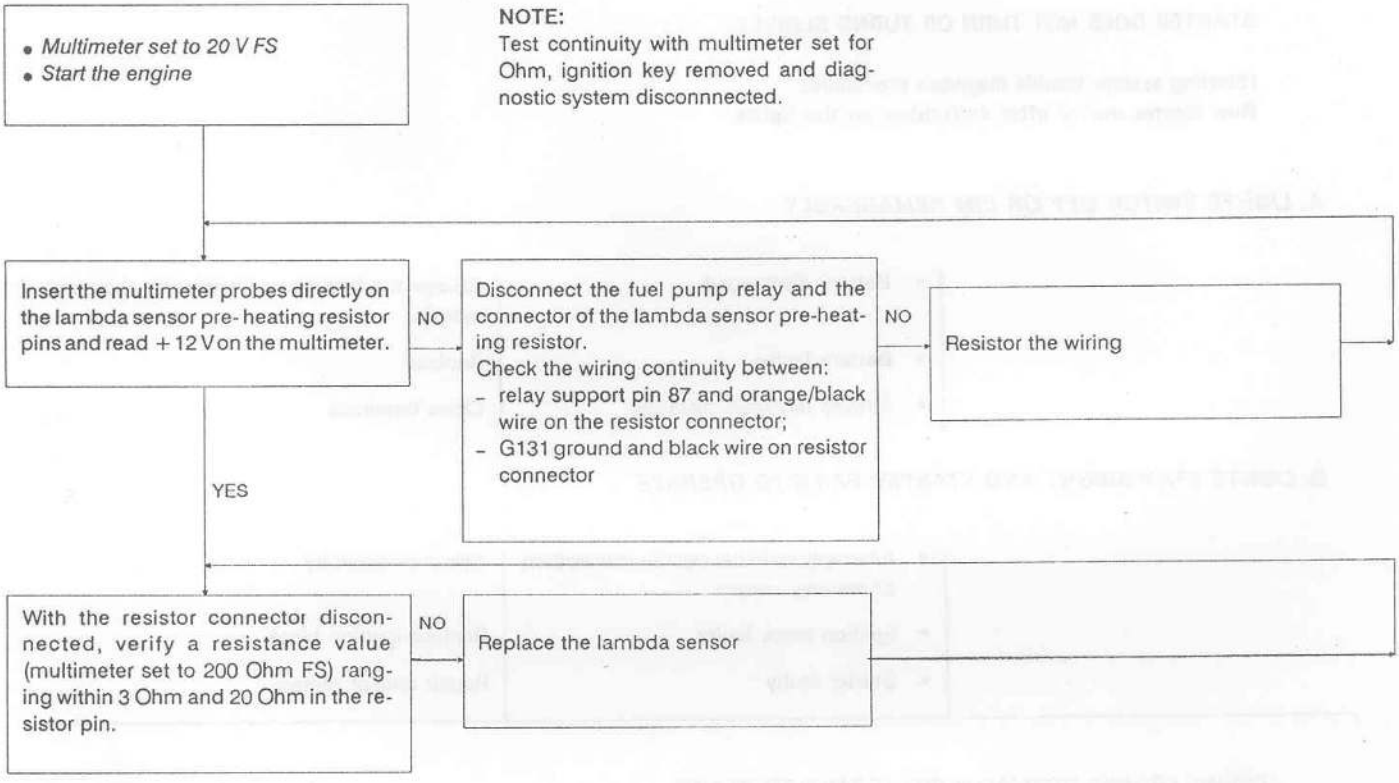
TEST No. 21.2 - CHECK ON SOLENOID VALVE CONTROLLING THE FUEL VAPOUR FLOW - CONTROL UNIT PIN 34



TEST No. 21.3

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TEST No. 21.3 - CHECK ON LAMBDA SENSOR PRE-HEATING RESISTOR POWER SUPPLY



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ENGINE TROUBLESHOOTING

Trouble	Probable cause	Corrective action
STARTER DOES NOT TURN OR TURNS SLOWLY		
(Starting system trouble diagnosis procedure) **Run starter motor after switching on the lights.**		
A. LIGHTS SWITCH OFF OR DIM REMARKABLY		
	• Battery discharged	Charge the battery and verify the charging system
	• Battery faulty	Replace
	• Battery terminals oxidized	Clean terminals
B. LIGHTS STAY BRIGHT AND STARTER FAILS TO OPERATE		
	• Interruptions in the electric connections of starting system	Restore continuity
	• Ignition block faulty	Replace ignition block
	• Starter faulty	Repair and/or replace
ENGINE CRANKS NORMALLY BUT IT FAILS TO START		
In the most cases the trouble lies in: – ignition system – fuel system Occasionally, the trouble can be due to the following: – valves operate incorrectly – poor engine compression		
Poor Compression	• Spark plugs tightening insufficient	Tighten spark plugs correctly
(Trouble diagnosis procedure) **Measure compression, then pour lubricant oil in the spark plug hole.**		
A. COMPRESSION INCREASES		
Poor sealing between cylinder and rings	• Compression rings sticking or damaged	▵ Replace compression rings
	• Cylinders too worn	▵ Overhaul engine

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Trouble	Probable cause	Corrective action
B. COMPRESSION REMAINS UNCHANGED		
Leaks through valves and head	• Valve clearance incorrect	Adjust
	• Poor tightness of valve seats	▵ Overhaul head
	• Head gasket faulty	▵ Replace gasket

VEHICLE FAILS TO REACH THE MAX SPEED

(Trouble diagnosis procedure)
Verify that: Fuel is of the prescribed type
Clutch does not slip
Wheels turn smoothly (brakes, bearings)
Tyres are at the prescribed pressure

Poor compression	• Previously mentioned	Previously mentioned
Engine overheating	• Coolant insufficient	Refill and check system tightness
	• Water pump drive belt loosened or broken	Overhaul or replace
	• Water pump faulty	○ Replace
	• Radiator clogged or leaks presence	○ Clean, repair or replace
Engine overcooling	• Thermostat faulty	○ Replace

ENGINE NOISY

(Trouble diagnosis procedure)
Verify that: Engine is not overloaded due to incorrect use of gearbox.
Check: "Knocking due to incorrect combustion"
"Mechanical knocking"

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Trouble	Probable cause	Corrective action
KNOCKING DUE TO INCORRECT COMBUSTION		
Backfire, self-ignition, detonations	• Improper fuel	Use the prescribed fuel
Incorrect ignition	• Improper spark plugs	Use the prescribed spark plugs
Mixture too lean	• Fuel delivered insufficient and/or air seepage in the air intake ducts	Check supply system
Cylinder heads faulty	• Carbon deposits in combustion chambers	▵ Disassemble heads and remove the carbon deposits
MECHANICAL KNOCKING		
Main bearing knocking	• Main bearing worn (this noise increases during acceleration)	▵ Replace bearings and grind or replace propeller shaft
Big end bearing knocking	• Big end bearings worn (noise is slightly louder with respect to that of main bearings; also this noise increases during acceleration)	▵ See previous item
Pistons noisy	• Piston and/or cylinder liners worn. (Noise is metallic and increases as soon as rotation increases; it decreases when engine is hot)	▵ Overhaul engine
Valves noisy	• Valve clearance adjustment incorrect	Adjust
Water pump noisy	• Rotor backlash	○ Replace pump
Alternator noisy	• Bearing backlash	◇ Replace bearings
Exhaust noisy	• Exhaust system components loosened or damaged	□ Check and replace if required

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Trouble	Probable cause	Corrective action
EXCESSIVE OIL CONSUMPTION		
Oil leaks	• Drain plug loosened	Tighten
	• Oil sump screws loosened	Tighten or replace
	• Oil sump gasket and/or oil seal rings inefficient	Replace gasket and/or oil seal rings
	• Oil filter loosened	Tighten, or replace if required
	• Oil pressure switch loosened	Tighten
	• Oil dipstick poor tightness	Replace dipstick
Excessive oil consumption	• Cylinders and pistons worn	△ Grind cylinders and replace pistons
	• Compression rings mounted incorrectly	△ Restore correct mounting
	• Compression rings worn	△ Replace compression rings, or grind cylinder and replace pistons if required
	• Valve guide and rubbers worn	△ Replace valve guides and rubbers
Other	• Valve stem worn	△ Replace valves
	• Improper oil grade	Change oil and refill with that prescribed
	• Engine overheating	Previously mentioned

EXCESSIVE FUEL CONSUMPTION

WARNING:
The utmost care is recommended in the measuring of fuel consumption, since speed, load, type of road and driving habits highly affect fuel consumption.

Engine power not up to normal	• Previously mentioned	Previously mentioned
Faults in the fuel system	• Accelerator return incorrect	Adjust
	• Fuel leaks	□ Check fuel feed circuit tightness
	• Air filtered clogged	Replace filter

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Trouble	Probable cause	Corrective action
OTHER TROUBLES		
Oil pressure reduced	• Unsuitable oil	Use the oil prescribed
	• Oil quantity insufficient	Top-up with the oil prescribed
	• Overheating	Previously mentioned
	• Oil pump pressure relief valve inefficient, or spring incorrect setting	Repair or replace
	• Excessive backlash in the sliding surfaces	△ Overhaul engine
	• Oil filter clogged	Replace cartridge
	• Oil pressure switch faulty	Replace
Sliding surfaces too worn	• Oil pressure insufficient	Previously mentioned
	• Improper oil quality or oil fouling	Use proper oil (replace cartridge)
	• Air filter defective	Replace cartridge
	• Overheating or overcooling	Previously mentioned
Seizing of sliding surfaces	• Oil pressure insufficient	Previously mentioned
	• Backlash insufficient	△ Replace the damaged parts checking backlashes
	• Overheating	Previously mentioned

△ Refer to Unit 01
□ Refer to Unit 04
◇ Refer to Unit 05
○ Refer to Unit 07

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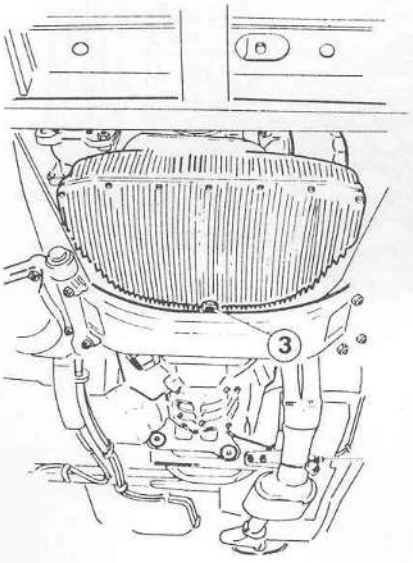
ENGINE MAINTENANCE - CARBURETTERS VERSION

ENGINE MAIN MECHANICAL UNIT

REPLACEMENT OF ENGINE OIL AND OIL FILTER — CHECK OF LUBRICATION SYSTEM TIGHTNESS

1. On hot engine, remove the oil filler plug and the oil sump plug, draining oil completely (wait **15 minutes** at least).

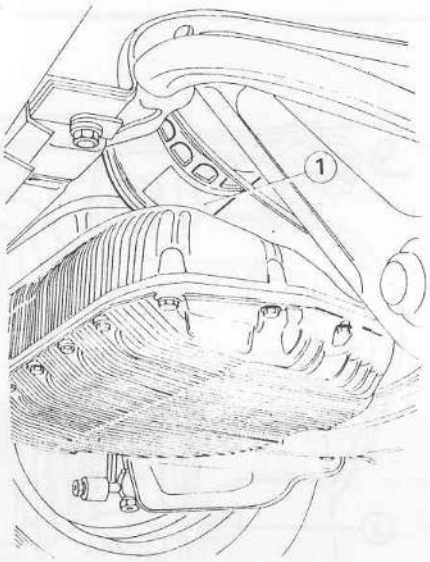




1 Oil filler plug
2 Oil dipstick
3 Oil drain plug

- **A milky oil indicates the presence of coolant leaks in the oil. Identify the cause and take corrective measures.**
- **An oil with extremely low viscosity, indicates dilution with fuel.**

2. Release oil filter, then remove it using appropriate wrench.



1 Oil filter

3. When engine oil is completely drained, clean the drain plug and tighten it on sump, together with the related gasket.
4. Moisten the oil filter gasket and tighten thoroughly.
5. Refill engine with the type and quantity of oil prescribed.

ENGINE OIL

Type:
AGIP Sint 2000 10W40
IP Sintiax 10W40
SHELL Super Plus
Motor Oil 15W50

Quantity (1)	6.0 kg - 6.6 l (13 lb)
Circuit capacity	6.37 kg - 7.16 l (14 lb)
Cylinder head support sumps (2)	415 g (0.91 lb)
Filter capacity	0.5 kg - 0.56 l (1.1 lb)

(1) Quantity required for complete oil change
(2) Refiling to be carried out for each support sump when disassembling

6. Check oil level by means of the dipstick.
7. Re-insert filler plug and start the engine, letting it idle for about 2 minutes.
8. Check for lubricant leaks. If necessary, replace or tighten any item with poor oil seal.
9. Switch off the engine and wait for a few minutes.
10. Remove the dipstick and clean it; insert the dipstick again, remove it, and verify that oil level reaches the MAX reference mark.

WARNING:
The oil level check is to be carried out with the vehicle parked on a level surface.

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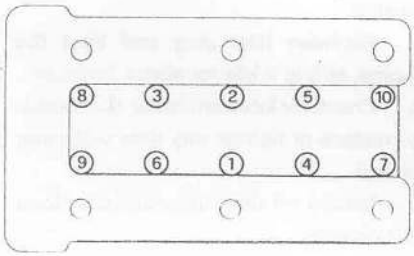
TIGHTENING OF CYLINDER HEAD NUTS

1. During first free maintenance operation.

a. On cold engine, loosen nuts by one turn, one at a time, according to the order indicated, moisten the surfaces between washer and nut with oil; tighten to the prescribed torque.

Ⓣ : **Tightening torques**

86 ÷ 88 N·m
(8.8 ÷ 9 kg·m
63 ÷ 65 ft·lb)



2. When reassembling cylinder head.

a. Lubricate washer, nut and threading with engine oil and, on cold engine, tighten nuts to the prescribed torque, tightening them gradually and at intervals.

Ⓣ : **Tightening torques**

77 ÷ 79 N·m
(7.9 ÷ 8.1 kg ·m
57 ÷ 58 ft ·lb)

b. After having covered about 1000 km (1250 miles) operate, with cold engine, as per step 1.

CHECK AND ADJUSTMENT OF VALVE CLEARANCE

The following operations are to be carried out on cold engine.

1. Remove camshaft cover.

a. Detach the battery negative terminal.

b. Detach the spark plug cables (1).

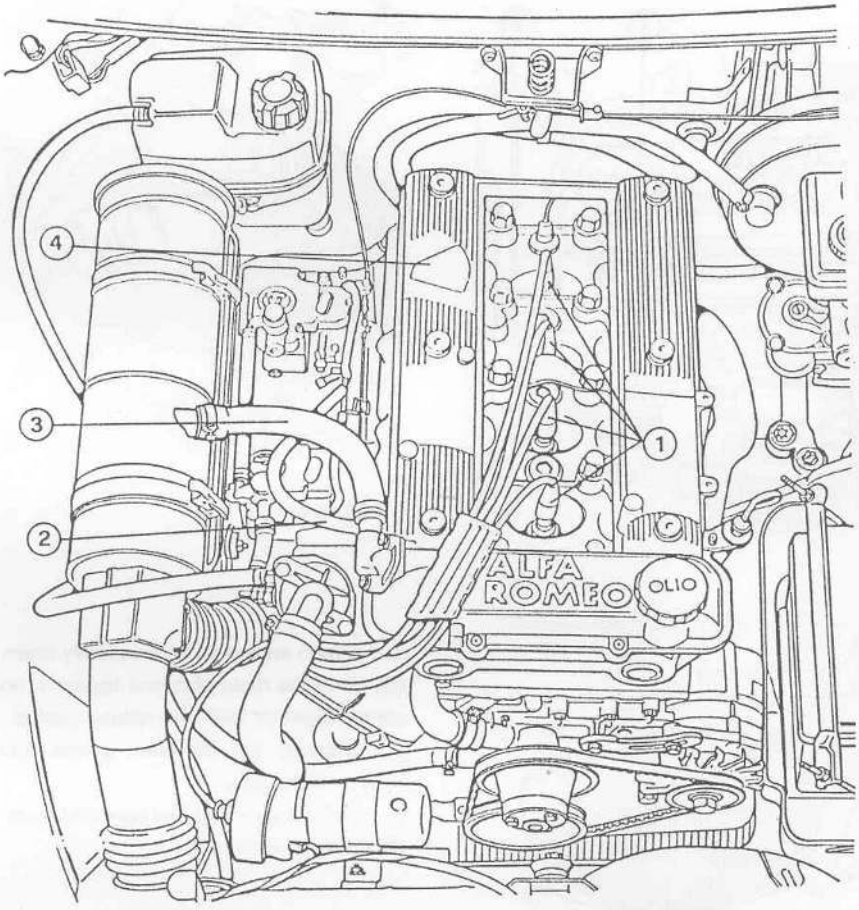
c. Detach hoses (2) and (3) from the filler plug on the camshaft cover.

d. Unscrew the front and upper screws securing the camshaft the cover (4) and remove the latter.

2. Clean the spark plug seats, remove spark plugs and plug the holes to prevent foreign matter from entering.

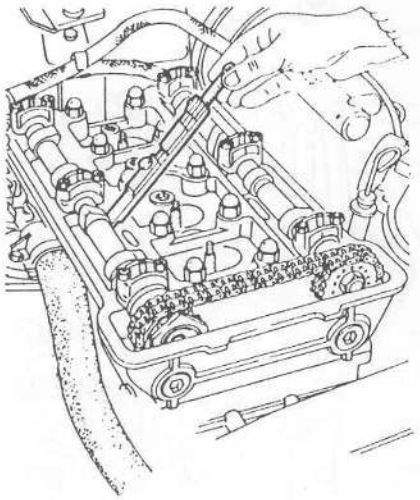
3. On cold engine and by means of feeler gauge, check that the clearance between the cams resting radius and cups crown, is within the prescribed values.

Valve clearance (on cold engine)
Intake:
0.400 thru 0.450 mm
(0.0157 thru 0.0177 in)
Exhaust:
0.450 thru 0.500 mm
(0.0177 thru 0.0197 in)



1 Spark plug cables
2 Blow-by pipe at idle r.p.m.
3 Blow-by pipe at peak r.p.m.
4 Camshaft cover

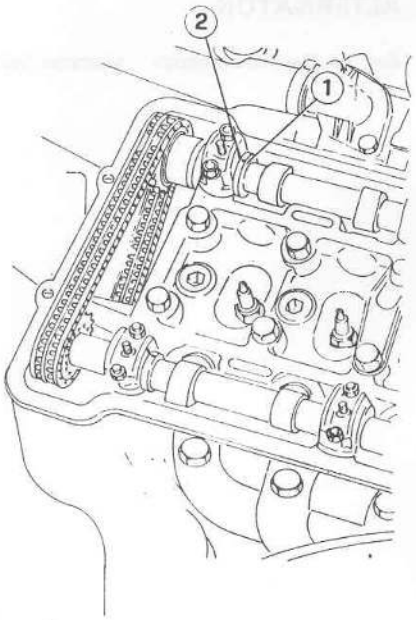
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4. If the clearance is not within the prescribed values, carry out the adjustment operating as follows.

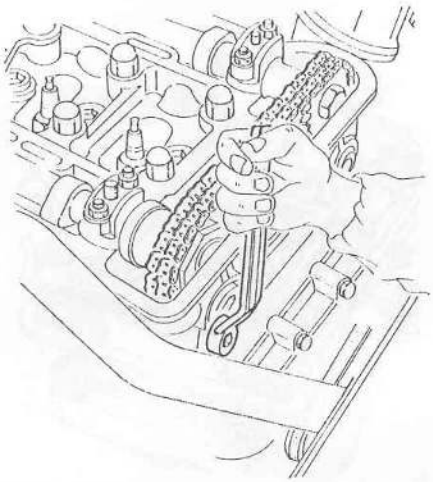
a. Rotate crankshaft until the notches (1) on camshaft are aligned with the notches (2) present on the related caps.

When in this position, the alignment between fixed index and notch P on front pulley must correspond, with cylinder n. 1 in the expansion stroke (cams outwards).



1 Camshaft notches
2 Cap notches

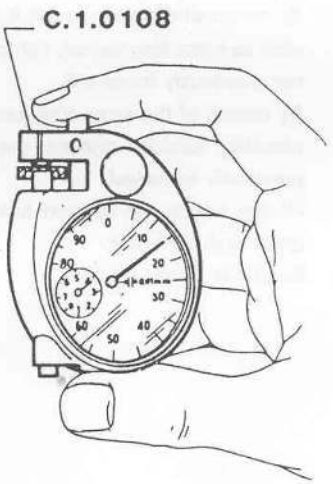
b. Release the chain tightener securing screw, compress the chain downwards so as to overcome the tension load of chain tightener spring; lock chain tightener in this position.

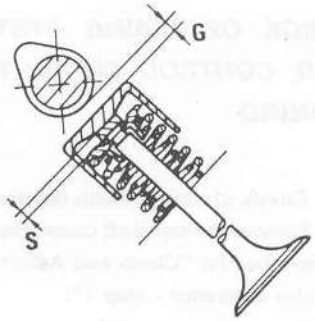


c. Remove camshaft caps, taking care not to move the chain with respect to gears; remove the complete camshaft and the chain, then rest them on the central part of head.

d. Withdraw valve bowl and the valve clearance adjusting cap; measure shim **S** by means of feeler gauge **C.1.0108.**

e. Select a new cap of suitable thickness; caps are available with thickness within **1.3 thru 3.5 mm (0.051 thru 0.138 in)**, with **0.025 mm (0.00098 in)** increments.



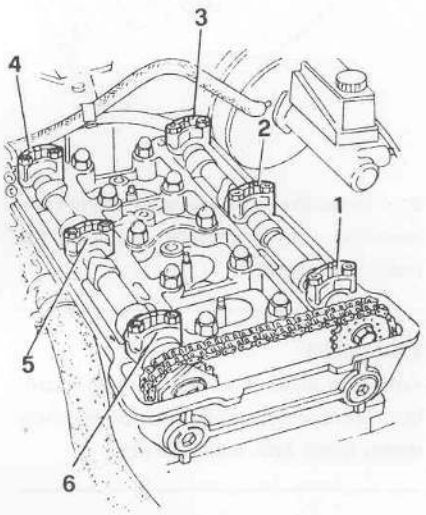


G: Valve clearance
S: Adjusting cap thickness

f. Refit valve bowl (after lubricating with engine oil), camshaft and chain.

g. Install caps on camshaft following the numbering marked on them.

Ⓣ : **Tightening torque**
Nuts securing camshaft caps (in oil)
20 thru 22 N·m
(2 thru 2.25 kg·m)
(15 thru 16 ft·lb)



5. Carry out the chain tensioning, recheck valve clearance, then proceed to adjust the timing system (refer to: Check of Timing System and Control Chain Tensioning).

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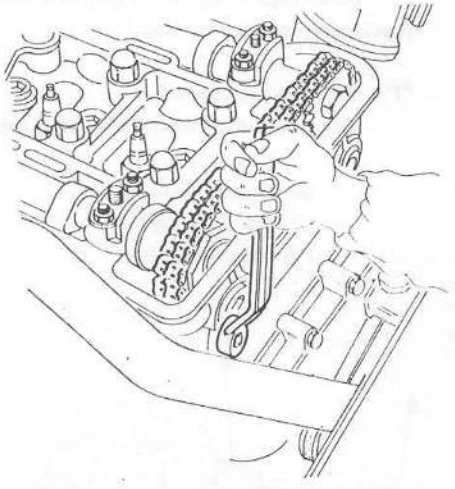
CHECK OF TIMING SYSTEM AND CONTROL CHAIN TENSIONING

1. Check of timing chain tensioning.

a. Remove the camshaft cover operating as described in: "Check and Adjustment of Valve Clearance - step 1".

b. Loosen the chain tightener securing screw.

c. Engage the 5th speed, move vehicle forwards and backwards and, keeping chain stretched, lock the chain tightener securing screw.



d. Install the camshaft cover and the surrounding components by reversing the order of removal.

WARNING:
Take the utmost care when positioning the rear seal rings interposed between head and valve cover.

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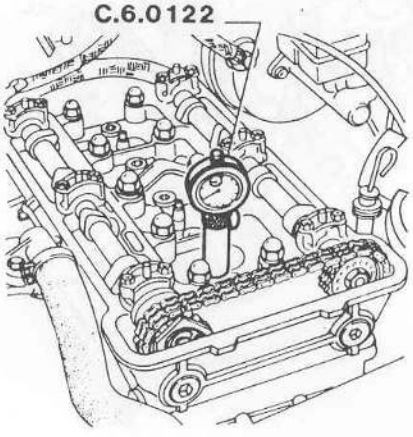
2. Adjustment of timing system.

Check is to be carried out with valve clearance to the prescribed torque and timing chain normally tensioned.

a. Remove the camshaft cover (refer to: Check and Adjustment of Valve Clearance - step 1.).

b. Clean the spark plug seat of first cylinder, remove the spark plug and insert tool **C.6.0122**, fitted with comparator, into the spark plug support hole.

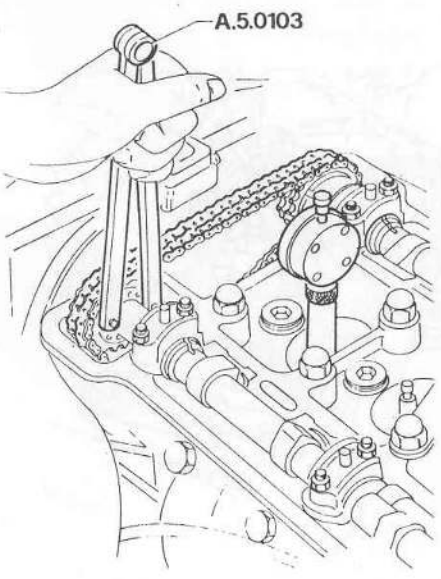
c. Engage the 5th speed and move vehicle forward and backward until the comparator needle stops oscillating (piston n. 1 at T.D.C., with valves closed and the notch P, marked on pulley, aligned with index on front cover).



d. Make sure that, when the cams of cylinder n. 1 are outwards, the notches on camshaft pins are aligned with those on caps.

e. If the notches on camshafts are not aligned, proceed as follows.

- Lift the edge of the nut clamp and, by means of tool **A.5.0103** used as blocking device, loosen the retaining nut securing gear to camshaft.
- Remove the bolt securing gear to the sleeve on camshaft.
- By means of the same tool **A.5.0103**, used as a blocking device, tighten the nut previously loosened.
- By means of the same tool, used as blocking device, tighten the nut previously loosened.
- Fit the nut in the aligned holes of gears and tighten it.
- Bend the clamp on nut.



f. Install the timing system cover by reversing the order of removal.

WARNING:
Take the utmost care when positioning the rear seal rings interposed between head and valve cover.

CHECKING GOOD CONDITIONS, REPLACING AND ADJUSTING DRIVE BELTS OF ALTERNATOR

See Engine Maintenance - Injection Version.

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CHECK OF CYLINDER COMPRESSION

See Engine Maintenance - Injection Version.

FUEL SYSTEM

CHECK AND ADJUSTMENT OF ACCELERATOR CONTROL

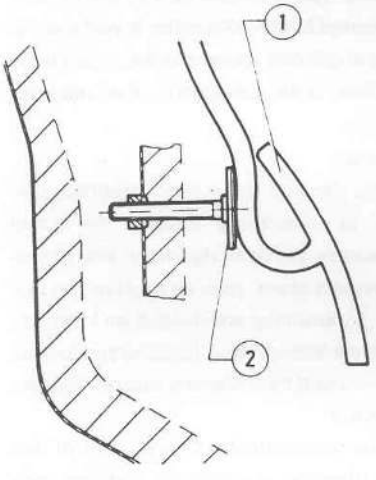
1. Control system check.

Check that the rods which form the control system can move freely.

2. Throttle valve max opening check.

a. Check that, with the accelerator pedal (1) fully pressed, up or down the corresponding throttle valve opening position, minimum or maximum, is achieved.

b. If necessary, adjust by operating on the end-of-travel screw (2) and the joints of the control rods.



1 Accelerator pedal
2 End-of-travel screw

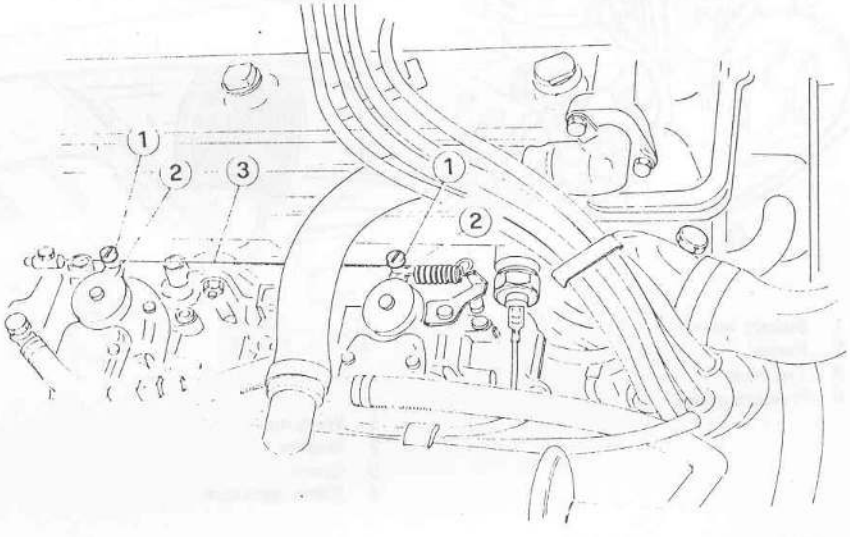
CHECK AND ADJUSTMENT OF CHOKE CONTROL

1. Check of cable sliding

Operate the choke control to verify that the cable slides freely into its sheath.

2. Adjustment

a. Loosen blocks (1) securing choke cable (3) to levers (2) on carburetters.



1 Choke cable blocks
2 Choke control levers
3 Choke cable

b. From inside the vehicle, operate the choke control moving it by **2 mm** approx.

c. Rotate and bring to end-of-travel levers overcoming the return springs (2) reaction; block the cable in this position by means of blocks (1) taking care to keep the cable taut.

CHECK OF FUEL SYSTEM PRESSURE AND SYSTEM TIGHTNESS

Carry out the check operating as follows:

1. Disconnect the fuel delivery hose between pump and carburetter.
2. Connect a pressure gauge, through a union-tee, at the ends of the inlet line previously disconnected.
3. Start the engine and, at zero delivery, hose throttled on the delivery after pressure gauge, and pressure gauge kept at the same geometrical dimension of pump, check, that with the engine running at

5.000 to 6.000 rpm

the pressure is within

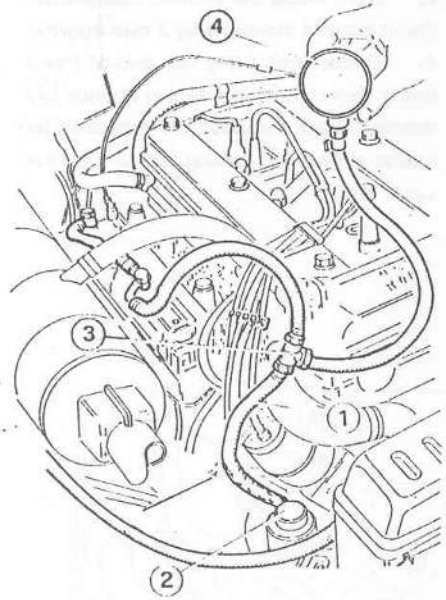
29.4 to 44.1 kPa
(0.294 to 0.441 bar;
0.30 to 0.45 kg/cm²;
4.26 to 6.4 p.s.i.).

4. Also check for leaks in the fuel supply unions and piping.

Carry out the checks rapidly so as to restore the system correct functioning without stressing the pump excessively.

5. If the fuel pressure does not reach the prescribed value and no leaks are present, check the pump functioning.

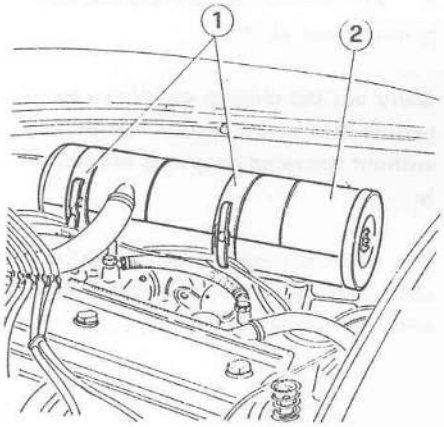
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1 Supply hose
2 Pump
3 Tee hose
4 Pressure gauge

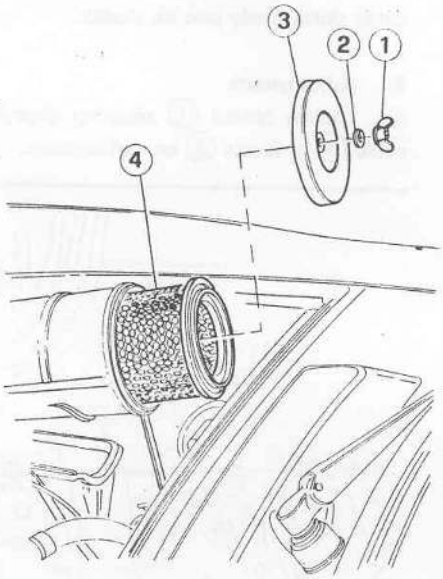
CHECK AND CLEANING OF AIR FILTER - CARTRIDGE REPLACEMENT

1. Release clips (1) securing filter container (2) to tank on the intake manifold.



1 Clips
2 Filter container

2. Raise container rear, unscrew wing nut (1), slide off cover (3) and withdraw cartridge (4).



1 Wing nut
2 Washer
3 Cover
4 Filter cartridge

3. Clean the cartridge thoroughly by blowing compressed air (at a low pressure) from outside inwards; clean the container thoroughly.

4. Insert the cartridge and re-assemble the cover being sure to position the gasket correctly and screw the wing nut tight.

5. Re-install the container on the tank ensuring that the gasket on the latter is duly inserted in its housing; fasten and lock the clips.

Replace the cartridge periodically (refer to: "Vehicle Maintenance Schedule").

CLEANING OF CARBURETTER JETS AND SPARK ARRESTER OF BREATHER GAS RETURN SYSTEM

1. Jets cleaning

If required, clean carburetter jets and the piping of breather gas return system operating as follows.

a. Remove main jets and those relevant to idle r.p.m.

b. Thoroughly clean the jets with gasoline and blow them with compressed air (do not use sharp metal tools or any tool which might alter the holes shape). Blow the ducts housing the jets.

2. Oil vapour and breather gas return system

The return of breather gases and oil vapours, which are generated inside engine block, and consequently burnt in the cylinders, is realized through blow-by hoses.

For any type of engine r.p.m., the vacuum generated in the carburetter is sufficient to convey gas and vapours in the intake duct, and then in the cylinders for the final combustion.

In detail:

At the idle and low r.p.m. (throttles partially or completely closed) the outlet vapours on the front righthand side of timing system cover, pass through return piping (2) and they are divided on both carburetters through four holes with diameter of 1 mm and then they are burnt in the four cylinders.

At the intermediate r.p.m., and at full load (throttle opened) the vapours pass through return piping (3) through spark arrester (4) and enter filter (1) on the clean side of filtering cartridge, then they join the intake air and are burnt in the four cylinders.

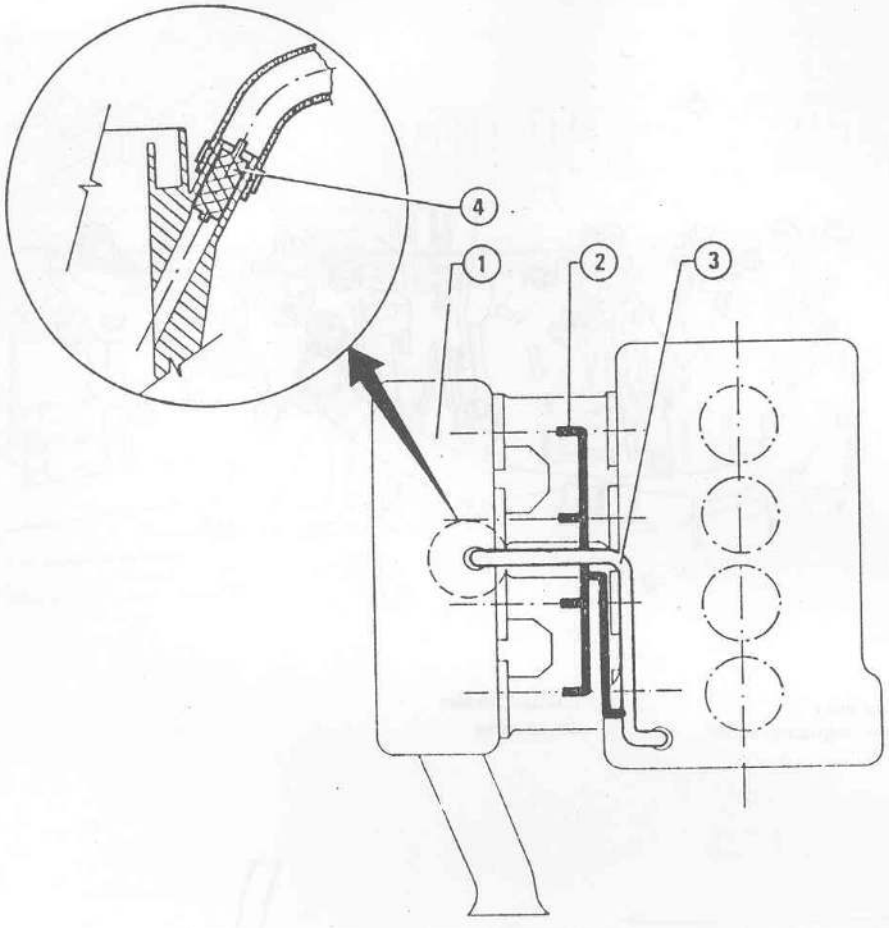
Checks

a. Check good conditions of peak and idle r.p.m. piping and the related connections; verify that no leaks are present.

b. Detach piping and clean it with an air jet. Replace if necessary.

c. Withdraw the spark arrester, located in the peak r.p.m. blow-by duct on air filter inlet, wash it with specific products, blow it with compressed air, then install it.

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1 Air cleaner
2 Return piping at idle r.p.m.
3 Return piping and peak r.p.m.
4 Spark arrester

g. Start the engine and bring it to the normal running temperature; then stop it.

h. Disconnect the oil vapours vent hoses from carburetters and then connect the four hoses of the four-column vacuum gauge C.2.0014/0001.

i. Start the engine and operate the throttle opening adjusting screw (2) so as to obtain the idle r.p.m. prescribed of

Idle r.p.m.

$$900\ ^{+100}_{-50}\ \text{r.p.m.}$$

At the same time, ensure that the average value of the vacuums in cylinders **1st** and **2nd** and **3rd** and **4th**, is present in the ducts leading to these cylinders by operating on the throttle synchronizing screw (3) and keeping the idle r.p.m. to the prescribed value (preferably towards the lower limit).

l. Eliminate any throbbing of the engine by operating a mixture screws (4), without compromising the compatibility between the vacuum value and the idle r.p.m.

CHECK AND ADJUSTMENT OF IDLE R.P.M. AND EXHAUST EMISSIONS

1. Adjustment of idle r.p.m.

This adjustment is to be carried out with engine at normal running temperature, speed gear to neutral, and all the ancillary devices excluded. Operate as follows.

a. Make sure that the accelerator control cable is correctly adjusted (refer to: Check and Adjustment of Accelerator Control).

b. Unscrew completely the throttle opening adjusting screw (2) located on rear carburetter.

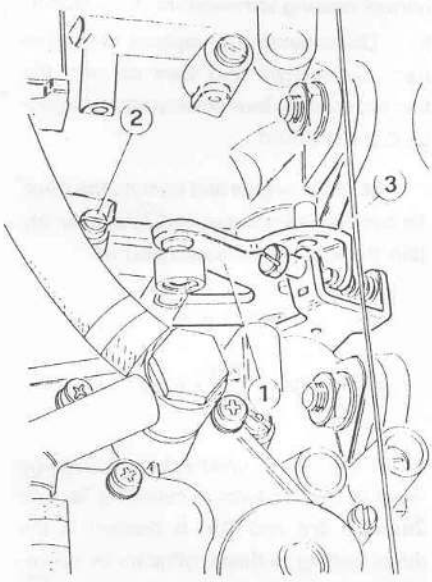
c. Unscrew screw (3) of the carburetters coupling and press control lever (1) so that all four throttle valves are closed.

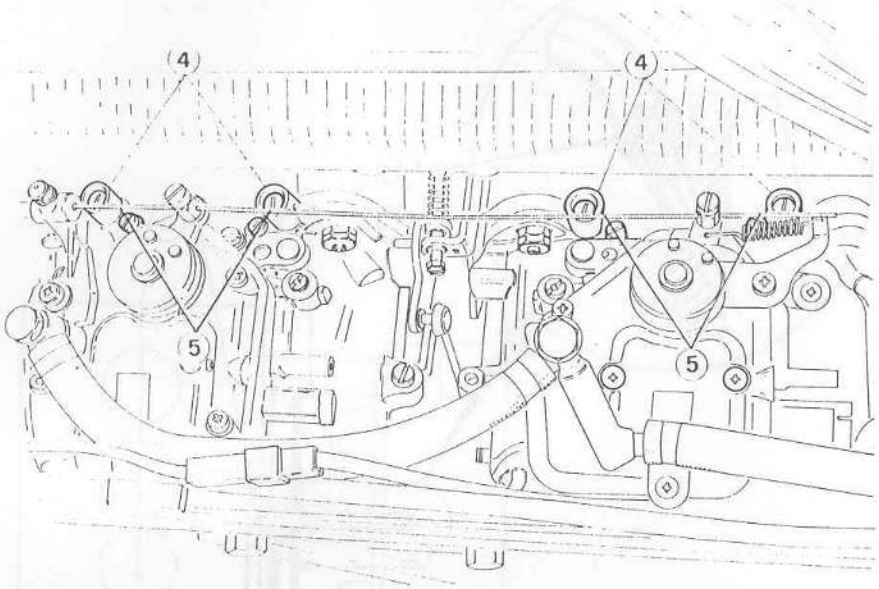
d. Always pressing the lever, tighten screw (3) of coupling, until it barely touches the lever on rear carburetters.

e. Screw the throttles opening adjusting screw (2) **by 1 to 2 turns** over the contact position with lever (1) of rear carburetter.

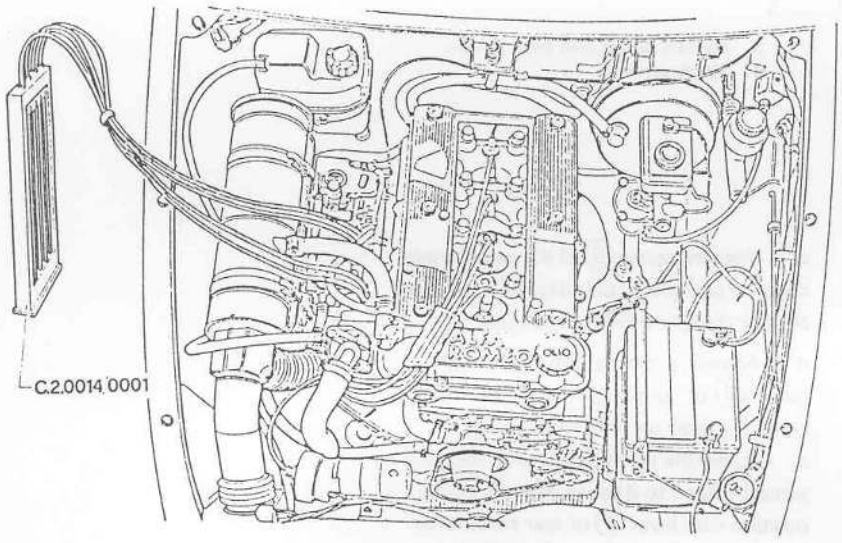
f. Remove the sealing caps from mixture screws (4) seats, then tighten mixture screws (4) completely, without forcing, then unscrew them **by 4 to 6 turns**.

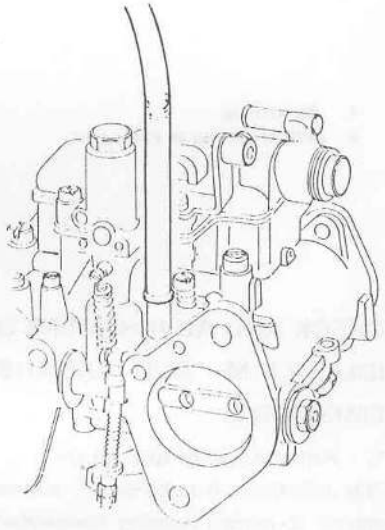
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1 Throttle control lever
2 Throttle opening adjusting screw
3 Balancing screw
4 Mixture screws
5 Choke cable



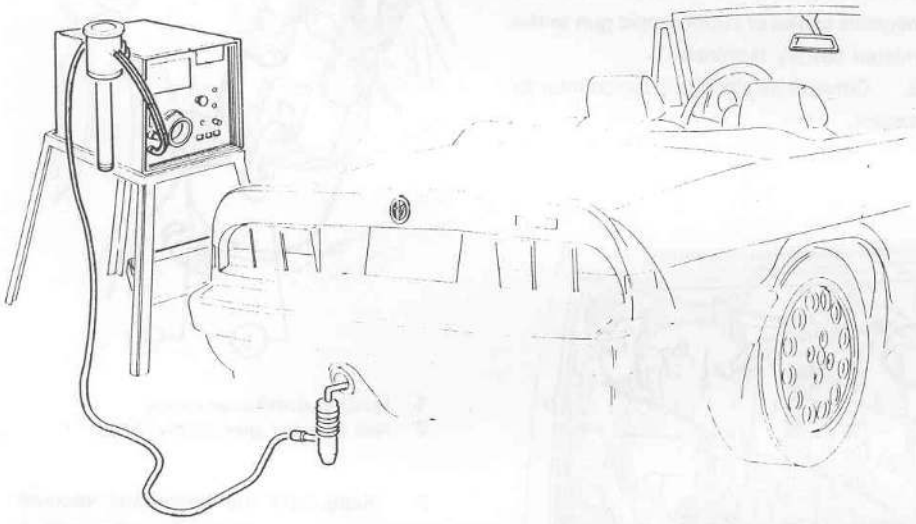


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2. Check and adjustment of exhaust emissions (carbon monoxide percentage CO%).

This check is to be carried out with engine at normal running temperature and after having carried out the idle r.p.m. adjustment (refer to: Adjustment of idle r.p.m.). Also the following preliminary checks are to be performed:

- Check of engine oil level
- Cleaning of air filter cartridge
- Efficiency of ignition system
- Ignition timing

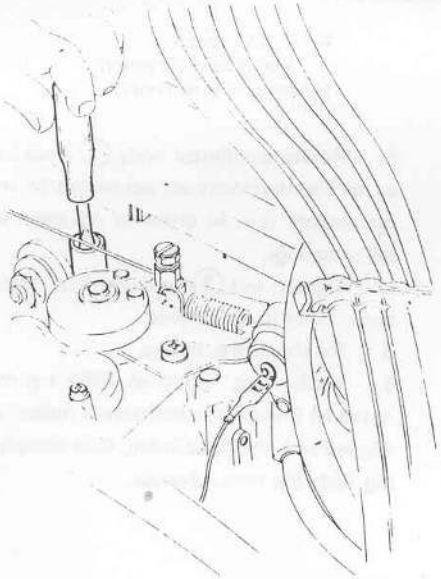


a. Insert the tester probe into the tail pipe; the carbon monoxide percentage (CO%), read on tester, shall be within the prescribed values.

$$\% \text{ CO} \leqslant 3.5$$

b. If the CO percentage is not within the specific range, operate on carburetters and remove the sealing caps, then operate on the mixture screws; make sure that the idle r.p.m., vacuum average value to be measured on vacuum gauge, and the idle r.p.m. throbbing remain unchanged.

It is advisable to keep the adjustment value as low as possible (compatibility with the engine functioning evenness) in order to allow the adjustment to remain within the mentioned max value when vehicle is used for any lenght of time.



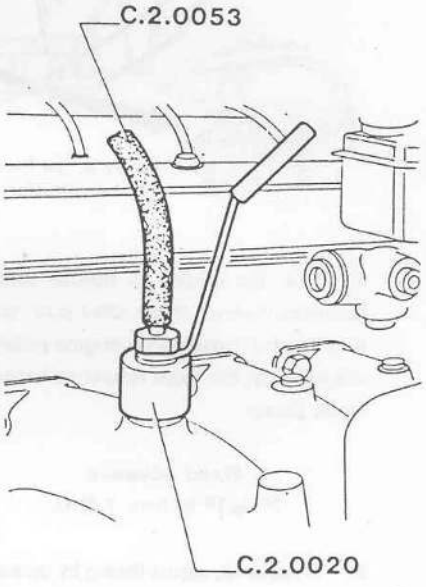
c. Disconnect all measurement instruments and fit the sealing caps on the mixture screws seats.

3. Check of exhaust emissions cylinder to cylinder

For a better adjustment, the plugs on each exhaust manifold (immediately after the outlet from cylinder head) can be removed and tester probe inserted, in order to measure the CO emitted by each cylinder. This also permits a better engine functioning evenness to be obtained because, since the various cylinder CO is balanced, also the related functioning conditions are balanced.

In this case, the procedure to be followed is that described in step 2. taking into account the following indications.

- Operating on one cylinder at a time, remove the plug on the related exhaust manifold and connect union **C.2.0020** with hose **C.2.0053** for the CO tester.
  Operate on mixture screw so as to adjust the CO of the cylinder in object to a value not exceeding the max allowed by the standards. Refit plug on the exhaust manifold.
- Adjust the ramaining cylinders CO% in the same way.



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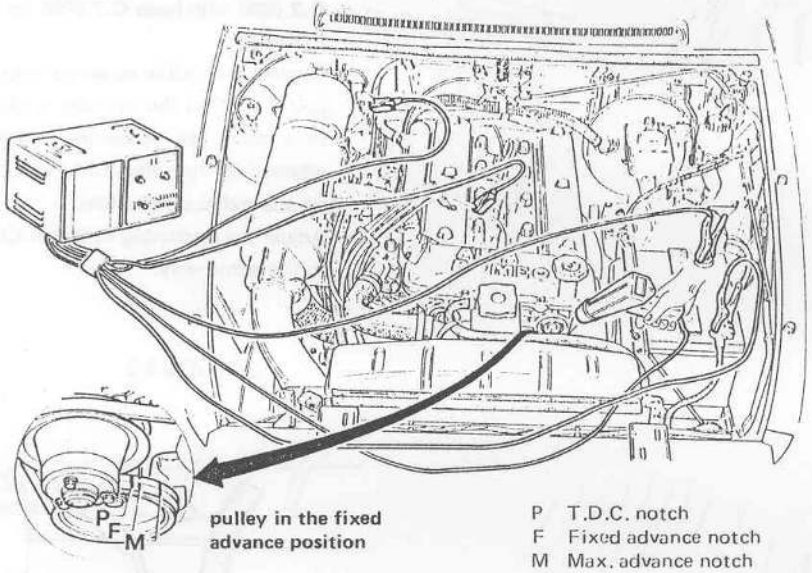
It is advisable to keep the real adjustment value as low as possible (compatibility with the engine functioning evenness) in order to permit the max CO allowed to be complied when vehicle, is used for any lenght of time.
Take into account that when adjusting the CO value, it is necessary to keep the idle r.p.m. to the prescribed value.

ENGINE IGNITION

CHECK OF IGNITION TIMING

WARNING:
Checking of idle r.p.m. timing, must be carried out with the utmost care; a correct timing in fact, is the most important factor as far as the emission levels are concerned.

1. Detach the vacuum intake hose for the pneumatic advance, from ignition distributor.
2. Connect the stroboscopic gun to the terminal of cylinder **n. 1** on ignition distributor; connect both positive and negative cables of stroboscopic gun to the related battery terminals.
3. Connect an electronic rev counter to engine.



pulley in the fixed advance position

P T.D.C. notch
F Fixed advance notch
M Max. advance notch

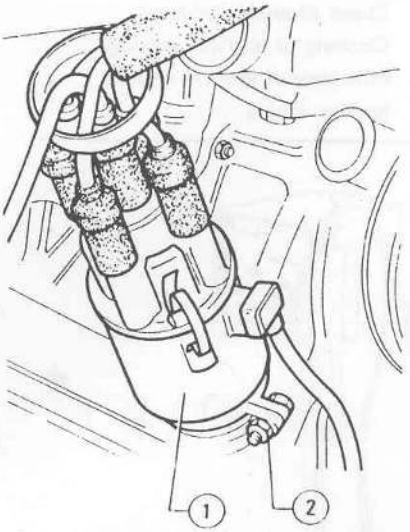
4. Run the engine to normal running temperature and, at the idle r.p.m. check that notch **F** (marked on engine pulley) is aligned with the fixed reference index on water pump.

Fixed advance
7° ±1° before T.D.C.

5. If required, adjust timing by operating as follows.
a. Unscrew nut (2) of the ignition distributor securing bolt.
b. Rotate distributor body (1) clockwise or counterclockwise according to requirements (i.e. in order to advance or delay timing).
c. Tighten nut (2) verifying that distributor body is not moved.
d. Re-check the timing.
6. Verify that, when at **5400 r.p.m.** notch **M** (marked on crankshaft pulley) is aligned with the fixed index, thus complying with the max advance.

Maximum advance
34° ±3° before T.D.C.
at 5400 r.p.m.

If not so, rotate ignition distributor position dividing error equably between the fixed and max advance value.



1 Ignition distributor casing
2 Nut securing ignition distributor

7. Reconnect the pneumatic vacuum hose to the vacuum pump on the ignition distributor.

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CHECK, CLEANING OR REPLACEMENT OF SPARK PLUGS; FIRING ORDER

1. Check

— The original spark plugs are of the surface discharge type, with four points and central electrode; no adjustment of the distance between electrodes is required by this type of spark plugs.

— Use of spark plugs having different features or dimensions, can cause serious engine damage and alter emission levels.

— Clean or replace the spark plugs periodically, according to the routine checks contained in the "Vehicle Maintenance Schedule".

— If the ceramic insulator is cracked, or electrodes are too worn, replace the spark plugs.

2. **Replacement**

a. On cold engine, roll up the rubber cap, remove cables, blow compressed air in the spark plug seats in order to remove any impurites; then remove the spark plugs.

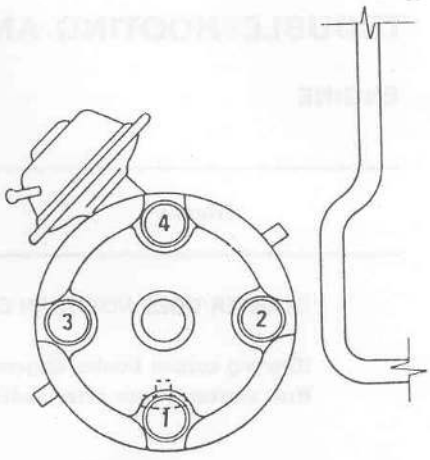
b. **Lubricate** the threading with **grease ISECO Molykote A**, and tighten the spark plugs to

25 thru 34 N·m
(2.5 thru 3.5 kg·m)
(18.4 thru 25 ft·lb)

c. Check for good mechanical and electrical connection between spark plug cables and coupling.

d. If in doubt, slide the rubber cap along cable, tighten the coupling fully, and refit rubber cap above coupling. Connect coupling to the spark.

WARNING:
The spark plug cables are to be reconnected according to firing order.
Firing order: 1 - 3 - 4 - 2.



ENGINE COOLING

See Engine Maintenance - Injection Version.

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TROUBLESHOOTING AND CORRECTIVE ACTIONS

ENGINE

Trouble	Probable cause	Corrective action
STARTER DOES NOT TURN OR TURNS SLOWLY		
(Starting system trouble diagnosis procedure) **Run starter motor after switching on the lights.**		
A. LIGHTS SWITCH OFF OR DIM REMARKABLY		
	• Battery discharged	Charge the battery and verify the charging system
	• Battery faulty	Replace
	• Battery terminals oxidized	Clean terminals
B. LIGHTS STAY BRIGHT AND STARTER FAILS TO OPERATE		
	• Interruptions in the electric connections of starting system	Restore continuity
	• Ignition block faulty	Replace ignition block
	• Starter faulty	Repair and/or replace

ENGINE CRANKS NORMALLY BUT IT FAILS TO START

In the most cases the trouble lies in:
- ignition system
- fuel system

Occasionally, the trouble can be due to the following:
- valves operate incorrectly
- poor engine compression

(Trouble diagnosis procedure)
First of all, check the spark plugs, operating as follows:
Disconnect the spark plug high voltage cable, keep it about 3 to 4 mm (0.12 to 0.16 in) from any engine metal parts and run the motor.

WARNING:
This operation is to be carried out with the utmost care.

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Trouble	Probable cause	Corrective action
A. SPARK IS NOT GOOD		
Ignition system faulty	• Spark plugs faulty	Clean or replace
	• High voltage cables interrupted	Replace cables
	• Rotor arm current leakage	Clean or replace cover
	• Ignition coil faulty	Replace coil
	• Low or no current in the primary circuit	Check for loosened or disconnected terminals in the primary circuit
	• Electronic module inefficient	Check electronic module
B. SPARK IS GOOD		
Ignition system faulty	• Spark plugs faulty	Replace
	• Incorrect timing	Adjust
Supply system faulty	• Lack of fuel	Refill
	• Tank, fuel filter and piping clogged	□ Clean and/or replace
	• Fuel tank breather pipe clogged	Repair
	• Fuel pump faulty	□ Replace
	• Fuel level adjustment incorrect	□ Adjust
	• Carburetter jets dirty or clegged	Disassemble and clean
Poor Compression	• Spark plugs tightening insufficient	Tighten spark plugs correctly

(Trouble diagnosis procedure)
Measure compression, then pour lubricant oil in the spark plug hole.

A. COMPRESSION INCREASES		
Poor sealing between cylinder and rings	• Compression rings sticking or damaged	△ Replace compression rings
	• Cylinders too worn	△ Overhaul engine
B. COMPRESSION REMAINS UNCHANGED		
Leaks through valves and head	• Valve clearance incorrect	Adjust
	• Poor tightness of valve seats	△ Overhaul head
	• Head gasket faulty	△ Replace gasket

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Trouble	Probable cause	Corrective action
ENGINE IDLING INCORRECT		
Fuel system faulty	• Accelerator control system faulty	Check and adjust
	• Idling adjustment incorrect	Adjust
	• Air filter clogged	Replace cartridge
	• Poor tightness of air intake system	Check ducts; tighten clamps, replace faulty components, if required
	• Carburetter jets or fuel filter clogged	Clean
	• Float level adjustment of carburetters incorrect	□ Adjust and check needle valve tightness
	• Excessive backlash of carburetters throttle valves	□ Overhaul carburetters
	• Incorrect operation of air filter mixing valve	Check and replace if necessary
	• Choke incorrect functioning	Replace
Poor compression	• Previously mentioned	Previously mentioned
Ignition system faulty	• Incorrect operation of ignition system (spark plugs, high voltage cable, coil etc.)	Adjust and/or replace
	• Ignition timing incorrect	Adjust
VEHICLE FAILS TO REACH THE MAX SPEED		
(Trouble diagnosis procedure) **Verify that: Fuel is of the prescribed type** **Clutch does not slip** **Wheels turn smoothly (brakes, bearings)** **Tyres are at the prescribed pressure**		
Poor compression	• Previously mentioned	Previously mentioned
Engine overheating	• Coolant insufficient	Refill and check system tightness
	• Thermal switch or electric fan faulty.	Overhaul

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Trouble	Probable cause	Corrective action
	• Radiator clogged or leaks presence • Air in the cooling system	○ Clean, repair or replace Bleed system and check tightness
Engine overcooling	• Thermostat faulty	○ Replace
Supply system faulty	• Previously mentioned	Previously mentioned
Ignition system faulty	• Spark plugs faulty • Ignition timing incorrect	Clean or replace Adjust

ENGINE NOISY

(Trouble diagnosis procedure)
Verify that: Engine is not overloaded due to incorrect use of gearbox.
Check: "Knocking due to incorrect combustion"
"Mechanical knocking"

KNOCKING DUE TO INCORRECT COMBUSTION

Backfire, self-ignition, detonations	• Improper fuel	Use the prescribed fuel
Incorrect ignition	• Ignition timing incorrect • Improper spark plugs	Check and replace Use the prescribed spark plugs
Mixture too lean	• Fuel delivered insufficient and/or air seepage in the air intake ducts	Check supply system
Cylinder heads faulty	• Carbon deposits in combustion chambers	△ Disassemble heads and remove the carbon deposits

MECHANICAL KNOCKING

Main bearing knocking	• Main bearing worn (this noise increases during acceleration)	△ Replace bearings and grind or replace propeller shaft
Big end bearing knocking	• Big end bearings worn (noise is slightly louder with respect to that of main bearings; also this noise increases during acceleration)	△ See previous item

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Trouble	Probable cause	Corrective action
Pistons noisy	• Piston and/or cylinder liners worn. (Noise is metallic and increases as soon as rotation increases; it decreases when engine is hot)	△ Overhaul engine
Valves noisy	• Valve clearance adjustment incorrect	Adjust
Water pump noisy	• Rotor backlash	○ Replace pump
Alternator noisy	• Bearing backlash	◇ Replace bearings
Exhaust noisy	• Exhaust system components loosened or damaged	□ Check and replace if required
EXCESSIVE OIL CONSUMPTION		
Oil leaks	• Drain plug loosened	Tighten
	• Oil sump screws loosened	Tighten or replace
	• Oil sump gasket and/or oil seal rings inefficient	Replace gasket and/or oil seal rings
	• Oil filter loosened	Tighten, or replace if required
	• Oil pressure switch loosened	Tighten
	• Oil dipstick poor tightness	Replace dipstick
Excessive oil consumption	• Cylinders and pistons worn	△ Grind cylinders and replace pistons
	• Compression rings mounted incorrectly	△ Restore correct mounting
	• Compression rings worn	△ Replace compression rings, or grind cylinder and replace pistons if required
	• Valve guide and rubbers worn	△ Replace valve guides and rubbers
Other	• Valve stem worn	△ Replace valves
	• Improper oil grade	Change oil and refill with that prescribed
	• Engine overheating	Previously mentioned

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Trouble	Probable cause	Corrective action
EXCESSIVE FUEL CONSUMPTION **WARNING:** **The utmost care is recommended in the measuring of fuel consumption, since speed, load, type of road and driving habits highly affect fuel consumption.**		
Engine power not up to normal	• Previously mentioned	Previously mentioned
Faults in the fuel system	• Idle r.p.m. too high	Adjust idle r.p.m.
	• Accelerator return incorrect	Adjust
	• Fuel leaks	□ Check fuel feed circuit tightness
	• Air filtered clogged	Replace filter
	• Too rich mixture	Check fuel system components
OTHER TROUBLES		
Oil pressure reduced	• Unsuitable oil	Use the oil prescribed
	• Oil quantity insufficient	Top-up with the oil prescribed
	• Overheating	Previously mentioned
	• Oil pump pressure relief valve inefficient, or spring incorrect setting	Repair or replace △ Overhaul engine
	• Excessive backlash in the sliding surfaces	
	• Oil filter clogged	Replace cartridge
	• Oil pressure switch faulty	Replace
Sliding surfaces too worn	• Oil pressure insufficient	Previously mentioned
	• Improper oil quality or oil fouling	Use proper oil (replace cartridge)
	• Air filter defective	Replace cartridge
	• Overheating or overcooling	Previously mentioned
Seizing of sliding surfaces	• Oil pressure insufficient	Previously mentioned
	• Backlash insufficient	△ Replace the damaged parts checking backlashes
	• Overheating	Previously mentioned

△ Refer to Unit 01
□ Refer to Unit 04
◇ Refer to Unit 05
○ Refer to Unit 07

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IGNITION

Trouble	Probable cause	Corrective action
Irregular firing	• Spark plugs faulty	Replace spark plugs
	• Poor high voltage connections	Replace or restore high voltage connections
	• Distributor cap with signs of flashover or burning	Replace distributor cap
	• Ignition distributor faulty	Replace distributor
	• Mechanical failure of ignition distributor (as visual check, verify presence of air gap between rotor and stator)	◇ Disassemble disributor and replace the faulty components; if required, replace the whole ignition distributor
	• Resistor of distributor pulse generator not in compliance with the specific values	◇ Replace pulse generator coil
	• Ignition coil cap with signs of flashover or burning	Replace ignition coil
	• Secondary winding of ignition coil under shortcircuit or interrupted	Replace ignition coil
	• Electronic module inefficient	Replace electronic module
	• Ignition control unit faulty	Replace control unit
	• Ignition timing incorrect	Check and replace
No spark	• Electric connections interrupted	Identify the interruption and restore or replace connection
	• Distributor cap punctured by high voltage or by discharges	Replace distributor cap
	• Ignition distributor rotor arm punctured by high voltage or by discharges	Replace distributor rotor arm
	• Air gap between rotor and stator of ignition distributor incorrect	◇ Disassemble distributor and replace the faulty components
	• Ignition coil cap punctured by high voltage or by discharges	Replace ignition coil
	• Ignition coil primary winding short circuiting or discharging	Replace coil
	• Coil secondary winding interrupted	Replace coil
	• Ignition electronic module faulty	Replace module

◇ Refer to Unit 05

FUEL SYSTEM

NOTE:
Refer to Unit 04 - Fuel System - Troubleshooting and Corrective Actions

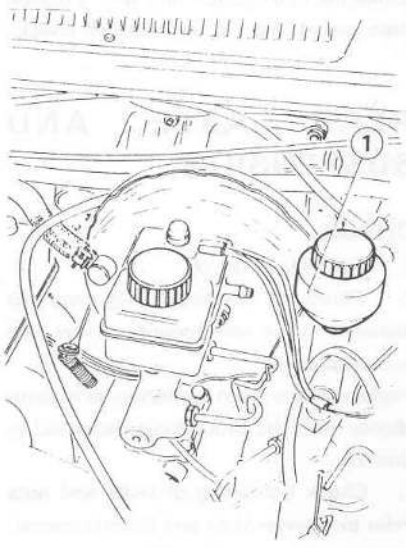
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MAINTENANCE OF MECHANICAL COMPONENTS AND BODY

CLUTCH

1. Clutch fluid level check.

Check that the level is up to the "max" mark on the reservoir (1).



1 Reservoir

If necessary, top-up with the specified fluid.

Clutch-brakes fluid
ATE "S"
AGIP Brake Fluid Super HD
IP Auto Fluid FR
ALFA ROMEO Brake Fluid

2. Circuit check.

Check the clutch pump and cylinder for fluid leaks.

If required, tighten unions to the prescribed torque, or overhaul or replace the components.

(T) : Tightening torques
Clutch piping
8 thru 11 N·m
(0.8 thru 1.1 kg·m)
(5.9 thru 8.1 ft·lb)

Check for good conditions of the clutch pushrod boot.

GEARBOX

1. Oil level check.

Remove filler plug (1) and verify that oil level reaches the lower edge of the related hole. Top-up if necessary with the prescribed oil; clean plug and tighten it.

2. Oil change.

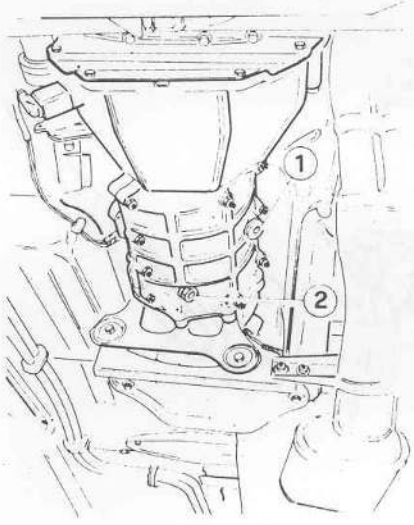
a. Remove drain plug (2) from sump and filler plug (1).

b. Drain the oil completely (wait **15 minutes** at least); then clean drain plug (2) and tighten it.

c. Fill with the quantity and quality of oil prescribed through filler hose (1).

Gearbox fluid
AGIP Rotra SX 75W90
IP Pontiax HDS 75W90
SHELL Spirax HD 80W90

Quantity:
1.650 kg (3.64 lb)

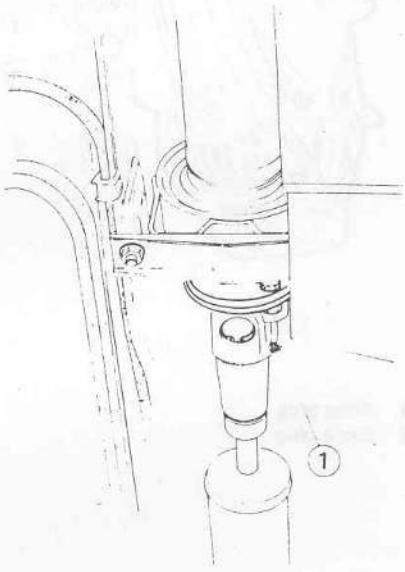


1 Filler plug
2 Drain plug

PROPELLER SHAFT

Lubricate the propeller central coupling by packing approximately 15 g (0.52 oz) of the specified grease in the plug supplied for this purpose (1).

Grease for propeller central coupling.
AGIP Grease 15
SHELL RETINAX A



1 Plug

DIFFERENTIAL

1. Oil level check.

Remove filler plug (1) and verify that oil level reaches the lower edge of the related hole. Top-up if necessary with the prescribed oil; clean plug and tighten it.

2. Oil change.

a. Remove drain plug (2) from sump and filler plug (1).

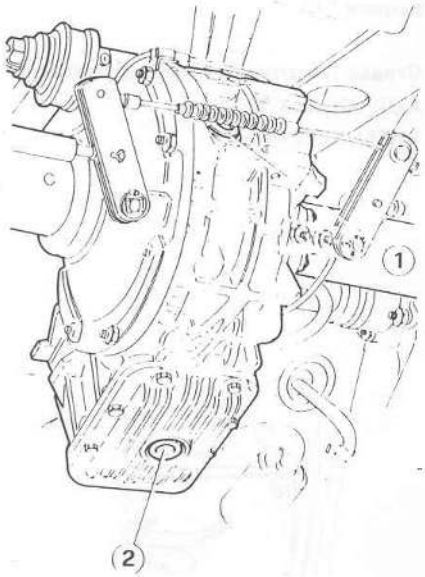
b. Drain the oil completely (wait **15 minutes** at least); then clean drain plug (2) and tighten it.

c. Fill with the quantity and quality of oil prescribed through filler hose (1).

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Differential fluid
AGIP Rotra SX 75W90
IP Pontiax HDS 75W90
SHELL Spirax HD 80W90

Quantity:
1.250 kg (2.76 lb)



1 Filler plug
2 Drain plug

FRONT AXLE AND SUSPENSION

CHECK

1. Set vehicle on lift.
2. Check good conditions and wear degree of suspension components.

Replace all the worn components in compliance with the procedures described in Unit 21.

3. Check tightening of bolts and nuts (refer to: Service Data and Specifications). If bolts and nuts are loosened, set the vehicle in the nominal trim corresponding to static load (refer to: Check of Vehicle Trim), and tighten the bolts and nuts loosened, to the prescribed torque.
4. Check shock absorbers for any oil leaks or damges.

ADJUSTMENT OF WHEEL BEARINGS PRELOAD

After replacement or disassembly of bearings, carry out the related adjustment operating as follows.
For bearing replacement refer to: Unit 21.

Grease bearings with the prescribed quantity of grease.

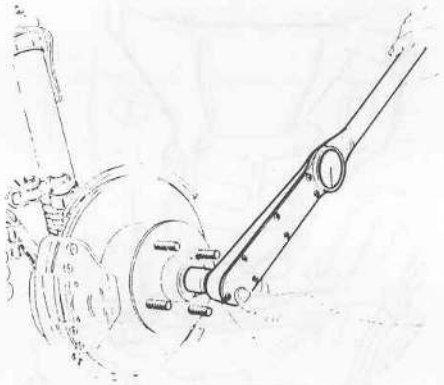
1. Lock the nut securing hub to

20 thru 24 N·m
(2 thru 2.5 kg·m; 15 thru 18 ft·lb)

torque, rotating hub, at the same time, by **4 thru 5 turns** to facilitate bedding of bearings into their seats and to prevent bevel races from being damaged by rollers.
2. Loosen nut and re-tighten it to the prescribed torque.

5 thru 10 N·m
(0.5 thru 1 kg·m; 3.7 thru 7.4 ft·lb)

3. Unscrew nut by **90°** and insert the split pin. If the nut notch and the hub support hole are not aligned, screw the nut to the minimum angle required to insert the split pin.



4. By means of a mallet, strike the hub support end, and verify that washer is not blocked (washer shall result to be easily movable, by using a screwdriver as a lever, in one of the washer radial holes).
Should the washer be blocked, remove split pin and unscrew the nut enough allow the split pin to be inserted into the hole on hub support, perpendicular to that previously used.
Strike the hub support end with a mallet; then repeat the washer backlash check.

REAR AXLE AND SUSPENSION

CHECK

1. Set vehicle on lift.
2. Check for any loosening, wears or damages in the components of rear axle and suspension.

Replace all the worn components in compliance with the procedures described in Unit 25.

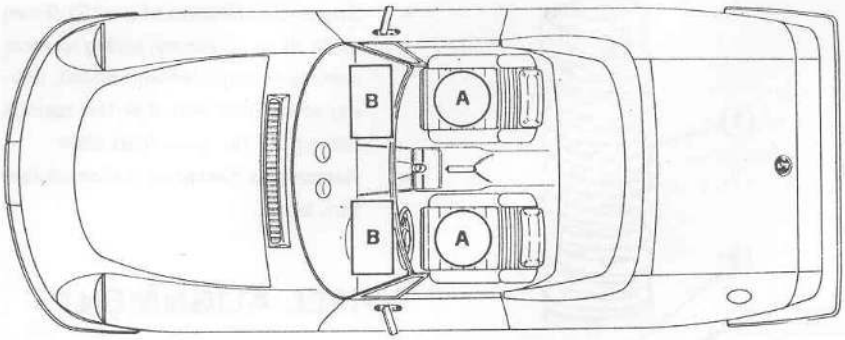
3. Check tightening of bolts and nuts (refer to: Service Data and Specifications). If bolts and nuts are loosened, set the vehicle in the nominal trim corresponding to static load (refer to: Check of Vehicle trim), and tighten the bolts and nuts loosened, to the prescribed torque.
4. Check shock absorbers for any oil leaks or damages.

CHECK OF VEHICLE TRIM

PRELIMINARY OPERATIONS

1. Set vehicle in running order, with fluids at the max level, and spare wheel.
2. Check that tyres pressure is that prescribed.
3. Set vehicle on lift.
4. Load the vehicle, arranging loads as per figure.

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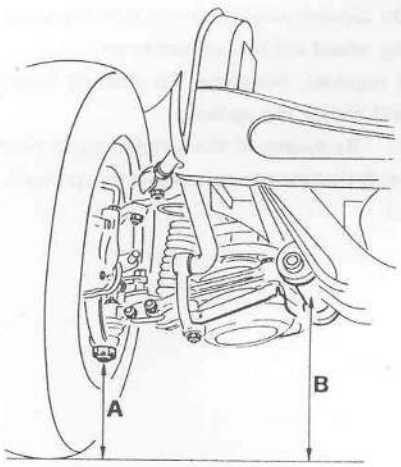
Static load equivalent to two passengers.

Load equivalent to one passenger
A + B = 490 + 245 = 735 N
(50 + 25 = 75 kg; 110 + 55 = 165 lb)

5. Raise vehicle, disconnect antiroll bars of front and rear suspensions, front and rear shock absorbers.
6. Shake vehicle a few times in order to obtain a good setting of suspensions.

FRONT TRIM

Check the front trim measuring dimensions **A** and **B** shown in the figure.



Front trim dimension
B − A = 24 ± 5 mm (0.94 ± 0.201 in)

The dimension measurement is to be carried out for the front right suspension as well as front left suspension.

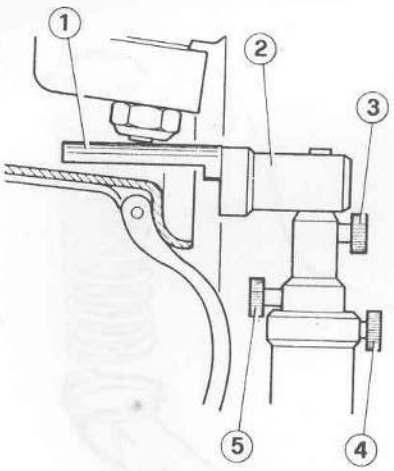
Dimension measurement

Measure dimensions **A** and **B**, using the below mentioned tools and setting the graduated movable stem of tester in the fully withdrawn position.

- Tool **A.4.0146**
- Tool **A.4.0149**
- Tool **A.4.0151**

Dimension A measurement

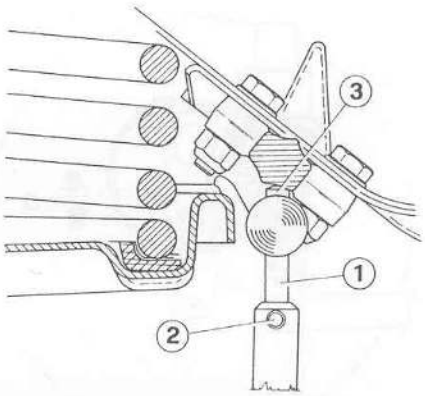
1. Position tool **A.4.0146** on the vehicle resting plane.
2. Screw probe (1) into upper hole of tool (2) head. Release screws (4) and (5), then tighten screw (3) with the graded stem fully withdrawn.
Rest the tool on the outer plane of ruler and skim lower end of hub support with the upper part of probe, as shown in the figure.
3. Tighten screws (4) and (5); the tool is now reset.



1 Probe
2 Tool for suspension trim check
3 Screw
4 Screw
5 Screw

Dimension B measurement

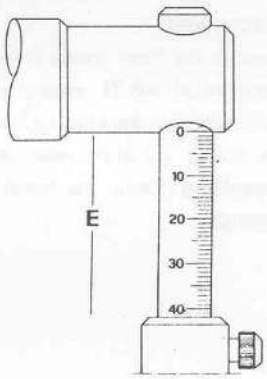
4. Move tool (1) on inner plane of ruler; release screw (2), withdraw the graduated stem until skimming the lower part of lever support with probe (3) head, as shown in the figure; then tighten screw (2).



1 Tool for suspension trim check
2 Screw
3 Probe

Measure the real dimension of front trim on the graduated stem, in correspondence with the upper edge of sleeve.

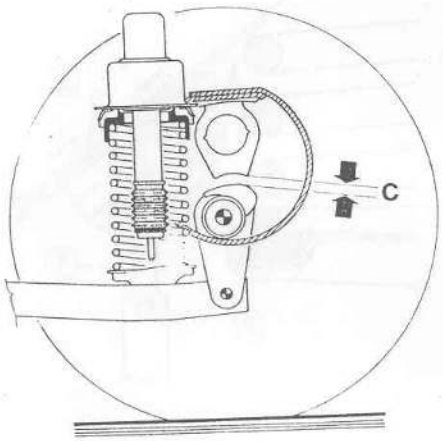
E = B − A



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REAR TRIM

Check the rear trim by measuring dimension C between end-of-travel buffer and differential axle.



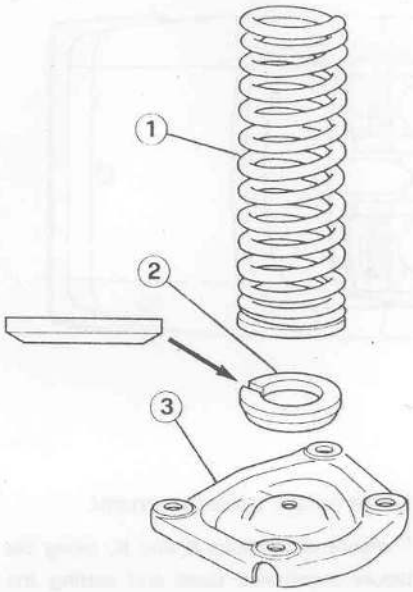
Rear trim dimension
C = 33 ± 5 mm
(1.304 ± 0.204 in)

CAR TRIM ADJUSTMENT

Front Trim

In order to adjust the front trim, follow these instructions.

- Remove the front spring working as instructed in Unit 21 - Helical Springs.
- Fit the appropriate shim (2) between the spring (1) and lower cap (3), assembling it with the bevel facing upwards.



1 Spring
2 Shim
3 Lower cap

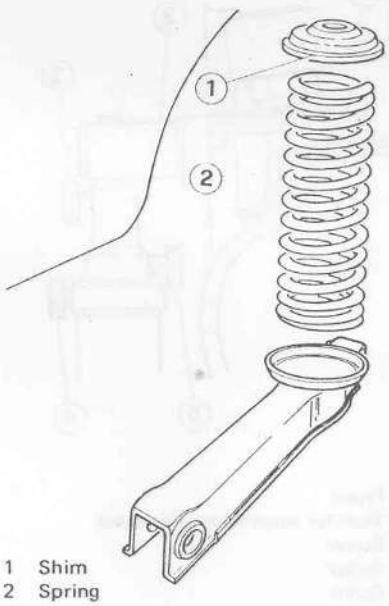
- Reassemble the spring and check front trim again.

Rear Trim

In order to adjust the rear trim, follow these instructions.

- Remove the rear spring, working as instructed in Unit 25 - Helical Springs.
- Select a suitable shim (1) from the spare parts and fit it between the spring (2) and upper resting cup. The shims should be available in the following sizes:

6.5 - 11.5 - 16.5 - 21.5 mm
(0.26 - 0.45 - 0.65 - 0.85 in)



1 Shim
2 Spring

- Should a correction of over 21.5 mm (0.85 in) be necessary, spring replacement is strongly recommended, paying close attention that the springs belong to the same load class.
- Reassemble the spring and check rear trim again.

WHEEL ALIGNMENT

CHECK OF FRONT WHEELS ALIGNMENT

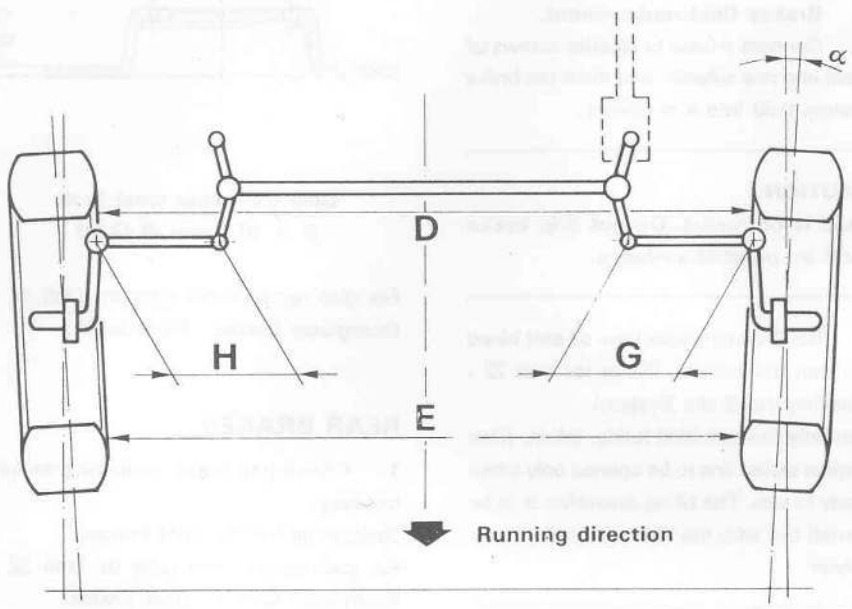
To carry out the check and adjustment of front wheels alignment, perform the following preliminary operations.

- Check that tyre pressure is that prescribed (refer to: Wheels and Tyres).
- Set the vehicle to the nominal trim corresponding to the static load.
- Measure the front trim dimension **E** and dimensions **C** and **T** related to rear trim (refer to: Check of Vehicle Trim).
- Check for any deformations of rims.
- Lock the brake pedal in the fully pressed position in order to prevent wheels from turning, when moving them from side to side on rotating plates.

1. Toe-in

On aligned wheels, check that the steering wheel spokes are centered.
If required, withdraw the steering wheel and center the spokes.
a. By means of the suitable equipment verify that the toe-out value is that prescribed.

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Toe-in value

D − E = 3 ± 1 mm (0.12 ± 0.04 in)

α = 14′

φ Rim = 365 mm (14.37 in)

Furthermore, verify the following condition along the steering tie rods.

G − H = 5 mm (0.20 in)

b. If necessary, adjust the toe-out dimension by acting on the length adjusting devices of both the central and lateral tie rods, in order to meet the previously specified conditions.

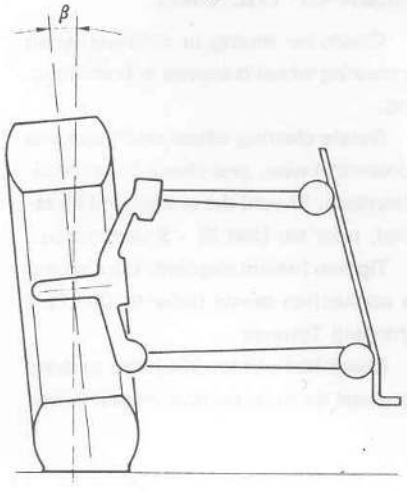
2. Camber angle.

Checking is to be performed on both wheels.

β = 20′ ± 30′

Maximum difference between right and left wheel.

40′



3. Caster angle.

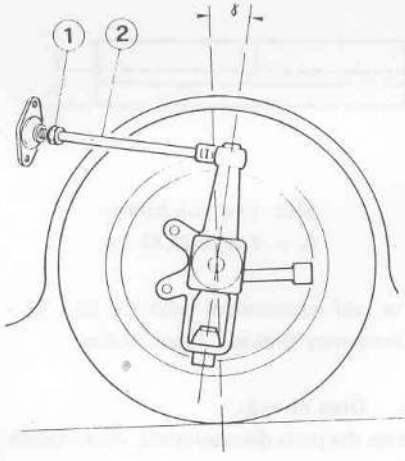
Checking is to be performed on both wheels.

γ = 1°30′ ± 30′

Maximum difference between right and left, wheel.

20′

If the caster angle is not that specified, carry out adjustment by working on the locknut (1) of the trailing arm (2).

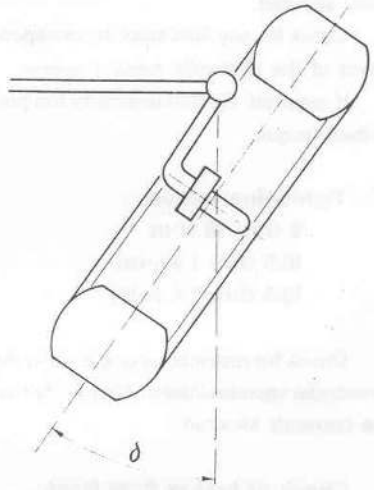


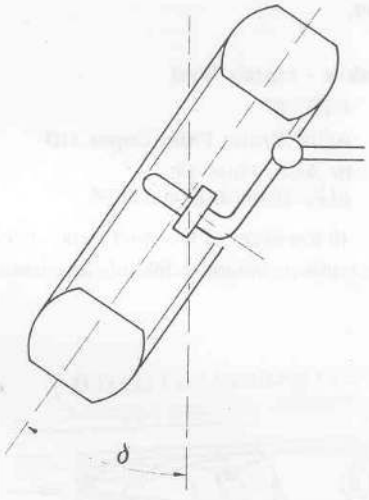
1 Locknut
2 Trailing arm

Slight caster variations, within the tolerance range allowed permit a slight drift of vehicle to be adjusted.

4. Maximum steering lock.

δ = 28°30′





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FRONT AND REAR BRAKES

BRAKE SYSTEM

1. Check of brake system.

a. Visually check for any damages and oxidation in the piping of the brake hydraulic system. Also verify that piping is correctly secured.

b. Check for any fluid leaks in correspondence of the hydraulic system unions.

c. If required, tighten unions to the prescribed torque.

(T) : Tightening torque
8 thru 10 N·m
(0.8 thru 1 kg·m)
(0.6 thru 7.4 ft·lb)

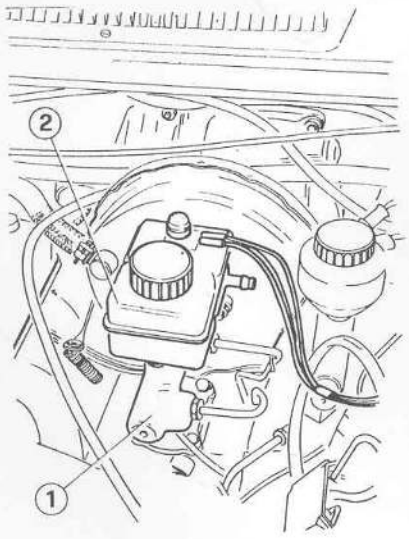
d. Check for restrictions or cracks in the servobrake vacuum intake. Also verify that it is correctly secured.

2. Check of brakes fluid level.

a. Verify that the fluid level reaches the max mark indicated on reservoir.
Top-up if necessary, with the prescribed fluid.

Brakes - clutch fluid
ATE "S"
AGIP Brake Fluid Super HD
IP Auto Fluid FR
ALFA ROMEO Brake Fluid

b. In the event of low fluid level, check the braking system to identify any leaks.



1 Brake master cylinder
2 Brake fluid reservoir

3. Brakes fluid replacement.

a. Connect a hose to bleeder screws of front and rear wheels, and drain the brake system fluid into a container.

CAUTION:
Fluid is corrosive. Do not drip brake fluid on painted surfaces.

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b. Refill system with new oil and bleed air from the system. (Refer to: Unit 22 - Bleeding the Brake System).
Use only the specified fluids, taken, from original sealed tins to be opened only when ready to use. The filling operation is to be carried out with the filter inserted into reservoir.

WARNING:
If brake pedal travel is long and spongy, it means that air bubbles are present. If so, repeat system bleeding.

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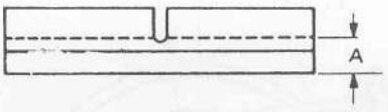
4. Servobrake check.

a. Check wear degree of vacuum hose and the related connections.
Check also that servobrake is free from dents.

b. Check for any cracks or restrictions in the vacuum intake hose.
Also verify that it is correctly secured.

FRONT BRAKES

1. Check of pad wear and replacement.

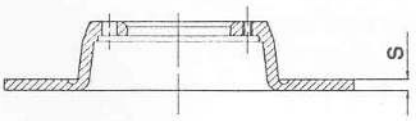


Min. pad thickness
A = 7 mm (0.28 in)

For pad replacement refer to: Unit 22 - Emergency Brakes - Front Brakes

2. Disc check.

With the pads disassembled, check brake disc wear.



Disc thickness wear limit
S = 10.7 mm (0.42 in)

For disc replacement refer to: Unit 22 - Emergency Brakes - Front Brakes

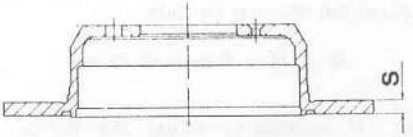
REAR BRAKES

1. Check pad wear, replacing as necessary.

Operate as for the front brakes.
For pad replacement refer to: Unit 22 - Emergency Brakes - Rear Brakes.

2. Disc check.

a. With the pads disassembled, check brake disc wear.



Disc thickness wear limit
S = 7.5 mm (0.30 mm)

b. For disc replacement refer to: Unit 22 - Emergency Brakes - Rear Brakes

STEERING SYSTEM

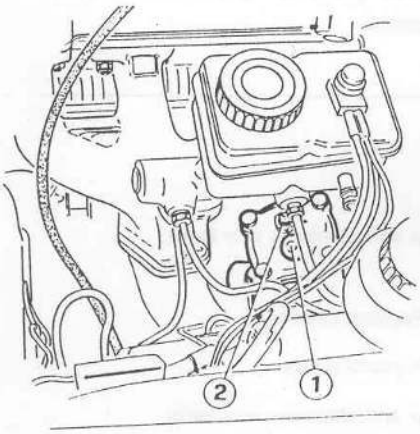
CHECK OF THE UNIT

1. Check for seizing or stiffness when the steering wheel is moved in both directions.
2. Rotate steering wheel clockwise and counterclockwise, and check for excessive backlash. Should the adjustment be required, refer to: Unit 23 - Steering Box.
3. Tighten (where required) the steering box connection points (refer to Unit 23 - Tightening Torques.
4. Check ball and flexible joints of steering wheel tie rods; replace them if worn.

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CHECK OF STEERING BOX OIL LEVEL

1. Check the oil level in the steering box (by removing the plug (1) shown in the figure).
2. Check the worm and roller for play; (see Unit 23 - Steering - Technical Specification and Features - Checks and Adjustment - Steering Unit Clearance Adjustment).



1 Plug
2 Nut

TYRES

TYRE PRESSURE CHECK

With the tyres at the ambient temperature, check that pressure is at the prescribed values; restore if necessary (refer to: Wheels and Tyres). The spare wheel must be at the highest value.

BODY

LOCKS AND HINGES

1. **Lubricate** locks and hinges.
2. Adjust lock strikers.

SEAT BELTS

WARNING:

- **If seat belts are to be washed, do not use chemical detergents or solvents, since they could damage the buckles.**
- **After a serious accident involving belt stress, replace same, even if apparently not damaged.**

1. Check anchors making sure they are not loose on mountings.
2. Check seat belt wear degree.
3. Check for proper working condition of buckles and tongues.
4. Fasten seat belts and check if, in the event of sudden movement, they are promptly locked.

If not so, check retractor locking system.

If the condition of any seat belt components is doubtful, replace the whole belt assembly.

TROUBLESHOOTING AND CORRECTIVE ACTIONS

TRANSMISSION

Trouble	Probable cause	Corrective action
Clutch slips	(Engine r.p.m. does not correspond to vehicle speed, particularly when accelerating or going uphill). (Trouble diagnosis procedure) — **Engage parking brake** — **Press clutch pedal and engage the 4th speed** — **Increase engine speed, and gradually release the clutch pedal; if vehicle does not move and engine does not stop, clutch is slipping.**	
	• Gasket worn or wet with oil	▲ Replace the worn components
	• Insufficient load of pressure plate diaphragm spring	▲ Replace pressure plate

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Trouble	Probable cause	Corrective action
Clutch noisy (Trouble diagnosis procedure)		
— Noisy when pressing the pedal	• Thrust bearing and/or support damaged	▲ Replace thrust bearing and/or support
— Noisy when clutch is engaged	• Clutch unit faulty	▲ Check clutch
Noisy with stationary vehicle (clutch checked) (speed gear to neutral)	• Propeller shaft and/or related support faulty	◆ Check propeller shaft and related supports
Noisy when running (clutch checked)		
— Noisy only when gearbox is engaged	• Oil level in the gearbox casing insufficient	Top-up and eliminate any leaks
	• Bearings damaged	▲ ■ Replace bearings
	• Gears worn or damaged	▲ ■ Replace gears
— Noisy also with gearbox to neutral	• Oil level in the differential casing insufficient	Top-up and eliminate any leaks
	• Differential and/or wheel bearings damaged	● Replace bearings
— Noisy during both acceleration and deceleration and pick-up	• Pinion - crown mating defective	● Check mating
	• Axle shafts damaged	● Replace the faulty components
— Noisy when taking a curve	• Differential faulty	● Check
Speed engagement/disengagement difficult	(Trouble diagnosis procedure) — **Disengage clutch and engage reverse gear** — **Shift into neutral and, after a short interval, engage the reverse speed**	
— If engagement is noisy	• Declutching defective	▲ Check clutch and related control
— If engagement is not noisy	• Outer and/or inner gearbox linkage faulty	■ Check linkage
	• Synchronizers inefficient	■ Replace synchronizers

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SUSPENSIONS

Trouble	Probable cause	Corrective action
Noisy when running	Make sure that wheels are correctly secured	
	• Connections of shock absorber and/or suspension arms damaged	▲ Replace the faulty components
	• Shock absorbers unloaded	▲ Replace
	• Wheel bearings damaged	▲ Replace
Vehicle drifts	• Tyres defective or incorrect pressure	Check
	• Wheel alignment incorrect	Check and restore
	• Resistance from brakes	Check brakes
	• Faults in the steering wheel linkage	Check linkage

STEERING WHEEL

Trouble	Probable cause	Corrective action
Steering wheel shock (suspensions checked)	• Steering wheel linkage connection defective	Check
	• Steering box loosened or damaged	Check and restore
Steering wheel stiff and/or noisy (suspension checked)	Make sure that tyres are correctly inflated	
	• Knocking in the steering box	◇ Adjust or replace

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BRAKES

Trouble	Probable cause	Corrective action
Poor braking action	(Trouble diagnosis procedure) — **With engine stopped, press brake pedal repeatedly** — **Start engine keeping brake pedal pressed**	
— Pedal raises against driver's feet — Pedal lowers; its travel is often long	• Servobrake inefficient	◘ Replace
	• Pads worn or wet with oil	Replace and eliminate any leaks
	• Fluid leaks from system	Check and restore
	• Master cylinder and/or plungers inefficient	Check and restore
	• Air in the system	◘ Carry out bleeding
Vehicle drifts when braking (suspensions checked)	• Tyres pressure incorrect	Restore correct pressure and check tyres
	• Pads and discs worn or wet with oil	Clean and/or replace. Eliminate any leaks
	• Brake calipers faulty	Check
Vehicle held back when running	• Parking brake faulty	Check and adjust
	• Brake master cylinder and/or calipers faulty	Check
	• Parking brake control sticking	Check and adjust
Noisy and vibrations when braking	• Pads deformed or wet with brake fluid	Replace pads and eliminate any leaks
	• Brake discs scratched	◘ Grind or replace discs

▲ Refer to Unit 12
■ Refer to Unit 13
◆ Refer to Unit 15
● Refer to Unit 17
▲ Refer to Unit 21 - 25
◘ Refer to Unit 22
◆ Refer to Unit 23

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SERVICE DATA AND SPECIFICATIONS

ENGINE MAINTENANCE

TECHNICAL DATA - CHECKS AND ADJUSTMENTS

Valve clearance (cold engine)		0.400 thru 0.450 (0.016 thru 0.018)
Intake	mm (in)	0.450 thru 0.500 (0.018 thru 0.020)
Exhaust	mm (in)	
Alternator - pump belt tensioning		
On assembly		400 thru 450 N (41 thru 46 kg; 90 thru 101 lb)
Minimum value (cold)		250 N (25 kg; 55 lb)
Re-tensioning		300 thru 350 N (31 thru 36 kg; 68 thru 79 lb)

Ignition

Timing (1)

Static advance	r.p.m.	900 $^{+100}_{-50}$
	advance degrees	7° ±1°(2)
Max Advance	r.p.m.	5400
	advance degrees	34° - 3°

(1) Timing values must be measured on vacuum advance calibrator tube disconnected.
(2) Before T.D.C.

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Fuel system

		Spider / Spider 2.0	Spider 1.6
Engine idle r.p.m. (speed gear into neutral - clutch engaged)	r.p.m.	750 ÷ 850	900 +100 −50
Exhaust CO percentage at idle r.p.m.	% in vol.	≤ 0.5	≤ 3.5
Exhaust HC values at idle r.p.m.	p.p.m.	≤ 100 p.p.m.	–
Fuel delivery pressure	kPa	284.3 thru 323.6	29.4 thru 44.1
	bar	2.8 thru 3.2	0.294 thru 0.441
	kg/cm²	2.9 thru 3.3	0.30 thru 0.45
	p.s.i.	41.2 thru 46.9	4.26 thru 6.4
Fuel system tightness test pressure	kPa	400	29.4 thru 44.1
	bar	4	0.294 thru 0.441
	kg/cm²	4.08	0.30 thru 0.45
	p.s.i.	58	4.26 thru 6.4

FLUIDS AND LUBRICANTS

Refer to: Recommended Fuel and Lubricants - Approximate Refill Capacities

WHEELS AND TYRES

As regards tyre pressure, refer to paragraph "Wheels and Tyres"

TIGHTENING TORQUES [N·m (Kg·m; ft·lb)]

Item		Spider / Spider 2.0	Spider 1.6
TIGHTENING OF CYLINDER HEAD NUTS (*)			
A) On reassembly			
1. cold engine	Nuts	74 thru 82 (7.5 thru 8.4; 55 thru 60)	77 ÷ 79 N·m (7.9 ÷ 8.1 kg·m 57 ÷ 58 ft·lb)
B) After 2000 km (1500 miles)			
1. cold engine	Nuts	82 thru 88 (8.4 thru 9; 60 thru 65)	86 ÷ 88 N·m (8.8 ÷ 9 kg·m 63 ÷ 65 ft·lb)
Nuts securing camshaft caps (1)		20 thru 22 (2 thru 2.25; 15 thru 16)	
Spark plugs tightening (2)		25 thru 34 (2.5 thru 3.5: 18 thru 25)	
Nut securing control gear on variable valve timing device (1)	with wrench A.5.0232	86 thru 94 (8.8 thru 9.6; 65 thru 71)	–
	on nut axis	108 thru 118 (11 thru 12; 79 thru 88)	
Variable valve timing device cover		59 (6; 43)	–
Fixing of variable valve timing device on camshaft tang		98 thru 118 (10 thru 12; 72 thru 88)	–

(*) During first free maintenance operation as per step B
(1) In oil
(2) In oil ISECO: Molikote A

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MAINTENANCE OF MECHANICAL COMPONENTS AND BODY

TECHNICAL DATA - CHECKS AND ADJUSTMENTS

Axles and Suspensions

Vehicle static load diagram (1)	N (kg; lb)	A + B = 490 + 245 = 735 (50 + 25 = 75; 110 + 55 = 165)
Front trim	mm (in)	E = B − A = 24 ± 5 (0.94 ± 0.20)
Rear trim	mm (in)	C = 33 ± 5 (1.30 ± 0.20)
Front toe-out (2) Front toe-out angle	mm (in)	D − E = 3 ± 1 (0.12 ± 0.04) α = 14′
Wheel rim diameter	mm (in)	ϕ = 365 (14.37)
Tie-rod length	m (in)	G − H = 5 mm (0.20 in)
Camber angle (2) Max RH/LH difference		β = 20′ ± 30′ 40′
Front caster angle (2) Max RH/LH difference Max steering lock (2)		γ = 1°30′ ± 30′ 20′ δ = 28°30′

(1) After loading, move care up and down to settle suspensions. Suspension trim is to be carried out with vehicle in running order.
(2) Values referring to vehicle in nominal trim, corresponding to static load.

Braking system

Front disc brakes	Disc min thickness	mm (in)	10.7 (0.42)
Rear disc brakes	Disc min thickness	mm (in)	7.5 (0.30)

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TIGHTENING TORQUES

Front suspension

Item	N·m	kg·m	ft·lb
Wheel hub nut; first tightening	20 thru 24	2 thru 2.5	14.8 thru 17.7
Wheel hub nut; second tightening	5 thru10	0.5 thru 1	3.7 thru 7.4
Nuts securing upper and lower ball and socket joints to the steering knuckle	74 thru 83	7.5 thru 8.5	54.6 thru 61.2
Nut securing the steering arm to the steering knuckle	39 thru 44	4 thru 4.5	28.8 thru 32.5
Bolts securing the lower wishbone to the body	55 thru 58	5.6 thru 5.9	40.6 thru 42.8
Bolt securing the upper wishbone to the body	108 thru 134	11 thru 13.6	79.7 thru 98.8
Screws securing the front arm to the body	22 thru 27	2.2 thru 2.8	16.2 thru 19.9
Nuts securing the lower ball and socket joint to the half wishbones	80 thru 90	8.2 thru 9.2	59 thru 66.4
Bolt securing the front arm to the upper wishbone	37 thru 46	3.8 thru 4.7	27.3 thru 33.9
Screws securing the front brake caliper to the steering knuckle	74 thru 83	7.5 thru 8.5	54.6 thru 61.2
Nuts securing the track bar ball and jocket joint	47 thru 54	4.8 thru 5.5	34.7 thru 39.8

Front and rear brakes

Item	N·m	Kg·m	ft·lb
Hydraulic brake system pipe unions (indicative value to be achieved with a wrench)	8 thru 10	0.8 thru 1	5.8 thru 7.2
Screws securing the front brake caliper to the steering knuckle	74 thru 83	7.5 thru 8.5	54.6 thru 61.2
Screws securing the rear brake caliper to the carrier	44 thru 54	4.5 thru 5.5	32.5 thru 39.8
Nuts securing the servo brake to the pedal unit case	12 thru 15	1.2 thru 1.5	8.9 thru 11.1

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Rear suspension

Item	N·m	Kg·m	ft·lb
Bolts securing the trailing arms to the bodywork	80 thru 98	8.1 thru 10	59 thru 72.3
Bolts securing the trailing arms to the axle	108 thru 133	11 thru 13.6	79.7 thru 98.1
Nut securing the reaction triangle to the bodywork	100 thru 123	10.2 thru 12.6	73.8 thru 90.7
Screws securing the reaction triangle to the bodywork	39 thru 45	4 thru 4.6	28.8 thru 33.2
Nut securing the stabilizer bar link rod to the bodywork	32 thru 34	3.3 thru 3.5	23.6 thru 25.1

Propeller shaft

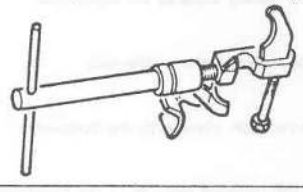
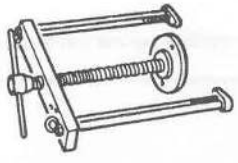
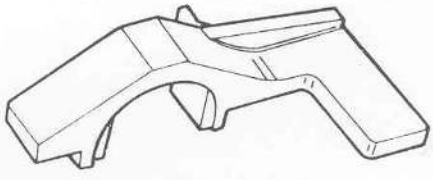
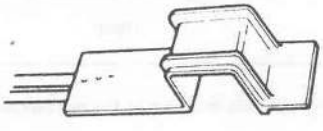
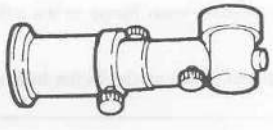
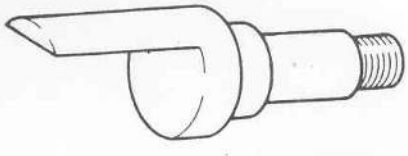
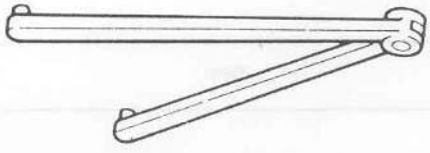
Item	N·m	Kg·m	ft·lb
Bolts securing the front flexible coupling to the gearbox fork and to the propeller shaft	54 thru 56	5.5 thru 5.7	39.8 thru 41.3
Bolts securing the intermediate propeller shaft flanges	37 thru 39	3.8 thru 4	27.3 thru 28.8
Bolts fixing the rear propeller shaft flange to the differential	37 thru 39	3.8 thru 4	27.3 thru 28.8
Nut fixing the flange and center carrier to the front propeller shaft	98 thru 137	10 thru 14	72.3 thru 101.1

Steering

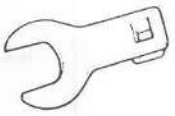
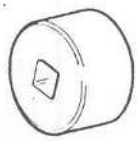
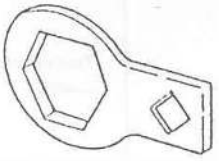
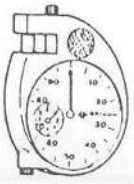
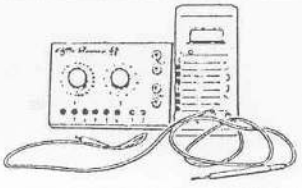
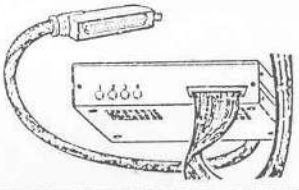
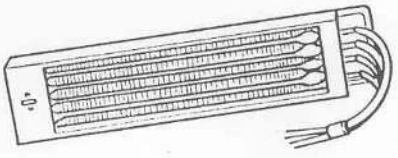
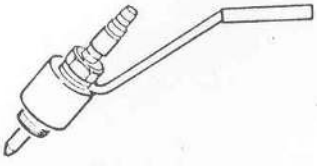
Item	N·m	kg·m	ft·lb
Screws fixing the steering box cover	23 thru 25	2.3 thru 2.5	17 thru 18.4
Bolts securing steering box to body	51 thru 53	5.2 thru 5.4	37.6 thru 39.1
Nut securing the steering art to the output shaft	123 thru 137	12.5 thru 14	90.7 thru 101.1
Bolts securing the crank to the body	44 thru 53	4.5 thru 5.4	32.5 thru 39.1
Bolts securing steering linkage	47 thru 54	4.8 thru 5.5	34.7 thru 39.8
Nut securing steering link ball joint to steering knuckle	39 thru 44	4 thru 4.5	28.8 thru 32.5

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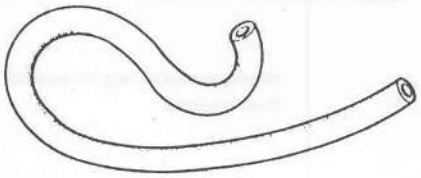
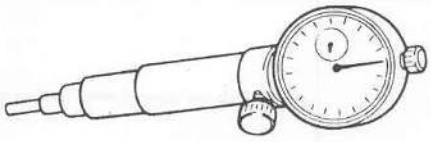
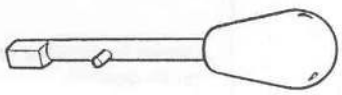
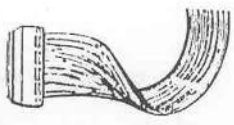
SPECIAL TOOLS

Identity N°	Denomination	Reference page
A.2.0143	Tool for rear spring assembly/removal 	Unit 25
A.2.0169	Tool for front spring assembly/removal 	Unit 21
A.2.0423	Tool for clamping valve timing variator 	00-20 00-23
A.4.0146	Ruler for suspension trim check 	00-93
A.4.0149	Tool for suspension trim check 	00-93
A.4.0151	Probe for suspension trim check 	00-93
A.5.0103	Wrench for turning camshaft 	00-20 00-76

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Identity N°	Denomination	Reference page
A.5.0232	55 mm wrench for ring nut securing camshaft sprocket 	00-20 00-21 00-23
A.5.0242	Wrench for valve timing variator cover 	00-22
A.5.0274	Wrench for tightening valve timing variator on camshaft 	00-21 00-22
C.1.0108	Dial gauge for checking valve caps 	00-18 00-75
C.1.0132	Multi-purpose tester 	00-31
C.1.0136	Tester interface 	00-31
C.2.0014/0001	Four - column vacuum gauge for throttle alignment (to be used with C.2.0015) 	00-79 00-80
C.2.0020	Adapter, gas analyser tap on manifold (to be used with C.2.0053) 	00-81

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Identity N°	Denomination	Reference page
C.2.0053	Hose for CO check probe 	00-81
C.6.0122	Tool for checking T.D.C. 	00-20 00-76
C.6.0203	Tool for variable valve timing device assembly 	00-18 00-19
C.9.0032	Tester and interface connecting cable 	00-31

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UNIT 01

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ENGINE REMOVAL AND INSTALLATION

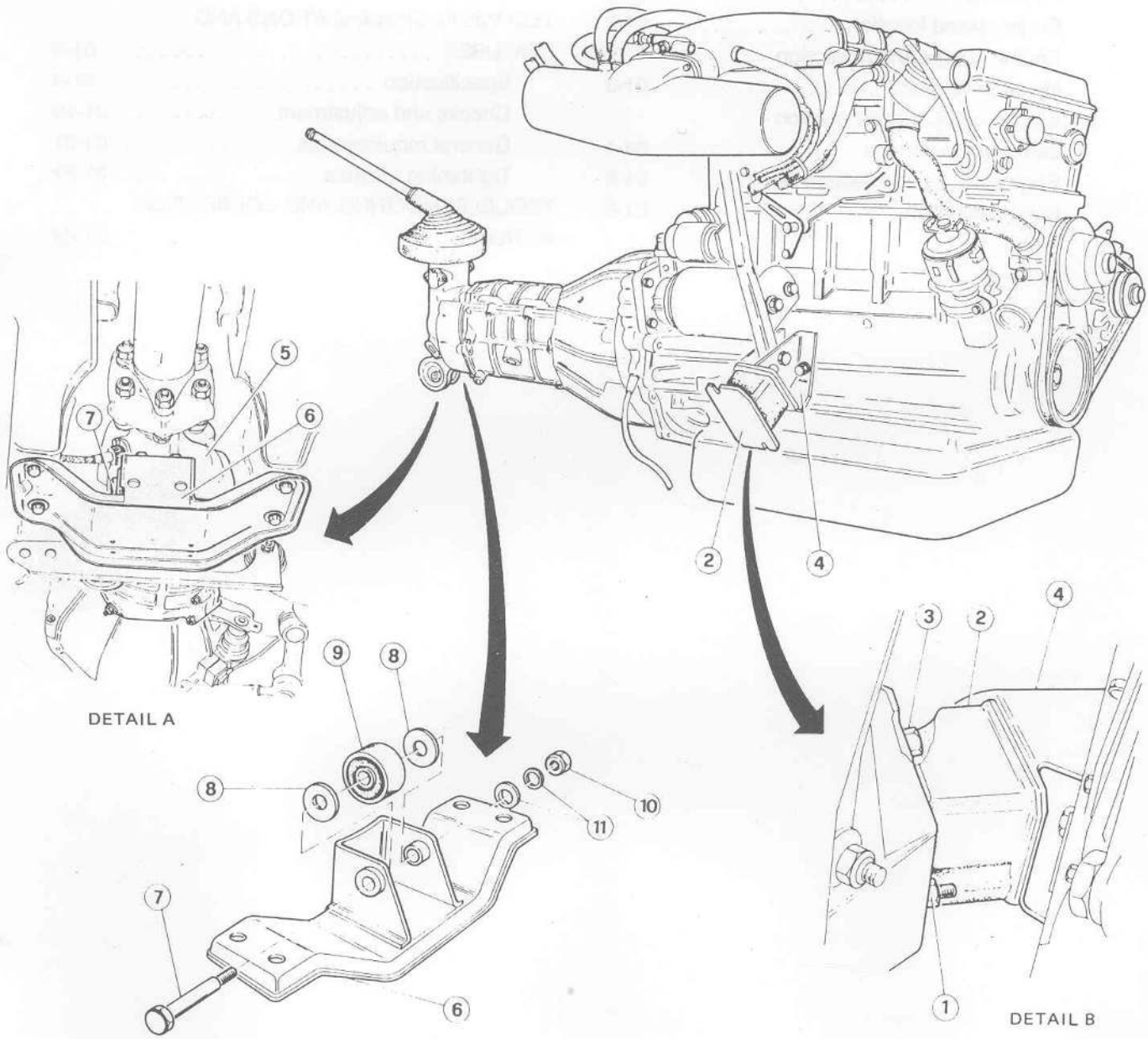
FOREWORD

Given the multiple nature of the operations to be carried out as regards removal and installation of the engine power packs, the operator is advised to read the operating procedures carefully, combining this with a close study of the assembly illustrations which provide a general picture, indispensable but necessarily incomplete, of the power pack in question.

This approach will allow the mechanic to acquire the correct techniques for working on each type of card without neglecting important technical data, cautions or warnings.

ENGINE STAND LOCATION

The following illustration shows the position of the various supports securing the power pack to the car body.

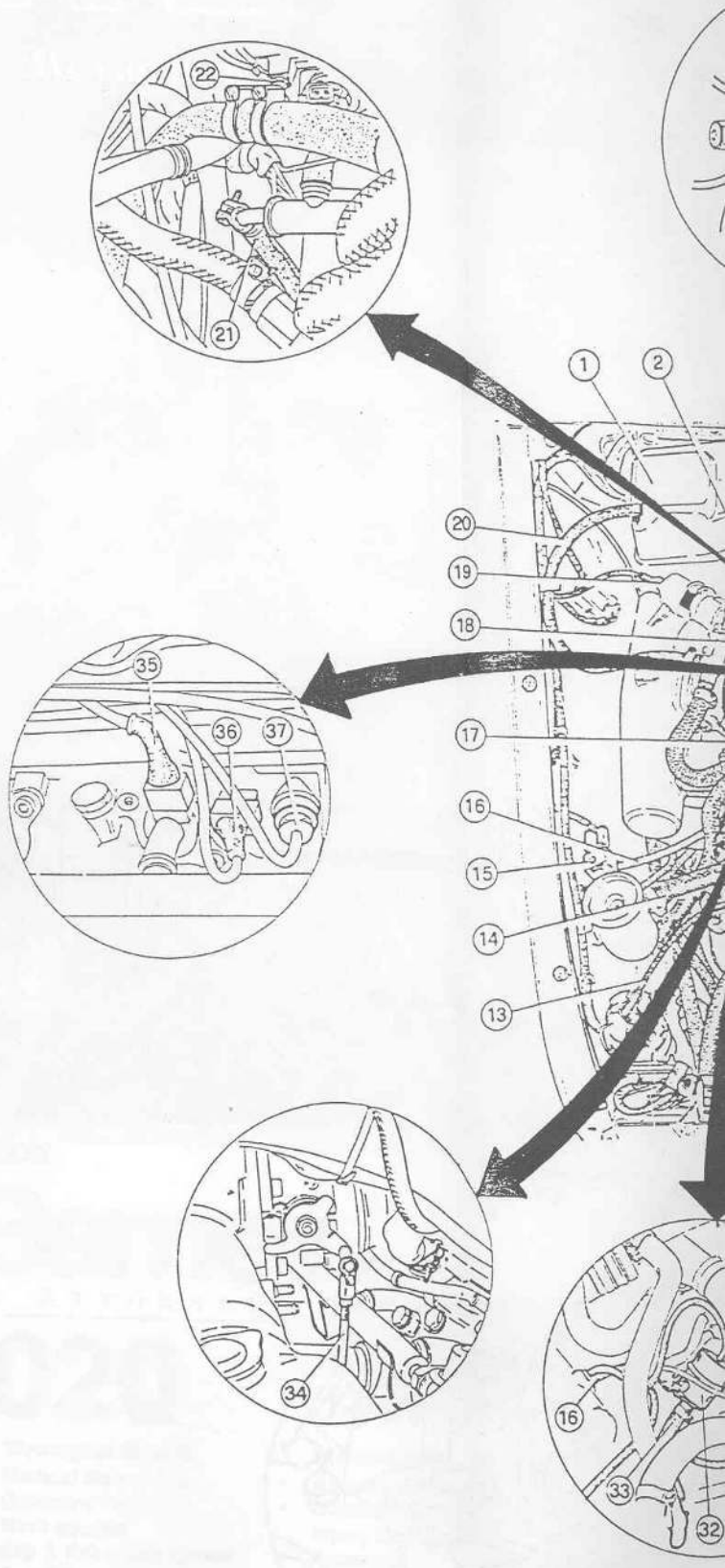


1 Screw securing lower part of side walls
2 Righthand side spring support
3 Screw securing upper part of side walls
4 Righthand side bracket
5 Gearbox
6 Cross member
7 Screw
8 Rubber washer
9 Gear supporting rubber bushing
10 Nut
11 Washer

DETAIL A : Rear stand
DETAIL B : R.H. side support (L.H. support is symmetrical)

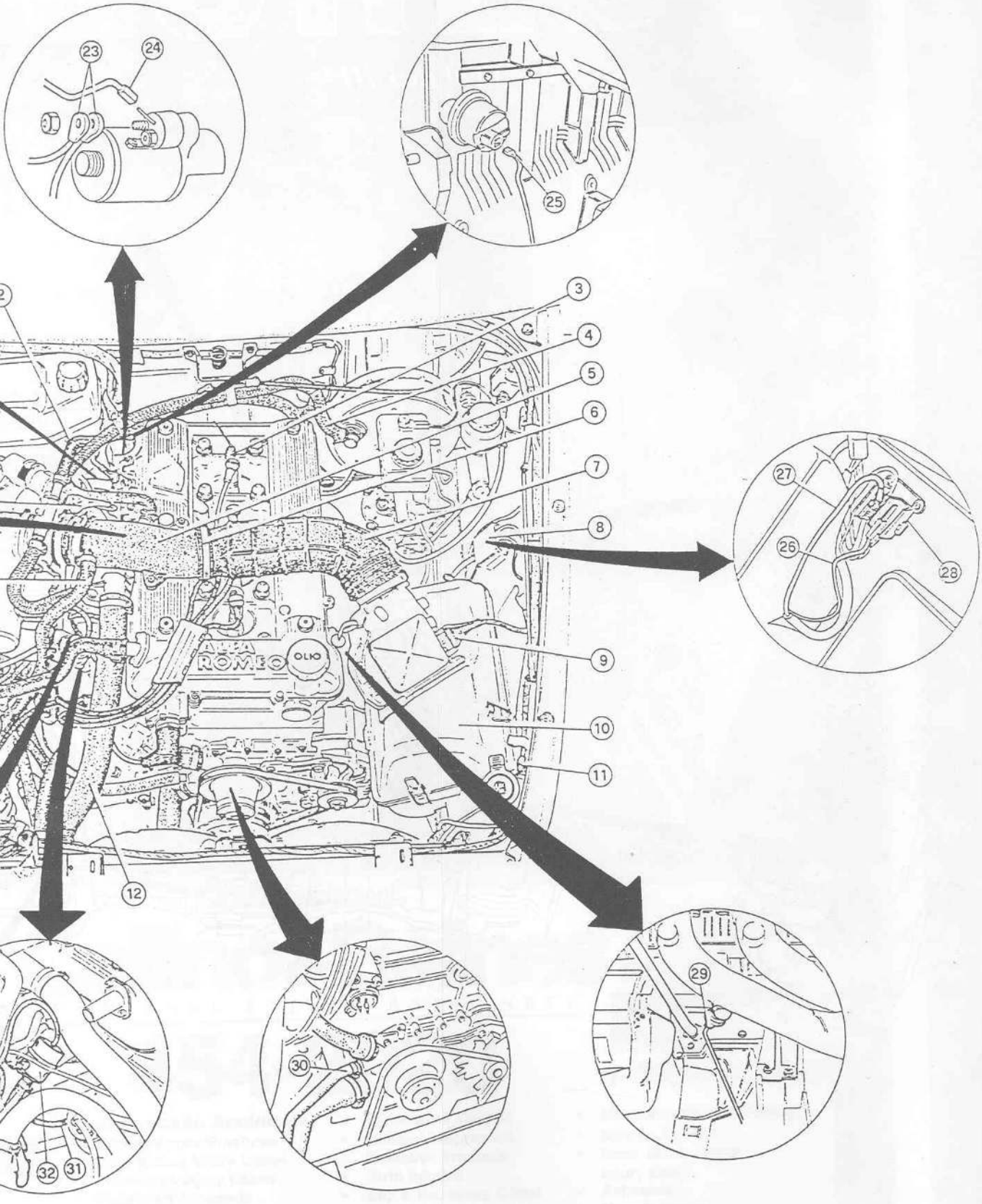
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1 Coolant expansion reservoir
2 Coolant delivery hose, to heater
3 High coolant temperature indicator cable
4 Vacuum intake hose for servo brake
5 Intake duct
6 Clamp
7 Rubber duct
8 Guard
9 Air flow transmitter wire
10 Cover with air flow sensor
11 Wiring for timing and r.p.m. sensor
12 Thermostat to radiator hose
13 High voltage wire
14 Oil vapour delivery hose, to separator
15 Evaporative solenoid valve
16 Fuel vapour return pipe
17 Full throttle oil vapour return hose
18 Throttle switch cable
19 Wiring for idle speed actuator
20 Vent hose from throttle body to expansion resevoir
21 Fuel delivery hose
22 System ground wiring
23 Starter supply cable
24 Starter field cable
25 Engine oil pressure indicator cable
26 Alternator lamp cable
27 Alternator supply cable
28 Terminal board
29 Minimum oil pressure sensor cable
30 Coolant return hose, from heater
31 Oil feedback hose
32 Pressure regulator
33 Fuel return hose
34 Accelerator control rod
35 Electro-injector control cable
36 Coolant temperature sensor cable
37 Coolant temperature indication cable



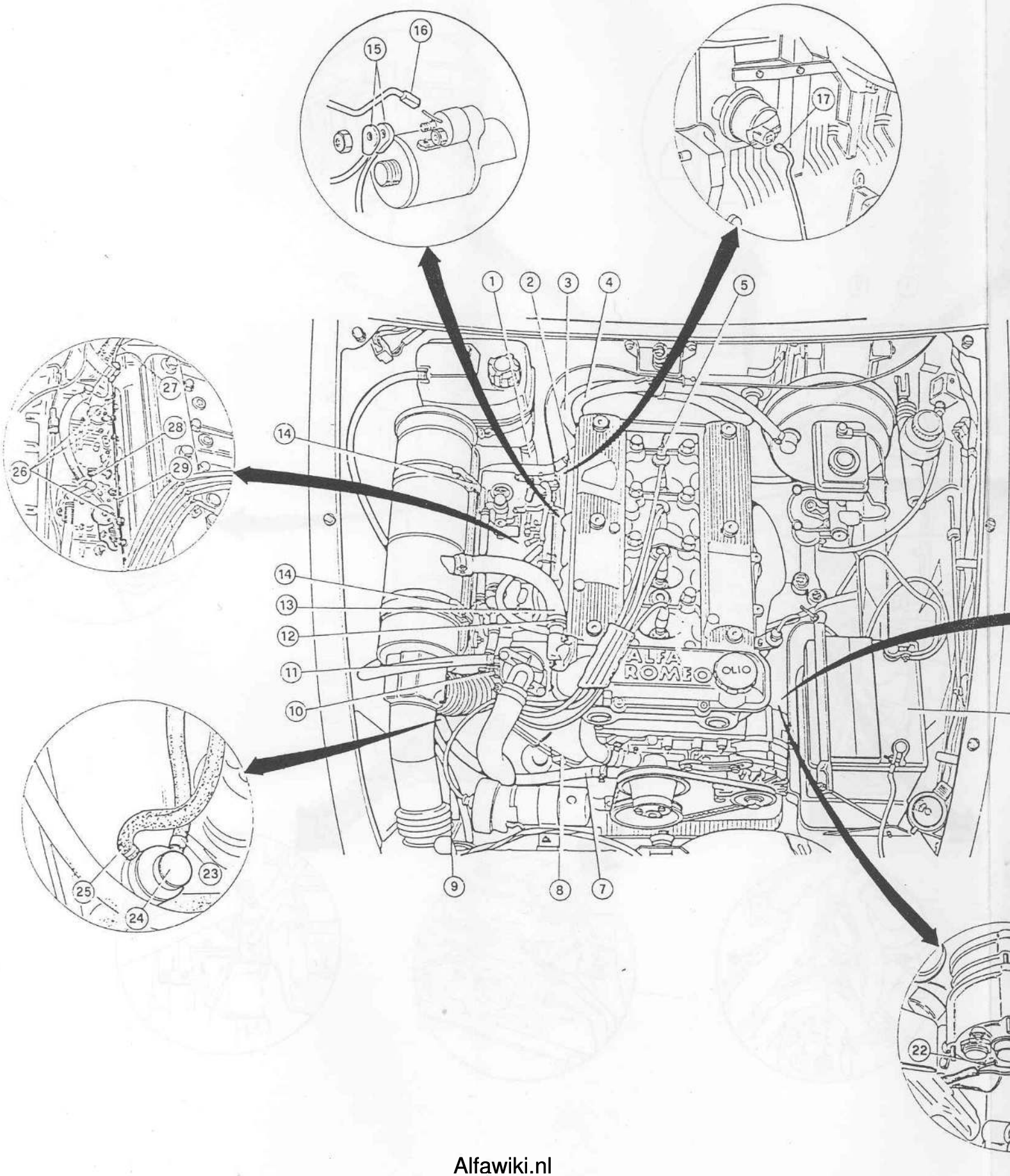
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NGINE COMPARTMENT SECTION - INJECTION VERSION

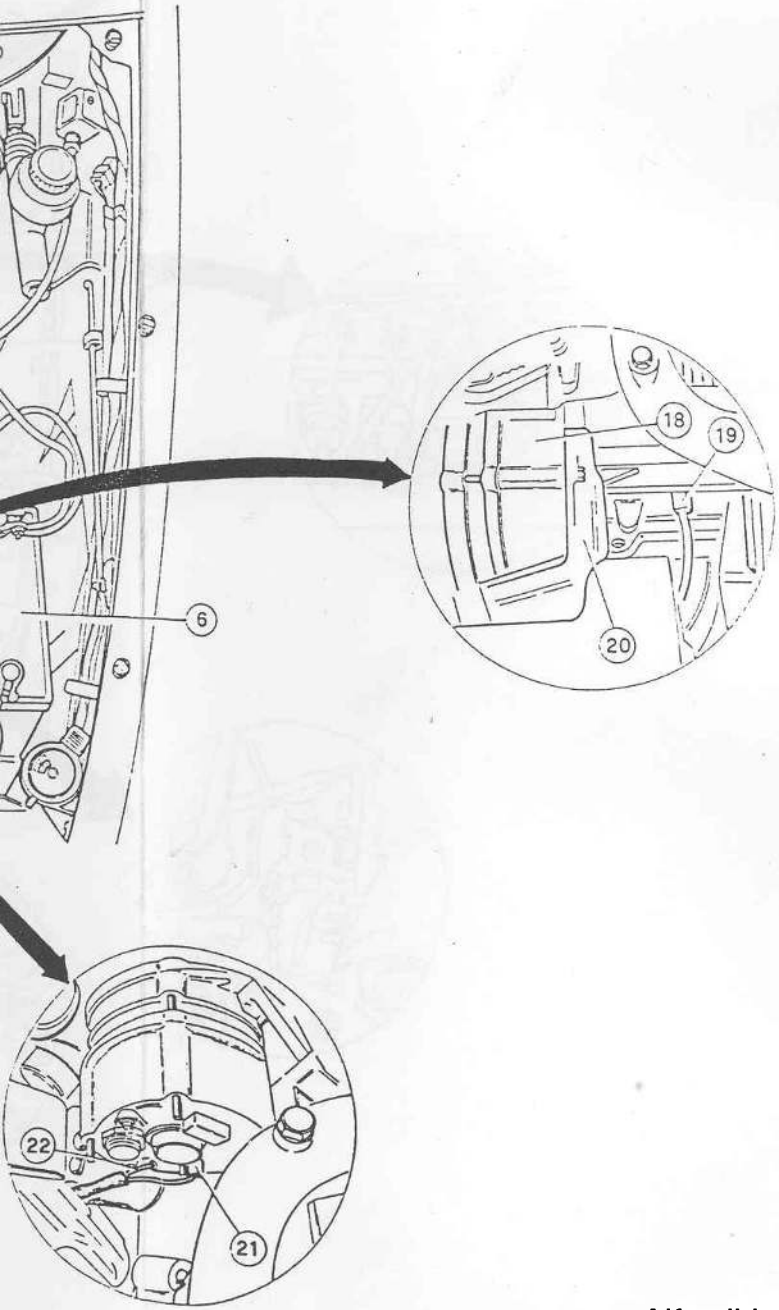


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ENGINE COMPARTMENT SECTION - CARBURATTERS VERSION



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1 Coolant expansion reservoir hose
2 Intake manifold
3 Coolant delivery hose (to radiator)
4 Vacuum servo line
5 Coolant temperature warning light cable
6 Battery
7 Coolant return line (from heater)
8 LT cable
9 HT cable
10 Coolant temperature gauge cable
11 Vent hose from thermostat to expansion reservoir
12 Clamp
13 Max. blow-by hose
14 Clips
15 Starter supply cable
16 Starter field cable
17 Engine oil pressure indicator cable
18 Alternator
19 Minimum oil pressure sensor cable
20 Heat guard
21 Alternator warning light cable
22 Charge cable
23 Fuel suction line
24 Fuel pump
25 Fuel delivery line
26 Screws
27 Choke cable sheath
28 Accelerator linkage
29 Choke cable

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ENGINE REMOVAL - INJECTION VERSION

PRELIMINARY OPERATIONS

1. Drive the car onto the elevator and lock the front wheels with suitable safety blocks.

CAUTION:
If the engine is hot, handle carefully to avoid burns.

Remove the front hood as instructed in Unit 56 - Hoods - Engine Hood - Removal and Installation.

REMOVAL OF ENGINE COMPARTMENT PARTS

The reference numbers in the following procedure refer to the figure "Engine Compartment Section".

1. Disconnect positive and negative terminals from the battery.

2. Cooling circuit removal.

a. Remove the radiator as instructed in Unit 07 - Engine Cooling System - Radiator - Removal.
b. Remove the thermostat to radiator hose (12).
c. Detach the expansion reservoir hose from the lower part of reservoir (1).
d. Detach the throttle body-expansion reservoir vent hose (20).
e. Detach the coolant return hose (30) (from heater) from the water pump.
f. Detach the coolant delivery hose (2) (to heater) from the throttle valve.

3. Air supply circuit removal.

a. Loosen the screw of clamp (6) and remove the rubber duct (7) from the intake duct (5).
b. Detach the servobrake vacuum intake hose (4).
c. Detach the fuel vapour return pipe (16) from the evaporative solenoid valve (15).

4. Fuel supply circuit removal.

CAUTION:
The fuel supply circuit is under pressure; it is therefore advisable to empty the fuel tank prior to detaching the delivery hose and in any case, after removal, to hold the hoses high up. Ensure furthermore that suitable equipment for safe operation is available in the workshop.

---

a. Disconnect the hose delivering fuel (21) to the electro injectors from the fuel distribution manifold.
b. Disconnect the fuel return hose (33) from the pressure regulator (32).

5. Disconnecting the accelerator control.

a. Disconnect the accelerator control rod (34) from the throttle opening control.

6. Oil vapour feedback circuit removal.

a. Disconnect the hose (14), delivering oil vapour to the separator, from the camshaft cover.
b. Disconnect the full throttle oil vapour return hose (17) from the intake duct.
c. Detach the oil feedback hose (31) from the engine block.
d. Remove the intake duct (5).

7. Wiring removal.

a. Disconnect the following electric wires, preferably removing them from the part indicated.
- High voltage wire (13) from the ignition coil.
- Supply wires (27) and alternator lamp (26) from terminal board (28) on the lefthand side of the car, having previously removed the guard (8).
- Minimum oil pressure sensor wire (29) from the sensor itself.
- Supply wire (23) and field wire (24) from the starter motor.
- Oil pressure indicator wire (25) from the bulb on the base.
- Electroinjector control wires (35) from the electroinjectors.
- Wiring of the coolant temperature sensor for the injection system (36), from the sensor on the engine head.
- Coolant temperature indicator wire (37) from the bulb on the engine head.
- Hight coolant temperature warning lamp wire (3) from the thermal contact on the engine head.
- Throttle switch wire (18) from the throttle switch.
- Timing and r.p.m. sensor wire from connector (11).
- System ground wires (22) from the engine head.
- Idle speed actuator wire (19) from the actuator.

WARNING:
Slide the injection system electrical wiring out from the upper part of the engine.

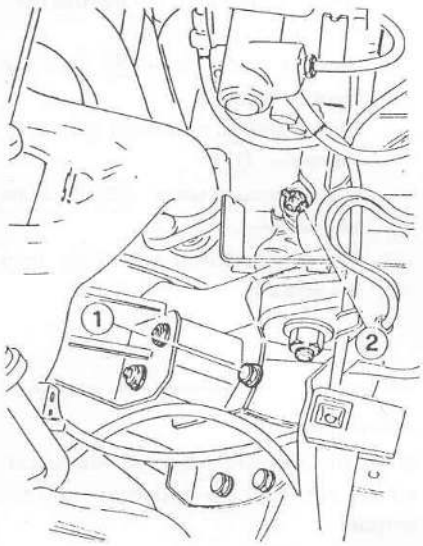
Extricate the electrical wiring from any clips and separate it from the engine so as not to impede its removal.

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8. Engine removal.

a. Remove on both sides the screws (1) securing the upper part of the engine side supports.

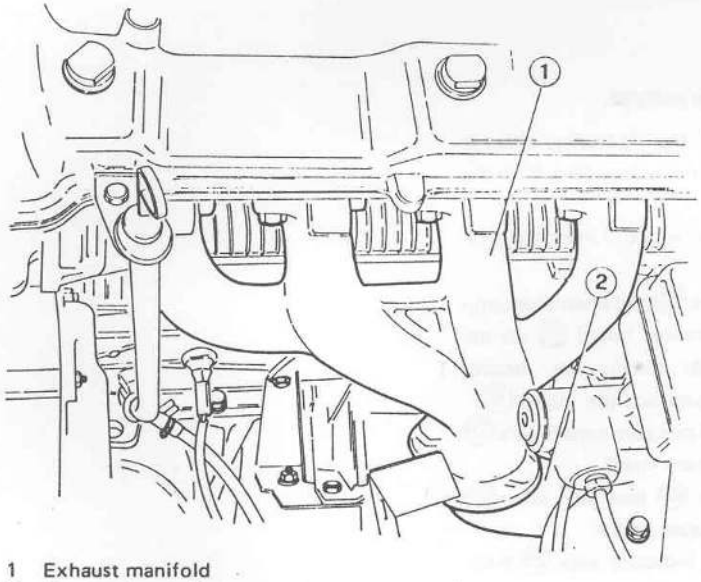
b. Slide out the cotter pin and unscrew the nut (2) securing the central track to the steering box transmission.



1 Screw
2 Nut

c. Raise the car and, as dictacted by the operations to be carried out, remove the oil sump cap and drain the oil, reinstall the cap and screwing it tight on completion of the operation.

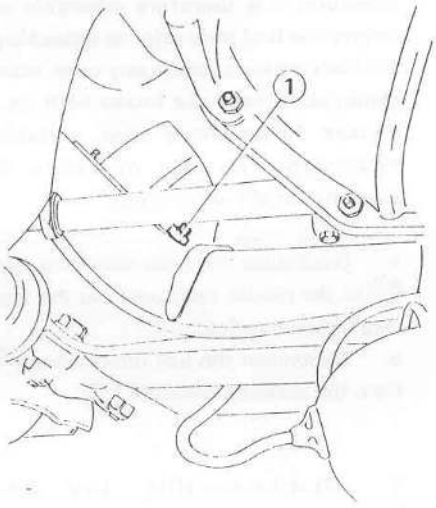
d. Unscrew the nuts securing the exhaust manifolds (1) to the front exhaust pipes (2).



1 Exhaust manifold
2 Front exhaust pipe

e. Operate as indicated in Unit 13 - Gearbox - 5 Gear Manual Gearbox - Removal, steps 2-10 and 12-15, omitting gearbox oil drain.

f. Unscrew on both sides the nuts (1) securing the lower part of the engine side supports.



1 Nut

g. Disconnect the central spark plug wires and remove spark plugs.
Lower the car then hook a suitable hydraulic peaked crane to the engine raising u-bolt provided for this purpose and, while working at the lower part of the car on the front end of the drive shaft to incline the engine, activate the hydraulic crane and raise the engine to a convenient height.

h. Lay the engine on the floor and separate it from the gearbox by unscrewing the corresponding nuts.

ENGINE INSTALLATION

Install the engine by operating in reverse order of removal and following these instructions.

- Lubricate the following elements as specified.

  Clutch throwout bearing work spot.

  Clutch control fork ball-and-socket joint washer.

  Grease:
  AGIP: Grease 33 FD
  IP: Autogrease FD

- Dampen adjoining surfaces of the gear lever bellows and support with specified sealant.

  Sealant:
  DIRING Heldite

- Observe the following locking torque.

(T): Tightening torque
Propeller shaft intermediate flange clamping bolts
37 thru 39 N·m
(3.8 thru 4 kg·m)
(27.3 thru 28.8 ft·lb)

- Refill engine with the type and quantity of prescribed oil (see Unit 00 - Complete Car - Engine Maintenance).

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ENGINE REMOVAL - CARBURETTERS VERSION

PRELIMINARY OPERATIONS

1. Drive the car onto the elevator and lock the front wheels with suitable safety blocks.

CAUTION:
If the engine is hot, handle carefully to avoid burns.

Remove the front hood as instructed in Unit 56 - Hoods - Engine Hood - Removal and Installation.

REMOVAL OF ENGINE COMPARTMENT PARTS

The reference numbers in the following procedure refer to the figure "Engine Compartment Section".

1. Intake system disconnection.

a. Release clips (14) and clamp (12), free hose (13) and remove air filter case.

b. Disconnect vacuum servo line (4).

2. Cooling circuit disconnection.

a. Detach radiator as instructed in Unit 07 - Engine Cooling System - Radiator - Removal.

b. Disconnect vent hose (11) from thermostat.

c. Disconnect hose (1) from coolant expansion reservoir.

d. Disconnect heater return line (20) from water pump.

e. Disconnect heater delivery lin(2)from intake manifold(3).

3. Fuel circuit disconnection.

a. Disconnect fuel and suction (23) hose from the fuel pump (24).

CAUTION:
The fuel supply circuit is under pressure; it is therefore advisable to empty the fuel tank prior to detaching the delivery hose and in any case, after removal, to hold the hoses high up. Ensure furthermore that suitable equipment for safe operation is available in the workshop.

---

4. Accelerator disconnection.

a. Disconnect accelerator linkage (28) from accelerator lever.

b. Release the choke cable (29) and sheath (27) by loosening the three screws (26).

5. Wiring removal.

a. Back off the four nuts and remove heat guard (20) from alternator (18).

b. Disconnect charge cable (22) and alternator warning light cable (21); retrieve heat guard.

c. Disconnect the following electrical cables and remove, preferably as indicated.

- Minimum oil pressure cable (19) from sending unit.
- HT cable (9) from ignition coil.
- LT cable (8) from distributor.
- Supply cable (15) and field cable (16) from the starter motor.
- Engine oil pressure indicator cable (17) from bulb on base.
- Coolant temperature gauge cable (10) from sending unit on thermostat
- Coolant temperature warning light cable (5) from sending unit on cylinder head.

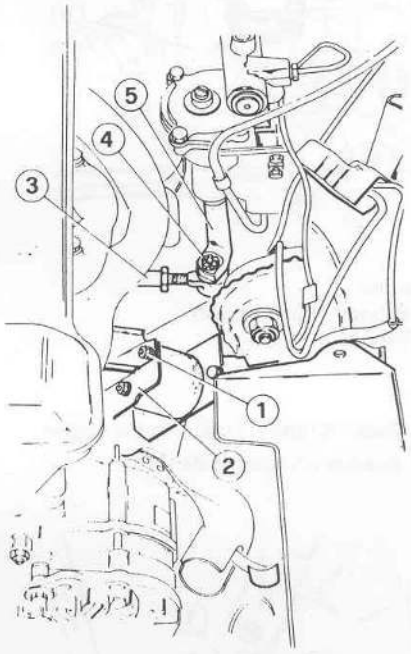
Release cables from any clips and arrange them so they will not interfere with engine removal.

Hereafter, reference should no longer be made to the Engine Compartment View but to the figures illustrating the various operations.

6. Engine removal.

a. Back off screws (1) securing the upper body of the engine side mounts on both sides.

b. Take out the cotter pin and back off nut (4) securing the centre rod (3) to the steering lever (5).



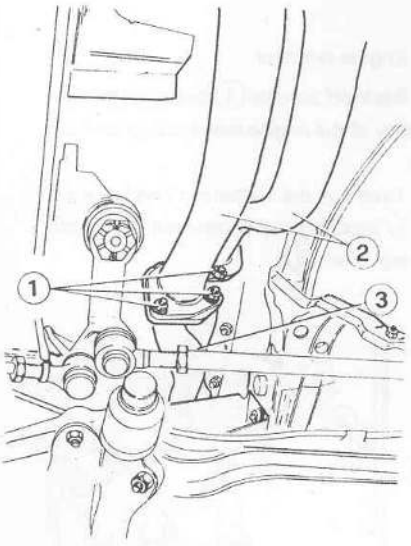
1 Screw
2 Engine side mount
3 Centre rod
4 Nut
5 Steering lever

c. Raise vehicle if operations so require, remove plug from oil pan and drain oil; on concluding remember to replace plug.

d. Operate as instructed in Unit 13 - Gearbox - 5 Gear Manual Gearbox - Removal-steps 2-10 and 12-25 without however drawing the gearbox oil.

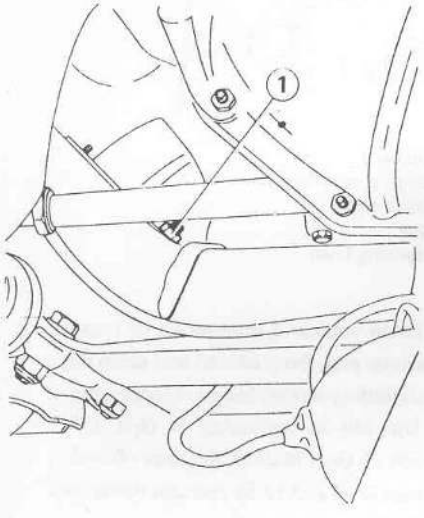
e. Back off six bolts (1) securing exhaust manifolds (3) to front of exhaust pipe (2).

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1 Bolts
2 Exhaust pipe front part
3 Exhaust manifold

f. Back off nuts (1) securing the engine side mounts on both undersides.



1 Nut

g. Lower and turn the rearwards, lower the car and disconnect the central spark plug wires and remove spark plugs. Hook on a suitable hydraulic lift.

h. Tilt engine by acting on front end of propeller shaft from below the car and at the same time raise engine with lift.

i. Rest engine on floor and separate from the gearbox by backing off nuts.

ENGINE INSTALLATION

Install in reverse order of removal, adhering is these instructions.

- Lubricate these parts as specified.

Clutch thrust bearing base.
Washer on clutch release fork ball and socket joint.

Grease:
AGIP: Grease 33 FD
IP: Autogrease FD

- Damper the gear lever bellows - support adjoining surfaces with recommended sealant.

Sealant:
DIRING Heldite

- Observe the following tightening torque.

(T) : **Tightening torque**
Bolts securing the intermediate propeller shaft flanges
37 thru 39 N·m
(3.8 thru 4 kg·m)
(27.3 thru 28.8 ft·lb)

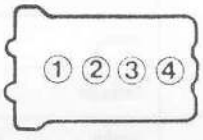
- Refill engine with the type and quantity of prescribed oil (see Unit 00 - Complete Car - Engine Maintenance).

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TECHNICAL SPECIFICATIONS AND FEATURES

SPECIFICATIONS

ENGINE SPECIFICATIONS

		Spider / Spider 2.0	Spider 1.6
Type		Otto cycle, 4-stroke	
No. and arrangement of cylinders		4, in-line	
Cylinder numbering			
Bore-Stroke	mm (in)	84 x 88.5 (3.31 x 3.48)	78 x 82 (3.07 x 3.23)
Displacement	cm^3 (cu.in)	1962 (119.72)	1570 (95.80)
Combustion chamber volume	cm^3 (cui.in)	61.3 (3.74)	49 (3.11)
Power output DIN Maximum	kW CEE (CV DIN)	86 (120) at 5800 rpm	78 (109) at 6000 rpm
Max. torque DIN	Nm (kgm) (ft-lb)	157 (16,4) (116) at 4200 rpm	134 (14) (99) at 4800 rpm
Octane rating	RON (1)	91 ÷ 95 (2)	≥ 95
Engine oil pressure (4) at 800 - 900 rpm at 5000 r.p.m.	kPa (bar; kg/cm^2; p.s.i.)	49.03 thru 98.06 (0.49 thru 0.98; 0.5 thru 1; 7.1 thru 14.2) 343.21 thru 490.3 (3.43 thru 4.90; 3.5 thru 5; 49.8 thru 71.1)	

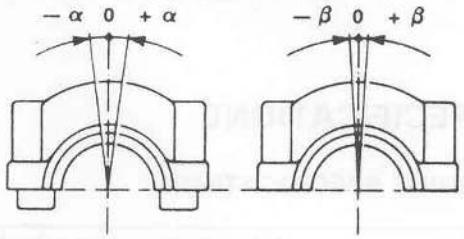
(1) Research Octane Number
(2) Unleaded fuel only
(3) Values to be recorded at operating temperature (oil at 90°C)

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CHECKS AND ADJUSTMENT

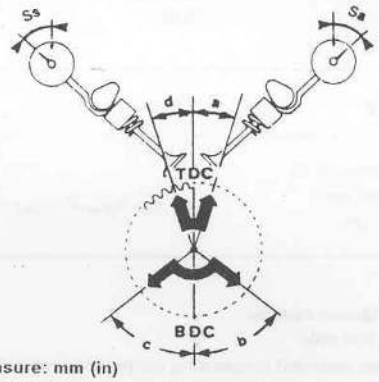
VALVE TIMING DATA (1)

REFERENCE MARKS ON FRONT CAMSHAFT BEARING CAP (viewed from flywheel side)



			Spider / Spider 2.0	Spider 1.6
Clearance between cam heel radius and tappet head	Intake	mm (in)	0.400 thru 0.450 (0.016 thru 0.018)	
	Exhaust	mm (in)	0.450 thru 0.500 (0.018 thru 0.020)	
Angular position of timing mark on front bearing cap	Intake	(β)	12° 45'	+1°
	Exhaust	(α)	-1°	-4°
Nominal lift	Intake	mm (in)	11	9
	Exhaust	mm (in)	9	9

VALVE OPENING AND CLOSING ANGLE CHECK (crankshaft rotation counterclockwise when viewed from flywheel side)



Unit of measure: mm (in)

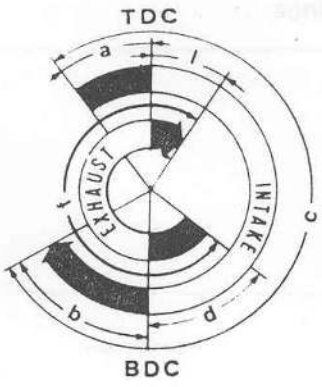
				Spider / Spider 2.0	Spider 1.6
Intake	Opening	Linear displacement of tappet	(Sa)	0.25 (0.010)	0.25 (0.010)
		Corresponding angular movement (BTDC)	(a)	4° thru -3°	20°30' thru 23°30'
	Closing	Linear displacement of tappet	(Sa)	0.25 (0.010)	0.25 (0.010)
		Corresponding angular movement (ABDC)	(b)	65° thru 72°	32°30' thru 35°30'
Exhaust	Opening	Linear displacement of tappet	(Ss)	0.20 (0.008)	0.20 (0.008)
		Corresponding angular movement (BBDC)	(c)	38°30' thru 41°30'	38°30' thru 41°30'
	Closing	Linear displacement of tappet	(Ss)	0.20 (0.008)	0.20 (0.008)
		Corresponding angular movement (ATDC)	(d)	14°30' thru 17°30'	14°30' thru 17°30'

(1) Engine cold

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VALVE TIMING DIAGRAM

(crankshaft rotation clockwise when viewed from front)

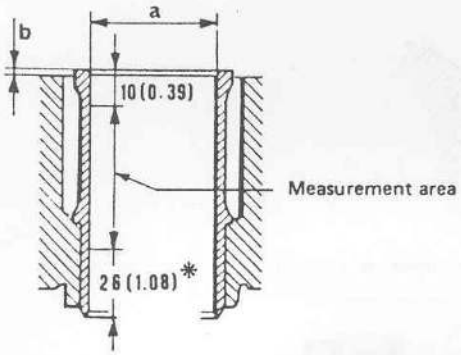


			Spider / Spider 2.0	Spider 1.6
Intake	Opens (BTDC)	(a)	28°44' thru 21°44'*	47°
	Closing (ABDC)	(b)	90°28' thru 97°28'*	58°
	Angle	(c)	299°12'	285°
Exhaust	Opens (BBDC)	(d)	58°12'	58°
	Close (ATDC)	(e)	33°48'	34°
	Angle	(f)	272°	272°

* Range indicates timing angular span

CYLINDER LINERS, PISTONS, RINGS AND PINS

Cylinder liners



*30 mm (1.16 in) for Spider 1.6

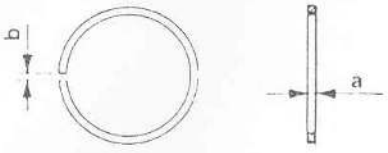
Unit of measure: mm (in)

Description			Spider / Spider 2.0	Spider 1.6
Liner bore dia. (a)	Class A (Blue)		83.985 thru 83.994 (3.3065 thru 3.3068)	77.985 thru 77.994 (3.0703 thru 3.0.706)
	Class B (Pink)		83.995 thru 84.004 (3.3069 thru 3.3072)	77.995 thru 78.004 (3.0707 thru 3.0710)
	Class C (Green)		84.005 thru 84.014 (3.3073 thru 3.3076)	78.005 thru 78.014 (3.0711 thru 3.0714)
Linear stand-out (1)		(b)	0.01 thru 0.06 (0.0004 thru 0.0024)	0.00 thru 0.06 (0.00 thru 0.0024)
Max. out of roundness			0.01 (0.0004)	0.01 (0.0004)
Max. ovality and taper (2)			0.01 (0.0004)	0.01 (0.0004)

(1) Check after fitting liner retainers and tightening nuts to 10 - 15 Nm (1 - 1.5 kgm; 7.4 to 11.1 ft·lb)
(2) Max. limit along entire liner length (a)

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Piston rings

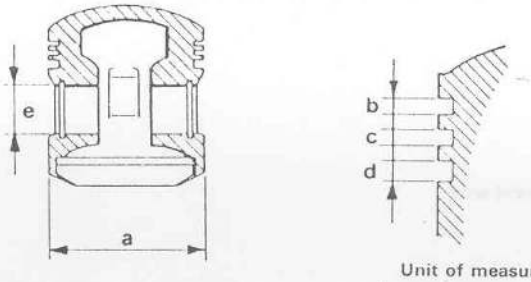


Unit of measure: mm (in)

Description			Spider / Spider 2.0	Spider 1.6
Ring thickness	(a)	Top compression ring	1.478 thru 1.490 (0.0582 thru 0.0587)	1.478 thru 1.490 (0.0582 thru 0.0587)
		2nd compression ring	1.478 thru 1.490 (0.0582 thru 0.0587)	1.728 thru 1.740 (0.0680 thru 0.0685)
		Oil control ring	3.478 thru 3.490 (0.1369 thru 0.1374)	3.978 thru 3.990 (0.1566 thru 0.1571)
Ring gap (1)	(b)	Top compression ring	0.30 thru 0.50 (0.012 thru 0.020)	0.30 thru 0.45 (0.012 thru 0.018)
		2nd compression ring	0.30 thru 0.50 (0.012 thru 0.020)	0.30 thru 0.45 (0.012 thru 0.018)
		Oil control ring	0.25 thru 0.50 (0.010 thru 0.020)	0.30 thru 0.45 (0.012 thru 0.018)

(1) Fitted in checking fixture or cylinder liner

Pistons



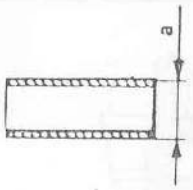
Unit of measure: mm (in)

Description			Spider / Spider 2.0	Spider 1.6
Piston diameter (1)	(a)	Class A (Blue)	83.935 thru 83.945 (3.3045 thru 3.3049)	77.945 thru 77.955 (3.0687 thru 3.0691)
		Class B (Pink)	83.945 thru 83.955 (3.3049 thru 3.3053)	77.955 thru 77.965 (3.0691 thru 3.0695)
		Class C (Green)	83.955 thru 83.965 (3.3053 thru 3.3057)	77.965 thru 77.975 (3.0695 tru 3.0699)
Top compression ring groove width		(b)	1.525 thru 1.545 (0.0600 thru 0.0608)	1.535 thru 1.555 (2) (0.0604 thru 0.0612) 1.525 thru 1.545 (3) (0.0600 thru 0.0608)
2nd compression ring groove width		(c)	1.525 thru 1.545 (0.0600 thru 0.0608)	1.775 thru 1.795 (0.0699 thru 0.0707)
Oil control ring groove width		(d)	3.515 thru 3.535 (0.1384 thru 0.1392)	4.015 thru 4.035 (0.1581 thru 0.1589)
Pin bore dia.	(e)	Black	22.000 thru 22.002 (0.86614 thru 0.86622)	
		White	22.003 thru 22.005 (0.86626 thru 0.86634)	

(1) Measure at right angles to pin bore and at the following distance from lower edge of skirt: 17 mm (0.67 in)
(2) Borgo piston
(3) Mondial piston

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Piston pins

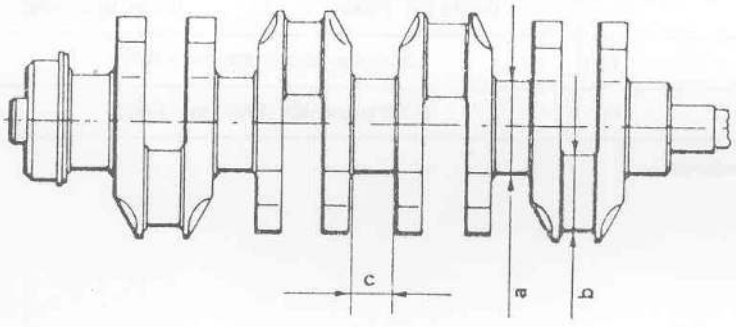


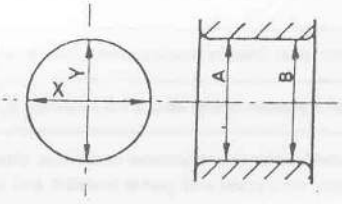
Unit of measure: mm (in)

Description		Spider / Spider 2.0	Spider 1.6
Pin diameter (a)	Black	21.994 thru 21.997 (0.8659 thru 0.8660)	
	White	21.997 thru 22.000 (0.8660 thru 0.8661)	
Pin clearance		0.003 thur 0.008 ((0.0001 thru 0.0003)	

CRANKSHAFT, ENGINE BLOCK, CONNECTING RODS, BEARINGS AND FLYWHEEL

Crankshaft





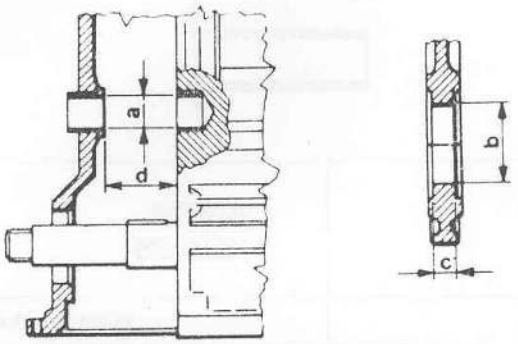
Ovality: X-Y
Taper: A-B

Unit of measure: mm (in)

Description		Spider / Spider 2.0	Spider 1.6
Main journal diameter (a)	Standard Blue	59.951 thru 59.961 (2.3603 thru 2.3607)	59.956 thru 59.966 (2.3605 thru 2.3609)
	Standard Red	59.961 thru 59.971 (2.3607 thru 2.3611)	59.966 thru 59.976 (2.3609 thru 2.3613)
Crankpin diameter (b)	Standard Blue	49.978 thru 49.988 (1.9676 thru 1.9680)	
	Standard Red	49.988 thru 49.998 (1.9680 thru 1.9684)	
Center main bearing journal width (c)	Standard	30.000 thru 30.035 (1.1811 thru 1.1825)	
Max. permissible main journal and crankpin ovality		0.007 (0.0003)	
Max. permissible main journal and crankpin taper		0.01 (0.0004)	
Max. crankpin misalignment relative to main journals		0.015 (0.0006)	
Max. main journal eccentricity		0.04 (0.0016)	
Max. crankpin offset (crankpin centerline to main journal centerline)		0.3 (0.012)	

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Engine block

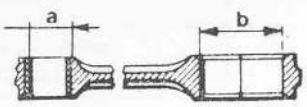


Unit of measure: mm (in)

Description		Spider / Spider 2.0	Spider 1.6
Timing idler shaft bushing fitted I.D. (after reaming) (1)	(a)	20.677 thru 20.698 (0.8141 thru 0.8149)	
Main bearing housing bore width	(b)	63.647 thru 63.666 (2.5058 thru 2.5065)	63.657 thru 63.676 (2.5062 thru 2.5069)
Center main bearing housing width over thrust faces	(c)	25.15 thru 25.20 (0.990 thru 0.992)	
Width between timing idler shaft bushings (2)	(d)	47.720 thru 47.820 (1.8787 thru 1.8827)	

(1) Should replacement become necessary, always replace both bushings
(2) Check with cover and gasket installed and tightened

Connecting rod

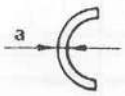


Unit of measure: mm (in)

Description		Spider / Spider 2.0	Spider 1.6
Small end bore I.D.	(a)	22.005 thru 22.015 (0.8663 thru 0.8667)	
Big end bore dia.	(b)	53.695 thru 53.708 (2.1140 thru 2.1145)	

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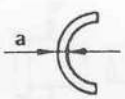
Connecting rod bearings



Unit of measure: mm (in)

Description			Spider / Spider 2.0	Spider 1.6
Connecting rod bearing wall thickness	(a)	Standard Blue	1.835 thru 1.841 (0.0722 thru 0.0725)	
		Standard Red	1.829 thru 1.835 (0.0720 thru 0.0722)	

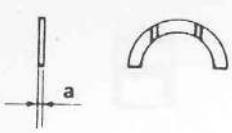
Main bearings



Unit of measure: mm (in)

Description			Spider / Spider 2.0	Spider 1.6
Main bearing wall thickness	(a)	Standard Blue	1.835 thru 1.841 (0.0722 thru 0.0725)	
		Standard Red	1.829 thru 1.835 (0.0720 thru 0.0722)	

Thrust rings

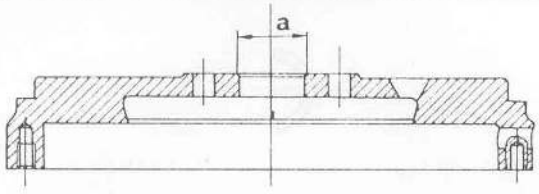


Unit of measure: mm (in)

Description			Spider / Spider 2.0	Spider 1.6
Thrust ring thickness	(a)	Standar	2.310 thru 2.360 (0.0909 thru 0.0929)	

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Flywheel

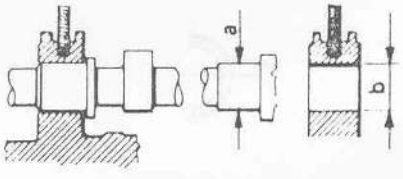


Unit of measure: mm (in)

Description			Spider / Spider 2.0	Spider 1.6
Center bushing fitted I.D.	(a)	After reaming	32.000 thru 32.025 (1.2598 thru 1.2608)	

CAMSHAFT, TAPPET, SPRINGS, CYLINDER HEAD AND VALVES

Camshaft



Unit of measure: mm (in)

Description		Spider / Spider 2.0	Spider 1.6
Camshaft journal diameter	(a)	26.959 thru 26.980 (1.0614 thru 1.0622)	
Camshaft journal housing bore dia.	(b)	27.000 thru 27.033 (1.0630 thru 1.0643)	

Tappet



Unit of measure: mm (in)

Description			Spider / Spider 2.0	Spider 1.6
Tappet diameter	(a)	Standard	34.973 thru 34.989 (1.3698 thru 1.3775)	
		Oversize	35.173 thru 35.189 (1.3848 thru 1.3854)	

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Springs

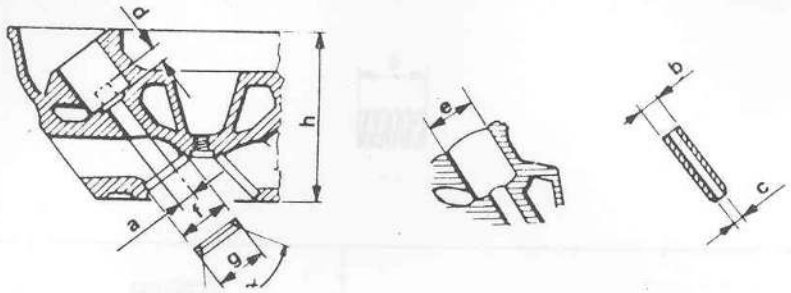


Unit of measure: mm (in)

Description			Spider / Spider 2.0	Spider 1.6
Spring length with valve open	(a)	Outer spring	25.5 (1.00)	
		Inner spring	23.5 (0.93)	
Load at length (a) - kg (lb)	(a)	Outer spring	46.1 to 47.9 (101.6 to 105.2)	
		Inner spring	24.87 to 25.73 (54.8 to 56.7)	

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Cylinder head



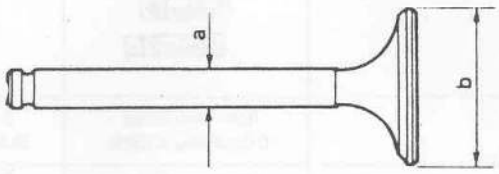
Unit of measure: mm (in)

Description			Spider ⛽ □ Spider 2.0	Spider 1.6
Valve guide housing bore dia.		(a)	13.990 thru 14.018 (0.5508 thru 0.5519)	
Valve guide O.D.		(b)	14.033 thru 14.044 (0.5525 thru 0.5529)	
Valve guide fitted I.D. (after reaming)		(c)	9.000 thru 9.015 (0.3543 thru 0.3549)	
Valve guida stand-out	(d)	Intake	11.800 thru 12.000 (0.4646 thru 0.4724)	
		Exhaust	16.300 thru 16.500 (0.6417 thru 0.6496)	11.800 thru 12.000 (0.4646 thru 0.4724)
Tappet housing bore dia.	(e)	Standard	35.000 thru 35.025 (1.3780 thru 1.3789)	
		Oversize	35.200 thru 35.225 (1.3858 thru 1.3868)	
Valve seat insert housing bore dia.	(f)	Intake (1)	45.000 thru 45.025 (1.7717 thru 1.7726)	42.532 thru 42.557 (1.6745 thru 1.6755)
		Exhaust (1)	41.000 thru 41.025 (1.6142 thru 1.6152)	38.532 thru 38.557 (1.5170 thru 1.5180)
		Intake (2)	45.300 thru 45.325 (1.7835 thru 1.7844)	42.832 thru 42.857 (1.6863 thru 1.6873)
		Exhaust (2)	41.300 thru 41.325 (1.6260 thru 1.6270)	38.832 thru 38.857 1.5288 thru 1.5298)
Valve seat insert O.D.	(g)	Intake (1)	45.065 thru 45.100 (1.7742 thru 1.7756)	42.597 thru 42.632 (1.6770 thru 1.6784)
		Exhaust (1)	41.065 thru 41.100 (1.6167 thru 1.6181)	38.597 thru 38.632 (1.5196 thru 1.5209)
		Intake (2)	45.365 thru 45.400 (1.7860 thru 1.7874)	42.897 thru 42.932 (1.6889 thru 1.6902)
		Exhaust (2)	41.365 thru 41.400 (1.6285 thru 1.6299)	38.897 thru 38.932 (1.5314 thru 1.5328)
Seat insert face angle		(α)	120°	
Min. cylinder head height after dressing		(h)	111.5 (4.39)	
Max. parallelism error between head faces			0.087 (0.034)	
Max. head bottom face warpage			0.05 (0.002)	

(1) Standard
(2) Oversize

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Valves



Unit of measure: mm (in)

Description			Spider ❖ Spider 2.0	Spider 1.6
Valve stem diameter	(a)	Intake	8.972 thru 8.987 (0.3532 thru 0.3538)	
		Exhaust	8.935 thru 8.960 (0.3518 thru 0.3528)	
Valve head dia. - ATE type	(b)	Intake	44.010 thru 44.150 (1.7327 thru 1.7382)	41.000 thru 41.200 (1.6142 thru 1.6220)
		Exhaust	40.010 thru 40.150 (1.5752 thru 1.5807)	37.000 thru 37.200 (1.4567 thru 1.4646)
Valve head dia. - Eaton-Livia type	(b)	Intake	44.000 thru 44.150 (1.7327 thru 1.7382)	41.850 thru 42.000 (1.6476 thru 1.6535)
		Exhaust	40.000 thru 40.150 (1.5752 thru 1.5807)	37.000 thru 37.150 (1.4567 thru 1.4626)

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FITTING DATA

Unit of measure: mm (in)

Description		Spider / Spider 2.0	Spider 1.6
Liner/piston clearance		0.040 thru 0.059 (0.0016 thru 0.0023)	0.030 thru 0.049 (0.0012 thru 0.0019)
Ring/groove clearance	Top compression ring	0.035 thru 0.067 (0.0014 thru 0.0026)	0.045 thru 0.077 (0.018 thru 0.030) (1) 0.035 thru 0.067 (0.014 thru 0.026) (2)
	2nd compression ring	0.035 thru 0.067 (0.0014 thru 0.0026)	
	Oil control ring	0.025 thru 0.057 (0.0010 thru 0.0022)	
Pin/piston bore clearance		0.003 thru 0.008 (0.0001 thru 0.0003)	
Pin/small end clearance	Black	0.008 thru 0.021 (0.0003 thru 0.0008)	
	White	0.005 thru 0.018 (0.0002 thru 0.0007)	
Main bearing journal running clearance	Blue	0.004 thru 0.045 ((0.0002 thru 0.0018)	
	Red	0.006 thru 0.047 (0.0002 thru 0.0019)	
Crankpin running clearance	Blue	0.025 thru 0.060 (0.010 thru 0.024)	
	Red	0.027 thru 0.062 (0.011 thru 0.025)	
Crankshaft end play		0.080 thru 0.265 (0.0031 thru 0.0104)	
Big end end play		0.2 thru 0.3 (0.008 thru 0.012)	
Camshaft journal running clearance		0.020 thru 0.074 (0.0008 thru 0.0029)	
Camshaft end play		0.065 thru 0.182 (0.0026 thru 0.0072)	
Tappet working clearance		0.011 thru 0.052 (0.0004 thru 0.0020)	
Valve stem/guide	Intake	0.013 thru 0.043 (0.0005 thru 0.0017)	
	Exhaust	0.040 thru 0.080 (0.0016 thru 0.0031)	
Valve guide interference fit		0.015 thru 0.054 (0.0006 thru 0.0021)	
Seat insert interference fit		0.04 thru 0.10 (0.002 thru 0.004)	

(1) Borgo piston
(2) Mondial piston

SHRINK-FIT TEMPERATURE

Component	Temperature
Cylinder head (valve seat installation)	100°C (212°F)
Starter ring gear	120° to 140°C (248° to 284°F)

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GENERAL REQUIREMENTS

FLUIDS AND LUBRICANTS

Application	Type	Denomination	Quantity
Rear main bearing cap seals	FLUID	UNION CARBIDE CHEMICALS CO: Ucon Lubricant: 50HB-5100 MILLOIL: Lubricant for rubber Norm. 4500-17502	As required
Crankshaft seals (front and rear) — Outer surface — Lip	 OIL GREASE	 Engine oil ISECO Molykote BRZ Norm. 3671-69841	 As required As required
Engine oil — Routine changes - pan and filter — Cylinder head well (1)	OIL*	AGIP SINT 2000 10W40 Norm. 3631-69352 IP SINTIAX 10W40 Norm. 3631-69352 SHELL Super Plus Norm. 3631-69352 Motor Oil 10W50	 6.0 kg (13.2 lb) 0.415 kg (0.91 lb) per well (2)
Spark plug threads	OIL	ISECO: Molykote A Norm. 4500-18304	As required

(1) Fill only after camshaft removal

(2) With cylinder head completely dry

* Classification: SAE 10W50
API SE
ASTM SF

SEALANTS

Application	Type	Name	Quantity
Front cover screws (to head) (1)	SEALING COMPOUND	DIRING: Curil Norm. 3522-00017	As required
Camshaft cover contact surface (1)	SEALING COMPOUND	DIRING: Heldite Norm. 3522-00015	As required
Flywheel screws (2) Timing variator spigot on camshaft ■ (2)	SEALING COMPOUND	LOCTITE 270 (green) Norm. 3524-00009	As required

(1) To remove traces of old gasket from cylinder head or block faces use butyl acetate or methylketone

(2) Before applying sealing compound, remove all traces of old sealant from threads using a suitable brush and compressed air
Always degrease threads using trichloroethylene or chlorothene

■ For injection versions

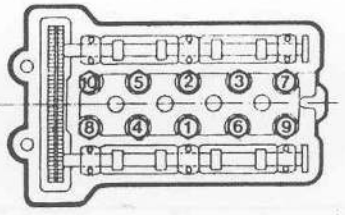
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ABRASIVES

Application	Type	Name	Quantity
Valves and valve seats	GRINDING PASTE	SIPAL AREXONS: Carbosilicium for valves Norm. 4100-31502	As required

TIGHTENING TORQUES

Unit of measure: N·m (Kg·m; ft·lb)

Item	Spider / Spider 2.0	Spider 1.6
Main bearing cap nuts (wet)	46 thru 49 (4.7 thru 5; 33.9 thru 36.1)	
Flywheel screws (with specified sealant)	110 thru 113 (11.2 thru 11.5; 81.1 thru 83.3)	
Connecting rod cap nuts (wet)	49 thru 52 (5 thru 5.3; 36.1 thru 38.4)	
Crankshaft pulley nut (wet)	187 thru 195 (19 thru 20; 137.9 thru 143.8)	
Variator on camshaft	98 thru 117 (10 thru 12; 72.3 thru 86.3)	—
Variator gear lockring (wet)	108 thru 118 (11 thru 12; 79.7 thru 87.0)	—
Cylinder head nut tightening sequence (1)		
a) On head installation proceed as follows: — with engine cold, tighten progressively in proper sequence with washers, nuts and threads lubricated	74 thru 82 (7.5 thru 8.4; 55 thru 60)	77 ÷ 79 N·m (7.9 ÷ 8.1 kg·m 57 ÷ 58 ft·lb)
b) After 1000 km (620 mi.), slacken nuts one at a time by one turn in proper sequence when engine is cold, lubricate washer and contact surfaces and retighten	82 thru 88 (8.4 thru 9; 60 thru 65)	86 ÷ 88 N·m (8.8 ÷ 9 kg·m 63 ÷ 65 ft·lb)
Camshaft bearing cap nuts (wet)	20 thru 25 (2 thru 2.5; 14.8 thru 18.4)	
Main bearing locknut (wet)	2 thru 3 (0.2 thru 0.3: 1.5 thru 2.2)	
Camshaft cover knobs	10 thru 14 (1 thru 1.4; 7.4 thru 10.3)	
Front cover and water pump nuts	14 thru 22 (1.4 thru 2.2; 10.3 thru 16.2)	
Spark plugs	25 thru 34 (2.5 thru 3.5; 18.4 thru 25.1)	
Coolant temperature sending unit on intake manifold	34 thru 39 (3.5 thru 4; 25.1 thru 28.8)	
High coolant temperature indicator sending unit on cylinder head	20 thru 25 (2 thru 2.5; 14.8 thru 18.4)	
Thermostat cover screws	10 thru 16 (1 thru 1.6; 7.4 thru 11.8)	

(1) Proceed as described in paragraph b) for service coupons A and B

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TROUBLESHOOTING AND CORRECTIVE ACTIONS

Trouble	Probable cause	Corrective action
Engine noisy. Crankshaft knocks	Excessive bearing journal or crankpin clearance and/or excessive play at thrust rings	Replace bearings and/or thrust rings
Pistons and connecting rods knock	• Improper installation • Pin shifts sideways	Remove and install correctly Remove and install correctly
Camshafts and valves knock	• Excessive valve clearance • Bad tappet fit • Failed valve spring • Worn camshafts	Adjust Replace Replace Replace
Water pump noisy	Excessive impeller shaft bearing clearance	Replace water pump
Other mechanical problems		
Burnt valves	• Incorrect valve clearance • Failed valve spring	Replace and adjust clearance Replace
Excessive piston and cylinder liner wear	• Bad piston fit • Poor quality oil • Air cleaner dirty or ineffective • Fuel mixture too rich	Install correctly Use suitable oil Replace air cleaner Adjust or replace carburetter
Damaged connecting rod bearing	• Oil starvation • Poor quality oil • Crankpins worn or out-of-round • Crankpin/bearing grade mismatched	Check lubrication system Use suitable oil Re-condition or replace Replace
Damaged main bearing	• Oil starvation • Poor quality oil • Main bearing journals worn or out-of-round • Main journal/bearing grade mismatched	Check lubrication system Use suitable oil Re-condition or replace Replace
Timing chain and chain tensioner noisy	• Worn chain • Incorrect chain tension • Noisy tensioner	Replace Adjust tensioner Replace
Incorrect ignition timing	Distributor incorrectly installed	Adjust

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Lubrication

Trouble	Probable cause	Corrective action
Oil leakage	• Loose drain plug	Tighten
	• Leakage past oil pan gasket	Replace gasket
	• Leakage past camshaft cover gasket and/or seals	Replace gasket and seals
	• Leakage past crankshaft seals and gaskets	Replace worn gasket and seals
	• Leakage past filter gasket	Tighten filter
Low oil pressure	• Clogged pressure regularing valve	Clean valve
	• Poor quality oil	Change oil

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UNIT 04

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INJECTION FUEL SYSTEM

IGNITION AND INJECTION SYSTEM (ML4.1 MOTRONIC SYSTEM)

FUNCTIONAL DESCRIPTION

The fuel is sent from the tank (14) to the injectors (24) by means of the two electric pumps (15) and (13) and through the filter (12).

The pressure regulator (4), according to the vacuum detected in the intake plenum chamber (5), adjusts the fuel pressure in the manifold (10) in order to keep constant the difference between the fuel pressure and the pressure in the plenum chamber.

When the fuel pressure exceeds the maximum specified value (3 bar; 45 p.s.i.), the pressure regulator forces the exceeding fuel to return to the fuel tank.

In this way, the quantity of the injected fuel only depends on the injection time established by the electronic control unit (22) according to the signals received from the sensors which monitor the following engine operational data:

- r.p.m.
- crankshaft angular position
- conditioning compressor actuation
- intaken air quantity
- intaken air temperature
- engine temperature
- engine load
- battery voltage
- exhaust gas emission.

The quantity of intaken air is monitored by the air flow sensor (27), the function of which is to quantify the air flow and send a signal to the electronic control unit which accordingly determines the exact quantity of fuel.

A sensor (28) monitoring the temperature of the intakon air is located inside the air flow meter.

This sensor delivers a signal to the electronic control unit so that a compensation of the injection time according to the variation of the air/fuel weight ratio can be carried out.

The engine temperature is monitored by the special sensor (25) dipped in the coolant.

The air enters the intake manifold (26) through the air flow sensor and then reaches the throttle valve body (7).

The throttle valve body is equipped with a switch (9), made up of two microswitches; the first controlling the minimum opening and delivering a signal for a throttle valve 0° (fully closed) to 1° angle; the second delivering a signal for throttle valve opening angles exceeding 72°.

The two microswitch signals reaching the electronic control unit allow the fuel cutoff control during deceleration with "throttle valve closed" condition and r.p.m. higher than 1080 (engine at running temperature), and the mixture enrichment control in acceleration, whenever, being the throttle valve opening angle greater than 72°, it is necessary to increase the fuel quantity to be injected into the cylinders, so as to reach the required r.p.m. at the soonest.

The idle speed actuator (8) is installed on the air circuit by-passing the throttle valve body; the actuator pass section, should the throttle valve be closed or slightly open, allows an air flow independent of the gas control to pass through upon command from the electronic control unit.

Consequently the actuator task is to keep the idle speed always constant throughout the operating conditions (for example, should the conditioning compressor be actuated, the electronic control unit increases, via the actuator, the r.p.m. up to the rated value allowing a higher quantity of air to enter the plenum chamber by-passing the throttle valve).

The intaken air from the throttle valve body enters the cylinders through the plenum chamber.

The ignition advance only depends on the r.p.m. and the engine temperature.

The ignition time is obtained from an electronic control unit programmed value corrected according to intaken air temperature, engine temperature and battery voltage measurements.

The sensor designed for the detection of the engine timing and r.p.m. (31) is an inductive type, the operation of which is due to the variation of the magnetic field generated by the passage of the gear teeth (impulse emitting wheel) splined on the crankshaft.

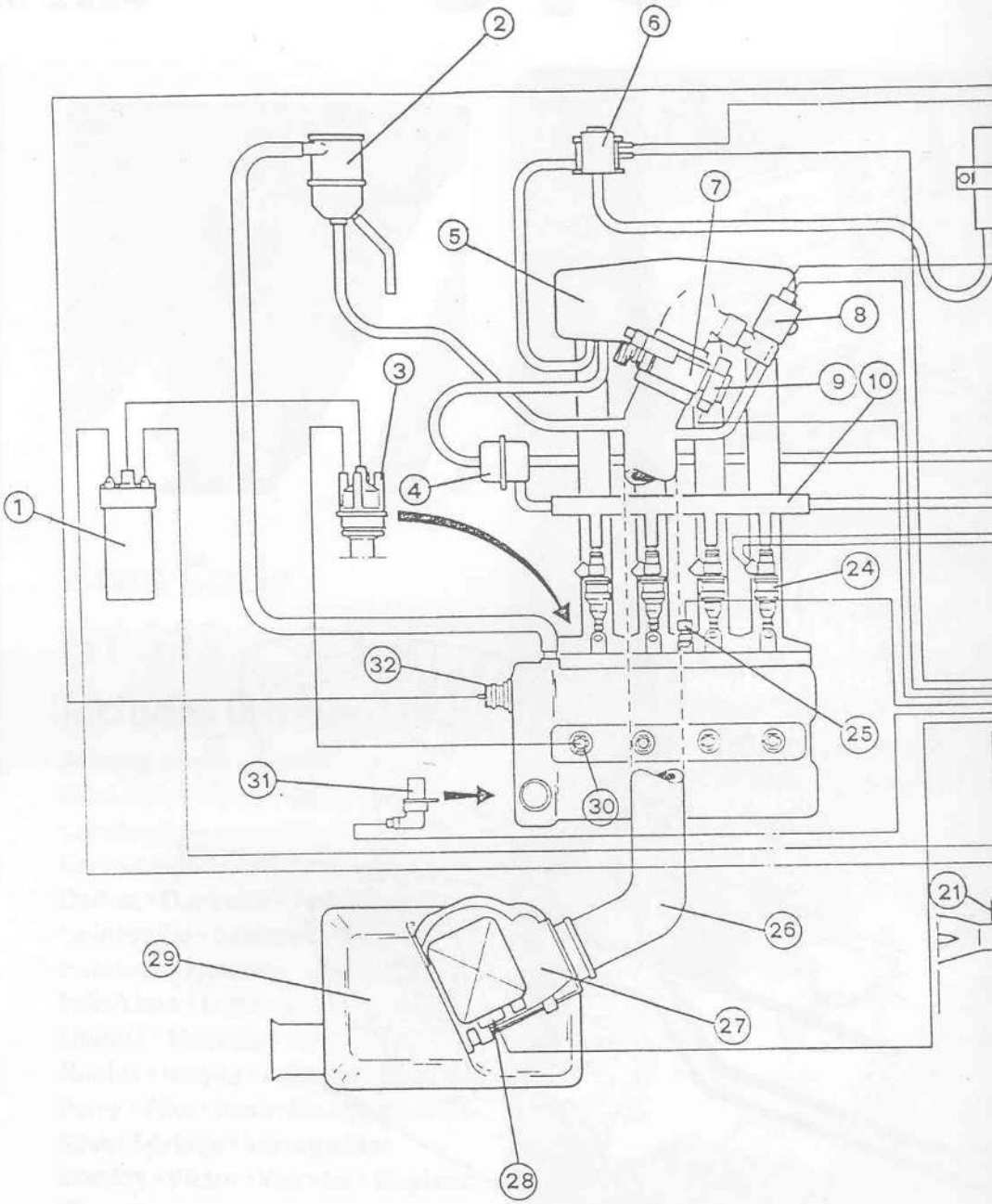
The ignition advance is processed by a programmed map inside the control unit, in relation with the engine load and r.p.m.; the value obtained is optimized according to the intaken air and engine temperatures.

Should the final value considerably differ from the one established by the programmed map, the injection time is increased to ensure enough interval from knocking limit.

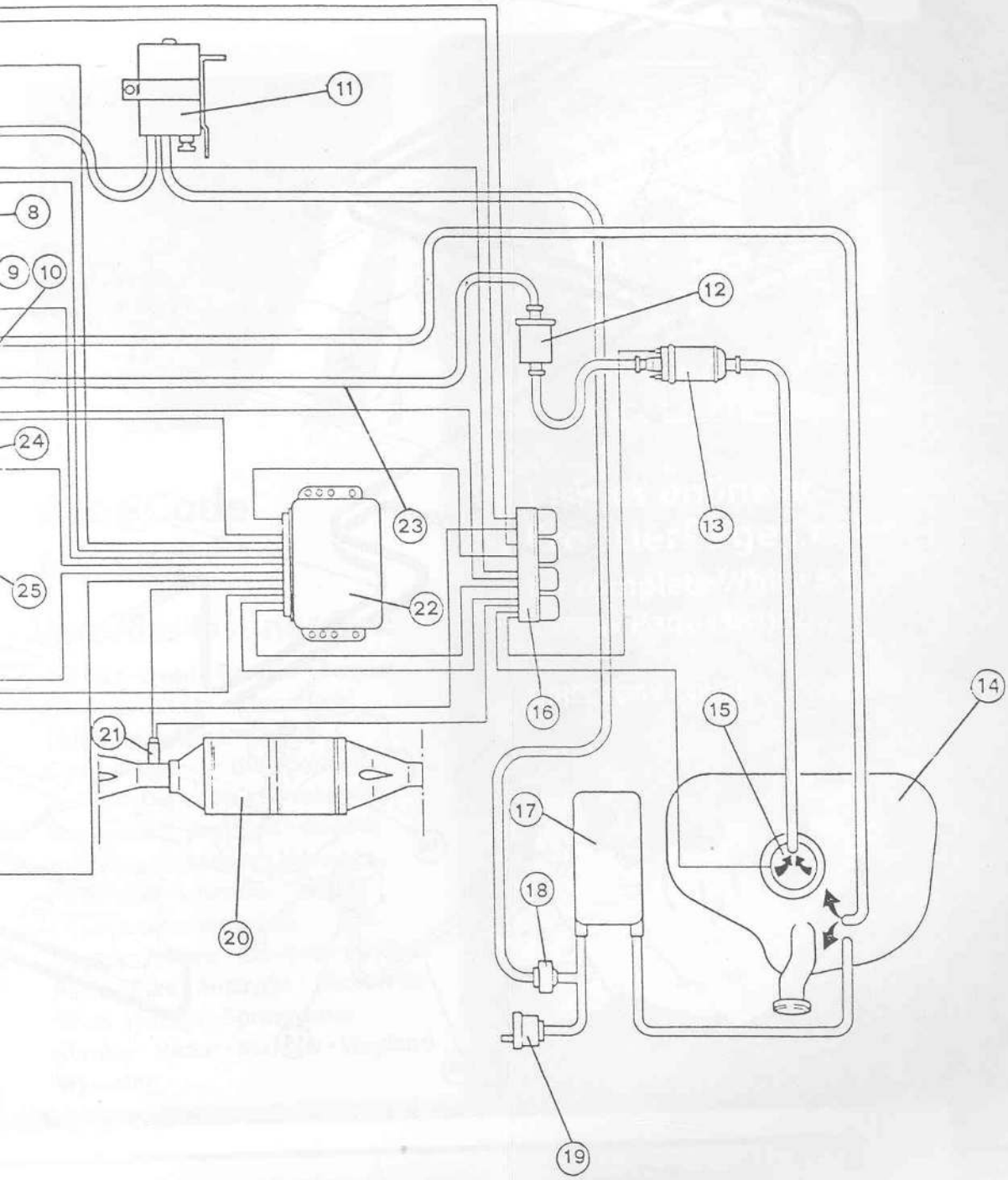
The camshaft (intake side) is equipped with an electro-mechanical-hydraulic timing variator (32) which modifies the intake timing (advance) in order to intake a higher quantity of air.

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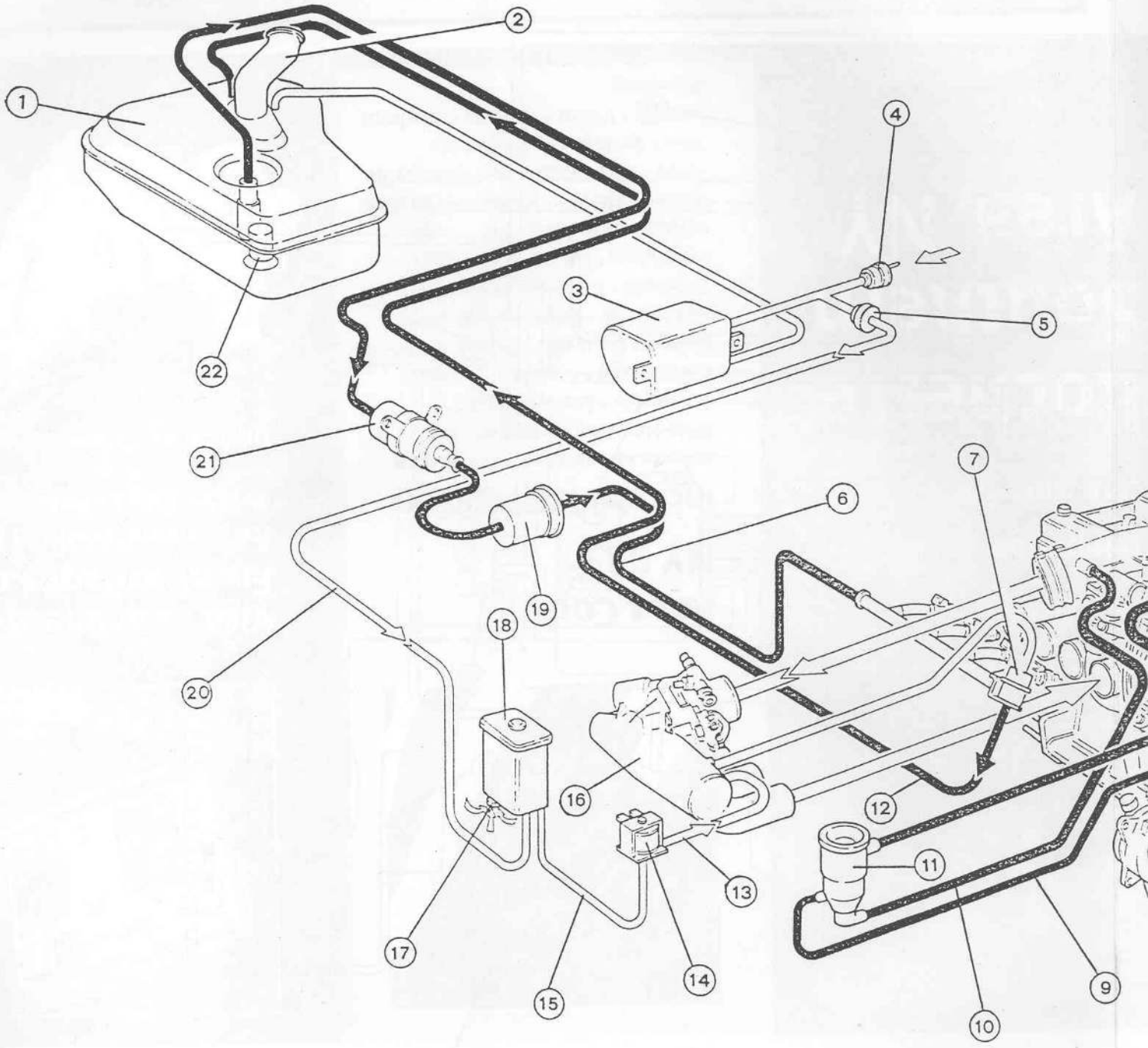
1 Ignition coil
2 Oil vapor separator
3 Ignition distributor
4 Fuel pressure regulator
5 Plenum chamber
6 Solenoid valve
7 Throttle valve body
8 Idle speed actuator
9 Throttle min/max opening switch
10 Fuel manifold
11 Carbon canister
12 Fuel filter
13 Fuel main pump
14 Fuel tank
15 Secondary fuel pump (submerged)
16 Relay unit
17 Fuel vapor trap
18 Check valve
19 Air inlet valve
20 Catalytic converter
21 Lambda sensor
22 Ignition and injection control unit (MOTRONIC ML4.1)
23 Fuel delivery hose
24 Electroinjectors
25 Engine coolant temperature sensor
26 Intake duct
27 Air flow meter
28 Intaken air temperature sensor
29 Air filter
30 Spark plugs
31 Timing and r.p.m. sensor
32 Timing variator



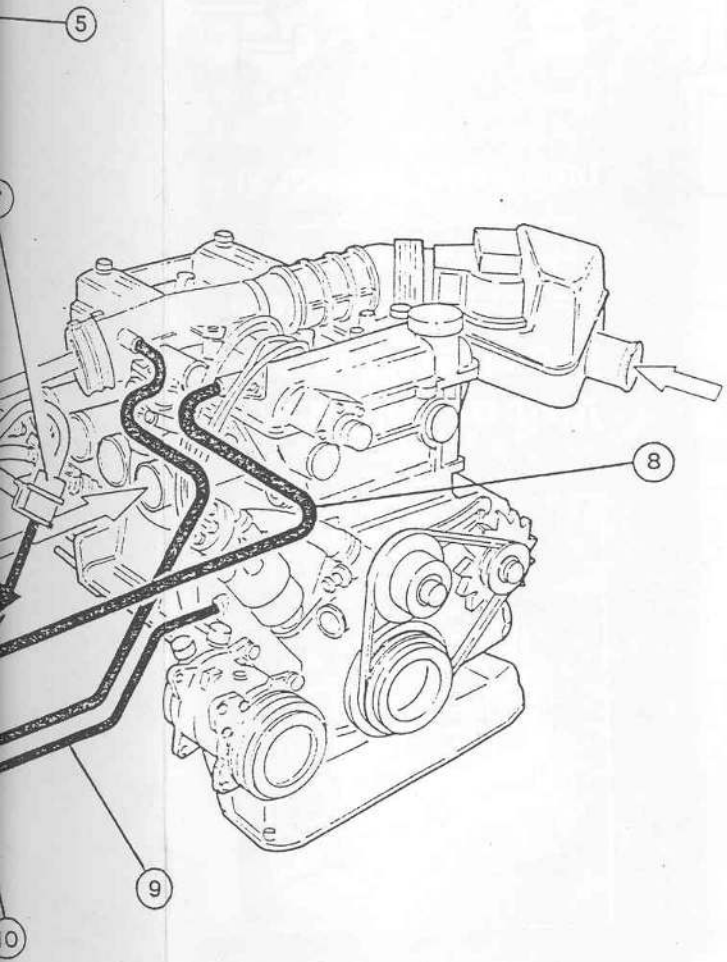
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1 Fuel tank
2 Tank filler
3 Gas vapor separator
4 Air inlet valve
5 Check valve
6 Fuel delivery
7 Fuel pressure regulator
8 Oil vapor breather hose
9 Oil breather hose
10 Oil vapor return hose
11 Oil vapor separator
12 Fuel-return line
13 Gas vapor intake hose (from solenoid valve to plenum chamber)
14 Solenoid valve
15 Gas vapor intake hose (from gas vapor filter to solenoid valve)
16 Plenum chamber
17 Washing hole
18 Carbon canister
19 Fuel filter
20 Gas vapor hose
21 Fuel main pump
22 Fuel secondary pump

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EVAPORATIVE EMISSION CONTROL SYSTEM

Gas vapors, emanating from fuel tank (1), are collected through a suitable connection piping in a vapor-liquid separator (3), which returns the condensate to the fuel tank.

The non condensated gas vapors outcome the separator (3) from the upper connection and reach the carbon canister (18) through the check valve (5) and the fuel vapor line (20).

The vapor flow is controlled by a solenoid valve (14) which opens (or closes) according to the signals received from the MOTRONIC control unit.

In fact, this unit controls the solenoid valve (14) opening whenever the air flow rate passing through the sensor is higher than the pre-established threshold value; thus, at the idle r.p.m., the evaporative solenoid valve is closed and gas vapors can only be fixed on the actived carbons contained in the canister (18).

When the solenoid valve (14) is opened, the canister (18) washing starts; during this operation, due to the pressure difference, the actived carbons are "washed" by an air stream flowing in the carbon canister through the hole (17).

Due to the vacuum action, the gas vapors and the atmospheric air are led to the plenum chamber (16) and then into the combustion chamber.

The valve (4) allows only outside air to enter, in order to keep the fuel tank and the gas vapor circuit at the atmospheric pressure.

GENERAL MAIN INFORMATION

- Never disconnect the battery when the engine has been started or the contact has been energized (ignition key in "Mar" position); otherwise severe and irreversible damages to the electric and electronic components of the system control unit may occur
- Before starting the engine, make sure that the battery terminals are correctly fastened
- Never start the enigne by using a rapid charge power supply
- Completely disconnect the battery from the system before recharging
- Do not start the engine in case of electrical connections interrupted or components removed from their seats
- Do not ground any high/low voltage parts and do not break any connection while the engine is running
- Remove the electronic control unit if the vehicle shall be furnace-painted at temperatures higher than 80 °C (176 °F)
- Always disconnect the electronic control unit, should an ancillary equipment be installed. Check the ancillary equipment for proper operation with the electronic control unit disconnected. It is strictly advised not to shunt any electric connection from the electronic control unit harness
- Before intervening on the various system components, verify the absence of unplugged connectors, unfastened clamps and cut or clogged hoses
- Never connect or disconnect the plug from the electronic control unit leads with ignition on
- Never ground high/low voltage cables for test purposes
- Make sure that shielded wire connectors are properly plugged
- Verify the ignition system and spark plug efficiency and check that the timing cover is not wet or cracked. Make sure that the cables between coil and distributor and distributor and spark plugs are properly connected and that the insulation does not show traces of burning or abrasion
- Before replacing any fuse, remove the ignition key; should a fuse repeatedly blow, troubleshoot the shorted circuit; never replace a fuse with a piece of cable.
  The blown fuse must be replaced by another one having the same amperage

TEMPERATURE OF THE CATALYTIC CONVERTER

Excessive temperature in the catalytic converter during driving can cause damage to the alumina monolith thereby lowering its conversion efficiency as well as causing damage to the container and to the vehicle or possibly constituting a fire hazard.

Engine malfunctions that can cause catalytic converter overtemperature are:

- Spark plug fouling on one or more cylinders.
- Defective electric fuel pump or fuel filter clogged fuel pressure (too low).
- Defective injectors.
- Air cleaner element very dirty.
- Engine accelerator control linkage out of setting.
- Engine and related devices not set to factory specifications.
- Leaks at the exhaust pipe upstream of the lambda sensor.
- Faulty pressure regulator.
- Battery voltage (too low) (or defective charging circuit).

Driving methods that can cause catalyst overtemperature are:

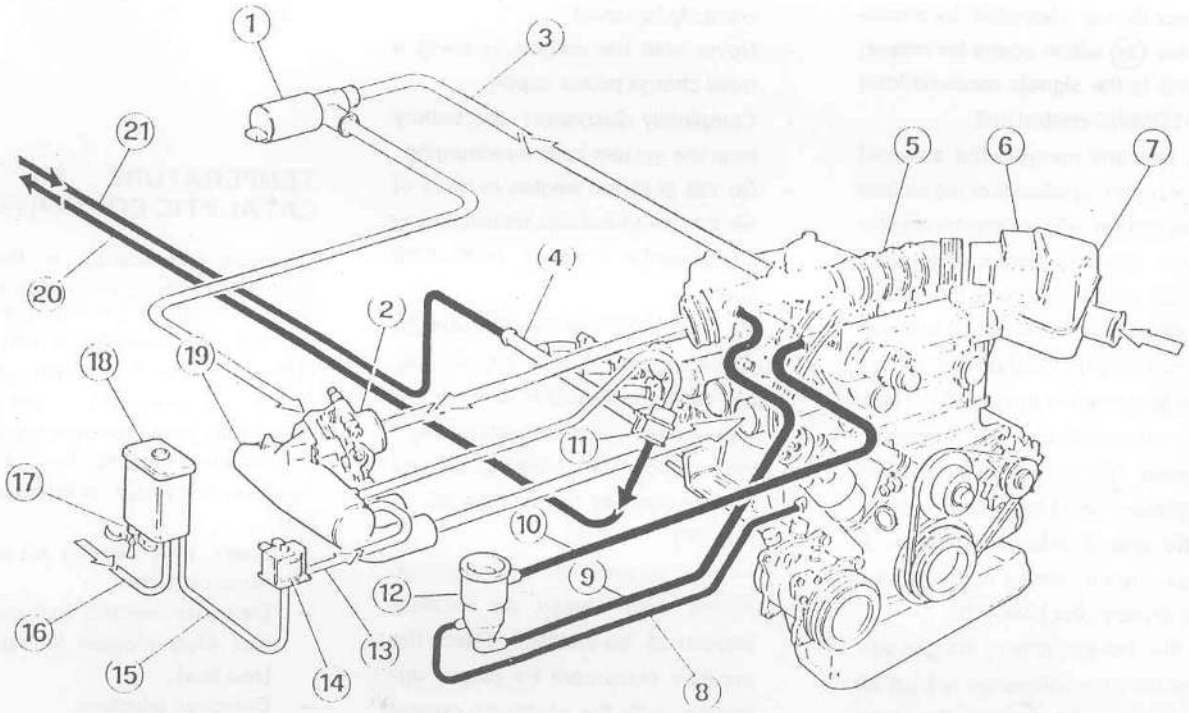
- Fuel tank too low.
- Engine overloading for prolonged period of time e.g. when racing the engine, pulling trailers or climbing long hills or grades.
- Driving or coasting with the ignition turned off.

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PRECAUTIONS TO BE TAKEN

— Use only unleaded gasoline (95 RON = 90 PON).
– Do not allow the fuel tank to become empty.
– Never operate the engine with a spark plug lead disconnected or ground the spark plug.
– Never overload the engine for a prolonged period. Be careful when pulling trailers or when climbing long hills or grades.
– Do not turn off ignition while driving in any condition or coasting. Vehicle must be stopped before shutdown.
– Avoid parking over or in vicinity of combustible materials such as; dry grass, spilled fuel, dry leaves, rubbish, etc.
– Do not tamper with any component of the emission control system. It is prohibited by law.
— The life of the catalytic converter depends on perfect engine maintenance.

AIR INTAKE CIRCUIT

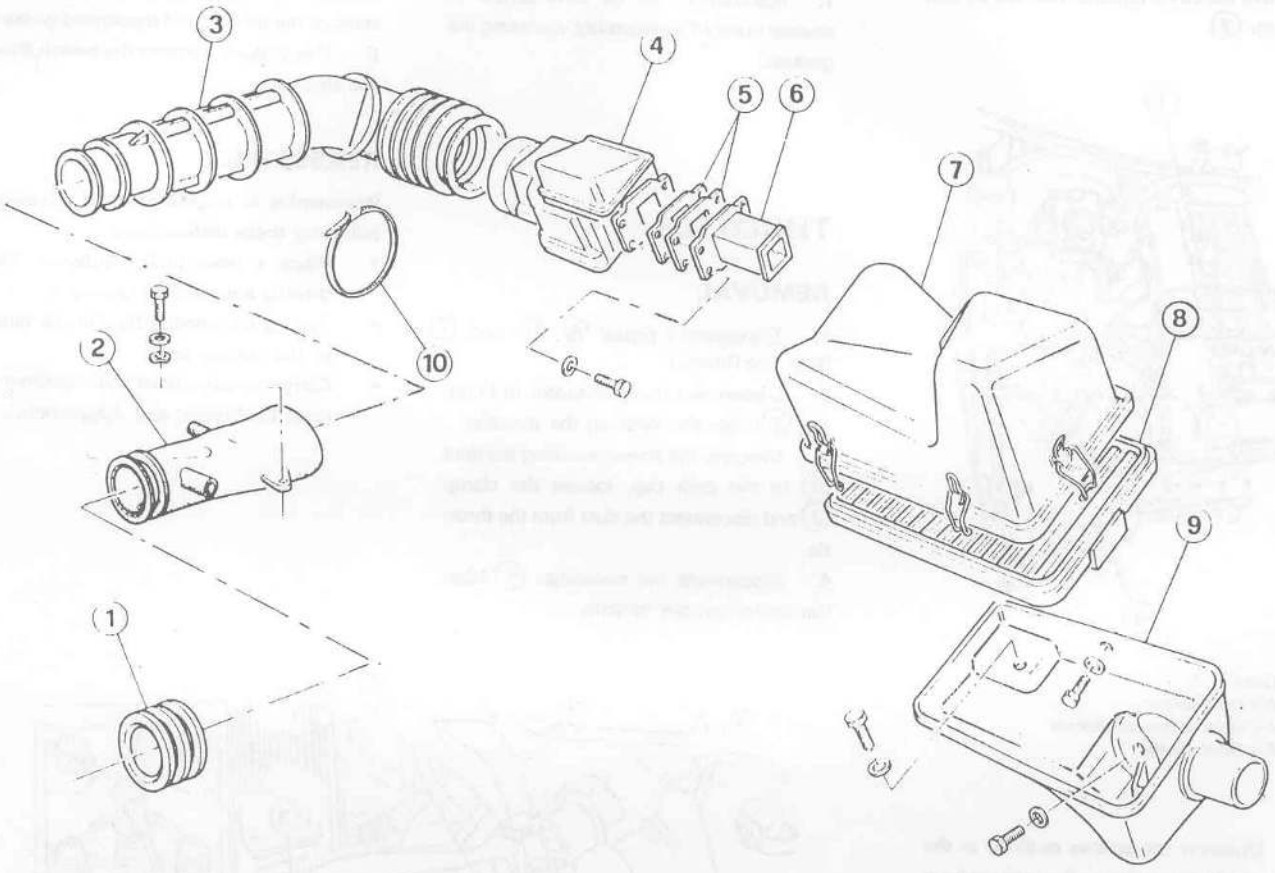


1 Idle speed actuator
2 Throttle valve body
3 By-pass hose
4 Fuel manifold
5 Intake duct
6 Air flow sensor
7 Air filter
8 Oil breather hose
9 Oil vapor return hose
10 Oil vapor breather hose
11 Fuel pressure regulator
12 Oil vapor separator
13 Gas vapor return hose (from solenoid valve to plenum chamber)
14 Solenoid valve
15 Gas vapor return hose (from carbon canister to solenoid valve)
16 Gas vapor return hose (from fuel tank to carbon canister)
17 Canister washing hole
18 Carbon canister
19 Plenum chamber
20 Fuel return hose
21 Fuel delivery hose

- After reassembling the components of the air supply circuit, make sure of the circuit tightness downstream the air flow sensor.
- Also check the correct fitting of the electric connectors and system grounding points.

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AIR CLEANER



1	Sleeve	6	Coupling flange
2	Duct	7	Air cleaner cover
3	Rubber duct	8	Air cleaner element
4	Air flow sensor	9	Air cleaner pan
5	Gaskets	10	Clip

REMOVAL

To remove the air cleaner unit:

1. Disconnect the rubber duct ③ from the air flow sensor ④.
2. Disconnect the connector from the air flow sensor ④.
3. Release the clips of the cover ⑦ and remove the latter together with the air flow sensor. Also remove the air cleaner element ⑧.
4. If necessary, unscrew the screws securing the pan ⑨ to the bodywork and remove the pan.
5. If necessary, unscrew the clamp screws and remove the air flow sensor ④ from the air cleaner cover ⑦.

INSPECTION AND CHECKS

1. Thoroughly clean the air cleaner element by blowing compressed air at a low pressure. If necessary replace the cleaner element.
2. Press on the air flow sensor floating flap and check that it rotates without jerking, or binding.

If necessary, clean the inner surfaces of the air flow sensor with a cloth.

REASSEMBLY

Reassemble the air cleaner in reverse order of disassembly.

- Place the cleaning element on the air cleaner pan, according to the mark indicating which is the top side.
- If the air flow sensor has been separated from the air cleaner cover replace the gaskets placed between them on reassembly.

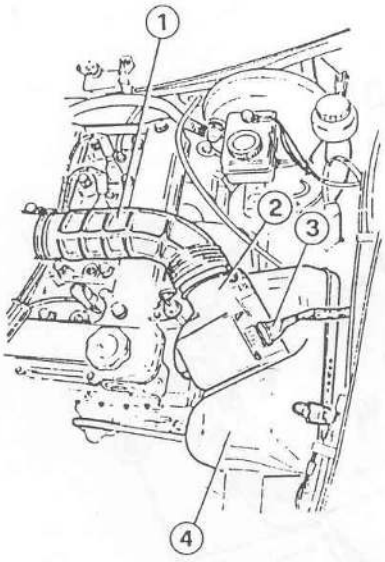
AIR FLOW SENSOR

REMOVAL

1. Loosen the rubber duct ① clip and disconnect the duct from the air flow sensor ②.
2. Disconnect the connector ③.

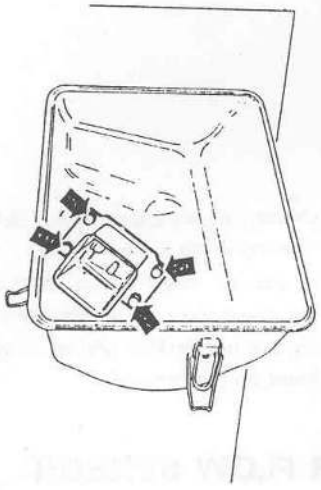
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3. Release the cover ④ clips and remove the cover together with the air flow sensor ②.



1 Duct
2 Air flow sensor
3 Air flow sensor connector
4 Air filter cover

4. Unscrew the screws outlined in the figure and remove the air flow sensor from the air cleaner cover.



INSPECTION AND CHECKS

Press the throttle valve of the air flow sensor and check that it rotates without jerking, or binding, until it abuts. If necessary, clean the inner surfaces of the air flow sensor with a cloth.

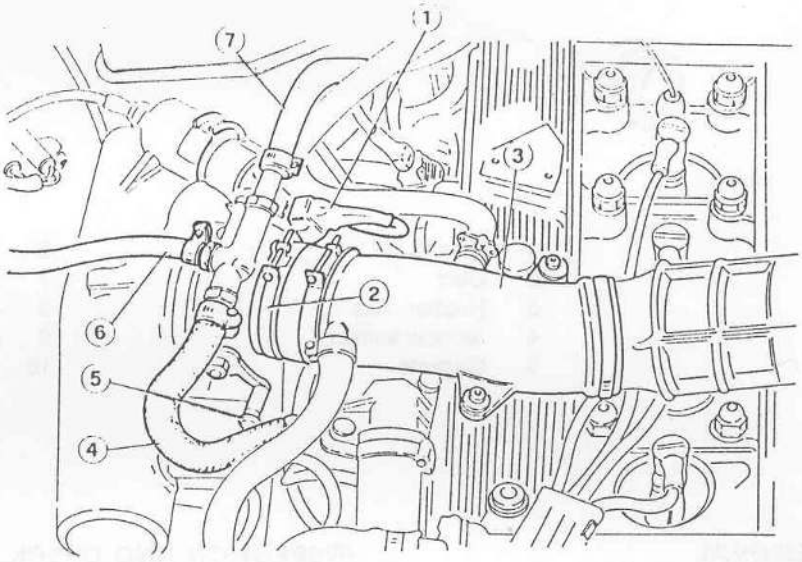
REASSEMBLY

1. Reassemble the air flow sensor in reverse order of disassembly, replacing the gaskets.

THROTTLE

REMOVAL

1. Disconnect pipes ④, ⑥ and ⑦ from the throttle.
2. Disconnect the accelerator rod control ⑤ from the lever on the throttle.
3. Unscrew the screws securing the duct ③ to the cam cap, loosen the clamp ② and disconnect the duct from the throttle.
4. Disconnect the connector ① from the switch on the throttle.
5. Unscrew the screws securing the throttle to the plenum chamber then remove the throttle and associated gasket.
6. If necessary, remove the switch from the throttle.



1 Throttle switch connector
2 Clamp
3 Intake duct
4 Coolant-to-throttle body deliver pipe
5 Accelerator control linkage
6 Cooling system vent pipe
7 Delivery pipe from throttle body to heater

REASSEMBLY

Reassemble in reverse order of removal, following these instructions:

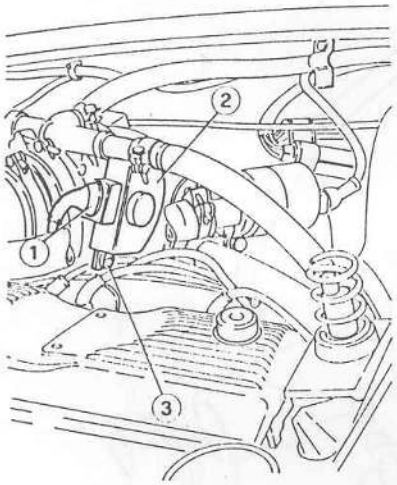
- Place a new gasket between the throttle and plenum chamber.
- Top up the cooling fluid in the tank to the correct level.
- Carry out calibrations and adjustment (see: Calibration and Adjustment).

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THROTTLE VALVE MIN/MAX OPENING SWITCH

REPLACEMENT

1. Disconnect the battery.
2. Unplug the connector ① from the switch ②.
3. Back off the two screws ③ and remove the switch.



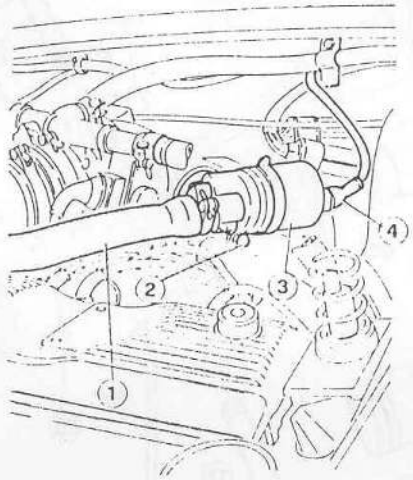
1 Connector switch
2 Throttle valve min./max. opening switch
3 Switch fixing screw

4. Install and adjust a new switch (see paragraph "Calibration and Adjustment").

IDLE SPEED ACTUATOR

REPLACEMENT

1. Disconnect the battery.
2. Unplug the connector ④.
3. Disjoin the by-pass hose ①.
4. Back off the clamp fixing screw ② and remove the idle speed actuator ③.



1 By-pass hose
2 Screw
3 Idle speed actuator
4 Connector

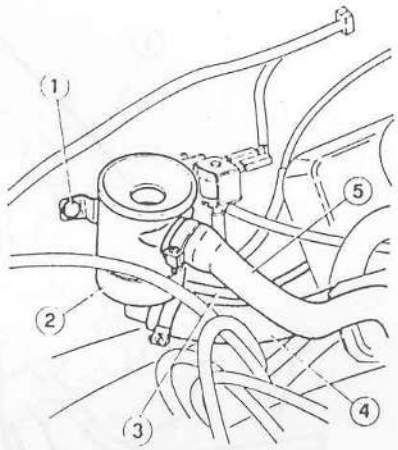
5. While reinstalling the idle speed actuator pay a special attention to the following steps:

- The by-pass hose fixing clamp must be tightened enough to prevent air leaks.
- The electric connector must be fully home pressed into its seat on the actuator.

OIL VAPOR SEPARATOR

REPLACEMENT

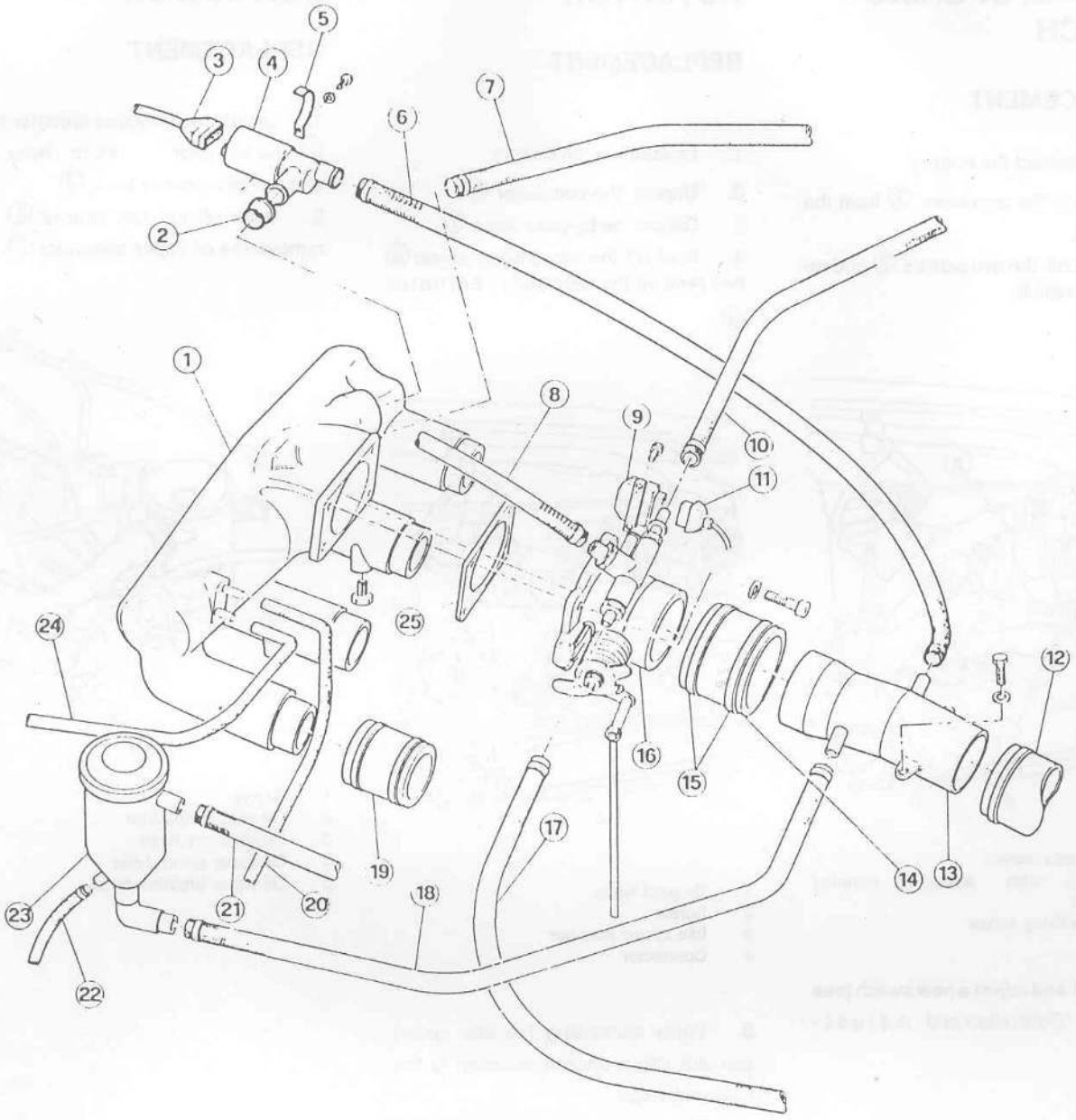
1. Disjoin the oil vapor breather hose ⑤, the oil vapor return hose ④ and the oil recovery hose ③.
2. Back off the two screws ① and remove the oil vapor separator ②.



1 Screw
2 Oil vapor separator
3 Oil recovery hose
4 Oil vapor return hose
5 Oil vapor breather hose

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PLENUM CHAMBER



1 Plenum chamber
2 Grommet
3 Connector
4 Idle speed actuator
5 Idle speed actuator fixing clamp
6 By-pass hose
7 Servo brake vacuum intake pipe
8 Cooling system vent pipe
9 Throttle valve min/max opening switch
10 Fluid delivery pipe from throttle valve body to heater
11 Connector
12 Wrinkled sleeve
13 Intake duct
14 Sleeve
15 Clamps
16 Throttle valve body
17 Fluid delivery pipe from thermostat to throttle valve body
18 Oil vapor return hose
19 Sleeve
20 Pressure regulator vacuum intake pipe
21 Oil vapor breather hose
22 Oil recovery pipe
23 Oil vapor separator
24 Gas vapor intake hose (from the evaporative solenoid valve)
25 Gasket

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FUEL SUPPLY CIRCUIT

REMOVAL

Refer to the exploded view and operate as follows:

1. Loosen the clips and detach pipes (6) e (7).
2. Disconnect piping (20) e (24) from the plenum chamber.
3. Disconnect the connector (3) from the idle speed actuator.
4. Detach the idle speed actuator (4) by removing the fixing clamp (5).
5. Disconnect the connector (11) from the throttle valve min/max opening switch.
6. Disconnect the accelerator control rod from the lever on the throttle (16).
7. Disconnect cooling system pipes (8), (10) e (17) from the throttle.
8. Loosen the plenum chamber clips at the sleeves (19) on the intake manifold.
9. Unscrew the screws securing the plenum chamber to the bracket on the cylinder block.
10. Loosen the clamp (15) and remove the plenum chamber (1) together with the throttle (16).
11. Working at the bench, unscrew the screws securing the throttle (16) to the plenum chamber then separate the latter, retrieving the gasket (25).

REASSEMBLY

Reassemble in reverse order of removal, following these instructions.

- Place a new gasket between the throttle and plenum chamber.
- If necessary, replace the sleeves between the plenum chamber and intake manifolds.
- Top up the coolant in the tank to the correct level.
- Carry out calibrations and adjustments (see: Calibrations and Adjustments).

CAUTION:

Prior to replacing supply circuit components, follow these instructions carefully:

a. Check that suitable tools allowing safe operation are available in the workshop (extinguishers)

b. Disconnect the battery

c. Put the fuel removed from the tank in a suitable container with safety cover.

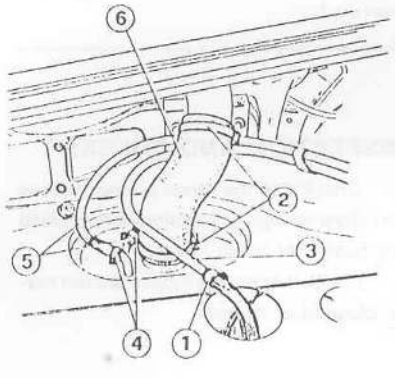
WARNING:

Having reassembled the fuel supply circuit components, ensure that the circuit is sealed at a pressure of 3 bar (45 p.s.i.).

FUEL TANK

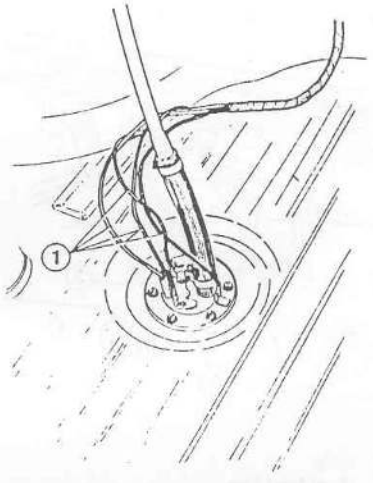
REMOVAL

1. Remove the plug on the fuel filler and suck the fuel from the tank using a pump.
2. Remove the inner lining of the luggage compartment, move to one side the lateral one (left side) and remove the cover of the secondary pump level sensor.
3. Loosen the two fuel feed line clips (2) and slide out the pipe.
4. Loosen the two clips (4) of the vent and return pipes (5) and remove the latter.
5. Loosen the clip (1) and slide out the fuel feed line (3).



1 Clip
2 Clip
3 Fuel feed line
4 Clip
5 Vent and return pipes
6 Fuel inlet pipe

6. Unscrew the eleven screws securing the tank cover to the bodywork. Then remove the cover.
7. Slide out the four electrical connections (1) of the secondary pump and fuel level sensor.



1 Electrical connections

8. Unscrew the six screws securing the tank to the bodywork and remove the entire tank.
9. If necessary, dismantle the tank into its component parts.

INSPECTION AND CHECKS

Check that the tank is neither cracked nor deformed; replace as necessary.

REASSEMBLY

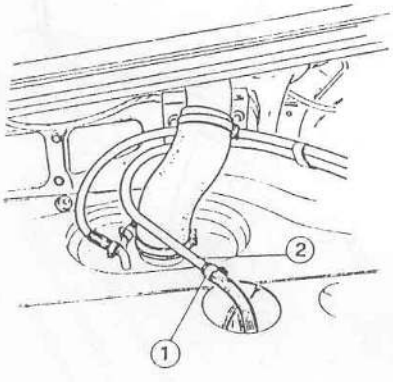
1. Install the tank in the car in reverse order of removal operations taking care to correctly reconnect the electrical connectors and escape pipes and tighten thoroughly the pipe clips.

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FUEL LEVEL SENSOR AND SUBMERGED PUMP

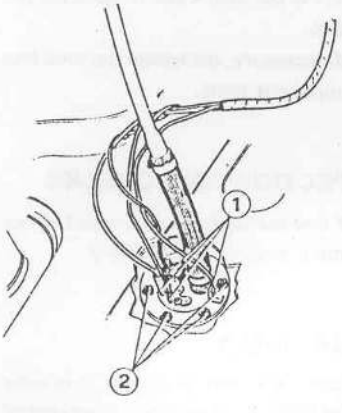
REPLACEMENT

1. Remove the luggage trunk floor lining.
2. Loosen the clip (1) and slide off the fuel feed line (2).



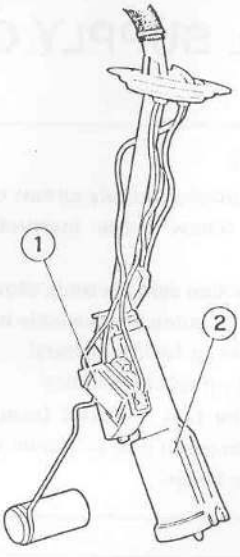
1 Clip
2 Fuel feed line

3. Slide off the four electrical connections (1) of the fuel level sensor and submerged pump, unscrew the six screws (2) and slide out the whole unit.



1 Electrical connections
2 Screws

4. Check that the fuel level sensor (1), submerged pump (2) and associated electrical connections are efficient.
When reassembling, replace the gasket if it shows signs of damage.



1 Fuel level sensor
2 Submerged pump

FEED LINES

REMOVAL

WARNING:
Only remove the feed lines when absolutely necessary.

1. Place the car on the lift.
2. Remove the plug on the fuel filler then, using a suitable pump, suck the fuel from the tank.
3. Loosen the clips at the ends of the lines to be removed.

WARNING:
Plug the rigid pipes and the hoses to prevent dirt and dust getting in during removal.

INSPECTION AND CHECKS

1. Check that the hoses are not porous and show no sign of deterioration; replace any hose that is not intact.
2. Check that the rigid pipes are not rusty, clogged or dented.

REASSEMBLY

Reassemble the lines carefully in reverse order of removal operations, observing the following warning.

WARNING:

a. Carefully remove the closing clips on the circuit joints.
Do not over tighten the clamps as this could damage the pipes.

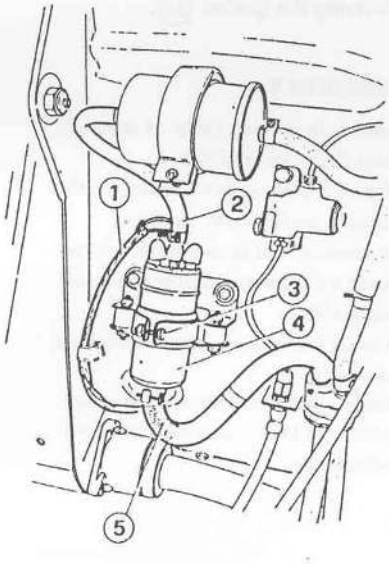
b. Do not twist or bend the rigid pipes when reassembling the latter on the car.

c. Start the engine and check that there are no leaks from the joints.

MAIN FUEL PUMP

REPLACEMENT

1. Place the car on the lift and disconnect the battery.
2. Working from beneath the car, disconnect the pump power supply wires (1).
3. Crimp pipes (2) and (5) then loosen the clips and disconnect the pipes from the pump.
4. Loosen the bolt (3) and remove the pump (4).



1 Pump supply wires
2 Pipe
3 Bolt
4 Pump
5 Pipe

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5. Assemble the new fuel pump, securing it with the corresponding clip then reconnect the pipes.

WARNING:

A spare pump is provided, sealed, filled with protecting oil and with the connectors plugged closed.

It is not necessary to empty it on assembly.

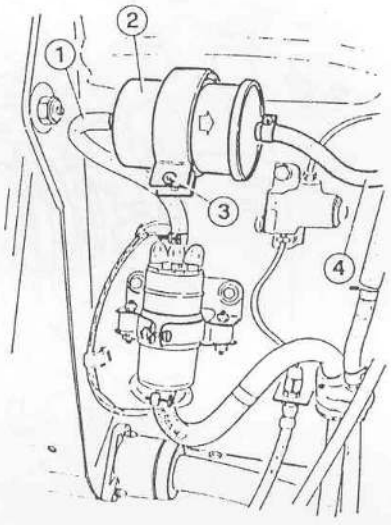
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6. Reconnect the pump power supply wires, taking care not to mix them up.
7. On completing assembly, remove the pliers on the fuel feed lines and reconnect the battery.

FUEL FILTER

REPLACEMENT

1. Place the car on the lift.
2. Working from beneath the car, crimp pipes ① and ④, loosen the clips then disconnect the pipes from the filter.
3. Unscrew the bolt ③ and slide out the filter ②.



1 Pipe
2 Filter
3 Bolt
4 Pipe

4. Assemble a new filter making sure that the arrow points in the direction shown in the previous figure.
Proceed in reverse order of removal and remove the fuel feed line pincers.

FUEL PRESSURE REGULATOR

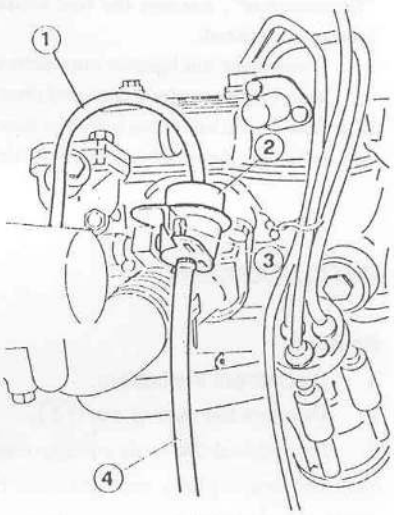
REPLACEMENT

1. Disjoin the vacuum intake pipe ①.
2. Disjoin the fuel return hose ④.
3. Back off the two bolts ③ and remove the pressure regulator ② by disjoining it from the fuel manifold.

CAUTION:

Work with caution; the feed circuit may be under pressure.

Suitably plug the pipes.



1 Vacuum intake pipe
2 Fuel pressure regulator
3 Bolt
4 Fuel return hose

4. Refit a new pressure regulator by reversing the disjoining operations.

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INJECTORS

INSPECTION AND CHECKS

1. **Injectors: correct opening check.**

A visual index of injector functionality is provided by comparing the spark plug electrodes.

- Black color corresponds to a mixture that is too rich.
- Light color corresponds to a mixture that is too lean.

2. **Injector seal check.**

a. Detach the injector set from the fuel feed manifold, working as indicated in "Replacement", keeping the fuel supply system connected.

b. Disconnect the injector connectors.

c. Activate the starter motor and check that there are no fuel leaks from the injectors, otherwise replace the faulty injector.

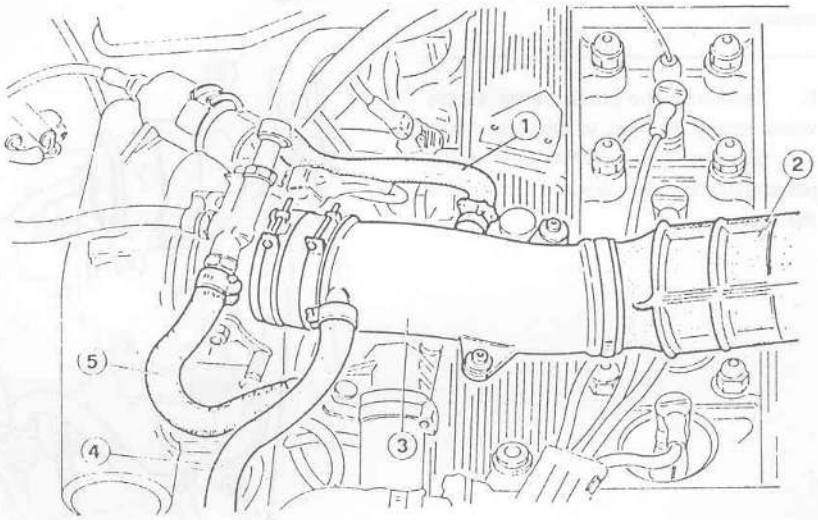
REPLACEMENT

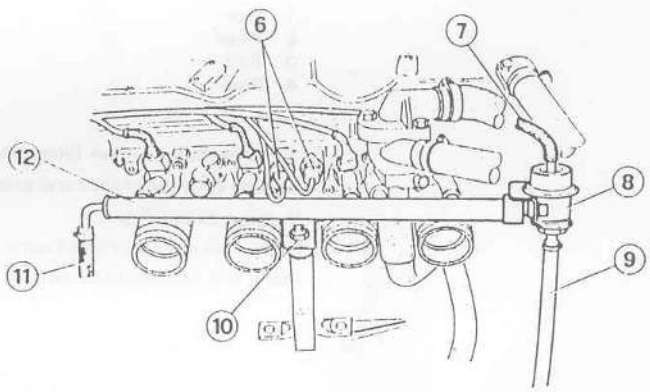
Removal

1. Disconnect the battery.
2. Remove the rubber duct (2).
3. Disconnect the high voltage wires from the spark plugs and coil then remove the distributor cap together with the wires.
4. Disjoin the by-pass hose (1) and the oil vapor return hose (4) from the intake duct (3).
5. Unscrew the screws securing the air intake duct (3) to the cam cover, slacken the clip fastened to the throttle and remove the duct.
6. Disconnect the connectors (6) from the coolant temperature transmitter bulbs.
7. Detach the pipe (5) from the throttle.
8. Detach the pipe (7) from the pressure regulator.
9. Disconnect the injector feed connectors.
10. Disconnect pipes (11) and (9) from the feed manifold and pressure regulator (8).

CAUTION:
Work with caution: the feed circuit may be under pressure.

11. Unscrew the nut (10) securing the fuel feed manifold to the support bracket; unscrew the injector securing screws and remove them together with the fuel feed duct.





1 By-pass hose
2 Rubber duct
3 Intake duct
4 Oil vapor return hose
5 Liquid delivery pipe from thermostat to throttle body
6 Coolant temperature sender connectors for control units and cluster
7 Vacuum intake pipe for pressure regulator
8 Fuel pressure regulator
9 Excess fuel return pipe
10 Nut securing fuel distributor manifold
11 Fuel supply pipe
12 Fuel distributor manifold

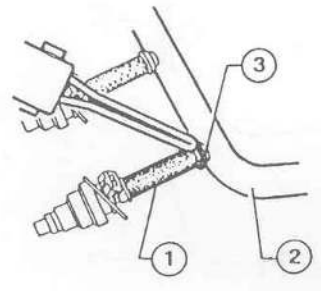
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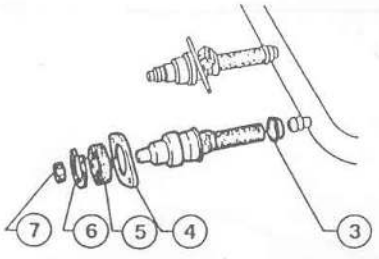
12. Replace the faulty injectors by working as follows:

WARNING:
Prior to replacing any injector, check the position of the connector on the injector in order to achieve the same position when assembling the new injector.

---

a. Cut the pipe (1) using a welder, remove it from the fuel manifold and keep the bushing (3).





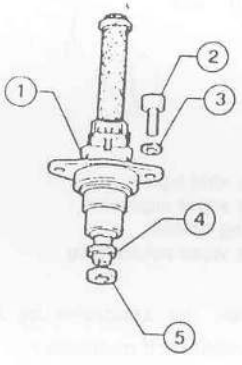
1 Electroinjector supply pipe
2 Fuel distributor manifold
3 Bushing
4 Flange
5 Rubber gasket
6 Seeger ring
7 O-ring

b. Assemble a new injector pressing the bushing and fuel pipe on the fuel distributor manifold home against the actual bushing.

WARNING:
The injector should be placed on the distributor manifold with the connector facing upwards as countermarked during disassembly.
In order to put the injector into place it is advisable to dampen the associated rubber hose with fuel; under no circumstance use grease or vaseline.

Reassembly

1. Replace the O-ring (4).
2. Assemble the injectors in their housings, making sure that the seal ring (5) is positioned correctly.



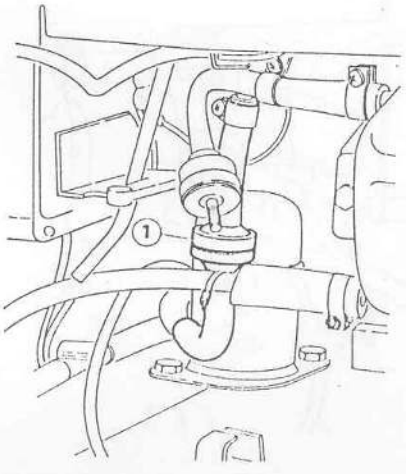
1 Flange
2 Electroinjector securing screw
3 Washer
4 O-ring
5 Seal ring

3. Assemble the remaining components in reverse order of removal operations, following these instructions:
- Top up cooling fluid to correct level.

CHECK VALVE

REMOVAL

1. By operating in the trunk, lower the front upholstery so as to gain access to the check valve (1) ; remove it.



1 Check valve

The calibration value of the check valve is the following:

6 thru 7.5 kPa
(0.06 thru 0.075 bar;
0.061 thru 0.077 kg/cm²;
0.86 thru 1.07 p.s.i.)

INSTALLATION

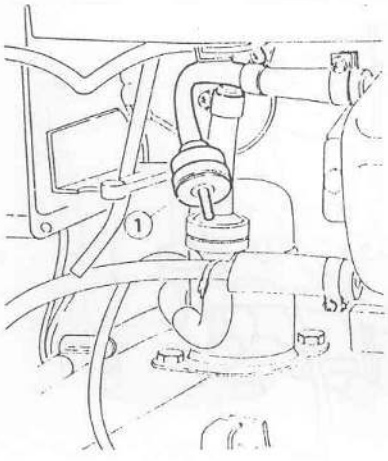
When a new check valve is to be installed, pay attention to observe the correct operational direction.

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AIR INLET VALVE

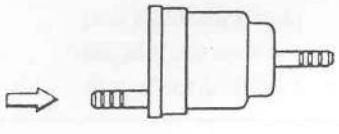
REMOVAL AND INSTALLATION

1. By operating in the trunk, lower the front upholstery so as to gain access to the air inlet valve (1); then remove it.



1 Air inlet valve

2. Check the valve efficiency by blowing compressed air and verifying that the air passage only occurs in the direction of the arrow.



The calibration value of the air inlet valve is the following:

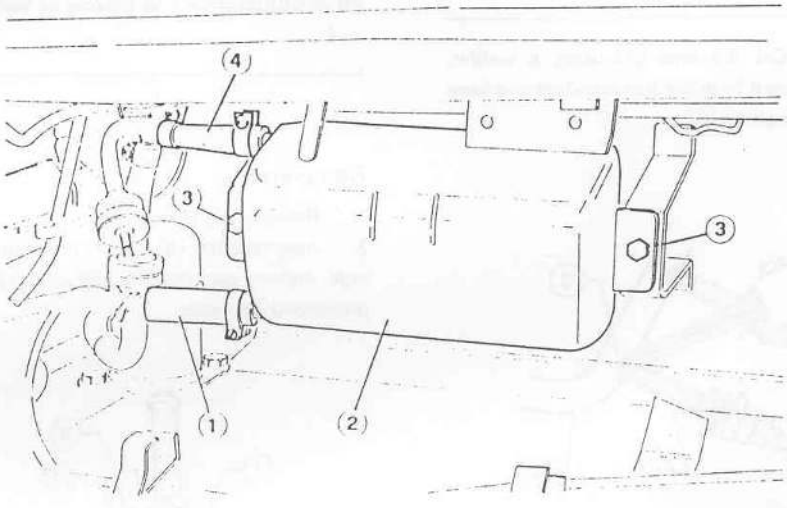
1 thru 2 kPa
(0.01 thru 0.02 bar;
0.01 thru 0.02 kg/cm²;
0.14 thru 0.29 p.s.l.)

3. Carry out the installation by reversing the removal procedures and referring to figure for the correct valve positioning.

GAS VAPOR SEPARATOR

REMOVAL AND INSTALLATION

1. By operating in the trunk, lower the front upholstery so as to gain access to the gas vapor separator.



1 Gas vent pipe
2 Gas vapor separator
3 Fixing screws
4 Gas vapor return hose

3. Clean the separator by blowing compressed air, if necessary.

4. Install the separator by reversing the removal procedures.

CARBON CANISTER

REPLACEMENT

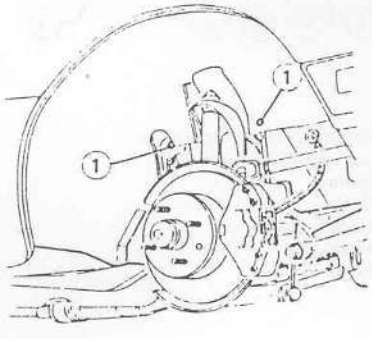
1. Position the vehicle on a lift platform and actuate the parking brake.

2. Lift the vehicle on the front side and apply proper stands.

3. Remove the right-front wheel.

4. Remove the rivets ① fixing the plastic fender to the body.

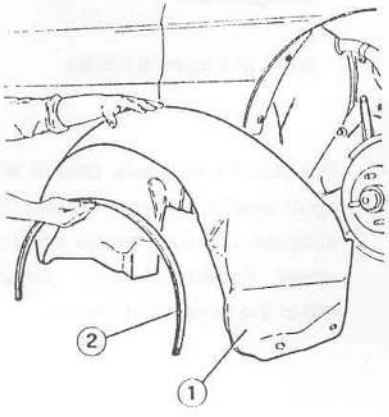
2. Back off the two screws ③; unloose the clamps and disjoin the pipes ① and ④.
Then remove the gas vapor separator ②.



1 Rivets fixing the plastic fender to the body.

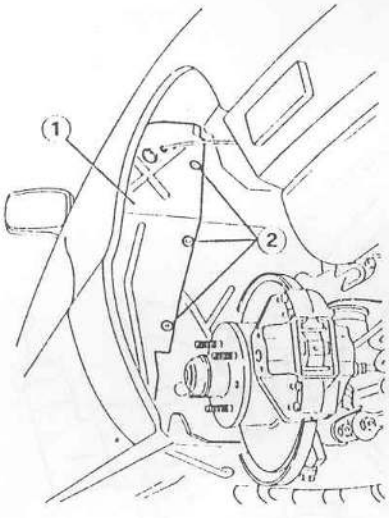
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5. Remove the plastic fender ① and the gasket ②.



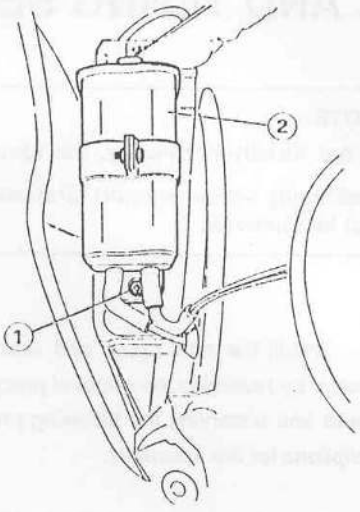
1 Plastic fender
2 Gasket

6. Back off the three screws ② and remove the covering plate ①.

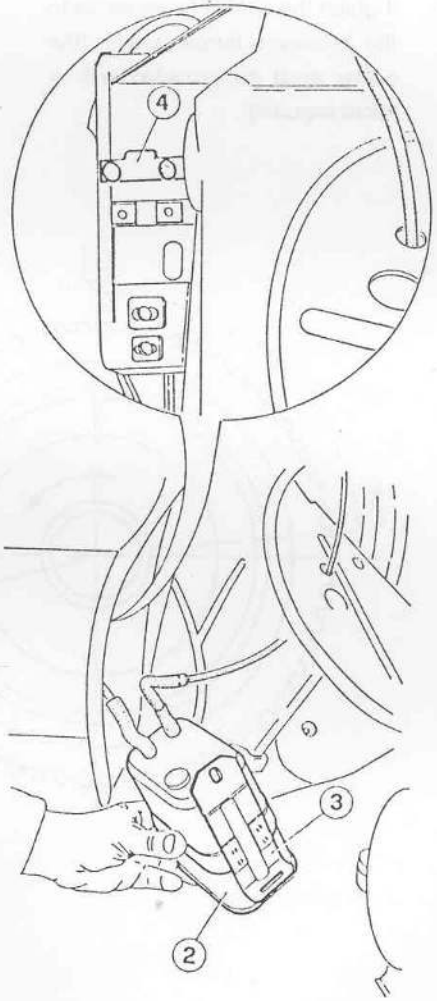


1 Covering plate
2 Screws

7. Back off the nut ① and remove the carbon canister ②, with the relevant supporting bracket ③, by releasing it from the hook ④.

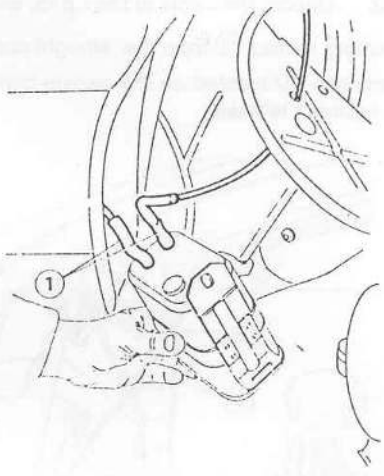


1 Nut
2 Carbon canister



2 Carbon canister
3 Supporting bracket
4 Fixing hook

8. Disconnect the two pipes ① and replace the carbon canister.

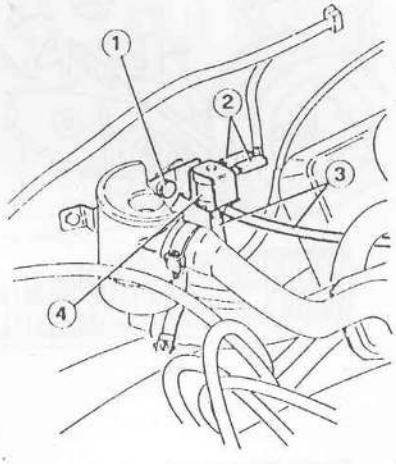


1 Pipes

EVAPORATIVE SOLENOID VALVE

REPLACEMENT

1. Disconnect the battery.
2. Unplug the electric connctions ②.
3. Disjoin the two pipes ③.
4. Back off the screw ① and remove the solenoid valve ④.



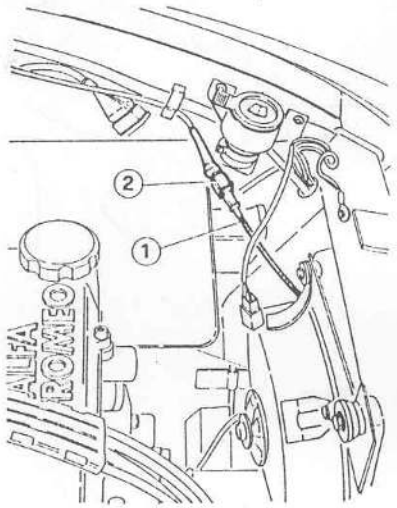
1 Screw
2 Electric connections
3 Pipes
4 Evaporative solenoid valve

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R.P.M. AND TIMING SENSOR

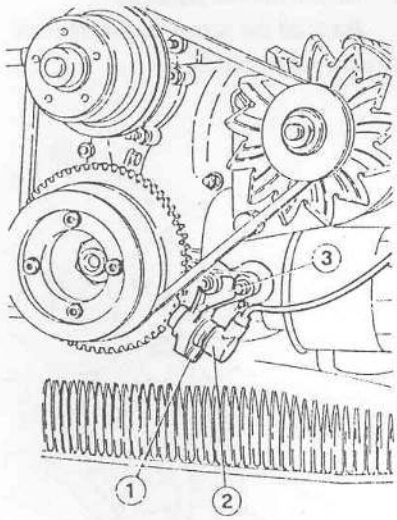
REPLACEMENT

1. Disconnect the battery.
2. Unplug the cable of the r.p.m. and timing sensor ① from the straight connection ② located on the engine compartment left-side.



1 R.p.m. and timing sensor cable
2 Connection

3. Back off and remove the screw ①; then withdraw the r.p.m. and timing sensor ② from its support ③.



1 Sensor fixing screw
2 R.p.m. and timing sensor
3 Sensor support

NOTE:
If not strictly necessary, the r.p.m. and timing sensor support ③ should not be removed.

4. Install the new r.p.m. and timing sensor by reversing the removal procedures and observing the following prescriptions for the assembly:

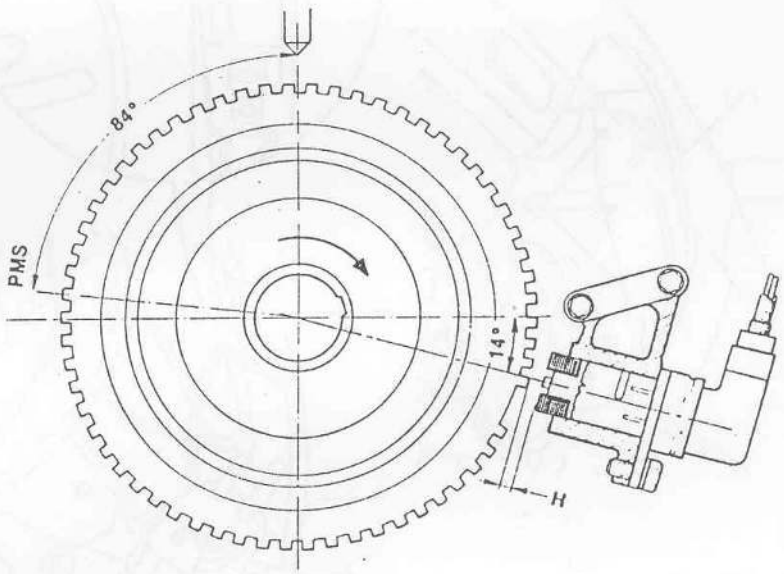
- Remove the new sensor protection before installation.
- Install the r.p.m. and timing sensor by manually pushing; do not make use of a mallet and do not hit the sensor.
- Tighten the sensor fixing screw to the following torque value (the screw must be provided with a micro capsule).

|T|: Tightening torque
R.p.m. and timing sensor fixing screw

8N·m (0.8 kg·m; 5.9 ft·lb)

- Position the magnetic pole of the r.p.m. and timing sensor so that the distance from the impulse emitting wheel (toothed pulley) ranges within the prescribed values.

H = Distance between the r.p.m and timing sensor and the impulse emitting wheel:
0.5 thru 1.5 mm

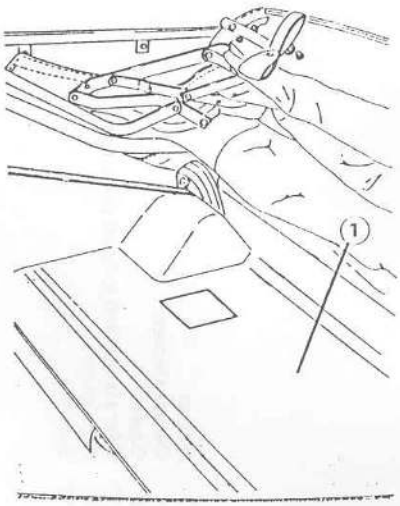


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IGNITION AND INJECTION CONTROL UNIT (ML4.1 MOTRONIC)

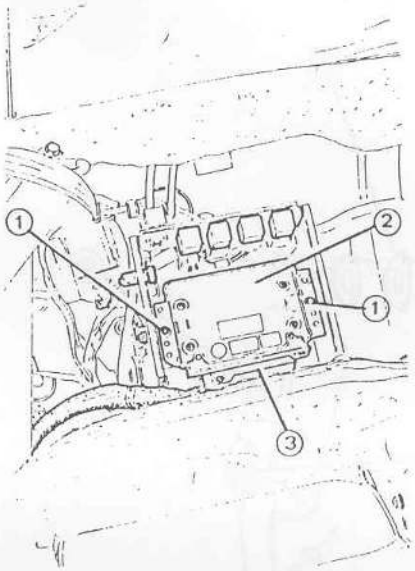
REMOVAL

1. Disconnect the battery
2. Remove the upholstery ①.



1 Upholstery

3. Unplug the connector ③ from the MOTRONIC control unit ②; then back off the two fixing screws ① and remove the control unit.



1 Fixing screws
2 MOTRONIC ML4.1 ignition and injection control unit
3 Connector

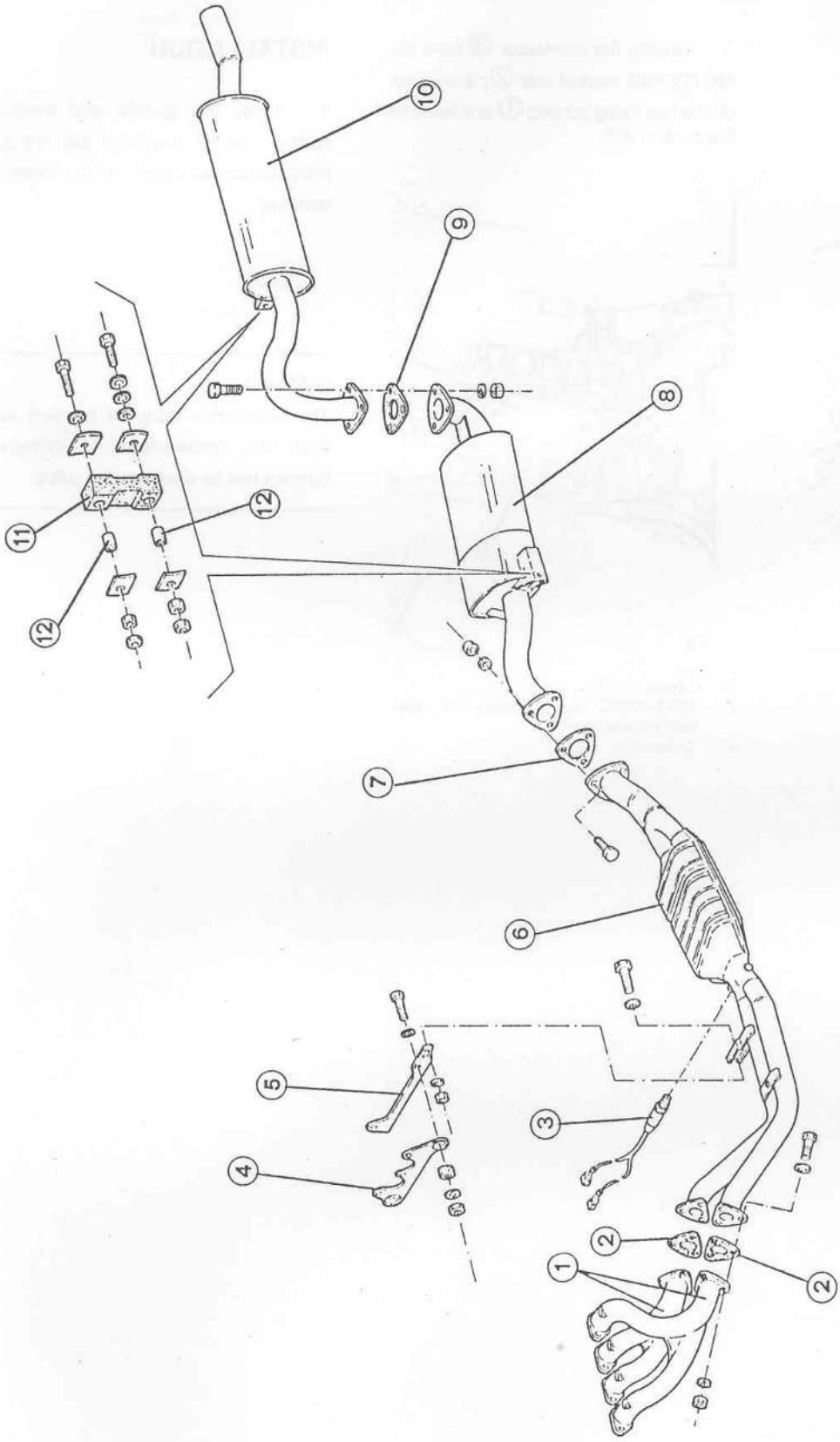
INSTALLATION

1. Install the ignition and injection control unit by reversing the removal procedures and observing the following warning.

WARNING:
The connector must be hooked and then fully home pressed, paying attention not to damage the pins.

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EXHAUST SYSTEM



1 Exhaust manifolds
2 Gaskets
3 Lambda sensor
4 Support
5 Bracket
6 Front pipe with catalytic converter
7 Gasket
8 Central silencer
9 Gasket
10 Rear silencer and exhaust end piece
11 Cushion pad
12 Bushings

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INSPECTION AND CHECKS

1. Check silencers and exhaust line for damage, with special reference to cracking and corrosion, and replace as necessary.
2. Check rubber cushion pads for cracks, porosity or signs of age hardening.

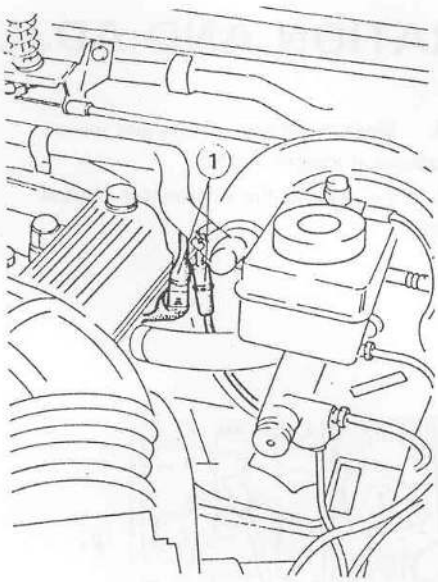
REMOVAL

- Removal procedure described below presupposes subsequent disassembly of the single component parts.
- Removal procedure may be altered depending on objective.
- Complete exhaust removal in one piece necessitates two operators.

MANIFOLDS AND SILENCERS

Refer to exploded view of exhaust system of applicable car model.
For further details refer to engine removal procedure in Unit 01 - Complete Engine - Engine Removal and Installation.

WARNING:
If the catalytic converter has to be removed, it will be necessary first of all to uncouple the two connectors (1) of the lambda sensor and associated heating resistance, housed in the engine compartment.



1 Connectors

1. Raise car on platform lift.
2. Remove tailpipe by operating thus:
   - Remove the bolts securing the rear cushion pad to the bodywork.
   - Unscrew the three bolts securing the intermediate piece to the tail piece and separate the two parts.
3. Remove the intermediate section by operating as follows:
   - Remove the bolts securing the central rubber cushion pad to the bodywork.
   - Separate the intermediate section from the tail piece as instructed previously.
   - Unscrew the three bolts securing the intermediate section to the front end and separate the two.
4. Detach the front end exhaust pipe as instructed in Unit 00 - Complete Car - Engine Maintenance - Fuel System - Catalytic Converter Replacement.

INSTALLATION

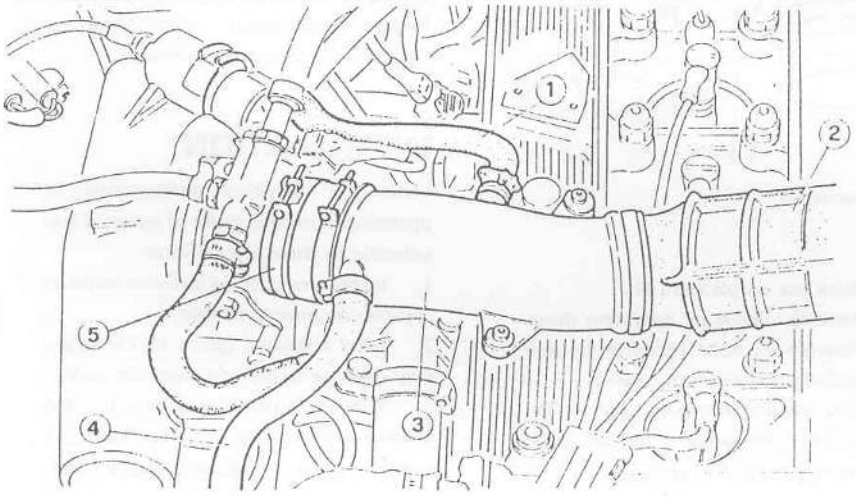
Install the individual components by operating in reverse order of removal and adhering to these instructions:
1. Install new gaskets between exhaust system component flanges.
2. After installing, check that the pipe may oscillate freely and does not lock.
3. With engine running, ensure that the exhaust connections are free from gas leaks and listen to detect any unsual noise.

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CALIBRATION AND ADJUSTMENT

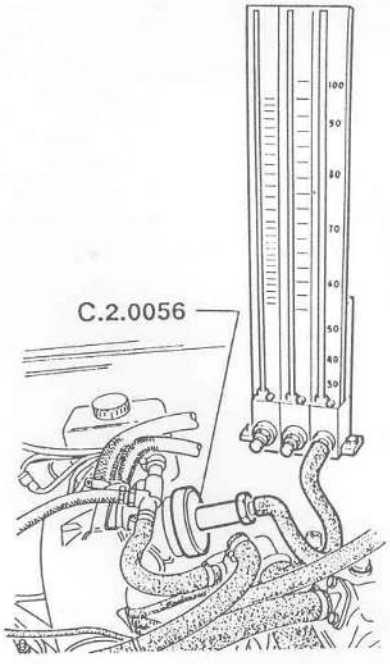
THROTTLE CALIBRATION (FLOW RATE)

1. Disconnect pipes (1), and (4) from the duct (2).
2. Slacken the clamp (5), unscrew the screws securing the duct (3) and remove the latter.
3. Slacken the screws securing the acceleration throttle switch.
4. Disconnect the accelerator control bar.



1 By-pass hose
2 Rubber duct
3 Intake duct
4 Oil vapor return hose
5 Clamp

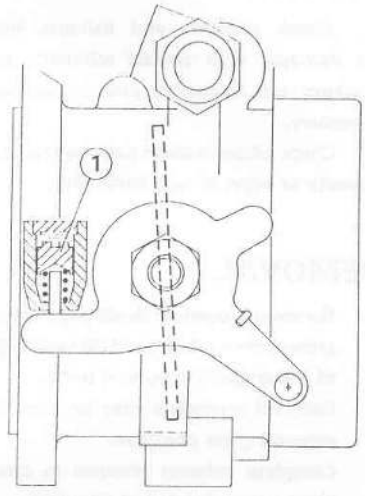
5. Using a flowmeter, checks throttle calibration by operating as follows:
a. Rest flowmeter pad **C.2.0056** at the throttle entrance.



b. Measure the flow of air through the throttle and check that it falls within the specified values.

Accelerator throttle air leakage in the closed position (Solex flowmeter):
240 thru 260 on N scale.

6. If specified limits fail to be recorded, adjust.
a. Remove the seal and manoeuvre the adjusting screw (1) until the specified flow is obtained.
b. Having accomplished adjustment, seal the adjusting screw housing once more with the plug provided for this purpose.
7. Reassemble the previously disconnected components operating in reverse order to removal, then carry out further adjustment.

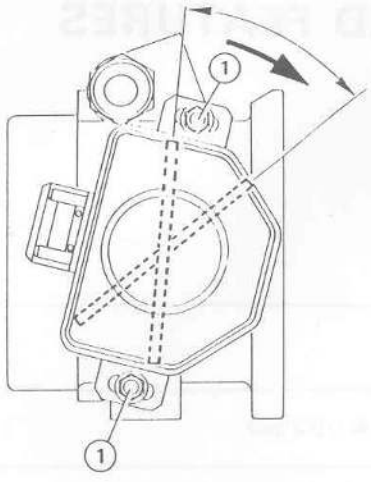


1 Adjusting screw

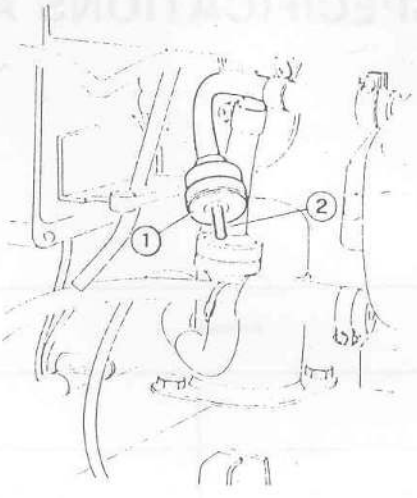
ACCELERATOR THROTTLE SWITCH CALIBRATION

1. Disconnect the female connector from the accelerator throttle switch then, using a tester, on the male connector, check for the following resistances.
a. With the throttle fully closed between terminals 2 and 18 a resistance of approximately 0Ω should be recorded.
b. Slowly turn the throttle: with the tester between terminals 2 and 18 a resistance equal to ∞ should be recorded prior to the throttle completing a revolution of 1° with respect to the fully closed position.
2. If this condition fails to arise, loosen the screws (1) and turn the switch until contact is achieved (resistance - 0Ω) between terminals 2 and 18 with the throttle fully closed; then tighten the screws.
3. Connect the ohmmeter across terminals 3 and 18, bring the throttle to its fully open position (full - load contact closed) and check whether ohmmeter indication is about 0 Ohm.

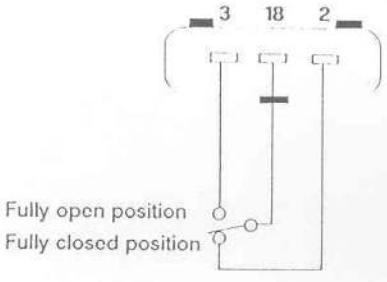
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1 Screws securing switch to throttle body



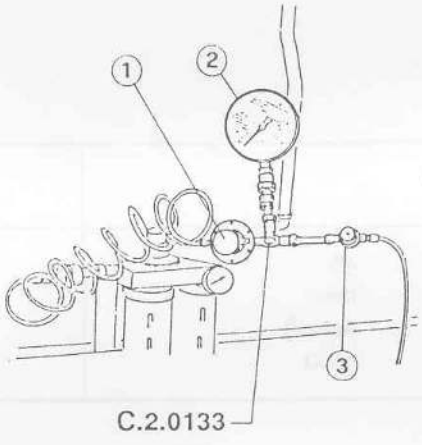
1 Air inlet valve
2 Air plug



4. If specified values are not obtained, check the accelerator control or replace the switch.

5. Acting on pressure regulator (1) take the fuel vapour emission circuit to a pressure of 3.7 kPa (0.037 bar; 370 mm H_2O).

6. Wait a few minutes until the pressure within the circuit has stabilized, then close the cock.



1 Pressure regulator
2 Pressure gauge
3 Cock

7. Wait 5 minutes and verify that the pressure drop does not exceed the value of 0.5 kPa (0.005 bar; 50 mm H_2O).

8. If the pressure drop is higher than the recommended value, re-set the pressure in the circuit by acting on the pressure regulator and, without closing the cock, check for leaks by covering the circuit unions with soapy water.

9. Replace the faulty components, suitably tighten the clamps met loose, then repeat the test.

EVAPORATIVE EMISSION CONTROL SYSTEM TEST

1. Connect the inlet pipe of tool **C.2.0133** to a suitable compressed air supply.
2. Connect an outlet pipe of tool **C.2.0133** to a "U-tube" pressure gauge, capable of reading pressure in millibars.
3. Operating on the vehicle luggage compartment, lower the front trimming in order to have access to air inlet valve (1).
4. Connect the other outlet pipe to plug (2) on air inlet valve (1).

FUEL FEED CIRCUIT SEALING TEST

If visible fuel leaks or persistent smell are encountered, carry out the fuel feed circuit sealing test.

CAUTION:
Keep a fire extinguisher handy in case of gasoline leaks. NO SMOKING!

1. Warm the engine up to running temperature.
2. Cut off the ignition.
3. Visually inspect all the components and connections of the fuel circuit for signs of leaks.
4. Using an exhaust analyzer (NDIR) examine the entire circuit, including all components and connections.
5. The HC analyzer needle will move when the probe is in the proximity of a fuel leak.

WARNING:
The test should be carried out slowly so as allow for instrument reaction time.

6. Replace all faulty components and tighten the previously slackened clips.
7. Start the engine and let it idle for a few minutes then cut off the ignition.
8. Check the circuit again, operating as in points 3 and 4.
9. Carry out a road test of at least 30 minutes and make a final check of circuit efficiency.

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TECHNICAL SPECIFICATIONS AND FEATURES

TECHNICAL FEATURES

FUEL TANK

Features	
Total capacity	46 l (12.2 gals)
Reserve	6-7 l (1.5 thru 1.8 gals)

FUEL

Gasoline with Octane rating 91 thru 95 (Research Octane Number)

CHECKS AND ADJUSTMENT

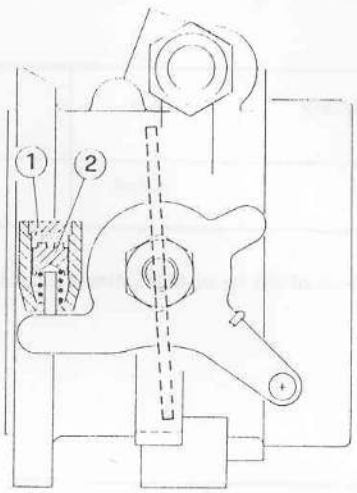
FUEL FEED CIRCUIT

		Values
Working pressure (1)	kPa	284.3 thru 323.6
	(bar)	(2.8 thru 3.2)
	(kg/cm^2)	(2.9 thru 3.3)
	(p.s.i.)	(41.2 thru 46.9)

(1) See Unit 00 - Complete Car - Fuel System - Check of Fuel System Pressure and System Tightness

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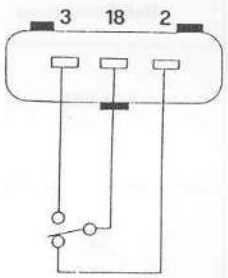
ACCELERATOR THROTTLE CALIBRATION (FLOW RATE)

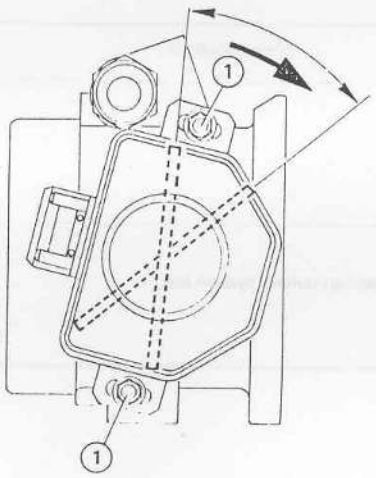


1 Seal
2 Air flow rate adjusting screw

	Reading
Air leakage with throttle disc in closed position (Solex flowmeter)	240 thru 260 scale N

ACCELERATOR THROTTLE SWITCH CALIBRATION





1 Screws securing switch to throttle body
2 Idle terminal (fully-closed throttle)
3 Full-load terminal (fully-open throttle)

Unit: Ω

	Resistances	
	Terminals 2-18	Terminals 3-18
Accelerator throttle opening angle 0 ÷ 1°	0	
Accelerator throttle opening angle >1°	∞	
Accelerator throttle fully open		0

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ENGINE IDLE AND CO - HC % AT EXHAUST (1)

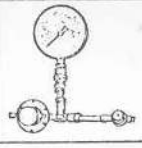
Engine idle r.p.m. (speed gear into neutral - clutch engaged)	r.p.m.	750 ÷ 850
Exhaust CO percentage with idle r.p.m. Exhaust HC percentage with idle r.p.m.	% in vol.	≤ 0.5 ≤ 100 p.p.m.

(1) See Unit 00 - Complete Car - Fuel System - Check of Idle r.p.m. and Exhaust Emission

FLUIDS AND LUBRICANTS

Application	Type	Denomination	Quantity
Rubber cushions, accelerator shaft carrier	GREASE	ISECO Molykote Pasta G Norm. 3671-69840	–
Accelerator pedal bellows	GREASE	REINACH Oleoblitz: E 10 TAC Norm. 3671-69812	–

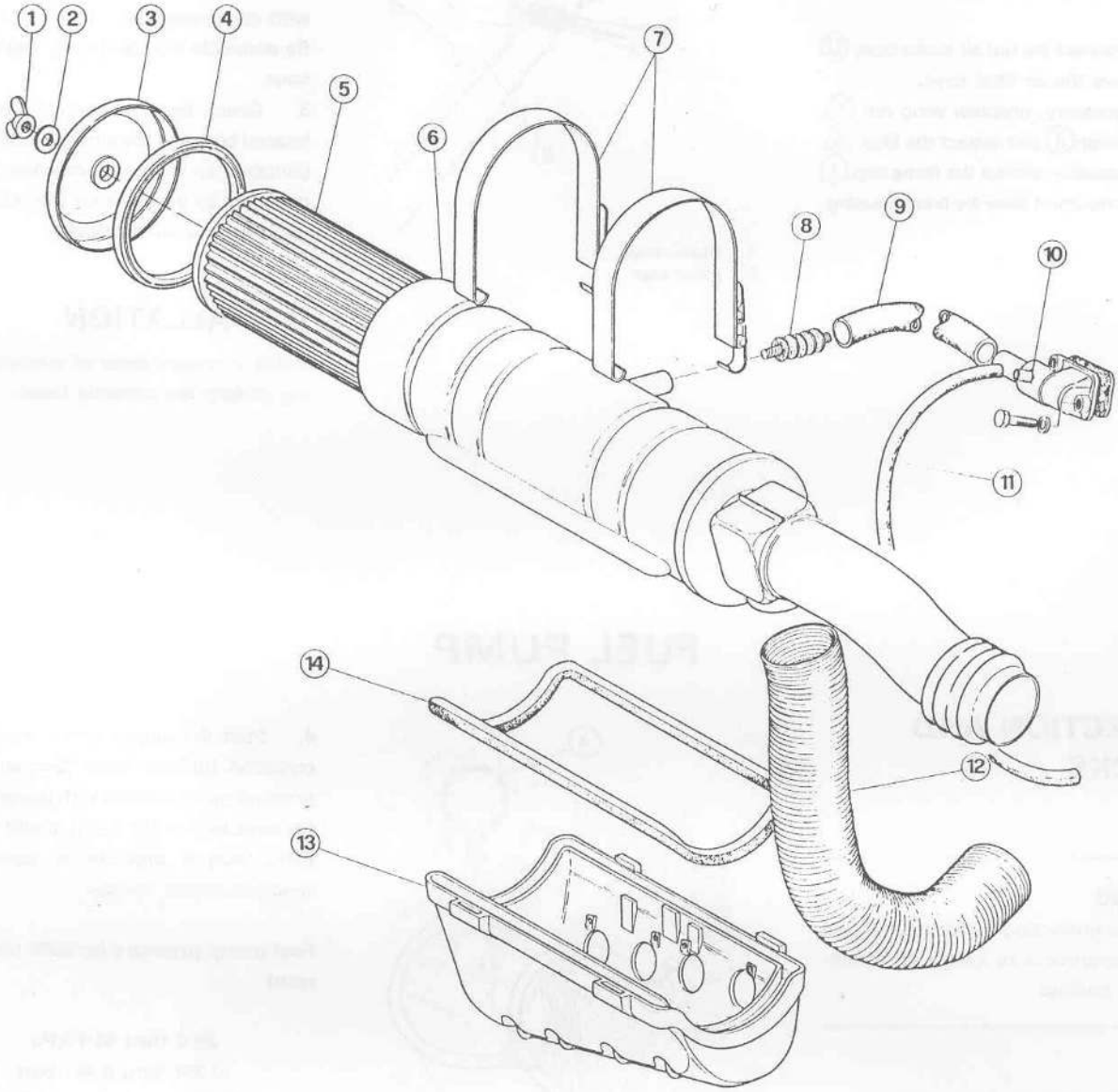
SPECIAL TOOLS

Identity N°	Denomination	Reference page
C.2.0056	Throttle calibration pad 	04-22
C.2.0133	Gauge for evaporative emission control system test 	04-23

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CARBURETTERS FUEL SYSTEM

AIR CLEANER



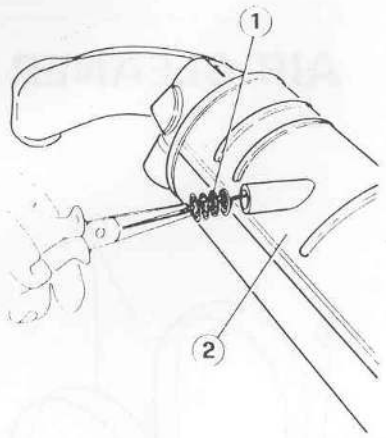
1 Wing nut
2 Washer
3 Cover
4 Gasket
5 Filter
6 Filter case
7 Chips
8 Flame trap
9 Maximum blow-by hose
10 Hose fitting on valve cover
11 Minimum blow-by hose
12 Hot air intake hose
13 Container on intake manifold
14 Gasket

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REMOVAL

Remove the cleaner casing complete with the filter, adhering to the sequence shown in the exploded diagram.

1. Release the clips (7) fastening the filter case (6) to the container on the intake manifold (13).
2. Detach the maximum blow-by hose (9).
3. Disconnect the hot air intake hose (12) and remove the air filter case.
4. If necessary, unscrew wing nut (1), remove cover (3) and extract the filter (5).
5. If necessary, extract the flame trap (1) from the maximun blow-by hose housing.



1 Flame trap
2 Filter case

INSPECTION

1. Clean the cleaner cartridge thoroughly by blowing low pressure compressed air from outside. If necessary, replace the filter.
2. Slip off the blow-by hose and flame trap from the air filter case and wash them with the recommended products then blow with compressed air.
Re-assemble the flame trap and blow-by hose.
3. Check the condition of the gasket located between the air filter case and the container on the intake manifold and the one fitted on the cover for filter extraction. Replace them as necessary.

INSTALLATION

Install in reverse order of removal ensuring gaskets are correctly fitted.

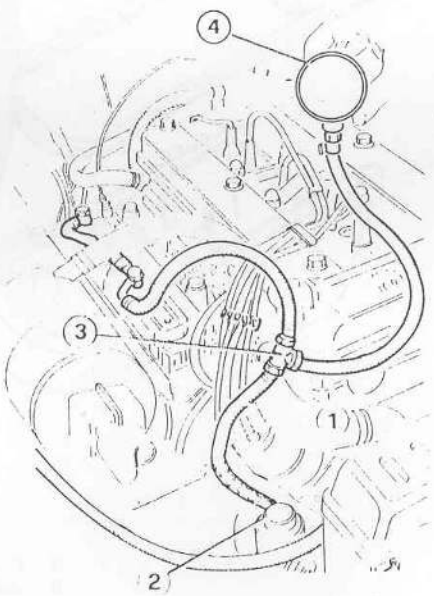
FUEL PUMP

INSPECTION AND CHECKS

WARNING:
When disconnecting fuel system hoses use a container with safety lid to collect fuel spilled.

PUMP OUTPUT PRESSURE

1. Disconnect supply hose (1) between fuel pump and carburetter.
2. Fit a Tee hose (3) with shutoff cock between fuel pump (2) and carburetter.
3. Connect a pressure gauge (4) to free end of hose.



1 Supply hose
2 Pump
3 Tee hose
4 Pressure gauge

4. Start the engine and in no-delivery condition (delivery cock downstream of pressure gauge closed) with gauge held at the same level as the pump, check that the pump output pressure is correct for specified engine speeds.

Fuel pump pressure (at 5000 thru 6000 rpm)

29.4 thru 44.1 kPa
(0.294 thru 0.441 bar)
(0.30 thru 0.45 kg/cm²)
(4.3 thru 6.4 psi)

5. If the pressure is not as specified replace fuel pump (2).
6. Restore initial conditions.

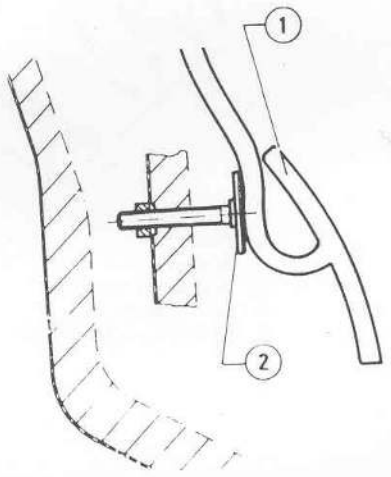
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CARBURETTERS

For technical specifications see Technical Specifications and Features - Carburetters.
For inspection procedures see Workshop Manual - Engines - Petrol Engines - Unit 04 - Fuel System - Carburetters.

CHECK AND ADJUSTMENT OF ACCELERATOR CONTROL

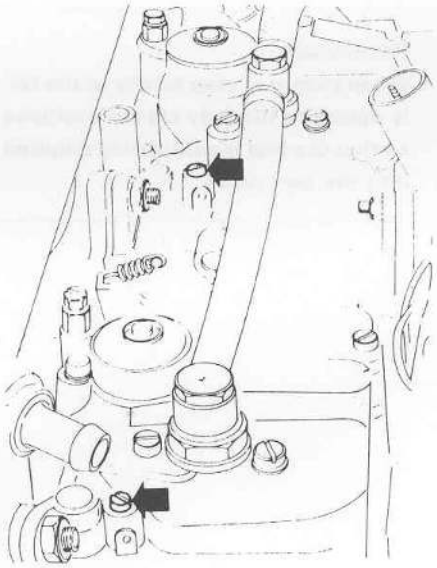
1. Control system check.
Check that rods which form the control system can move freely.
2. Throttle valve max opening check.
a. Check that, with the accelerator pedal (1) fully pressed, up or down the corresponding throttle valve opening position, minimum or maximum, is achieved.
b. If necessary, adjust by operating on the end-of-travel screw (2) and the joints of the control rods.



1 Accelerator pedal
2 End-of-travel screw

ON VEHICLE ACCELERATING PUMP OUTPUT TEST

With the carburetter on vehicle, and preferably with engine cold, check the accelerating pump as follows:
1. Remove four capscrews and lift out the accelerating pump jets from the respective Venturi.



1 Jet capscrews

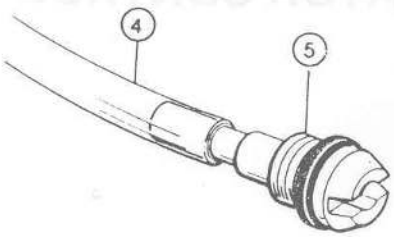
2. Screw four tester rods (1) into jet holes according to type of carburetter.

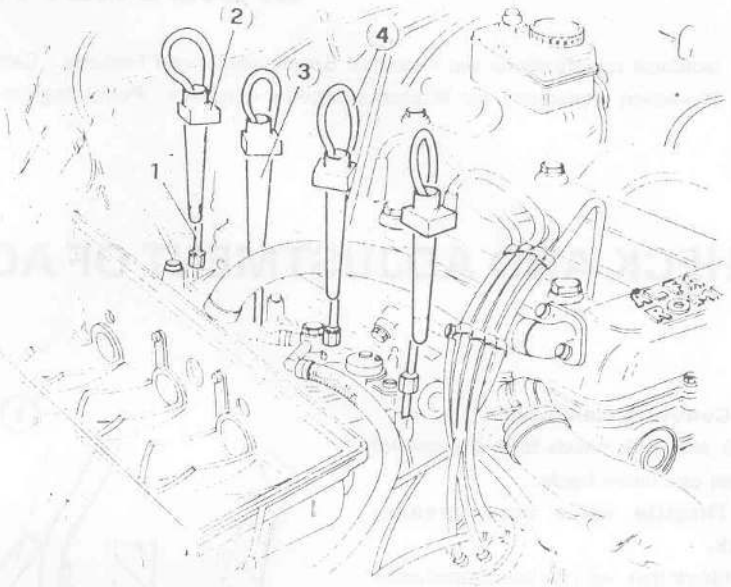
Horizontal carburetter tester:
Weber: C.4.0124

3. Install four supports (2) complete with respective graduated test tubes (3) on top of four rods (1).
4. Connect four plastic hoses (4) to the ends of the four rods (1).

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5. Connect free ends of plastic hoses (4) to the respective accelerating pump jets (5), previously removed.





1 Rods
2 Supports
3 Graduated test tubes
4 Plastic hoses
5 Accelerating pump jets

6. Place four pump jets (5) inside the respective graduated test tubes (3).
7. To ensure that the carburetter chamber is filled turn the engine over for a few seconds through the starter.
8. Pump the accelerator until all the air is removed from the hoses connected to the jets.
Empty the test tubes of any fuel spilled during this process.
9. Pump the accelerator until the fuel level in the test tubes reaches «0».
10. Pump twenty times, equal to the same number of throttle opening and closing cycles, using either control lever or accelerator pedal.

WARNING:
When pumping stop briefly in the fully open and the fully closed positions so that the fuel is completely emptied into the test tubes.

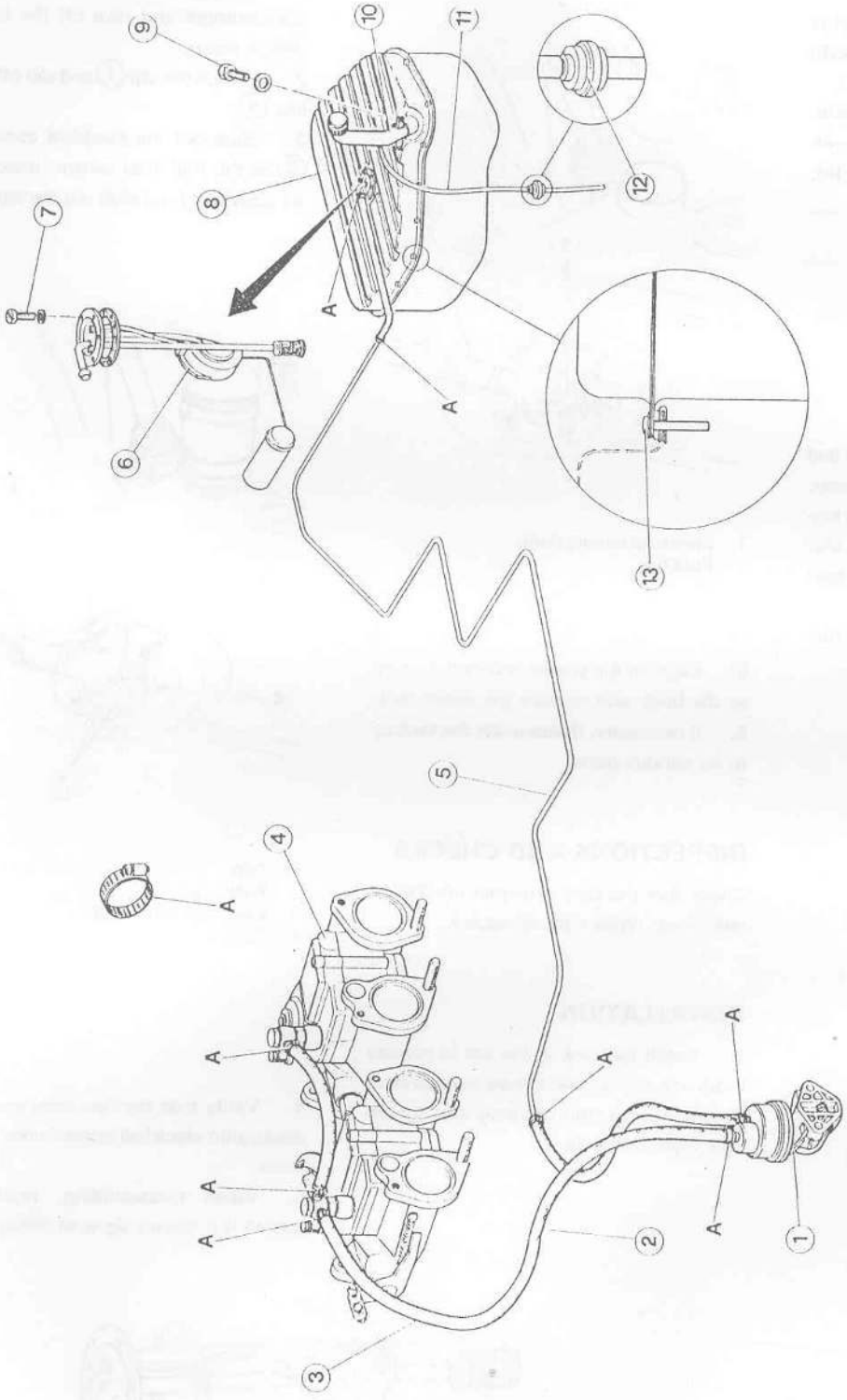
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11. The quantity of fuel collected in the test tubes shows:
- pump output;
- jet delivery.

12. Check that the amount of fuel in the graduated test tubes is as specified, see: Technical Specifications and Features - Technical Features - Carburetters.
13. If the volume is not as specified check and, if necessary, replace pump jet or accelerating pump diaphragm, or adjust accelerating pump link.
14. Check jet delivery to ensure that the amount of fuel in the four test tubes is identical.
15. Loosen the connections, install capscrews and clean thoroughly.

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FUEL SYSTEM DIAGRAM



1 Fuel pump
2 Hose
3 Carburetter supply hose
4 Twin-barrel carburetters
5 Supply line
6 Float assy
7 Float retaining screw
8 Fuel tank
9 Screw
10 Filler pipe
11 Vent hose
12 Check valve
13 Tank capscrew

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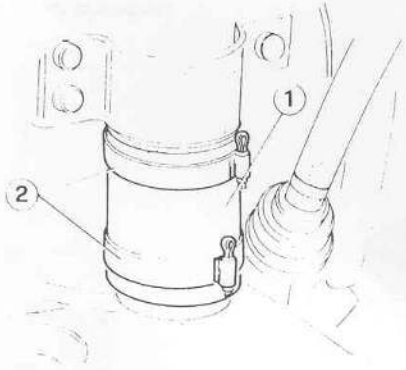
CAUTION:
Prior to replacing fuel supply circuit components, adhere strictly to the following instructions:

a. **Ensure that suitable equipment is available in the workshop for safe operation (extinguishers etc.).**
b. **Detach the battery ground cable.**
c. **Pat the fuel taken from the tank into a suitable container with lid.**

FUEL TANK

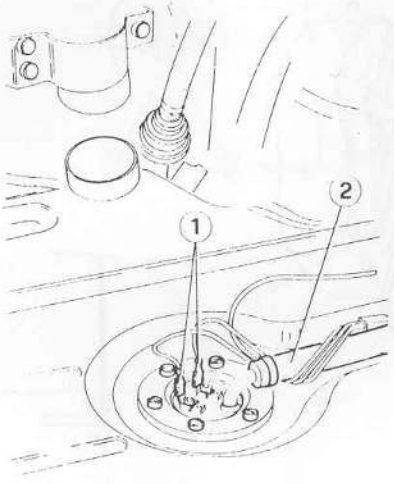
REMOVAL

1. Remove the plug on the fuel filter and suck the fuel from the tank using a pump.
2. Remove the lower lining from the luggage compartment, put the lefthand side lining to one side and take off the fuel level sensor cover.
3. Loosen the clips (2) securing the fuel inlet pipe (1) and slide it out.



1 Fuel inlet pipe
2 Clips

4. Slide out the two electrical connections (1) of the fuel level sensor and fuel line (2), having loosened the clip.



1 Electrical connections
2 Fuel line

5. Back off the screws securing the tank to the body and remove the entire tank.
6. If necessary, disassemble the tank into its various parts.

INSPECTIONS AND CHECKS

Check that the tank is neither cracked or deformed; replace as necessary.

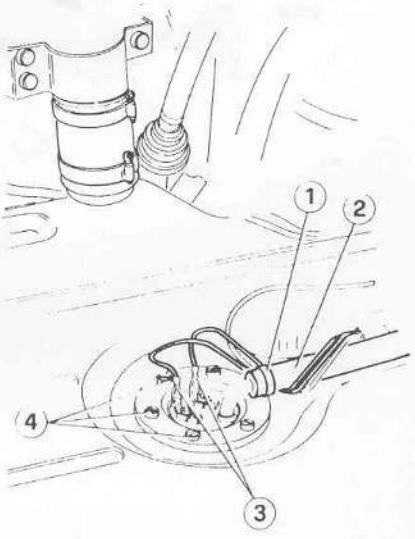
INSTALLATION

1. Install the tank in the car in reverse order of removal, taking care to reconnect electrical connectors correctly and tighten pipe clips with care.

FUEL LEVEL SENSOR

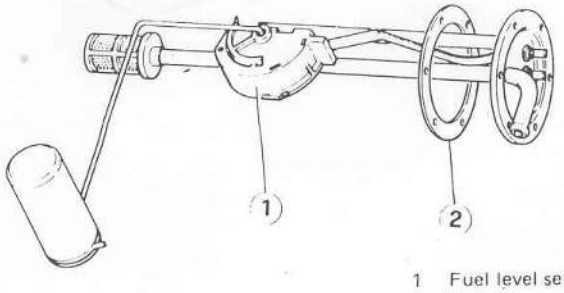
REPLACEMENT

1. Remove the floor lining of the luggage compartment and take off the fuel level sensor cover.
2. Loosen the clip (1) and slip off the fuel line (2).
3. Slide out the electrical connections (3) of the fuel level sensor, unscrew the six screws (4) and slide out the whole unit.



1 Clip
2 Fuel line
3 Electrical connections
4 Screws

4. Verify that the fuel level sensor and associated electrical connections are efficient.
5. When reassembling, replace the gasket if it shows signs of damage.



1 Fuel level sensor
2 Gasket

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FEED LINES

REMOVAL

WARNING:
Only remove the feed lines when absolutely necessary.

1. Place the car on the lift.
2. Remove the plug on the fuel filler then, using a suitable pump, suck the fuel from the tank.
3. Loosen the clips at the ends of the lines to be removed.

WARNING:
Plug the rigid pipes and the hoses to prevent dirt and dust getting in during removal.

INSPECTION AND CHECKS

1. Check that hoses are not porous and show no sign of deterioration; replace any hose that is not intact.
2. Check that the rigid pipes are not rusty, clogged or dented.

REASSEMBLY

Reassemble the lines carefully in reverse order of removal operations, observing the following warning.

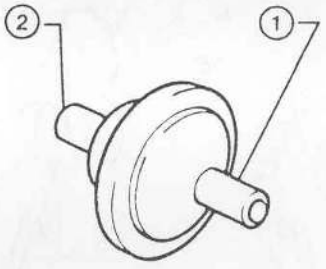
WARNING:

a. **Carefully remove the closing clips on the circuit joints.**
   Do not over tighten the clamps as this could damage the pipes.
b. **Do not twist or bend the rigid pipes when reassembling the latter on the car.**
c. **Start the engine and check that there are no leaks from the joints.**

CHECK VALVE

REMOVAL

1 Remove the lower lining of the luggage compartment and raise the lefthand side lening.
2. Remove the check valve by sliding it out from the associated hoses in the vicinity of the fuel inlet pipe.



1 Filler end connection
2 Atmosphere end connection

CHECKS AND INSPECTION

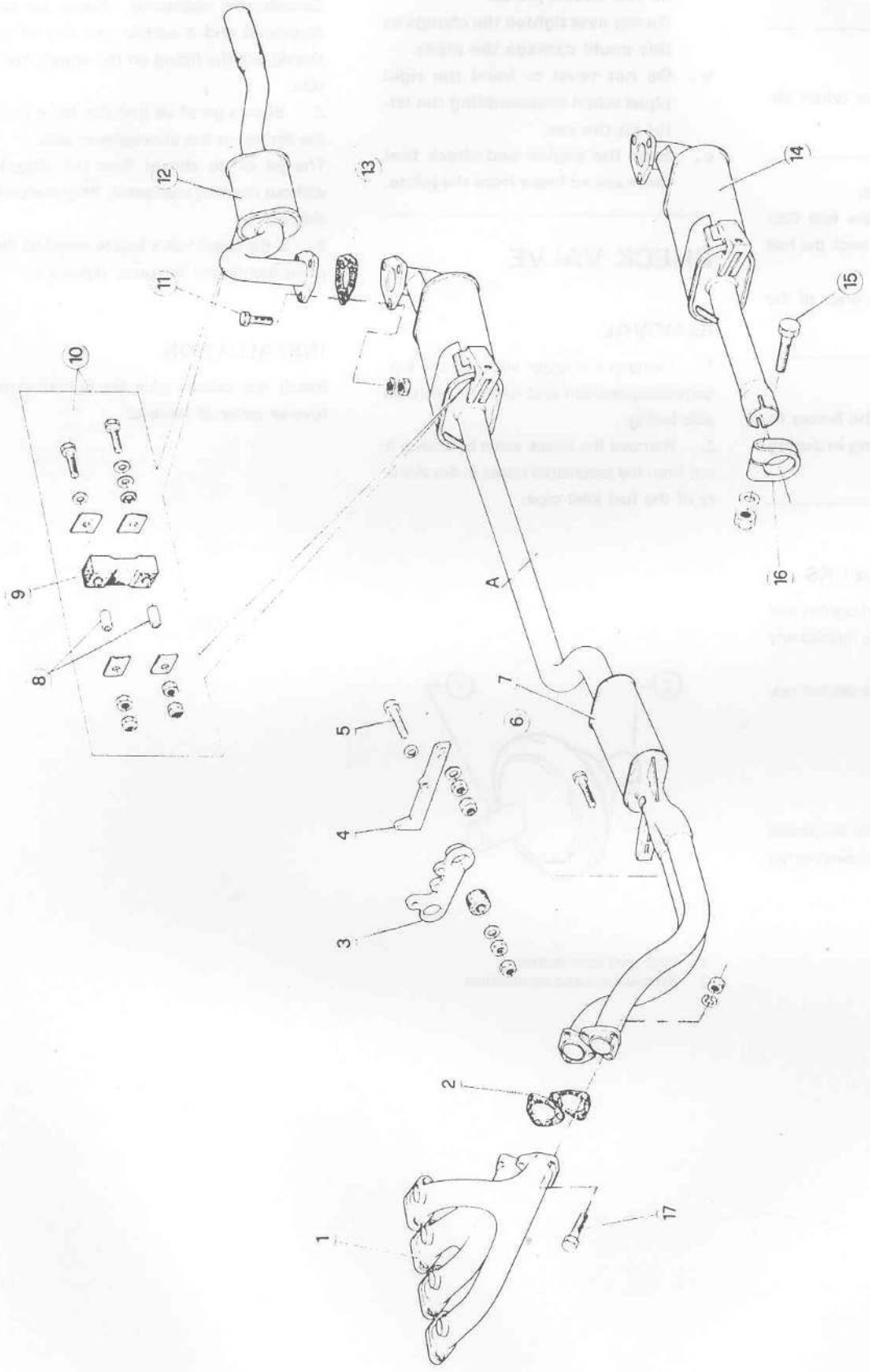
1. Blow a jet of air into the valve from the fitting on the fuel filler side.
Considerable resistance should be encountered and a certain quantity of air should exit the fitting on the atmospheric side.
2. Blow a jet of air into the valve from the fitting on the atmospheric side.
The jet of air should flow out directly without meeting resistance, from the tank side fitting.
3. If the check valve fails to manifest the afore mentioned features, replace it.

INSTALLATION

Install the check valve by operating in reverse order of removal.

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EXHAUST SYSTEM



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CHECKS AND INSPECTIONS

1. Check the silencers and exhaust pipes for damage, cracks or rust. Replace as necessary.
2. Check the rubber dowels replacing if they are cracked, porous or show signs of wear.

REMOVAL

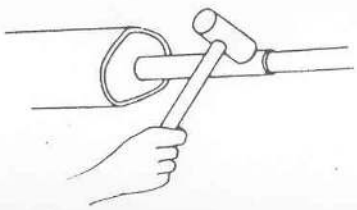
- The procedures illustrated allow a removal which permits the single system parts to be taken off separately.
- It is possible to modify the method of removal according to the purpose of the operation.
- If the complete exhaust system is to be removed the help of another person will be required.

MANIFOLDS AND SILENCERS

When removing, reference should be made to the exploded view of the exhaust system previously shown.

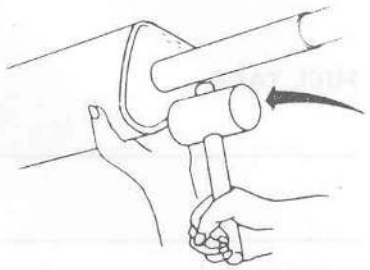
For further details reference should be made to the procedure for engine removal in Unit 01 - Complete Engine - Engine Removal and Installation.

1. Raise the car on the platform list.
2. Detach the rear element of the exhaust system by operating as follows:
   - Remove the bolts securing the rear rubber dowels to the bodywork.
   - Back off the bolts securing the central element to the rear one and separate the two parts.
3. Uncouple the central exhaust pipe as follows:
   - Remove the bolts securing the central rubber dowel to the bodywork.
   - Detach the part to be dealt with from the front or rear part by backing off the connecting bolts.
   - Loosen the clip securing the front part to the rear one.
   - Tap lightly and repeatedly with a suitable hammer along the circumference of the connection of the two trunks then rotate the silencer clockwise and counterclockwise in order to facilitate the separation.





   - If necessary, tap the silencer lightly with a plastic hammer in the direction in which it is to be removed, until the rear part is pulled completely out from the front one.



4. Detach the exhaust manifolds thus:
   - Back off the nuts securing the exhaust manifold flanges to the cylinder head.
   - Back off the bolts securing the manifold to the front part.
   - Remove the manifolds.

INSTALLATION

Install the single parts in reverse order of removal, bearing in mind the following instructions:

1. Assemble new gaskets between the flanges.
2. Once it has been installed, check that the pipe can oscillate freely and does not stick with the engine running.
3. Check that pipe connections shows no signs of gas leaks and that the system as a whole does not manifest strange noises.

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TECHNICAL SPECIFICATIONS AND FEATURES

FUEL TANK

Features	
Total capacity	46 l (12.2 gals)
Reserve	6-7 l (1.5 thru 1.8 gals)

FUEL

Gasoline with Octane rating ≥ 95 RON (Research Octane Number)

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CARBURETTER	Model	Twin-barrel Weber 40DC0M4 (Front) 40DC0M5 (Rear)
	Position	SIDE
Venturi	ϕ mm	30
Main jet	ϕ mm	1.20
Main air corrector	ϕ mm	1.50
Main emulsion tube		F47
Idle jet	ϕ mm	0.59
Idle air corrector	ϕ mm	-
Progression holes	ϕ mm	4 holes ø 1.1
Accelerating pump jet	ϕ mm	0.35
Needle plug	ϕ mm	1.50
Float weight	g	26
Starting jet	ϕ mm	0.85
Starting air corrector	ϕ mm	3 holes ø 2.5
Starting emulsion tube	ø mm	F9
Accelerating pump output (20 shots per port)	cm^3	10 ÷ 1.5
Accelerating pump adjustment check Lever-rod clearance with close throttle	mm	0.5
Float level height above cover with gasket (dim. «A»)	mm	7 ÷ 0.5

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GENERAL SPECIFICATIONS

FLUIDS AND LUBRIFICANTS

Application	Type	Denomination	Quantity
Shaft, accel. pedal (at rubber supports)	GREASE	ISECO Molykote Pasta G Norm. 3671-69840	–
Bellows, accel. pedal	GREASE	REINACH Oleoblitz: E 10 TAC Norm. 3671-69812	–

SEALANTS

Application	Type	Denomination	Quantity
Gaskets, carburetter cushion pads to supply manifold	SEALANT	DIRING: Heldite DOW CORNING: Hermetite Norm. 3522-00015	–
Seal, air cleaner to air intake (on intake side)	SEALANT	I.C.E.R. Pluricolla Alpha 75TRSP D.E.B. B400/AR Norm. 3521-00004	–

CHECKS AND ADJUSTMENT

FUEL PUMP

	Pump pressure (1)	Pump output
FISPA	29.4 to 44.1 kPa (0.294 to 0.441 bar) (0.30 to 0.45 kg/cm²) (4.3 to 6.4 psi) at 5000 to 6000 rpm	nil
SAVARA	29.4 to 44.1 kPa (0.294 to 0.441 bar) (0.30 to 0.45 kg/cm²) (4.3 to 6.4 psi) at 5000 to 6000 rpm	nil

(1) Pressure gauge level with pump

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TROUBLESHOOTING AND CORRECTIVE ACTIONS

Trouble	Problable cause	Corrective action
Loss of fuel	• Needle valve dirty or worn, or threaded seat loose	Wash fuel filter and valve, tighten seat. Replace seat as necessary
	• Float binding (on pivot or sides) or heavy	Free and adjust float travel. Replace float if necessary, using a genuine spare
	• Lines loose or failed	Tighten or replace lines or connectors
	• Seals age-hardened or deteriorated or incorectly tightened	Replace seals and tighten correctly
	• Acceleration pump diaphragm pierced or torn	Replace diaphragm using a genuine replacement
Carburetter starved	• Fuel pump or lines overheated and vapor lock formation	Bleed and trace and remedy cause of overheating
	• Fuel pump affected by mechanical defects	Overhaul pump replacing defective parts or replace pump as a whole
	• Fuel lines, filter or carburetter ports obstructed	Clean lines, filter and carburetter
	• Fuel tank vent obstructed or water deposits on tank bottom	Open vent and discharge water from tank, lines and carburetter chamber
Cold starting difficult or impossible	If fuel in chamber is correct (see above) check for:	
	• Choke cable binding, failed, disconnected, etc.	Remedy as necessary or replace
	• Starting air valve binding, tending to remain stuck open or closed	Restore smooth valve movement
	• Starting jet dirty or tampered with (if applicable)	Clean and if necessary replace starting jet
	• Inefficient ignition and starting system	Overhaul ignition and starting system
Excessive fuel consumption	• Carburation, ignition or compression defective, as indicate for "Vehicle fails to reach top speed or lacks power uphill"	Check as specified
	• "Summer-winter" air intake lever in incorrect position	Put the lever to the correct position **Important**: check fuel consumption figures carefully, as speed, load, route and driving habits may greatly affect fuel consumption
Poor pickup , especially in direct drive	• Carburation, ignition or compression defective, as per "Vehicle fails to reach top speed or lacks power uphil" (Possible smoky exhaust)	Check as specified

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Trouble	Problable cause	Corrective action
	• Acceleration pump misadjusted or defective, or valve circuit and pump jet defective	Overhaul pump and associated circuits
	• Emulsion chamber obstructed or otherwise defective	Overhaul air corrector, emulsion tube and chamber, ensuring that all setting are as specified
Tendency to knock, preignition or engine overheating	• Carburation or ignition defective as per "Vehicle fails to reach top speed or lacks power uphill"	Check as specified above
	• Low octane number fuel	Remplacer with higher ON fuel
	• Engine cooling system defective	Check radiator and thermostat. Check radiator curtain (if applicable) for incorrect adjustment
	• Engine cylinders heavily carbonized	Decarbonize engine
	• If ignition is O.K. check for poor engine compression possibly due to inefficient piston rings, valves or head gasket	Check engine compression installing special tester in spark plug seats, and overhaul or replace any defective engine parts
	• Poor engine compression	Check compression and overhaul engine as necessary
Uneven engine idling or progression	• Fuel level in float chamber, starting valve, ignition and engine compression inadequate as per difficult cold starting	Check and remedy as specified
	• Idle adjusting screw setting incorrect	Adjust idle directed in maintenance instructions
	• Idle jet, fouled, loose or tampered with	Check or replace idle jet
	• Progression holes or idle circuit ports obstructed or tampered with	Check and clean progression holes and ports
	• Mounting flange or other connections not airtight	Tighten flange. Replace any worn or defective seals
	• Throttle shaft not airtight	Replace shaft. If oversize shaft is needed, open out seats in body
	• Throttle or associated linkage binding	Free throttle from any obstruction
Vehicle fails to reach top speed or lacks power uphill	• Fuel level in float chamber, starting valve, ignition and engine compression inadequate as above	Check and remedy as specified
	• Max fuel jet, power jet, air corrector or emulsion tube obstructed, tampered with or loose	Check and clean or replace defective parts
	• Fuel filters obstructed	Clean filters
	• Air cleaner obstructed	Clean and replace cartridge
	• Throttle does not open fully	Check throttle and associated linkage

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Trouble	Probable cause	Corrective action
Excessive or abnormal exhaust noise	• Exhaust silencers perforated • Exhaust piping perforated • Exhaust leakage through loose connections	Replace defective silencer Replace defective pipin Tighten connections

SPECIAL TOOLS

Identity No.	Denomination	Reference page
C.4.0124	Tester, on-vehicle, accelerating pump output, Weber horizontal carburetter 	04-27

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UNIT 05

CONTENTS

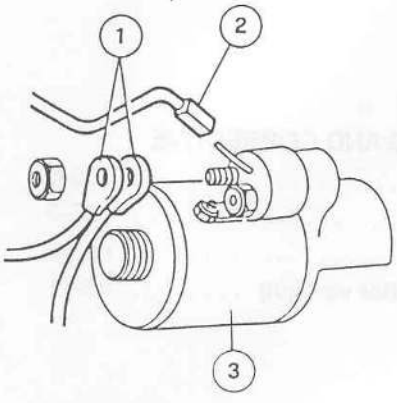
STARTER MOTOR 05-2
ALTERNATOR 05-2
TECHNICAL SPECIFICATIONS AND FEATURES 05-3
TROUBLESHOOTING AND CORRECTIVE ACTIONS 05-8
Starter 05-8
Alternator 05-10
Ignition (carburetter version) 05-11

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STARTER MOTOR

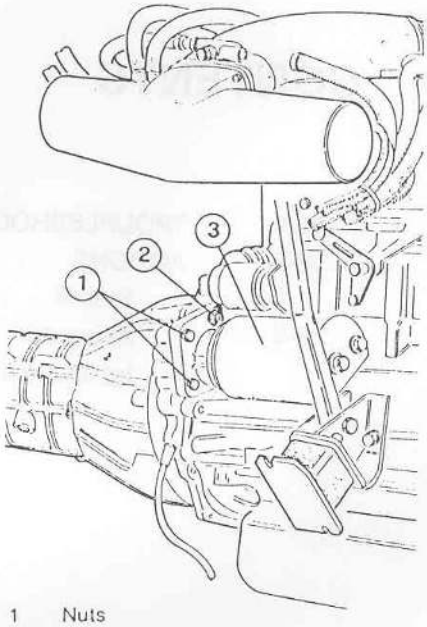
REMOVAL

1. Disconnect battery cables.
2. Disconnect supply wires (1) and field wire (2) from the starter motor (3).



1 Supply wires
2 Field wire
3 Starter motor

3. Working from beneath the car, unscrew nuts (1) fixing starter motor.
4. Working from the front side of the engine compartment, unscrew nut (2) and extract the starter motor (3).



1 Nuts
2 Nut
3 Starter motor

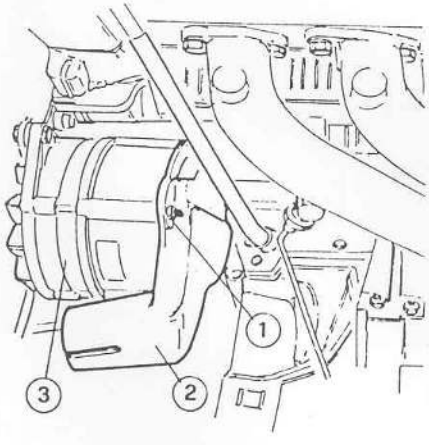
INSTALLATION

Install the starter motor by operating in reverse order of removal.

ALTERNATOR

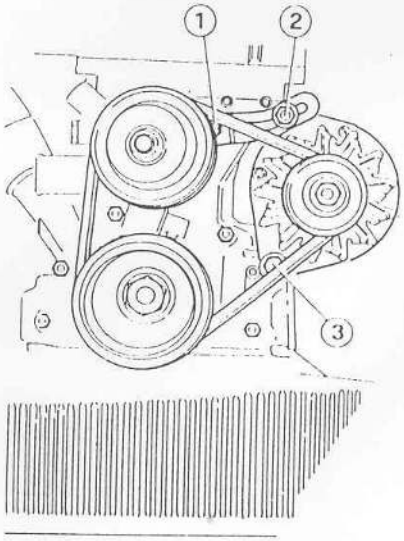
REMOVAL

1. Detach the air filter cover, then remove the filtering element and the lower box.
2. Unscrew nuts (1), extract cover (2) and disconnect electrical connection from alternator (3).



1 Nut
2 Cover
3 Alternator

3. Loosen nut (1), unscrew nut (2) and bolt (3). Remove alternator and release it from belt.



1 Nut
2 Nut
3 Bolt

INSTALLATION

Install the alternator by operating in reverse order of removal.

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WARNING:
Reference should be made to Workshop Manual - Engines - Petrol Engines - Unit 05 - Engine Ignition, Starting, Charging for checks and overhaul of the component parts of the Ignition, Starting and Charge System

TECHNICAL SPECIFICATIONS AND FEATURES

TECHNICAL FEATURES

BATTERY

	Spider / Spider 2.0	Spider 1.6
Voltage (V)	12	12
Capacity (Ah)	60	50
Discharge rating (A)	-	185

COMPONENT UNITS

Models	Starter motor	Alternator (1)	Distributor	Spark plug
Spider / Spider 2.0	BOSCH 0.001.108.011 12V-1,4 KW	BOSCH K1-14V-28/70A	BOSCH 0.237.501.006	LODGE 2HL
Spider 1.6	BOSCH 0.001.211.207 EF→12V-0,8KW	BOSCH 0.120.489.903-904 K1→14V55A20	BOSCH 0.237.002.133	
	PARIS-RHONE D8E-145	MAGNETI MARELLI		
	DUCELLIER DmE 124 P1	PARIS-RHONE A13R 192		

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STARTER

Type		BOSCH 0.001.108.011 12V-1,4KW	BOSCH 0.001.211.207 EF→12V-0,8KW	PARIS-RHONE D8E-145	DUCELLIER DmE 124 P1
Rated voltage	V	12	12	12	12
Rated output	kW (HP)	1.4 (1.9)	0.51 (0.7)	0.92 (1.25)	0.88 (1.2)
Max. brush length	mm (in)	–	11 (0.43)	9 (0.35)	9 (0.35)
Max. commutator eccentricity	mm (in)	–	0.06 (0.0024)	0.05 (0.002)	0.05 (0.002)
Armature shaft running clearance	mm (in)	0.02 thru 0.05 (0.001 thru 0.002)	0.02 thru 0.05 (0.001 thru 0.002)	0.02 thru 0.05 (0.001 thru 0.002)	–
Running torque test (pinion meshing with braked ring gear)					
– Voltage	V	9	10	9.3	–
– Current consumption	A	≤ 315	≤ 230	≤ 230	–
Speed	rpm	≥ 1700	≥ 1450	1600 thru 1700	–
– Torque	Nm (kgm) (ft.lb)	7,5 (0,75) (5.9)	5 (0.5) (3.7)	5 (0.5) (3.7)	– – –
Lock torque test (pinion meshing with locked ring gear)					
– Voltage	V	4	8	7.2	–
– Current consumption	A	≤ 750	≤ 400	≤ 410	–
– Torque	Nm (kgm) (ft.lb)	≥ 1.6 (≥ 0.16) (≥ 1.2)	≥ 10.5 (≥ 1.07) (≥ 7.7)	11.8 (1.2) (8.7)	– – –
Freewheel overrunning torque	Ncm (kgcm) (in.lb)	12 thru 18 (1.2 thru 1.8) (1.1 thru 1.6)	13 thru 22 (1.3 thru 2.2) (1.1 thru 1.9)	12 thru 19 (1.2 thru 1.9) (1.1 thru 1.7)	– – –
Starter-mounted switch test					
– Max. draw at rated voltage	A	≤ 40	–	≤ 55	–
– Min. cut-in voltage	V	≤ 7.8 at 20 thru 25°C (68 thru 77°F)	–	–	–
Pinion teeth module		2.1167	2.11	2.116	2.116

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ALTERNATOR (1)

Type			BOSCH K1-14V-28/70A	BOSCH K1-14V55A20 0.120.489.549	MAGNETI MARELLI	PARIS-RHONE A13R192
Rated voltage		V	14	14	14	14
Read current (speed)		A (rpm)	70 (6000)	–	–	–
Output data	Max. current output	A	70	55	~60	50
	Initial output speed	rpm	1060	1000	1100	1000
	Speed at 2/3rd of max. output	rpm	2100	2000	2100	2000
	Max. output speed	rpm	15000	6000	7000	8000
Brush wear limit		mm (in)	-	5 (0.20)	7 (0.28)	6 (0.24)
Field winding resistance		Ω	-	4 ± 0.1	–	3.1 ± 0.1
Voltage regulator resistance		Ω	-	60 thru 64	–	–
Diode resistance		Ω	-	0 thru 10	0 thru 10	0 thru 10

(1) Integral electronic voltage regulator version.

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IGNITION ADVANCE (1) (CARBURRETTER VERSIONS)

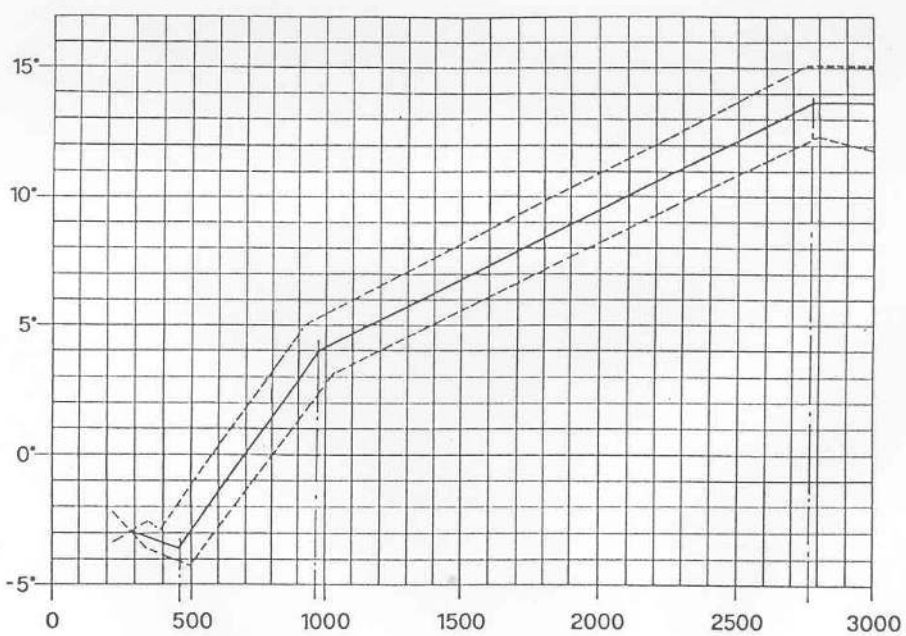
Static advance (2)	7° ± 1° B.T.D.C. at idle
Max. advance (3)	34° $^{+0°}_{-3°}$ B.T.D.C. at 5400 rpm

(1) Check static and max. advance with distributor vacuum pipe disconnected.

(2) Static advance position: Align pointer to ref. mark «F»

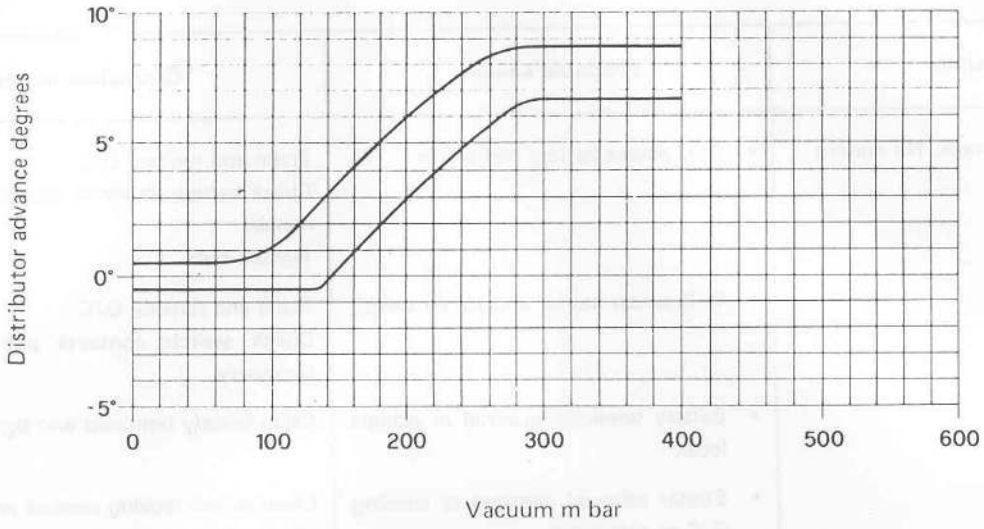
(3) Max. advance position: Align pointer to ref. mark «M».

Ignition distributor advance diagrams



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Pneumatic advance diagram



GENERAL REQUIREMENTS

Fluids and lubricants

Description	Type	Denomination	Quantity
Battery terminal	GREASE	Grease REINACH: E10 Tac Norm. 3671-69812	As necessary
Spark plug thread	OIL	ISLCO Molykote A norm 4500- 18304	As necessary

TIGHTENING TORQUES

Item	N·m	kg·m	ft·lb
Spark plug (wet, ISECO Molykote A)	25 to 34	2.5 to 3.5	18.4 to 25.1

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TROUBLESHOOTING AND CORRECTIVE ACTIONS

STARTER

Trouble	Probable cause	Corrective action
Starter does not crank. No current draw	• O/C across battery and starter	Trace and remedy O/C Check battery terminals and starter lead terminals Tighten nuts
	• O/C across starter and starter switch	Trace and remedy O/C Check switch contacts and replace as necessary
	• Battery terminals oxidized or clamps loose	Clean battery terminals and tighten clamps
	• Starter solenoid contacts or winding O/C or grounded	Clean switch moving contact and fixed contacts or replace switch
	• Worn brushes preventing proper contact on commutator	Replace brushes with genuine spares and check commutator conditions
Starter draws current but does not turn on turns slowly or does not crank the engine	• Armature fouling pole shoes or stuck between poles	If bushes are worn replace bushes and/or supports Check support alignment Check armature shaft Ensure that pole shoes are correctly positioned and tight on yoke
	• Seized armature shaft	Replace armature and seized bush
	• Field winding S/C or grounded	Replace field winding
	• Armature O/C or grounded	Replace armature
	• Armature S/C	Clean commutator and brush holders to remove carbon and copper dust Check and replace armature as necessary
Starter turns but does not crank the engine	• Ring gear teeth worn: pinion does not mesh	Replace starter ring gear on flywheel
	• Incorrect assembly: pinion does not mesh fully	Check pinion-to-ring gear alignment and distance
	• Foreign matter in drive: starter drive binds on armature shaft	Clean and lubricate: clean the entire drive as necessary
	• Pinion meshes with ring gear but engine does not crank	Freewheel defective needing replacement Clutch defective needing overhaul Incorrect solenoid operation needing repair or replacement
Starter operates but generates excessive or undue noise	• Defective mechanical components	Check supports Check bushes Replace supports as necessary
	• Trapped foreign matter	Remove foreign matter

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Trouble	Probable cause	Corrective action
Starter lacks power	• Incorrect brush contact	Replace or bed in brushes by operating starter in no-load conditions Check brush spring load Replace any weak springs
	• Brushes binding in holders	Clean holders or replace as necessary
Premature brush wear	• Commutator ovalized	Dress commutator within specified limits, undercut mica and clean commutator
	• Mica protruding from commutator laminations	Undercut mica and clean commutator
	• Brush spring load excessive	Check brush spring load and compare to requirements
	• Unsuitable brushes	Replace brushes with the specified type
Commutator sparking	• General overload	Overhaul starter
	• Weak brush springs	Replace brush springs
	• Mica protruding from copper laminations	Undercut mica and clean commutator

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ALTERNATOR

Trouble	Probable cause	Corrective action
Alternator fails to charge	• Slack drive belt	Tension belt
	• Charging or ground return circuit affected by O/C	Check circuit
	• Defective brushes	Replace brushes
	• Field diode S/C	Replace heat sink
	• Field circuit affected by O/C	Check circuit
	• Rotor winding O/C	Replace rotor
	• Voltage regulator inefficient	Replace voltage regulator
	• Stator winding grounded	Replace stator
Output low or unsteady	• Slack drive belt	Tension belt
	• Intermittent O/C in charging circuit	Check circuit
	• Worn brushes	Replace brushes
	• Voltage regulator inefficient	Replace voltage regulator
	• Field diode O/C or S/C	Replace heat sink
	• Rotor partially S/C	Replace rotor
	• Stator O/C, grounded or partially S/C	Replace stator
High output	• Voltage regulator inefficient	Replace voltage regulator
Noisy alternator	• Worn drive belt	Replace belt
	• Loose drive pulley	Tighten retaining nut
	• Bearings inefficient	Replace bearings
	• Field diode S/C	Replace heat sink
	• Alternator loose	Tighten retaining capscrews

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IGNITION (CARBURRETTER VERSION)

Trouble	Probable cause	Corrective action
Engine misfires	• Erratic HT connections	Replace or fasten HT connections
	• Ignition coil cap sparking or burnt	Replace coil
	• Distributor cap sparking or burnt	Replace distributor cap
	• Rotor arm sparking or burnt	Replace rotor arm
	• Coil secondary S/C or O/C (coil sparks weak)	Replace coil
	• Mechanical fault in distributor (visually check for gap between rotor and stator)	Disassemble distributor and replace defective parts. If necessary, replace entire distributor
	• Pulse generator resistance inside distributor not as specified	Replace pulse generator coil
	• Incorrect ignition timing	Check and adjust ignition timing
	• Defective fuel supply system	Remedy as necessary
	• Defective ECU	Replace ECU
Engine will not fire	• Connections O/C	Trace and rectify O/C or replace connections
	• Ignition coil cap burnt through by HT or grounded	Replace ignition coil
	• Distributor cap burnt through by HT or grounded	Replace ignition distributor cap
	• Rotor arm burnt through or grounded	Replace rotor arm
	• Coil primary S/C or grounded	Replace ignition coil
	• Coil secondary O/C	Replace ignition coil
	• Distributor gap incorrect	Disassemble distributor and replace any defective parts

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UNIT 07

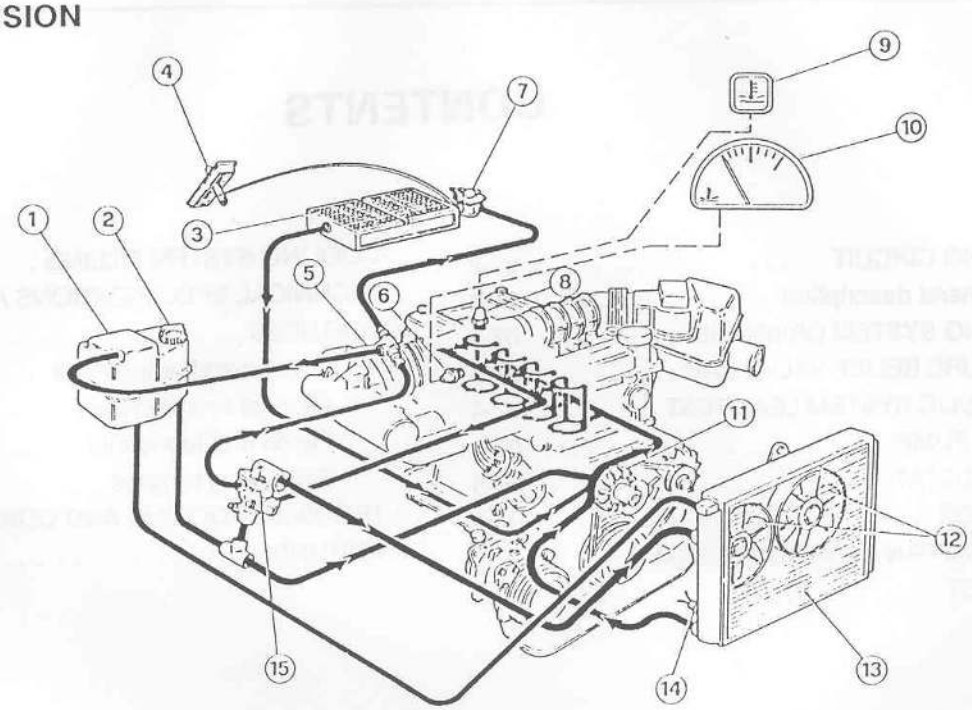
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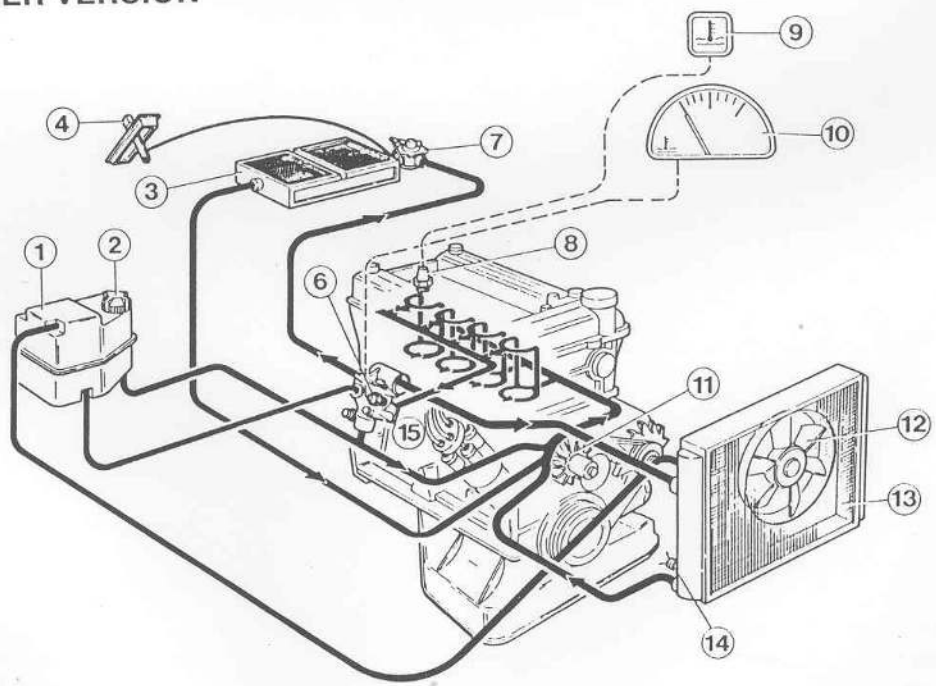
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COOLING CIRCUIT

INJECTION VERSION



CARBURETTER VERSION



1 Filler tank
2 Filler tank cap
3 Heater
4 Heater cock control lever
5 Throttle valve unit
6 Coolant temperature sensor
7 Heater cock
8 Coolant maximum temperature warning light sensor
9 Coolant maximum temperature warning light
10 Coolant temperature indicator
11 Water pump
12 Electric fans
13 Radiator
14 Electric fan thermal switch
15 Thermostat unit

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GENERAL DESCRIPTION

The cooling system is a sealed type with a centrifugal water pump driven by the crankshaft through a 'V' belt. The pump (11) rotation causes a vacuum in the return circuit allowing the coolant coming from the cylinders to be intaken through the thermostat unit (15), either from the heater (3), when the relevant cock (7) is open, or from the radiator (13), when at temperatures higher than 85° C, the thermostat unit (15) valve is open.

The thermostat valve allows the engine to reach in a very short time its running temperature, and then keep it within operational values.
In fact, until the engine temperature is below 85° C, the thermostat valve is closed, deflecting the coolant diretly towards the pump.
On the contrary the thermostat valve opening allows the coolant to reach the radiator.

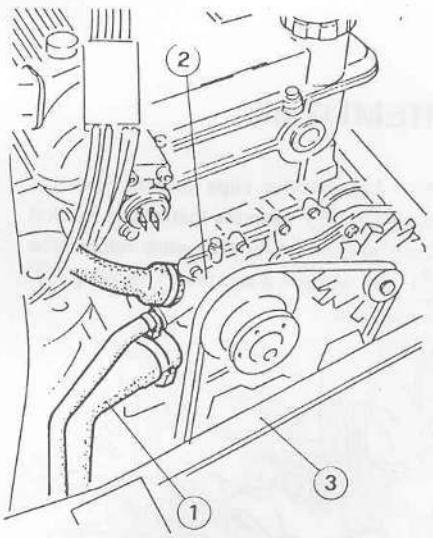
Besides the dynamic air, the radiator is cooled also by two electric fans (12), the actuation of which is controlled by the thermal switch (14) whenever the coolant temperature, outcoming the radiator, reaches 88° C.
Circuit topping up or refilling is paerformed through the cap (2) located on the filler tank (1).

COOLING SYSTEM DRAINAGE

1. Disconnect the battery negative cable.
2. Place a can under the vehicle to recover the coolant.

CAUTION
To avoid burns, take care when discharging coolant with hot engine.

3. Remove the expansion tank cap and open heater cock.
4. Disconnect sleeve (1) connecting radiator (3) to water punp (2). Discharge and recover the coolant.



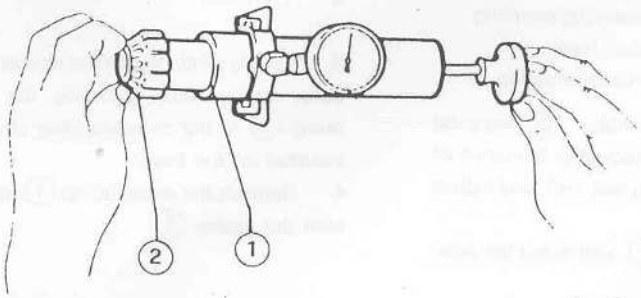
1 Pump-radiator sleeve
2 Water pump
3 Radiator

PRESSURE RELIEF VALVE CAP

LEAKAGE TEST

1. Fasten connector (1) to tester and insert in pressurized cap (2).
2. Apply pressure and check on tester that upon reaching the specified pressure setting the relief valve opens.

Cap pressure relief valve setting:
107.9 kPa
(1.0 bar; 1.1 kg/cm²; 15.64 psi)



1 Connector
2 Cap setting

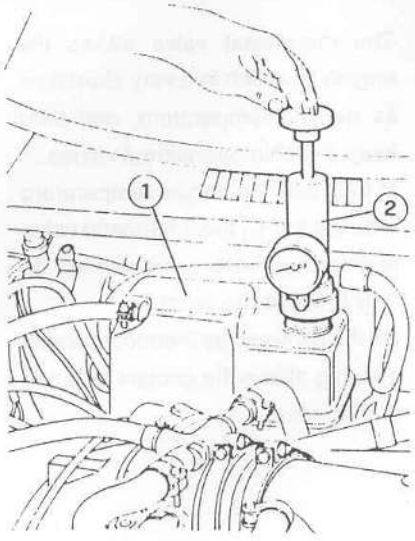
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HYDRAULIC SYSTEM LEAK TEST

1. Unscrew pressurized plug from filler tank (1).
2. Screw suitable tool (2) to tank filler to test the system.
3. Act on tool so as to increase pressure in the system and verify on dial indicator that pressure keeps at the prescribed value.

Hydraulic system checking pressure:

150 kPa
(1.5 bar; 1.53 kg/cm^2; 21.43 psi)



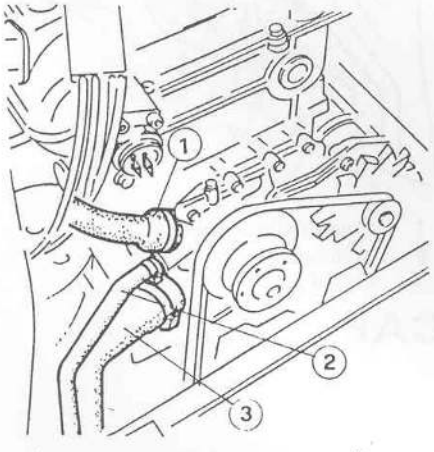
1 Filler tank
2 Tester

4. If pressure does not stay at specified value, check radiator for leaks: if necessary, remove and carry out checks as instructed in the paragraph "Radiator".

WATER PUMP

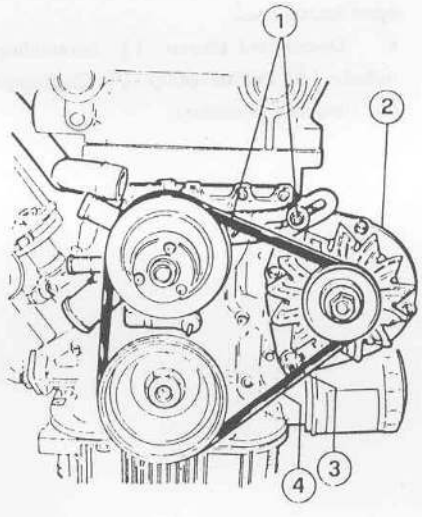
REMOVAL

1. Loosen the clips and remove the coupling (1) from the thermostat support then remove the heating water return tube (2) and radiator water return coupling (3) from fillers.



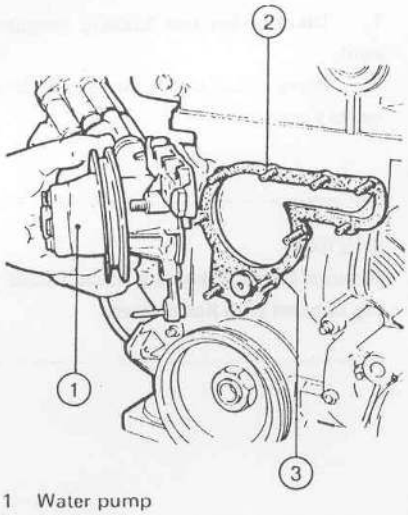
1 Water pump-thermostat coupling
2 Heater water return hose
3 Radiator water return coupling

2. Loosen the alternator (2) securing nuts (1) and (3), move the former so as to slacken the driving belt (4) and extract it from the pulleys.
Remove the nuts (1) and move the alternator outwards.



1 Alternator securing nuts
2 Alternator
3 Bolt
4 Drive belt

3. Slacken and remove the nine nuts and associated washers securing the water pump (1) to the corresponding studs (2) installed on the base.
4. Remove the water pump (1) together with the gasket (3).



1 Water pump
2 Studs
3 Gaskets

INSPECTION AND CHECKS

The water pump cannot be overhauled and in case of failure must be replaced.
1. Check pump body and impeller for indications of wide oxidation and corrosion; if any, replace pump.
2. Verify that there is no excessive play in the rotation and axial movement of impeller.

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INSTALLATION

1. Fit water pump with new relevant gasket to block and tighten securing screws to specified torque value.

(T) : Tightening torque
Screws securing water pump
14 thru 22 N·m
(1.36 thru 2.25 kg·m)
(10.3 thru 16.2 ft·lb)

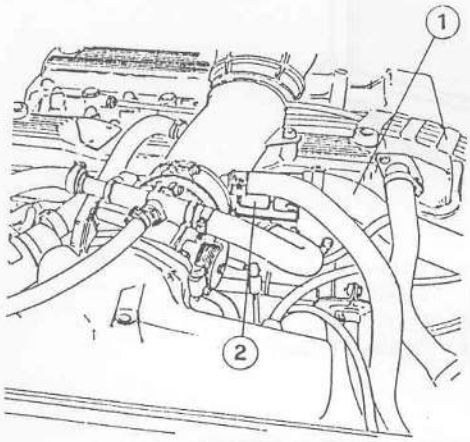
2. Refit alternator and pump drive belt in reverse order of removal.

3. Refit couplings on water pump and lock with associated clips.
4. Adjust pump - alternator drive belt tension.
For belt tension adjustment procedure refer to Unit 00 - Engine Maintenance.

THERMOSTAT

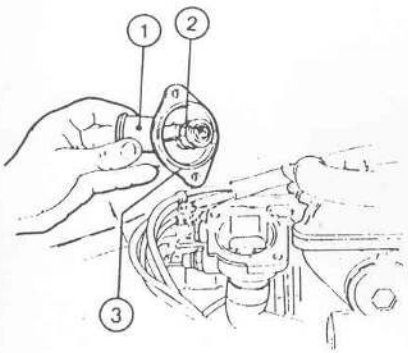
REMOVAL

1. Drain coolant to lower level of thermostat cup.
2. Loosen the clip and remove the hose (1) which connects the thermostat cover (2) to the radiator.



1 Water hose
2 Thermostat cover

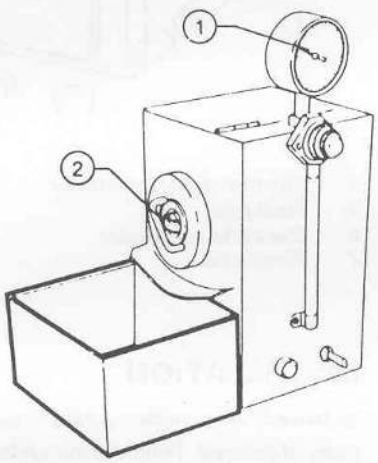
3. Unscrew the two screws and remove the cover (1) together with the thermostat (2) and seal ring (3).



1 Thermostat cover
2 Thermostat
3 Seal ring

INSPECTION AND CHECKS

Thermostat should be checked in accordance with the following procedure:
1. Fit thermostat (2) to suitable test equipment.
2. Fill container with water and switch on equipment to heat water.



1 Temperature gauge
2 Thermostat

3. Check that, when thermostat opens, temperature value read on thermometer (1) dial indicator is 81 thru 85°C (178 thru 185°F).
4. Additionally check that thermostat is fully open at 95°C (203°F) and valve travel greater than 7.5 mm (0.3 in).
5. If above values are not met, thermostat must be replaced.

INSTALLATION

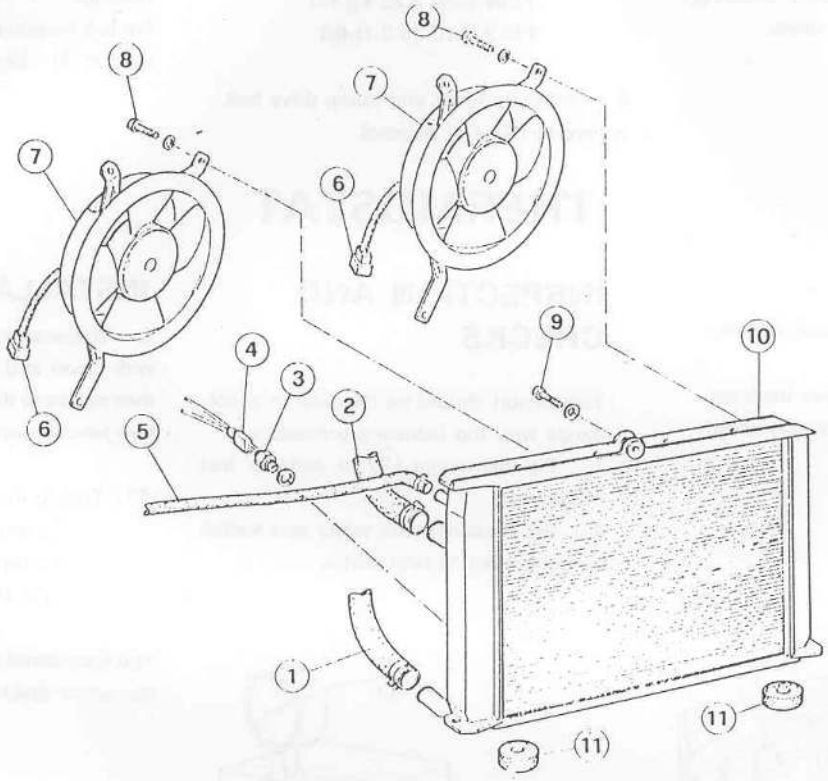
1. Accomodate the thermostat complete with cover and seal ring into its housing then secure to the specified torque with the two junction screws.

(T) : Tightening torque
10 thru 16 N·m
(1 thru 1.6 kg·m)
(7.4 thru 11.8 ft·lb)

The thermostat should be positioned with the arrow towards flow direction.

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RADIATOR



1 Outer coupling
2 Inlet coupling
3 Electric fan control thermal contact
4 Thermal contact connector
5 Feed pipe
6 Electric fan connector
7 Electric fan
8 Electric fan fixing screw
9 Radiator fixing screw
10 Radiator
11 Rubber bushing

REMOVAL

1. Remove the engine hood as instructed in "Unit 56 - Hoods".
2. Discharge the coolant by operating as instructed in "Hydraulic Circuit Drainage".
3. Disconnect couplings (1) and (2) and pipe (5) from the radiator.
4. Disconnect connectors (6) of the electric fans (7) supply cables and connectors (4) of thermal contact (3).
5. To facilitate radiator removal, detach the air filter cover, then remove the filtering element and the lower box.
6. Unscrew screw (9) securing the radiator to the housing, remove the radiator and extract the rubber bushings (11).
7. If necessary, unscrew screws (8) and remove the electric fans.

INSTALLATION

To reinstall the radiator, operate in reverse order of removal. Refill cooling system as instructed in "Cooling System Filling".

LEAKAGE TEST

1. Plug radiator inlet and outlet ports.
2. Dip radiator in a water tank, admit compressed air to radiator through supply hose, pressurize to 150 kPa (1.5 bar; 1.5 kg/cm^2; 21.43 psi) and check for leakage.
3. If leakage is detected, replace radiator.

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ELECTRIC FAN CONTROL THERMAL CONTACT

REPLACEMENT

1. Discharge the coolant by operating as instructed in "Hydraulic Circuit Drainage".
2. Disconnect the connectors from the thermal contact on the radiator.
3. Unscrew the thermal contact and remove it from the radiator.
4. Check the thermal contact setting. Replace it if the correct values are not met.

Electric fan activation enabling temperature:

84 thru 88°C.

5. Lubricate the thermal contact threading with Antiseize R.GORI Never Seez, screw the thermal contact onto the radiator previously interposing a new gasket, then tighten to the recommended torque.

(T): **Tightening torque for electric fan thermal contact on radiator**

20 thru 25 N·m

(2 thru 2.5 kg·m)

6. Refill the cooling system as instructed in "Cooling System Filling".

COOLING SYSTEM FILLING

CAUTION:
The antifreeze is harmful to paint therefore avoid contact with varnished areas.

NOTE:
To increase protection from -20°C to -25°C without emptying the entire circuit, replace 2 litres of the antifreeze with an equal amount of specific concentrated antifreeze.

1. Execute filling with fluid of the quality and in the quantity indicated in the table herewith enclosed.
2. Unscrew the expansion tank pressurized cap and open the heater cock.
3. Discharge the circuit, then refill until MAX level of the expansion tank is reached.
4. Start the engine and run until operative temperature is reached and the thermostat opening frees the quantity of residual air contained in the circuit.
5. With cold engine, top up to expansion tank maximum level.
6. Replace the expansion tank cap.

ANTIFREEZE

Minimum external temperature	°C (°F)	-20 (-4)	-35 (-31)
Concentrated antifreeze	l	2.8	4.25
Dilution distilled water	l	5.7	4.25
Ready-to-use antifreeze	l	8.5	-

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TECHNICAL SPECIFICATIONS AND FEATURES

CHECKS AND ADJUSTMENT

THERMOSTAT

TEMPERATURE

- Initial opening: 81 to 85°C (178 to 185°F)
- Fully open: 95°C (203°F)
- Bulb travel: ≥7.5 mm (0.3 in)

RADIATOR

Leakage test pressure: 150 kPa (1.5 bar; 1.53 kg/cm^2; 21.43 psi)

PRESSURE RELIEF VALVE CAP

Calibration pressure: 107.9 kPa (1.0 bar; 1.1 kg/cm^2; 15.64 psi)

HYDRAULIC SYSTEM LEAK TEST

Checking pressure: 150 kPa (1.5 bar; 1.53 kg/cm^2; 21.43 psi)

GENERAL REQUIREMENTS

COOLANT

Minimum external temperature	°C (°F)	-20 (-4)	-35 (-31)
Concentrated antifreeze	l	2.8	4.25
Dilution distilled water	l	5.7	4.25
Ready-to-use antifreeze	l	8.5	-

FLUIDS AND LUBRICANTS

Application	Type	Denomination	Q.ty
Threading of electric fan control thermal contact on radiator	Antiseizure	R.GORI Never Sez Norm. 3671-69850	-

SEALANT AND SURFACE FIXING AGENTS

Application	Type	Denomination	Q.ty
Sealing compound for cooling system	Sealing powder	AREXONS Norm. 3522-00101	7.5 g (0.21 oz)

ALUMASEAL can be used as an alternative.

TIGHTENING TORQUES

Item	N·m	Kg·m	ft·lb
Sending unit, water temp. gauge	34 to 39	3.5 to 4	25.1 to 28.8
Nuts, water pump to front cover	14 to 22	1.36 to 2.25	10.3 to 16.2
Capscrews, thermostat cover	10 to 16	1 to 1.6	7.4 to 11.8
Sending unit, high water temp. indicator	20 to 25	2 to 2.5	14.8 to 18.4
Electric fan control thermal contact on radiator	20 to 25	2 to 2.5	14.8 to 18.4

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TROUBLESHOOTING AND CORRECTIVE ACTIONS

Trouble	Probable cause	Corrective action
Water leakage	• Radiator damaged	Repair or replace
	• Leaks in system couplings	Repair
	• Loose or broken clamps	Tighten or replace
	• Leakages from thermostat	Replace gasket or thermostat
	• Damaged cylinder head gasket	Replace. Check engine oil for contamination
	• Loose cylinder head tightening screws	Restore correct tightening
Poor circulation	• Pipes obstructed	Check pipes and clean system
	• Insufficient coolant	Top up
	• Inoperative water pump	Replace
	• Water pump and alternator driving belt loosen	Adjust
Corrosion and scales		Periodically change coolant at intervals recommended. Follow instructions for use shown on packaging.
Overheating	• Inoperative thermostat	Replace
	• Dirty and scaled radiator	Clean pipes flushing with the specified descaling compound. Follow instructions for use shown on packaging.
	• Poor lubrication	Restore oil level
	• Faulty water pump	Replace
	• Insufficient coolant	Restore coolant level and check system for leaks
	• Faulty electric fan control thermal contact	Replace thermal contact
	• Faulty electric fan	Check and replace

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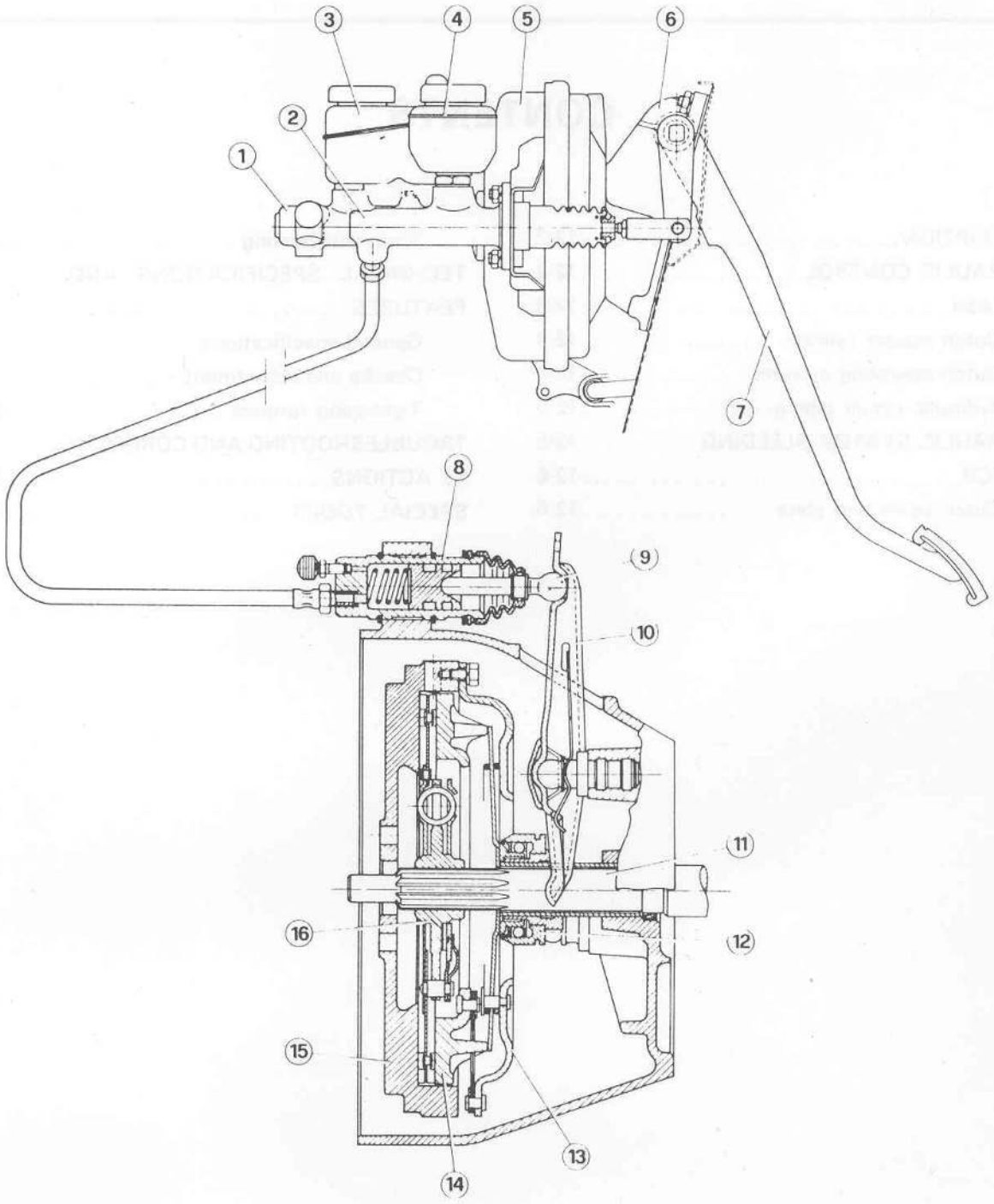
UNIT 12

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DESCRIPTION



1 Brake master cylinder
2 Clutch master cylinder
3 Brake tank
4 Clutch tank
5 Servo brake
6 Pedal assy
7 Clutch pedal
8 Operating cylinder
9 Cap
10 Release fork
11 Gearbox propeller shaft
12 Throwout bearing
13 Clutch cover
14 Pressure plate assy
15 Flywheel
16 Clutch plate

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The clutch is the hydraulically controlled dry single-plate type with a throwout bearing that by acting upon the diaphragm spring allows the driven disc to engage and disengage.

Clutch disengagement is achieved by means of a master cylinder which, activated by the clutch pedal, transmits the circuit pressure increase to the clutch operating cylinder piston.

The latter, by means of a cap, acts on the clutch disengagement fork which shifts the throwout bearing and overcomes the action of the diaphragm spring with consequent backing of the pressure plate body and clutch disengagement.

The special feature of the hydraulic control is to keep the throwout bearing in contact with the diaphragm spring, independent of the wear and tear of the driven disc, gradually achieving, automatically, recovery of play. This means that no clutch adjustment is necessary.

HYDRAULIC CONTROL

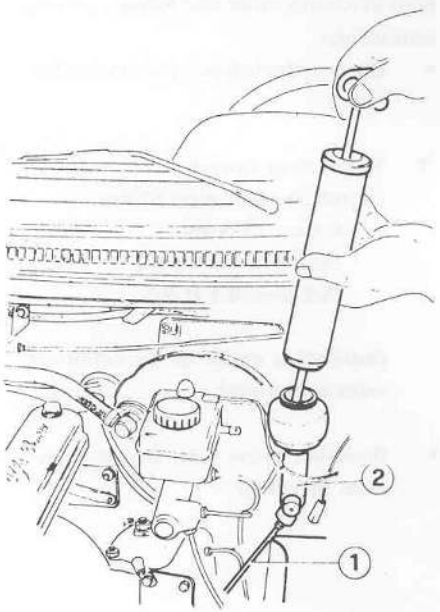
PEDAL

See "Unit 22" Service Brake - Pedals - Removal" for the clutch pedal disengagement procedure.

CLUTCH MASTER CYLINDER

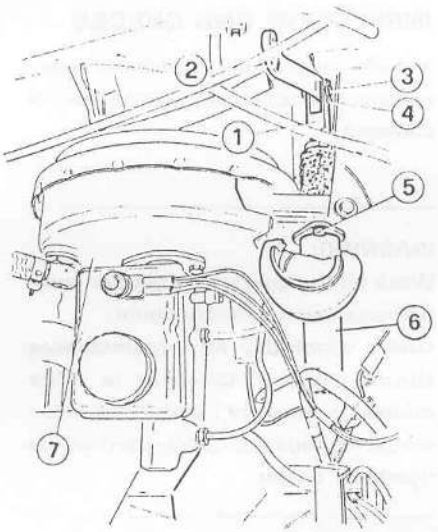
REMOVAL

1. Working from the engine compartment, remove the clutch master cylinder tank plug and suck out the fluid with a syringe and separate the tank from the master cylinder.
2. Unscrew the pipe union (1) and disconnect it from master cylinder.



1 Pipe
2 Clutch master cylinder

3. Remove the cotter pin (4) and slide out the pin (3) then disconnect the lever (2) from the fork (1).
4. Unscrew the two bolts (5) and separate the master cylinder (6) from the servo brake (7).

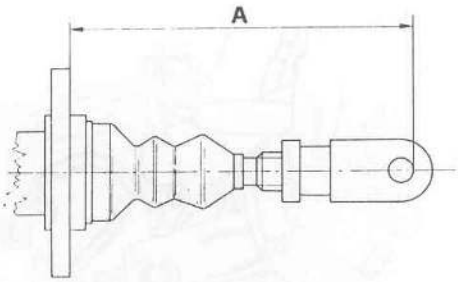


1 Fork
2 Lever
3 Pin
4 Cotter pin
5 Bolt
6 Clutch master cylinder
7 Servo brake

INSTALLATION

Reassemble the master cylinder in the car by carrying out the removal operations in reverse order and following these instructions.

- Adjust the clutch master cylinder control rod.



Dimension "A", clutch master cylinder control rod adjustment.

A = 134 mm (5.28 in)

- Observe the following tightening torque.

(T) : Tightening torque
Clutch assembly pipe unions
8 thru 11 N·m
(0.8 thru 1.1 kg·m)
(5.9 thru 8.1 ft·lb)

(indicative value to be achieved with a wrench)

- Top up the tank level using specified fluid.

Hydraulic clutch system fluid
ATE S
AGIP Brake Fluid Super HD
IP Auto Fluid FR
ALFA ROMEO Brake Fluid

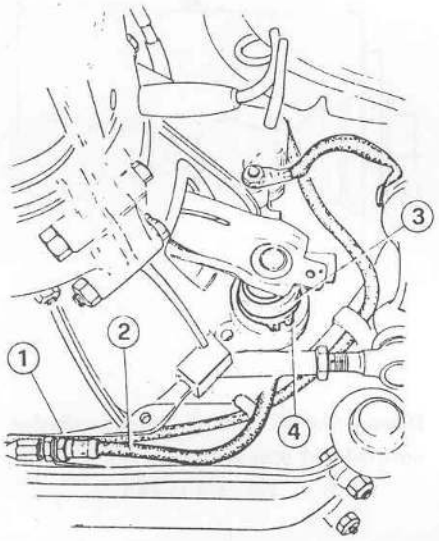
- Bleed the clutch hydraulic circuit (see: Hydraulic System Bleeding).

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CLUTCH OPERATING CYLINDER

REMOVAL (WORKING ON THE VEHICLE)

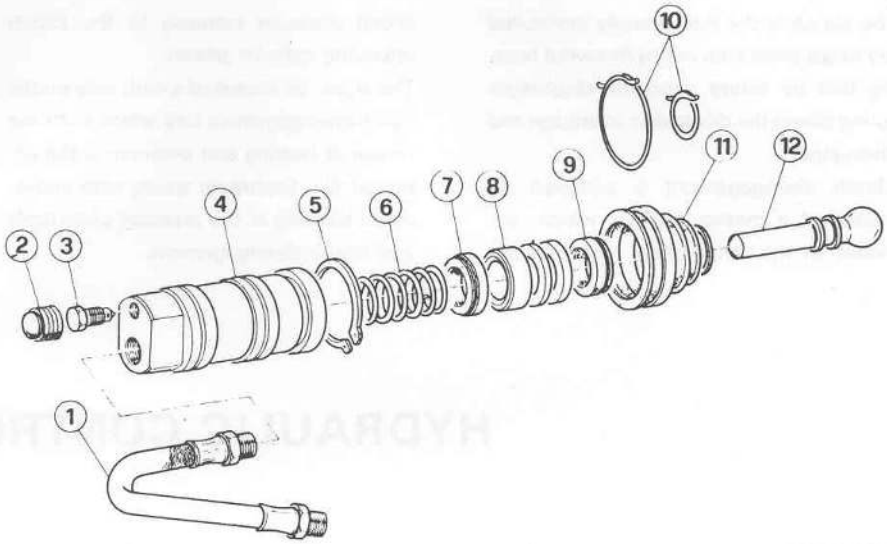
1. Disconnect the hose (2) of the clutch cylinder (3), the union (1) and plug the two uncoupled parts accordingly.
2. Extract the rear retainer ring (4) and the front one securing the cylinder to the clutch cover and slide out the cylinder.



1 Union
2 Hose
3 Clutch cylinder
4 Rear retainer ring

DISASSEMBLY

1. Unscrew and remove the hose (1), extract the two spring rings (10), slide out the cap (12) with the bellows (11) and dismantle the cylinder component parts according to the following exploded view.



1 Hose
2 Escape valve cover
3 Escape valve
4 Cylinder
5 Spring retainer ring
6 Spring
7 Gasket
8 Piston
9 Gasket
10 Spring ring
11 Guard
12 Cap with ball and socket joint

INSPECTION AND CHECKS

Visually inspect the dismantled components and replace any that are worn or damaged.

WARNING:
Wash all the operating cylinder components using suitable liquid.
Under absolutely no circumstances should gasoline, kerosene or other mineral detergents be used, as these would damage the rubber parts of the hydraulic circuit.

---

1. Check that no scoring or traces of rust are present on the piston or inside the clutch operating cylinder.
2. Check that the spring is efficient and the returner rings intact.
3. Check that the bleeder is free from impurities.

REASSEMBLY

Reassemble the clutch operating cylinder, carrying out the disassembly operations in reverse order.

INSTALLATION

Proceed by carrying out the removal operations in reverse order and following these instructions.

- Observe the following tightening torque.

(T): **Tightening torque**
Clutch system pipe union
8 thru 11 N·m
(0.8 thru 1.1 kg·m)
(5.9 thru 8.1 ft·lb)

(indicative value to be achieved with a wrench)

- Bleed the circuit (see: Hydraulic System Bleeding).

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HYDRAULIC CIRCUIT PIPING

INSPECTION AND CHECKS

Visually inspect the hydraulic circuit piping ensuring that it is intact.
Replace any damaged parts.
If fluid leakage due to slacking is encountered, tighten up and, if necessary, replace the damaged parts.

DISASSEMBLY

1. Remove the feed tank fillercap and, using a syringe, suck out the fluid.
2. Slacken the hose and pipe unions connecting the master cylinder and the clutch uncoupling operating cylinder then remove the pipes.

REASSEMBLY

1. Reassemble the pipes in the vehicle, carrying out disassembly oeprations in reverse order.
2. Tighten the unions to the specified torque.

(T) : **Tightening torque**
Clutch hydraulic system pipe unions
8 thru 11 N·m
(0.8 thru 1.1 kg·m)
(5.9 thru 8.1 ft·lb)

(indicative value to be achieved with a wrench)

3. Top up the fluid in the tank to the correct level then bleed the hydraulic circuit (see: Hydraulic System Bleeding).

HYDRAULIC SYSTEM BLEEDING

WARNING:
The clutch hydraulic system should be bled every time the circuit is disconnected or that air has penetrated it.

Adhere to the following:
1. Remove the fillercap of the clutch hydraulic circuit and, if necessary, top up the level with the specified fluid.

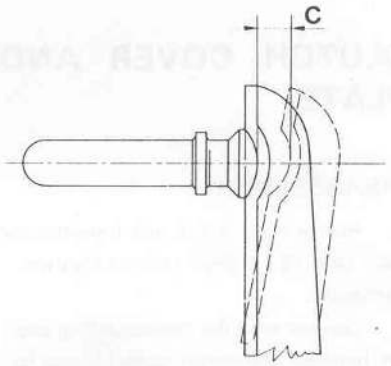
Hydraulic clutch system fluid
ATE S
AGIP Brake Fluid Super HD
IP Auto Fluid FR
ALFA ROMEO Brake Fluid

2. Remove the protective cover of the escape valve on the cylinder and attach a hose onto the latter, immersing its end in a transparent container holding the same fluid as the circuit.
3. At the same time loosen the escape valve and press the clutch pedal right down, allowing it to return slowly; repeat the operation until any bubbles have been fully expelled.
4. With the pedal pressed right down, close the escape valve, remove the hose and assemble the protective cap.
5. Top up the fluid in the tank to the correct level then reclose by means of the proper cap.

WARNING:
a. **Do not use the hydraulic fluid drained off during the bleeding procedure again.**
b. **Work carefully to prevent hydraulic fluid from splashing the paintwork thus damaging it.**
c. **During the bleeding operation, keep the tank fluid level above the minimum mark.**

6. Check that clutch and gear disengagement are accomplished correctly. Also, check that the operating cylinder achieves the scheduled travel.
This travel cannot be adjusted and depends on the volume of fluid displaced by the clutch master cylinder piston.

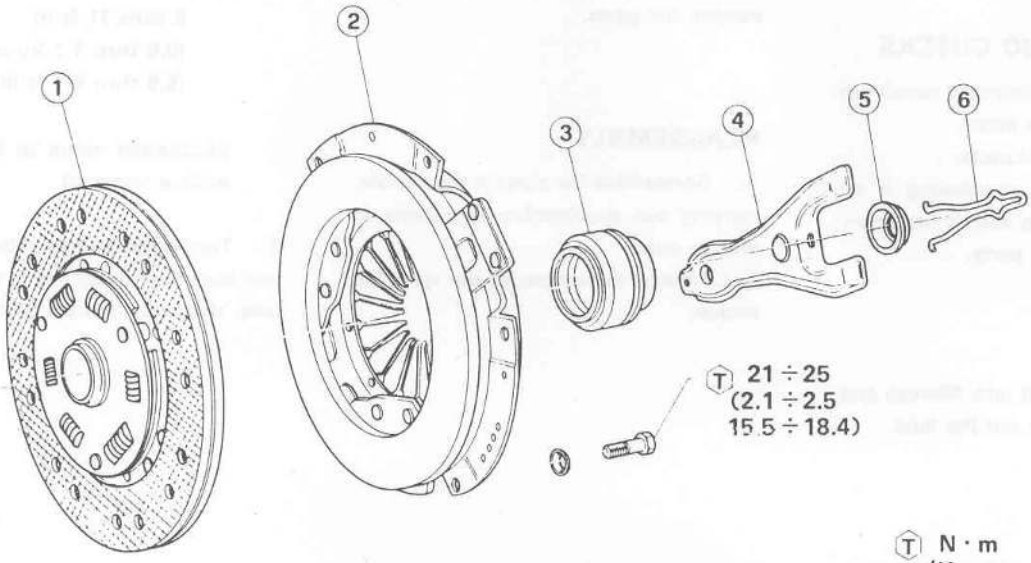
Travel "c", clutch operating cylinder cap .
11 thru 12 mm (0.43 thru 0.47 in)



7. If the scheduled "c" travel value is not net, check hydraulic control circuit efficiency.

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CLUTCH

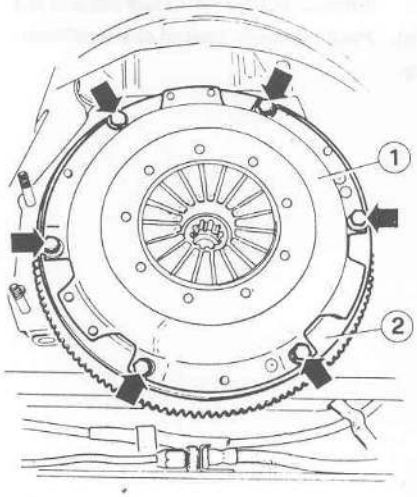


1 Clutch plate
2 Clutch cover
3 Throwout bearing
4 Release fork
5 Washer
6 Spring

CLUTCH COVER AND PLATE

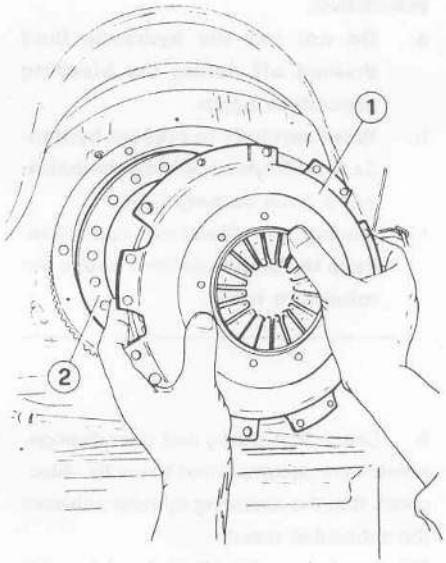
DISASSEMBLY

1. Remove the clutch unit from the car (see: Unit 13 - 5 Gear Manual Gearbox - Removal).
2. Countermark the corresponding position between the clutch cover (1) and flywheel (2), then unscrew the six screws joining the two parts.



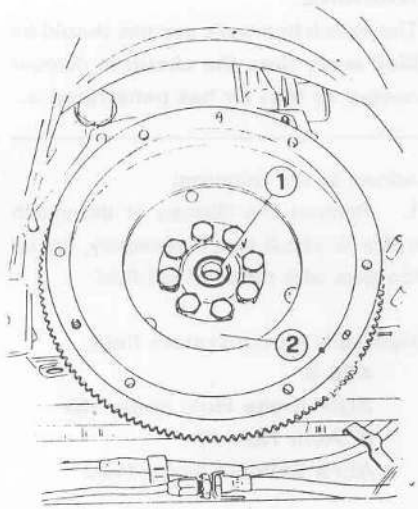
1 Clutch cover
2 Flywheel

3. Remove the cover (1) with the clutch plate (2).



1 Clutch cover
2 Clutch plate

4. If necessary, take out the centering bushing (1) of the gearbox propeller shaft from the end of the output shaft (2).



1 Centering bushing
2 End of output shaft

INSPECTION AND CHECKS

Prior to carrying out inspection and checking, wash all dismantled parts, with the exception of the driven plate, using a suitable solvent in order to eliminate all traces of dirt and grease.

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Clutch plate

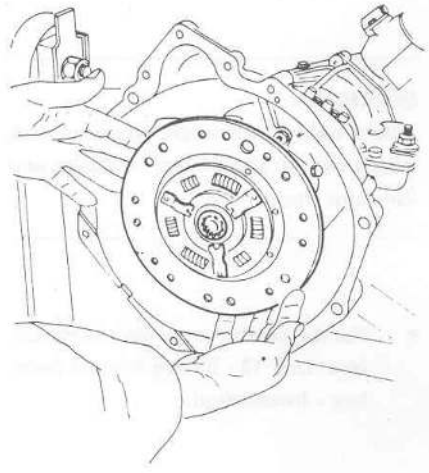
Check clutch plate wear and tear, verifying that:

- The friction gaskets forming the plate show no signs of burning or traces of grease and are not vitrified.
- Wear and tear is even and not peculiar to certain points.
- The gasket securing rivets are perfectly riveted.
- The spring drives are intact.

In the event of friction failure due to oil leaks from the seal ring associated with the gearbox or the one corresponding to the engine, replace both the clutch plate and seal rings.

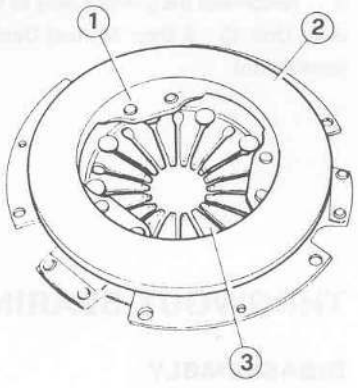
Check that the clutch plate hub is intact and runs freely, without seizing or excessive play, along the gearbox propeller shaft spline.

If necessary, replace the clutch plate.



Pressure plate cover

1. Check that the work surface (2) of the pressure plate cover (1) shows no sign of overheating, uneven wear, cuts or material removal.
2. Check that the diaphragm spring (3) parts are not damaged.
3. If necessary replace the pressure plate cover.



1 Pressure plate cover
2 Working surface
3 Diaphragm spring

Output shaft bushing

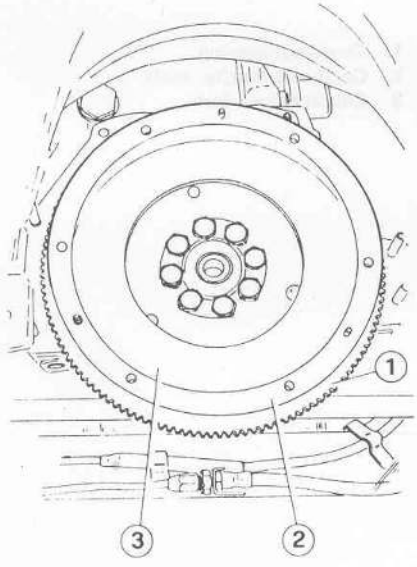
Visually inspect that the output shaft bushing shows no signs of binding or excessive wear.

If necessary, replace.

Flywheel

Check that the work surface (3) of the flywheel (1) shows no signs of overheating, uneven wear, cuts or removal of material.

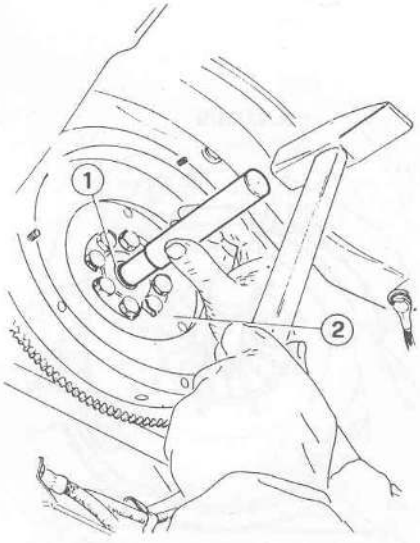
If necessary, dismantle the flywheel and rectify both the work and resting surfaces of the clutch cover (2) (see: Technical Features and Specifications - Checks and Adjustment).



1 Flywheel
2 Clutch cover resting surface
3 Working surface

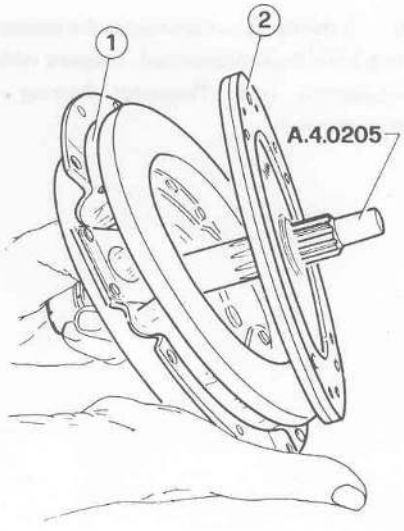
REASSEMBLY

1. If previously dismantled, assemble the centering bushing (1) of the gearbox propeller shaft in the housing on the end of the output shaft (2).



1 Centering bushing
2 End of output shaft

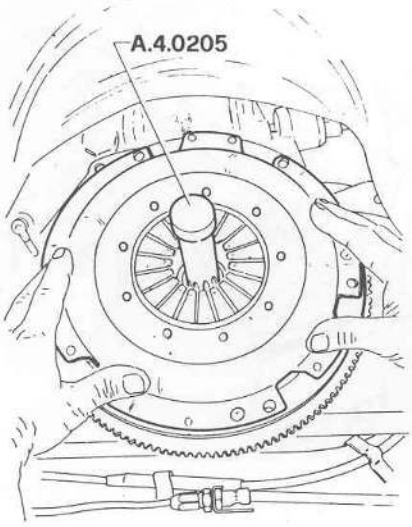
2. Ensure that the work surfaces of the flywheel, clutch plate and pressure plate cover are perfectly clean and dry.
3. Slide the clutch cover (1) and clutch plate (2) onto the centering tool **A.4.0205.**



1 Clutch cover
2 Clutch plate

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4. Place the clutch plate and cover on the flywheel, adhering to the marks made beforehand, then screw up and lock, diagonally, the six clamping screws to the specified torque, retrieving tool **A.4.0205.**



Ⓣ : **Tightening torque**
Screws clamping the clutch cover to the engine flywheel.
21 thru 25 N·m
(2.1 thru 2.5 kg·m)
(15.5 thru 18.4 ft·lb)

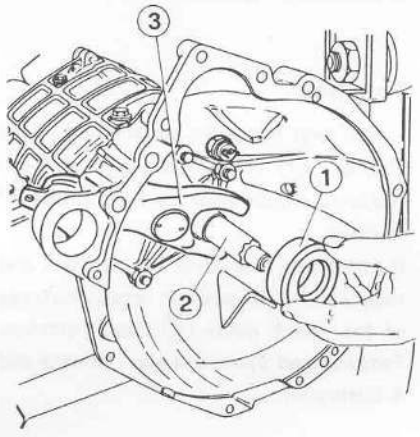
5. If the throwout bearing or the release fork have been dismantled, proceed with reassembly (see: Throwout Bearing - Reassembly).

6. Reconnect the gearbox assy to the car (see: Unit 13 - 5 Gear Manual Gearbox - Installation).

THROWOUT BEARING

DISASSEMBLY

1. Take the gearbox assy from the car (see: Unit 13 - 5 Gear Manual Gearbox - Removal).
2. Slide the throwout bearing ① off the end of the gearbox propeller shaft ②.
3. Slide the clutch fork ③ having released it from the associated spring.



1 Throwout bearing
2 Gearbox propeller shaft
3 Clutch release fork

INSPECTION AND CHECKS

1. Check that the throwout bearing is not noisy, that its play is not excessive and that it runs freely on the transmission shaft, otherwise replace it with a new one.
2. Check that the clutch release fork shows no cracks, deformation or excessive wear in the working areas. If necessary replace it with a new one.

REASSEMBLY

Reassemble by carrying out the disassembly operations in reverse order and lubricating the following parts as instructed.
Working area of the clutch throwout bearing.
Washer on the clutch release fork ball and socket joint.

Grease:
AGIP Grease 33 FD
IP Autogrease FD

WARNING:
Avoid using too much grease which might splash the clutch surfaces and damage them.

- Put the gearbox assy back in the car (see: Unit 13 - 5 Gear Manual Gearbox - Installation).

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TECHNICAL SPECIFICATIONS AND FEATURES

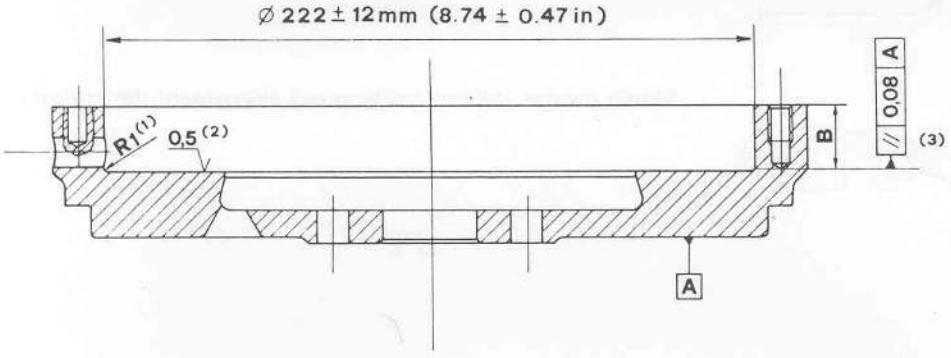
GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

Application	Type	Denomination	Q.ty
Working area of the clutch throwout bearing Washer on the clutch release fork ball and socket joint	GREASE	AGIP: Grease 33 FD IP: Autogrease FD Norm. 3671-69833/34	
Clutch hydraulic unit supply	FLUID	AGIP: Brake Fluid Super HD ATE: S IP: Auto Fluid FR Norm. 3681-69905 ALFA ROMEO Brake Fluid Order no. 10500.45300.00.01 WARNING: Product is harmful to paint-work	

CHECKS AND ADJUSTMENT

FLYWHEEL RECTIFICATION DIMENSIONS AND WORKING TOLERANCE LIMITS



(1) [mm]; (2) √ Roughness [μ]; (3) // Parallelism [mm]

Removal of material from the driven disc resting surface should be such that dimension **B** between the driven disc resting surface and clutch cover is:

B = 22.5 + 0.2 mm (0.88 + 0.01 in).

Should dimension be not fall within the tolerated limit, also remove material from the clutch cover resting surface.

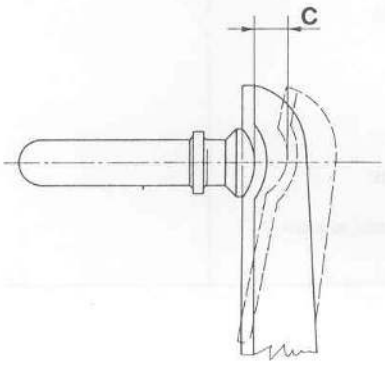
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CLUTCH PLATE

Wear limit thickness of the clutch plate .... 6 mm (0.24 in)

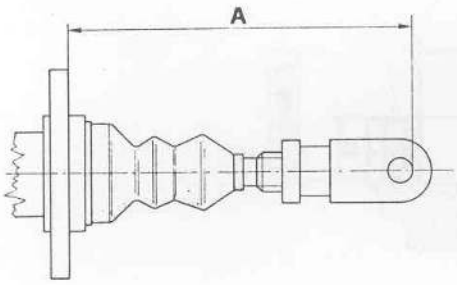
NOTE:
Control, anyway, that the rivets do not rub on the skin friction.

CLUTCH OPERATING CYLINDER



Clutch operating cylinder cap travel ..... 11 thru 12 mm (0.43 thru 0.47 in)

CLUTCH MASTER CYLINDER



Clutch master cylinder striking rod adjustment dimension ..... 134 mm (5.28 in)

TIGHTENING TORQUES

Item	N·m	Kg·m	ft·lb
Screws clamping the clutch cover to the flywheel	21 thru 25	2.1 thru 2.5	15.5 thru 18.4
Clutch hydraulic system pipe unions (indicative value to be achieved with a wrench)	8 thru 11	0.8 thru 1.1	5.9 thru 8.1

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TROUBLESHOOTING AND CORRECTIVE ACTIONS

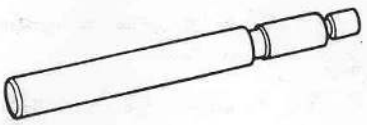
Trouble	Probable cause	Corrective action
Clutch slips Symptoms of the failure: — the car fails to respond to the engine accelerating speed	Certain problem symptoms arise when there are also engine operation faults. It is necessary, first of all, to establish whether the cause is attributable to the engine or to the clutch. Check that the clutch slips by proceeding as follows: — engage the parking lock — disengage the clutch and go into 4th gear — accelerate, gradually releasing the clutch pedal: if the car does not move and the engine does not stall, the clutch is slipping.	
— power to the wheels is insufficient in upshifting — abnormal increase in gasoline consumption	• Excessive wear of the clutch plate gaskets	Replace the clutch plate
	• Oil or grease on the gaskets	Replace the clutch plate (replace the output shaft oil seal ring, if defective)
	• Diaphragm spring damaged or worn in correspondence to the throwout bearing resting area	Replace the pressure plate cover
	• Flywheel or pressure plate deformed	Repair or replace the flywheel and/or pressure plate
	• The cap of the clutch operating cylinder fails to return to the starting position: Cylinder piston seized or master cylinder piston seized	Overhaul the cylinder or the master cylinder
Clutch not disconnecting well Symptoms of the failure: when changing gear, especially during low gear ratios, noise is encountered	In order to verify that the clutch is not disengaging properly, proceed as follows: — disengage the clutch and engage the reverse gear — put into neutral then accelerate gradually, keeping the clutch pedal pressed down — after a short period engage reverse gear If noise is encountered during gear engagement, the clutch is not detaching properly	
	• Wear or rust on the clutch plate hub spline	Clean or replace the clutch plate
	• Oil leak from the master cylinder, operating cylinder, hydraulic circuit	Replace faulty parts
	• Air in the hydraulic system	Bleed
	• Insufficient pedal travel	Adjust travel
	• Operating cylinder inefficient	Overhaul, or replace, the cylinder
	• Master cylinder inefficient	Overhaul, or replace, the master cylinder
	• Clutch plate eccentric or deformed	Replace the clutch plate
	• Diaphragm spring worn out	Replace diaphragm spring
	• Oil on the clutch plate gaskets	Replace the clutch plate (replace the output shaft oil seal ring if faulty)

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Trouble	Probable cause	Corrective action
Clutch vibrates Symptoms of the failure: the clutch pedal vibrates when the car starts and the clutch is still partly connected	• Clutch plate gaskets vitrified on account of overheating	Replace the clutch plate
	• Clutch plate gaskets show traces of oil or grease	Replace the clutch plate
	• Clutch plate gaskets deformed	Replace the clutch plate
	• Working surface on flywheel is worn or deformed	Repair or replace the flywheel
	• Working surface of the pressure plate is worn or deformed	Replace the clutch cover
	• Gasket rivets loose	Replace the clutch plate
	• Rubber supports of the engine unit slack or deteriorated	Secure or replace the supports
	• Diaphragm spring worn out	Replace the clutch cover
Clutch is noisy	• Throwout bearing out of order	Replace the throwout bearing
	Noisy disengaging:	
	• Throwout bearing and/or support either damaged or insufficiently lubricated	Replace the throwout bearing and/or support, otherwise lubricate
	Noise with clutch engaged:	
	• Gasket rivets loose	Replace the clutch plate
	• Clutch plate gaskets are worn	Replace the clutch plate
	• Torsion spring of the plate is worn out	Replace the clutch plate
	• Output shaft bushing worn or damaged	Replace the output shaft bushing
Clutch jerks Symptoms of the failure: — car does not start smoothly	• Oil or grease on the clutch plate gaskets	Replace the clutch plate (Replace the output shaft oil seal ring, if faulty).
	• Gaskets worn or rivets loose	Replace the clutch plate
	• Wear or rust on the propeller shaft spline and/or on the clutch plate spline	According to necessity clean or replace the propeller shaft and/or the clutch plate
	• Working surfaces of the flywheel and/or pressure plate are worn or deformed	Repair or replace the flywheel and/or clutch plate
	• Engine unit carriers loose or deteriorated	Secure well or replace the carriers

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SPECIAL TOOLS

Identity N°	Denomination	Reference page
A.4.0205	Clutch plate centering tool 	12-7 12-8

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UNIT 13

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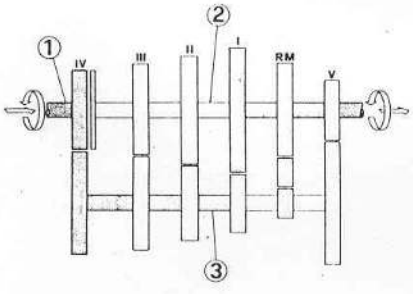
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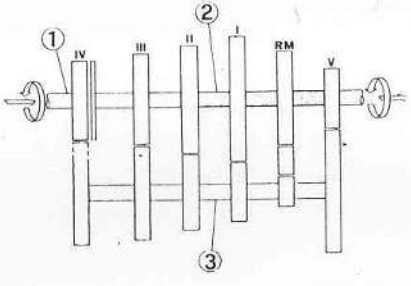
DESCRIPTION

The gearbox is mechanical with five gears plus reverse.
The gearbox is joined to the engine by means of the clutch housing bell.
At the rear there is the propeller shaft coupling fork by means of which the motion reaches the rear axle-differential and then the rear wheels.
The structure of the gear case divides the unit into three distinct parts.
The front part (clutch bell housing) includes the clutch assembly with throwout bearing and shifting fork.
The middle part comprises an autonomous carrier containing the propeller, output and layshafts, the gear selector rods and gear shifting forks.
The rear part (rear cover) carries the gear selector and engagement trunnion connected directly to the central floor lever.
The forward gears, meshed, are the helical-toothed type to guarantee maximum silence; they feature synchronizers activated by sleeves for engagement of the individual gears.
The Reverse gears are the straight toothed type. Engagement is accomplished by the deviation of a sliding gear which transmits the rotation of the transmission shaft gear to that of the output shaft, causing the motion to invert.
The sleeves are moved by means of the forks, in turn activated by the gear selector rods. The rods slide along the corresponding housings on the facings of the intermediate carrier where the positioning devices and, interlock rollers which serve to prevent several gears being engaged simultaneously, are located.
A further safety device is composed of a ratchet gear secured to the rear cover, the purpose of which is to prevent an accidental gear change from 5th to Reverse when changing from 5th to 4th.
The synchronizers cause the neutral gear on the output shaft (still driving with the transmission shaft) to take up the same gear as the toothed coupling by means of an action of friction.
This makes the final engagement, which leads up to fitting the sleeve-driven gear engagement toothing much easier.
In detail, the synchronizers are made up of a synchronizer ring, a reference and a stop sector, and two check straps (one only for the 1st gear).

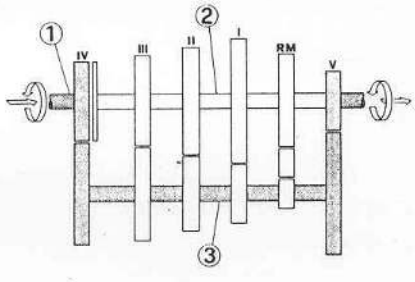
1st gear



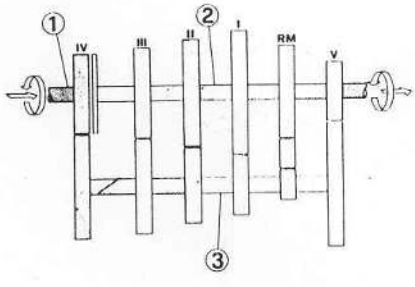
3rd gear



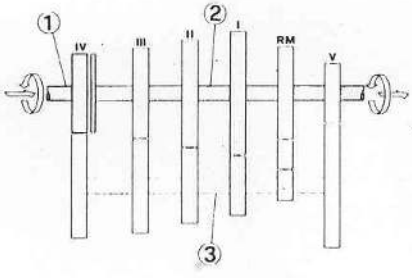
5th gear



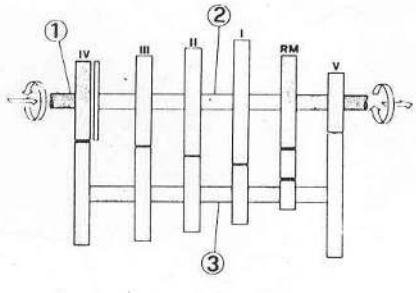
2nd gear



4th gear



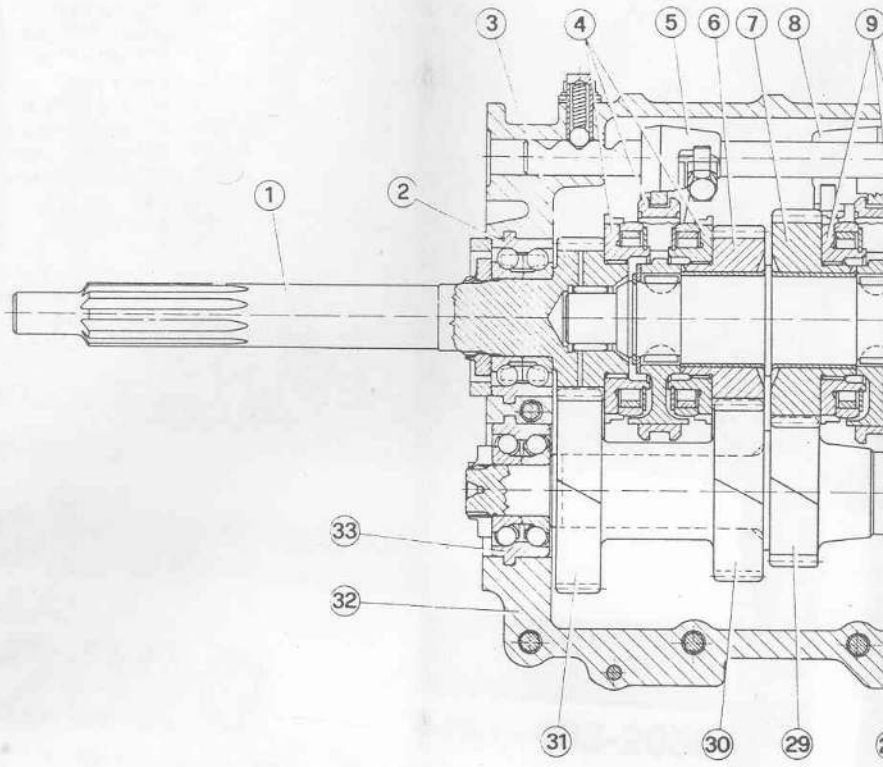
Reverse gear



1 Direct drive shaft
2 Output shaft
3 Layshaft

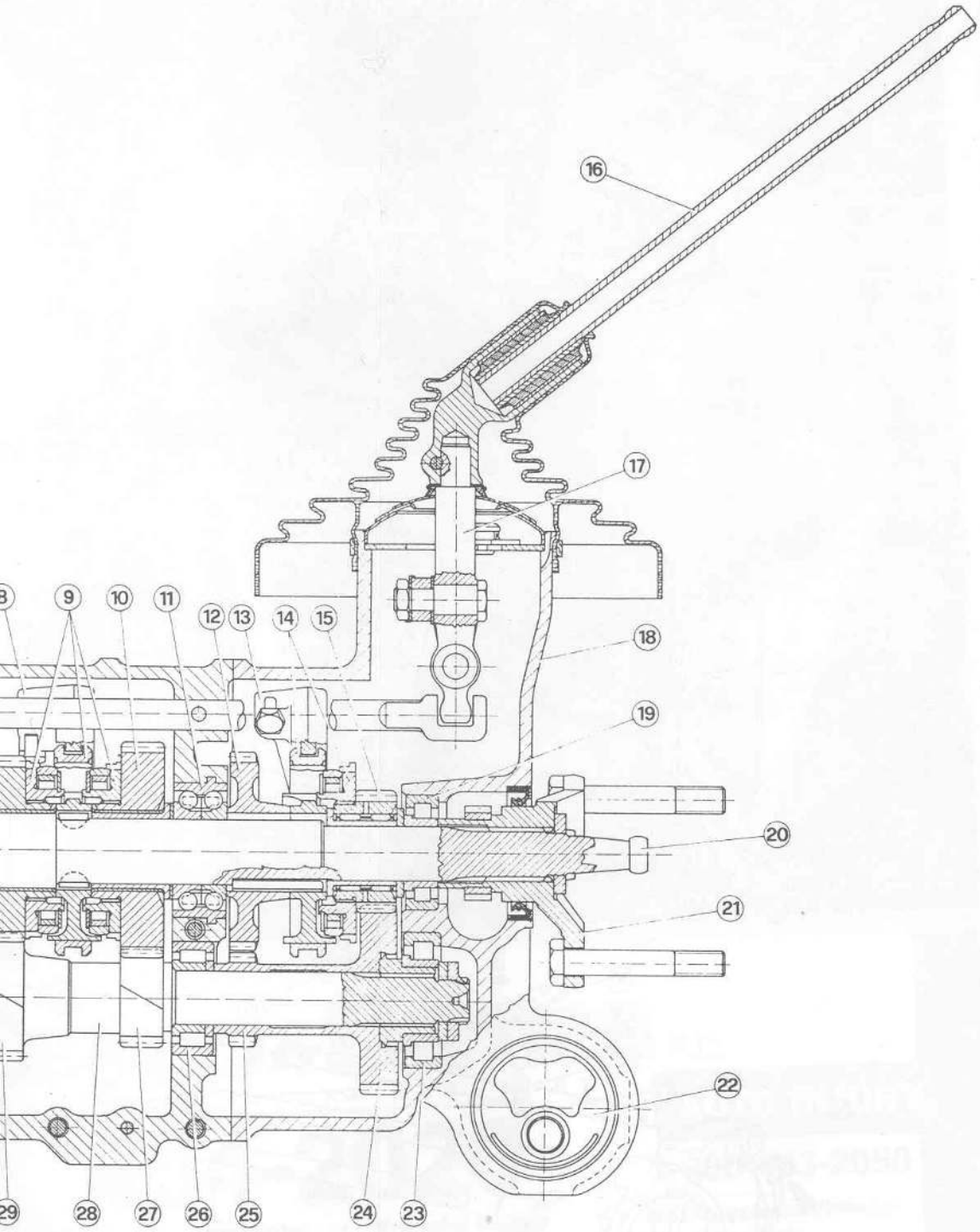
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1 Direct drive shaft
2 Direct drive shaft front bearing
3 4th gear on direct drive shaft
4 3rd and 4th gear synchronizing elements
5 3rd and 4th gear shift fork
6 3rd gear, driven
7 2nd gear, driven
8 1st and 2nd gear shift fork
9 1st and 2nd gear synchronizing elements
10 1st gear, driven
11 Output shaft intermediate bearing
12 Reverse gear, driven
13 Reverse and 5th gear shift fork
14 5th gear synchronizing elements
15 5th gear, driven
16 Gear rod
17 Spider
18 Rear cover
19 Main shaft rear bearing
20 Main shaft
21 Drive coupling fork
22 Spring bushing
23 Layshaft rear bearing
24 5th gear, driving
25 Reverse gear, driving
26 Layshaft center bearing
27 1st gear, driving
28 Layshaft
29 2nd gear, driving
30 3rd gear, driving
31 4th gear on layshaft
32 Gearbox casting
33 Layshaft front bearing



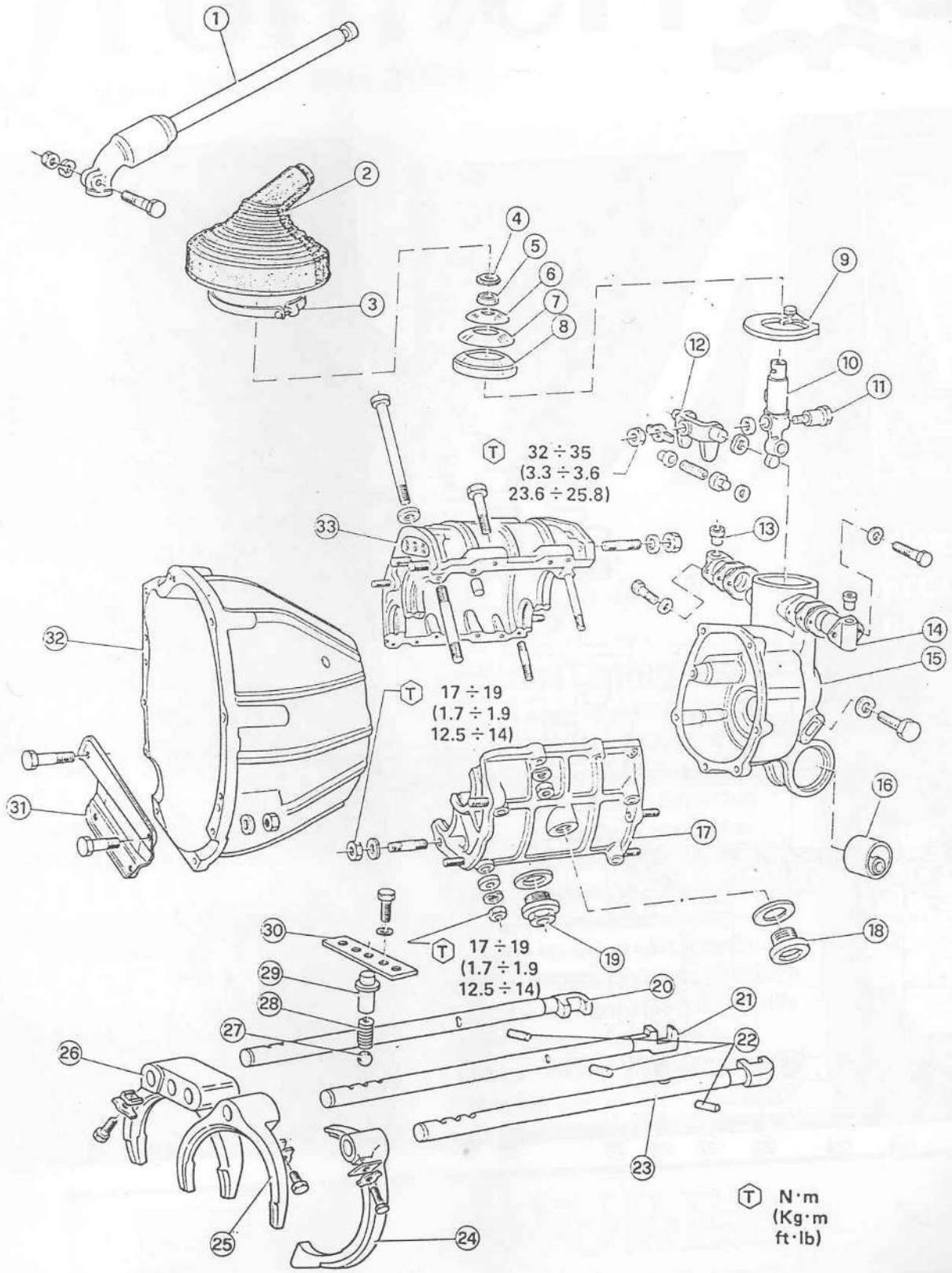
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GEARBOX - EXTERNAL CONTROLS - RODS AND FORKS



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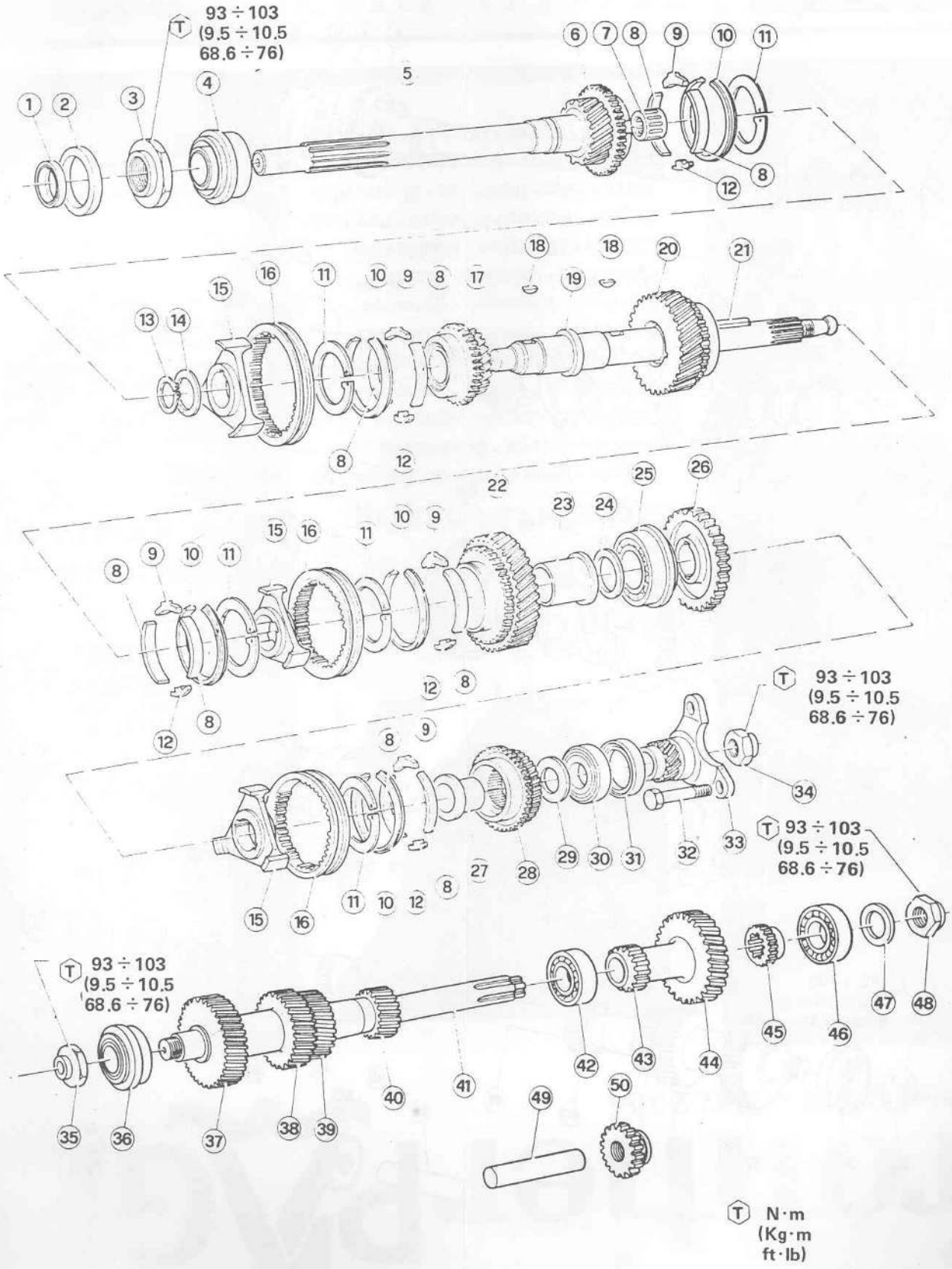
1 Gear selector rod
2 Bellows
3 Clip
4 Container
5 Ring
6 Outer cap
7 Intermediate cap
8 Fixed cap
9 Ratchet gear
10 Inner lever
11 Pin
12 Trunnion
13 Vent plug
14 Carrier
15 Rear cover
16 Spring bushing
17 Lower half box
18 Filler plug
19 Drain plug
20 1st and 2nd gear selector rod
21 3rd and 4th gear selector rod
22 Safety pawl
23 5th and Reverse gear selector rod
24 5th and Reverse gears shift fork
25 3rd and 4th gearshift fork
26 1st and 2nd gearshift fork
27 Ball
28 Spring
29 Case
30 Stop plate
31 Bell housing lower pan
32 Clutch bell housing
33 Upper half box

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1 Seal ring
2 Centering ring
3 Nut
4 Direct drive shaft front bearing
5 Direct drive shaft
6 4th gear on direct drive shaft
7 Needle bushing
8 Check strap
9 Check sector
10 Synchronizing ring
11 Spring retainer ring
12 Reference sector
13 Spring retainer ring
14 Adjusting washer
15 Synchronizing hub
16 Synchronizing sleeve
17 3rd gear, driven
18 Key
19 Output shaft
20 2nd gear, driven
21 Key
22 1st gear, driven
23 Spacer
24 Adjusting ring
25 Output shaft intermediate bearing
26 Reverse gear, driven
27 Spacer
28 5th gear, driven
29 Adjusting ring
30 Output shaft rear bearing
31 Seal ring
32 Screw
33 Propeller coupling fork
34 Nut
35 Nut
36 Layshaft front bearing
37 4th gear on layshaft
38 3rd gear, driving
39 2nd gear, driving
40 1st gear, driving
41 Layshaft
42 Layshaft intermediate bearing
43 Reverse gear, driving
44 5th gear, driving
45 Rotoring over sleeve
46 Layshaft rear bearing
47 Washer
48 Nut
49 Pin
50 Reverse runner

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SHAFTS AND GEARING (Except Spider 1.6)

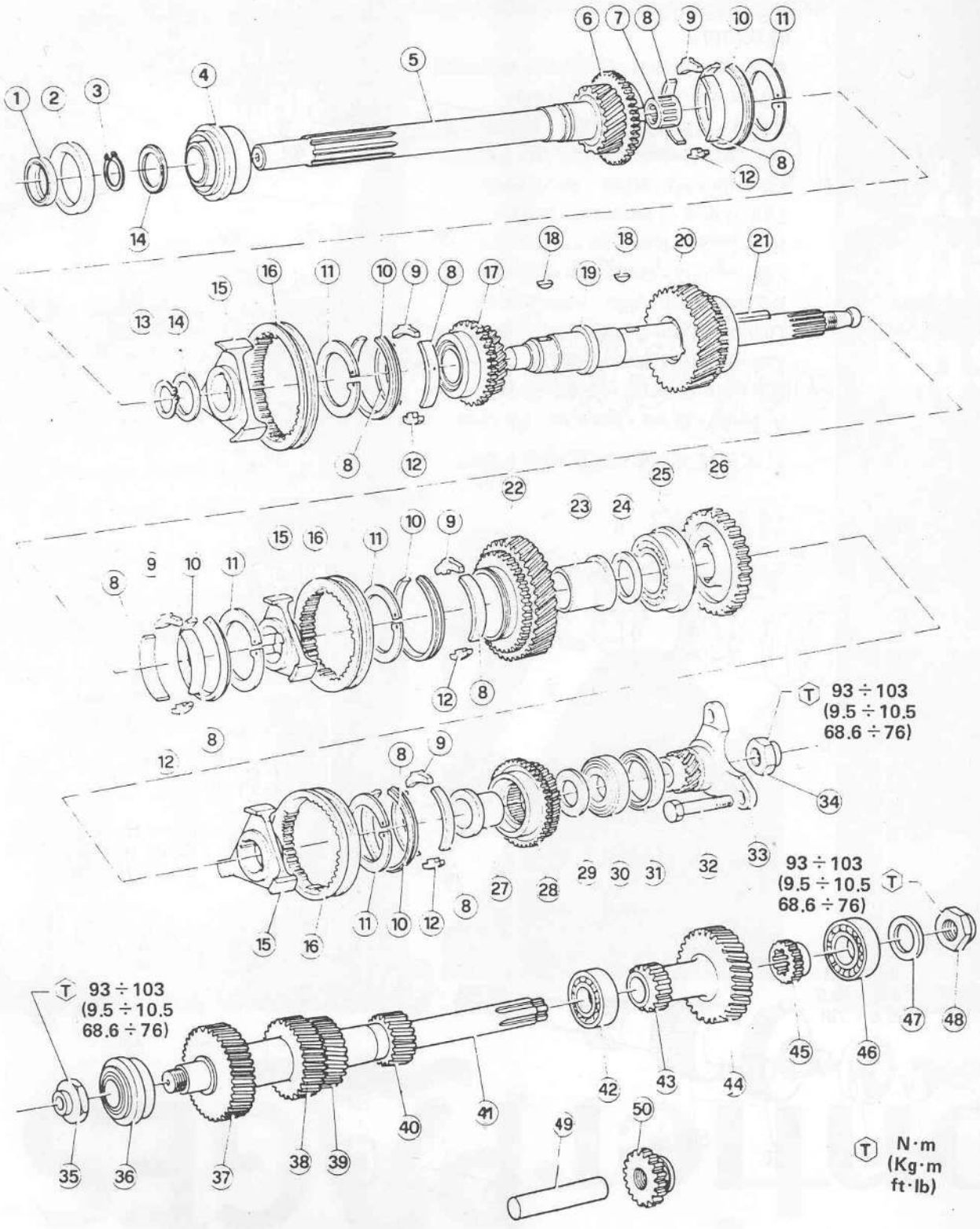


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1 Seal ring
2 Centering ring
3 Retainer ring
4 Direct drive shaft front bearing
5 Direct drive shaft
6 4th gear on direct drive shaft
7 Needle bushing
8 Check strap
9 Check sector
10 Synchronizing ring
11 Spring retainer ring
12 Reference sector
13 Spring retainer ring
14 Adjusting washer
15 Synchronizing hub
16 Synchronizing sleeve
17 3rd gear, driven
18 Key
19 Output shaft
20 2nd gear, driven
21 Key
22 1st gear, driven
23 Spacer
24 Adjusting ring
25 Output shaft intermediate bearing
26 Reverse gear, driven
27 Spacer
28 5th gear, driven
29 Adjusting ring
30 Output shaft rear bearing
31 Seal ring
32 Screw
33 Propeller coupling fork
34 Nut
35 Nut
36 Layshaft front bearing
37 4th gear on layshaft
38 3rd gear, driving
39 2nd gear, driving
40 1st gear, driving
41 Layshaft
42 Layshaft intermediate bearing
43 Reverse gear, driving
44 5th gear, driving
45 Rotoring over sleeve
46 Layshaft rear bearing
47 Washer
48 Nut
49 Pin
50 Reverse runner

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SHAFTS AND GEARING (Spider 1.6)

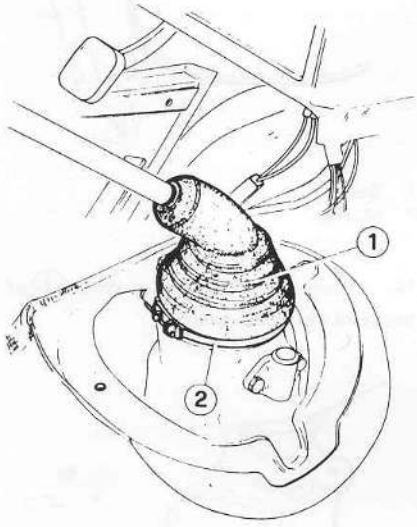


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5 - GEAR MANUAL GEARBOX

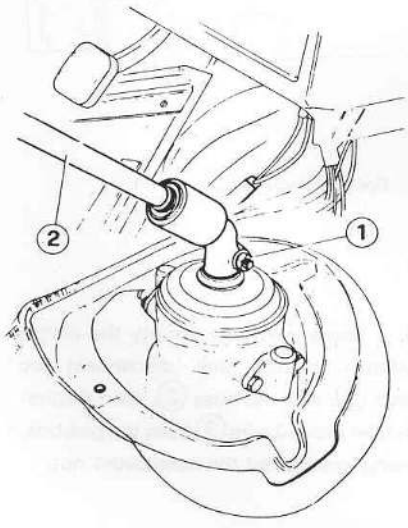
REMOVAL

1. Put the car on the lift and disconnect the battery.
2. Working from the passenger compartment, remove the console as illustrated in: Unit 66 - Internal Upholstery - Console.
3. Remove the clamp (2) and slide out the rubber bellows (1).



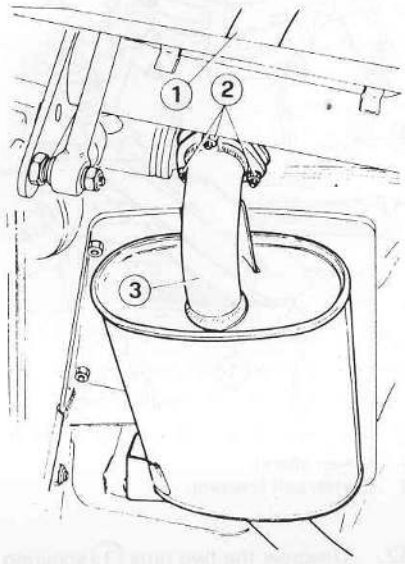
1 Bellows
2 Clamp

4. Unscrew the bolt (1) securing the gear selector rod (2) to the trunnion pivot pin then remove the rod.



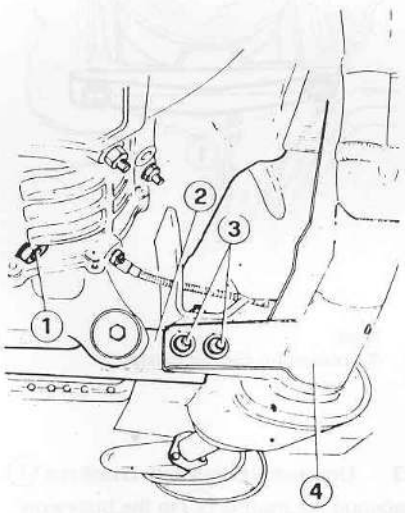
1 Bolt
2 Gear selector rod

5. Raise the car and disconnect the rear exhaust pipe (1) by unscrewing the three bolts (2) which secure it to the front exhaust pipe (3).



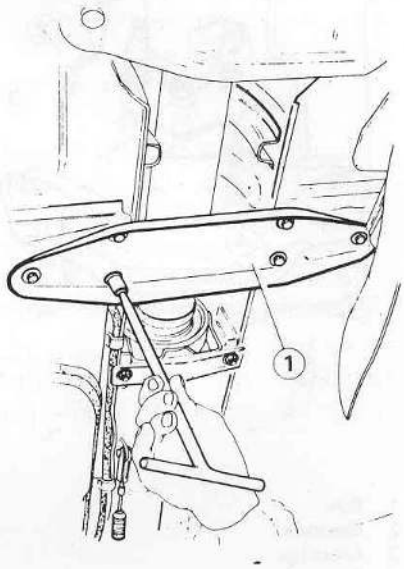
1 Rear exhaust pipe
2 Bolts
3 Front exhaust pipe

6. Unscrew the plug (1) and drain the oil from the gearbox. Unscrew the two bolts with check nut (3) securing the front exhaust pipe (4) to the bracket (2).



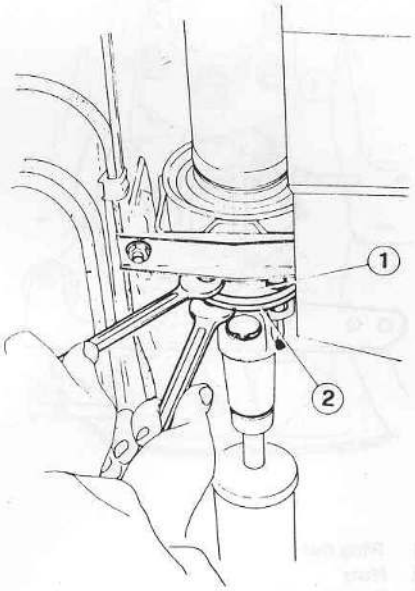
1 Plug
2 Bracket
3 Bolts
4 Front exhaust pipe

7. Partially disconnect and bend the protection located above the catalytic converter so as to gain access to all six screws securing the tie bar (1) to the body, unscrew them and get hold of the tie bar.



1 Tie bar

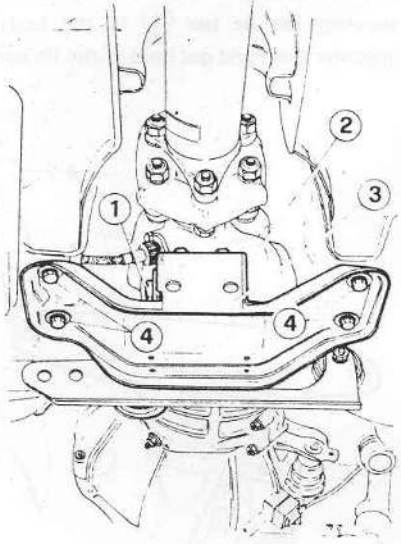
8. Countermark the corresponding position of the intermediate flanges (1) and (2) of the propeller shaft and unscrew the four bolts joining them, rotating the shaft each time.



1 Front flange
2 Rear flange

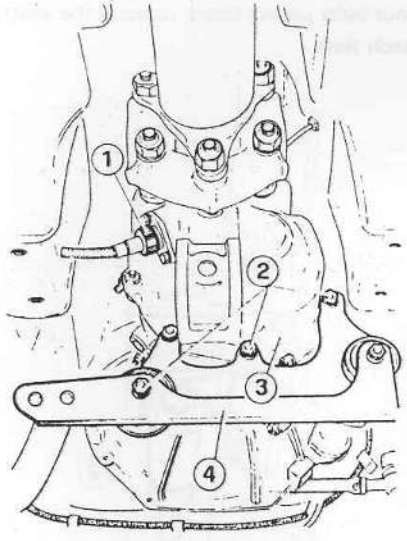
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9. Unscrew and remove the bolt (1) securing the gearbox (2) to the supporting cross bar (3); unscrew the four screws (4) and remove the cross bar retrieving the gearbox rubber support washers.



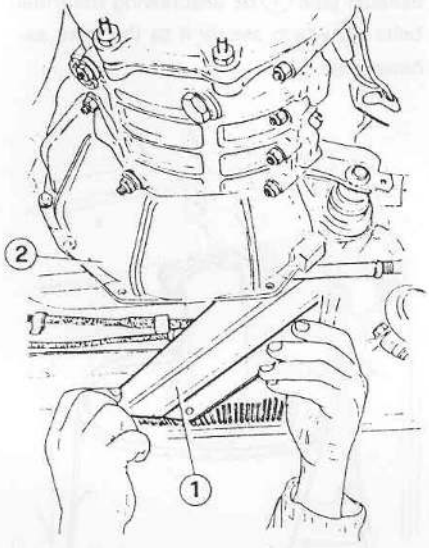
1 Bolt
2 Gearbox
3 Cross bar
4 Screws

10. Unscrew the rev-counter wire coupling ring nut (1), unscrew the three nuts (2) securing the carrier (3) to the gearbox and retrieve the carrier along with the bracket (4).



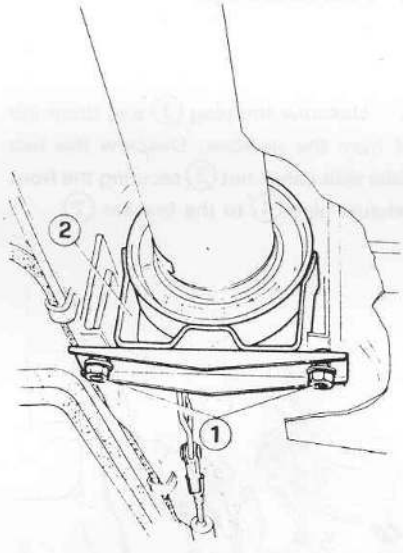
1 Ring nut
2 Nuts
3 Carrier
4 Bracket

11. Get hold of the lower shield (1) by unscrewing the four bolts which secure it to the clutch bell housing (2).



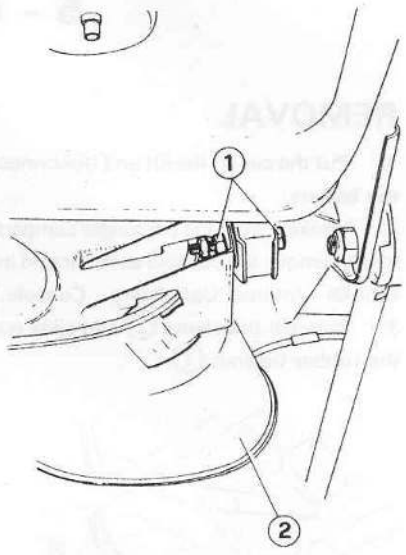
1 Lower shield
2 Clutch bell housing

12. Unscrew the two nuts (1) securing the transmission central carrier (2) to the bodywork.



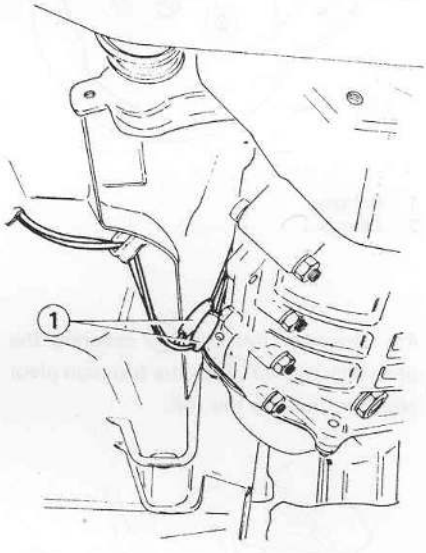
1 Nuts
2 Transmission central carrier

13. Unscrew the bolt with check nut (1) securing the muffler (2) to the bodywork.



1 Bolt
2 Muffler

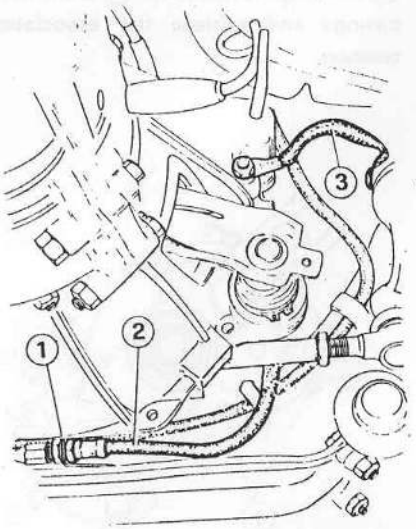
14. Disconnect the electric wires (1) of the back-up lamp switch.



1 Back up lamp wiring

15. Using a syringe, empty the clutch hydraulic system tank, disconnect the union (1), and the hose (2), then disconnect the ground wire (3) from the gearbox, having unscrewed the associated nut.

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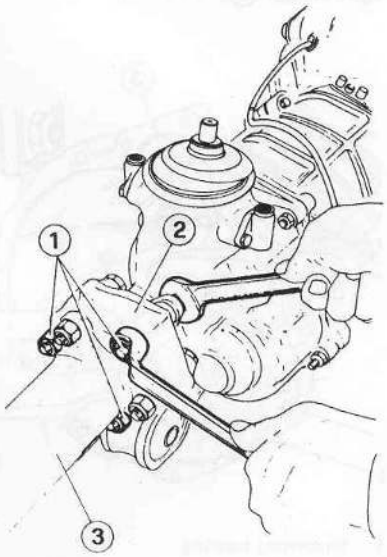


1 Union
2 Flexible hose
3 Ground wire

16. Hold up the gearbox with a column type jack, unscrew the nuts securing the gearbox-clutch assembly to the engine and the three bolts securing the starter motor, retrieve the associated washers and slide off the whole assembly.



17. Unscrew the three bolts (1) securing the flexible coupling (2) of the front propeller shaft (3) to the gearbox output propeller fork.

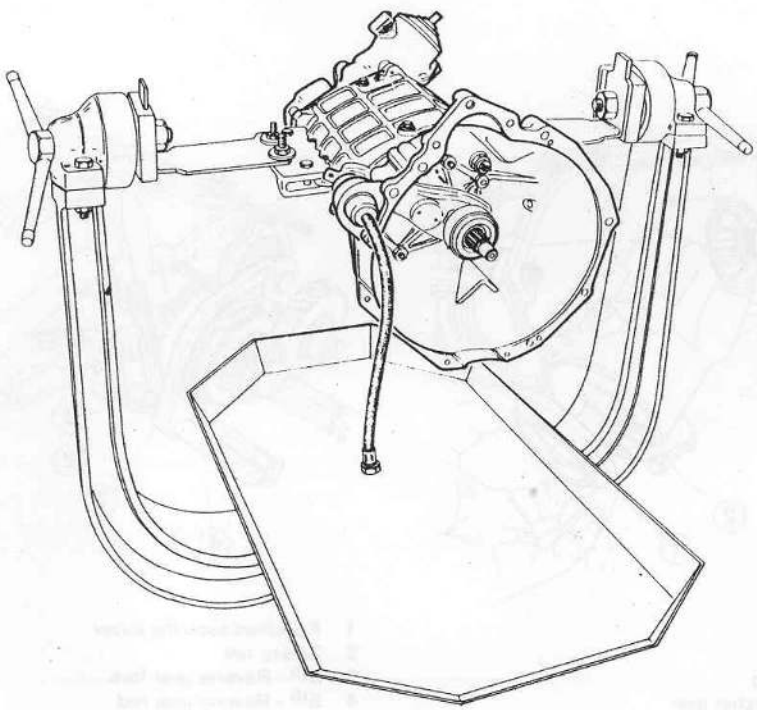


1 Bolts
2 Flexible coupling
3 Front propeller shaft

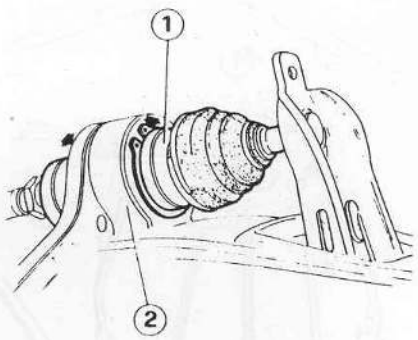
DISASSEMBLY

1. Separating the clutch bell housing.

a. Set up the gearbox assy on a suitable stand.



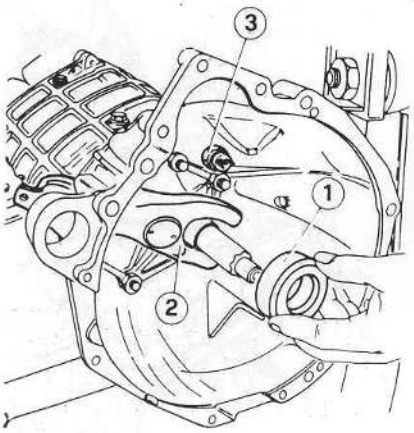
b. Remove the retainer rings which hold the clutch slave cylinder (1) to its housing on the clutch bell (2) and slide out the cylinder.



1 Clutch slave cylinder
2 Clutch bell housing

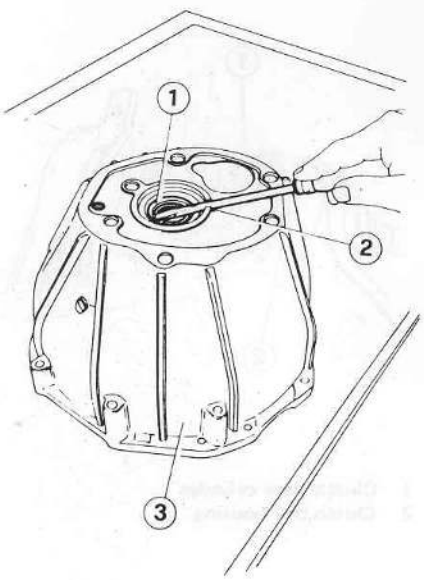
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c. Slide off the throwout bearing (1) and the clutch release fork (2), having freed it from the associated clamp.
d. Unscrew and remove the back-up light switch (3).



1 Throwout bearing
2 Clutch fork
3 Back-up light switch

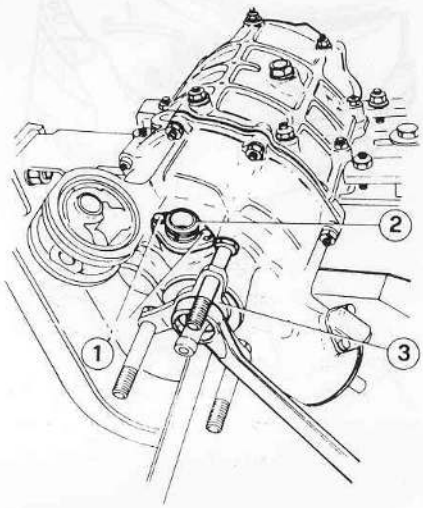
e. Unscrew and remove the six nuts which fix the clutch housing pan to the half-casings and slide off the actual bell housing.
f. Fit a screwdriver into the notch (2) and pry the seal ring (1) off the clutch bell housing (3).



1 Seal ring
2 Notch
3 Clutch bell housing

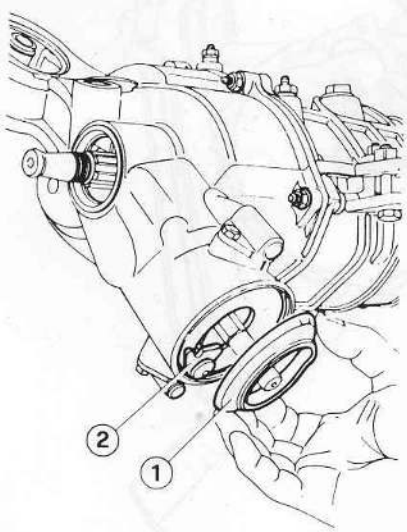
2. Separating the rear cover.

a. Rotate the gearbox on the stand, unscrewing the two screws (1) and sliding off the rev-counter drive (2)..
b. Unscrew and remove the nut securing the propeller shaft fork (3). To prevent the fork from turning press one of the three screws against the rear cover.



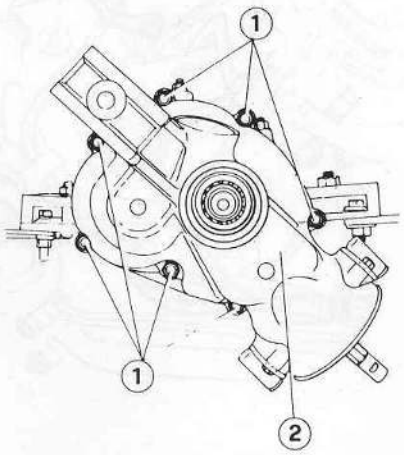
1 Screws
2 Rev-counter drive
3 Propeller shaft fork

c. Notch up position reference marks of the fork and output shaft tang and slide out the fork.
d. Slide out the seal ring, caps (1) and ratchet gear (2) from the gearshift trunnion housing.



1 Cap
2 Ratchet gear

e. Unscrew and remove the seven nuts (1) securing the rear cover (2) to the half-casings and retrieve the associated washers.

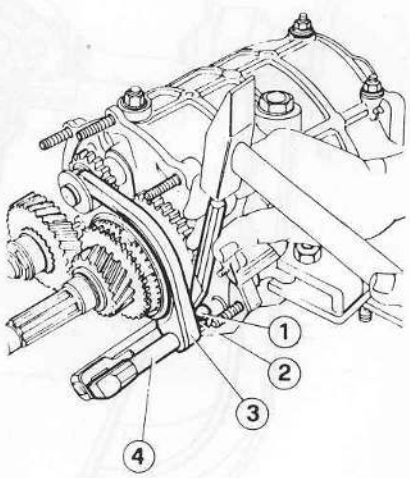


1 Nuts
2 Rear cover

f. Engage the 3rd gear and slide off the rear cover.

3. Disassembling striking rods and forks.

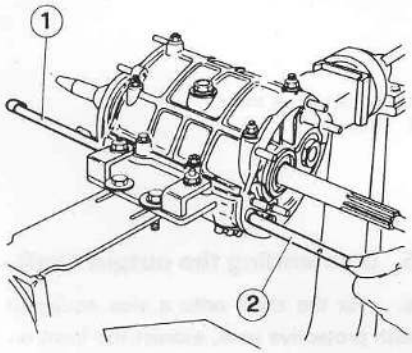
a. Straighten the safety tabs (2) unscrew screw (1) securing the 5th and Reverse gearshift fork (3) to its rod (4) and retrieve the two tabs and slide off the rod.



1 Fork/rod securing screw
2 Safety tab
3 5th - Reverse gear fork
4 5th - Reverse gear rod

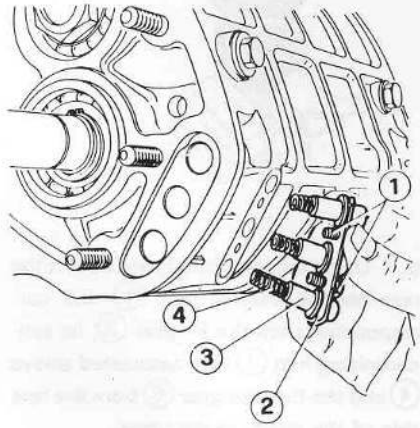
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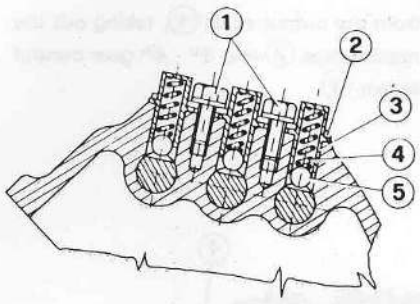
WARNING:
Should it be necessary to extract one striking rod only, or the check on the rod positioning ball and interlock rollers unit not be requested, take out the striking rods by pushing them with dummy rods inserted at the opposite end.



1 Rod
2 Dummy rod

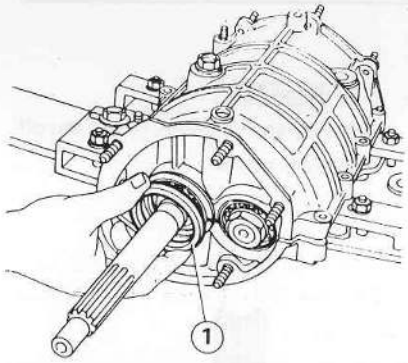
b. Rotate the gearbox on the stand. Unscrew the two screws (1) securing the plate (2) and slide the latter off together with the sheaths (3) and the springs (4). Then retrieve the three rod positioning balls (5).

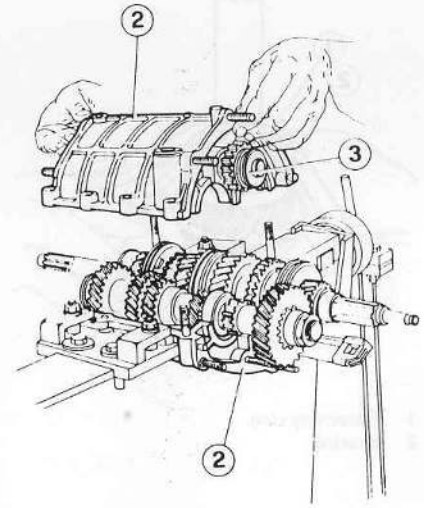




1 Screws
2 Plate
3 Sheath
4 Spring
5 Rod positioning ball

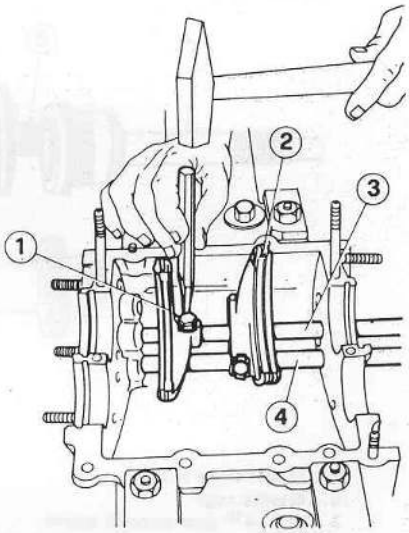
c. Rotate the gearbox on the stand. Unscrew the nuts and bolts securing the two halfboxes between them and retrieve the associated washers.
d. Slide off the front centering ring (1) separate the two half-casings (2) and retrieve the reverse gear runner (3).





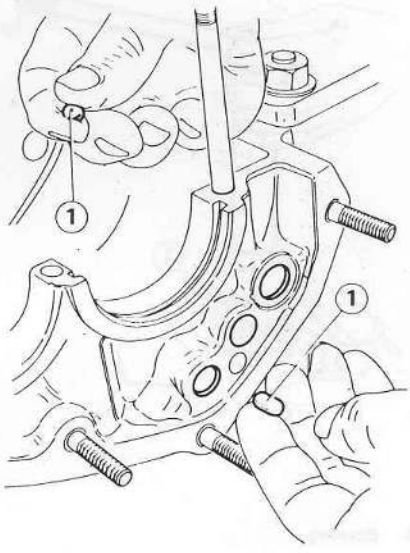
1 Front centering ring
2 Half-casings
3 Reverse runner

e. Remove the shaft assemblies from the gearbox.
f. Operating as in previous step "a", retrieve the striking rods and 1st - 2nd and 3rd - 4th gearshift forks.



1 3rd - 4th fork
2 1st - 2nd fork
3 3rd - 4th rod
4 1st - 2nd rod

g. Retrieve the two interlock rollers from their housings in the gearbox casings.
h. Retrieve the third pawl by sliding it out from its housing in the 3rd and 4th gear striking rod.

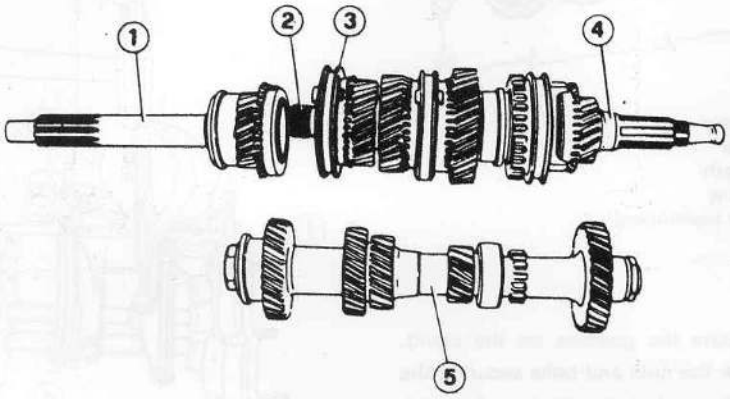


1 Interlock rollers

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4. Disassembling the direct drive shaft.

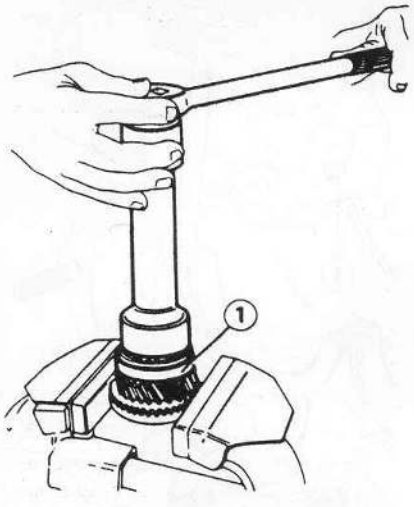
a. Separate the direct drive shaft (1) from the output shaft (4), taking out the needle cage (2) and 3rd - 4th gear control sleeve (3).



1 Direct drive shaft
2 Needle cage
3 3rd - 4th gear control sleeve
4 Output shaft
5 Layshaft

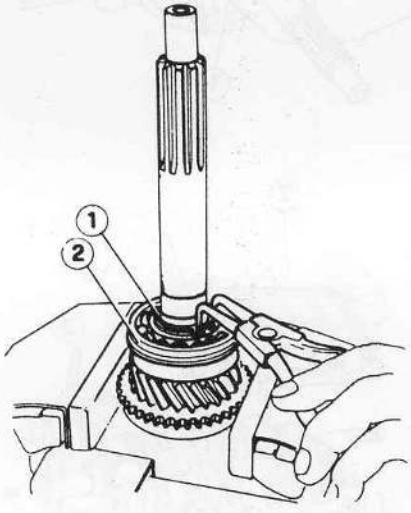
b. Fix the shaft onto a vice equipped with jaw liners

— All models except Spider 1.6 : back off and remove bearing check nut (1), having eliminated calking.



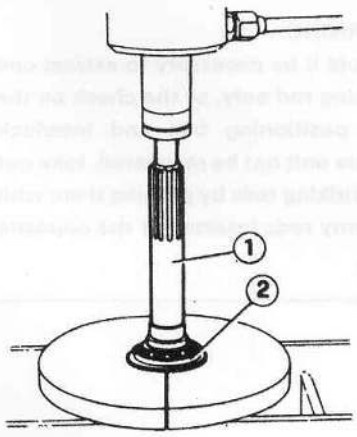
1 Bearing

— For Spider 1.6 : remove retaining ring (1) and slip off adjusting washer.



1 Retaining ring
2 Bearing

c. Using two half plates at the press, extract the bearing (2) from the shaft (1).



1 Direct drive shaft
2 Bearing

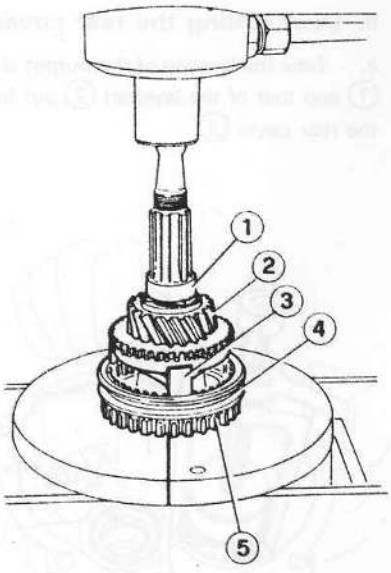
5. Dismantling the output shaft.

a. Fix the shaft onto a vice equipped with protective jaws, extract the front retainer ring and retrieve the associated shims.



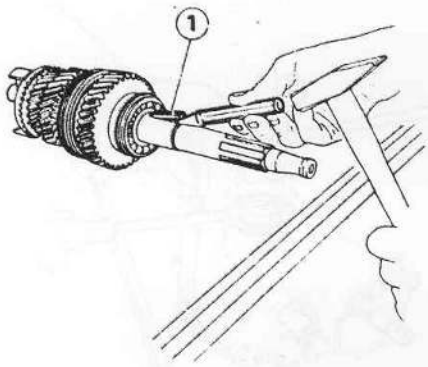
b. Using the two half-plates, extract the rear bearing internal race (1), the corresponding shim the 5th gear (2), its synchronizing hub (3) with associated sleeve (4) and the Reverse gear (5) from the rear side of the shaft, at the press.

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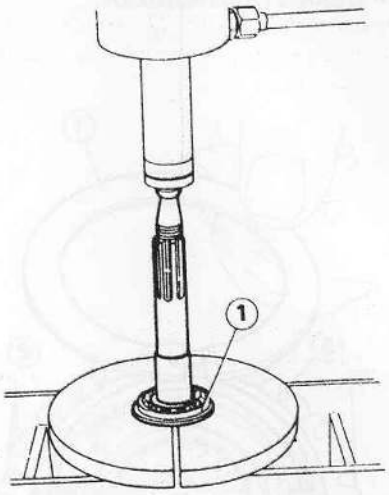
1 Rear bearing internal race
2 5th gear
3 Hub
4 Sleeve
5 Reverse gear

c. Remove the Reverse gear key from its groove in the shaft.



1 Key

d. Still using the two half-plates extract the intermediate bearing (1) at the press.



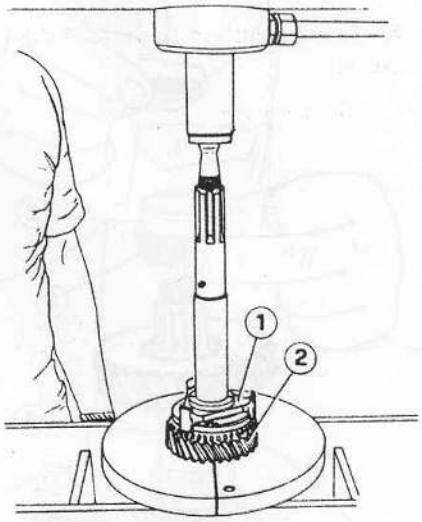
1 Intermediate bearing

e. Slide out the shims the spacer (1), the 1st gear (2) and the 1st - 2nd gear sleeve (3).



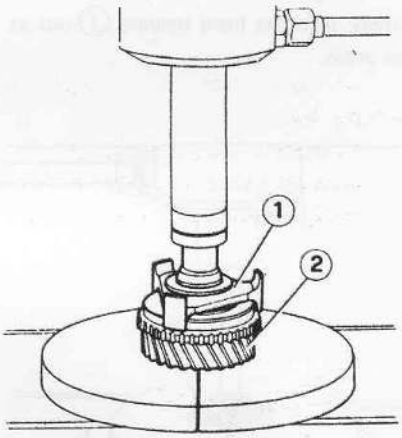
1 Spacer
2 1st gear
3 1st - 2nd gear sleeve

f. Still using the two half-plates, take the 2nd gear (2) out at the press along with the associated synchronizing hub (1).



1 Hub
2 2nd gear

g. Using the two half-plates and working from the front side of the shaft, at the press take out the 3rd gear (2) and the associated synchronizing hub (1).

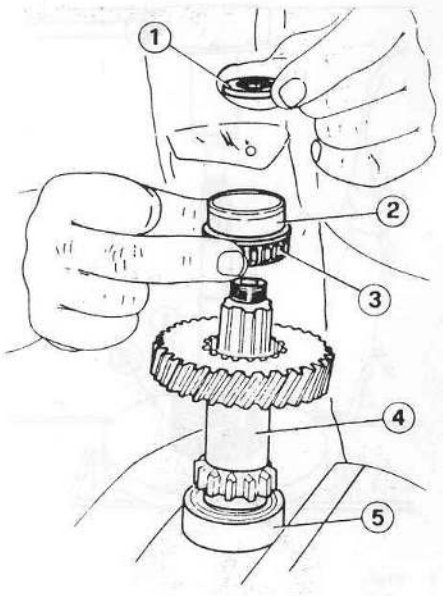


1 Hub
2 3rd gear

6. Dismantling the layshaft.

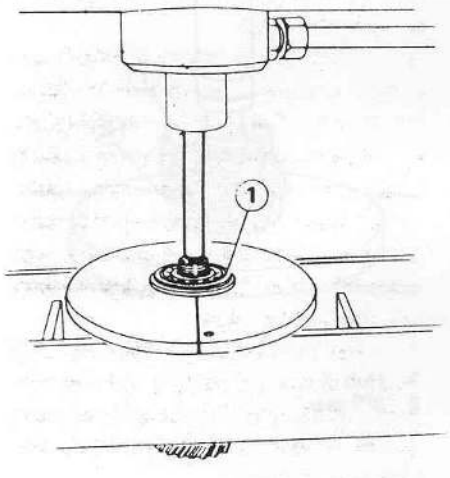
a. Mount the shaft on the vice equipped with protective jaws, eliminate the calking of the end nuts and unscrew these nuts.
b. By acting from the rear side slide off the washer (1), the splined coupling (3), together with the rear bearing internal race (2), the 5th and Reverse gear (4) and the intermediate bearing (5).

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1 Washer
2 Rear bearing internal race
3 Splined coupling
4 5th and Reverse gear
5 Intermediate bearing

c. Using the two half-plates and a punch, take the front bearing (1) out at the press.

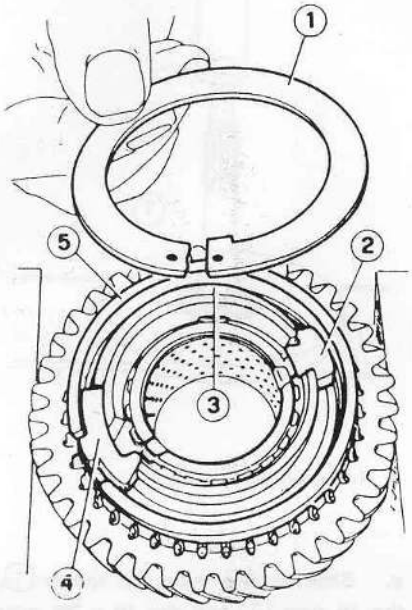


1 Front bearing

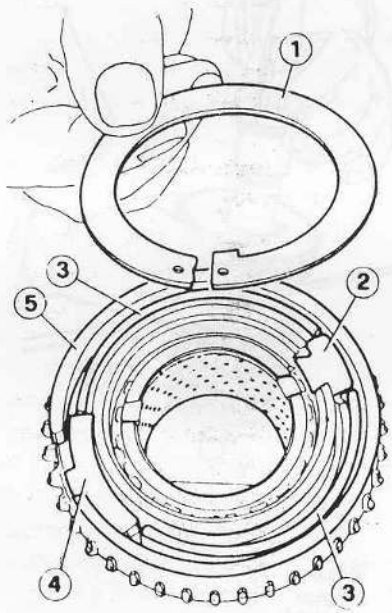
7. Dismantling the synchronizers.

a. Fix the desired gear onto a vice equipped with protective jaws and remove the spring retainer ring (1). Then remove the ring (5), the sectors (2) and (4) and the straps (3).

1st GEAR SYNCHRONIZER



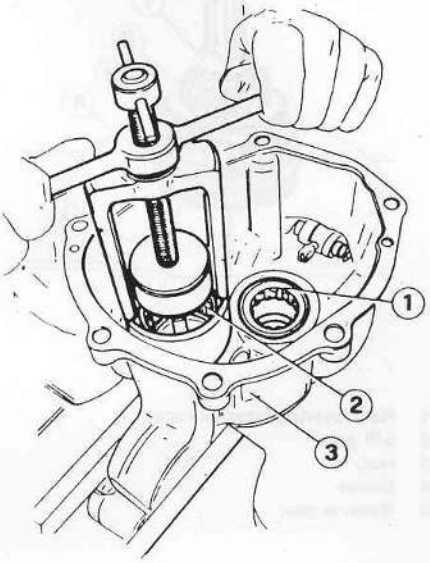
2nd, 3rd, 4th, 5th GEAR SYNCHRONIZER



1 Retainer ring
2 Stop sector
3 Stop strap
4 Reference sector
5 Synchronizing ring

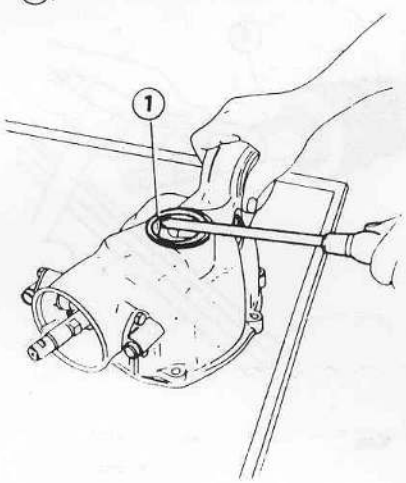
8. Dismantling the rear cover.

a. Take the bearing of the output shaft (1) and that of the layshaft (2) out from the rear cover (3).



1 Output shaft bearing
2 Layshaft bearing
3 Rear cover

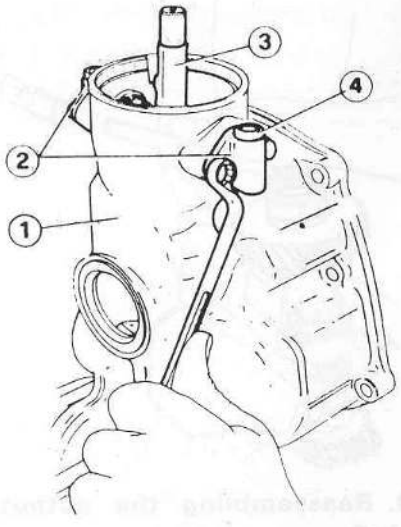
b. Take out the output shaft seal ring (1).



1 Seal ring

c. Unscrew and remove the screws with washers securing the two supports (2) of the trunnion (3) complete with vent plugs (4) to the rear cover (1).

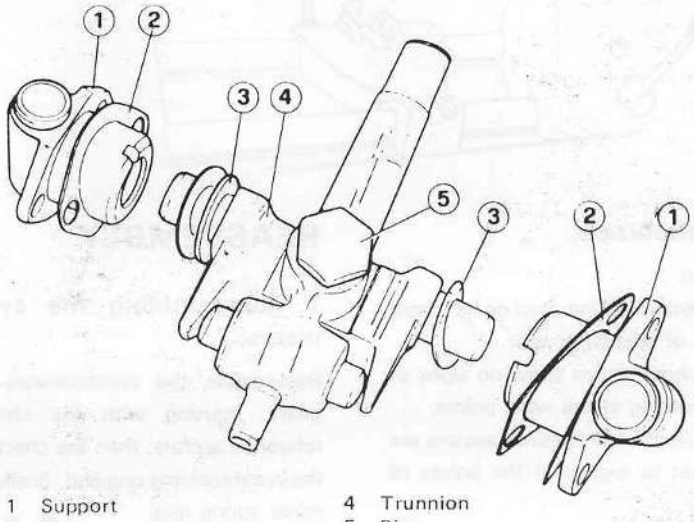
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1 Rear cover
2 Support
3 Trunnion
4 Vent plug

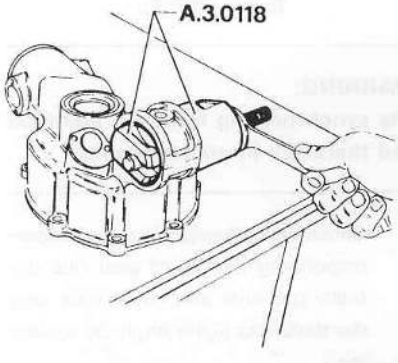
d. Slide off the supports (1), retrieve the washers (3) and shims (2) then remove the trunnion (4).

e. If necessary remove the trunnion by unscrewing the pin (5).



1 Support
2 Shim
3 Washer
4 Trunnion
5 Pin

f. Take out the rear spring bushing using tool **A.3.0118.**



INSPECTION AND CHECKS

Prior to carrying out the checks, wash the parts thoroughly.
This makes it easier to recognize superficial defects, wear and tear and the efficiency of the individual parts.

1. Springs, balls, interlock rollers.

a. Check that the pressure springs of the rod positioning balls are efficient. If suspect stretching is encountered, replace them.
b. Check that the positioning balls and the rod interlock rollers have no cuts and show no signs of binding.

2. Rods and forks.

a. Check that the rods are in no way deformed and that the slots on the striking rods have no cuts and show no signs of binding.
b. Check that the gearshift forks are neither deformed nor worn.
c. Check that the rods run freely, without noticiable play, in their housings.

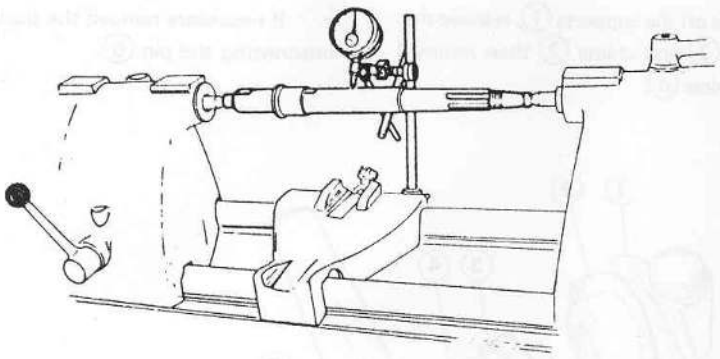
3. Half-casings clutch bell housing, rear cover.

a. Clean the parts with solvent then check for cracks, chipping or dimpling.
b. Check the joining surfaces between the parts and ensure that there are no notches, roughness or traces of sealant.
c. Inspect the ball bearings of the output and layshafts housed in the rear cover. Check that rotation is achieved silently with neither slight seizing nor excessive play.
d. Check that the spring ring achoring to the crosspiece is not damaged and in particular that the rubber part is not worn, otherwise replace it.

4. Gears, shafts, splines, bearings.

a. Visually inspect the gear teeth. If unusually worn gears or gears with chipped teeth are encountered, replace and check that the gears they mesh with are not also damaged.
b. Check the threaded and splined surfaces of the shafts and especially the housing surfaces of the bearing internal races.
c. Inspect the condition of the bearing ring surfaces and of the revolving parts, checking that they show no signs of scoring, marks, or grinding due to the abrasive action of foreign bodies, otherwise replace the damaged bearings.
d. Mount the output shaft between two counter points and using a dial indicator check that the shaft eccentricity does not exceed a value of 0.05 mm (0.002 in), otherwise replace.

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5. Synchronizers.

Check that:

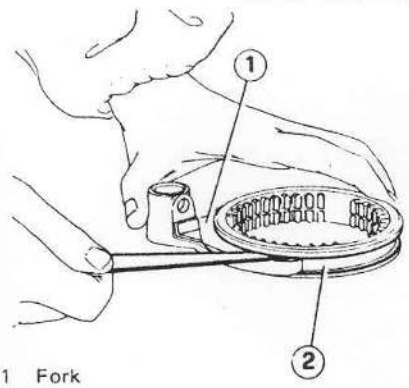
- The synchronizing rings do not show signs of excessive wear.
- The check straps show no signs of overheating at the work points.
- The check and reference sectors are not cut to excess at the points of work.
- The synchronizing sleeves run freely on the corresponding hubs.
- The front teeth engaging the sleeves and the corresponding ones on the gears show no signs of seizing or excessive wear.

6. Forks and sleeves.

Inspect the work surfaces of the forks (1) and the runner sleeves (2), checking that there are no signs of binding and that axial play is within tolerated limits:

Axial play, forks and sleeves 1st - 2nd and 3rd - 4th gear.
0.15 thru 0.34 mm
(0.006 thru 0.013 in).

Axial play, forks and sleeves 5th gear - Reverse.
0.25 thru 0.56 mm
(0.010 thru 0.022 in).



1 Fork
2 Sleeve

REASSEMBLY

1. Reassembling the synchronizers.

Reassemble the synchronizers on the gears, starting with the check and reference sectors, then the check straps, the synchronizing ring and, finally, the retainer spring ring.

WARNING:
Having reassembled, check that the spring retainer ring is correctly fitted in its housing and that the synchronizing ring can move freely.

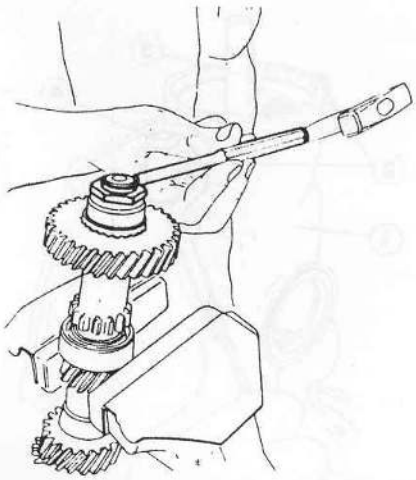
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2. Reassembling the layshaft.

a. Reassemble the layshaft by carry out the disassembly operations in reverse order, consulting the exploded view in page 13-5 and tightening the end nuts to the specified torque.

(T) : **Tightening torque**
Transmission shaft end nuts
93 thru 103 N·m
(9.5 thru 10.5 kg·m)
(68.6 thru 76 ft·lb)

b. Caulk both the end nuts.



3. Reassembling the output shaft.

Reassemble the output shaft by operating as for disassembly but in reverse order, consulting the exploded view in page 13-5 and adhering to the following instructions.

- Assemble the synchronizing hubs hot, having heated them to the specified temperature.

Heating temperature of the synchronizing sleeve guide hubs to be mounted on the output shaft.
150°C (302°F).

WARNING:
The synchronizing hubs are identical and therefore interchangeable.

- Check that the adjusting washer corresponding to the 3rd gear hub actually prevents play, otherwise vary the thickness accordingly by replacing.
- Assemble the layshaft fork and tighten the associated nut to the prescribed torque.

(T) : **Tightening torque**
Layshaft fork nut
93 thru 103 N·m
(9.5 thru 10.5 kg·m)
(68.6 thru 76 ft·lb).

- Using a feeler gauge, check that the axial play of the gears corresponds to the specified values.

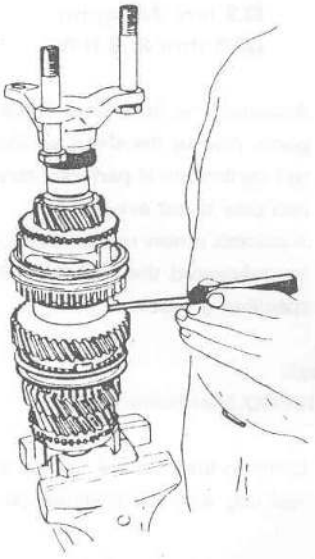
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Axial play of the gears driven on the output shaft.

1st gear
0.200 thru 0.300 mm
(0.008 thru 0.012 in)

2nd and 3rd gears
0.130 thru 0.205 mm
(0.005 thru 0.008 in)

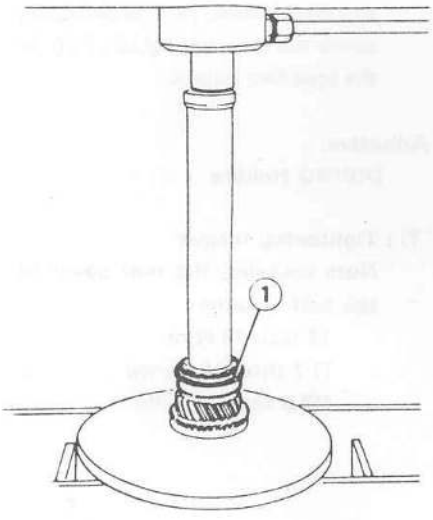
5th gear
0.190 thru 0.270 mm
(0.007 thru 0.011 in)



4. Reassembling the propeller shaft.

Reassemble the propeller shaft by carrying out the disassembly operations in reverse order, consulting the exploded view on page 13-5 and adhering to the following instructions:

- Assemble the front bearing (1) at the press.



1 Front bearing

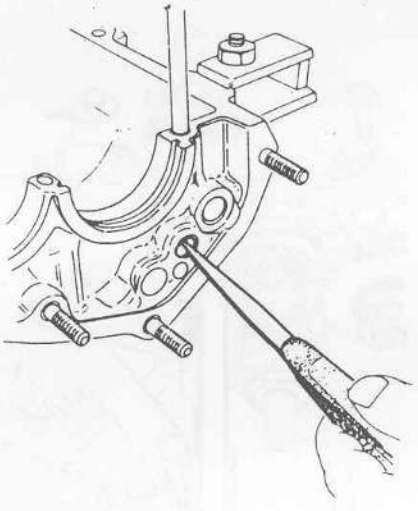
- All models except Spider 1.6 : screw on bearing check nut, tighten to the specified torque and caulk.

(T) : Tightening torque
Direct drive shaft bearing nut
93 thru 103 N·m
(9.5 thru 10.5 Kg·m)
(68.6 thru 76 ft·lb).

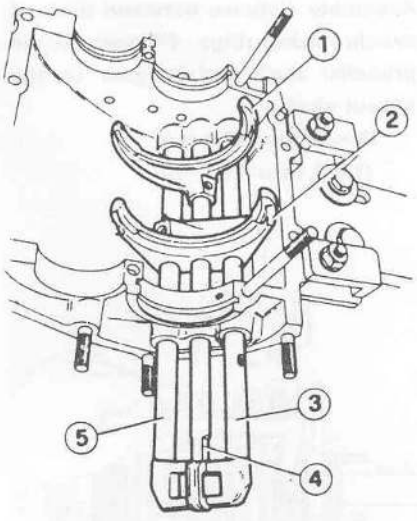
- For Spider 1.6 : fit on the previously removed adjusting washer, assemble the retaining ring and check proper installation in base. Verify that the adjusting washer prevents all axial play, otherwise replace with one of the appropriate thickness.

5. Reassembling the rods and forks.

a. Put two interlock rollers into the corresponding housings in the gearbox and the third one in the housing located in the 3rd and 4th gear striking rod.

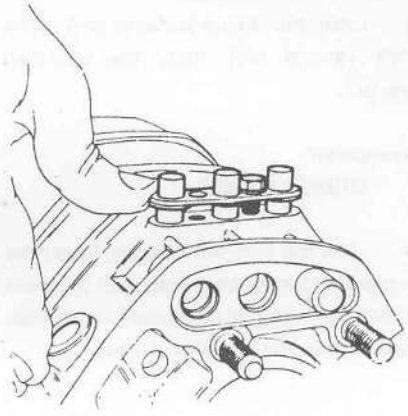


b. Slip the 3rd and 4th gear striking rods into their housings and into the 3rd and 4th (1) and 1st - 2nd (2) gear shift forks.
c. Slide in the two other rods, positioning them as indicated in the figure.



1 3rd - 4th fork
2 1st - 2nd fork
3 5th - Reverse rod
4 3rd - 4th rod
5 1st - 2nd rod

d. Place the two forks with respect to the associated rods, inserting the clamp screws together with the tabs, but without tightening them.
e. Turn the gearbox on the stand position the rod aligning balls, the springs and the sheaths in their housings and fix the stop plate into place with its screws.
f. Turn the gearbox again on the stand, and place the shafts in their housings.

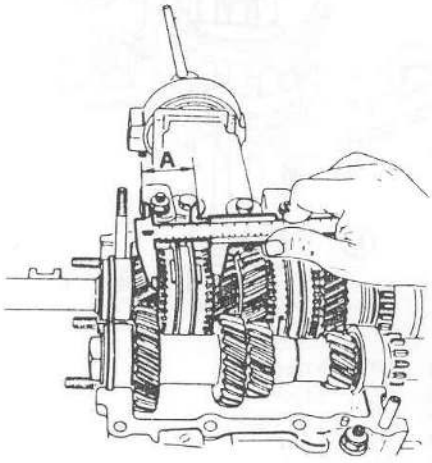


g. Using a sliding gauge, check that distance "A", shown in the figure, corresponds to the specified value.

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Assembly distance between toothed synchronizing rings, 4th gear on the propeller shaft and 3rd gear on the output shaft.

A = 42 thru 42.2 mm
(1.654 thru 1.661 in)



If this is not the case, replace the adjusting washer positioned between the 1st gear spacer and the output shaft bearing.

h. Center the 1st - 2nd and 3rd - 4th gear control sleeve with respect to the associated gears, checking the position with a sliding gauge.

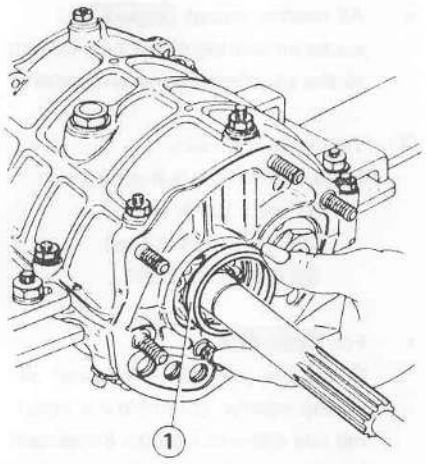
i. Tighten the screws securing the two forks to the striking rods and bend the corresponding safety tabs.

j. Clean the joining surfaces of the two half casings and apply the specified sealant.

Adhesive:
DIRING Heldite.

k. Join the two half casings, insert the corresponding locking bolts, put the front centering ring (1) in its housing and tighten the nuts to the specified torque.

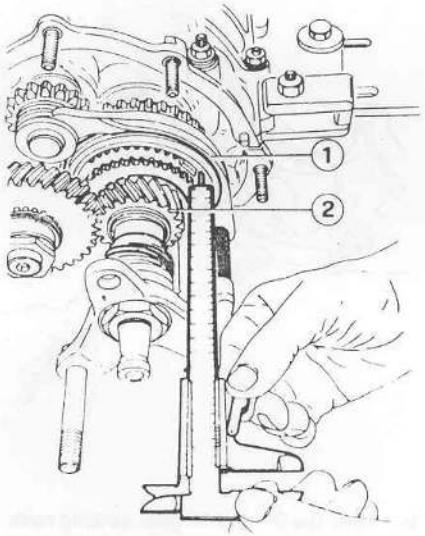
(T) : Tightening torque
Half-casings, stop nuts
17 thru 19 N·m
(1.7 thru 1.9 kg·m)
(12.5 thru 14 ft·lb)



1 Front centering ring

l. Using a dummy rod, slide out the 5th - Reverse gear striking rod, slide in the corresponding fork (1) and put the rod back in again, pushing the dummy rod.

m. Position the clamp screw of the fork and associated taps, check with a sliding gauge that the distance between the sleeve and the rear plane of the engaging teeth of the 5th gear (2) is approximately 12.9 mm (0.508 in), tighten the screw and bend back the associated tabs.



1 5th - Reverse fork
2 5th gear

6. Reassembling and joining up the rear cover.

Reassemble by carrying out the disassembly operations in reverse order and adhering to the following instructions:

- If previously dismantled, reassemble the trunnion and tighten the nut to the specified torque.

(T) : Tightening torque
Gear control trunnion nut
32 thru 35 N·m
(3.3 thru 3.6 kg·m)
(23.6 thru 25.8 ft·lb).

- Assemble the trunnion and the supports, placing the shims so that the rod control pin is perfectly centered and play is not excessive.
- Assemble a new rear seal ring, having lubricated the surface with the specified grease.

Grease:
ISECO Molykote BR2.

- Dampen the external surface of the seal ring with the specified oil.

Oil:
AGIP Rotra SX 75W90
IP Pontiax HDS 75W90
SHELL Spirax HD 80W90

- Unscrew and remove the check nut of the propeller shaft fork, slide out the fork and engage the 3rd gear.
- Clean the surfaces joining the half casings with the rear cover, apply the specified sealant, join the two parts, screw the nuts and tighten them to the specified torque.

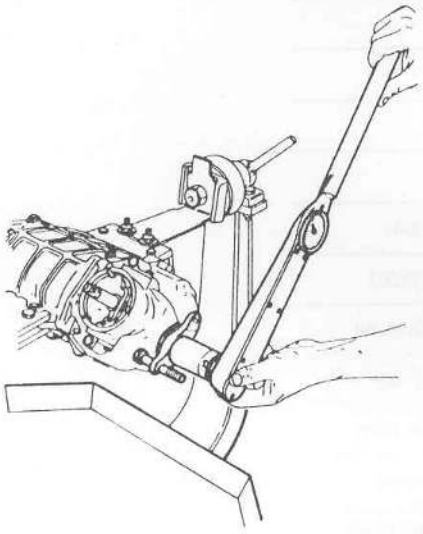
Adhesive:
DIRING Heldite

(T) : Tightening torque
Nuts securing the rear cover to the half casings
17 thru 19 N·m
(1.7 thru 1.9 kg·m)
(12.5 thru 14 ft·lb)

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- Check that the lever meshes perfectly with the rods and that there is no interference among the latter.
- Assemble the propeller shaft fork, keeping to the marks made during the disassembly phase, screw the nut and tighten it to the specified torque.

(T) : **Tightening torque**
Drive fork nut
93 thru 103 N·m
(9.5 thru 10.5 kg·m)
(68.6 thru 76 ft·lb)



7. Uniting the clutch bell housing.

a. Assemble a new seal ring on the clutch bell housing after having lubricated its surface with grease.

Grease:
ISECO Molykote BR2.

b. Dampen the external surface of the seal ring with the oil specified.

Oil:
AGIP Rotra SX 75W90
IP Pontiax HDS 75W90
SHELL Spirax HD 80W90

c. Clean the uniting surfaces of the half casings-clutch bell housing, apply the specified sealant, join the two parts, screw the nuts and tighten them to the stipulated torque.

Adhesive:
DIRING Heldite

(T) : **Tightening torque**
Nuts securing the clutch bell housing to the half casings
17 thru 19 N·m
(1.7 thru 1.9 kg·m)
(12 thru 14 ft·lb)

d. Screw on the back-up light switch and tighten it to the torque stipulated.

(T) : **Tightening torque**
Back up light switch
40 thru 48 N·m
(4.1 thru 4.9 Kg·m)
(29.5 thru 35.4 ft·lb).

e. In reverse order with respect to disassembly operations assemble the clutch release fork and associated operating cylinder.

INSTALLATION

Reassemble by carrying out the disassembly operations in reverse order and adhering to the following instructions.

- Observe the following tightening torque

(T) : **Tightening torque**
Nuts securing the flexible coupling of the gearbox to the gearbox fork
54 thru 56 N·m
(5.5 thru 5.7 Kg·m)
(39.8 thru 41.3 ft·lb)

- Lubricate the following parts as specified.

Clutch throwout bearing work area. Washer on the clutch operating fork ball and socket joint.

Grease:
AGIP Grease 33 FD
IP Autogrease FD

- Dampen the joining surface of the floor lever bellows-carrier with the suggested sealant.

Sealant:
DIRING Heldite

- Observe the following tightening torque.

(T) : **Tightening torque**
Nuts securing the intermediate propeller flange
37 thru 39 N·m
(3.8 thru 4 kg·m)
(27.3 thru 28.8 ft·lb)

- Fill up the gear case with the specified oil.

Oil:
AGIP Rotra SX 75W90
IP Pontiax HDS 75W90
SHELL Spirax HD 80W90

Quantity: 1.650 kg (3.638 lb)

- Bleed the clutch circuit as indicated in: Unit 12 - Clutch - Hydraulic System Bleeding.

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TECHNICAL SPECIFICATIONS AND FEATURES

TECHNICAL FEATURES

TRANSMISSION RATIOS

		Spider / Spider 2.0	Spider 1.6
Gear ratios	1st	1:3.30	
	2nd	1:1.99	
	3rd	1:1.35	
	4th	1:1.00	
	5th	1:0.79	
	Reverse	1:3.01	
Final drive		10/41	9/41
Total gear - differential ratios	1st	1:13.530	1:15.031
	km/h (mph)	8.54 (5.31)	7.564 (4.70)
	2nd	1:8.159	1:9.064
	km/h (mph)	14.18 (8.81)	12.544 (7.79)
	3rd	1:5.535	1:6.149
	km/h (mph)	20.90 (12.99)	18.491 (11.49)
Nominal gear at 1000 engine RPM	4th	1:4,100	1:4.555
	km/h (mph)	28.18 (17.51)	24.962 (15.10)
	5th	1:3.239	1:3.598
	km/h (mph)	35.63 (22.14)	31.601 (19.64)
	Reverse	1:12.341	1:13.710
	km/h (mph)	9.39 (5.83)	8.293 (5.15)

GENERAL SPECIFICATIONS

SEALANTS AND SURFACE FIXING AGENTS

Application	Type	Denomination	Quantity
Halfbox joining surfaces Rear cover - gear case joining surfaces Clutch bell housing - gear case joining surfaces Floor lever bellows - carrier joining surfaces	ADHESIVE	DIRING: Heldite Norm. 3522-00015	

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TIGHTENING TORQUES

Item	N·m	Kg·m	ft·lb
Nuts at the end of the layshaft	93 thru 103	9.5 thru 10.5	68.6 thru 75
Nut, propeller shaft fork	93 thru 103	9.5 thru 10.5	68.6 thru 76
Direct drive shaft bearing nut (1)	93 thru 103	9.5 thru 10.5	68.6 thru 76
Nut securing the gear half casings	17 thru 19	1.7 thru 1.9	12.5 thru 14
Nut, gear control trunnion	32 thru 35	3.3 thru 3.6	23.6 thru 25.8
Nuts securing the rear cover to the half casings	17 thru 19	1.7 thru 1.9	12.5 thru 14
Nuts securing the clutch bell housing to the half casings	17 thru 19	1.7 thru 1.9	12.5 thru 14
Back-up lamp switch	40 thru 48	4.1 thru 4.9	29.5 thru 35.4
Nuts securing the flexible coupling of the gearbox to the fork	54 thru 56	5.5 thru 5.7	39.8 thru 41.3
Nuts securing the intermediate propeller flange	37 thru 39	3.8 thru 4	27.3 thru 28.8

(1) Except Spider 1.6

TROUBLESHOOTING AND CORRECTIVE ACTIONS

Trouble	Probable cause	Corrective action
Noisy transmission in the forward gears	Having located the origin of the noise, which does not, therefore, derive from the engine, locate the faulty unit by following the procedure below: - put the car into the gear which emphasizes the noise - adjust the speed, engaging as logically as possible, various gears Once the cause of the noise has been detected, repair or replace defective parts	
	• Oil level is insufficient or presence of oil with inadequate lubricating qualities	Top up the oil level or replace with specified oil
	• Oil leaks from the seal rings, from the uniting surfaces of the half casings and covers and/or filler or drain plug	Replace the seal rings and/or plugs, or renew surface sealing
	• Layshaft and propeller shaft bearings (in this case there should also be noise in neutral gear)	Replace the bearings
	• Output shaft bearings (noise present only when gear is engaged, in every gear)	Replace the bearings

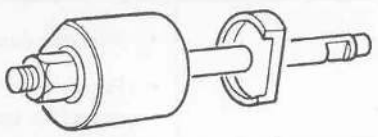
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Trouble	Probable cause	Corrective action
Noise when car is in motion, even in neutral	• Differential carrier bearings either faulty or seized	Replace the bearings
	• Bevel pinion bearings noisy	Check and/or replace
Noise in a specific gear	• Contact point sufaces of gear toothing either worn or traces of binding	Replace the gears
Noise in "acceleration and deceleration"	• Excessive gear play	Adjust play
Noisy transmission in "neutral" (car at a halt)	• Irregular variation in the driving torque	Adjust engine idle
	• Lack of oil	Top up
Noisy transmission in reverse	• Reverse gears worn or damaged	Replace faulty parts
Difficulty in gear engage/disengage	First of all, determine whether the source of the problem lies with the gear change or the control system. Verify that the clutch mates with the pedal released and disengages with the pedal pressed down, correctly. If the clutch is not faulty, the gear change or the control system are at the origin of the fault.	
Hardening of the gear control and/or failure of the lever to return to the neutral position	• Lack of oil in the gear case-differential	Top up the oil level
	• Synchronizing unit faulty	See "Synchronizing unit faulty or crashing"
	• Internal controls worn or deformed	Repair or replace faulty parts
Excessive play in selection of gears	• Unusual wear of the gear engagement pin or the spring bushing associated with the selector rod	Replace any worn items
Gears disengage	• Sleeves, gears worn or faulty	Replace worn parts
	• Excessive axial play for the gear, which uncouples spontaneously (Noise in both acceleration and deceleration)	Check adjustment of the gear unit
Scanty sensitivity of gear engagement	• Floor lever bushing is worn	Replace worn items
	• Interlock rollers worn or damaged	Replace interlock rollers
	• Springs worn out or broken	Replace springs
	• Rod milling worn or deformed	Replace the rods
Synchronizing unit faulty or crashing	• Sleeve and gear have worn or damaged front toothing	Replace faulty items
	• Distance between the gear and sleeve front toothing is incorrect	Replace faulty items
	• Synchronizer ring worn	Replace
	• Sleeve splines worn or damaged	Replace

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Trouble	Probable cause	Corrective action
When the Reverse gear is engaged the associated back-up lamp fails to illuminate	• Back-up lamp switch is inefficient	Replace the switch
Gear stick is noisy and vibrates	• Floor lever bushing is worn • See noisy gears	Replace worn items
Seizure, meshing or breakage	• Lack or inadequate type, of oil	Replace faulty parts and use specified oil
	• Insufficient play	Adjust play and replace faulty parts
	• Incorrect adjustment of gears and bearings	Overhaul the gearbox assy
	• Operation under excessive loads or incorrect use of the clutch	Replace faulty parts
	• Clamping screws loose	Replace faulty parts and renew tightening torques

SPECIAL TOOLS

Identity N°	Denomination	Reference page
A.3.0118	Spring bushing inserter/extractor 	13-15

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UNIT 15

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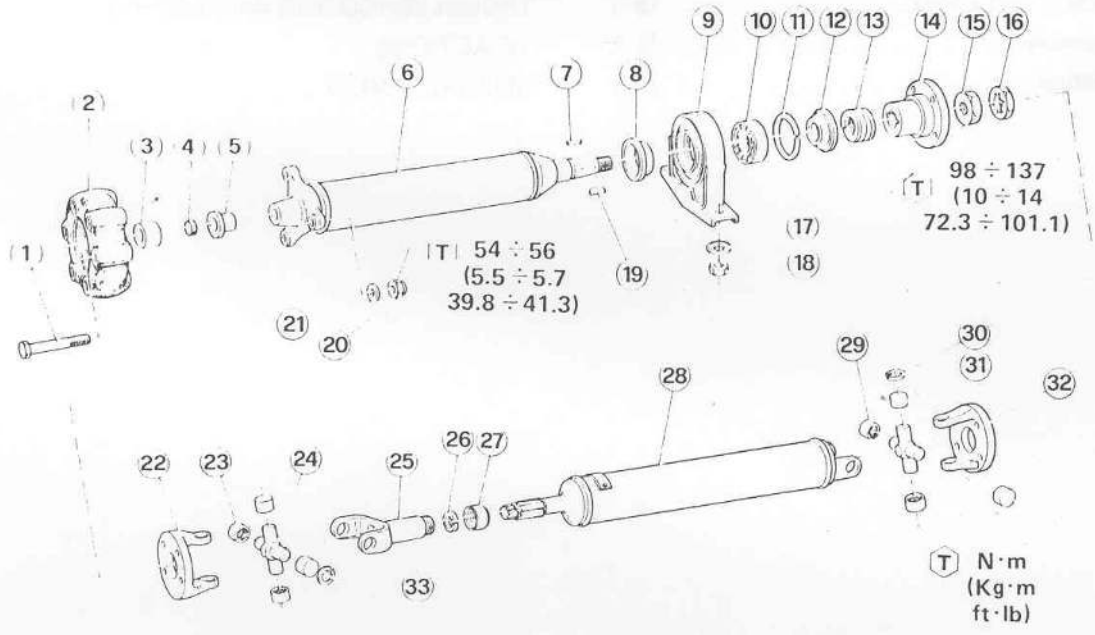
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DESCRIPTION

The propeller shaft comprises a shaft which connects the front gear case unit to the rear axle-differential.
The shaft is, in reality, made up of two axle shafts united by a bolted flange.
The front axle shaft is connected to the gearbox fork by means of a flexible coupling. The rear axle shaft is equipped with two universal joints.
Anchoring to the bodywork is guaranteed by a center carrier equipped with ball bearing.



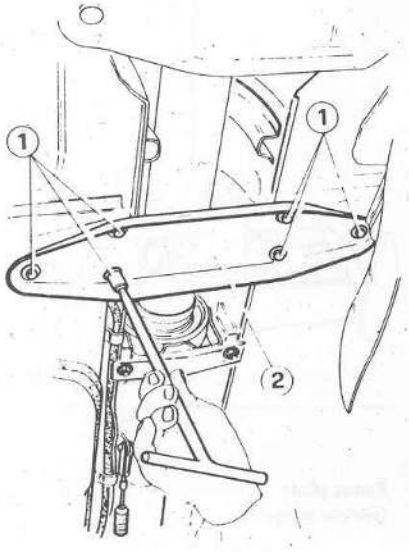
1 Screw
2 Flexible coupling
3 Seal ring
4 Plug
5 Bushing
6 Front shaft
7 Key
8 Cup
9 Central support
10 Bearing
11 Ring
12 Cup
13 Spring
14 Front shaft central flange
15 Nut
16 Laminate lock nut
17 Washer
18 Nut
19 Key
20 Nut
21 Washer
22 Rear shaft central flange
23 Needle cage
24 Trunnion
25 Slip yoke
26 Ring
27 Ring nut
28 Rear shaft
29 Needle cage
30 Retainer ring
31 Trunnion
32 Rear flange
33 Retainer ring

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PROPELLER SHAFT

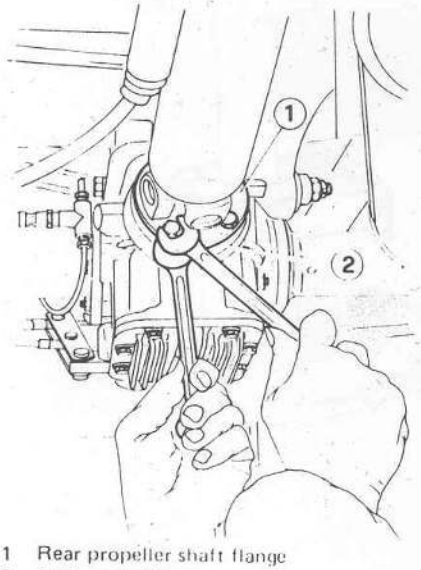
REMOVAL

1. Put the car on the lift and raise it.
2. Partially disconnect and bend the protection located above the catalytic muffler so as to gain access to all six screws (1) securing the tie bar (2) to the body, unscrew them and retrieve the tie bar.



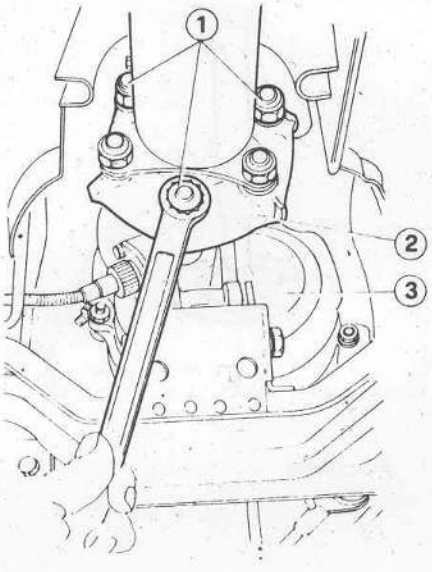
1 Screws
2 Tie bar

3. Put reference marks on the front (gearbox fork - flexible coupling - transmission fork) and rear (propeller shaft flange-differential pinion flange) sides of the propeller shaft.
4. Unscrew the four bolts uniting the rear propeller shaft flange (1) with the differential one (2), rotating the flange each time.



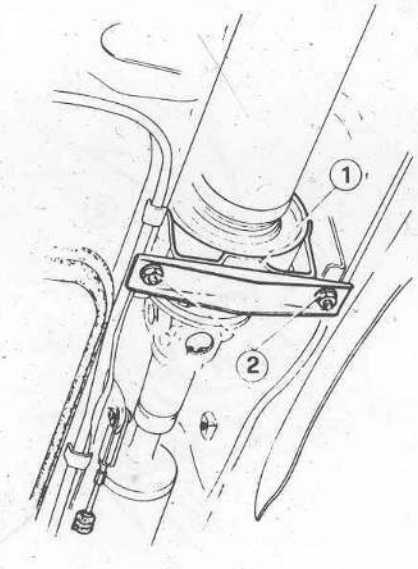
1 Rear propeller shaft flange
2 Differential flange

5. Similarly, unscrew the three bolts (1) securing the front flexible coupling (2) to the gearbox fork (3).



1 Bolts
2 Front flexible coupling
3 Gearbox

6. Unscrew the two nuts (2) securing the center carrier (1) to the bodywork and get hold of the whole propeller shaft.

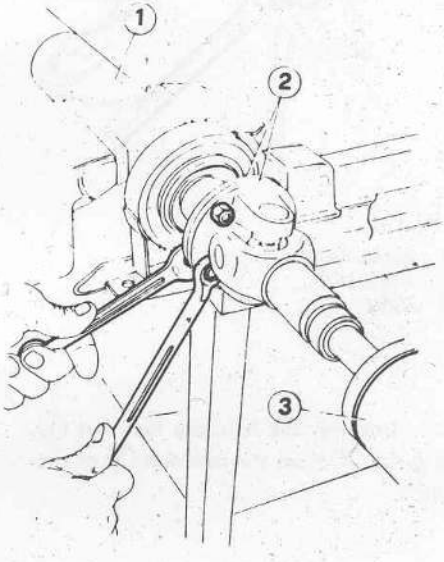


1 Center carrier
2 Nuts

DISASSEMBLY

SEPARATING THE SHAFTS

1. If not already present, make some reference marks which correspond to the intermediate flanges and the rear shaft spline.
2. Put the front shaft (1) onto a vice equipped with protective jaws.
3. Separate the front shaft from the rear one (3), having unscrewed the four bolts joining the two intermediate flanges (2).

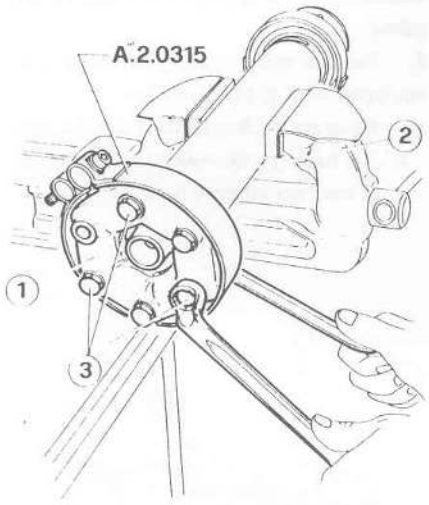


1 Front shaft
2 Intermediate flanges
3 Rear shaft

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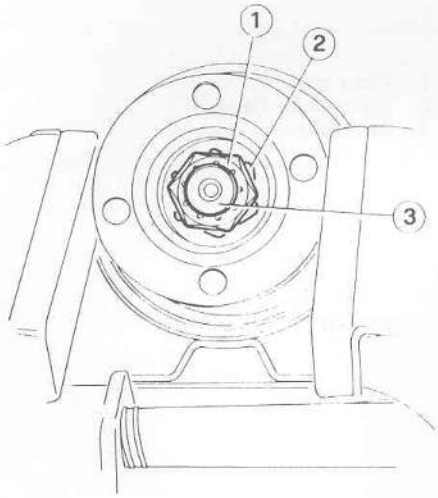
DISMANTLING THE FRONT SHAFT

1. Mount tool **A.2.0315** on the front flexible coupling (1), unscrew the three bolts (3) securing the coupling to the shaft and slide off the coupling.



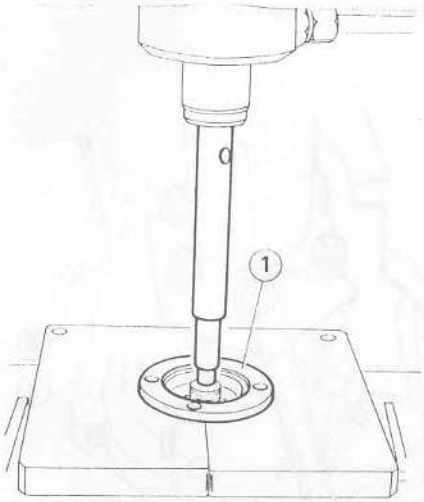
1 Front flexible coupling
2 Front shaft
3 Bolts

2. Unscrew the laminate lock nut (1) and nut (2) from the rear end (3) of the shaft.



1 Laminate lock nut
2 Nut
3 End of shaft

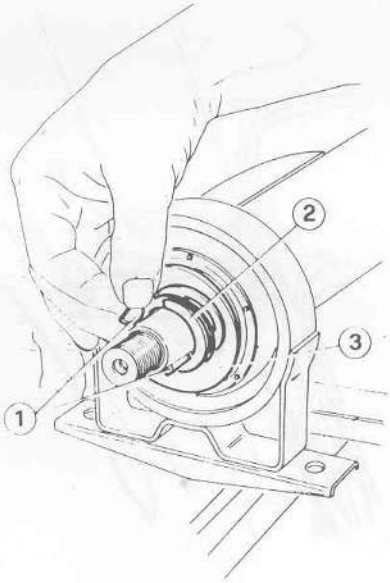
3. Using the two halfplates and a punch, at the press take out the rear flange (1) from the shaft.



1 Rear flange

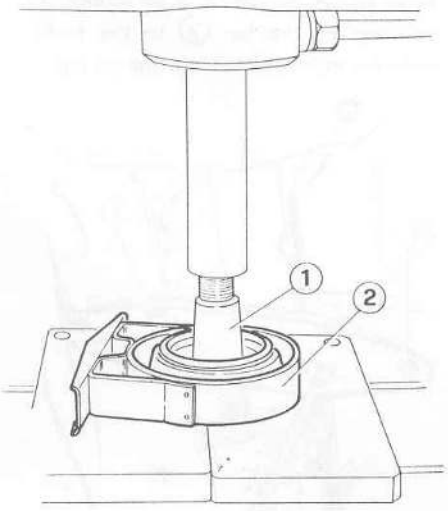
WARNING:
Never allow the shaft to drop.

4. Extract the two keys (1) and slide out the spring (2) and the cup (3).



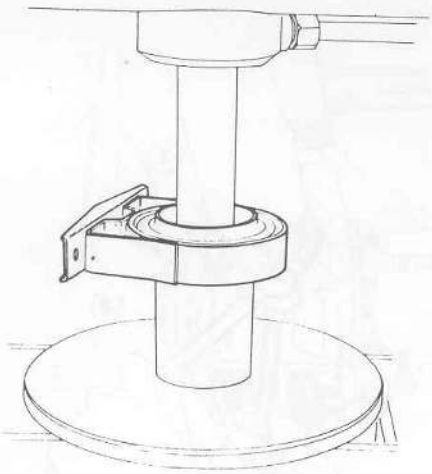
1 Keys
2 Spring
3 Cup

5. Using the halfplates which beat against the internal part of the central support, slide off at the press the central support (2), together with the bearing, from the shaft (1) and retrieve the second cup.



1 Front shaft
2 Central support

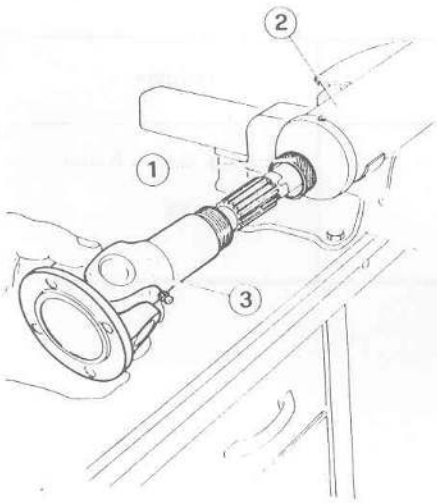
6. Take the bearing out from the central support at the press.



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DISASSEMBLING THE REAR SHAFT

1. Unscrew the ring nut (1) and slide off the front universal joint (3) from the shaft spline (2).



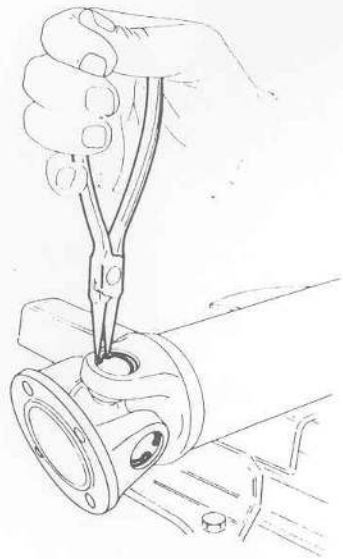
1 Ring nut
2 Rear shaft spline
3 Universal joint

2. If necessary, dismantle the universal joints.

WARNING:
Make sure that replacement trunnions and needle cages are available as spares.

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a. Mark the references for the reciprocal position of the two forks of the universal joint.
b. Take out the four retainer spring rings securing the trunnion to the forks.



c. Using a punch, tap one end of the trunnion, retrieve the needle cage from the opposite side, free the trunnion and retrieve the needle cages.

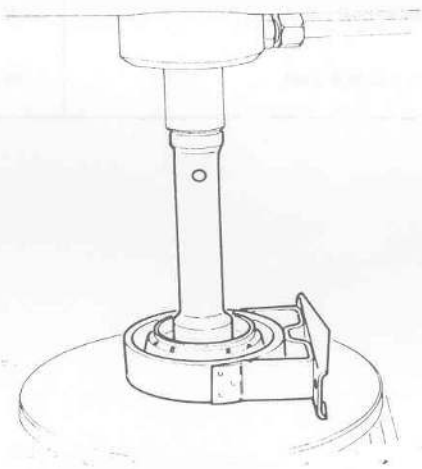
INSPECTION AND CHECKS

1. Wash the parts thoroughly and inspect carefully for any superficial defects.
2. Check that the bearing of the central support is neither worn nor damaged. When the bearing is revolved there should be no noise or seizing.
3. Verify that the flexible coupling is intact (replace if there are cracks or cuts).
4. Check whether the spline are damaged or show signs of excessive wear.
5. Replace all components considered no longer efficient.

REASSEMBLY

Reassemble the drive shaft in reverse order of disassembly.
The following instructions must be strictly adhered to:

- Keep to the marks made during disassembly or existing before hand.
- Using a press reassemble the central support bearing as illustrated.



- Observe the following tightening torques.

(T) : **Tightening torques**
Bolts securing the front flexible coupling to the transmission
54 thru 56 N·m
(5.5 thru 5.7 kg·m)
(39.8 thru 41.3 ft·lb)

Bolts securing the intermediate transmission flanges
37 thru 39 N·m
(3.8 thru 4 kg·m)
(27.3 thru 28.8 ft·lb)

Nut securing the flange and central support to the front drive shaft
98 thru 137 N·m
(10 thru 14 kg·m)
(72.3 thru 101.1 ft·lb)

- Pack the front transmission bushing with the specified grease.

Grease:
AGIP Grease 15
SHELL Retinax A
IP Auto Grease MP

- Using approximately 15 g (0.53 oz) of the same grease, lubricate the central transmission sleeve.

INSTALLATION

Reconnect the propeller shaft by carrying out removal operations in reverse order and adhering to the following instructions:

- If not already done during the overhaul, fill the front bushing with the specified grease and lubricate the slip yoke of the propeller shaft with approximately 15 g (0.53 oz) of the same grease.

Grease:
AGIP Grease 15
SHELL Retinax A
IP Auto Grease MP

- Use new self-locking nuts and observe the following tightening torques.

(T) : **Tightening torques**
Bolts securing the front flexible coupling to the gearbox fork
54 thru 56 N·m
(5.5 thru 5.7 kg·m)
(39.8 thru 41.3 ft·lb)

Bolts securing the rear flange to the differential
37 thru 39 N·m
(3.8 thru 4 kg·m)
(27.3 thru 28.8 ft·lb)

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TECHNICAL SPECIFICATIONS AND FEATURES

GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

Application	Type	Denomination	Quantity
Propeller shaft slip yoke Propeller shaft front bushing	GREASE	AGIP: Grease 15 IP: Auto Grease MP SHELL: Retinax G11 Norm. 3631-69408	15 ± 5 g. (0.52 ± 0.17oz) Fill

TIGHTENING TORQUES

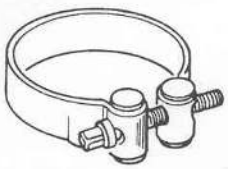
Item	N·m	Kg·m	ft·lb
Bolts securing the front flexible coupling to the gearbox fork and to the propeller shaft	54 thru 56	5.5 thru 5.7	39.8 thru 41.3
Bolts securing the intermediate propeller shaft flanges	37 thru 39	3.8 thru 4	27.3 thru 28.8
Bolts fixing the rear propeller shaft flange to the differential	37 thru 39	3.8 thru 4	27.3 thru 28.8
Nut fixing the flange and center carrier to the front propeller shaft	98 thru 137	10 thru 14	72.3 thru 101.1

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TROUBLESHOOTING AND CORRECTIVE ACTIONS

Trouble	Probable cause	Corrective action
Vibration	• Lack of lubricant on the propeller shaft slip yoke	Grease the spline
	• Elastic supports of the engine assy excessively pre-loaded, or damaged	Check the alignment of the supports and, if necessary, replace them
	• Excessive trunnion play	Replace the trunnions
	• Propeller shaft not balanced	• Check that the four arrows cut in the shaft are aligned • If vibration fails to cease, detach the propeller shaft from the rear differential flange and turn the shaft 180° • If vibration persists, either balance or replace the propeller shaft
Noise	• Propeller shaft center carrier bearing is worn	Replace the bearing
	• Elastic part of the propeller shaft center carrier has deteriorated features	Replace the carrier
	• Flexible coupling is worn	Replace the coupling
	• Nuts securing the flexible coupling are loose	Tighten coupling nuts
	• Screws securing the center carrier are loose	Tighten carrier screws
Noise during acceleration and deceleration	• Excessive play in the spline	Check and/or replace
	• Spring coupling worn	Replace the coupling
	• Nuts securing the flexible coupling are loose	Tighten the coupling nuts

SPECIAL TOOLS

Identity N°	Denomination		Reference page
A.2.0315	Tool for disassembly and assembly of the flexible coupling		15-4

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UNIT 17

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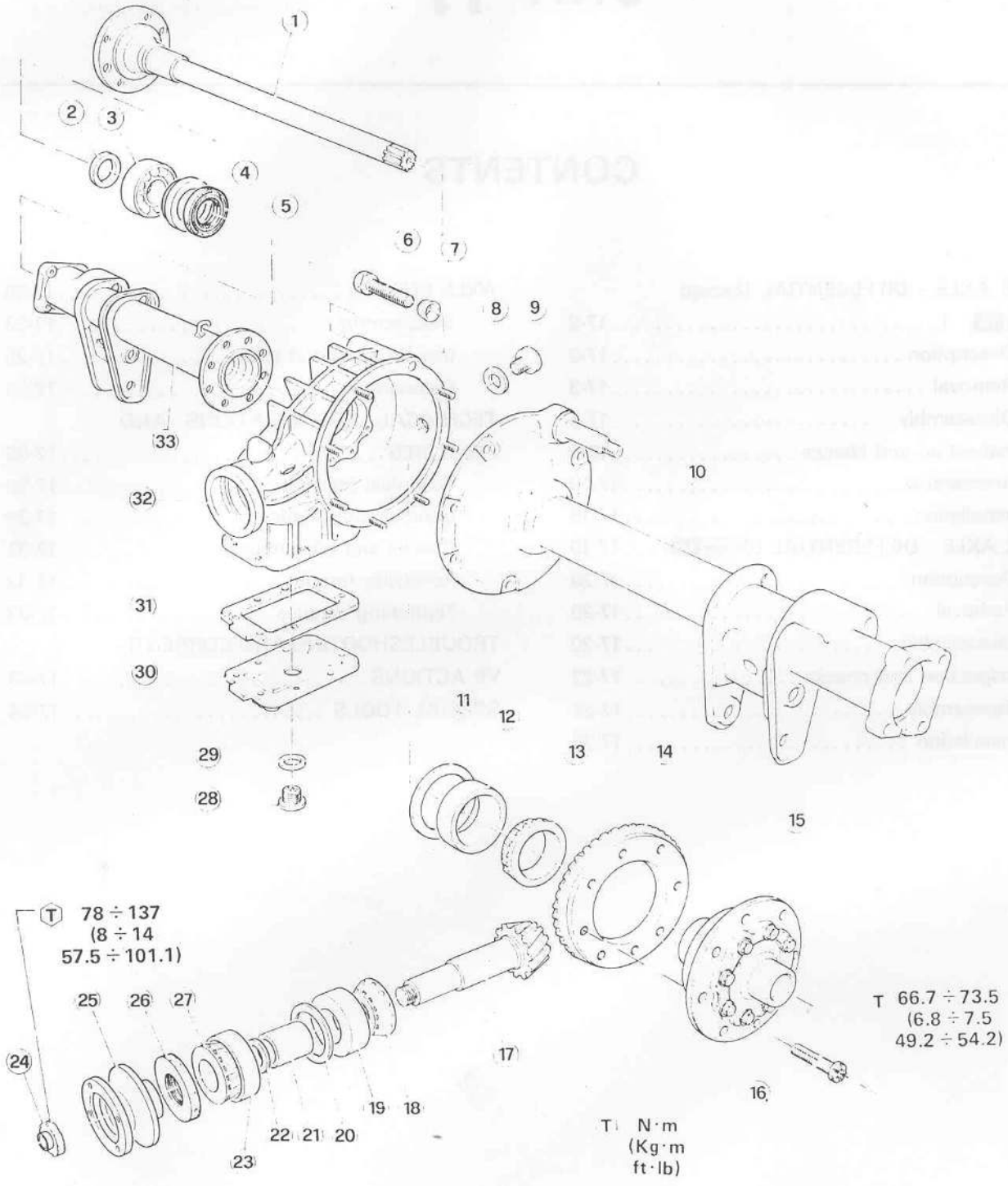
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REAR AXLE - DIFFERENTIAL (Except Spider 1.6)



1 Axle shaft
2 Spacer
3 Axle shaft bearing
4 Ring
5 Seal ring
6 Screw
7 Washer
8 Washer
9 Filler plug
10 Pipe of left axle
11 Adjusting ring
12 Differential bearing external race
13 Differential bearing internal race
14 Ring gear
15 Differential case
16 Screw
17 Pinion
18 Pinion rear bearing internal race
19 Pinion rear bearing external race
20 Adjusting ring
21 Spacer
22 Adjusting ring
23 Pinion front bearing external race
24 Ringnut
25 Propeller shaft flange
26 Seal ring
27 Pinion front bearing internal race
28 Drain plug
29 Washer
30 Bottom cover
31 Gasket
32 Differential carrier
33 Pipe of right axle

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DESCRIPTION

The rear axle, connected elastically to the bodywork, is made up of the differential unit (pinion (17), ring gear (14) and differential casing (15) housed in an aluminium case (32) from which the tubular pipes (axle pipes (10) and (33)), housing the axle shaft (1) which take the motion from the differential unit, all stem.

Structurally, the differential unit is the hypoid crown wheel and pinion type with a limited-slip differential case.

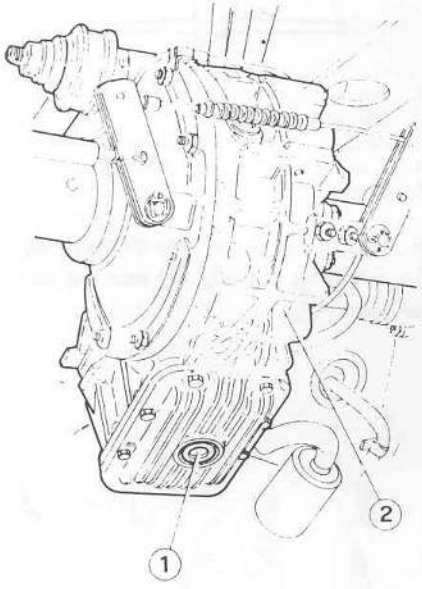
The axle shafts (1), each one assembled inside the corresponding rear axle pipe, connect the wheels and the differential and are supported, on the wheel side, by a ball-bearing (3).

Each rear axle pipe features connections securing the rear axle to the trailing arms and rebound straps of the rear suspension limit stop.

Adjustment of the distance between the pinion and ring axis, as for adjustment of the pinion taper bearing and differential case pre-load, as well as that of the play between pinion and ring gear toothing is accomplished by means of shims.

REMOVAL

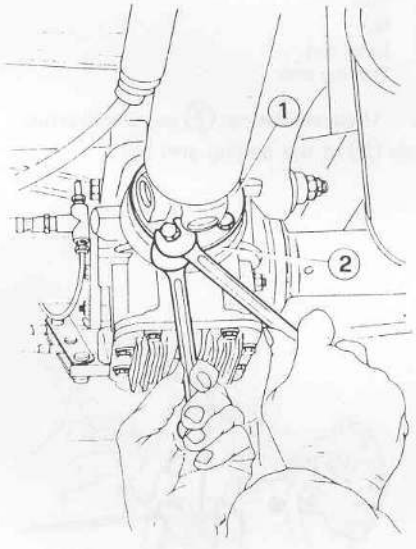
1. Put the car on a lift and raise.
Unscrew the screw plug (1) and drain the oil from the differential (2).



1 Plug
2 Differential

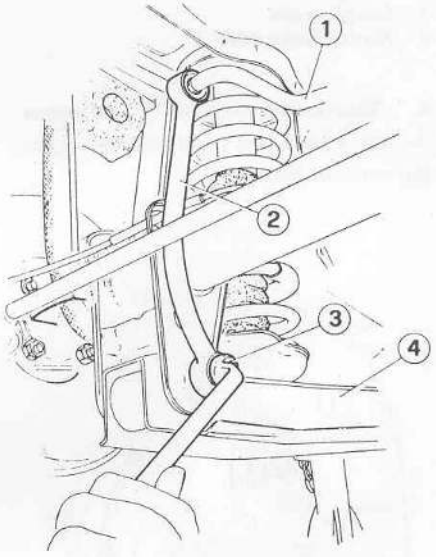
2. Position a column type jack beneath the differential, raise the car at the rear, secure it onto safety stands and remove the rear wheels.

3. Put some reference marks on the rear transmission flange (1) and on the differential one (2), unscrew the four bolts uniting them, rotating the propeller shaft each time, then separate the two flanges.



1 Rear transmission flange
2 Differential flange

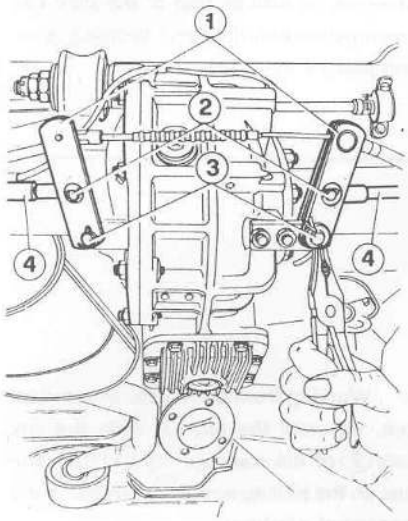
4. Working from both sides of the rear-axle, unscrew the nut (3) slide the link rods (2) of the stabilizer bar (1) from the pins on the trailing arms (4), retrieving the associated washers.



1 Stabilizer bar
2 Stabilizer bar rod
3 Nut
4 Trailing arm

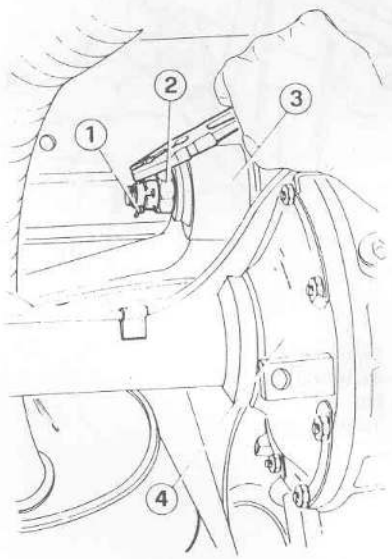
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5. Extract the cotter pins and slide out the pins (2) and (3) coupling the cables (4) and parking brake brackets (1) and retrieve the associated washers.



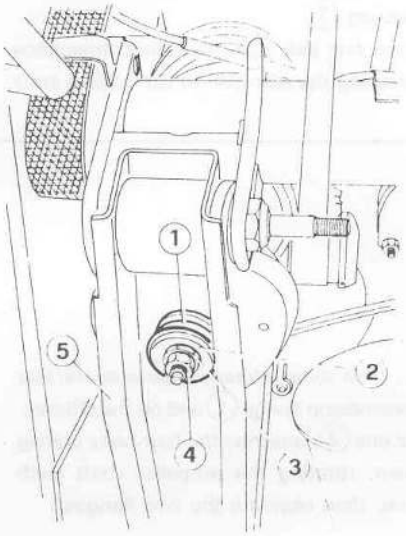
1 Brackets
2 Wire pin
3 Coupling pin
4 Parting brake cable

6. Take out the cotter pin (1) and loosen the nut (2) securing the differential (4) to the reaction triangle (3).



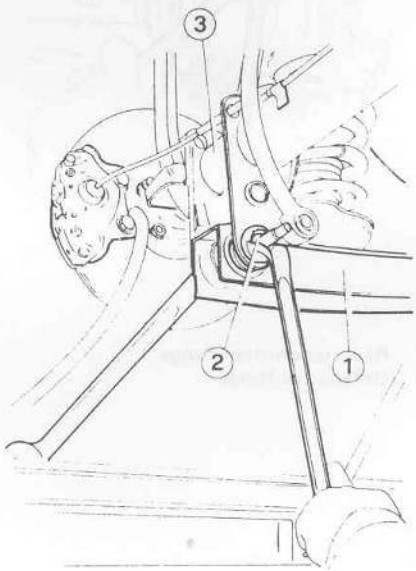
1 Cotter pin
2 Nut
3 Reaction triangle
4 Differential

7. Working from both sides of the rear axle, unscrew the lock nut (4) and nut (3) securing the shock absorber to the trailing arm (5) retrieving the cup (2) and the rubber cushion (1).



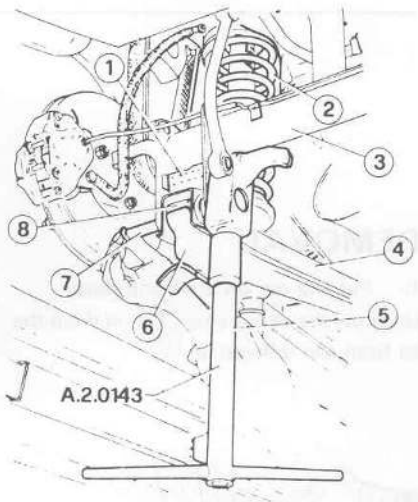
1 Rubber cushion
2 Cup
3 Nut
4 Lock nut
5 Trailing arm

8. Unscrew the nut (2) securing the rear axle (3) to the trailing arm (1).



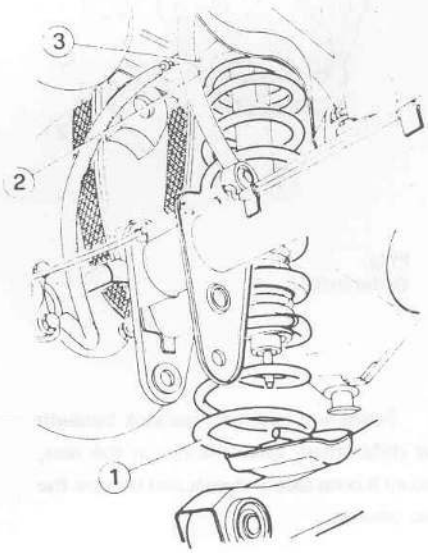
1 Trailing arm
2 Nut
3 Axle

9. Assemble tool **A.2.0143**, by inserting pin (1) in the hole on the axle flange.
Turn the tool sleeve (5) until the tool bracket (6) comes against the spring bushing housing (8).
At this point it is possible to free the pin (7) coupling the trailing arm (4) and axle (3).
Turn the tool sleeve so as to lower the bracket and release the spring (2).



1 Pin
2 Spring
3 Axle
4 Trailing arm
5 Sleeve
6 Bracket
7 Pin
8 Spring bushing housing

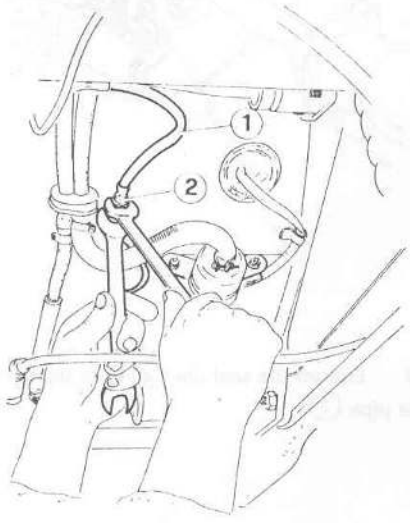
10. Dismantle the tool, slide off the spring (1), retrieving the cup (2) and the upper gasket (3).



1 Spring
2 Cup
3 Gasket

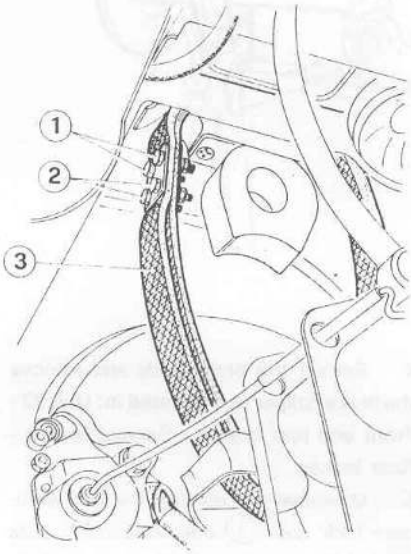
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11. Using a syringe, empty the hydraulic brake assembly then disconnect the hose (1) from the union (2).



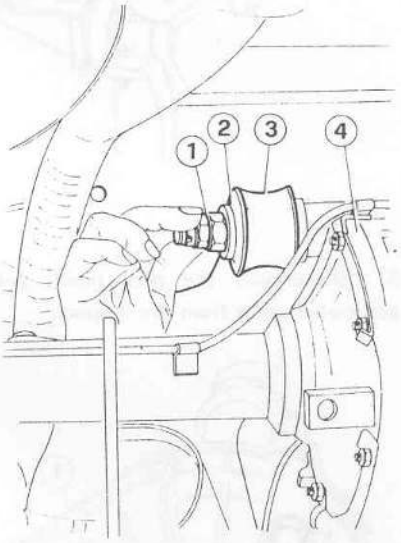
1 Hose
2 Union

13. Working from both sides of the rear-axle, loosen the two upper bolts (1), unscrew the lower ones (2) and slide off the limit rebound strap (3).



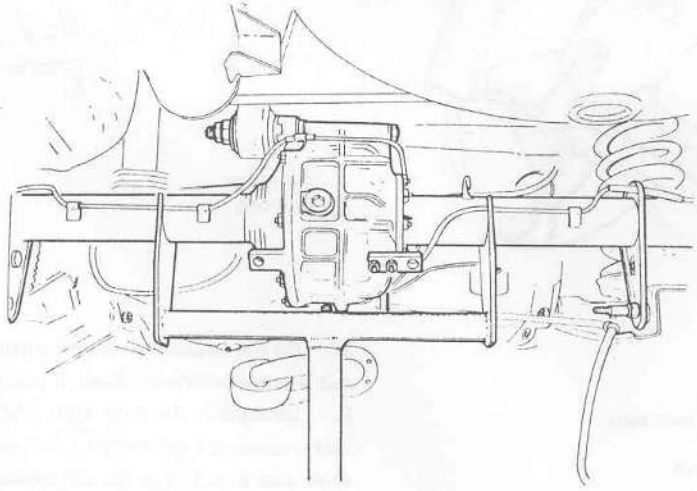
1 Upper bolts
2 Lower bolts
3 Rebound strap

14. Unscrew the previously slackened nut (1) securing the differential (4) to the reaction triangle (3), retrieving the bushing (2), then move the rear-axle towards the right so as to slide off the nut, lower the lift and retrieve the entire rear-axle.



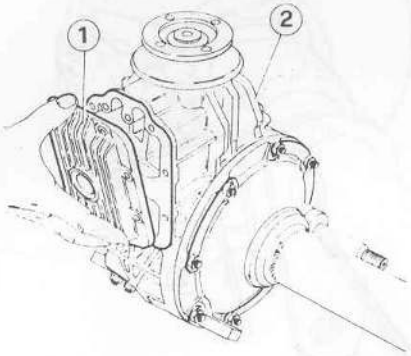
1 Nut
2 Bushing
3 Reaction triangle
4 Differential

12. Place a column type jack complete with suitable carrier beneath the rear-axle.



DISASSEMBLY

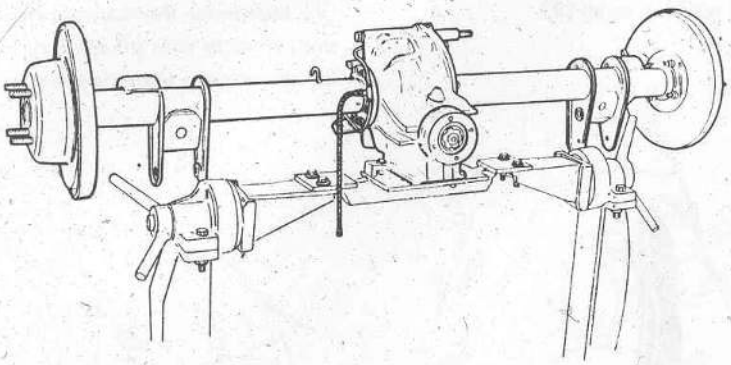
1. Check that the oil is drained, unscrew and remove the eight screws and washer securing the lower cover (1) to the differential carrier (2), retrieve the cover and associated gasket.

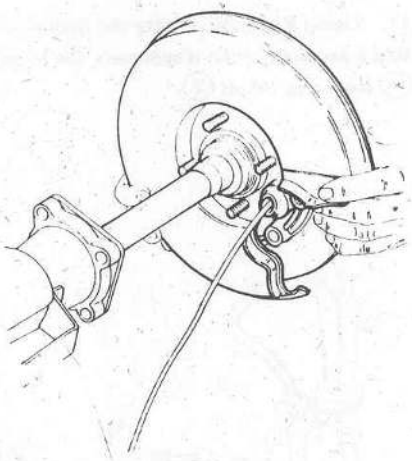


1 Lower cover
2 Differential carrier

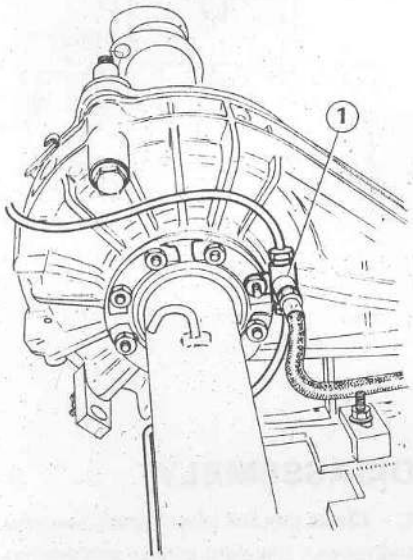
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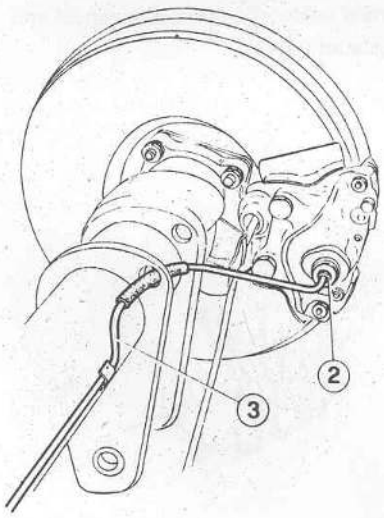
2. Mount the axle on a suitable stand equipped with support.





3. Disconnect the pipe union and associated pipes from the calipers.

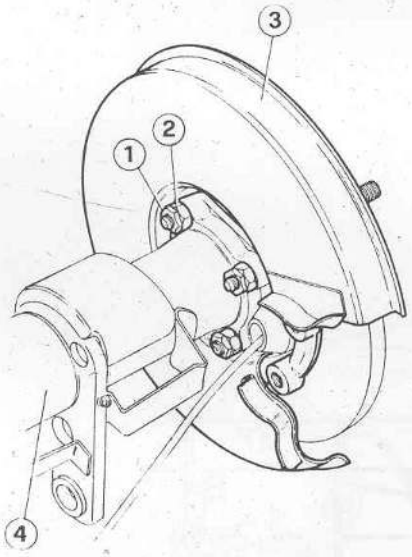




1 Pipe union
2 Brake caliper union
3 Brake circuit pipe

4. Extract the brake pads and remove the brake caliper as illustrated in: Unit 22 - Front and rear brakes - Service brakes - Rear brakes.

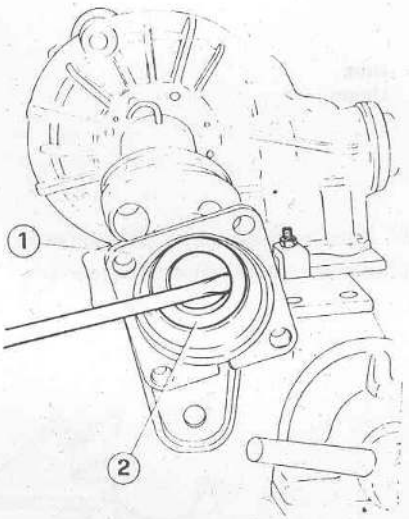
5. Unscrew and remove the four laminate lock nuts (1) and associated nuts (2) holding the shoe-holders and splash shield (3) to the axle pipe (4).



1 Laminate lock nuts
2 Nut
3 Splash sheld
4 Axle pipe

6. Slide off the complete axle-shaft - brake disc - shoe-holder - splash shield assembly.

7. Extract the seal ring (2) from the axle pipe (1).

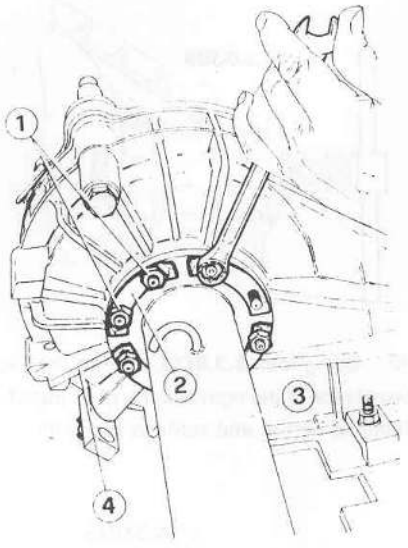


1 Axle pipe
2 Seal ring

8. On the opposite side of the axle carry out the operations outlined in points 4-7.

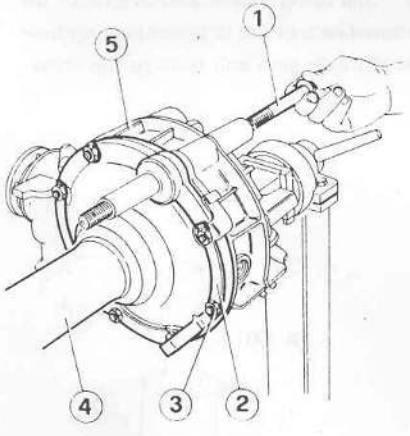
9. Straighten the four stop plates (2) and unscrew the eight nuts (1) securing the right axle pipe (3) to the differential carrier (4). Retrieve the plates and slide out the pipe.

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1 Nuts
2 Stop plate
3 Right axle pipe
4 Differential carrier

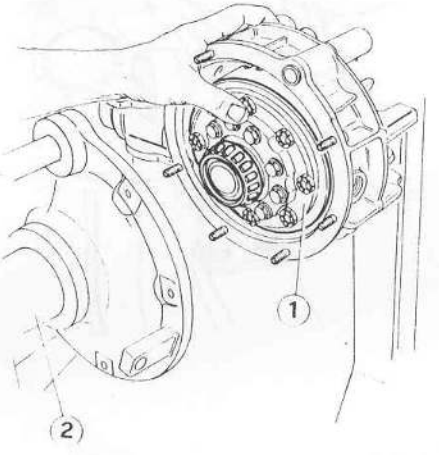
10. Unscrew and remove the screw (1) from the right side, straighten the four stop plates (2), unscrew and remove the seven nuts (3) securing the left axle pipe (4) to the differential carrier (5) and retrieve the plates.



1 Screw
2 Stop plate
3 Nut
4 Left axle pipe
5 Differential carrier

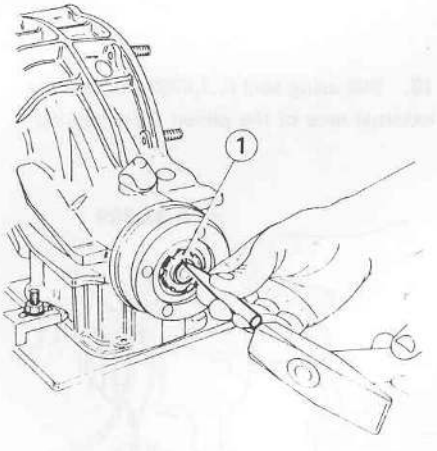
11. Slide out the left axle pipe (2) and retrieve the differential case (1) together with the ring gear.

CAUTION:
While sliding out the axle pipe, hold the differential case to prevent it from falling.



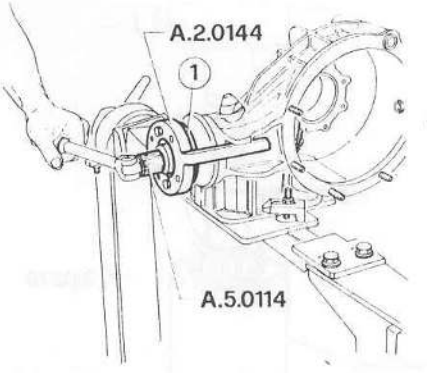
1 Differential case
2 Left axle pipe

12. Eliminate the two calks of the front ring nut (1).



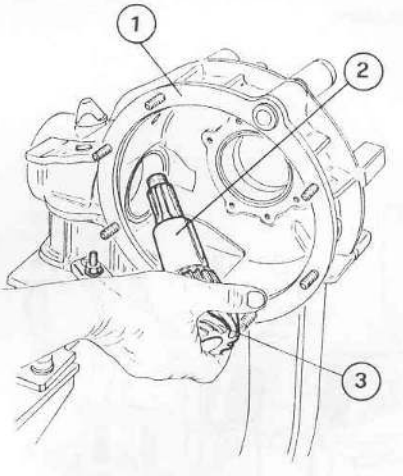
1 Ring nut

13. Apply tool **A.2.0144** to the propeller shaft coupling flange (1) to prevent the pinion from turning, unscrew the ring nut using tool **A.5.0114** and slide off the flange.



1 Propeller shaft coupling flange

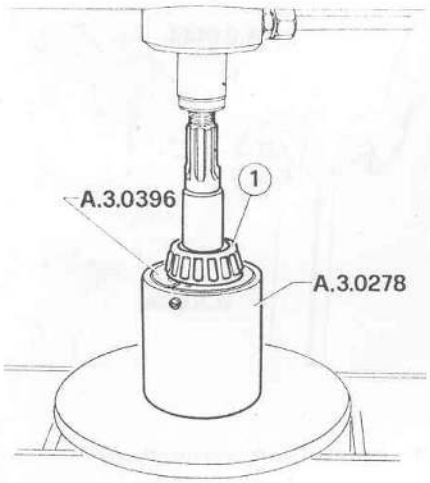
14. Slide out the pinion (3) from inside the differential carrier (1) and retrieve the spacer (2).



1 Differential carrier
2 Spacer
3 Pinion

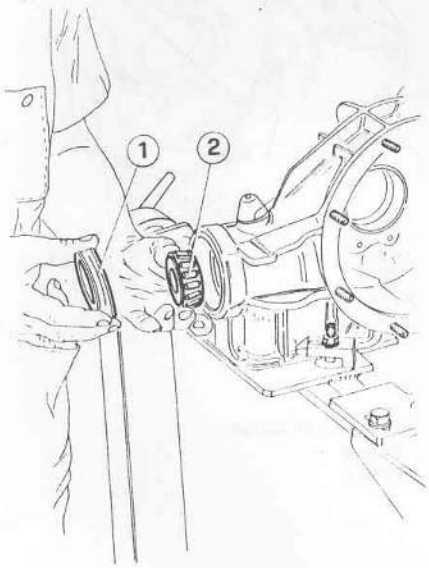
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15. Using base **A.3.0278** and the half rings **A.3.0396** extract the internal race (1) of the pinion rear bearing at the press.



1 Internal race of the pinion rear bearing

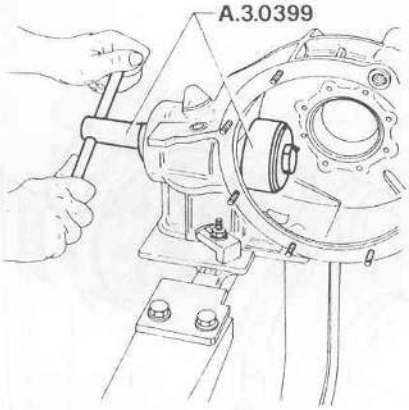
16. Extract the seal ring (1), slide out the internal race (2) of the front bearing and the shim.

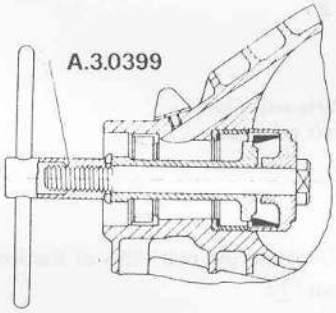


1 Seal ring
2 Pinion front bearing internal race

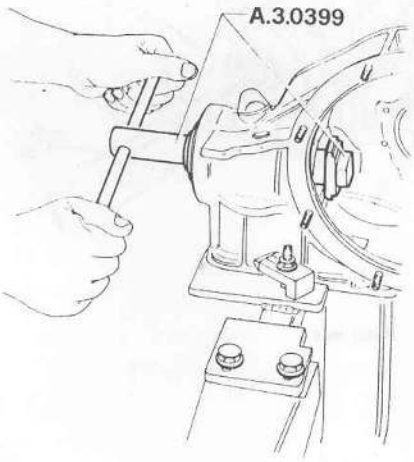
WARNING:
Keep separate the shims associated with each bearing.

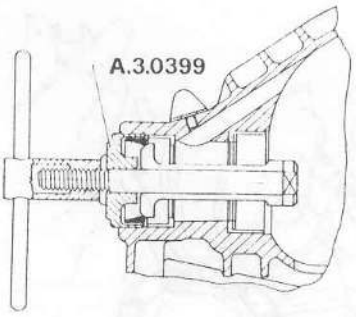
17. Using tool **A.3.0399**, take out the external race of the pinion rear bearing from the differential carrier and retrieve the shim.



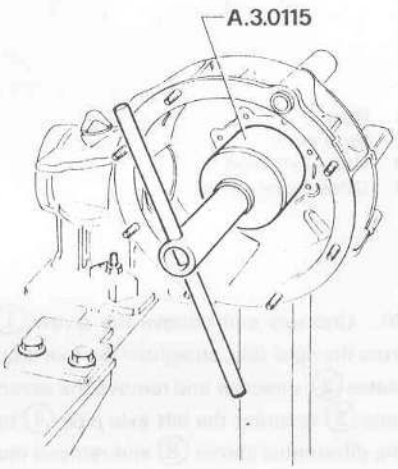


18. Still using tool **A.3.0399**, extract the external race of the pinion front bearing.

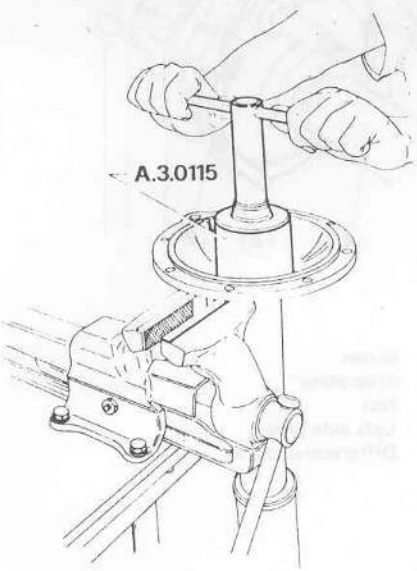




19. Using tool **A.3.0115**, extract the external race of the right bearing from the differential carrier and retrieve the shim.

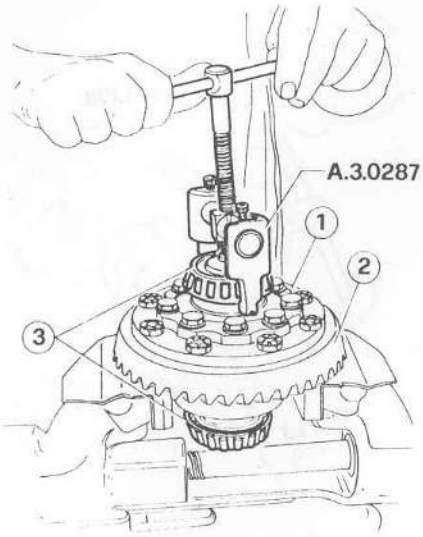


20. Still using tool **A.3.0115** extract the external race of the lefthand bearing from the left axle pipe and retrieve the shim.



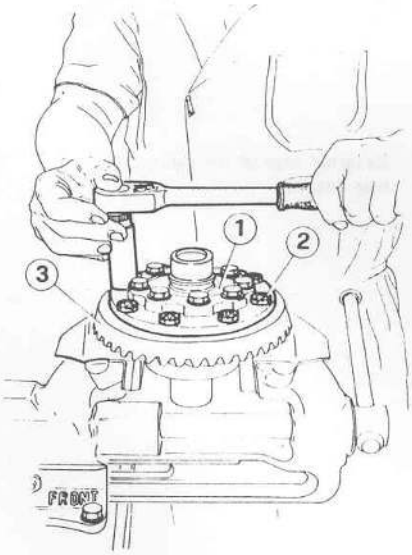
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21. Mount the differential case (1) together with the ring gear (2) on a vice equipped with protective jaws then, using tool **A.3.0287**, extract the internal races of the left and righthand bearings (3).



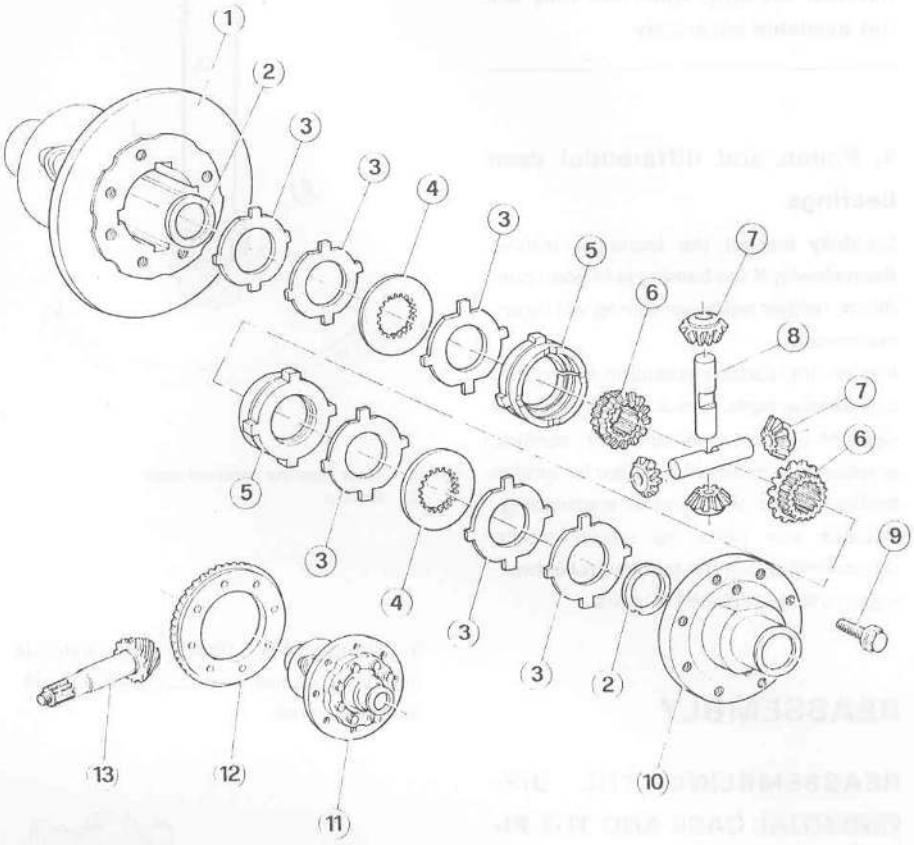
1 Differential case
2 Ring gear
3 Bearing internal races

22. Mark the corresponding positions of the differential case (1) and ring gear (3), unscrew the eight clamp screws (2) and separate the two parts.



1 Differential case
2 Screw
3 Ring gear

23. Unscrew the eight screws (9) and disassemble the component parts of the differential case.



1 Differential case
2 Shim
3 External blade
4 Internal blade
5 Pressure ring
6 Side gear
7 Planetary gear
8 Pin
9 Screw
10 Differential case cover
11 Differential case complete
12 Ring gear
13 Pinion

INSPECTION AND CHECKS

Thoroughly wash the components and in particular clean sealant residue from the surfaces joining the differential carrier to the axle pipes and lower cover, using denaturated alcohol.
Visually inspect the various mechanical parts.

1. Differential carrier

Check that the differential carrier is not cracked or chipped. Particularly, check that the housings of the external rings of the pinion bearings and of the differential case are not damaged.

2. Differential case

Check visually that the gear teeth have no cuts or signs of seizing and that they mesh evenly on all the surface.
Replace damaged parts.

3. Final drive gears

Check that the bevel pinion teeth work on the entire surface.
Furthermore, check whether gear teeth shows signs of binding or excessive wear. Moreover, if chipped teeth or noisy operation is experienced, both final drive gears must be replaced with new ones.

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WARNING:
Pinion and ring gear are supplied as a notched set only, therefore they are not available separately.

4. Pinion and differential case bearings

Carefully inspect the bearings, turning them slowly; if the bearing is in good condition, neither noise nor seizing will be encountered.
Inspect the surface condition of the ring and rotating parts, which should not show signs of unusual wear and tear, scoring, grinding due to abrasive action by foreign bodies, traces of seizing or overheating.
Replace any parts no longer intact, remembering that the tape red roller bearings must be replaced in pairs.

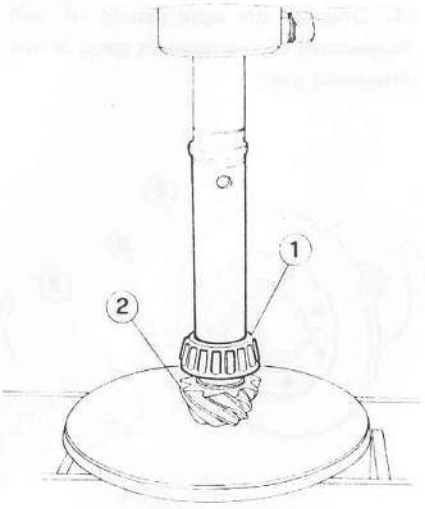
REASSEMBLY

REASSEMBLING THE DIFFERENTIAL CASE AND THE PINION

1. Reassemble the differential case by carrying out disassembly operations in reverse.
2. Check the state of the differential case - ring gear joining surfaces, eliminating any flashlines.
3. Mount the ring gear on the differential case, observing the reference marks made on disassembly, screw on the clamp screws and associated plates, tighten them in diagonal order to the specified torque and bend the plates back.

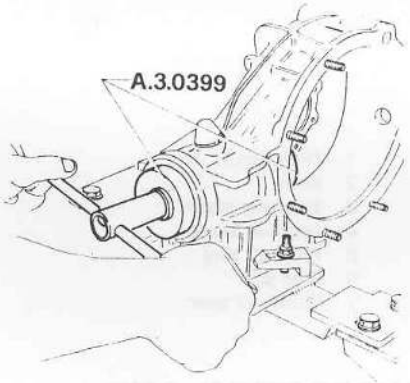
(T) : **Tightening torque**
Screws clamping the ring gear to the differential case
66.7 thru 73.5 N·m
(6.8 thru 7.5 kg·m)
(49.2 thru 54.2 ft·lb)

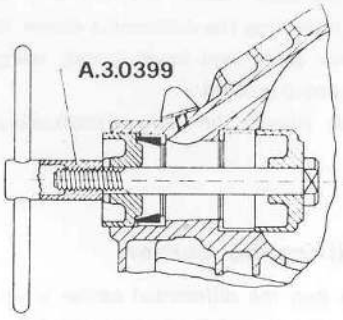
4. Working at the press, mount the rear bearing internal race (1) onto pinion (2).



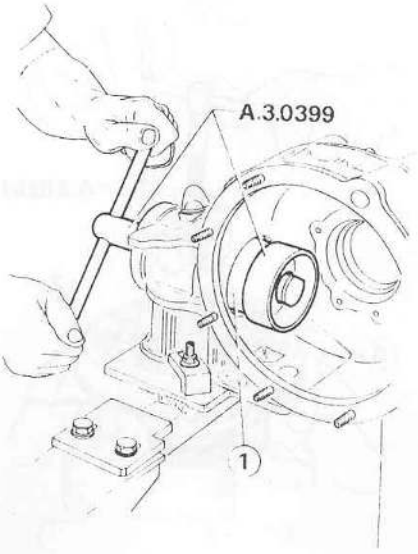
1 Rear bearing internal race
2 Pinion

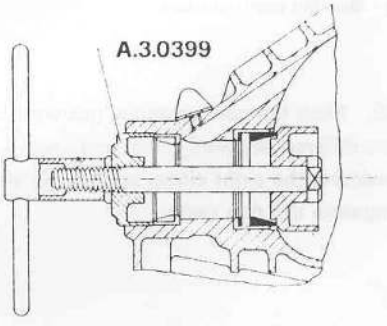
5. Using tool **A.3.0399**, put the external ring of the pinion front bering into the differential carrier.





6. Still using tool **A.3.0399**, put in the external race of the pinion rear bearing and the associated shim.

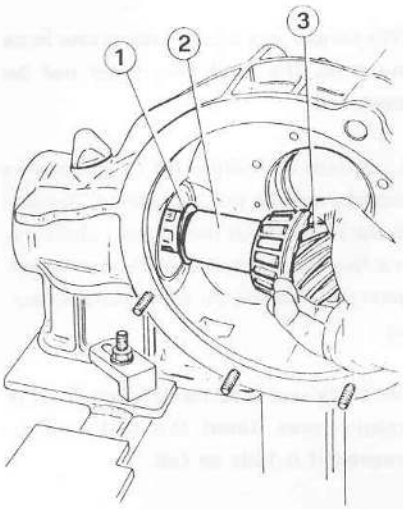




1 External race of the pinion rear bearing

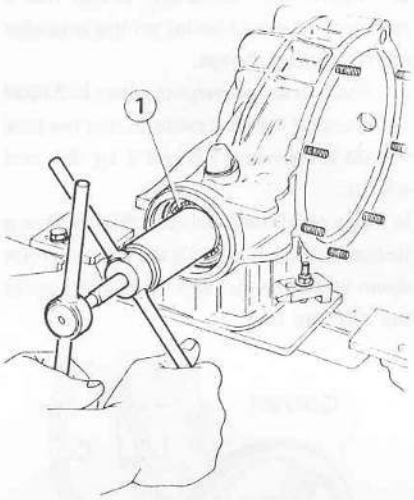
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7. Insert pinion (3) together with spacer (2) and shim (1) associated with the front bearing and previously removed, in the differential carrier.



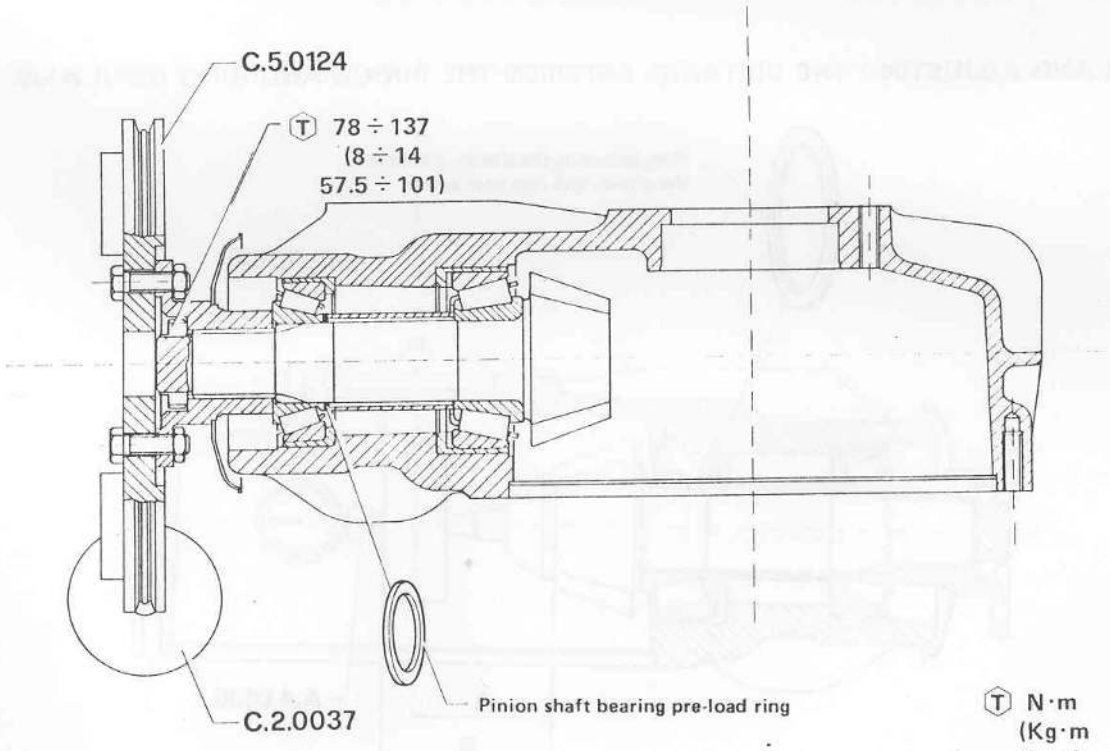
1 Shim
2 Spacer
3 Pinion

8. Mount the internal race of front bearing (1) on the pinion.



1 Front bearing internal race

CHECKING THE PRE-LOAD OF PINION BEARINGS

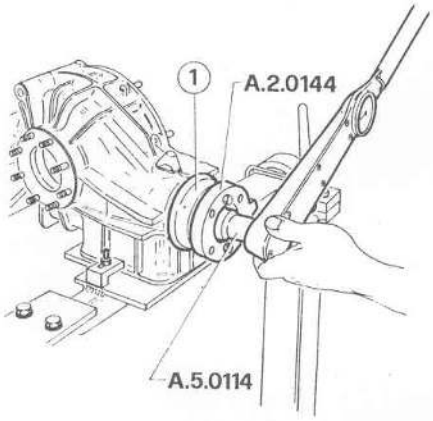


T N·m
(Kg·m
ft·lb)

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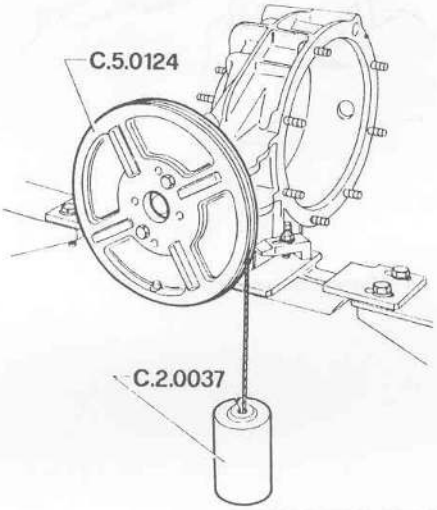
1. On the pinion mount the propeller shaft coupling flange (1) together with tool **A.2.0144**, screw on the ring nut and tighten it to the specified torque using a torque wrench equipped with an extension (tool **A.5.0114**).

(T) : **Tightening torque**
Ring nut securing the flange to the propeller shaft
78 thru 137 N·m
(8 thru 14 kg·m)
(57.5 thru 101 ft·lb)



1 Propeller shaft coupling flange

2. Remove flange stopping tool **A.2.0144** and turn the pinion several times by hand in both directions in order to settle the bearings.
3. Mount disc **C.5.0124**, which has a radius of 10 cm (3.94 in) on the propeller shaft coupling flange.
4. Position some weights of set **C.2.0037** at the end of the steel cable so that the total weight is between 1.5 and 2 kg (3.3 and 4.4 lb).
In these conditions the specified revolving torque is accomplished if the weight drops down without a halt and without dragging the disc too fast.



T : **Revolving torque of the pinion alone**
147 thru 196 N·m
(15 thru 20 kg·m)
(1.08 thru 1.44 ft·lb)

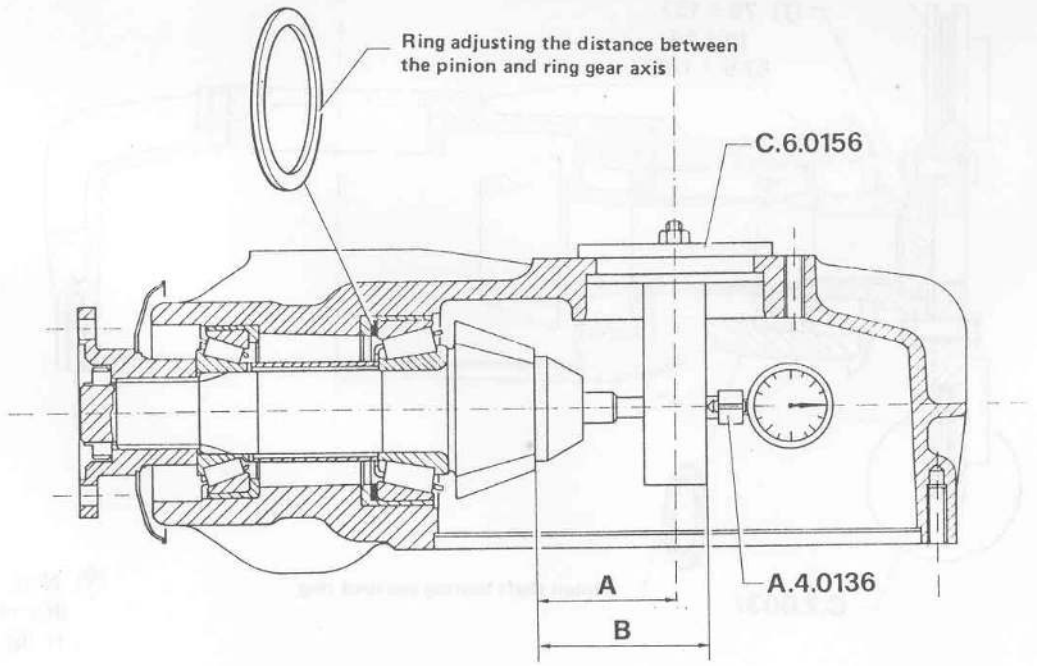
This torque is a sheer rolling one in as much as the seal ring need not be mounted.

5. Should the weight fail to go down in accordance with this description, dismantle the pinion from the support and vary, to achieve an appropriate thickness, the adjusting ring associated with the front bearing.

The thickness is to be decreased if the weight goes down too fast and increased if it fails to fall.

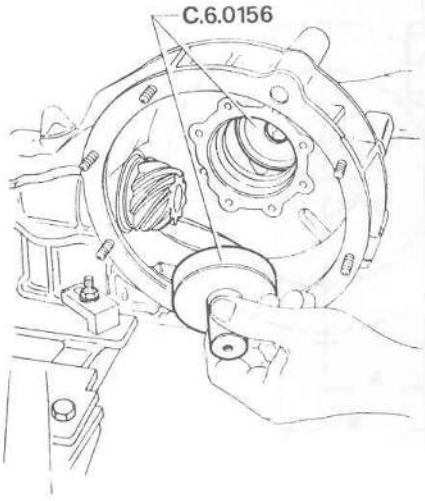
6. Proceed by trial and error until the correct pre-load value is achieved.

CHECKING AND ADJUSTING THE DISTANCE BETWEEN THE PINION AND RING GEAR AXIS



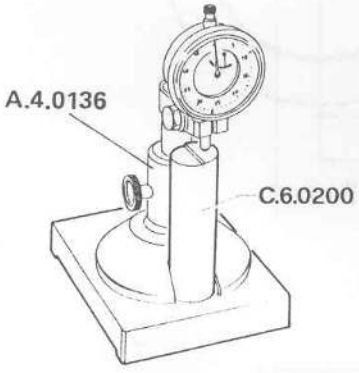
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In order to determine the pinion - ring gear axis distance and therefore the tickness of the adjusting ring to be placed in correspondence with the pinion rear bearing, observe the following procedure.



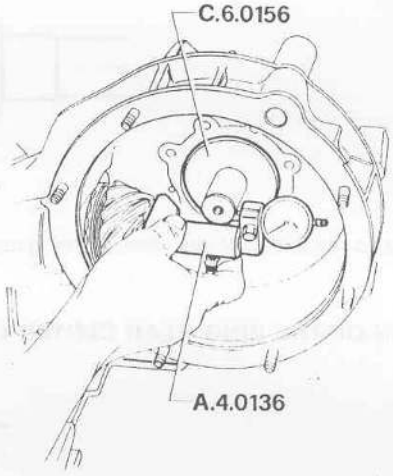
1. Mount tool **C.6.0156** on the differential carrier in the housing of the differential support righthand bearing.
2. Mount a dial gage on support **A.4.0136** and zero it with the aid of the check gauge **C.6.0200**.

Reset the dial gage to the highes distance, equal to 71.5 mm.



3. Read dimension "C", plus or minus, stamped on the pinion head.
4. Rest the support **A.4.0136** with the dial gage on the pinion head and read the deviation "L", plus or minus with respect to dimension "B" (nominal distance between the piston head and the generating line of tool **C.6.0156** pin for ring gear axis reference).

This reading should correspond, is value and sign, to the dimension stamped on the piston head.



5. Should this condition fail to be accomplished, it shall be necessary to put the pinion back to the correct assembly position by varying thickness "S", located between the external ring of the pinion rear bearing and the housing on the differential carrier, accordingly.

The calculation to be made is:

$$S = \pm L - (\pm C)$$

- Increase the thickness to move the pinion closer to the ring gear axis.
- Decrease the tickness to move the pinion away from the ring gear axis.

6. From the range of adjusting rings available as spare parts, select the one closest to the value established.

WARNING:

So as not to change the pinion bearing pre-load, vary the thickness of the adjusting washer located between the spacer and the internal ring of the pinion front bearing, simultaneously, to the same quantity and sign.

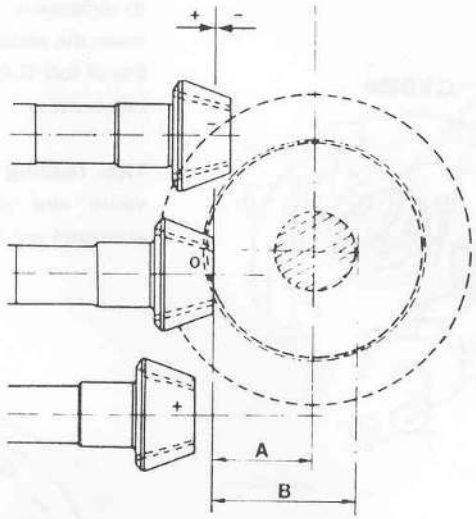
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PRACTICAL EXAMPLES

INTERPRETATION OF THE VALUE (IN HUNDREDTHS OF mm) STAMPED ON THE PINION HEAD

DISTANCE BETWEEN THE RING GEAR CENTER LINE AND THE PINION HEAD

— less than nominal
\+ greater than nominal
0 equal to nominal

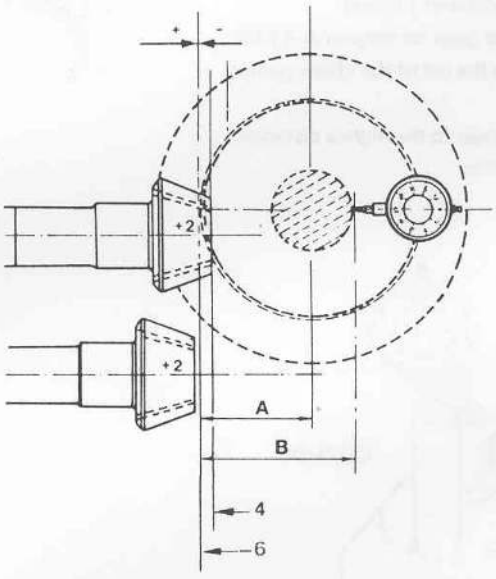


A : Nominal dimension
B : Nominal control dimension corresponding to the indicator dial reset on the gauge

CHECK AND CONSEQUENT CORRECTION OF THE RING GEAR CENTER LINE - PINION DISTANCE

S = (± Dial indicator reading minus)
(± Mark on the pinion)
S = (−4) − (+2) = −6

The value, expressed in hundredths of mm to which the pinion should be moved away from the ring gear, subtracting the shims displayed below the pinion head.

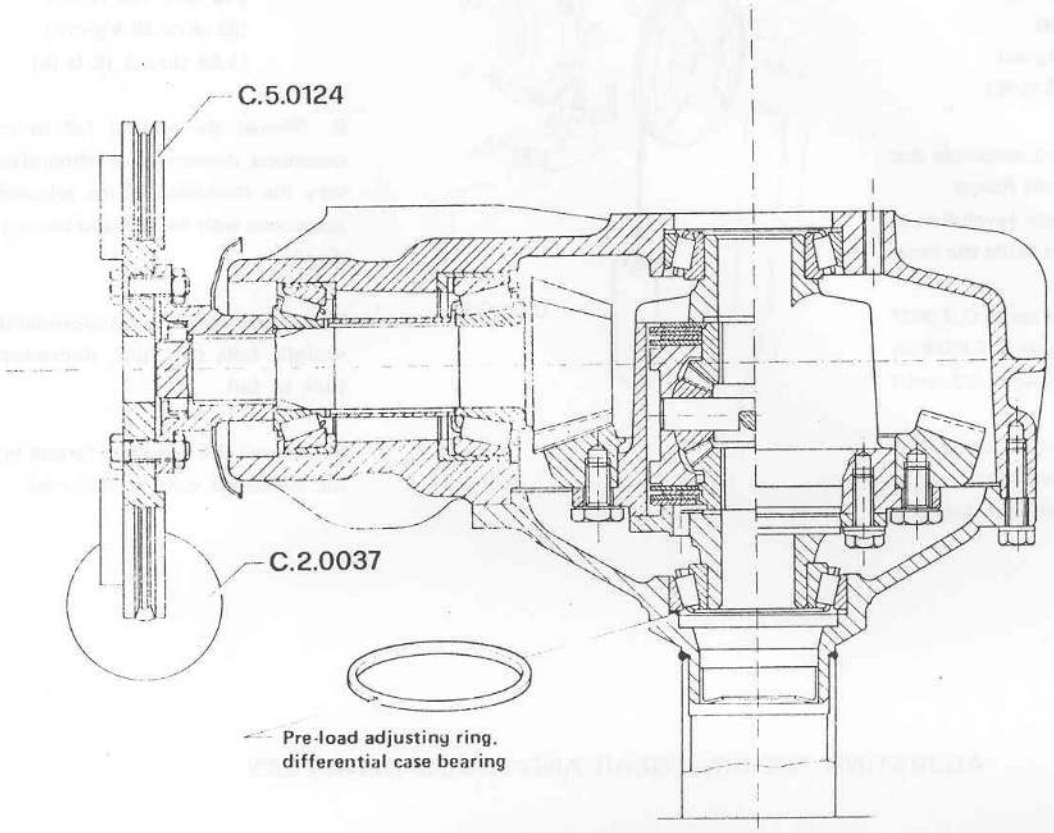


ACTUAL EXAMPLE

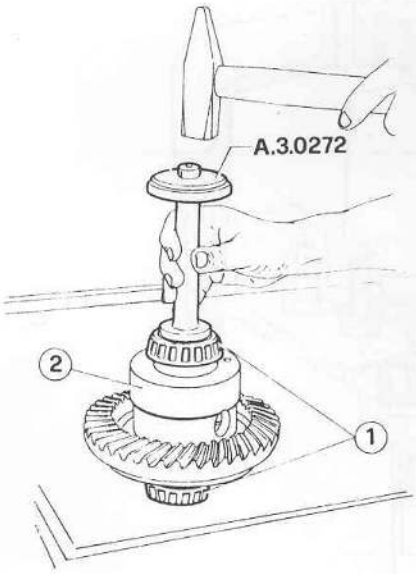
	Dial Gage Reading	Mark on Pinion	Adjustment
1st Case	−4	+2	−6 (subtract shims)
2nd Case	+4	−2	+6 (add shims)
3rd Case	−2	+4	−6 (subtract shims)
4th Case	+2	−4	+6 (add shims)
5th Case	−4	−2	−2 (subtract shims)
6th Case	+4	+2	+2 (add shims)
7th Case	−2	−4	+2 (add shims)
8th Case	+2	+4	−2 (subtract shims)

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ADJUSTMENT OF THE TOTAL PRE-LOAD OF THE PINION AND RING GEAR BEARINGS

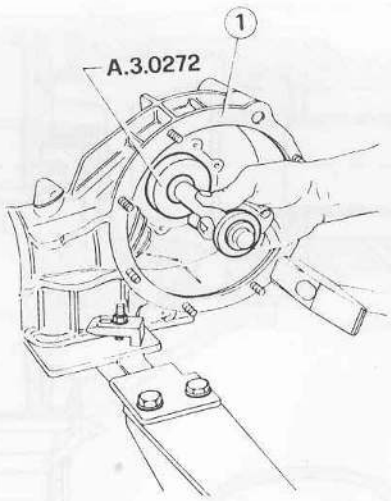


1. Using tool **A.3.0272** drive the internal races of the right and lefthand bearings (1) onto the differential case (2).



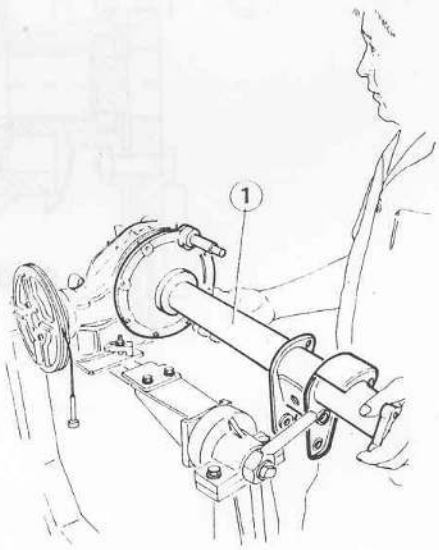
1 Bearing internal races
2 Differential case

2. Still using tool **A.3.0272**, drive the external race of the righthand bearing, with the adjustment ring previously dismantled, onto the differential carrier (1).



1 Differential carrier

3. Similarly, assemble the external race of the lefthand bearing, with the adjusting ring previously dismantled, in the housing on the lefthand axle pipe.
4. Insert the differential case and mount the lefthand pipe (1), blocking the fixing nuts to the correct coupling.

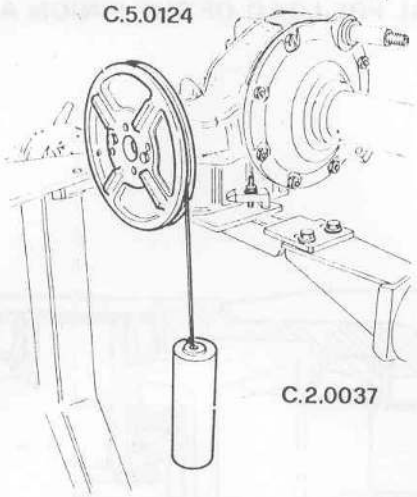


1 Lefthand pipe

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(T) : **Tightening torque**
Nuts securing the lefthand pipe to the differential carrier
25 thru 27 N·m
(2.5 thru 2.8 kg·m)
(18.4 thru 19.9 ft·lb)

5. If previously dismantled, assemble disc **C.5.0124** on propeller shaft flange.
6. Turn the pinion several revolution in both directions in order to settle the bearings.
7. Place some weights of series **C.2.0037** at the end of the disc cable **C.5.0124** so that the total weight is between 2.2 and 3 kg (4.8 and 6.6 lb).
In these conditions the stipulated revolving torque is accomplished if the weight falls without a halt and without dragging the disc too fast.



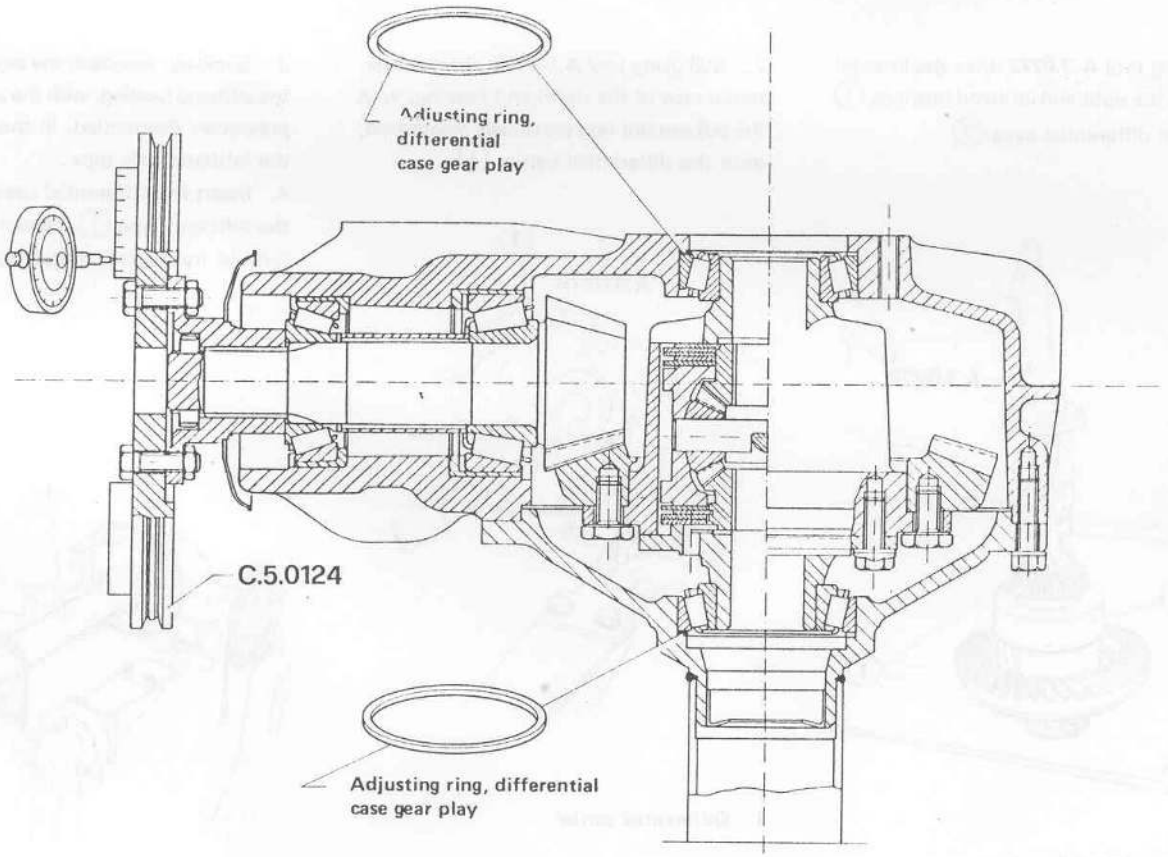
T1 : **Dynamic revolving torque, pinion and ring gear**
216 thru 296 N·cm
(22 thru 30 kg·cm)
(1.59 thru 2.18 ft·lb)

8. Should the weight fail to drop as described, dismantle the lefthand pipe and vary the thickness of the adjusting ring associated with the lefthand bearing accordingly.

The thickness is to be increased if the weight falls too fast, decreased if it fails to fall.

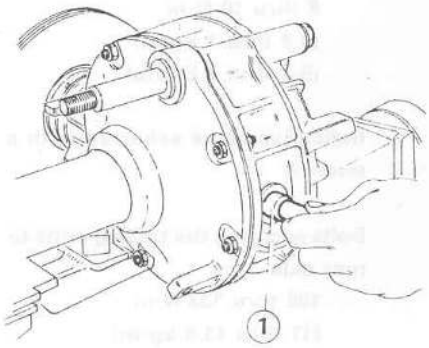
9. Repeat the revolving torque test until the stipulated value is achieved.

ADJUSTING THE RING GEAR AND PINION GEAR PLAY



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1. Screw a suitable screw (1) in the housing of the rear plug on the differential support so as to lock the ring gear.

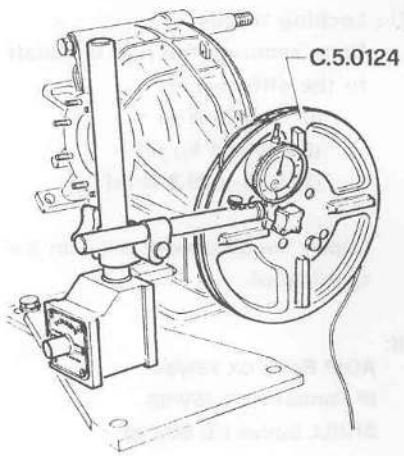


1 Screw

2. Arrange the magnetic base of a dial gage on the differential unit carrier, position the sensing needle on one of the four tabs of disc **C.5.0124** at a distance of 45 mm from the pinion center line and reset the dial gage.

Dimension "A", dial indicator positioning with respect to the pinion center line.

A = 45 mm (1.77 in)



3. Cause the disc **C.5.0124** to rotate as far as allowed by the play between the teeth and, by means of the dial gage, verify that play "G" is as specified.

Play "G_1" to be recorded on the dial gage

G_1 = 0.15 thru 0.30 mm
(0.006 thru 0.012 in)

True play, of approximately three times less, between the teeth of the ring wheel and pinion gear, corresponds to thus value registered at 45 mm from the pinion center line.

Play "G_2" assembly between pinion and ring gear

G_2 = 0.05 thru 0.10 mm
(0.002 thru 0.004 in)

WARNING:
Play testing should be carried out in four positions of the ring gear, causing the pinion to turn one revolution after each reading and locking the ring gear in each position by means of the corresponding screw.

---

4. Should the play recorded differ from the one specified, it shall be necessary to disassemble the lefthand pipe and vary the thickness of the adjusting rings associated with the bearings of the differential case.
a. If the play is less than the specified value, it shall be necessary to move the ring gear away from the pinion and therefore to increase the thickness of the adjusting ring put in place from the opposite side to the ring gear (righthand bearing) and decrease, by the same amount, the thickness of the ring put in place from the ring gear side (lefthand bearing).
b. If play is above the specified value the ring gear must be brought closer to the pinion, therefore it shall be necessary to decrease the thickness of the adjusting ring put into place from the side opposite to the ring gear (righthand bearing) and increase the thickness of the ring put in place from the ring gear side (lefthand bearing) by the same amount.

WARNING:
A variation of play G_1 corresponds to each variation in thickness. It is registered at the dial indicator as being approximately three times greater.

It is essential to increase the thickness of the adjusting ring on one side and decrease it on the other **by the same amount** so as not to alter the bearing pre-load.

CONCLUDING REASSEMBLY

1. Retrieve the base and the dial indicator, remove the lefthand pipe, the screw clamping the ring gear, the disc **C.5.0124** and the propeller shaft coupling flange, having reassembled on it tool **A.2.0144**.
2. Clean the joining surfaces between the differential carrier and the right and lefthand pipes, applying the specified sealant to them.

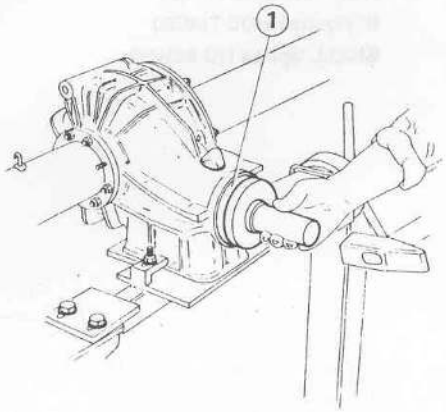
Sealing agent:
LOWAC Perfect Seal adhesive.

3. Assemble the two pipes, slide in the stop plates, tighten the nuts to the specified torque and bend back the plates.

(T) : Tightening torque
Nuts securing the left and righthand pipes to the differential carrier
25 thru 27 N·m
(2.5 thru 2.8 kg·m)
(18.4 thru 19.9 ft·lb)

4. Assemble a new front seal ring, having lubricated its sealing lip and the work area on the shaft with the specified grease.

Grease:
ISECO Molykote BR2



1 Seal ring

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5. Dampen the external surface of the seal ring with the specified oil.

Oil:

AGIP Rotra SX 75W90
IP Pontiax HDS 75W90
SHELL Spirax HD 80W90

6. Slide the propeller shaft coupling flange onto the end of the pinion using tool **A.2.0144**, screw on the ring nut and tighten it to the specified torque with the aid of a torque wrench equipped with extension **A.5.0114**.

(T) : **Tightening torque**
Ring nut securing the drive shaft coupling flange
78 thru 137 N·m
(8 thru 14 kg·m)
(57.5 thru 101.1 ft·lb)

7. Caulk the ring nut and retrieve the tool **A.2.0144**.
8. Proceed with the complete assembly of the rear axle-differential unit by carrying out the disassembly operations in reverse order and adhering to the following instructions:

- Using tool **A.3.0274**, assemble the two new seal rings on the right and lefthand pipes, having lubricated as instructed.

Seal rings of the axle shafts
— **Sealing lip and work area on the axle shafts.**

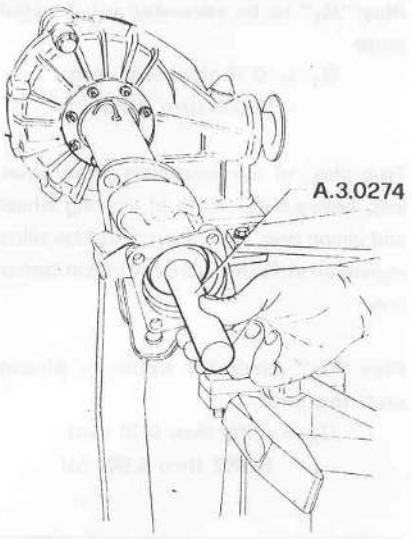
Grease:

ISECO Molykote BR2

— **External surface of the seal ring.**

Oil:

AGIP Rotra SX 75W90
IP Pontiax HDS 75W90
SHELL Spirax HD 80W90



- Observe the following tightening torques:

(T) : **Tightening torques**
Nuts securing the shoe holders to the axle pipe
47 thru 54 N·m
(4.8 thru 5.5 kg·m)
(34.7 thru 39.8 ft·lb)

Screws clamping the brake caliper to the shoe holders.
44 thru 54 N·m
(4.5 thru 5.5 kg·m)
(32.4 thru 39.8 ft·lb)

INSTALLATION

Reassemble by carrying out removal operations in reverse order and following these instructions.

- Lubricate the pin coupling the differential to the reaction triangle using specified grease.

Grease:

SPCA Spagraph
ISECO Ergon Rubber Grease n° 3

- Using specified antiseize dampen the lower pins of the shock absorbers, the lock bolts, trailing arms at the rear-axle and the bolts securing the limit rebound straps.

Antiseize:

R. GORI Never Seez

- Observe the following torques.

(T) : **Tightening torques**
Hydraulic brake system pipe unions
8 thru 10 N·m
(0.8 thru 1 kg·m)
(5.8 thru 7.2 ft·lb)

Indicative value achieved with a wrench

Bolts securing the trailing arms to rear axle
108 thru 133 N·m
(11 thru 13.6 kg·m)
(79.7 thru 98.1 ft·lb)

Nut securing the reaction triangle to the rear-axle
100 thru 124 N·m
(10.2 thru 12.6 kg·m)
(73.8 thru 91.5 ft·lb)

Nuts securing the link rods of the stabilizing bar to the rear-axle
32 thru 34 N·m
(3.3 thru 3.5 kg·m)
(23.6 thru 25.1 ft·lb)

- Reconnect the propeller shaft to the differential, adhering to the marks made previously and tightening the bolts to the specified torque.

(T) : **Locking torque**
Bolts securing the rear lay shaft to the differential
37 thru 39 N·m
(3.8 thru 4 kg·m)
(27.3 thru 28.8 ft·lb)

- Supply the differential unit with the specified oil.

Oil:

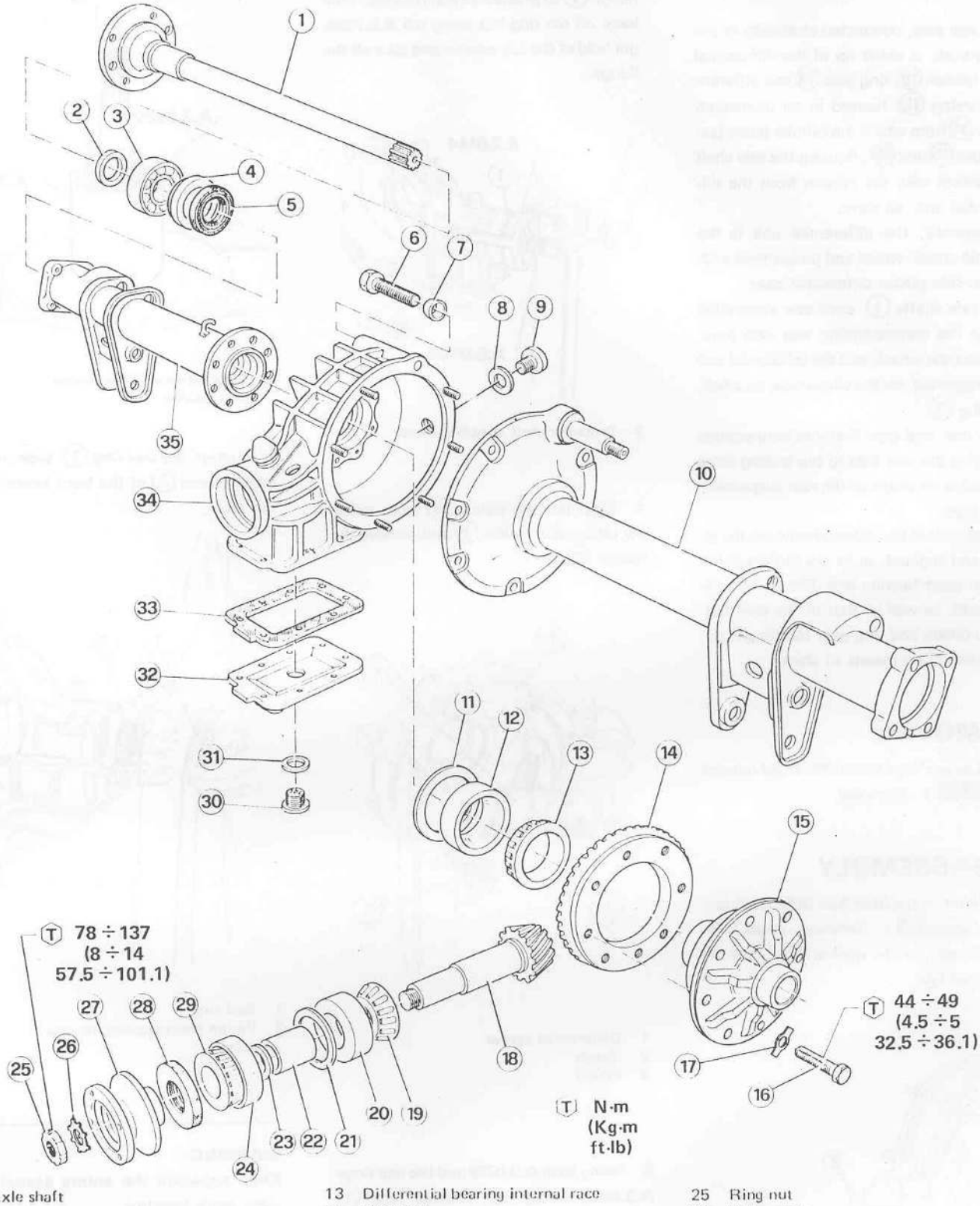
AGIP Rotra SX 75W90
IP Pontiax HDS 75W90
SHELL Spirax HD 80W90

Quantity 1.250 kg

- Bleed the brake system as instructed in: Unit 22 - Front and Rear Brakes - Brake System Bleeding.
- Check rear suspension height (see: Unit 00 - Maintenance of Mechanical Components and Body).

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REAR AXLE - DIFFERENTIAL (Spider 1.6)



1 Axle shaft
2 Spacer
3 Axle shaft bearing
4 Ring
5 Seal ring
6 Screw
7 Washer
8 Washer
9 Filler plug
10 Pipe of left axle
11 Adjusting ring
12 Differential bearing external race
13 Differential bearing internal race
14 Ring gear
15 Differential case
16 Screw
17 Stop plate
18 Pinion
19 Pinion rear bearing internal race
20 Pinion rear bearing external race
21 Adjusting ring
22 Spacer
23 Adjusting ring
24 Pinion front bearing external race
25 Ring nut
26 Tabwasher
27 Propeller shaft flange
28 Seal ring
29 Pinion front bearing internal race
30 Drain plug
31 Washer
32 Bottom cover
33 Gasket
34 Differential carrier
35 Pipe of right axle

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DESCRIPTION

The rear axle, connected elastically to the bodywork, is made up of the differential unit (pinion (18), ring gear (14) and differential casing (15)) housed in an aluminium case (34) from which the tubular pipes (axle pipes (10) and (35)), housing the axle shaft (1) which take the motion from the differential unit, all stem.

Structurally, the differential unit is the hypoid crown wheel and pinion type with a two side pinion differential case.

The axle shafts (1), each one assembled inside the corresponding rear axle pipe, connect the wheels and the differential and are supported, on the wheel side, by a ball-bearing (3).

Each rear axle pipe features connections securing the rear axle to the trailing arms and rebound straps of the rear suspension limit stop.

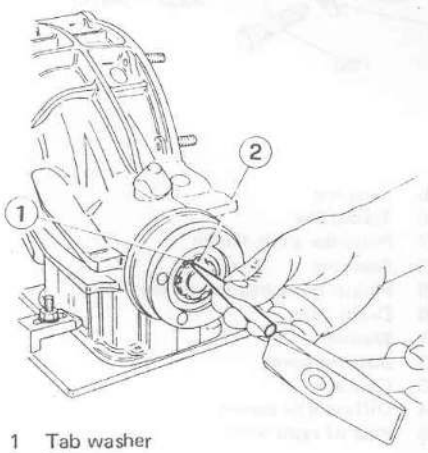
Adjustment of the distance between the pinion and ring axis, as for adjustment of the pinion taper bearing and differential case pre-load, as well as that of the play between pinion and ring gear toothing is accomplished by means of shims.

REMOVAL

Work as per Rear Axle Differential (except Spider 1.6) - Removal.

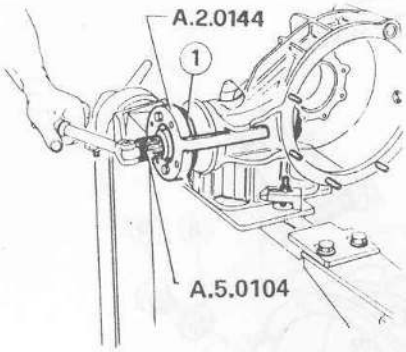
DISASSEMBLY

1. Work as per Rear Axle Differential (except Spider 1.6) - Removal - steps 1-11.
2. Straighten the washer tabs (1) of the wing nut (2).



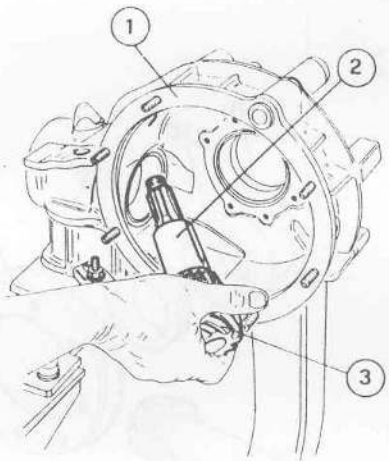
1 Tab washer
2 Ring nut

3. Fit tool **A.2.0144** on to propeller shaft flange (1) to prevent pinion rotating, then back off the ring nut using toll **A.5.0104**, get hold of the tab washer and take off the flange.



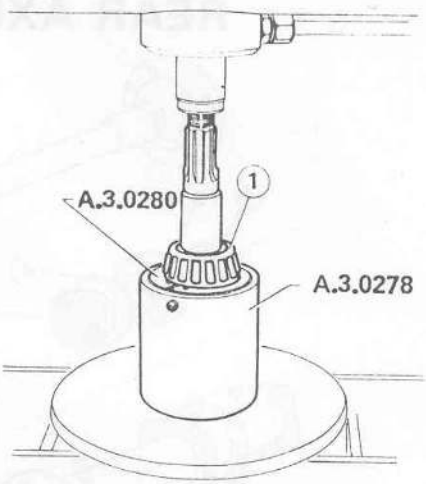
1 Propeller shaft coupling flange

4. Slide out the pinion (3) from inside the differential carrier (1) and retrieve the spacer (2).



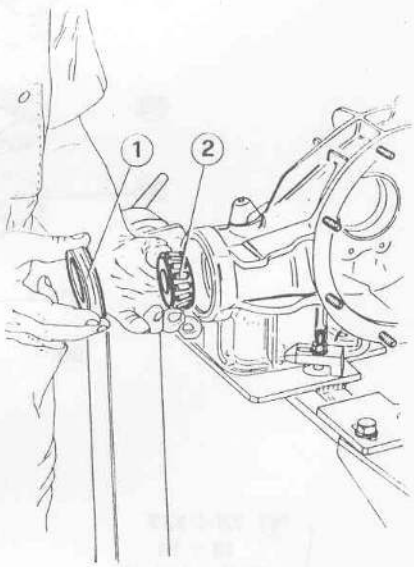
1 Differential carrier
2 Spacer
3 Pinion

5. Using base **A.3.0278** and the half rings **A.3.0280** extract the internal race (1) of the pinion rear bearing at the press.



1 Internal race of the pinion rear bearing

6. Extract the seal ring (1), slide out the internal race (2) of the front bearing and the shim.

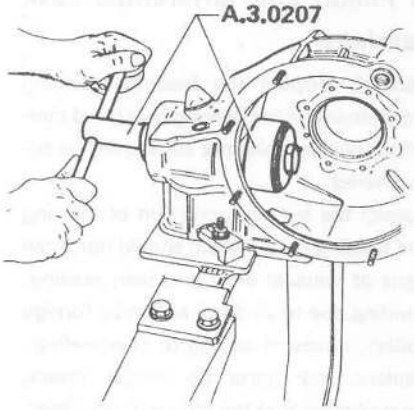


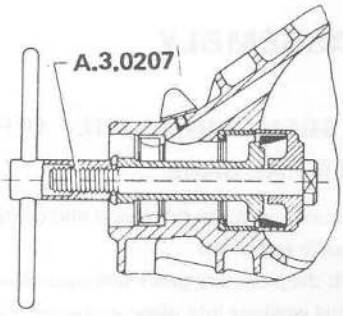
1 Seal ring
2 Pinion front bearing internal race

WARNING:
Keep separate the shims associated with each bearing.

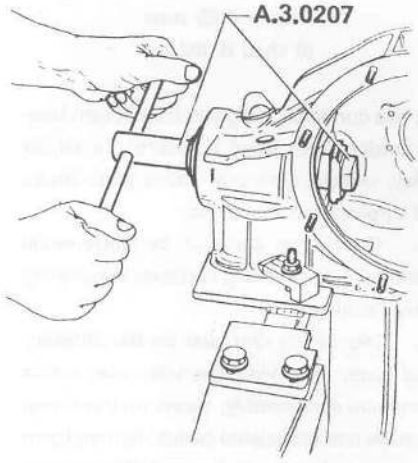
7. Using tool **A.3.0207**, take out the external race of the pinion rear bearing from the differential carrier and retrieve the shim.

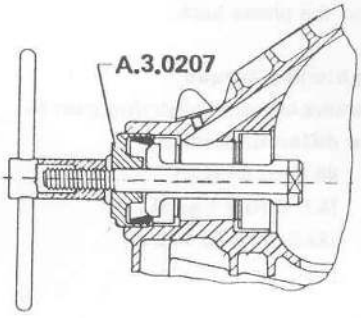
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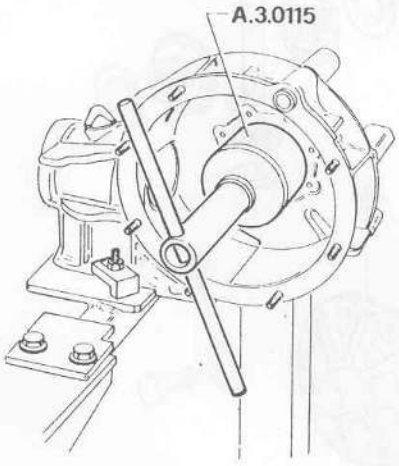


8. Still using tool **A.3.0207**, extract the external race of the pinion front bearing.

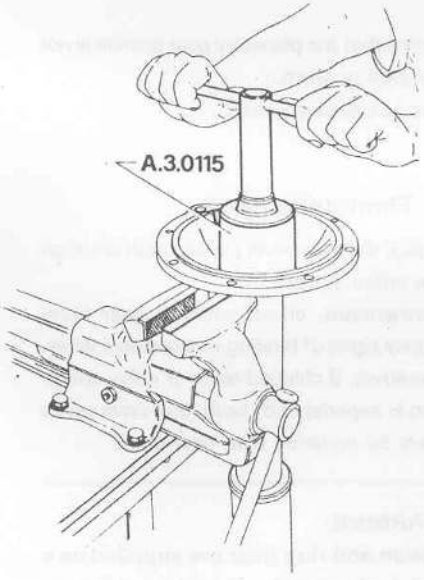




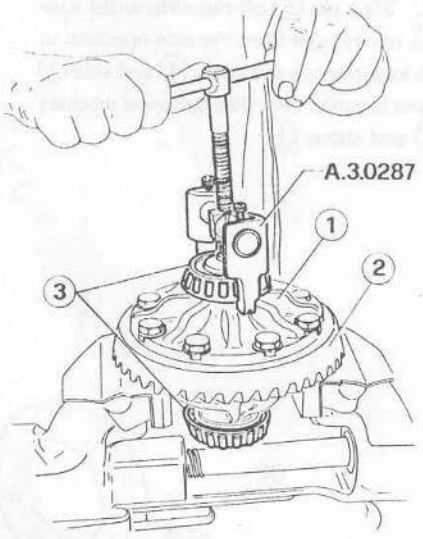
9. Using tool **A.3.0115**, extract the external race of the right bearing from the differential carrier and retrieve the shim.



10. Still using tool **A.3.0115** extract the external race of the lefthand bearing from the left axle pipe and retrieve the shim.

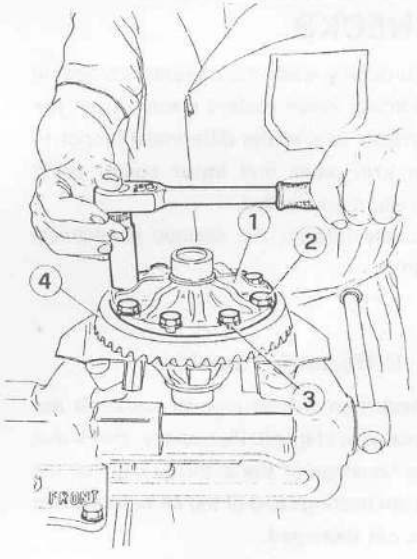


11. Mount the differential case (1) together with the ring gear (2) on a vice equipped with protective jaws then, using tool **A.3.0287**, extract the internal races of the left and righthand bearings (3).



1 Differential case
2 Ring gear
3 Bearing internal races

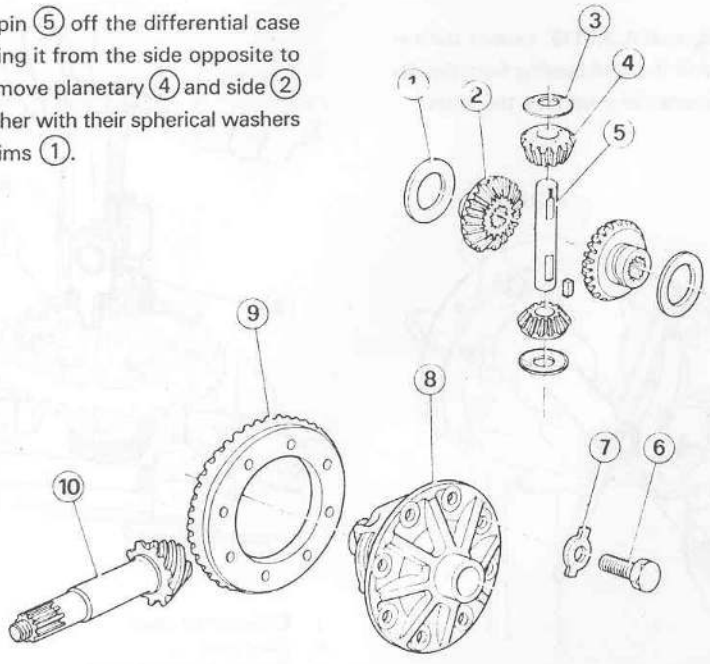
12. Mark the corresponding positions of the differential case (1) and ring gear (4), straighten the check plates (3), back off the eight screws (2) and separate the two parts.



1 Differential case
2 Screw
3 Check plate
4 Ring gear

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13. Slide pin (5) off the differential case (8), removing it from the side opposite to the key; remove planetary (4) and side (2) gears together with their spherical washers (3) and shims (1).



1 Shim
2 Side gear
3 Spherical washer
4 Planetary gear
5 Pin
6 Screw
7 Check plate
8 Differential case
9 Ring gear
10 Pinion

INSPECTION AND CHECKS

Thoroughly wash the components and in particular clean sealant residue from the surfaces joining the differential carrier to the axle pipes and lower cover, using denaturated alcohol.
Visually inspect the various mechanical parts.

1. Differential carrier

Check that the differential carrier is not cracked or chipped. Particularly, check that the housings of the external rings of the pinion bearings and of the differential case are not damaged.

2. Differential case

Check visually that the gear teeth have no cuts or signs of seizing and that they mesh evenly on all the surface.
Replace damaged parts.

Check that the planetary gear spindle is not chipped or worn.
Replace damage parts.

3. Final drive gears

Check that the bevel pinion teeth work on the entire surface.
Furthermore, check whether gear teeth shows signs of binding or excessive wear. Moreover, if chipped teeth or noisy operation is experienced, both final drive gears must be replaced with new ones.

WARNING:
Pinion and ring gear are supplied as a notched set only, therefore they are not available separately.

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4. Pinion and differential case bearings

Carefully inspect the bearings, turning them slowly; if the bearing is in good condition, neither noise nor seizing will be encountered.
Inspect the surface condition of the ring and rotating parts, which should not show signs of unusual wear and tear, scoring, grinding due to abrasive action by foreign bodies, traces of seizing or overheating.
Replace any parts no longer intact, remembering that the tape red roller bearings must be replaced in pairs.

REASSEMBLY

REASSEMBLING THE DIFFERENTIAL CASE

1. Reassemble the side gears and shims previously removed.
2. Fit the planetary gears and associated spherical washers into place and insert the pin.
3. Check that play between the planetary and side gear teeth is as specified.

Assembly play between planetary and side gears
0 thru 0.05 mm
(0 thru 0.002 in)

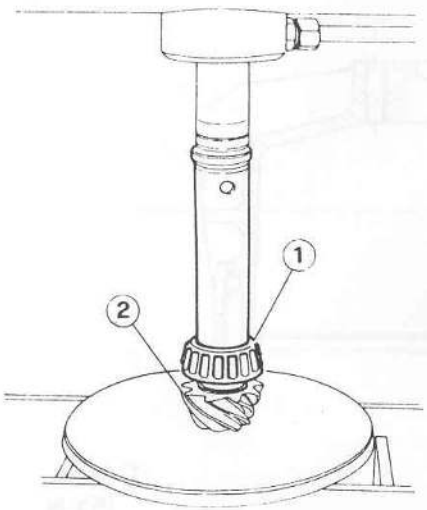
In this condition the gears should turn freely under slight hand pressure. To adjust play, replace side gear shims with others of appropriate thickness.
4. Check the state of the differential case - ring gear joining surfaces, eliminating any flashlines.
5. Mount the ring gear on the differential case, observing the reference marks made on disassembly, screw on the clamp screws and associated plates, tighten them in diagonal order to the specified torque and bend the plates back.

(T) : **Tightening torque**
Screws clamping the ring gear to the differential case
44 thru 49 N·m
(4.5 thru 5 kg·m)
(32.5 thru 36.1 ft·lb)

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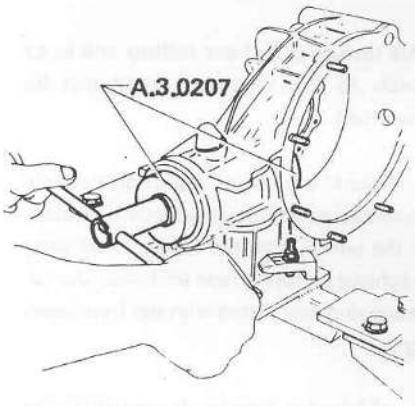
REASSEMBLING THE PINION

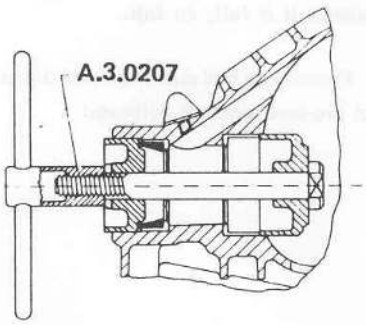
1. Working at the press, mount the rear bearing internal race (1) onto pinion (2).



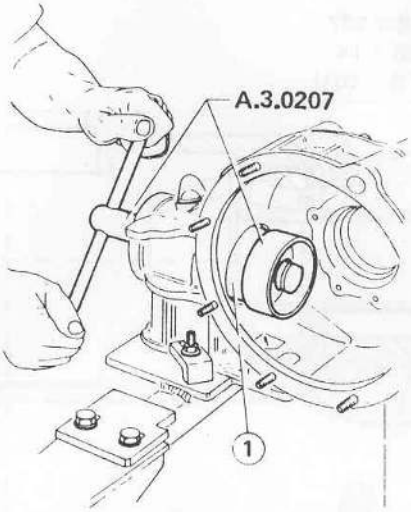
1 Rear bearing internal race
2 Pinion

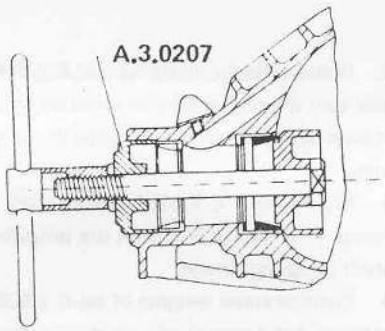
2. Using tool **A.3.0207**, put the external ring of the pinion front bearing into the differential carrier.





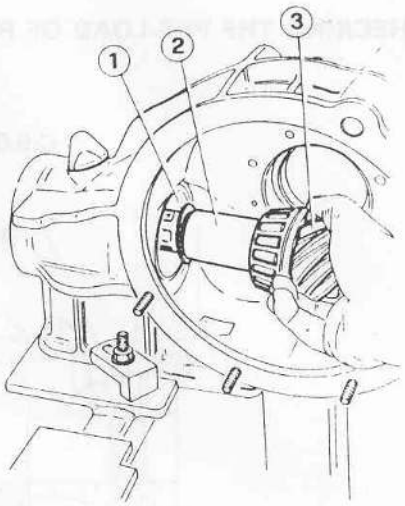
3. Still using tool **A.3.0207**, put in the external race of the pinion rear bearing and the associated shim.





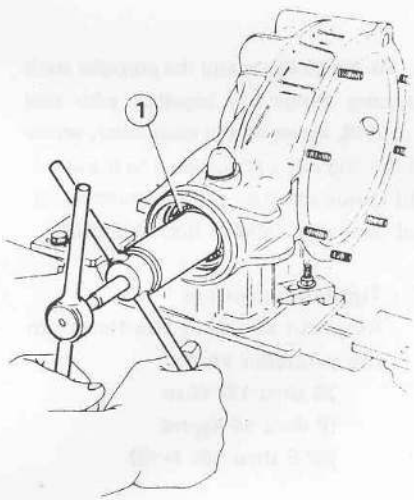
1 External race of the pinion rear bearing

4. Insert pinion (3) together with spacer (2) and shim (1) associated with the front bearing and previously removed, in the differential carrier.



1 Shim
2 Spacer
3 Pinion

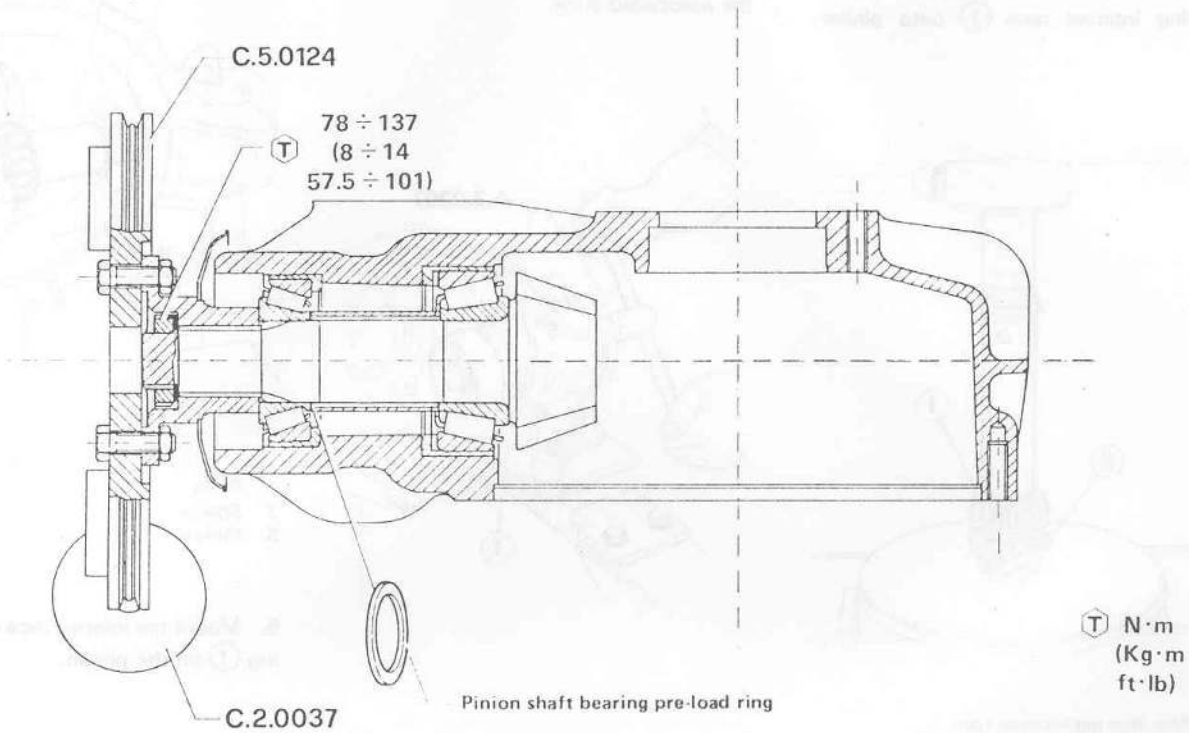
5. Mount the internal race of front bearing (1) on the pinion.



1 Front bearing internal race

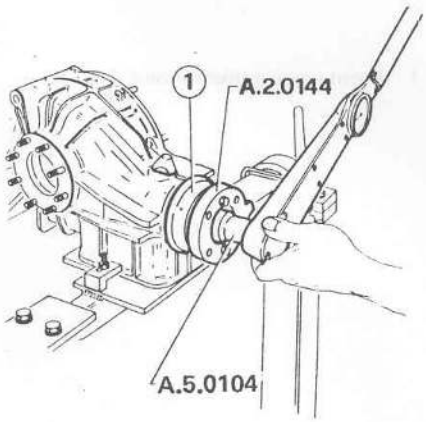
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CHECKING THE PRE-LOAD OF PINION BEARINGS



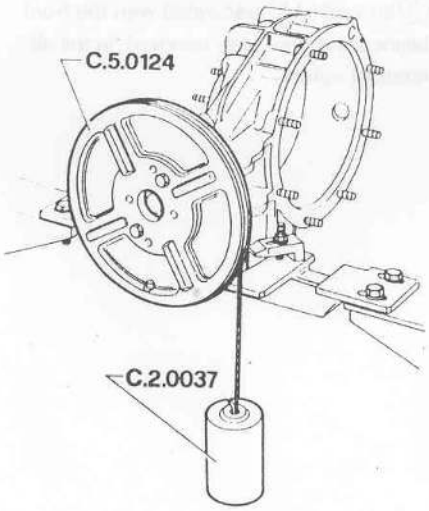
1. On the pinion mount the propeller shaft coupling flange (1) together with tool **A.2.0144**, insert on the tabwasher, screw on the ring nut and tighten it to the specified torque using a torque wrench equipped with an extension (tool **A.5.0104**).

(T) : Tightening torque
Ring nut securing the flange to the propeller shaft
78 thru 137 N·m
(8 thru 14 kg·m)
(57.5 thru 101 ft·lb)



1 Propeller shaft coupling flange

2. Remove flange stopping tool **A.2.0144** and turn the pinion several times by hand in both directions in order to settle the bearings.
3. Mount disc **C.5.0124**, which has a radius of 10 cm (3.94 in) on the propeller shaft coupling flange.
4. Position some weights of set **C.2.0037** at the end of the steel cable so that the total weight is between 1.5 and 2 kg (3.3 and 4.4 lb).
In these conditions the specified revolving torque is accomplished if the weight drops down without a halt and without dragging the disc too fast.



(T) : Revolving torque of the pinion alone
147 thru 196 N·m
(15 thru 20 kg·m)
(1.08 thru 1.44 ft·lb)

This torque is a sheer rolling one in as much as the seal ring need not be mounted.

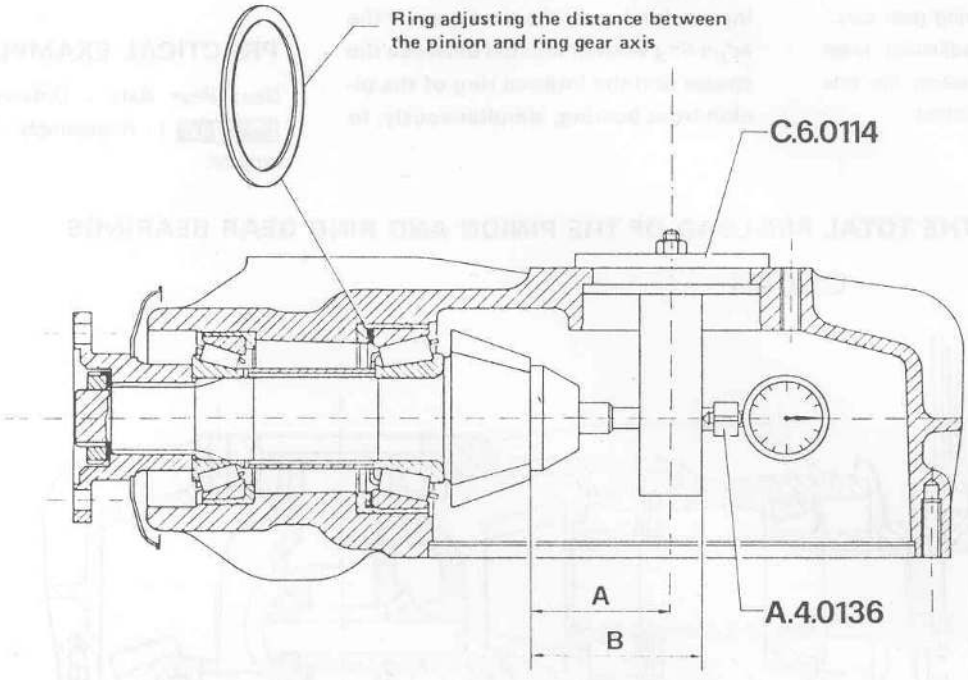
5. Should the weight fail to go down in accordance with this description, dismantle the pinion from the support and vary, to achieve an appropriate thickness, the adjusting ring associated with the front bearing.

The thickness is to be decreased if the weight goes down too fast and increased if it fails to fall.

6. Proceed by trial and error until the correct pre-load value is achieved.

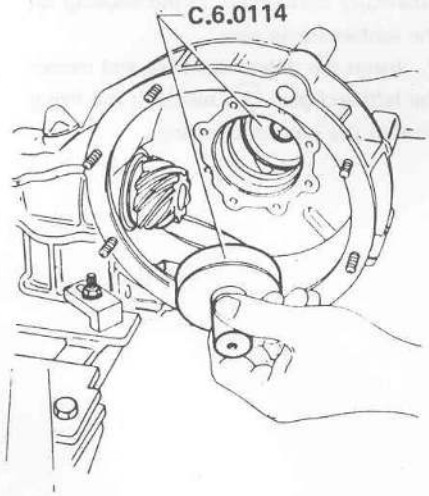
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CHECKING AND ADJUSTING THE DISTANCE BETWEEN THE PINION AND RING GEAR AXIS

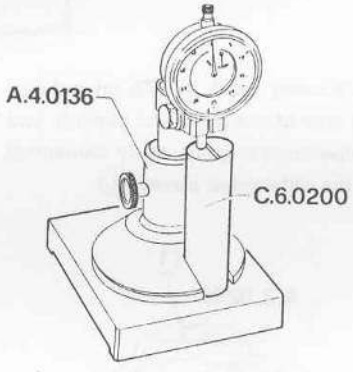


In order to determine the pinion - ring gear axis distance and therefore the tickness of the adjusting ring to be placed in correspondence with the pinion rear bearing, observe the following procedure.

1. Mount tool **C.6.0114** on the differential carrier in the housing of the differential support righthand bearing.

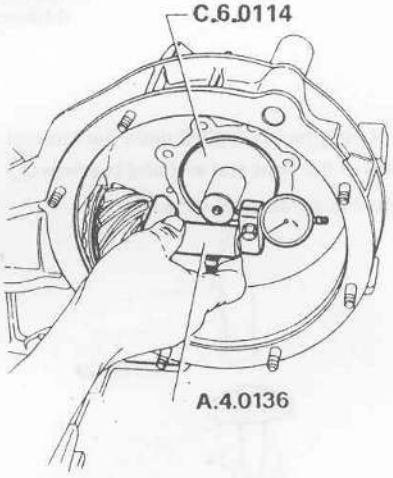


2. Mount a dial gage on support **A.4.0136** and zero it with the aid of the check gauge **C.6.0200.**
Reset the dial gage to the lower distance, equal to 70 mm.



3. Read dimension "C", plus or minus, stamped on the pinion head.
4. Rest the support **A.4.0136** with the dial gage on the pinion head and read the deviation "L", plus or minus with respect to dimension "B" (nominal distance between the piston head and the generating line of tool **C.6.0114** pin for ring gear axis reference).

This reading should correspond, is value and sign, to the dimension stamped on the piston head.



5. Should this condition fail to be accomplished, it shall be necessary to put the pinion back to the correct assembly position by varying thickness "S", located between the external ring of the pinion rear bearing and the housing on the differential carrier, accordingly.
The calculation to be made is:

$$S = \pm L - (\pm C)$$

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- Increase the thickness to move the pinion closer to the ring gear axis.
- Decrease the tickness to move the pinion away from the ring gear axis.

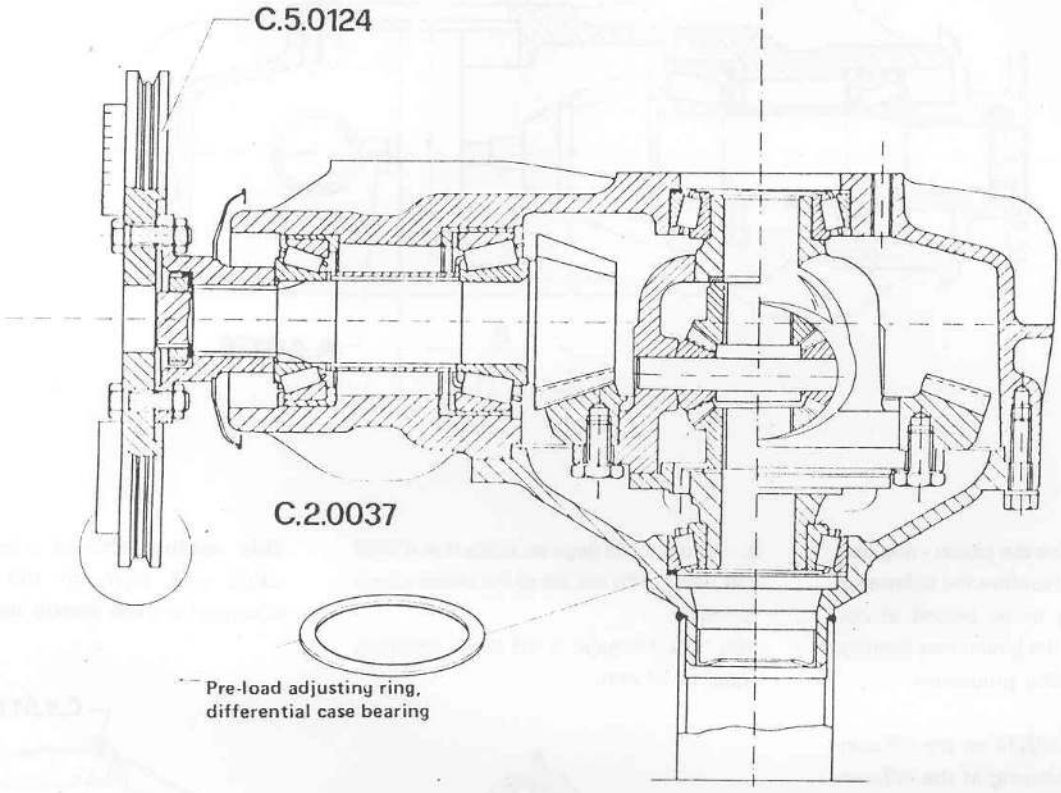
6. From the range of adjusting rings available as spare parts, select the one closest to the value established.

WARNING:
So as not to change the pinion bearing pre-load, vary the thickness of the adjusting washer located between the spacer and the internal ring of the pinion front bearing, simultaneously, to the same quantity and sign.

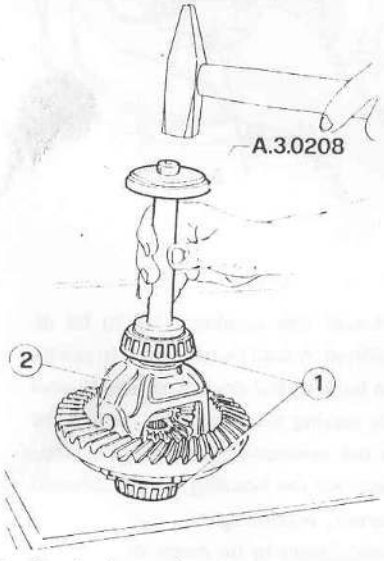
PRACTICAL EXAMPLES

See: Rear Axle - Differential (except Spider 1.6) - Reassembly - Practical Examples.

ADJUSTMENT OF THE TOTAL PRE-LOAD OF THE PINION AND RING GEAR BEARINGS

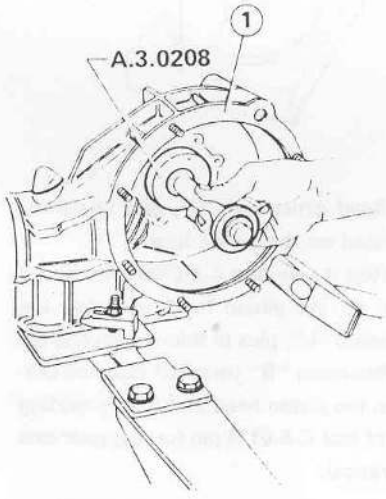


1. Using tool **A.3.0208** drive the internal races of the right and lefthand bearings (1) onto the differential case (2).



1 Bearing internal races
2 Differential case

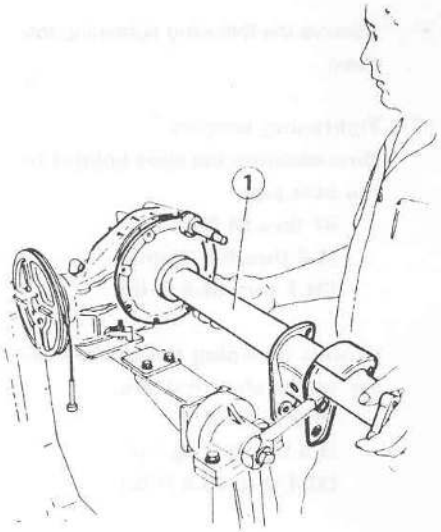
2. Still using tool **A.3.0272**, drive the external race of the righthand bearing, with the adjustment ring previously dismantled, onto the differential carrier (1).



1 Differential carrier

3. Similarly, assemble the external race of the lefthand bearing, with the adjusting ring previously dismantled, in the housing on the lefthand axle pipe.
4. Insert the differential case and mount the lefthand pipe (1), blocking the fixing nuts to the correct coupling.

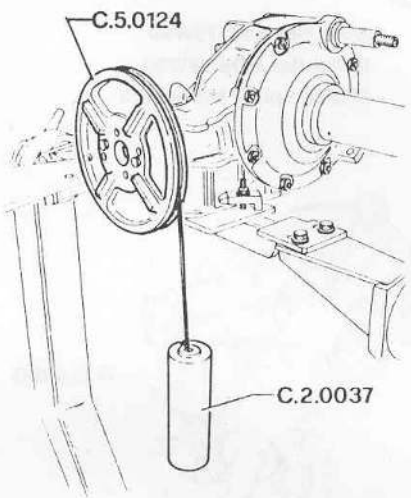
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1 Lefthand pipe

Ⓣ : **Tightening torque**
Nuts securing the lefthand pipe to the differential carrier
25 thru 27 N·m
(2.5 thru 2.8 kg·m)
(18.4 thru 19.9 ft·lb)

5. If previously dismantled, assemble disc **C.5.0124** on propeller shaft flange.
6. Turn the pinion several revolution in both directions in order to settle the bearings.
7. Place some weights of series **C.2.0037** at the end of the disc cable **C.5.0124** so that the total weight is between 2.2 and 3 kg (4.8 and 6.6 lb).
In these conditions the stipulated revolving torque is accomplished if the weight falls without a halt and without dragging the disc too fast.



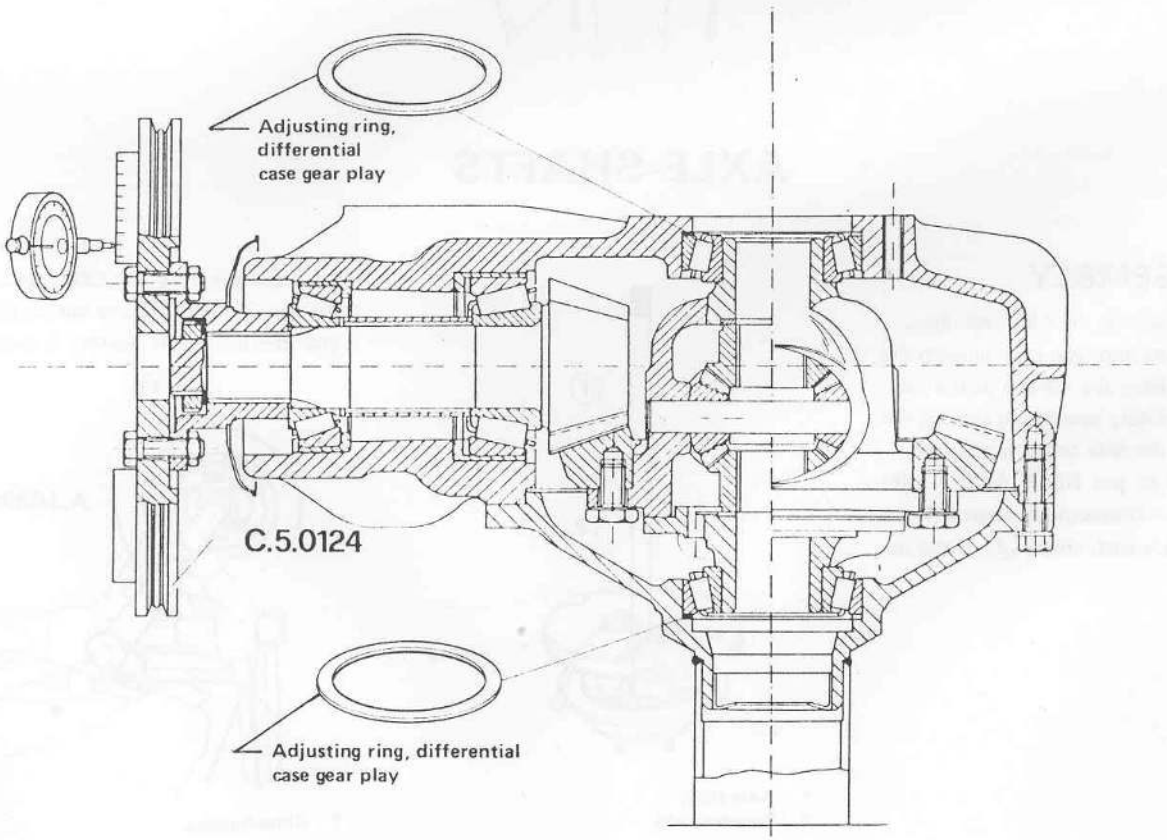
Ⓣ : **Dynamic revolving torque, pinion and ring gear**
216 thru 296 N·cm
(22 thru 30 kg·cm)
(1.59 thru 2.18 ft·lb)

8. Should the weight fail to drop as described, dismantle the lefthand pipe and vary the thickness of the adjusting ring associated with the lefthand bearing accordingly.

The thickness is to be increased if the weight falls too fast, decreased if it fails to fall.

9. Repeat the revolving torque test until the stipulated value is achieved.

ADJUSTING THE RING GEAR AND PINION GEAR PLAY



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Proceed as per Rear Axle - Differential (Except Spider 1.6) - Reassembly - Adjusting the Ring Gear and Pinion Gear Play.

CONCLUDING REASSEMBLY

1. Proceed as per Rear Axle - Differential (Except Spider 1.6) - Reassembly - Concluding reassembly - steps 1-5.
2. Using tool **A.2.0144**, slip the propeller shaft coupling flange on to the end of the pinion, then add the tab washer and screw on the ring nut, locking it to the specified torque with the aid of a torque wrench equipped with extension **A.5.0104**.

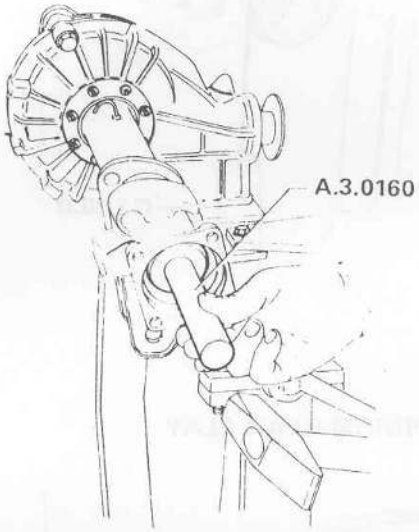
(T) : **Tightening torque**
Ring nut securing the propeller shaft coupling flange
78 thru 137 N·m
(8 thru 14 kg·m)
(58 thru 101 ft·lb)

3. Bend back tabs and remove tool **A.2.0144**.

4. Proceed with the complete assembly of the rear axle-differential unit by carrying out the disassembly operations in reverse order and adhering to the following instructions:

- Using tool **A.3.0160**, assemble the two new seal rings on the right and lefthand pipes, having lubricated as instructed.

Seal rings of the axle shafts
— **Sealing lip and work area on the axle shafts.**
Grease:
ISECO Molykote BR2
— **External surface of the seal ring.**
Oil:
AGIP Rotra SX 75W90
IP Pontiax HDS 75W90
SHELL Spirax HD 80W90



- Observe the following tightening torques:

(T) : **Tightening torques**
Nuts securing the shoe holders to the axle pipe
47 thru 54 N·m
(4.8 thru 5.5 kg·m)
(34.7 thru 39.8 ft·lb)

Screws clamping the brake caliper to the shoe holders.
44 thru 54 N·m
(4.5 thru 5.5 kg·m)
(32.4 thru 39.8 ft·lb)

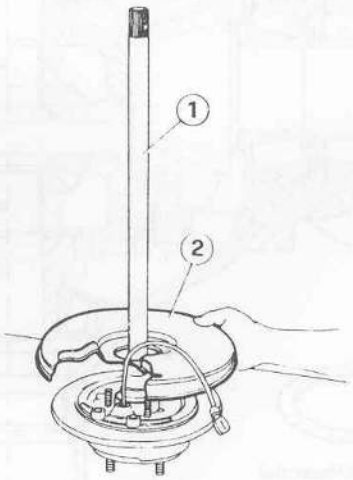
INSTALLATION

Work as per Rear Axle Differential (Except Spider 1.6) - Installation.

AXLE-SHAFTS

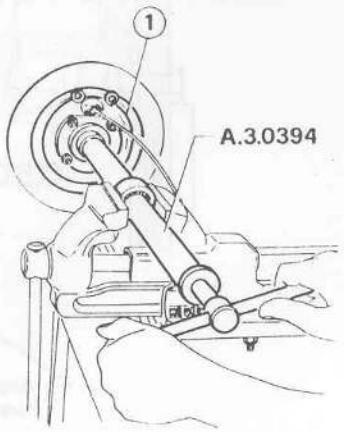
DISASSEMBLY

1. Put the vehicle on a lift and raise.
2. Place a column type jack beneath the differential, raise the vehicle at the rear, secure it on safety stands and remove the wheel from the side to be worked on.
3. Proceed as per REAR AXLE - DIFFERENTIAL - Disassembly steps 3-7.
4. Slide the splash shield (2) of the axle shaft (1).



1 Axle shaft
2 Splash shield

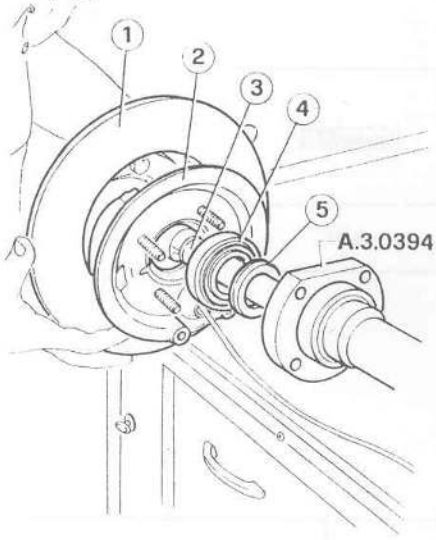
5. Assemble tool **A.3.0394**, secure it to the shoe-holders (1) and act on the latter until the axle shaft bearing is extracted.



1 Shoe-holders

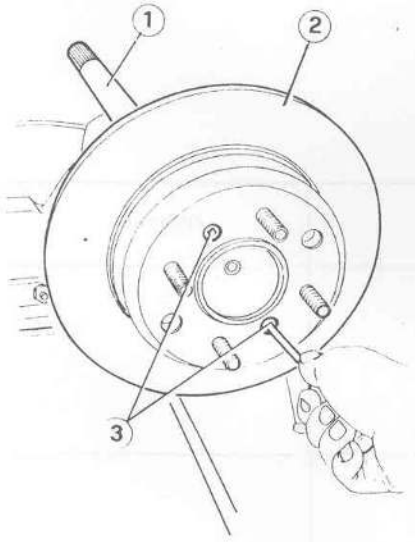
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6. Unscrew the nuts securing tool **A.3.0394** to the shoe-holders (2) and slide off brake disc (1) together with the axle shaft (3), the shoe-holder, bearing (4) and ring (5).



1 Brake disc
2 Shoe-holders
3 Axle shaft
4 Bearing
5 Ring

7. Unscrew the two screws (3) and separate the brake disc (2) from the axle shaft (1).



1 Axle shaft
2 Brake disc
3 Screws

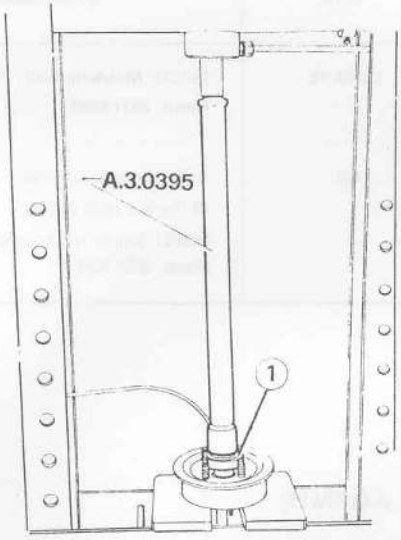
INSPECTION AND CHECKS

Clean all parts.

1. Check that the bearings roll freely without noise and ensure that they are neither worn nor damaged, otherwise replace.
2. Visually inspect the axle shafts, checking that they are intact, in particular that the splines shown no signs of cuts, binding or excessive wear and tear.

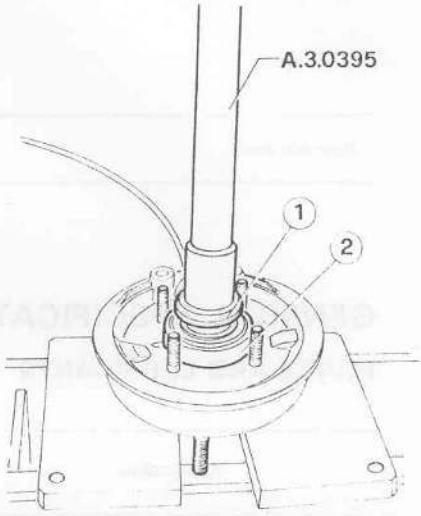
REASSEMBLY

1. Slide the shoe-holder onto the axle shaft.
2. Using tool **A.3.0395**, at the press drive bearing (1) onto the axle shalft.



1 Bearing

3. Slide out tool **A.3.0395**, heat ring (1) and, again using tool **A.3.0395** drive the ring until it abuts against bearing (2). Allow the ring to cool, still under the action of tool **A.3.0395**.



1 Ring
2 Bearing

4. Assemble the brake disc and proceed with reassembly as per Rear axle - Differential - Reassembly - Conclusion at step 8.

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TECHNICAL SPECIFICATIONS AND FEATURES

TECHNICAL FEATURES

REAR AXLE RATIO

	Spider ☐ Spider 2.0	Spider 1.6
Rear axle ratio	10/41	9/41

GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

Application	Type	Denomination	Quantity
Seal rings and associated work surfaces	GREASE	ISECO: Molykote BR2 Norm. 3671-69841	–
Differential oil supply Seal ring external surfaces	OIL	AGIP Rotra SX 75W90 IP Pontiax HDS 75W90 SHELL Spirax HD 80W90 Norm. 3631-69408	1.250 Kg (2.750 lb)

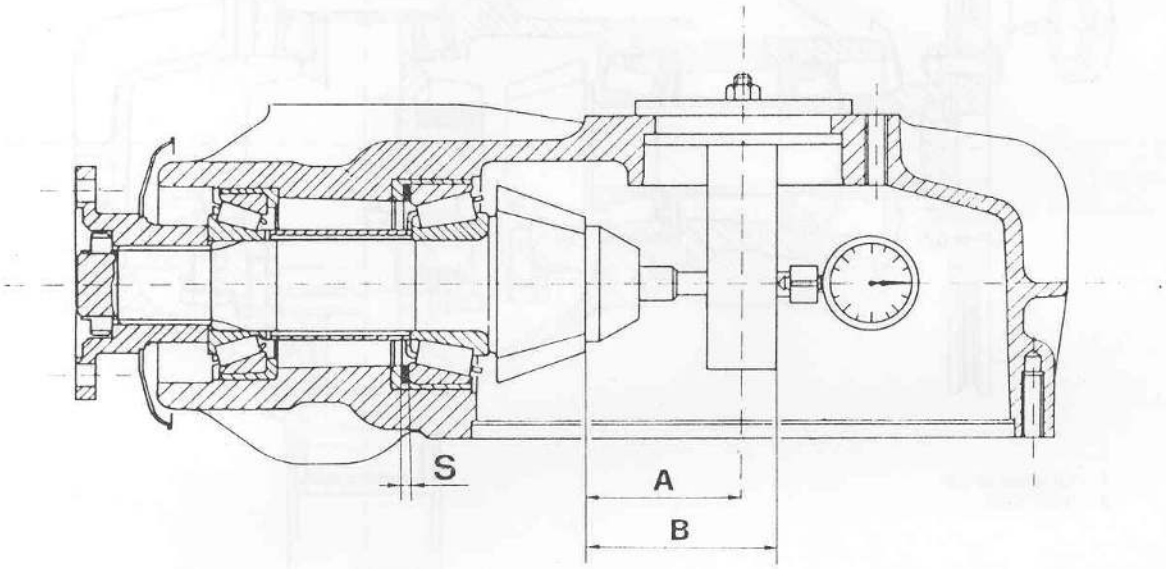
SEALANTS AND SURFACE FIXING AGENTS

Application	Type	Denomination	Quantity
Lefthand pipe - differential carrier uniting surfaces Righthand pipe - differential carrier uniting surfaces	ADHESIVE	LOWAC: Perfect Seal Norm. 3522-00011	–
Pinion spline clutch for transmission coupling flange	SEALANT	LOCTITE 241 Norm. 3524-00010	–

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CHECKS AND ADJUSTMENT

Thickness "S", correction of the ring adjusting the distance between the pinion and ring gear axis.



$$S = \pm L - (\pm C)$$

where:

L = Deviation value of the ring axis recorded by a dial gage (hundredths)

C = Value stamped on the pinion head.

The actual dimension should correspond to the normal value - the algebraic one stamped on the piston head (in hundredths).

		Spider 1.6	other models
Normal distance between the ring gear axis and pinion head	A mm (in)	57 ± 0.03 (2.24 ± 0.001)	58.5 ± 0.03 (2.30 ± 0.001)
Dimension of tool C.6.0200 for resetting the dial gage	B mm (in)	70 (2.76)	71.5 (2.81)

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TIGHTENING TORQUES [N·m (Kg·m; ft·lb)]

Item	Spider 1.6	Other models
Screw clamping the ring gear to the differential carrier	44 thru 49 (4.5 thru 5; 32.5 thru 36.1)	66.7 thru 73.5 (6.8 thru 7.5; 49.2 thru 54.2)
Ring nut securing the propeller shaft coupling flange	78 thru 137 (8 thru 14; 57.5 thru 101)	
Nuts securing the right and lefthand pipes to the differential carrier	25 thru 27 (2.5 thru 2.8; 18.4 thru 19.9)	
Nuts securing the shoeholders to the rear axle pipe	47 thru 54 (4.8 thru 5.5; 34.7 thru 39.8)	
Screws clamping the brake caliper to the shoeholders	44 thru 54 (4.5 thru 5.5; 32.5 thru 39.8)	
Bolts securing the trailing arms to rear axle	108 thru 133 (11 thru 13.6; 79.7 thru 98.1)	
Nut securing the reaction triangle to the rear axle	100 thru 124 (10.2 thru 12.6; 73.8 thru 91.5)	
Nut securing the links rods of the stabilizing bar to the rear axle	32 thru 34 (3.3 thru 3.5; 23.6 thru 25.1)	
Bolts securing the rear lay shaft to the differential	37 thru 39 (3.8 thru 4; 27.3 thru 28.8)	

TROUBLESHOOTING AND CORRECTIVE ACTIONS

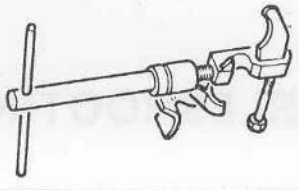
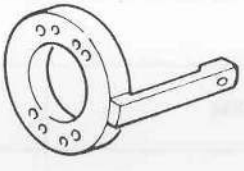
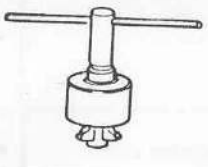
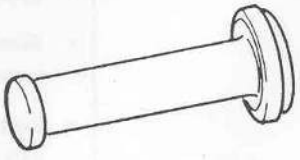
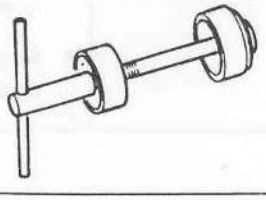
If noise or break down is encountered, ensure that it is not due to failures at the gear, propeller shaft or rear suspension assemblies.

Trouble	Probable cause	Corrective action
Noise when car is in motion, even in neutral gear	• Pinion bearings of the differential carrier or half axles are worn	Replace the bearing
	• Lack of oil in the differential unit	Top up the level and check that there are no leaks
Noise during "acceleration and deceleration"	• Differential gears worn or damaged	Replace the gears
	• Excessive play of the hypoid gear pair	Check and, if necessary, replace
	• Screws clamping the ring bevel gear are loose	Tighten the screws
	• Pinion adjusting rings determining the axis pinion ring gear distance are worn or damaged	Replace the washer with a new thickness determined by the adjustment
	• Ring nut securing the propeller shaft coupling flange to the pinion is loose	Tighten the ring nut

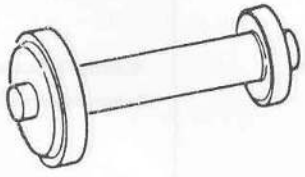
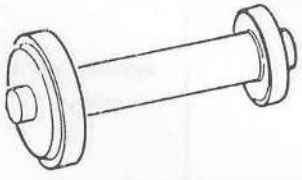
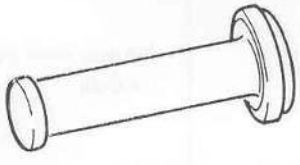
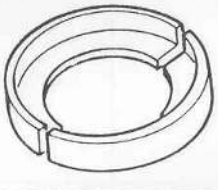
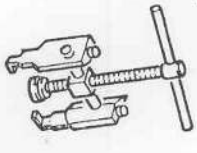
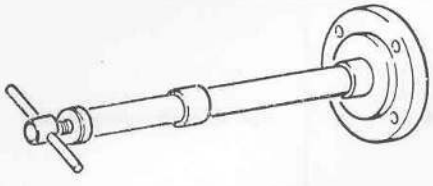
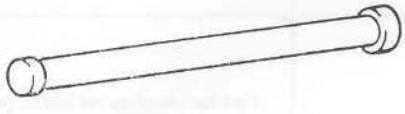
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Trouble	Probable cause	Corrective action
Noise at bends, in both normal and neutral gears	• Bevel and planetary gear toothing is worn, damaged or shows traces of meshing	Replace the differential casing
	• Half axle bearings are worn or damaged	Replace the bearings
Oil leaks	• Seal rings worn	Replace the seal rings
	• Lower cover gasket no longer efficient	Replace the gasket
	• Filler or drain plug loose	Tighten the plug

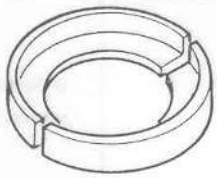
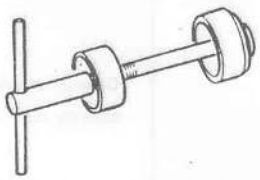
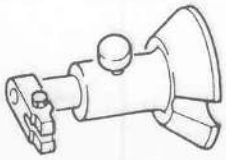
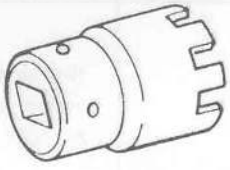
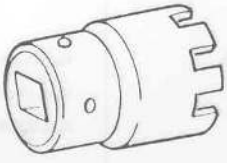
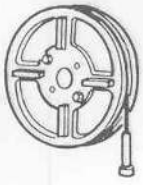
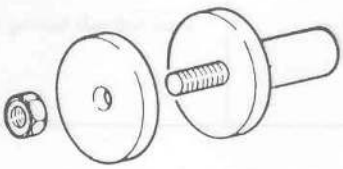
SPECIAL TOOLS

Identity N°	Denomination		Reference page
A.2.0143	Tool for rear spring assembly and disassembly		17-4
A.2.0144	Tool for clamping pinion rotation		17-7 17-12 17-17 17-18 17-20 17-24 17-28
A.3.0115	Differential carrier bearing external race extractor		17-8 17-21
A.3.0160	Seal ring insert, into axle pipes		17-28
A.3.0207	Extractor - insert, pinion bearing external races		17-21 17-23

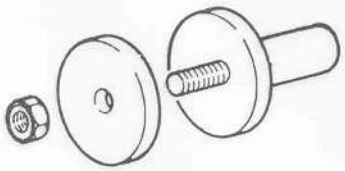
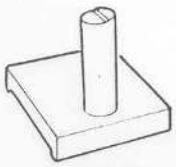
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Identity N°	Denomination	Reference page
A.3.0208	Differential carrier bearing internal and external race inserter 	17-26
A.3.0272	Differential carrier bearing internal and external race inserter 	17-15
A.3.0274	Seal ring inserter, into axle pipes 	17-18
A.3.0278	Base for extracting pinion rear bearing internal race (use with A.3.0396 and A.3.0280) 	17-8 17-20
A.3.0280	Halfrings for extraction of the pinion rear bearing internal race (use with A.3.0278) 	17-20
A.3.0287	Differential carrier bearing internal race extractor 	17-9 17-21
A.3.0394	Drive half axle bearing extractor 	17-28 17-29
A.3.0395	Drive half axle bearing inserter 	17-29

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Identity N°	Denomination	Reference page
A.3.0396	Halfrings for extraction of the pinion rear bearing internal race (use with A.3.0278) 	17-8
A.3.0399	Extractor - inserter, pinion bearing external races 	17-8 17-10
A.4.0136	Dial gage carrier (use with C.6.0156 and C.6.0200) 	17-13 17-25
A.5.0104	Key for pinion ring nut 	17-20 17-24 17-28
A.5.0114	Key for pinion ring nut 	17-7 17-12 17-18
C.2.0037	Set of weights for bearing pre-load test 	17-12 17-15 17-16 17-24 17-26 17-27
C.5.0124	Disc for bearing pre-load test 	17-11 17-12 17-15 17-16 17-17 17-24 17-26 17-27
C.6.0114	Tool for checking the pinion generator (use with A.4.0136 and C.6.0200) 	17-25

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Identity N°	Denomination	Reference page
C.6.0156	Tool for checking the pinion generator (use with A.4.0136 and C.6.0200) 	17-13
C.6.0200	Master gage (use with A.4.0436 and C.6.0156) 	17-13 17-25

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UNIT 21

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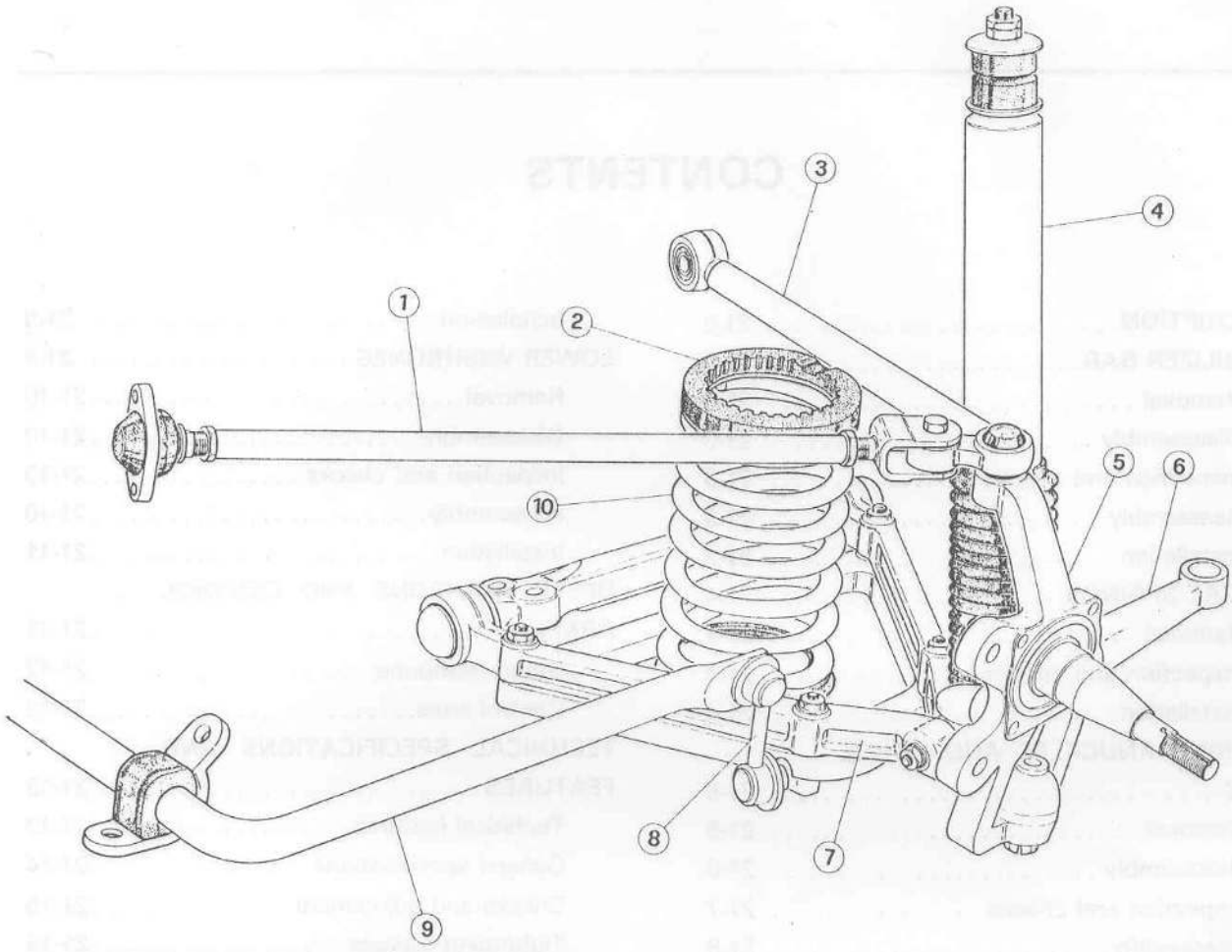
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DESCRIPTION



1 Control arm
2 Spring washer
3 Upper wishbone
4 Shock absorber
5 Steering knuckle
6 Steering lever
7 Lower wishbone
8 Stabilizer bar link rod
9 Stabilizer bar
10 Spring

Front suspension is the independent wheel type the wheels being connected to the body by means of transversal levers. The elastic (helical spring) and absorbing (hydraulic shock absorber) parts are assembled between the body and the lower wishbone. A stabilizer bar reduces rolling motion on bends. Wishbone rotation is restricted by buffers.

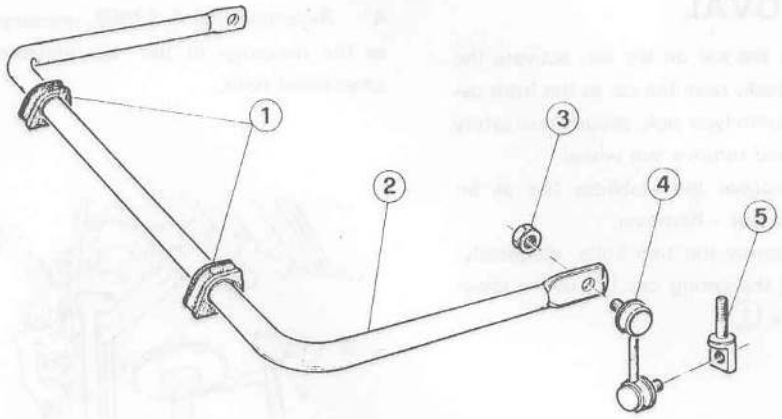
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STABILIZER BAR

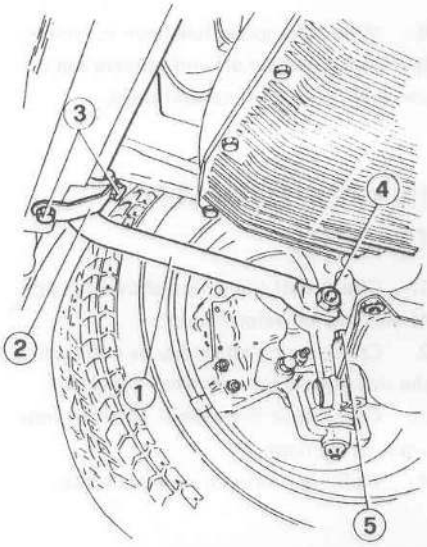
REMOVAL

1. Raise the car on platform lift, unscrew the nuts (5) coupling to the lower wishbone arms and screws (3) coupling to the body.
Disconnect the stabilizer bar (1) and get hold of the supports (2).

WARNING:
When operating exclusively on the stabilizer bar and not on the rods, unscrew the nuts (4) securing the bar, leaving the rods connected to the lower wishbone arms.



1 Rubber cushions
2 Stabilizer bar
3 Nut
4 Rod
5 Pin



1 Stabilizer bar
2 Supports
3 Screws
4 Nut
5 Nut

DISASSEMBLY

1. Secure the stabilizer bar (2) on a vice equipped with jaw liners.
2. Unscrew the nut (3) securing the rod (4) to the stabilizer bar.
3. If necessary, unscrew the pin (5) coupling with the lower wishbone, having eliminated the corresponding calking.
4. If necessary, slide off the rubber cushions (1) having dampened the surface of the stabilizer bar with vasline or grease.

INSPECTION AND CHECKS

Clean all parts.
1. Check that the bar and rods are neither damaged nor bent.
2. Replace the rods if the ball and socket joints show signs of binding or excessive play.
3. Check that the rubber cushions are not worn, otherwise replace them with new ones.

REASSEMBLY

1. Lubricate the inner surface of the stabilizer bar support cushions with the specified grease and assemble cushions on bar.

Grease:
ISECO: Ergon Rubber Grease N.3
SPCA: Spagraph
REINACH: Sferul B2AR

2. Secure the lower wishbone coupling pins to the rods, observing the following tightening torque and calking the screw.

(T) : Tightening torque
Stabilizer bar rod ball and socket joint to lower wishbone coupling pin
72 thru 80 N·m
(7.3 thru 8.2 kg·m)
(53.1 thru 59 ft·lb)

3. Re-install the rods on the stabilizer bar but do not lock the nuts.

INSTALLATION

1. Position the stabilizer bar on the car and secure it correctly in place. Observe the following tightening torques:

(T) : Tightening torques
Nuts securing rods to stabilizer bar
72 thru 80 N·m
(7.3 thru 8.2 kg·m)
(53.1 thru 59 ft·lb)

Nuts securing rod pins to lower wishbone arms
48 thru 53 N·m
(4.9 thru 5.4 kg·m)
(35.4 thru 39.1 ft·lb)

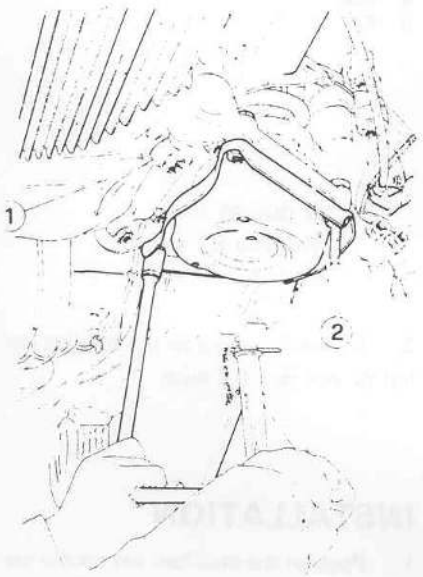
Screws securing stabilizer bar support to body
20 thru 22 N·m
(2 thru 2.2 kg·m)
(14.8 thru 16.2 ft·lb)

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HELICAL SPRINGS

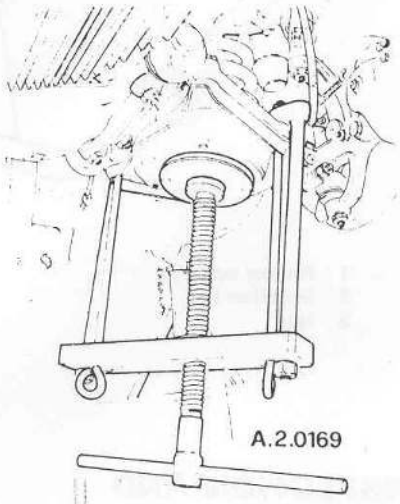
REMOVAL

1. Put the car on the lift, activate the parking lock, raise the car at the front using a column type jack, secure it on safety stands and remove the wheel.
2. Uncouple the stabilizer bar as in: Stabilizer Bar - Removal.
3. Unscrew the two bolts, diagonally, securing the spring cap (2) to the lower wishbone (1).



1 Lower wishbone
2 Spring

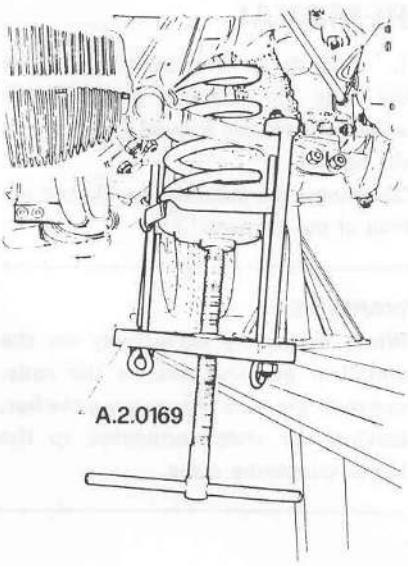
4. Assemble tool **A.2.0169**, securing it in the housings of the two previously unscrewed bolts.



CAUTION:
Ensure that the tool is secure and positioned correctly.

---

5. Unscrew the other two bolts which secure the spring cap to the lower wishbone, thus the cap lowers and the spring is released.



6. When the spring has been completely released, slide it off and retrieve the upper and lower buffers and caps.

INSPECTION AND CHECKS

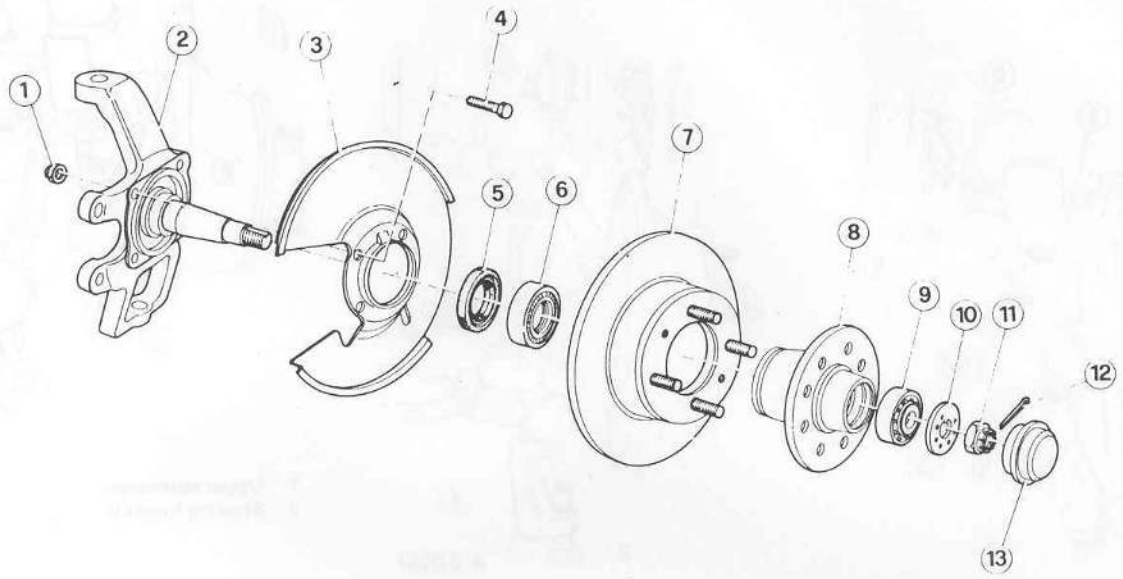
1. Check that the spring shows no sign of yielding or deformation.
2. Check spring efficiency by comparing the data obtained with that stipulated.
3. Check that the rubber parts are not worn or damaged.
4. Make appropriate replacements.

INSTALLATION

Carry out removal operations in reverse order and check that the car trim is as indicated in: Unit 00 - Maintenance Mechanical Components and Body - Car Trim.

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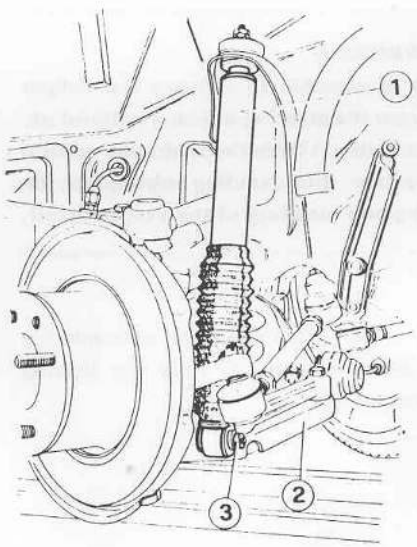
STEERING KNUCKLES AND WHEEL HUBS



1 Nut
2 Steering knuckle
3 Splash shield
4 Screw
5 Seal ring
6 Inner bearing
7 Brake disc
8 Wheel hub
9 External bearing
10 Washer
11 Nut
12 Cotter pin
13 Hub cover

REMOVAL

1. Put the car on the lift, activate the parking lock, raise the car at the front with a column type jack, secure it onto safety stands and remove the wheel.
2. Remove the stabilizer bar as in: Stabilizer Bar - Removal.
3. Unscrew the nut (3) securing the shock absorber (1) to the pin on the lower wishbone (2). Slide off the shock absorber and retrieve the two outer washers and the inner one.



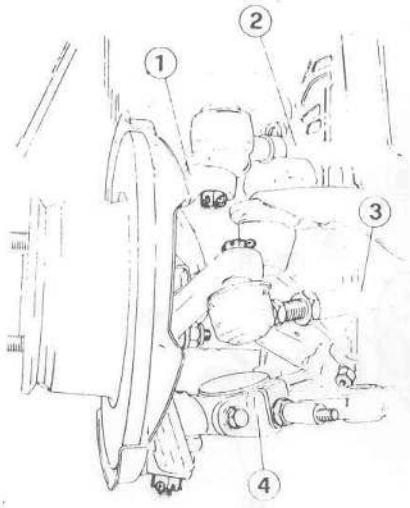
1 Shock absorber
2 Lower wishbone
3 Nut

4. Remove the spring as in: Helical Spring - Removal.

WARNING:
If work is to be carried out on the wheel hub and bearings only, it is possible to dismantle the brake disc wheel hub assembly by removing the brake pads as indicated in Unit 22 - Front brakes, without detaching the steering knuckle and brake caliper.

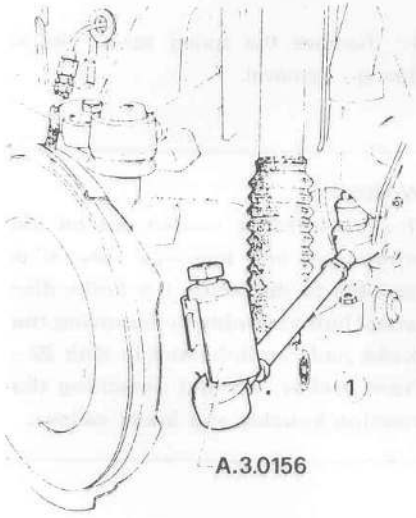
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5. Slide out the cotter pins and unscrew the three nuts securing the upper wishbone (2), the track rod (3) and the lower wishbone (4) to the steering knuckle (1).



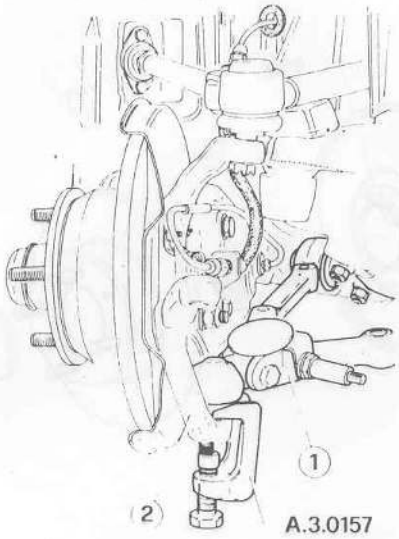
1 Steering knuckle
2 Upper wishbone
3 Track rod
4 Lower wishbone

6. Using tool **A.3.0156**, uncouple the track rod (1) from the steering knuckle.



1 Track rod

7. Using tool **A.3.0157**, uncouple the lower wishbone (1) from the steering knuckle (2).



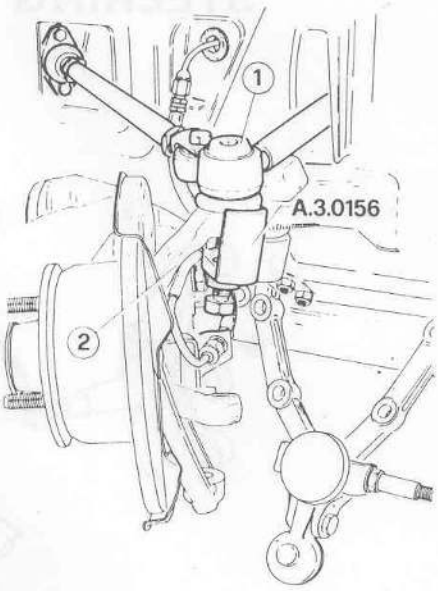
1 Lower wishbone
2 Steering knuckle

8. Disconnect the brake fluid hose from the front caliper, having emptied the brake fluid tank with a syringe.

WARNING:
It is possible to remove the caliper from the steering knuckle without uncoupling it from the hydraulic control system, thus avoiding subsequent filling and bleeding of the system itself.

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9. Using tool **A.3.0155**, uncouple the upper wishbone (1) from the steering knuckle (2).

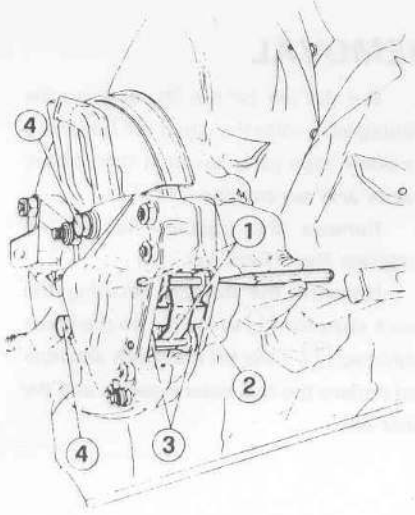


1 Upper wishbone
2 Steering knuckle

10. Remove the steering knuckle together with the wheel hub.

DISASSEMBLY

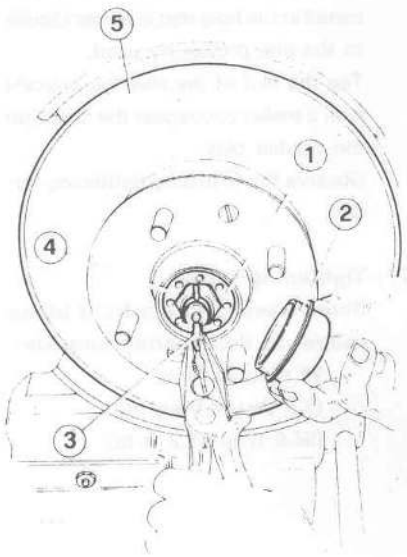
1. Fit the whole hub assembly in a vice; using a punch, drive the check pins (1) of the brake pads and extract them, then extract the cross spring (2) and pads (3).
2. Unscrew the two screws (4) securing the brake caliper to the steering knuckle.



1 Check pins
2 Cross spring
3 Brake pads
4 Screws

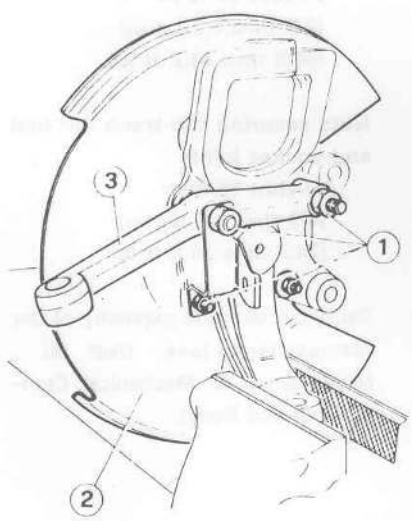
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3. Take out the hub cap cover (2) and the cotter pin (3), unscrew the nut (4), remove the brake-wheel hub disc assembly (5) from the steering-knuckle, retrieving the washer (1) and the internal race of the external bearing below.



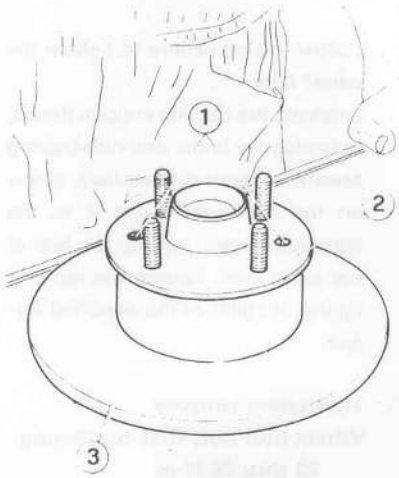
1 Washer
2 Hub cover
3 Cotter pin
4 Nut
5 Brake-disc-wheel hub

4. Unscrew the four nuts (1), retrieving the splash shield (2) and the steering lever (3).



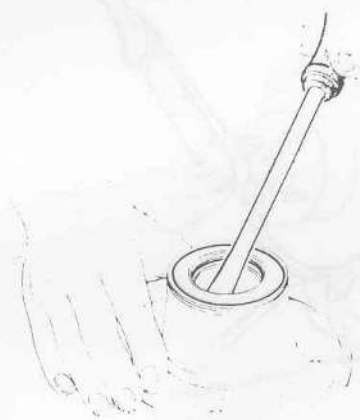
1 Nuts
2 Splash shield
3 Steering lever

5. Unscrew the two screws (1) securing the wheel hub (2) to the brake disc (3) and separate the two parts.

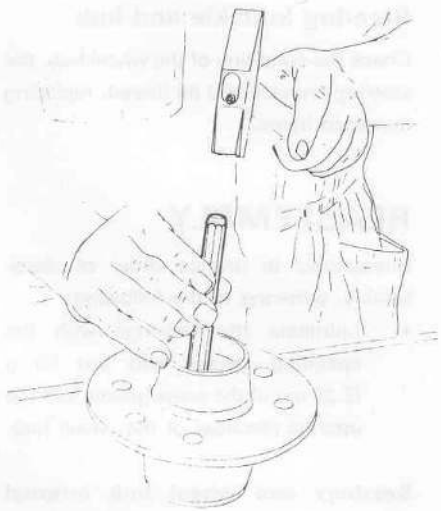


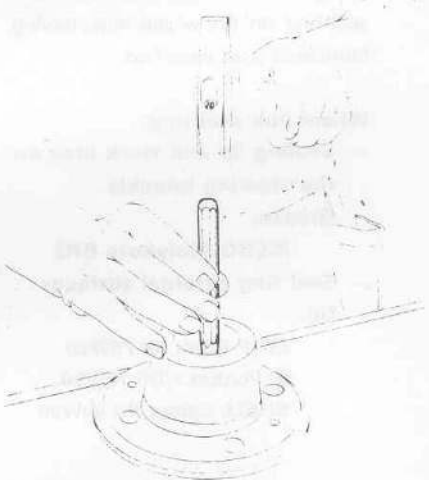
1 Screws
2 Wheel hub
3 Brake disc

6. Using a screwdriver, take the seal ring out from the hub and retrieve the internal race of the inner bearing below.



7. Extract the external races of the bearings.





INSPECTION AND CHECKS

Clean all the components.

Wheel bearings

If the surfaces of the races and balls are dimpled, rough or out of round, replace the bearing.

WARNING:
Should a bearing be beyond repair, replace both the inner and outer ones at the same time.

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Steering knuckle and hub

Check the condition of the wheel hub, the steering knuckle and its thread, replacing damaged items.

REASSEMBLY

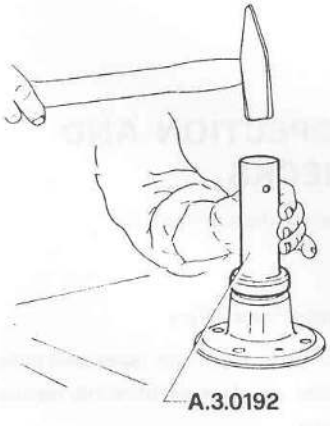
Reassemble in reverse order of disassembly, adhering to the following:

- Lubricate the bearings with the specified grease and put 65 g (2.29 oz) of the same grease into the internal chamber of the wheel hub.

Bearings and wheel hub internal chamber.
Grease:
AGIP Grease 33 FD
IP Autogrease FD

- Using tool **A.3.0192**, assemble a new seal ring on the wheel hub, having lubricated it as specified.

Wheel hub seal ring.
— **Sealing lip and work area on the steering knuckle.**
Grease:
ISECO Molykote BR2
— **Seal ring external surfaces.**
Oil:
AGIP Rotra SX 75W90
IP Pontiax HDS 75W90
SHELL Spirax HD 80W90



A.3.0192

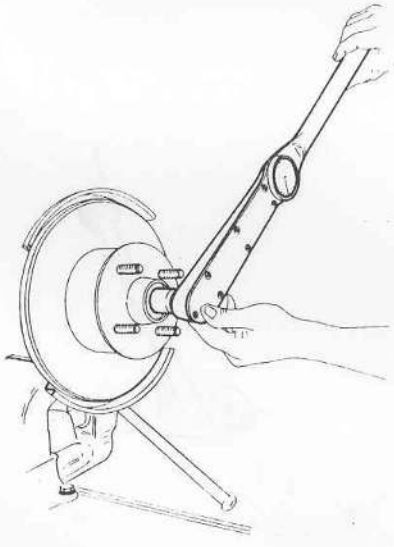
- Assemble new self-locking nuts.
- Observe the following tightening torque:

(T) : **Nuts securing the steering lever to the steering knuckle**
39 thru 44 N·m
(4 thru 4.5 kg·m)
(28.8 thru 32.4 ft·lb)

- Follow this procedure to tighten the wheel hub.
Lubricate the steering knuckle thread, assemble the brake disc-hub-bearing assembly, insert the washers, screw on the nut and tighten it to the specified torque, turning the hub at the same time. Loosen the nut and tighten it again to the specified torque.

(T) : **Tightening torques**
Wheel hub nut, first tightening
20 thru 25 N·m
(2 thru 2.5 kg·m)
(14.8 thru 18.4 ft·lb)

Wheel hub nut, second tightening
5 thru 10 N·m
(0.5 thru 1 kg·m)
(3.7 thru 7.4 ft·lb)



Unscrew the nut by 90° and put in the cotter pin. If a notch on the nut and a hole on the steering knuckle fail to align, screw the nut to the minimum angle necessary to allow insertion of the cotter pin settle the bearings, tapping the end of the steering knuckle once with a mallet and check that the washer is not stuck (it should be possible to move it by exerting slight pressure with the end of a screwdriver put into one of the radial holes of the washer. If the washer is stuck, remove the cotter pin and unscrew the nut until the cotter pin can be inserted in the hole that is perpendicular to the one previously used.
Tap the end of the steering knuckle with a mallet and repeat the check on the washer play.

- Observe the following tightening torque.

(T) : **Tightening torque**
Screws securing the front brake caliper to the steering knuckle
74 thru 83 N·m
(7.5 thru 8.5 kg·m)
(54.6 thru 61.2 ft·lb)

INSTALLATION

Proceed to reassemble by carrying out removal operations in reverse order and adhering to the following instructions.

- Observe the following tightening torques.

(T) : **Tightening torques**
Nuts securing the upper and lower ball and socket joints to the steering knuckle
74 thru 83 N·m
(7.5 thru 8.5 kg·m)
(54.6 thru 61.2 ft·lb)

Nuts securing the track bar ball and socket joints
47 thru 54 N·m
(4.8 thru 5.5 Kg·m)
(34.7 thru 39.8 ft·lb)

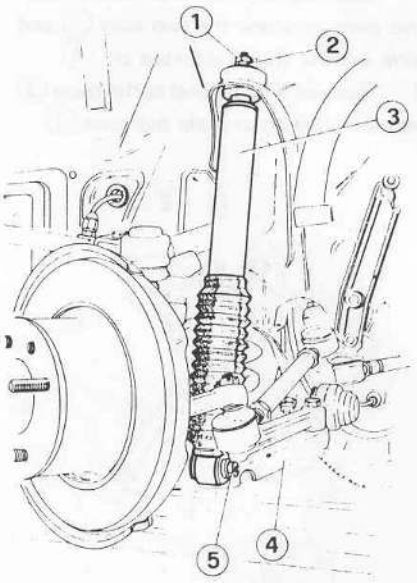
- Verify car trim and geometry of the fore-carriage (see: Unit 00 - Maintenance of Mechanical Components and Body).

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SHOCK ABSORBERS

REMOVAL

1. Activate the parking lock, raise the car at the front, secure it onto safety stands and remove the wheel.
2. Unscrew the lock nut (1) and nut (2) securing the shock absorber (3) at the top to the bodywork.
3. Unscrew the nut (5) securing the lower wishbone (4) and slide out the shock absorber, retrieving the lower washers and upper buffers.



1 Lock nut
2 Nut
3 Shock absorber
4 Lower wishbone
5 Nut

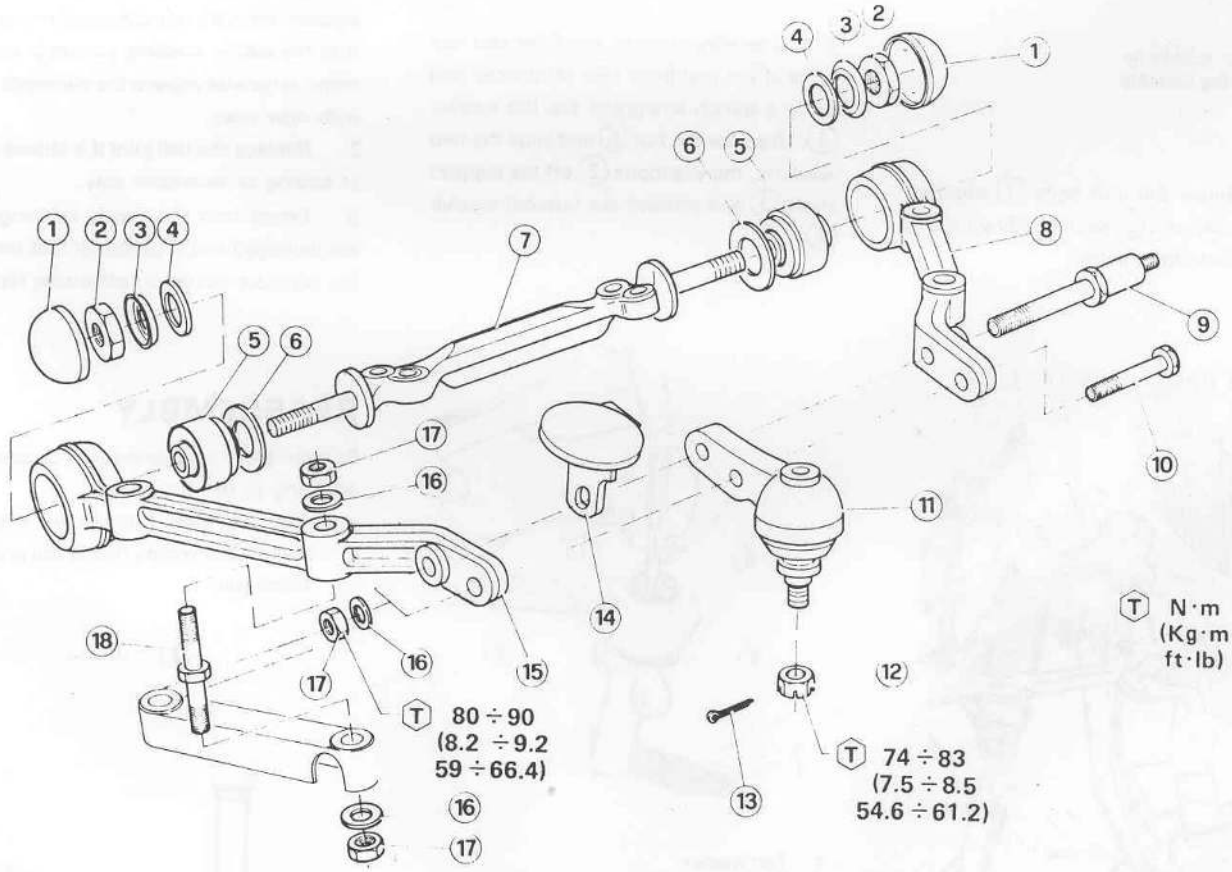
INSPECTION AND CHECKS

1. Check absorber efficiency and replace if oil leaks are encountered.
2. If considered necessary, record the absorber calibration data (see: Technical Specifications and Features - Checks and Adjustment).

INSTALLATION

Proceed by carrying out removal operations in reverse order.

LOWER WISHBONES

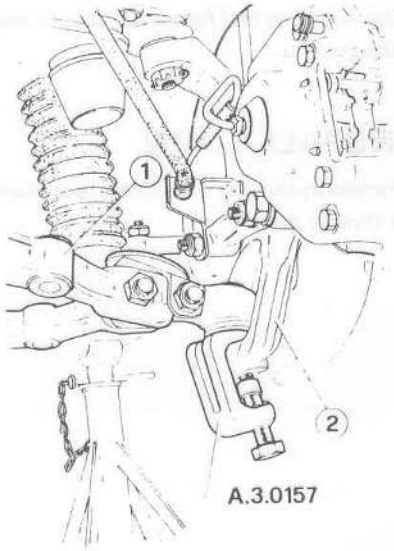


1 Cap
2 Nut
3 Tab washer
4 Washer
5 Elastic bushing
6 Washer
7 Lever support shaft
8 Rear arm
9 Shock absorber pin
10 Screw
11 Steering knuckle ball joint
12 Nut
13 Cotter pin
14 Rebound buffer plate
15 Front arm
16 Washer
17 Nut
18 Pin

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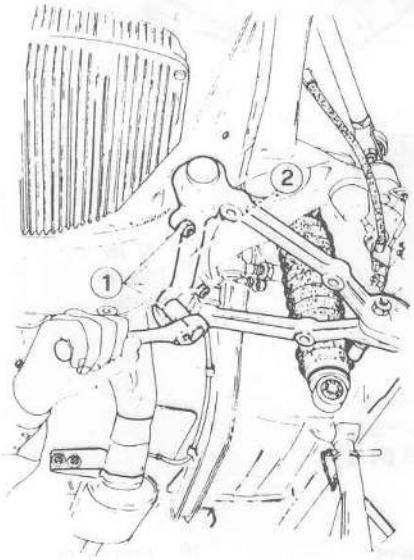
REMOVAL

1. Proceed as instructed in "Steering Knuckle and Wheel Hubs - Removal", steps 1-4.
2. Slide out the cotter pin, unscrew the nut securing the lower wishbone (1) to the steering knuckle (2) then, using tool **A.3.0157**, uncouple the two parts.



1 Lower wishbone
2 Steering knuckle

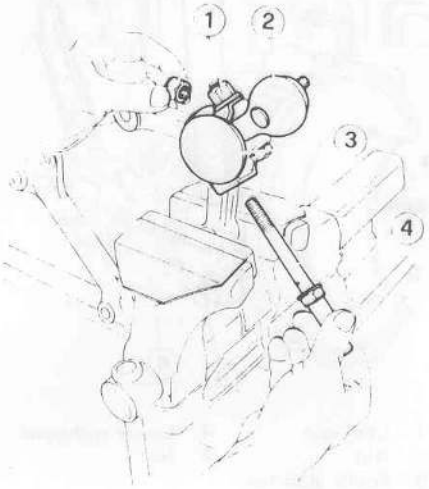
3. Unscrew the four bolts (1) securing the lever support (2) to the bodywork and remove the entire lever.



1 Bolts
2 Lever support

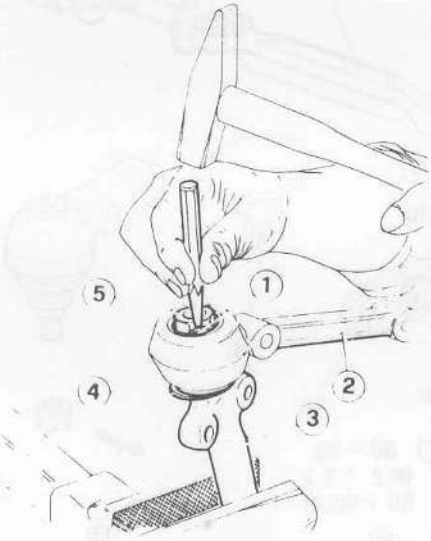
DISASSEMBLY

1. Lock the lever in a vice with protective jaws, unscrew the two nuts (1) and slide out the shock absorber pin (4).
2. Retrieve the rebound buffer plate (3) and the steering knuckle ball joint (2).



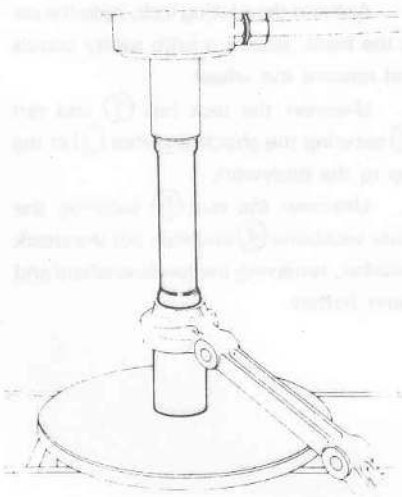
1 Nuts
2 Ball joint
3 Plate
4 Shock absorber pin

3. Operating both on the front and rear sides of the wishbone take off the cap and using a punch straighten the tab washer (1). Unscrew the nut (5) and slide the two washers, the wishbone (2) off the support shaft (3) and retrieve the internal washer (4).



1 Tab washer
2 Wishbone
3 Support shaft
4 Internal washer
5 Nut

4. Retrieve the protection sponges of the elastic bushings and, at the press, extract the elastic bushings from the wishbones.



INSPECTION AND CHECKS

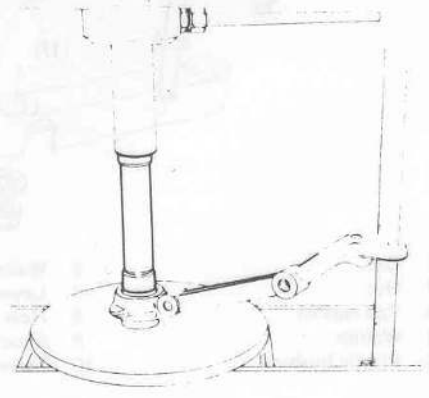
Clean all the components.

1. Check that the wishbones and the support shaft are not damaged or bent and that the elastic bushing housings are not worn, otherwise replace the damaged parts with new ones.
2. Replace the ball joint if it shows signs of seizing or excessive play.
3. Check that the elastic bushings are not damaged and in particular that the rubber parts are not worn, otherwise replace.

REASSEMBLY

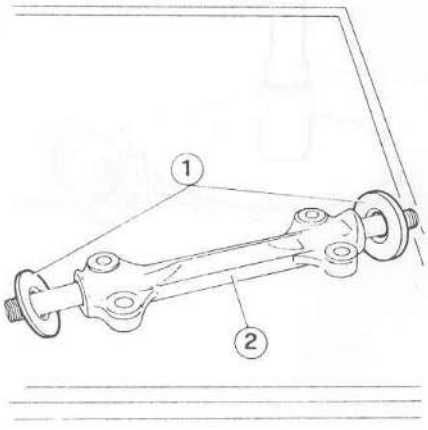
Reassemble in reverse order of disassembly adhering to the following:

- Put the elastic bushings into the associated wishbones at the press as illustrated.



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- Slide the two internal washers into the support shaft directing them with the chamfer turned towards the body of the support shaft.



1 Washer
2 Support

- Assemble new self-locking nuts.
- Observe the following tightening torque.

(T) : Tightening torque
Nuts fixing the lower ball and socket joint to the wishbones
80 thru 90 N·m
(8.2 thru 9.2 kg·m)
(59 thru 66.4 ft·lb)

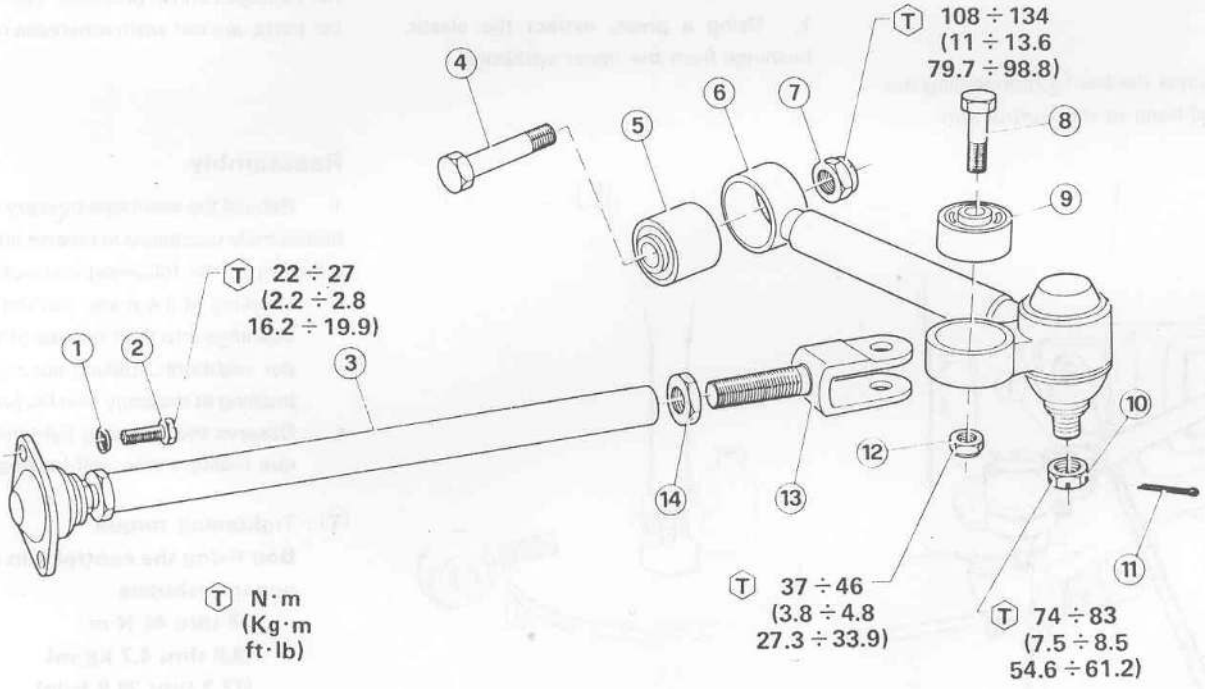
INSTALLATION

Proceed to reassemble by carrying out removal operations in reverse order and observing the following tightening torques.

(T) : Tightening torques
Bolts securing the lower wishbone support to the body
55 thru 58 N·m
(5.6 thru 5.9 kg·m)
(40.6 thru 42.8 ft·lb)

Nut securing the lower ball and socket joint to the steering knuckle
74 thru 83 N·m
(7.5 thru 8.5 kg·m)
(54.6 thru 61.2 ft·lb)

UPPER WISHBONE AND CONTROL ARMS



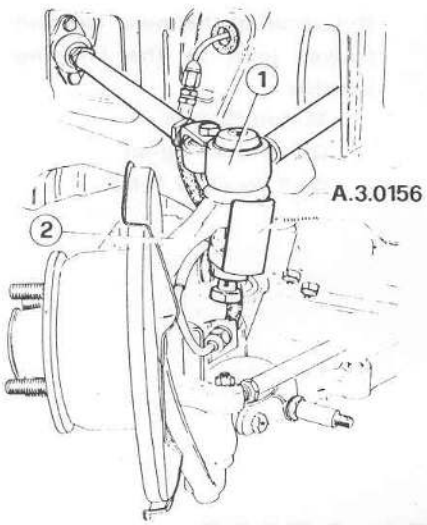
1 Washer
2 Screw
3 Control arm
4 Nut
5 Elastic bushing
6 Upper wishbone
7 Nut
8 Screw
9 Elastic bushing
10 Nut
11 Cotter pin
12 Nut
13 Fork
14 Nut

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UPPER WISHBONE

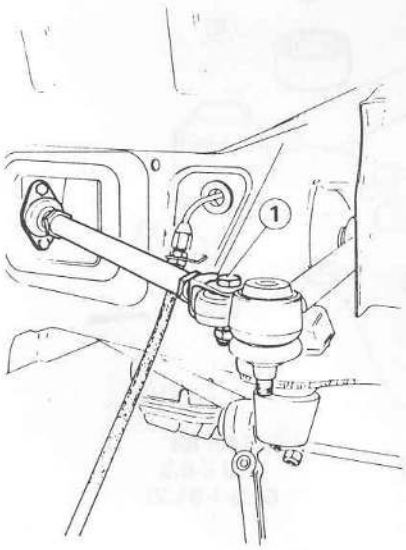
REMOVAL

1. Proceed as instructed in "Steering Knuckles and Wheel Hubs - Removal", steps 1-4.
2. Slide out the cotter pin, unscrew the nut securing the upper wishbone (1) to the steering knuckle (2) then, using tool **A.3.0156**, uncouple the two parts.



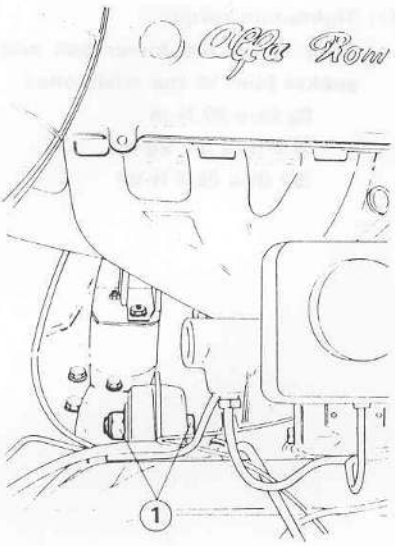
1 Upper wishbone
2 Steering knuckle

3. Unscrew the bolt (1) connecting the upper wishbone to the control arm.



1 Bolt

4. Working from the engine compartment, unscrew the bolt (1) securing the upper wishbone to the body.

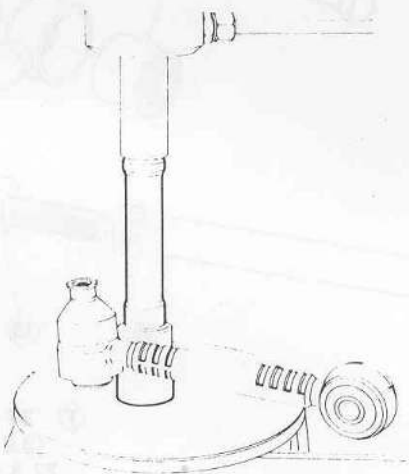


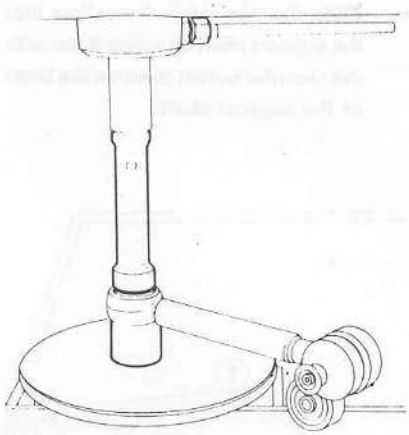
1 Bolt

5. Remove the upper wishbone.

DISASSEMBLY

1. Using a press, extract the elastic bushings from the upper wishbone.





INSPECTION AND CHECKS

1. Check that the upper wishbones are not damaged or bent and that the elastic bushing housings are not worn, otherwise replace the damaged parts.
2. Replace the upper arm if the steering knuckle ball joint shows signs of seizing or excessive play.
3. Check that the elastic bushings are not damaged and in particular that the rubber parts, are not worn otherwise replace.

Reassembly

1. Rebuild the wishbone by carry out the disassembly operations in reverse order and adhering to the following instructions.

- Working at the press, put the elastic bushings into their houses of the upper wishbone, making sure that the bushing at the body side fits properly.
- Observe the following tightening torque (using a new self-locking nut).

(T) : **Tightening torque**
Bolt fixing the control arm to the upper wishbone
37 thru 46 N·m
(3.8 thru 4.7 kg·m)
(27.3 thru 33.9 ft·lb)

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INSTALLATION

Carry out removal operations in reverse order and follow these instructions.

- Apply the specified anti-scuff to the screw securing the upper lever to the body.

Antiseize:
R. GORI Never Seez

- Observe the following tightening torques.

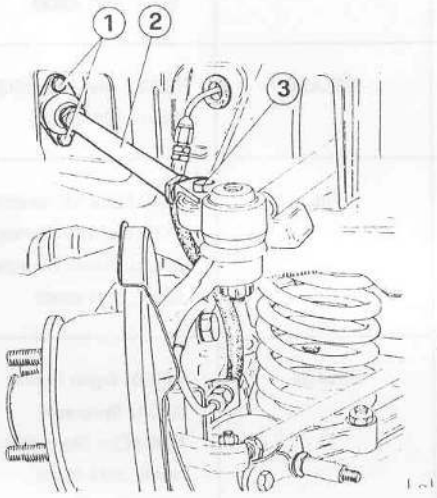
(T) : Tightening torques
Bolt securing the upper wishbone to the bodywork
108 thru 134 N·m
(11 thru 13.7 kg·m)
(79.7 thru 98.8 ft·lb)

Nut securing the upper ball and socket joint to the steering knuckle
74 thru 83 N·m
(7.5 thru 8.5 Kg·m)
(54.6 thru 61.2 ft·lb)

CONTROL ARMS

Replacement

If the control arm is damaged or bent, raise the car at the front, remove the wheel and proceed with replacement by unscrewing the two screws (1) securing the control arm (2) to the bodywork and the bolt (3) connecting the upper wishbone.



1 Screws
2 Control arm
3 Bolt

On reassembling, observe the following tightening torque.

(T) : Tightening torque
Screws securing the front arm to the bodywork
22 thru 27 N·m
(2.2 thru 2.8 kg·m)
(16.2 thru 19.9 ft·lb)

TECHNICAL SPECIFICATIONS AND FEATURES

TECHNICAL FEATURES

HELICAL SPRINGS

Wire diameter	16.3 ± 0.05 mm (0.64 ± 0.002 in)
Spiral diameter	120 mm (4.72 in)
Free length	318 mm (12.52 in)
Rigidity	70.9 N/mm (7.23 Kg/mm; 405 lb/in)
Static load	7377 ± 221 N (752 ± 22.5 Kg; 1658 ± 50 lb)
Length with static load	214 mm (8.43 in)

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GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

Application	Type	Denomination	Quantity
Wheel hub inner chamber	GREASE	AGIP: Grease 33 FD IP: Autogrease FD Norm. 3671-69833	65 g (2.29 oz)
Wheel hub seal ring lip and work area on steering knuckle	GREASE	ISECO: Molykote BR2 Norm. 3671-69841	–
Wheel hub seal ring outer surface	OIL	AGIP Rotra SX 75W90 IP Pontiax HDS 75W90 SHELL Spirax HD 80W90 Norm. 3671-69408	Dampen
Inner surface of the stabilizer bar carrier rubber cushions	GREASE	ISECO: Ergon Rubber Grease n. 3 SPCA: Spagraph REINACH: Sferul B2AR Norm. 3671-69816	Dampen
Upper wishbone spring bushing Screw securing the upper wishbone to the bodywork	FLUID	R. GORI: Never Seez - Antiseize Norm. 3671-69850	Dampen
Lower half-wishbone covers	GREASE	NOVO: Calypsol AE63 Norm. 3671-69823	A.R.

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CHECKS AND ADJUSTMENT

FRONT SUSPENSION SPRING LOAD CLASSES

Only springs having the same load class should be assembled on any one axle.

The springs should reach assembly already selected, in appropriate countermarked containers and divided into five classes each one with a tolerance range of approximately 98 N (10 Kg; 22 lb) on the static load [7156 thru 7598 N (729.5 thru 774.5 Kg; 1608 thru 1708 lb)].

Distinctive number	Load class		
	N	Kg	lb
19	7156 thru 7240	729.5 thru 738	1608 thru 1628
20	7241 thru 7330	739 thru 747	1629 thru 1648
21	7331 thru 7420	748 thru 756	1649 thru 1668
22	7421 thru 7520	757 thru 766	1669 thru 1690
23	7521 thru 7598	767 thru 774.5	1691 thru 1708

FRONT WHEELS AND CAR ATTITUDE, CHARACTERISTIC ANGLES

See Unit 00 - Complete Car - Maintenance of Mechanical Components and Body

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TIGHTENING TORQUES

Item	N·m	kg·m	ft·lb
Wheel hub nut; first tightening	20 thru 24	2 thru 2.5	14.8 thru 17.7
Wheel hub nut; second tightening	5 thru10	0.5 thru 1	3.7 thru 7.4
Nuts securing upper and lower ball and socket joints to the steering knuckle	74 thru 83	7.5 thru 8.5	54.6 thru 61.2
Nut securing the steering arm to the steering knuckle	39 thru 44	4 thru 4.5	28.8 thru 32.5
Bolts securing the lower wishbone to the body	55 thru 58	5.6 thru 5.9	40.6 thru 42.8
Bolt securing the upper wishbone to the body	108 thru 134	11 thru 13.6	79.7 thru 98.8
Screws securing the front arm to the body	22 thru 27	2.2 thru 2.8	16.2 thru 19.9
Nuts securing the lower ball and socket joint to the half wishbones	80 thru 90	8.2 thru 9.2	59 thru 66.4
Bolt securing the front arm to the upper wishbone	37 thru 46	3.8 thru 4.7	27.3 thru 33.9
Screws securing the front brake caliper to the steering knuckle	74 thru 83	7.5 thru 8.5	54.6 thru 61.2
Nuts securing the track bar ball and jocket joint	47 thru 54	4.8 thru 5.5	34.7 thru 39.8
Stabilizer bar rod ball and socket joint to lower wishbone coupling pin	72 thru 80	7.3 thru 8.2	53.1 thru 59
Screws securing rods to stabilizer bar	72 thru 80	7.3 thru 8.2	53.1 thru 59
Screws securing rod pins to lower wishbone arms	48 thru 53	4.9 thru 5.4	35.4 thru 39.1
Screws securing stabilizer bar supports to bodywork	20 thru 22	2 thru 2.2	14.8 thru 16.2

TROUBLESHOOTING AND CORRECTIVE ACTIONS

Trouble	Probable cause	Corrective action
Steering wheel vibration or shimmy-ing	- Steering wheel shudders when the front wheels encounter obstacles on the road. This circumstance could be due to excessive play in the steering box or among other steering parts. - Steering wheel vibration is often encountered in the presence of excessive play in the steering box or tie bars, or in the event of front wheel oscillation. - The "shimmy" is a rapid oscillation transmitted to the steering wheel and is often encountered when the car reaches a certain speed.	
	• Tire pressure incorrect	Adjust
	• Wheels not balanced or tire rims deformed	Balance or repair
	• Tires worn or wheel securing screws loose	Replace or tighten
	• Ball and socket joint connecting the suspension in worn	Replace the ball and socket joint

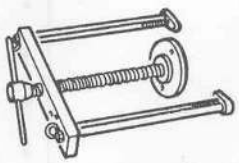
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Trouble	Probable cause	Corrective action
	• Steering box incorrectly adjusted	Adjust
	• Rubber bushings of the suspension leverages are faulty	Replace
	• Excessive play in steering tie bars	Check and if necessary replace
	• Steering box securing screws are loose	Tighten
	• Shock absorber inefficient, or loose fixings	Tighten or replace
The car drifts or fails to maintain the trajectory	- Drifting is obvious when travelling on a level surface and letting go of the steering wheel. Reference should also be made to: Unit 25 - Troubleshooting and Corrective Action	
	• Tires worn or faulty	Replace
	• Tire pressure incorrect, and/or wheel screws loose	Adjust and/or tighten
	• Difference in height between the tread of the left and righthand tires	Replace the tire with the least tread
	• Asymmetrical car trim	Renew trim
	• Wheel angles incorrect	Renew
	• Brake resistance	Check and renew operating functions
	• Rubber bushings of the suspension leverages are worn	Replace worn parts
	• Steering-suspension connection is faulty	Replace faulty parts
Excessive play of steering wheel	• Steering box incorrectly adjusted	Adjust
	• Steering components worn	Replace worn parts
	• Screws securing the steering box are worn	Tighten
Noise	• Tire pressure incorrect	Adjust
	• Ball and socket joints or steering components damaged and worn, or lacking oil	Replace or lubricate
	• Steering or suspension leverage fasteners loose	Tighten
	• Faulty shock absorbers	Replace
	• Wheel bearings faulty	Replace
	• Suspension leverage bushings faulty	Replace
	• Helical springs damaged	Replace
	• Nut securing the shock absorber is loose	Tighten

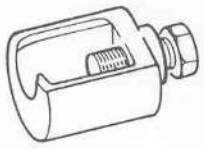
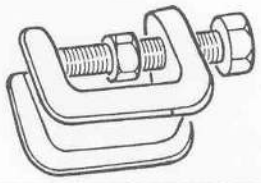
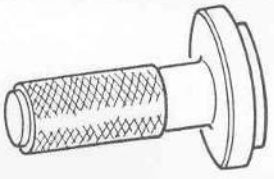
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Trouble	Probable cause	Corrective action
Tires squeak on bends	• Tire pressure incorrect	Adjust
	• Wheel angles incorrect	Adjust
	• Bad driving	Avoid
Abnormal (or uneven) tire wear	- See: Unit 28 - Wheels and Tires	
Stiff steering wheel	• Tire pressure incorrect	Adjust
	• Tires excessively worn	Replace
	• Pinion-rack coupling incorrectly adjusted	Adjust
	- If the fault persists subsequent to these preliminary operations, check and take action as follows. Using the jack, raise the front of the car and rest it on safety stands. Separate the tie bar and steering knuckle then remove the steering wheel. a) If the steering wheel is light, look for the cause of the fault in the suspension or steering leverages. b) If the steering wheel is stiff, look for the cause of the fault in the steering box or steering post.	
	• Incorrect lubrication of the steering box and/or polluted lubricant	Lubricate
	• Incorrect lubrication of the tie bar, polluted grease or abnormal steering wear	Lubricate correctly; replace the grease or worn parts
	• Ball and socket joints worn or seized	Replace
	• Tie bars deformed	Replace
	• Wheel angles incorrect	Renew

SPECIAL TOOLS

Identity N°	Denomination	Reference page
A.2.0169	Tool for front spring assembly/disassembly 	21-4

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Identity N°	Denomination	Reference page
A.3.0156	Extractor for the upper pins of the steering knuckles and ball joints of the steering wishbones 	21-5 21-12
A.3.0157	Extractor for the lower pins of the steering knuckles 	21-5 21-10
A.3.0192	Inserter, seal ring onto hubs 	21-8

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UNIT 22

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- Servobrake 22-8
- Vacuum system 22-9
- Front brakes 22-9
- Rear brakes 22-11
- Brake pressure adjusting valve 22-13

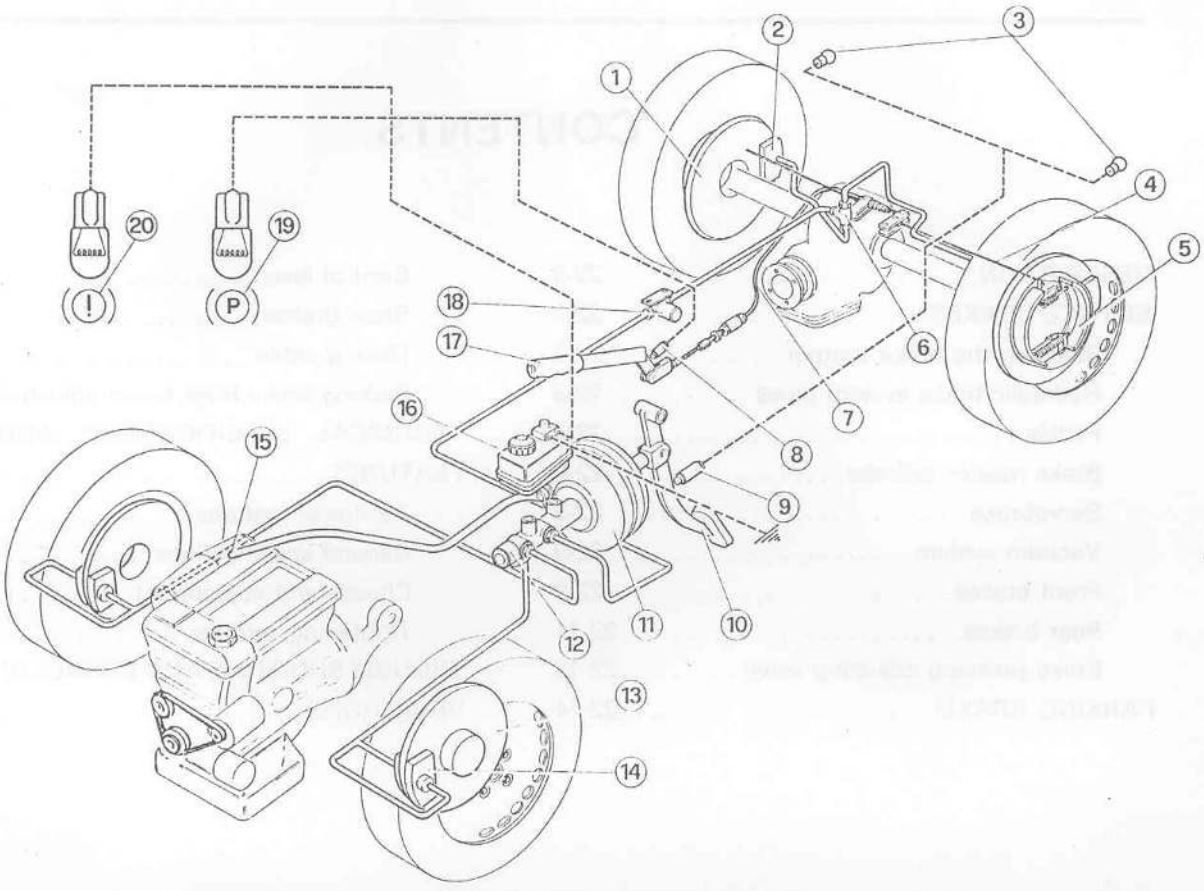
PARKING BRAKE 22-14
- Control lever 22-14
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DESCRIPTION



1 Rear brake disc
2 Pads
3 Stop lights
4 Parking brake shoe operating cable
5 Parking brake shoe
6 Union T
7 Parking brake cable
8 Parking brake lamp switch
9 Stop light switch
10 Brake pedal
11 Servo brake
12 Brake master cylinder
13 Front brake disc
14 Pads
15 Brake booster vacuum port
16 Brake fluid reservoir
17 Parking brake lever
18 Brake pressure adjusting valve
19 Parking brake "on" light
20 Brake fluid minimum level warning light

Service brakes

- The hydraulic circuit is activated by a dual master cylinder, assembled coaxially to a vacuum brake booster.
- The vacuum brake booster is a device which utilizes the depression formed in the intake manifold in order to make brake master cylinder activation easier.
- The front stage of the brake master cylinder acts on the circuit which activates the front caliper while the rear stage acts on the circuit which activates the rear calipers, by means of the pressure control valve.
- This system, which is hence formed by two independent circuits guarantees, first of all, braking when one of the two circuits is broken and also assures car road holding by means of the pressure control valve which restricts the pressure in the rear circuit accordingly; the rear axle is thus prevented from locking.

Parking brake

- The parking brake, which is activated manually, is autonomous with respect to the service brake and controls two shoe brakes which acts on the internal surfaces of the rear brake discs. It is controlled by means of a mechanical device with Bowden cable, two return squares located to the rear of the differential and the two shoe expansion systems.
  To adjust clearance, work on individual shoes and driving cable.

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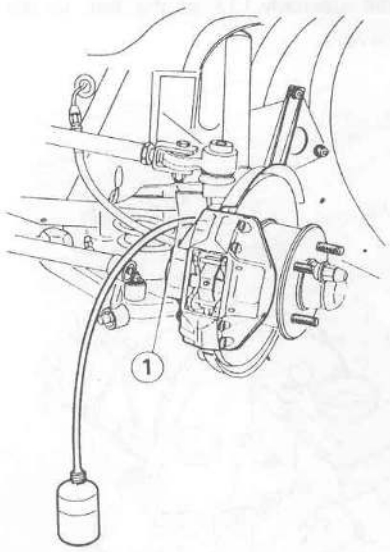
SERVICE BRAKES

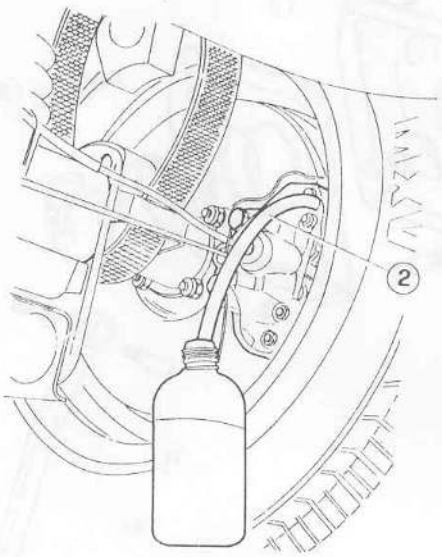
BLEEDING THE BRAKE SYSTEM

WARNING:

a. **Check that the fluid level does not go below the minimum level during the bleeding operation.**
b. **Do not use the oil drained off again.**
c. **Prevent the fluid from splashing the paintwork and damaging it.**
d. **The operation is to be carried out by acting on the front and rear calipers simultaneously, first from one side, then from the other.**

1. Put the car on the lift.
2. If necessary, fill the fluid reservoir with the specified oil (ATE "S" or AGIP Brake Fluid Super HD or IP Auto Fluid FR or ALFA ROMEO Brake Fluid).
3. Raise the car and remove the caliper bleeder valve boots.
4. Slip a hose onto the caliper bleeder screws (1) and (2) then immerse the end of the hose in a container holding the specified brake fluid.





1 Front brake bleed
2 Rear brake bleed

5. Loosen the bleeder screws and press the brake pedal repeatedly, making sure that it returns to the initial position and waiting a few seconds between times. Repeat the operation until the liquid going into the container is totally bubble-free, then press the pedal right down and lock the bleeder valves.
6. Slip off the hose, reassemble the boots and top up the fluid level as required.
7. If the bleeding has been done carefully, a completely spring free pedal reaction should be accomplished, subsequent to an initial idle stroke, otherwise the operation shall have to be repeated.

HYDRAULIC BRAKE SYSTEM PIPES

INSPECTION AND CHECKS

Check the braking system pipes (rigid pipes and hoses), ensuring that there are no signs of deformation, cracks nor evidence of external rust.
Replace any items not fully intact.

REMOVAL AND REASSEMBLY

WARNING:

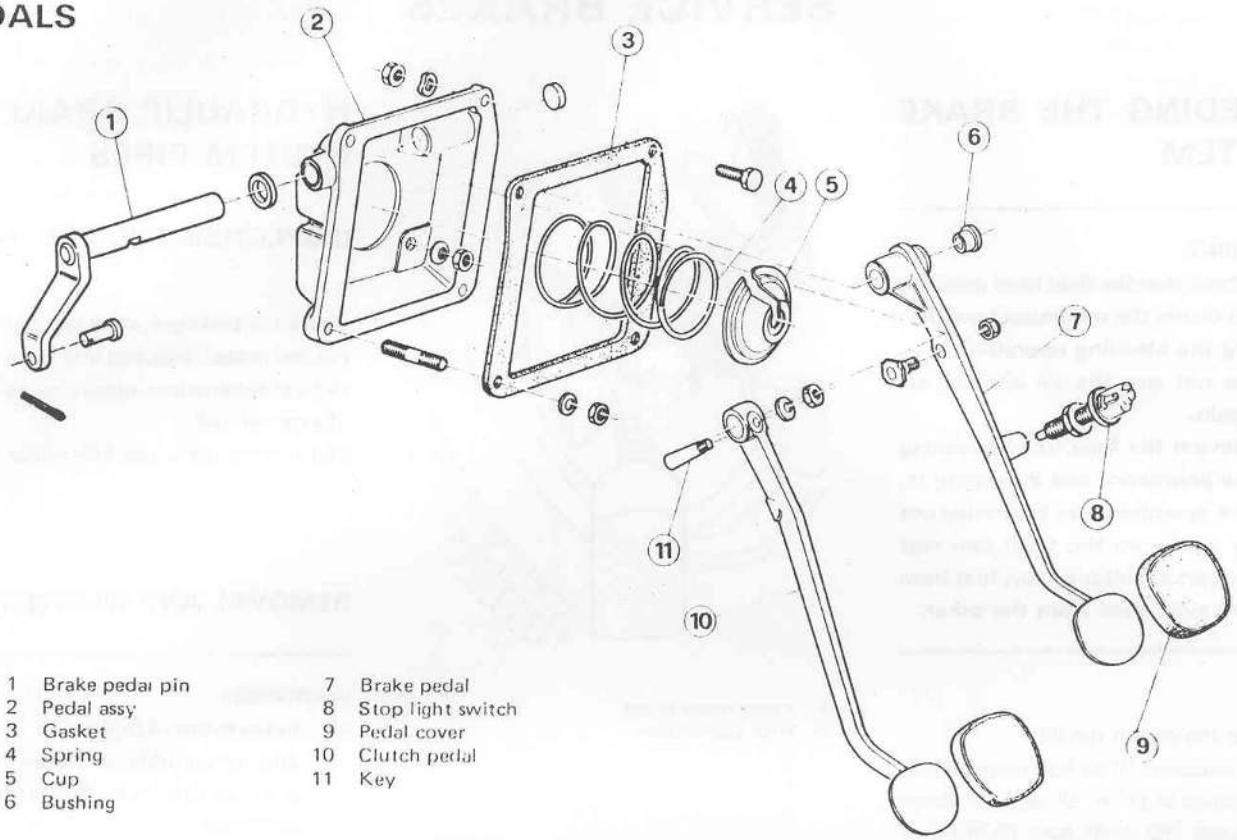
a. **In the event of brake pipe removal and reassembly, use a syringe to suck up the brake fluid from the reservoir.**
b. **Every time that the pipes are dismantled, plug the ends to prevent foreign bodies entering.**
c. **Once reassembly has been accomplished, ensure that the front and rear hoses are not twisted.**

(T) : **Tightening torque**
Hydraulic brake system pipe unions
8 thru 10 N·m
(0.8 thru 1 kg·m)
(5.8 thru 7.2 ft·lb)

(indicative value to be achieved with a wrench)

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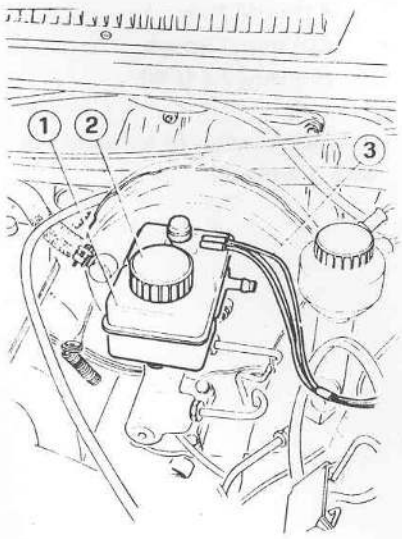
PEDALS



1 Brake pedal pin
2 Pedal assy
3 Gasket
4 Spring
5 Cup
6 Bushing
7 Brake pedal
8 Stop light switch
9 Pedal cover
10 Clutch pedal
11 Key

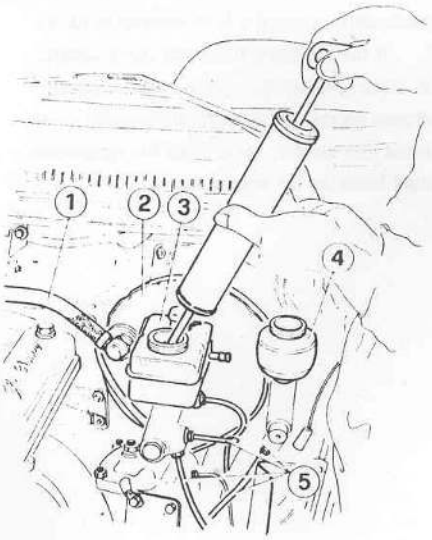
REMOVAL

1. Working from the engine compartment, disconnect the electric wires (3) from the brake fluid warning lamp, unscrew the plug (2) and remove the filter from the tank (1).



1 Tank
2 Plug
3 Electric wires

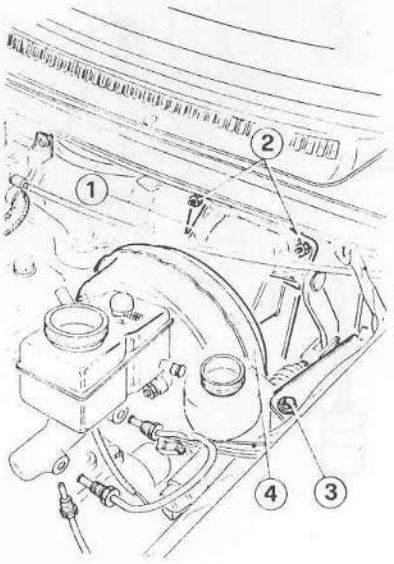
2. Using a syringe, suck up the liquid present in the brake (3) and clutch (4) reservoirs. Disconnect the pipe unions (5) of the clutch and brake circuits from the corresponding master cylinders.
3. Disconnect the vacuum port hose (1) from the servo brake (2).



1 Vacuum port hose
2 Servo brake
3 Brake reservoir
4 Clutch reservoir
5 Pipes

WARNING:
Prevent the fluid from splashing the paintwork thus damaging it.

4. Unscrew the bolt (3) securing the servo brake (4) to the bodywork and unscrew the two nuts (2) securing the pedal assembly (1), at the top, to the bodywork.



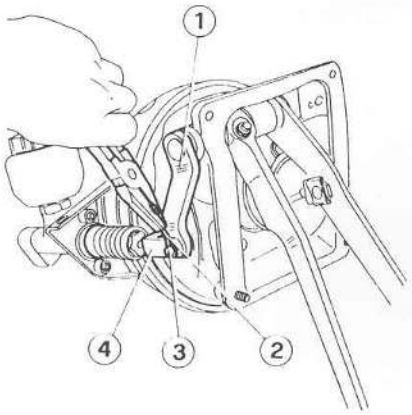
1 Pedal assy
2 Nuts
3 Bolt
4 Servo brake

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5. Working from within the car, unscrew the two nuts which secure the pedal assembly, at the bottom, to the bodywork.
6. Remove the pedal assembly-servo brake-clutch and brake master cylinders from the engine compartment.

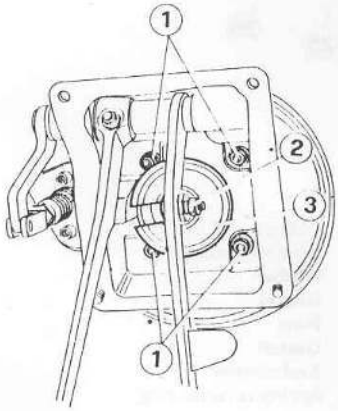
DISASSEMBLY

1. Extract the cotter pin (2), slide off the pin (3) and disconnect the clutch operating fork (4) from the lever (1).



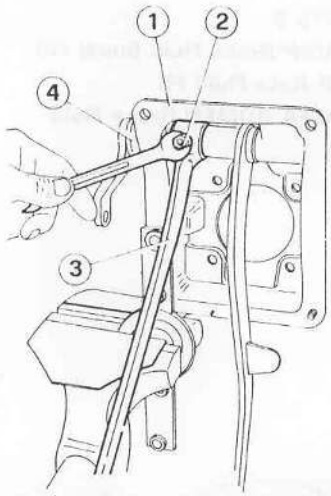
1 Lever
2 Cotter pin
3 Pin
4 Clutch operating fork

2. Unscrew the bolt (2) securing the servo brake fork to the brake pedal, retrieve the cup (3) and spring below it then unscrew the four nuts (1) and separate the pedal assembly from the servo brake.



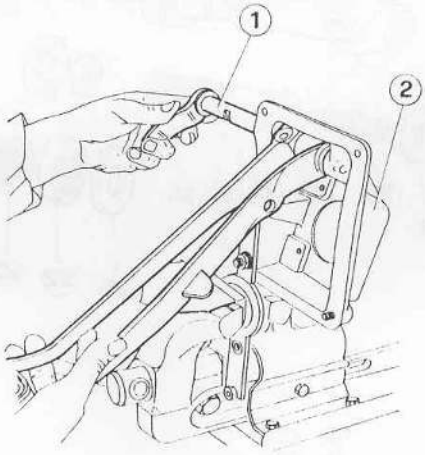
1 Nuts
2 Bolt
3 Cup

3. Unscrew the nut (2) securing the clutch pedal (3) to the pedal assembly pin (4) and retrieve the internal pin.



1 Pedal assembly
2 Nut
3 Clutch pedal
4 Pedal assembly pin

4. Slide out the pedal assembly pin (1) from the pedal unit body (2) and get hold of the pedals.



1 Pedal assembly pin
2 Pedal unit body

5. If necessary, slide out the bushings from the housing on the brake pedal.

INSPECTION AND CHECKS

1. Check that the pedals are not bent and that the bushings, associated housings on the brake pedal and the pedal assembly pin show no signs of excessive wear, or binding, otherwise replace the damaged parts.
2. Check that the brake pedal counter spring has not yielded, otherwise replace it with a new one.

REASSEMBLY

Reassemble the pedal unit by carrying out removal operations in reverse order, following these instructions.

- Lubricate the pedal assembly pin with the specified grease.

Grease:
ISECO Molykote Longterm n° 2

- Apply the specified fixing agent to the adjoining surfaces of the servo brake and pedal assy case.

Adhesive:
LOWAC Perfect Seal

- Observe the following tightening torque.

(T) : Tightening torque
Nuts securing the servo brake to the pedal carrier
12 thru 15 N·m
(1.2 thru 1.5 kg·m)
(8.9 thru 11.1 ft·lb)

INSTALLATION

Reassemble by carrying out removal operations in reverse order, following these instructions.

- Replace the gasket between the body, pedal assy and bodywork, throroughly cleaning the contact surfaces.
- Observe the following tightening torques.

(T) : Tightening torques
Hydraulic brake system pipe unions
8 thru 10 N·m
(0.8 thru 1 kg·m)
(5.8 thru 7.2 ft·lb)

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Hydraulic clutch system pipe union

8 thru 11 N·m
(0.8 thru 1.1 kg·m)
(5.8 thru 8.1 ft·lb)

(indicative values to be achieved with a wrench).

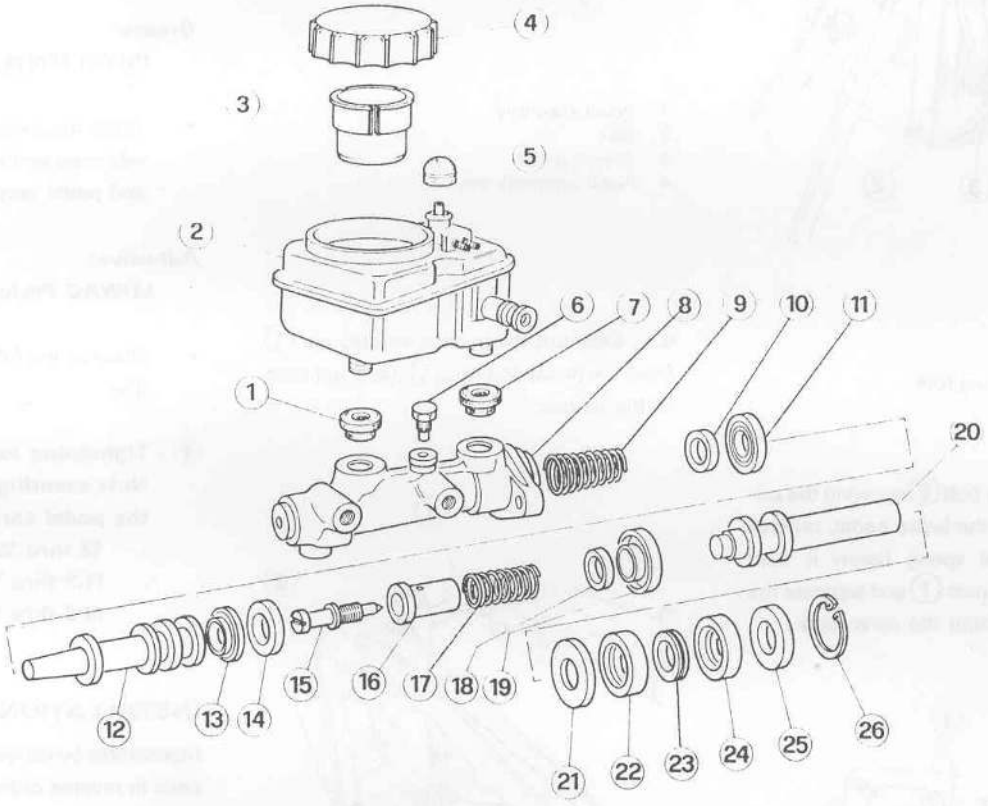
- Fill the clutch and brake reservoirs with the specified fluid.

Clutch and brake hydraulic assembly fluid:

ATE S
AGIP Brake Fluid Super HD
IP Auto Fluid FR
ALFA ROMEO Brake Fluid

- Bleed the brake system (see: Bleeding the Brake System) and clutch system (see: Unit 12 - Hydraulic System Bleeding).

BRAKE MASTER CYLINDER

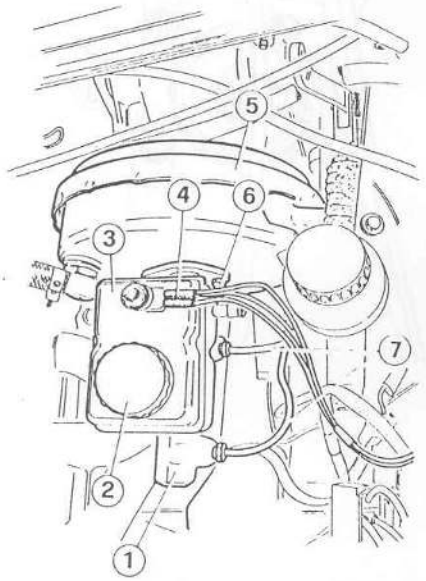


1 Connecting rubber cushion
2 Reservoir
3 Filter
4 Plug
5 Float cover
6 Setscrew
7 Connecting rubber cushion
8 Master cylinder barrel
9 Spring
10 Cup
11 Gasket
12 Intermediate piston
13 Gasket
14 Spacer
15 Screw
16 Bushing
17 Spring
18 Cup
19 Gasket
20 Control piston
21 Washer
22 Gasket
23 Ring
24 Gasket
25 End washer
26 Spring retainer ring

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REMOVAL

1. Disconnect the electric wires (4) for the brake fluid level lamp.
2. Remove the plug (2) from the reservoir (3), take off the filter and suck up the fluid with a syringe.
3. Disconnect the couplings (7) from the brake master cylinder (1).
4. Unscrew the two nuts (6) securing the brake master cylinder to the servo brake (5) and remove the brake master cylinder.

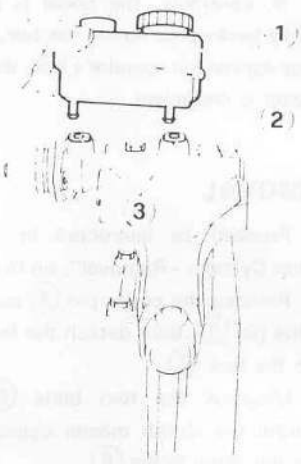


1 Brake master cylinder
2 Plug
3 Reservoir
4 Electric wires
5 Servo brake
6 Nut
7 Couplings

DISASSEMBLY

Lock the pump onto a vice equipped with protective jaws and carry out the following operations.

1. Separate the brake fluid reservoir (1) from the pump casing (2) and slide the rubber cushions (3) off the two unions.

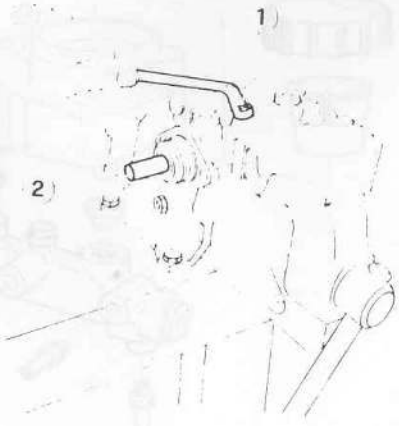


1 Tank
2 Brake master cylinder
3 Rubber cushions

2. Remove the spring retainer ring from the pump casing.



3. Unscrew the check screw (1), remove it together with the associated washer and slide the control piston (2) complete with all its component parts, off the master cylinder barrel.



1 Setscrew
2 Control piston

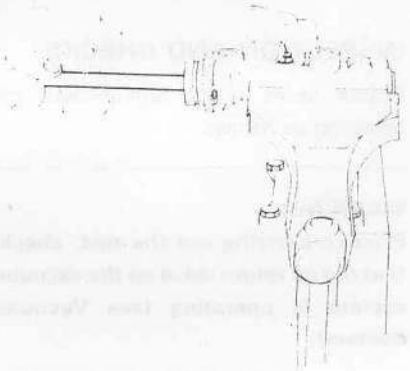
4. Remove the master cylinder from the vice and turn it upside down in order to take out the whole intermediate piston then dismantle the piston into its component parts.

INSPECTION AND CHECKS

1. Thoroughly clean all the parts using alcohol or brake fluid then dry with compressed air.
2. Check whether the internal surface of the master cylinder barrel is scored or has rusty spots. Master cylinders showing rust or scoring in their barrels should be replaced.
3. Check the condition of the internal components, replacing any worn or damaged parts with new ones and, in any case, renewing the gaskets.

REASSEMBLY

1. Reassemble the intermediate piston, paying close attention to gasket orientation, then put the piston in the master cylinder barrel together with the associated spring.
2. Press the piston fully home on the bottom of the master cylinder barrel and screw on the check screw, equipped with washer, in such a way that it binds with the end shoulder of the piston.



3. Reassemble the control piston, paying close attention to gasket orientation, then put it in the master cylinder barrel with the associated spring.
4. Mount the spring retainer ring, pressing on the end washer.

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INSTALLATION

Reassemble by carrying out removal operations in reverse order and following these instructions.

- Check that there is a seal ring in the housing located between the master cylinder and servo brake.
- Observe the following tightening torque.

(T) : **Tightening torque**
Hydraulic brake system pipe unions
8 thru 10 N·m
(0.8 thru 1 kg·m)
(5.8 thru 7.2 ft·lb)

(indicative value to be achieved with a wrench)

- Fill the reservoir with the specified fluid.

Hydraulic brake system fluid:
ATE S
AGIP Brake Fluid Super HD
IP Auto Fluid FR
ALFA ROMEO Brake Fluid

- Bleed (see: Bleeding the Brake System).

SERVOBRAKE

INSPECTION AND CHECKS

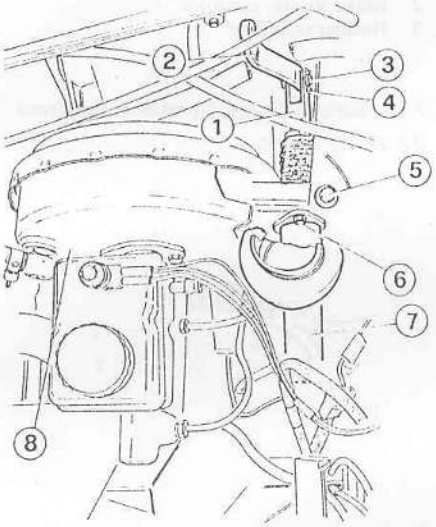
Ensure servo brake functionality by operating as follows.

WARNING:
Prior to carrying out the test, check that the no return valve on the vacuum system is operating (see Vacuum System).

1. With the engine switched off, and without booster-assisted action (released by activating the brake pedal 5 thru 6 times), lightly press the pedal and keep it in this position.
2. Start the engine.
3. Keeping the pedal activation pressure constant, in the presence of a good booster-assisted action and consequent to the aid supplied by the engine, the pedal lowers.
4. If, contrarily, the pedal is pushed slightly backwards during the test, that is to say against the operator's foot, the brake booster is inefficient.

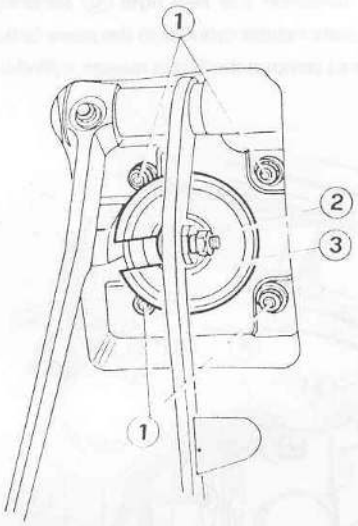
REMOVAL

1. Proceed as instructed in "Brake Master Cylinder - Removal", up to step 3.
2. Remove the cotter pin (4) and slide off the pin (3), then detach the lever (2) from the fork (1).
3. Unscrew the two bolts (6) and separate the clutch master cylinder (7) from the servo brake (8).
4. Unscrew the bolt (5) securing the servo brake to the body.



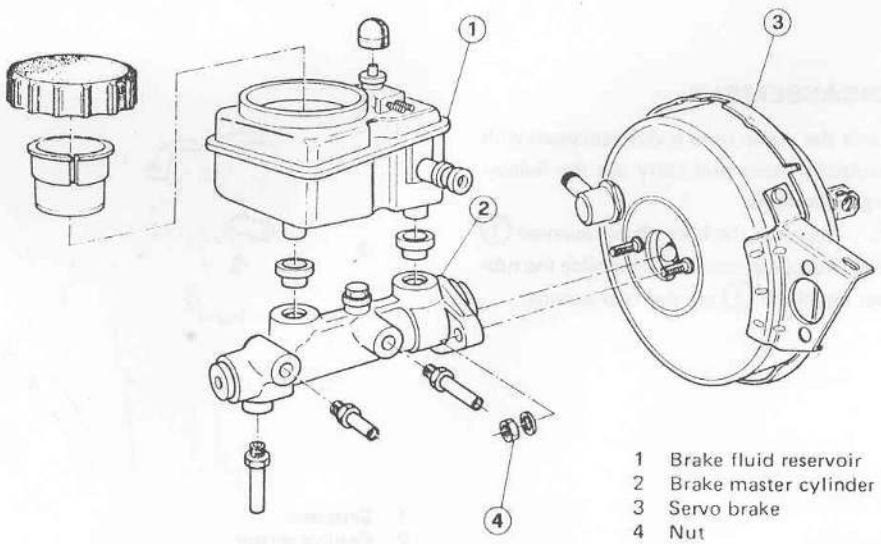
1 Fork
2 Lever
3 Pin
4 Cotter pin
5 Bolt
6 Bolt
7 Clutch master cylinder
8 Servo brake

5. Working from inside the car, unscrew the bolt (2) securing the servo brake fork to the brake pedal, retrieve the cup (3) and spring below, unscrew the four nuts (1) then slide out the servo brake - brake master cylinder assembly from the engine compartment.



1 Nuts
2 Bolt
3 Cup

6. Working at the bench, unscrew the two nuts (4) and separate the brake master cylinder (2) from the servo brake (3).



1 Brake fluid reservoir
2 Brake master cylinder
3 Servo brake
4 Nut

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INSTALLATION

Reassemble by carrying out removal operations in reverse order, following these instructions.

- Check that there is a seal ring in the housing located between the master cylinder and servo brake.
- Apply the specified fixing agent to the servo brake - pedal unit casing uniting surfaces.

Adhesive:
LOWAC Perfect Seal

- Observe the following tightening torques.

(T) : Tightening torques
Nuts securing the servo brake to the pedal carrier
12 thru 15 N·m
(1.2 thru 1.5 kg·m)
(8.9 thru 11.1 ft·lb)

Hydraulic brake system pipe securing unions
8 thru 10 N·m
(0.8 thru 1 kg·m)
(5.8 thru 7.2 ft·lb)

(indicative value to be achieved with a wrench).

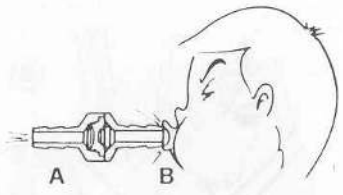
- Fill the reservoirs using specified fluid.

Hydraulic clutch and brake system fluid:
ATE S
AGIP Brake Fluid Super HD
IP Auto Fluid FR
ALFA ROMEO Brake Fluid

- Bleed clutch and brake systems (refer to Bleeding the Brake System; Unit 12 - Hydraulic System Bleeding).

VACUUM SYSTEM

1. Check visually that the pipes are intact, ensuring that they are neither obstructed nor damaged and that the connecting clamps are well tightened.
2. If necessary, remove the no return valve.
3. Check that the valve functions perfectly, that is that it only allows air to pass through in the direction indicated by the arrow.



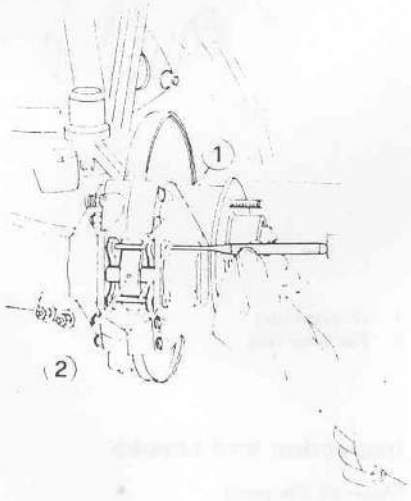
A Vacuum port end
B Servo brake end

4. When reassembling, place the no return valve with the arrow indicated in the previous figure facing the booster-assisted action pipe.

FRONT BRAKES

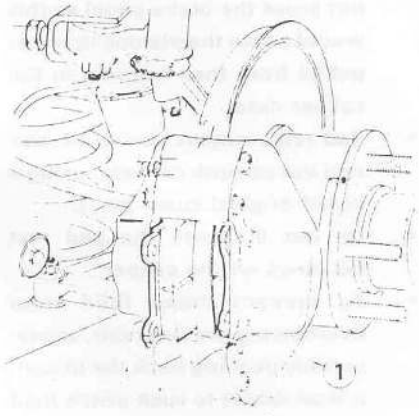
PAD REPLACEMENT

1. Put the car on the lift, raise it and loosen the nuts securing the front wheels.
2. Using a column type jack, raise the car at the front, rest it on safety stands and remove the front wheels.
3. Using a punch, remove one of the pins (1), take the cross spring (2) out from the brake caliper then remove the other pin.



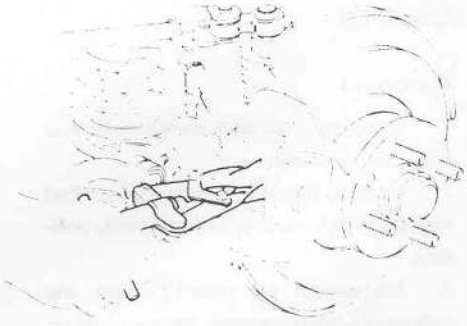
1 Lock pins
2 Cross spring

4. Slide off the pads (1).



1 Pads

5. Using a suitable tool, replace the pistons in the calipers.



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WARNING:

- **When the pads are dismantled do not press the brake pedal as this would cause the pistons to be expelled from their housing in the caliper case.**
- **Pad replacement should be carried out on both calipers, using a set of original spare parts.**
- **Do not lubricate the pad rest housings on the caliper.**
- **To prevent brake fluid from overflowing the reservoir, consequently pushing back the piston, it is advisable to suck a little fluid out of the reservoir with a syringe.**
- **If the pads have been dismantled but do not need to be replaced, countermark the assembly position.**

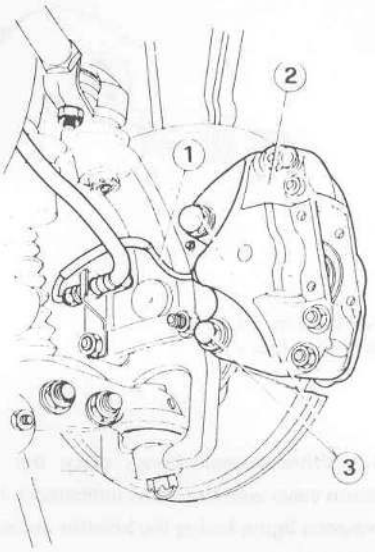
6. Reassemble by carrying out removal operations in reverse order.
7. Top up with the specified fluid.

Hydraulic brake system fluid:
ATE S
AGIP Brake Fluid Super HD
IP Auto Fluid FR
ALFA ROMEO Brake Fluid

CALIPER

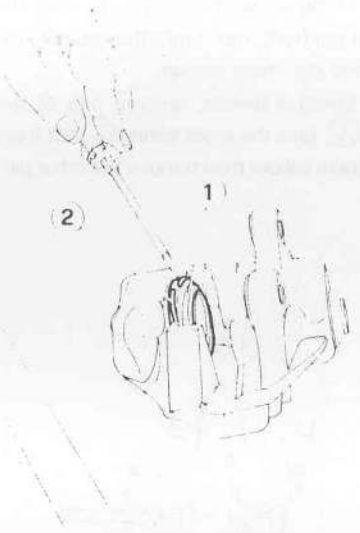
Removal

1. Using a syringe suck up the brake fluid from the reservoir.
2. Remove the pads as indicated in "Pad Replacement", making their assembly position.
3. Disconnect the pipe (1) from the caliper (2), then unscrew the two screws (3) and remove the caliper.



1 Pipe
2 Brake caliper
3 Screws

4. If necessary, replace the brake caliper boots by removing the retainer ring (2) and sliding off the actual boot (1).



1 Actual boot
2 Retainer ring

Inspection and checks

Clean all the parts.

WARNING:
Do not use detergents which have a mineral oil base, or metallic tools.

Check that each part is intact and replace accordingly.
It is, in any case, advisable to replace the boots and associated retainer rings.

Reassembly

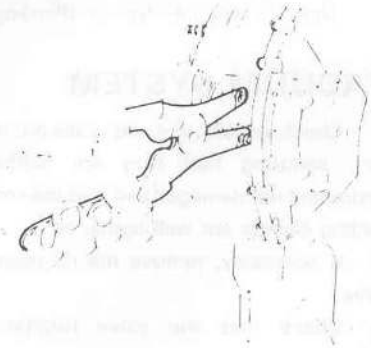
1. If the boots have been previously dismantled, slide them back into their housings, having lubricated them with the specified grease, then secure them with the corresponding retainer rings.

Grease:
ATE Bremszylinder Pasta.

2. Using a square gage (1), with a 20° corner verify the exact position of the brake operating pistons (2); if this is not the case, rotate the pistons with a suitable caliper.



1 Square gage
2 Piston



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WARNING:
The calipers are not interchangeable in as much as the bleeder connection should face upwards.

3. Reassemble by carrying out removal operations in reverse order, following these instructions.

- Check that brake pad thickness is above the minimum limit (see: Technical Specifications and Features - Checks and Adjustment).
- If the same pads are to be reused, adhere to the marks made during removal.
- Observe the following tightening torques.

(T) : **Tightening torques**

Screws securing the caliper to the steering knuckle
74 thru 83 N·m
(7.5 thru 8.5 kg·m)
(54.6 thru 61.2 ft·lb)

Hydraulic brake system pipe unions
8 thru 10 N·m
(0.8 thru 1 kg·m)
(5.8 thru 7.2 ft·lb)

(indicative value, to be achieved with a wrench).

- Fill the reservoir with the specified fluid.

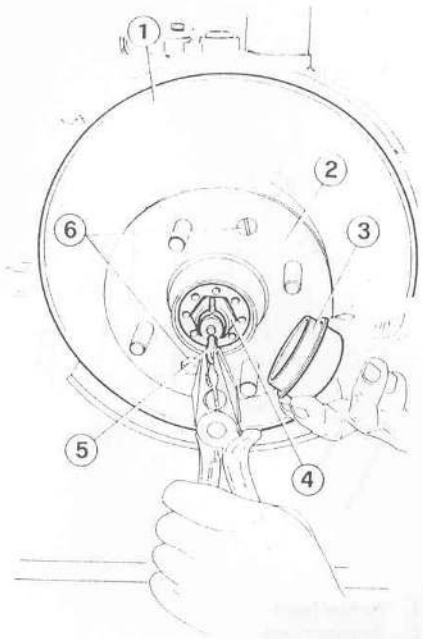
Hydraulic brake system fluid:
ATE S
AGIP Brake Fluid Super HD
IP Auto Fluid FR
ALFA ROMEO Brake Fluid

- Bleed (see: Bleeding the Brake System).

BRAKE DISC

Removal

1. Remove the pads as instructed in "Pad Replacement", marking their assembly position.
2. Remove the cover (3), take off the cotter pin (5) then unscrew the nut (4) and screws (6).
3. Get hold of the hub (2) and brake disc (1).



1 Brake disc
2 Hub
3 Cover
4 Nut
5 Cotter pin
6 Screws

Inspection and checks

1. Clean the disc and check that the working surfaces show no signs of scoring or porosity.
Rectify or replace accordingly.
2. If the working surface of the disc is to be rectified, the following rules should be observed.
a. Always rectify on both disc surfaces, removing equal quantities of material.
b. As far as the rectification and check of the shim are concerned, adhere to the tolerances and dimensions recorded in "Technical Specifications and Features" under the item "Checks and Adjustment".

Reassembly

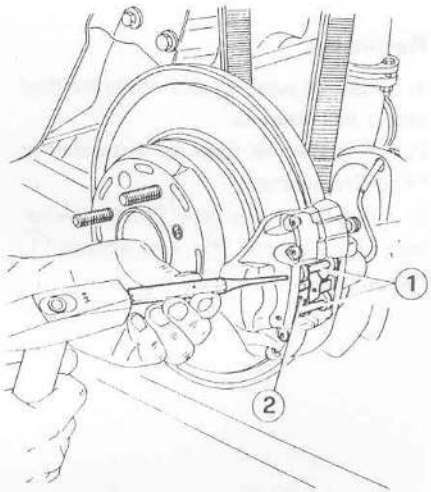
Reassemble by carrying out removal operations in reverse order, following these instructions.

- Lubricate the housing of the wheel hub nut with the specified grease (AGIP Grease 33 FD; IP Autogrease FD).
- Adjust wheel bearings (see: Unit 00 - Wheel Bearing Adjustment).

REAR BRAKES

PAD REPLACEMENT

1. Put the car on the lift, raise it and loosen the nuts securing the rear wheels.
2. Using a column type jack, raise the car at the rear, rest in on safety stands and remove the rear wheels.
3. Using a punch, remove one of the retainer pins (1), extract the cross spring (2) from the brake caliper then remove the other caliper and slide off the pads.



1 Retainer pins
2 Cross spring

4. Using a suitable tool, replace the pistons in the calipers.

WARNING:
- **When the brakes are dismantled, do not press the brake pedal as this would cause the pistons to be expelled from their housing in the caliper case.**
- **Pads should be replaced on both calipers, using a set of original spare parts.**
- **To prevent brake fluid from overflowing the reservoir, consequently pushing back the piston, it is advisable to suck a little fluid out of the reservoir with a syringe.**
- **Do not lubricate the pad rest housings on the caliper.**
- **Pads should be mounted with the arrow pointing in the direction the car travels.**

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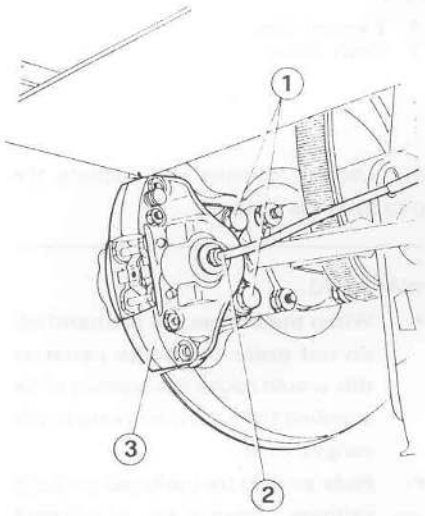
5. Reassemble by carrying out removal operations in reverse order.
6. Top up the tank level with the specified fluid.

Hydraulic brake system fluid:
ATE S
AGIP Brake Fluid Super HD
IP Auto Fluid FR
ALFA ROMEO Brake Fluid

CALIPER

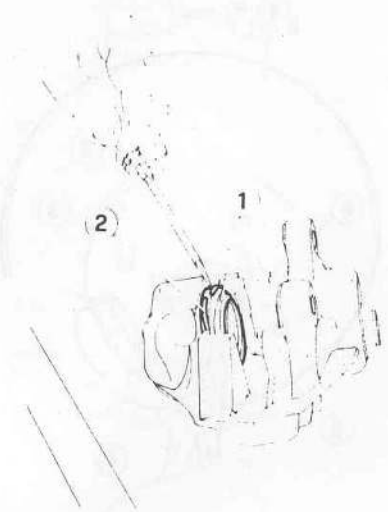
Removal

1. Using a syringe, suck the brake fluid out of the reservoir.
2. Remove the pads as instructed in "Pad Replacement".
3. Disconnect the pipe (2) from the caliper (3), unscrew the two screws (1) then remove the caliper.



1 Screws
2 Pipe
3 Brake caliper

4. If necessary replace the brake caliper boots by removing the retainer ring (2) and sliding off the actual boot (1).



1 Actual boot
2 Retainer ring

Inspection and checks

Clean all the parts.

WARNING:
Do not use mineral oil base detergents, or metallic tools.

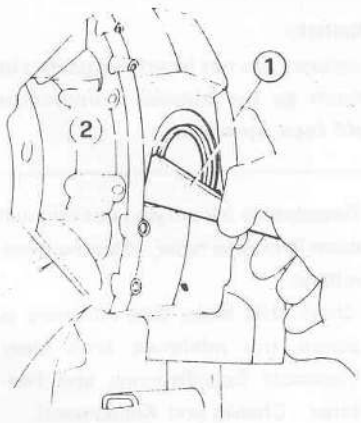
Ensure that every part is intact, replacing accordingly.
It is in any case, advisable to replace the boots and associated retainer rings.

Reassembly

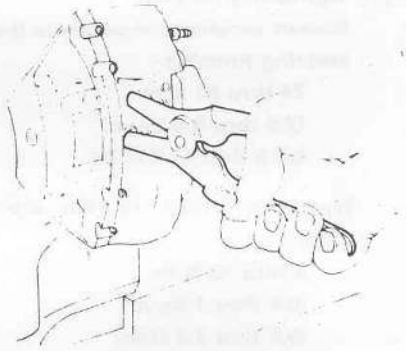
1. If they have been previously dismantled, slip the boots into their housings, having lubricated them with the specified grease, then secure with the corresponding retainer rings.

Grease:
ATE Bremszylinder Pasta

2. Using a square gage, verify the exact position of the brake operating pistons; otherwise rotate them with a suitable caliper.



1 Square gage
2 Piston



WARNING:
The calipers are not interchangeable in as much as the bleeder connection should face upwards.

---

3. Reassemble by carrying out removal operation in reverse order, following these instructions.

- Check that the pad thickness is above the minimum value (see: Technical Specifications and Features - Checks and Adjustment).
- If the same pads are remounted, adhere to the marks made during disassembly.
- Observe the following tightening torques.

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Ⓣ : Tightening torques

Screws securing the brake caliper to the carrier

44 thru 54 N·m
(4.5 thru 5.5 kg·m)
(32.5 thru 39.8 ft·lb)

Hydraulic brake system pipe unions

8 thru 10 N·m
(0.8 thru 1 kg·m)
(5.8 thru 7.2 ft·lb)

(indicative value, to be achieved with a wrench).

- Fill the reservoir with the specified fluid.

Hydraulic brake system fluid:

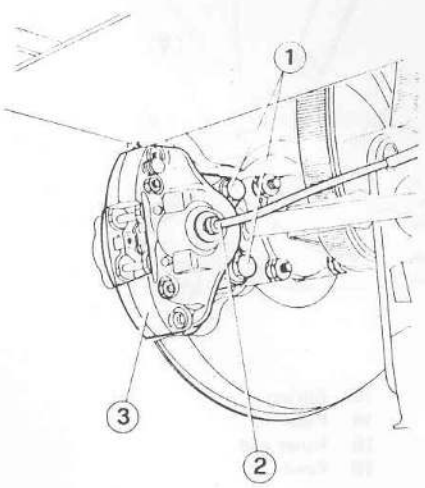
ATE S
AGIP Brake Fluid Super HD
IP Auto Fluid FR
ALFA ROMEO Brake Fluid

- Bleed (see: Bleeding the Brake System).

BRAKE DISC

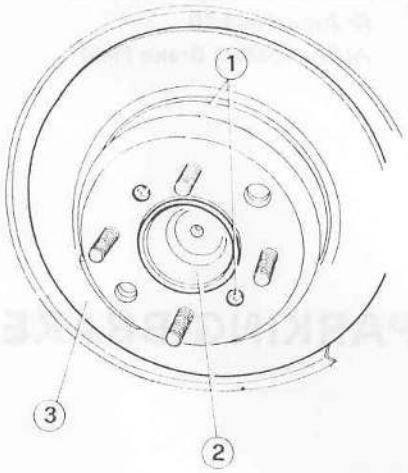
Removal

1. Remove the pads as instructed in "Pad Replacement", marking their assembly position.
2. Unscrew the two screws (1) and, without disconnecting the pipe (2) from the caliper (3), move the caliper to outside the brake disc.



1 Screws
2 Pipe
3 Brake caliper

3. Unscrew the two screws (1) and separate the brake disc (3) from the axle shaft (2).



1 Screws
2 Axle shaft
3 Brake disc

Inspection and checks

1. Clean the discs and check that the working surfaces show no signs of scoring or porosity. Rectify or replace them as necessary.
2. If the working surfaces of the discs need to be rectified, observe the following rules.

a. Always carry out rectification on both disc surfaces, removing equal quantities of material.

b. As regards the check and rectification of the thickness observe the tolerances and dimensions recorded in "Technical Specifications and Features" under item "Checks and Adjustment".

Reassembly

Reassemble by carrying out removal operations in reverse order, observing the following tightening torque.

Ⓣ : Tightening torque

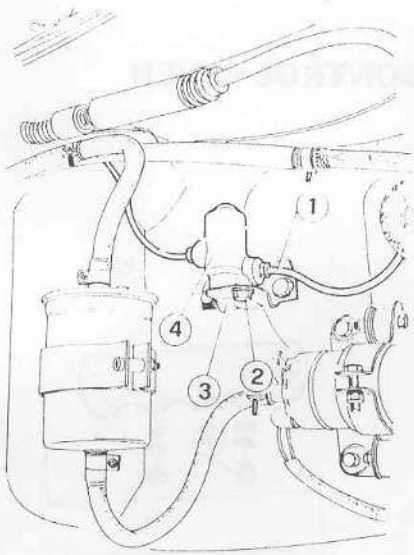
Screws securing the brake caliper to the carrier

44 thru 54 N·m
(4.5 thru 5.5 kg·m)
(32.5 thru 39.8 ft·lb)

BRAKE PRESSURE ADJUSTING VALVE

REMOVAL

1. Remove the brake fluid reservoir plug, take out the filter and suck out the fluid with a syringe.
2. Put the car on the lift and raise it.
3. Disconnect the two couplings (1) from the adjusting valve (4).
4. Unscrew the screw (2) securing the adjusting valve to the carrier (3) and get hold of the valve.



1 Couplings
2 Screw
3 Carrier
4 Adjusting valve

WARNING:
Do not dismantle the adjusting valve into its component parts

REASSEMBLY

Reassemble by carrying out removal operations in reverse order, following these instructions.

- Observe the following tightening torque

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Ⓣ : Tightening torque
Hydraulic brake system pipe unions
8 thru 10 N·m
(0.8 thru 1 kg·m)
(5.8 thru 7.2 ft·lb)

(indicative value to be achieved with a wrench)

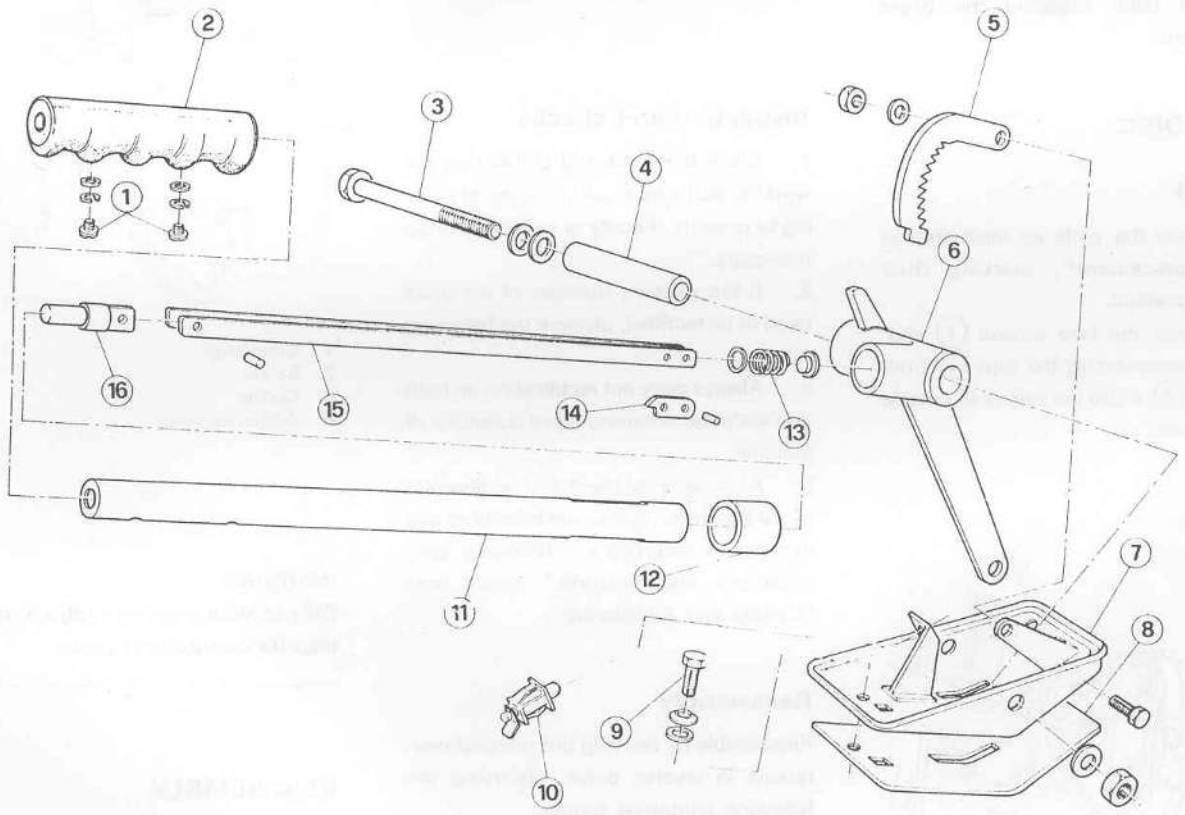
- Fill the reservoir with brake fluid.

Hydraulic brake system fluid
ATE S
AGIP Brake Fluid Super HD
IP Auto Fluid FR
ALFA ROMEO Brake Fluid

- Bleed (see: Bleeding the Brake System).

PARKING BRAKE

CONTROL LEVER

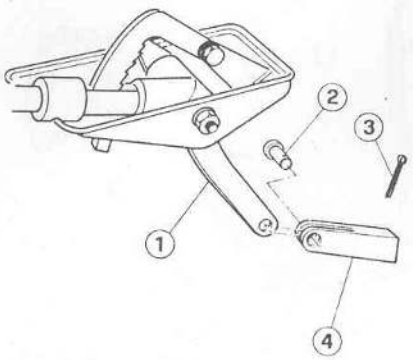


1 Screws
2 Grip
3 Bolt
4 Bushing
5 Ratchet
6 Crank
7 Carrier
8 Gasket
9 Screw
10 Parking brake light switch
11 Control lever
12 Bushing
13 Spring
14 Pawl
15 Inner rod
16 Pawl

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REMOVAL

1. Put car on lift, raise and by acting on the driving lever crank (1), extract the cotter pin (3) and slide out the pin (2) which connects it to the driving cable fork (4).



1 Crank
2 Pin
3 Cotter pin
4 Fork

2. Working from the passenger compartment and referring to the previous exploded view, carry out the following set of operations.

- Unscrew the two screws (1) and slide off the grip (2).
- Remove the console as instructed in Unit 66 - Console.
- Disconnect the electric wire of the parking brake lamp switch (10).
- Unscrew the three screws (9) securing the lever carrier to the bodywork and remove the entire lever.
- If necessary, slide off the parking brake lamp switch (10).
- If necessary, unscrew the bolt (3) and disassemble the lever into its various component parts.

INSPECTION AND CHECKS

1. Visually inspect the single parts, checking for excessive wear or damage. In particular, check the surface condition of the bushing (4) and state of wear of the pawl (14) and ratchet (5).
2. Check that the switch (of the lamp indicating that the parking brake is engaged) is operating.
3. Replace worn or faulty components with new ones.

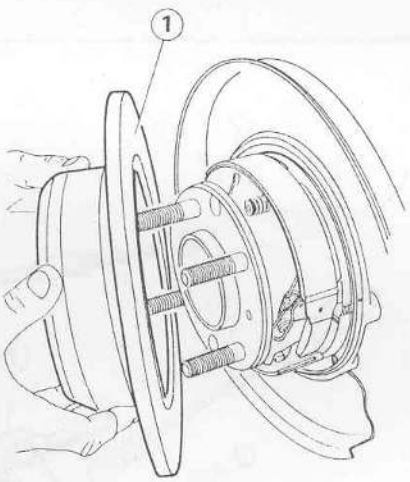
REASSEMBLY

1. Reassemble the control lever, with carrier, in the car by carrying out removal operations in reverse order.
2. Adjust the parking brake as instructed in "Parking Brake Lever Travel Adjustment".

SHOE BRAKES

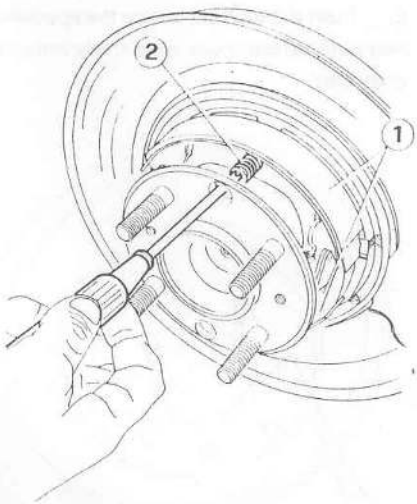
REMOVAL

1. Remove the rear brake disc (1) as instructed in Rear Brakes - Brake Disc - Removal.



1 Rear brake disc

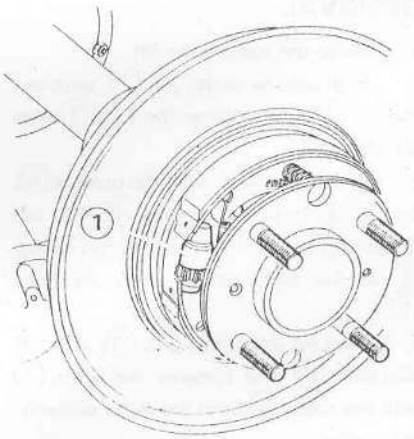
2. If it is necessary to replace the shoes (1), press and rotate the two bayonet pins (2) so as to free the shoes then retrieve them together with the reaction spring and the expansion control spring.



1 Shoes
2 Bajonet pin

INSPECTION AND CHECKS

1. Check that the shoe friction gaskets are not excessively worn and show no signs of binding.
2. Check that the shoe control system is operating and that the return springs are not damaged and have not yielded.
3. Reassemble the shoes, releasing the toothed adjusting device (1).

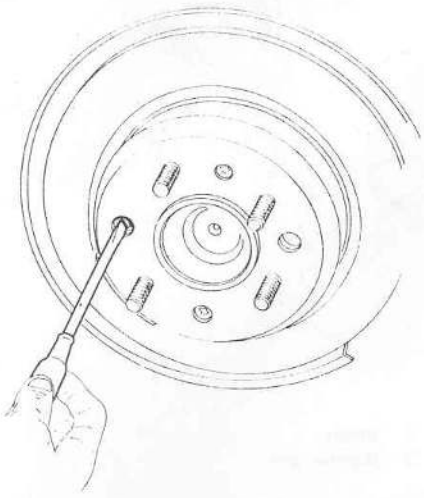


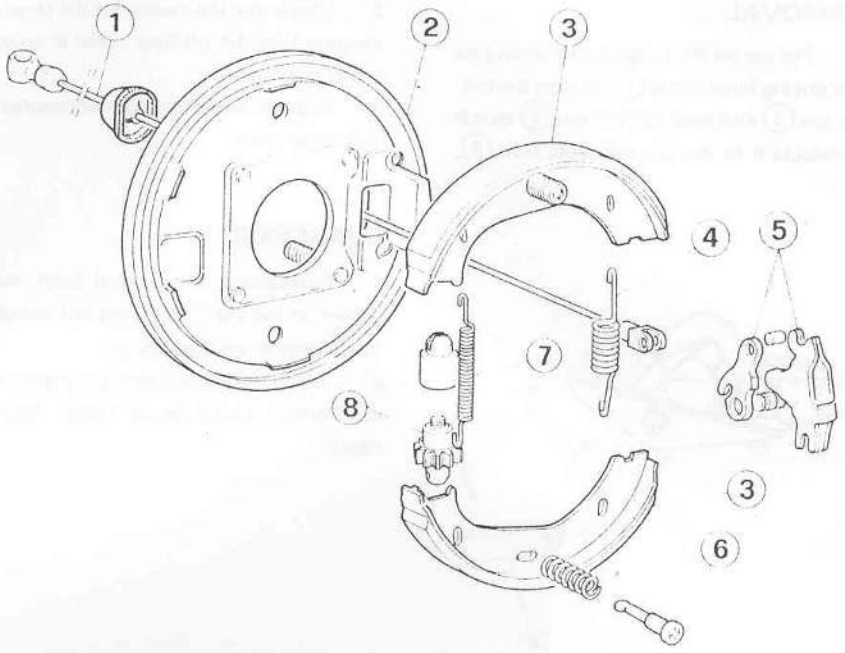
1 Toothed adjustment device

4. Assemble the brake disc, work on the toothed device bringing the shoes into contact with the drum fitted on the brake disc.

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5. Push the toothed device the opposite way until the brake disc turns freely without obstacles.





1 Control cable
2 Shoe-holder
3 Shoe
4 Shoe extension spring
5 Shoe expansion control
6 Bajonet pin
7 Return spring
8 Toothed adjustment device

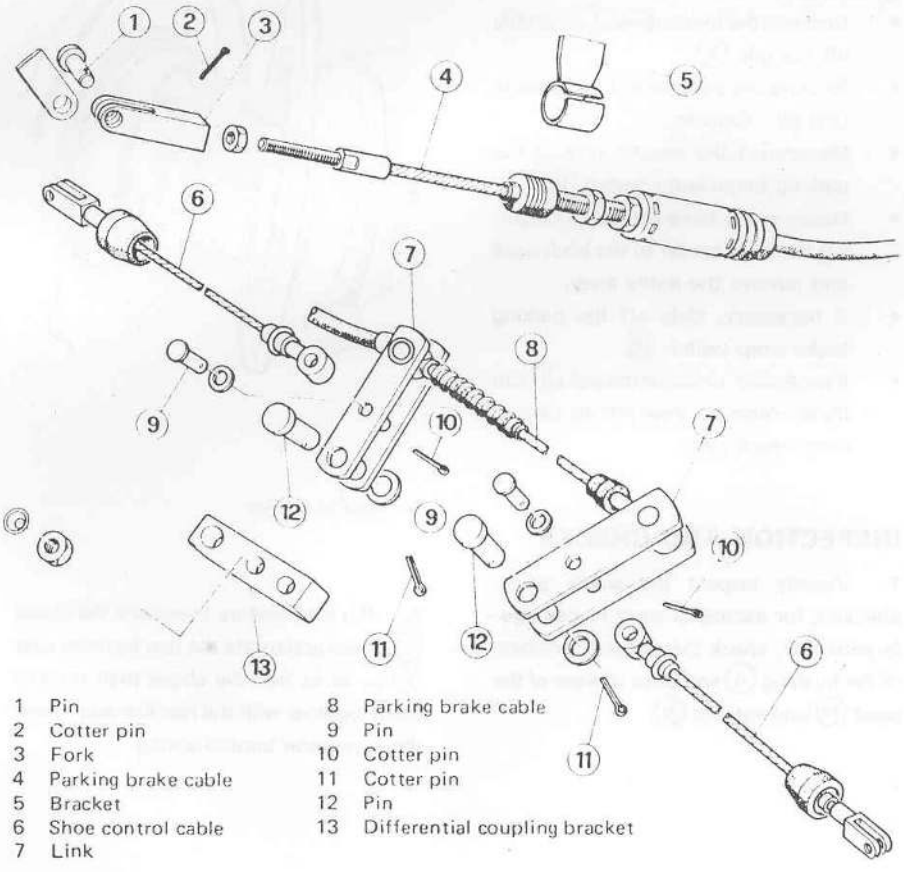
REASSEMBLY

Carry out removal operations in reverse order until the unit is fully reassembled.

DRIVING CABLE

REMOVAL

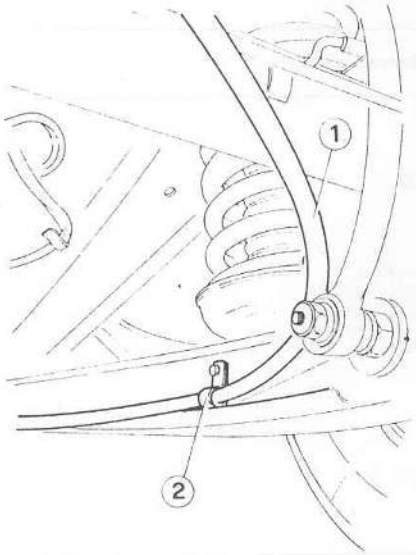
1. Raise the car on the lift.
2. Remove the cotter pin (2), slide out the pin (1), then release the fork (3) with the cable (4).
3. Detach the cable from the bracket (5).
4. Take out the cotter pins (10), slide out the pins (9) and release the driving cables (6) of the brake shoes from the links (7).
5. Take off the cotter pins (11), slide off the pins (12) and remove the links (7) with the cable (8) from the outer differential casing.



1 Pin
2 Cotter pin
3 Fork
4 Parking brake cable
5 Bracket
6 Shoe control cable
7 Link
8 Parking brake cable
9 Pin
10 Cotter pin
11 Cotter pin
12 Pin
13 Differential coupling bracket

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6. Release the sheath (1) from the bracket (2) on the righthand trailing arm.



1 Sheath
2 Bracket

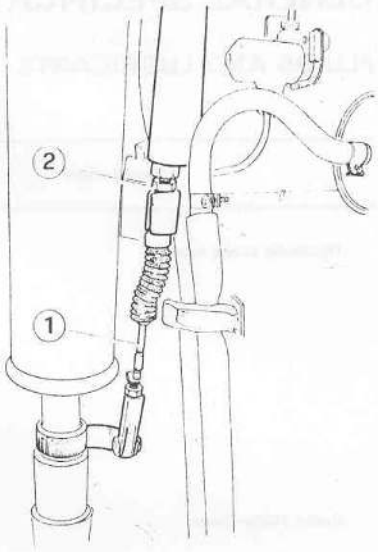
INSTALLATION

Reassemble in reverse order of removal, following these instructions.

- Adjust the parking brake cable as instructed in "Parking Brake Lever Travel Adjustment".

PARKING BRAKE LEVER TRAVEL ADJUSTMENT

1. Check that the parking brake control lever is in the rest position.
2. Adjust the brakes as instructed in: Parking Brake - Shoe Brakes.
3. Screw the nut (2) until axial clearance of the cable is zeroed.



1 Cable
2 Nut

4. Activate the parking brake control lever and check that the rear wheels lock.

TECHNICAL SPECIFICATIONS AND FEATURES

TECHNICAL FEATURES

SERVO BRAKE

Vacuum cylinder dia	26.64 cm (8 in)

BRAKE MASTER CYLINDER

Diameter	22.2 mm (0.87 in)
Travel front/rear	16.5/10

BRAKE CALIPERS

Front	ATE
Rear	ATE

Cylinder diameters

Front	48 mm (1.89 in)
Rear	38 mm (1.5 in)

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GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

Application	Type	Denomination
Hydraulic brake system	FLUID	ATE: S AGIP: Brake Fluid Super HD IP: Auto Fluid FR Norm. 3681-69903 ALFA ROMEO Brake Fluid Order No. 10500.45300.00.01
Brake caliper boot	GREASE	ATE: Bremszylinder Pasta
Pedal assy pin	GREASE	ISECO: Molykote Longterm n° 2 Norm. 3671-69831

SEALANTS AND SURFACE FIXING AGENTS

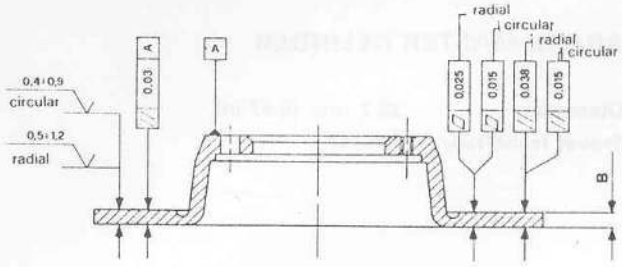
Application	Type	Denomination
Servo brake - shim and pedal carrier uniting surfaces	ADHESIVE	LOWAC: Perfect Seal Norm. 3522-00011

CHECKS AND ADJUSTMENT

BRAKE DISC ADJUSTMENT: DIMENSIONS (1)

Front brakes

Thickness of brake-disc B mm (in)	
Minimum after adjustment	11.7 (0.46)
Limit of use	10.7 (0.42)

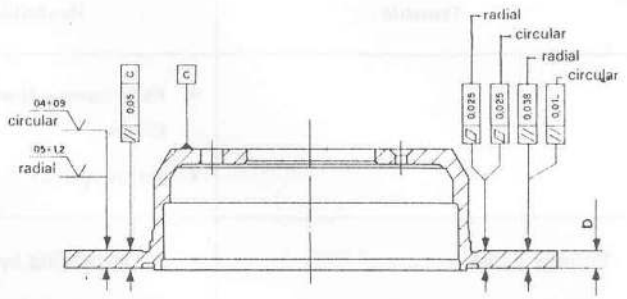


(1) Key to symbols: √ Roughness in μ // Parallelism in mm // Levelness in mm; ⊥ Perpendicularity in mm

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Rear brakes

Thickness of brake disc D mm (in)	
Minimum after adjustment	8.5 (0.33)
Limit of use	7.5 (0.3)



[mm]

BRAKE PAD THICKNESS AT WEAR LIMIT

Front pads 7 mm (0.28 in)
Rear pads 7 mm (0,28 in)

TIGHTENING TORQUES

Item	N·m	Kg·m	ft·lb
Hydraulic brake system pipe unions (indicative value to be achieved with a wrench)	8 thru 10	0.8 thru 1	5.8 thru 7.2
Screws securing the front brake caliper to the steering knuckle	74 thru 83	7.5 thru 8.5	54.6 thru 61.2
Screws securing the rear brake caliper to the carrier	44 thru 54	4.5 thru 5.5	32.5 thru 39.8
Nuts securing the servo brake to the pedal unit case	12 thru 15	1.2 thru 1.5	8.9 thru 11.1

TROUBLESHOOTING AND CORRECTIVE ACTIONS

Essential preliminary steps for any brake system troubleshooting operation are:
- Tire wear check
- Tire pressure check
- Brake fluid check and in any case a check that scheduled maintenance regulations are upheld.

Trouble	Probable cause	Corrective action
Excessive pedal travel	• Fluid leakage from brake master cylinder	Overhaul the brake master cylinder
	• Vacuum system no return valve is faulty	Replace the valve
	• Fluid leakage from the brake adjusting valve	Overhaul or replace

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Trouble	Probable cause	Corrective action
	• Fluid leakage from braking system couplings	Tighten the couplings
	• Air in system	Bleed the system
Springy pedal	• Air in braking system	Bleed the system
	• Bleeder on the reservoir cover is clogged	Clean and bleed the system
	• Hoses are swollen due to deterioration or use of poor quality hoses	Replace the hoses and bleed the system
	• Caliper sealing gaskets are worn	Drain the hydraulic system, wash it with alcohol and replace the gaskets
	• Use of brake fluid which has a too-low boiling point	Replace with specified brake fluid and bleed the system
Scanty braking action	• Fluid leakage from the braking system pipes	Check the brake master cylinder and piping to locate any leaks and repair
	• Air in the braking system	Bleed the braking system
	• Grease, oil, mud or water on the brake pad surfaces	Clean again and check the cause of the problem Replace the pads
	• Excessive wear or deterioration of the gaskets	Replace the pads and if necessary rectify the discs
	• Contact located between the braking surfaces of the pads and the disc surfaces	Replace the pads and if necessary rectify the discs
	• Brake master cylinder scarcely efficient	Repair or replace
	• Brake operating pistons worn or seized	Disassemble the calipers, overhaul the pistons accordingly
	• Mechanical obstacles to brake travel and pad movements	Free as required
Braking is unbalanced	• Incorrect tire pressure	Blow up to correct pressure
	• Grease, mud or water on the braking surfaces of the pads	Clean the mechanisms again and check the causes of the problem Replace the pads
	• Excessive wear or deterioration of the braking surfaces of the pads	Replace the pads
	• Braking adjustment valve incorrectly adjusted or inefficient	Adjust or replace according to necessity
	• Wheel bearing adjustment incorrect	Adjust the bearings
	• Wheel angles incorrect	Adjust the angles
Brakes prone to "fading"	• Use of unsuitable, or no longer efficient, friction material	Replace the pads

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Trouble	Probable cause	Corrective action
Vibration when braking	• Scored discs	Rectify or replace accordingly
	• Deformed pads	Replace according to necessity
	• Grease or brake fluid on the braking surfaces	Replace the pads
Screeching brakes	• Return springs yielded or broken	Replace faulty parts
	• Braking gaskets vitrified	Restore abrasive quality to the braking surfaces; if this proves impossible replace the pads
The brakes resist forward motion	• Pedal articulation has mesh or adjustment of the servo brake output rod is too long	Lubricate the connection, check the condition of the pedal return spring and adjust the output rod as necessary
	• Brake master cylinder compensating element is obstructed	Blow off foreign bodies with compressed air
	• Brake master cylinder pistons seized	Overhaul the master cylinder and bleed the system
	• Piston casings deformed	Replace
	• Calipers remain partially closed due to faulty piston sealing gaskets	Replace piston gaskets
	• Excessive disc deformation	Rectify or replace the disc
	• Parking brake fails to return	Check and repair
	• Brake master cylinder clogged	Overhaul the master cylinder and bleed
	• System piping clogged	Check and clean
	• Pedal idle stroke lacking	Adjust pedal travel
Pedal pulsates	• Excessive lateral deformation of the discs	Check with a gage, turning the disc by hand. If variation exceeds specified value repair or replace the disc
	• Excessive variation in disc thickness	Measure along the circumference with a gage. If necessary replace the disc
The rear axle locks (with slight pressure on the brake pedal)	• Braking adjusting valve faulty	Replace
The rear axle locks (when pressing hard on the brake pedal)	• Scanty braking action of front brakes	Overhaul the front brakes
	• Grease, oil, mud or water on the braking surfaces	Clean again or replace and locate the cause of the problem
	• Excessive wear of front pads	Replace the pads
	• Brake master cylinder in poor repair	Repair or replace
Inefficient servo brake	• Air leak from no return valve	Check the valve
	• Air leak from seal ring between the vacuum chamber and control case	Replace the entire servo brake

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Trouble	Probable cause	Corrective action
	• Air blow-by through the disc valve	
	• Air blow-by through the control piston gasket	
	• Air leak from seal ring between the master cylinder and servo brake	Replace the seal ring
	• Damaged hose or couplings	Repair or replace
It is impossible to correctly adjust idling (all couplings are hermetical)	• Engine taking in air from the servo brake vacuum port	Replace the no return valve or the servo brake
Parking brake fails to lock	• Incorrect adjustment	Adjust
	• Control cable damaged or broken	Replace the cable
	• Brake control cable connection is faulty	Check the connection
	• Grease, oil, mud or water on the shoe braking surfaces	Clean again and check the causes of the problem Replace the shoes
	• Excessive wear or deterioration of the shoe gaskets	Replace the shoes
Disengaging the parking brake, the car stays locked	• Cable return travel is impeded	Remove impediments or replace the cable
	• Lever release pushbutton fails to pop up	Dismantle and free, or replace, the lever
	• Shoe return springs are either broken or have yielded	Replace the return springs
Parking brake lamp fails to illuminate	• Electrical connection cut off	Renew connection
	• Switch faulty	Replace
	• Lamp faulty	Replace

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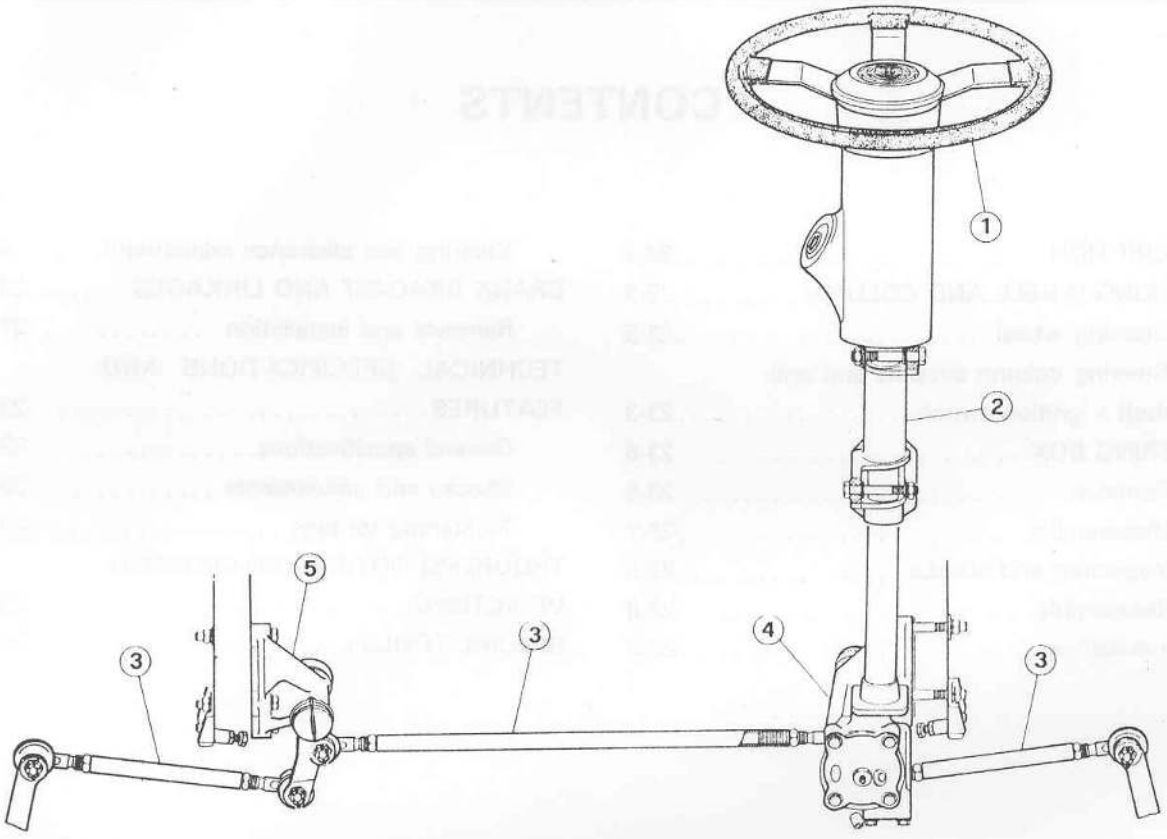
UNIT 23

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DESCRIPTION



1 Steering wheel
2 Steering column support
3 Tie rods
4 Steering box
5 Crank bracket

Steering is of the hourglass screw mechanical unit type. The steering gear shaft acts on a crank and linkage system thus adjusting wheel steering.
To afford the driver increased protection in the event of frontal impact, the steering box is offset rearward.

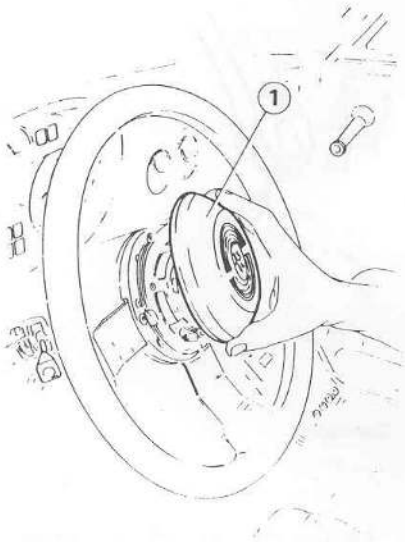
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STEERING WHEEL AND COLUMN

STEERING WHEEL

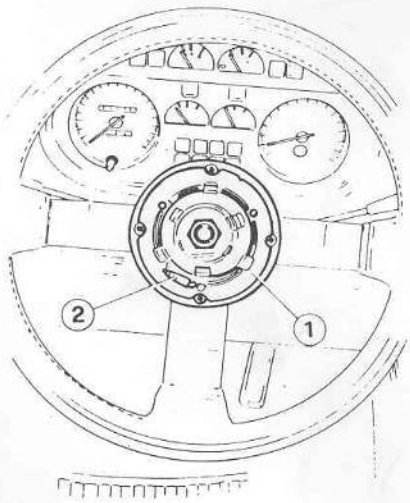
REMOVAL

1. Disconnect battery ground cable.
2. Remove hub cover (1) by finger pressure.



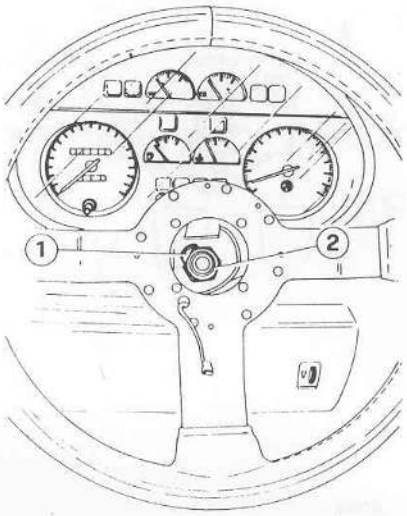
1 Hub cover

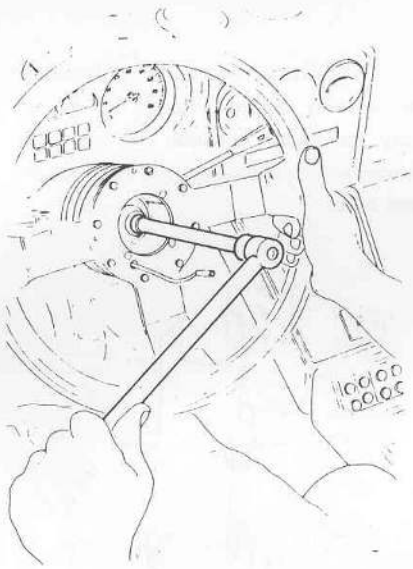
3. Unscrew the four horn pushbutton capscrews, disconnect the cable (2) and remove the pushbutton (1).



1 Horn pushbutton
2 Horn ground cable

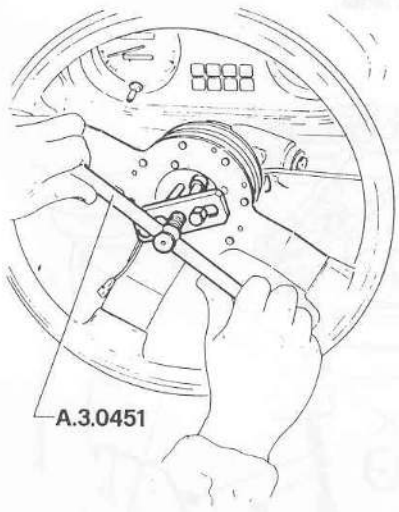
4. Straighten the nut keep plate (1) and, holding the steering wheel still, usncrew the nut (2).





1 Nut keep plate
2 Nut

5. Take off the steering wheel using tool **A.3.0451**.



INSTALLATION

Install steering wheel on car by reversing the removal sequence and adhering to the instructions given below.

- Align the wheels.
- Position the steering wheel on the steering column, centralize the spokes and lock the nut to the specified torque.

(T) : **Tightening torque**
Nut securing steering wheel to column
50 thru 55 N·m
(5.1 thru 5.6 kg·m)
(36.9 thru 40.6 ft·lb)

- Having completed installation, rotate steering wheel in both directions and check for binding.
- Check horn operation.

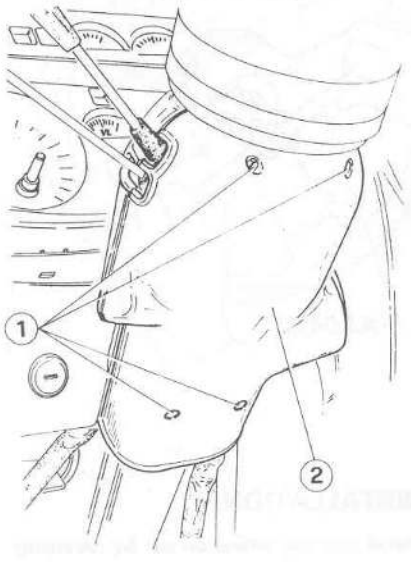
STEERING COLUMN SUPPORT AND ANTITHEFT - IGNITION SWITCH

REMOVAL AND INSTALLATION

1. Place car on lift and remove the steering wheel as instructed in Steering Wheel - Removal.
2. Remove the fixed and movable kneepadding, driver's side, as instructed in Unit 66 - Internal Trimming.

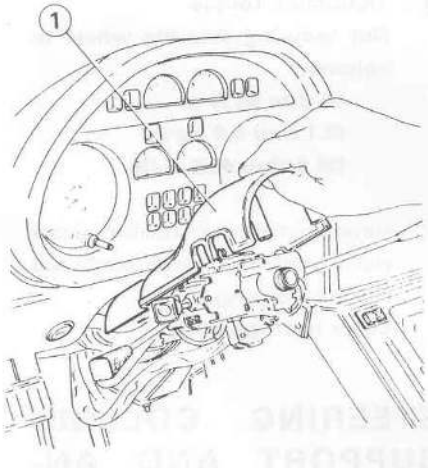
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3. Unscrew the four screws (1) securing the lower half casing (2) and remove the latter.



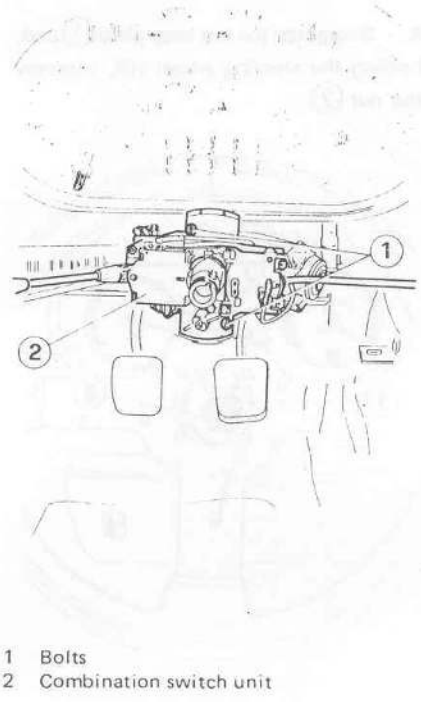
1 Screws
2 Lower half casing

4. Disengage and remove from above the upper half casing (1).



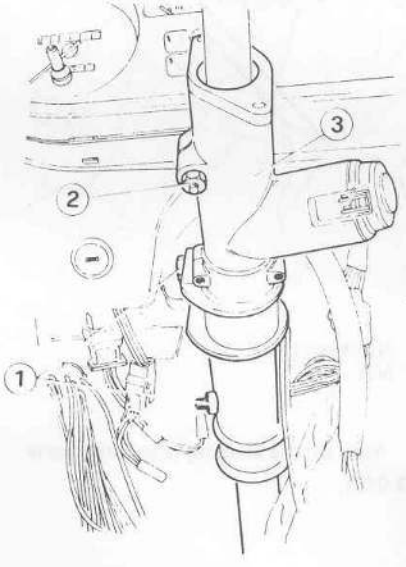
1 Upper half casing

5. Unscrew the two bolts (1) and slide out the combination switch unit (2), keeping it connected.



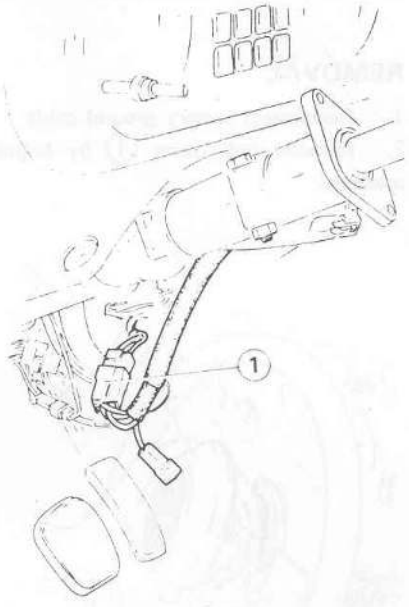
1 Bolts
2 Combination switch unit

6. Unscrew the two bolts (1) securing the steering column support (3) to the body and loosen the bolt (2) tying the steering column support to the steering column tube.



1 Bolts
2 Bolt
3 Steering column support

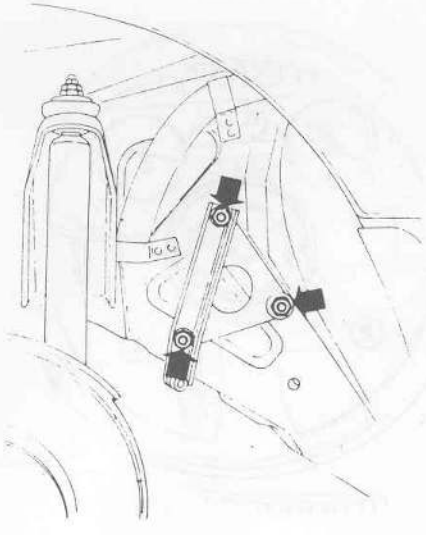
7. Uncouple the antitheft - ignition switch connector (1).



1 Connector

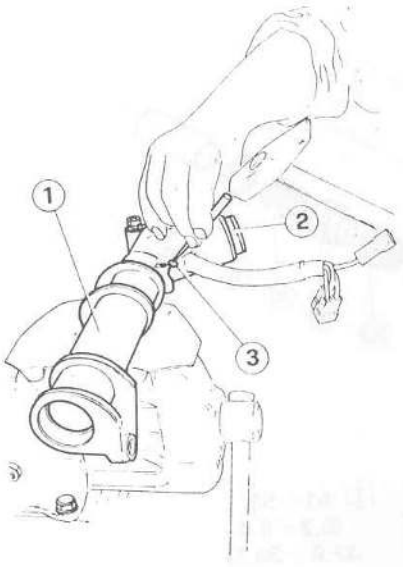
8. Remove the front lefthand wheel, having propped the vehicle on safety stands.

9. Unscrew the three bolts securing the steering box to the body. Working inside the car, lower the steering column support slightly and remove it from the steering column.



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10. If necessary, clamp the steering column support (1) in a vice provided with jaw liners; using a punch, unscrew the capscrew (3) and slide off the antitheft device (2) without damaging the leads.



1 Steering column support
2 Antitheft device
3 Capscrew

WARNING:
It is possible to disassemble antitheft - ignition switch without removing the steering column support, even if with some difficulty. Operate as instructed in previous steps 2-5. Using a punch and working inside the car, unscrew the capscrew, detach the antitheft connector and remove it from the steering column support taking care not to damage leads.

11. If previously disassembled, re-install the antitheft ignition switch, securing it to the steering column support with the capscrew provided for this purpose, also available as spare, and tighten until head is wrenched off.

12. Re-install the steering column support by operating in reverse order of removal, observing the following tightening torques.

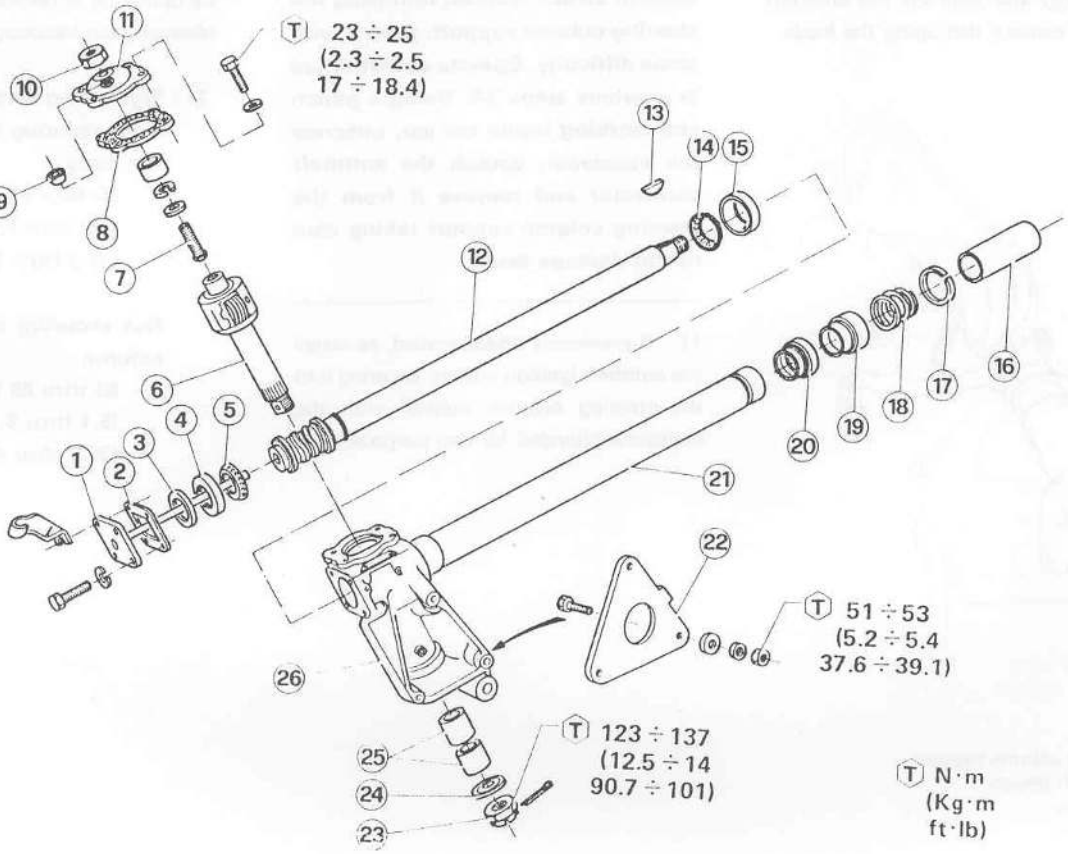
(T) : **Tightening torques:**

Bolts securing the steering box to the body
51 thru 53 N·m
(5.2 thru 5.4 kg·m)
(37.6 thru 39.1 ft·lb)

Nut securing steering wheel to column
50 thru 55 N·m
(5.1 thru 5.6 kg·m)
(36.9 thru 40.6 ft·lb)

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STEERING BOX

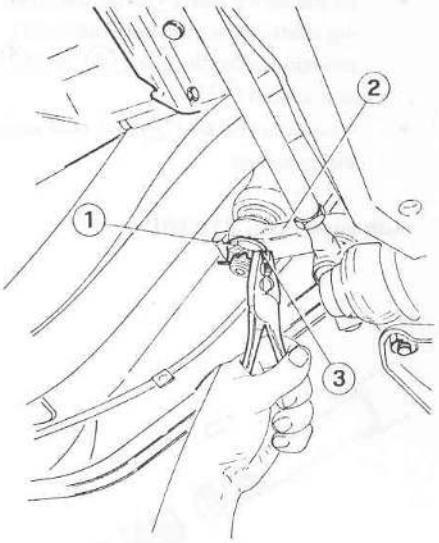


1 Front cover
2 Shim
3 Spacer
4 Front bearing external race
5 Front bearing external race
6 Output shaft
7 Center pin
8 Gasket
9 Filler plug
10 Nut
11 Upper cover
12 Steering column with worm
13 Key
14 Rear bearing internal race
15 Rear bearing external race
16 Spacer
17 Ring
18 Spring
19 Spring seat
20 Internal bushing
21 Steering column tube
22 Support
23 Nut
24 Washer
25 Output shaft bushings
26 Steering box

REMOVAL

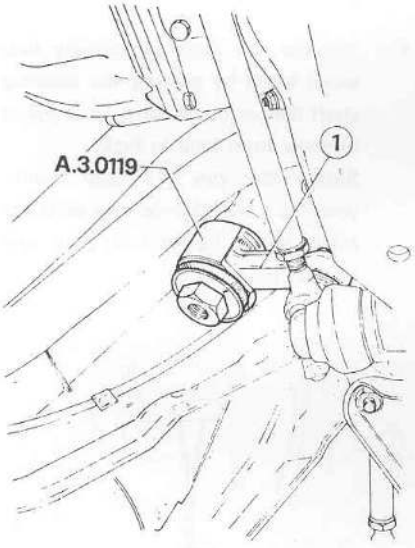
1. Detach the steering column support as instructed in Steering Wheel and Steering Column Support - Steering Column Support and Antitheft - Ingnition Switch - Removal and Installation.
2. Remove the air filter container as instructed in Unit 04 - Fuel System - Air Intake Circuit - Air Cleaner - Removal.
3. Remove the pedal assy as instructed in Unit 22 - Front and Rear Brakes - Service Brakes - Pedals - Removal.
4. Extract the cotter pin (3) and unscrew the nut (1) securing the steering arm (2) to the steering box.

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1 Nut
2 Steering arm
3 Cotter pin

5. Assemble tool A.3.0119 and, working on this, extract the steering arm (1) from the steering box output shaft.

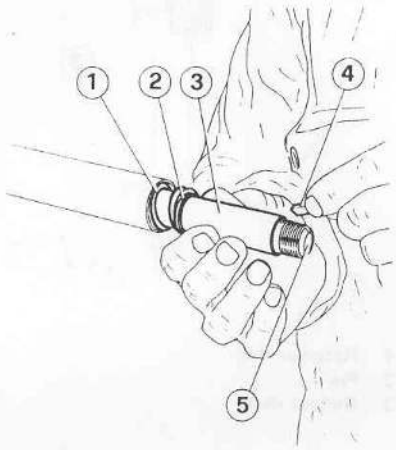


1 Steering arm

6. Working from the engine compartment, remove the steering box.

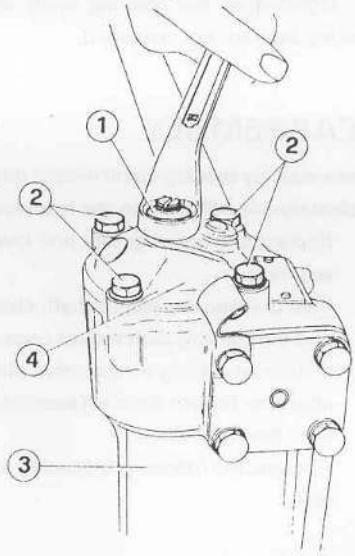
DISASSEMBLY

1. Fit the steering box onto a vice with protective jaws.
2. Working at the end of the steering shaft (5), remove the key (4), slide off the spacer (3), ring (2) and spring (1).



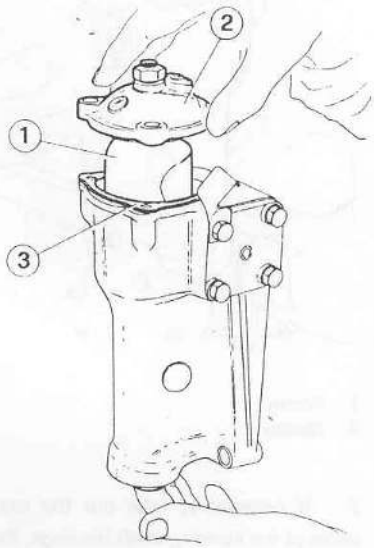
1 Spring
2 Ring
3 Spacer
4 Key
5 Steering shaft

3. Loosen the center nut (1) and unscrew the four screws (2) securing the cover (4) to the steering box (3).



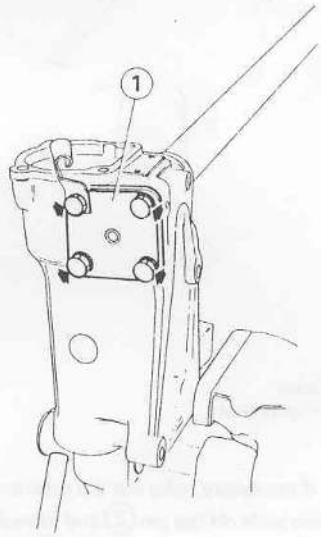
1 Center screw
2 Screws
3 Steering box
4 Cover

4. Push the output shaft (1) from below and slide it out from above with the cover (2), retrieving the gasket (3).



1 Output shaft
2 Cover
3 Gasket

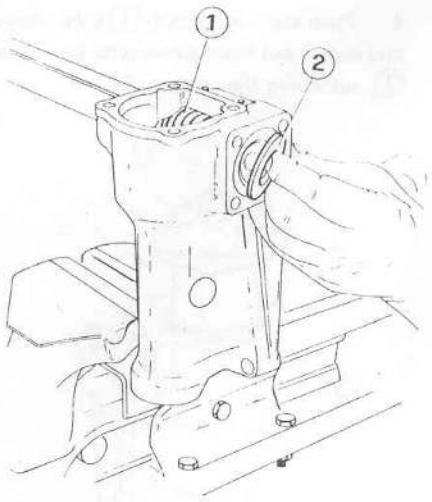
5. Unscrew the four screws and slide off the front cover (1) and shim, if present.



1 Front cover

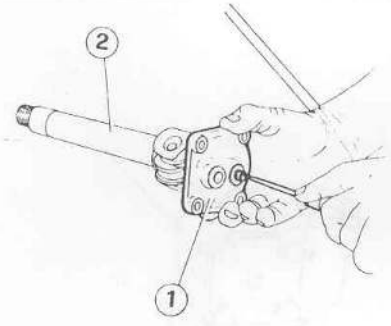
6. Remove the spacer (2) and slide off the steering shaft and worm (1) as a unit from the front, retrieving the associated bearings.

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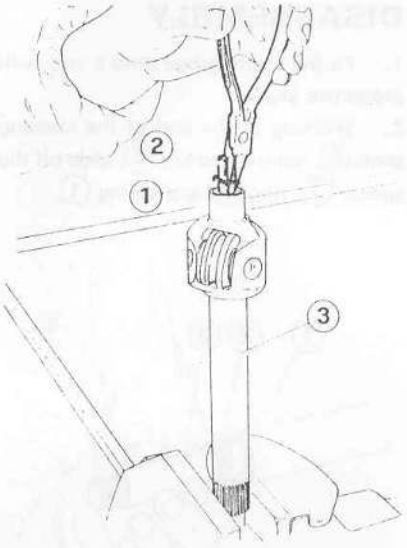
1 Worm
2 Spacer

7. If necessary, take out the external races of the steering shaft bearings, the upper bearing housed in the outer tube and the output shaft bushings.
8. Separate the cover (1) from the output shaft (2), retrieving the nut and unscrewing the center pin.



1 Cover
2 Output shaft

9. If necessary, take out the retainer ring (1) then slide off the pin (2) and associated washer from the output shaft (3).



1 Retainer ring
2 Pin
3 Output shaft

INSPECTION AND CHECKS

1. Check that the bushings and bearings are not damaged, otherwise replace.
2. Check that the teeth on the output shaft roller and those of the worm on the steering shaft are not worn, damaged or show any signs of biding otherwise replace inefficient parts.
3. Check that the steering shaft and steering box are not damaged.

REASSEMBLY

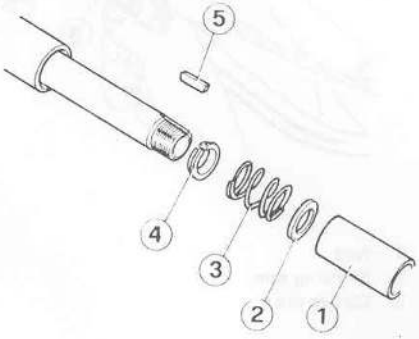
Reassemble by carrying out in reverse order of disassembly adhering to the following:

- Replace the upper gasket and lower seal ring.
- Prior to fitting the output shaft, check that the steering shaft rotates correctly without seizing or excessive play, otherwise replace the shim associated with the front cover.
- Observe the following tightening torque.

(T) : **Tightening torque**
Screws fixing the steering box cover
23 thru 25 N·m
(2.3 thru 2.5 kg·m)
(17 thru 18.4 ft·lb)

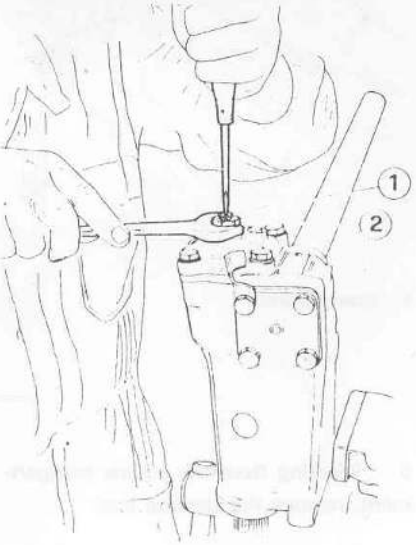
- Fit the spring seat (4) onto the steering shaft in the direction indicated i the figure then fit spring (3), ring (2) and spacer (1).
- Assemble the key (5) and seal with the specified.

Adhesive: LOCTITE 601



1 Spacer
2 Ring
3 Spring
4 Spring seat
5 Key

- Position the steering midway between locks by turning the steering shaft half as many turns as required to steer from lock to lock.
  Screw the pin (1) fully home, unscrew it until the steering shaft can rotate freely, but without play, and tighten the nut (2).



1 Pin
2 Nut

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INSTALLATION

Re-install by operating in reverse order of removal, adhering to the following indications.

- Observe the following tightening torques.

Ⓣ : **Tightening torques**

Nut securing the steering arm to the steering box

123 thru 137 N·m
(12.5 thru 14 kg·m)
(90.7 thru 101.1 ft·lb)

Bolts securing the steering box to the body

51 thru 53 N·m
(5.2 thru 5.4 kg·m)
(37.6 thru 39.1 ft·lb)

Nut securing the steering wheel to the steering column

50 thru 55 N·m
(5.1 thru 5.6 kg·m)
(36.9 thru 40.6 ft·lb)

- Replenish steering box with specified oil (remove plug ① and bring the oil level up to the inner lip of the corresponding hole).

OIL:

AGIP Rotra SX 75W90
IP Pontiax HDS 75W90
SHELL Spirax HD 80W90

Quantity: 120g (4.23 oz)

- Adjust the steering box as instructed in Steering Box Clearance Adjustment.

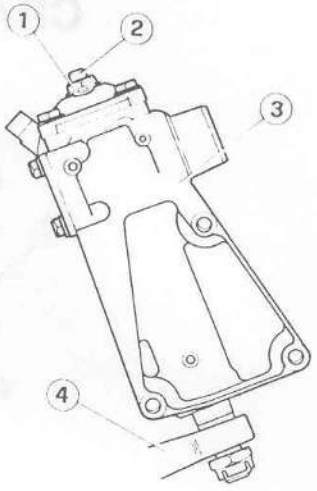
STEERING BOX CLEARANCE ADJUSTMENT

1. Straighten the wheels and disconnect the tie rods from the steering arm ④.
2. Unlock the nut ① and unscrew pin ② fully so as to obtain a high clearance on the arm ④.
3. If necessary, center the steering by taking the steering wheel to a limit and turning it half as many times as required to take it to the opposite limit.
4. Screw the pin ② back on gradually until there is no longer angular clearance on the arm ④.
5. Tighten the pin ② by 1/4 thru 1/2 rev. and, holding it in place, lock the nut ① to the specified torque.

Ⓣ : **Tightening torque**

Check nut for steering box adjusting pin

25 thru 29 N·m
(2.5 thru 3 kg·m)
(18.4 thru 21.4 ft·lb)



1 Nut
2 Adjusting pin
3 Steering box
4 Steering arm

6. Reconnect the tie rods, observing the following tightening torque.

Ⓣ : **Tightening torque**

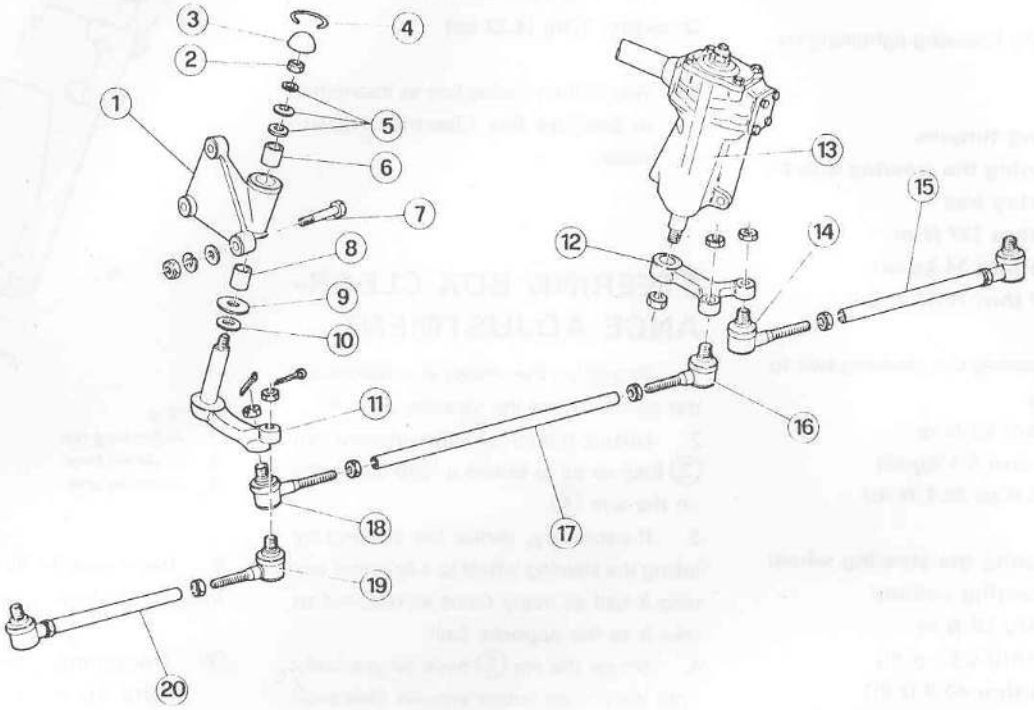
Nuts securing ball and socket joints of tie rods

47 thru 54 N·m
(4.8 thru 5.5 kg·m)
(34.7 thru 39.8 ft·lb)

7. If necessary, align the steering wheel position with respect to the wheels by operating as indicated in Steering Wheel and Steering Column Support - Steering Wheel.

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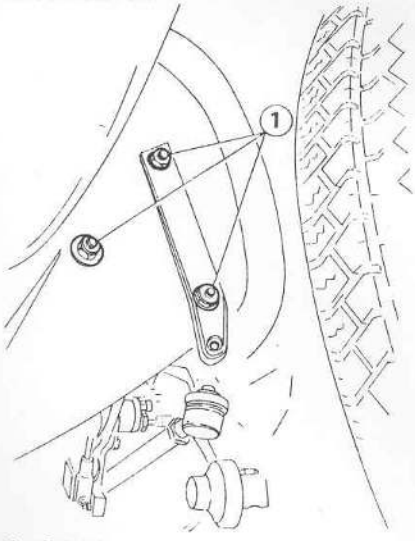
CRANK BRACKET AND LINKAGES



1 Crank bracket support
2 Nut
3 Cap
4 Clip
5 Washer
6 Bush
7 Bolt
8 Bush
9 Oil seal
10 Washer
11 Crank bracket
12 Steering arm
13 Steering box
14 Ball joint for L.H. side rod
15 L.H. side rod
16 Ball joint for center rod
17 Center rod
18 Ball joint for center rod
19 Ball joint for R.H. rod
20 R.H. side rod

REMOVAL AND INSTALLATION

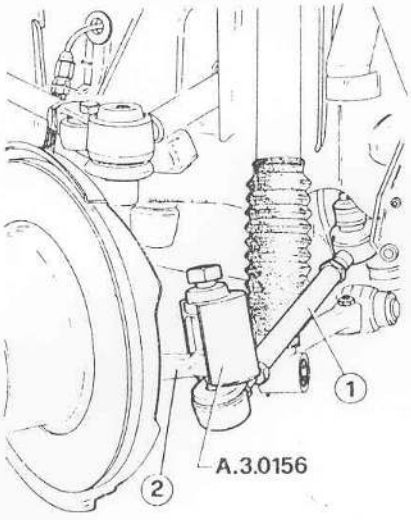
1. Put the car on platform lift and raise.
2. If necessary, detach the crank bracket support by unscrewing the three nuts (1) securing it to the body in the front right-hand wheel arch.



1 Screws

3. Remove the components to be operated on as illustrated in preceding exploded view.

WARNING:
The ball and socket joints of the side tie rods (1) are pulled from the steering arm (2) on the steering knuckles with tool A.3.0156.



1 Side tie rods
2 Steering arm

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4. Check that the ball and socket joints of the rods and crank bracket give no signs of binding or excessive lash, otherwise replace damaged items.
5. When re-installing, adhere to the following indications.

- Lubricate the crank pin and crank bracket cover with specified grease.

Grease:
AGIP Grease 30

- Observe the following tightening torques.

(T) : **Tightening torques**
Nut securing steering arm to steering box
123 thru 137 N·m
(12.5 thru 14 kg·m)
(90.7 thru 101.1 ft·lb)

Bolts securing crank bracket with steering locking bracket to bodywork
44 thru 53 N·m
(4.5 thru 5.4 kg·m)
(32.5 thru 39.1 ft·lb)

Nuts securing tie rod ball and socket joints
47 thru 54 N·m
(4.8 thru 5.5 kg·m)
(34.7 thru 39.8 ft·lb)

- Check for characteristic angles of the front wheels (see Unit 00 - Complete Car - Maintenance of Mechanical Components and Body).

TECHNICAL SPECIFICATIONS AND FEATURES

GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

Application	Type	Denomination	Quantity
Crank bracket pin on crank support cover	GREASE	AGIP: Grease 30	–
Steering box oil refill	OIL	AGIP Rotra SX 75W90 IP Pontiax HDS 75W90 SHELL Spirax HD 80W90 Norm. 3639-69408	120 g (4.23 oz)

SEALANTS AND SURFACE FIXING AGENTS

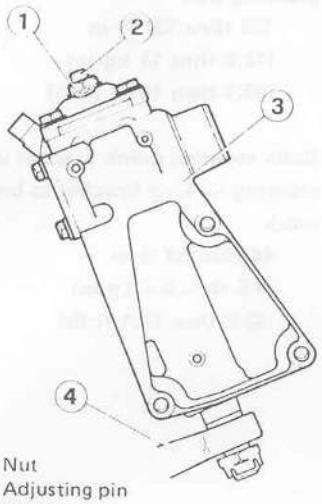
Application	Type	Denomination	Quantity
Key securing steering wheel to column	SEALANT	LOCTITE 601 Norm. 3524-00011	–

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CHECKS AND ADJUSTMENTS

STEERING BOX CLEARANCE ADJUSTMENT

1. Straighten the wheels and uncouple the tie rods from the steering arm (4).
2. Unlock the nut (1) then fully unscrew the pin (2) so as to obtain a high clearance on the arm (4).
3. Screw the pin (2) back on gradually until there is no longer angular clearance on the arm (4).
4. Screw the pin (2) on by 1/4 thru 1/2 a rev and, holding it in place, lock the nut (1) to the specified torque.
5. Attach the tie rods and observe the specified tightening torque.



1 Nut
2 Adjusting pin
3 Steering box
4 Steering arm

TIGHTENING TORQUES

Item	N·m	Kg·m	ft·lb
Nut securing steering wheel to steering column	50 thru 55	5.1 thru 5.6	36.9 thru 40.6
Screws securing steering box cover	23 thru 25	2.3 thru 2.5	17 thru 18.4
Bolts securing steering box to body	51 thru 53	5.2 thru 5.4	37.6 thru 39.1
Nut securing steering arm to steering box	123 thru 137	12.5 thru 14	90.7 thru 101.1
Bolts securing crank bracket with steering locking bracket to body	44 thru 53	4.5 thru 5.4	32.5 thru 39.1
Nuts securing tie rod ball and socket joints	47 thru 54	4.8 thru 5.5	34.7 thru 39.8
Steering arm to steering knuckle	39 thru 44	4 thru 4.5	28.8 thru 32.5
Steering box adjusting pin locknut	25 thru 29	2.5 thru 3	18.4 thru 21.4

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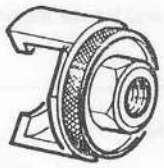
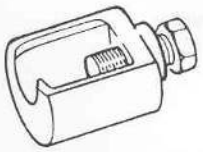
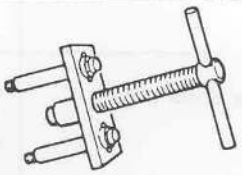
TROUBLESHOOTING AND CORRECTIVE ACTIONS

Preliminary operations:
- Check tire pressure and wear
- Check vehicle trim and wheel alignment

Trouble	Probable cause	Corrective action
Noisy steering column	• Worn and/or damaged column bearings	Replace defective parts
	• Column fouling half casings	Install half casing correctly
	• Loose bolts securing column support to upper and lower brackets	Tighten correctly
Excessive steering wheel play	• Loose steering box capscrews	Tighten screws
	• Damaged tie rods or U-joints	Replace defective parts
	• Excessive steering box play	Adjust
Noisy steering	• Loose steering box capscrews	Tighten screws
	• Worn steering linkage	Replace defective parts
	• Excessive steering box play	Adjust
	• Crank bracket worn or damaged	Replace defective parts
	• Tie rod ball and socket joints worn	Replace
Hard steering	• Incorrect suspension geometry	Adjust
	• Worn or under-inflated tires	Check and adjust
	• Insufficient steering box play	Adjust
	• Insufficient lubrication	Lubricate
	• Tie rod ball and socket joints worn	Replace
	• Steering column fouling combination switch unit	Check correct installation of combination switch unit

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SPECIAL TOOLS

Identity No.	Denomination	Reference page
A.3.0119	Puller, steering arm 	23-7
A.3.0156	Puller, side tie rod ball and socket joint 	23-10
A.3.0451	Puller, steering wheel 	23-3

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UNIT 25

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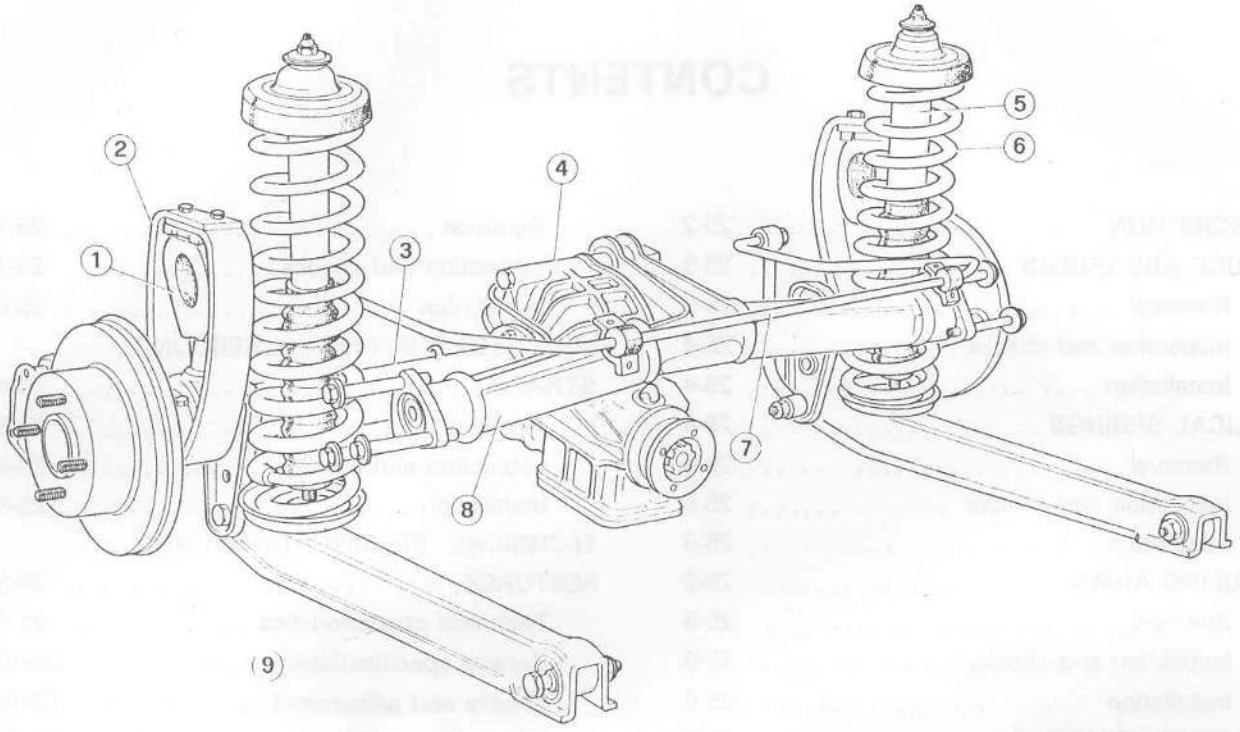
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DESCRIPTION



1 Limit stop buffer
2 Rebound strap
3 Rear axle
4 Differential
5 Shock absorber
6 Spring
7 Stabilizer bar
8 Reaction triangle
9 Trailing arm

The rear suspension is the rigid axle type made up of the differential axle, its achorings to the bodywork (trailing arms and reaction triangle), the springs, shock absorbers and limit rebound straps and buffers.

The axle is held lengthwise by two trailing arms and the reaction triangle which also inhibits any lateral rebound of the body with respect to the wheels.

The reaction triangle is held in place by spring gaskets and bushings and secured both to the body and outer differential casing.

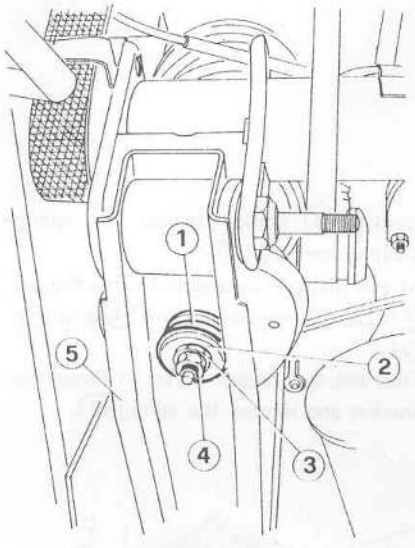
The spring and absorbing parts (springs and shock absorbers) are housed between the trailing arms and the bodywork. Wheel jolting is restricted at the top by the rubber buffers and below by the vulcanized rubber and rebound straps.

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SHOCK ABSORBERS

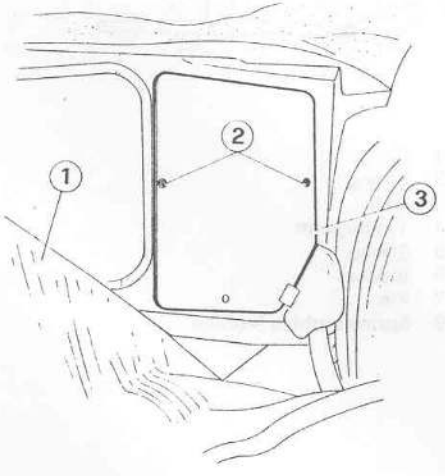
REMOVAL

1. Put the car on the lift and raise.
2. Unscrew the lock nut (4) and nut (3) securing the shock absorber to the trailing arm (5), retrieve the cup (2) and rubber cushion (1).



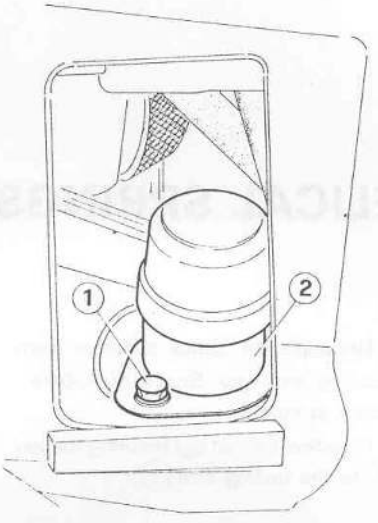
1 Rubber cushion
2 Cup
3 Nut
4 Lock nut
5 Trailing arm

3. Lower the car and, working from within the passenger compartment remove the rear upholstery (1) at the side to be worked on.
4. Unscrew the two screws (2) securing the door (3) to the bodywork and remove it.



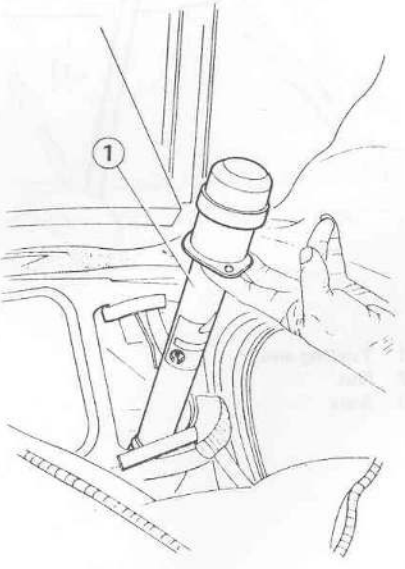
1 Rear upholstery
2 Screws
3 Door

5. Unscrew the two screws (1) securing the shock absorber (2), at the top, to the bodywork.



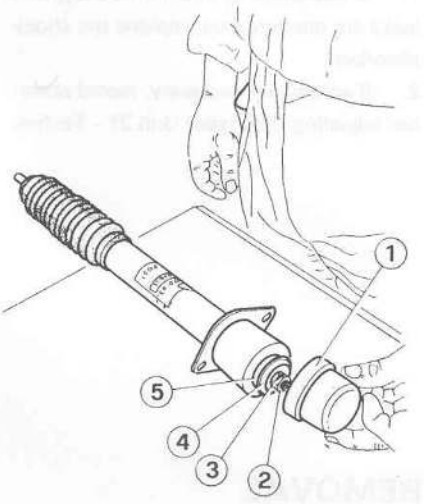
1 Screw
2 Shock absorber

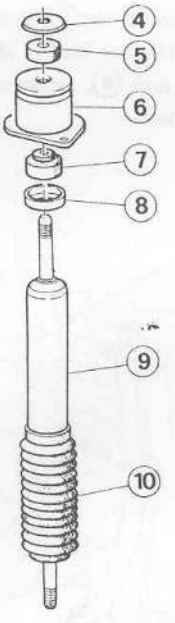
6. Get hold of the shock absorber (1) sliding it out from above.



1 Shock absorber

7. If necessary, dismantle the shock absorber by sliding off the upper cowling (1) and unscrewing the lock nut (2) and the nut (3). Then slide off the various parts as shown in the figure.





1 Upper cowling
2 Lock nut
3 Nut
4 Cup
5 Rubber cushion
6 Carrier
7 Rubber cushion
8 Cup
9 Shock absorber casing
10 Bellows

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INSPECTION AND CHECKS

1. Check shock absorber efficiency; if oil leaks are encountered, replace the shock absorber.
2. If considered necessary, record absorber adjusting data (see: Unit 21 - Technical Specifications and Features - Checks and Adjustment), replacing the absorbers if necessary.
3. Check the wear and tear, damage and deformation on the various rubber parts. Replace damaged items.

INSTALLATION

Apply the specified antiseize to the lower shock absorber pin and reunite by carrying out removal operations in reverse order.

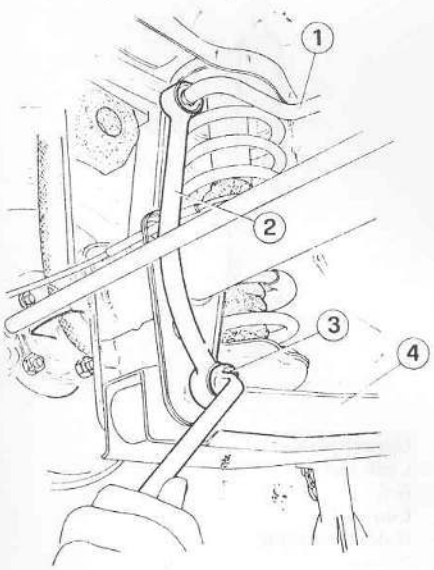
Antiseize:

R. GORI Never Seez

HELICAL SPRINGS

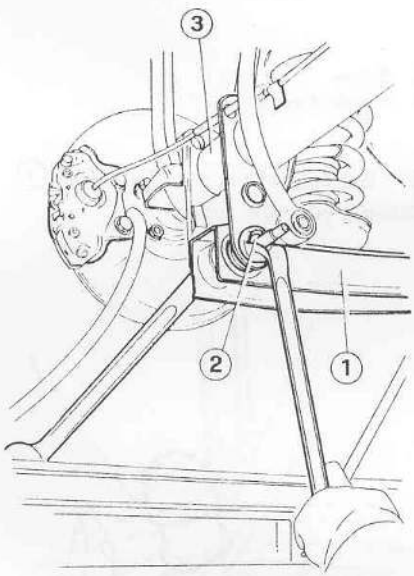
REMOVAL

1. Put the car on the lift and raise.
2. Place a column type jack beneath the differential, raise the car at the rear, position it on safety stands and remove the wheel from the side to be worked on.
3. Unscrew the nut (3), slide the link rod (2) of the stabilizer bar (1) off the pin on the trailing arm (4), retrieving the associated washers.



1 Stabilizer bar
2 Rod
3 Nut
4 Trailing arm

4. Uncouple the shock absorber from the trailing arm (see: Shock Absorbers - Removal at step 2).
5. Unscrew the nut (2) securing the axle (3) to the trailing arm (1).

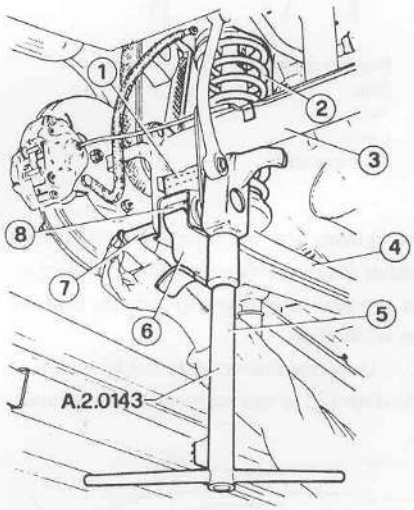


1 Trailing arm
2 Nut
3 Axle

6. Assemble tool **A.2.0143**, by inserting pin (1) in the hole on the axle flange. Turn the tool sleeve (5) until the tool bracket (6) comes against the spring bushing housing (8).

At this point it is possible to free the pin (7) coupling the trailing arm (4) and axle (3).

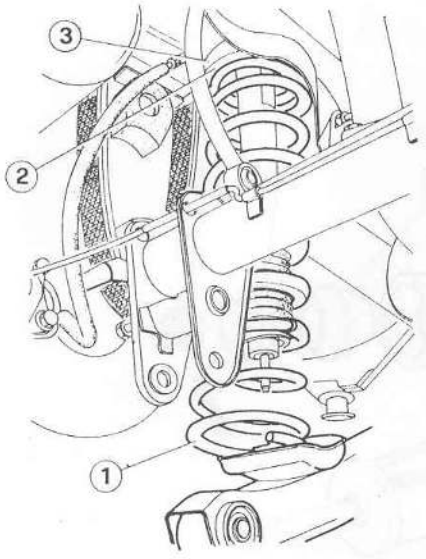
Turn the tool sleeve so as to lower the bracket and release the spring (2).



1 Pin
2 Spring
3 Axle
4 Trailing arm
5 Sleeve
6 Bracket
7 Pin
8 Spring bushing housing

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7. Dismantle the tool, slide out the spring (1), retrieving the upper cup (2) and gasket (3).



1 Spring
2 Cup
3 Gasket

INSPECTION AND CHECKS

1. Check that the spring shows no sign of yielding or deformation.
2. Check efficiency of the spring by comparing its rigidity values with those stipulated (see: Technical Specifications and Features).
3. Check for wear and tear, damage or deformation of the rubber parts. Replace as necessary.

INSTALLATION

Reunite by carrying out removal operations in reverse order and adhering to the following instructions.

- Apply the specified antiseize to the lower absorber pin and to the bolt securing the trailing arm to the axle.

Antiseize:
R. GORI Never Seez

- Observe the following tightening torques.

(T) : Tightening torques
Bolts securing the trailing arm to the axle
108 thru 133 N·m
(11 thru 13.6 kg·m)
(79.7 thru 98.1 ft·lb)

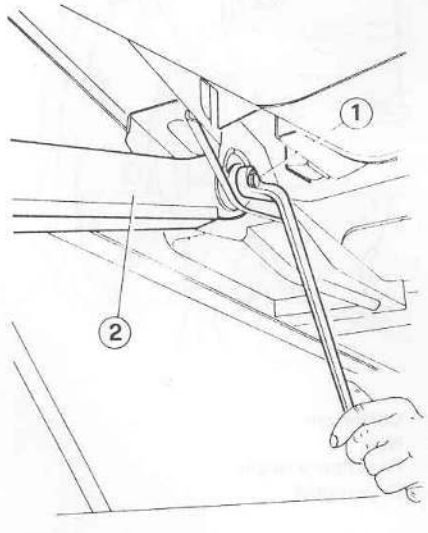
Nuts securing the stabilizer bar link rods to the axle
32 thru 34 N·m
(3.3 thru 3.5 kg·m)
(23.6 thru 25.1 ft·lb)

- Check rear trim of the car (see: Unit 00 - Maintenance of Mechanical Components and Body).

TRAILING ARMS

REMOVAL

1. Release the spring on the side to be worked on, proceeding as instructed in: Helical Springs - Removal.
2. Unscrew the bolt (1) connecting the trailing arm (2), at the front, to the bodywork.



1 Bolt
2 Trailing arm

3. If necessary, take the front and rear spring bushings out at the press.

INSPECTION AND CHECKS

1. Check that the trailing arms are not damaged or bent and that the housings of the spring and spring bushings are not worn, otherwise replace the part.
2. Check that the spring bushings are not damaged and especially that the rubber parts are not worn, otherwise replace.

INSTALLATION

1. Apply the specified antiseize to the bolt coupling the trailing arm to the bodywork.

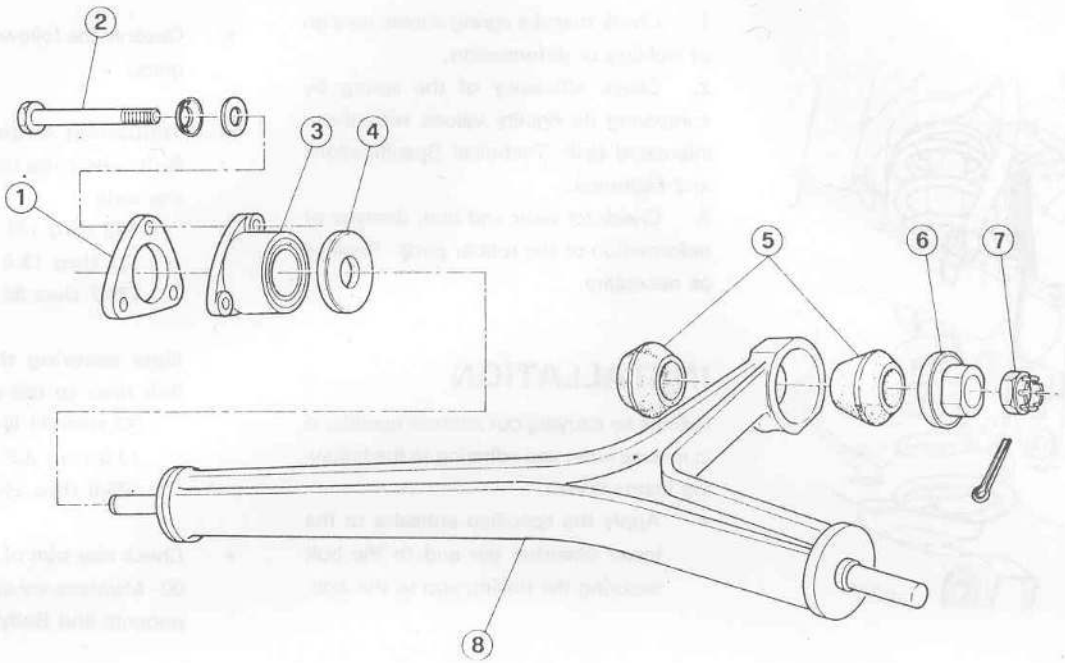
Antiseize:
R. GORI Never Seez

2. Recouple the trailing arm to the bodywork and lock the bolt.
3. Reassemble as instructed in: Helical Springs - Installation observing, furthermore, the following tightening torque.

(T) : Tightening torque
Bolts securing the trailing arms to the bodywork
80 thru 98 N·m
(8.1 thru 10 kg·m)
(59 thru 72.3 ft·lb)

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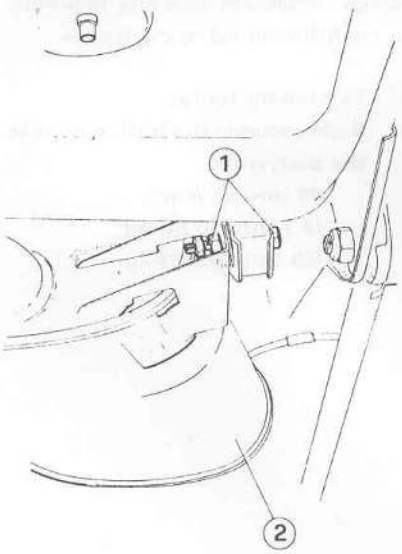
REACTION TRIANGLE



1 Shim
2 Screw
3 Carrier
4 Washer
5 Buffers
6 Bushing
7 Nut
8 Reaction triangle

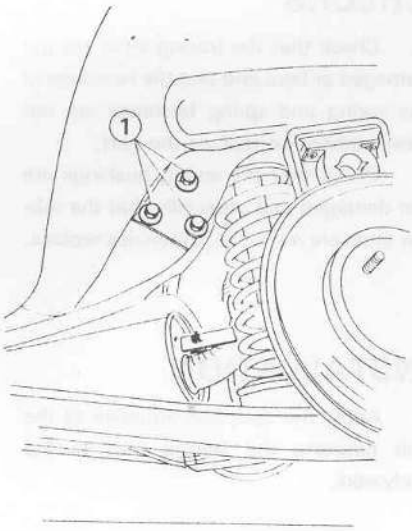
REMOVAL

1. Put the car on the lift and raise.
2. Uncouple the rear exhaust pipe from the bodywork and the center pipe.
3. Unscrew the bolt with the lock nut (1) securing the center muffler (2) to the bodywork.



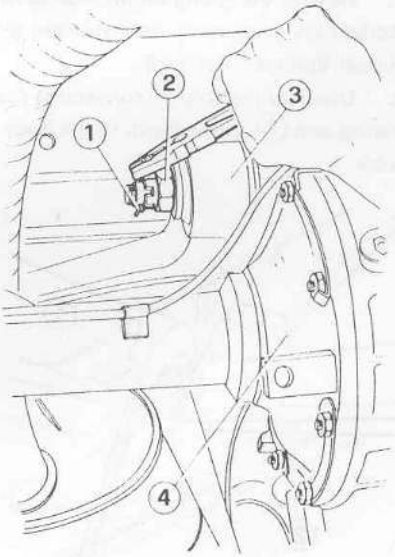
1 Bolt with lock nut
2 Center muffler

4. Place a column-type jack beneath the differential, raise the car at the rear, position it on safety stands and remove the wheels.
5. Working from both sides of the car, unscrew the three screws (1) securing the reaction triangle carrier to the bodywork.



1 Screws

6. Extract the cotter pin (1) and unscrew the nut (2) securing the reaction triangle (3) to the differential (4).



1 Cotter pin
2 Nut
3 Reaction triangle
4 Differential

7. Get the reaction triangle out from the body.

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INSPECTION AND CHECKS

1. Check the condition of the buffers in the differential coupling housing and replace them if deteriorated.
2. Check that the spring bushings of the carriers coupling with the body are not damaged or worn, otherwise replace the carriers, working at the press.
3. Check that the reaction triangle is not bent or damaged, otherwise replace it with a new one.

INSTALLATION

Reassemble by carrying out removal operations in reverse order and following these instructions.

- Lubricate the pin on the differential with the specified grease.

Grease:
ISECO Ergon Rubber Grease n. 3
SPCA Spagraph
REINACH Sferul B2AR

- Lubricate reaction triangle washers with the specified grease.

GREASE:
ISECO Molykote Pasta G

- Apply the specified antiseize to the triangle carriers.

Antiseize:
R. GORI Never Seez

- Observe the following tightening torques.

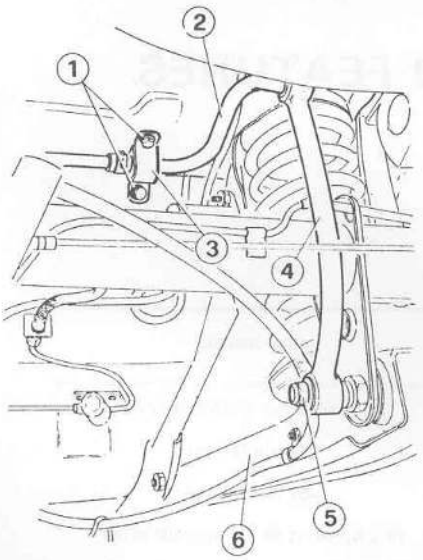
(T) : Tightening torques
Nut securing the reaction triangle to the differential
100 thru 123 N·m
(10.2 thru 12.6 kg·m)
(73.8 thru 90.7 ft·lb)

Screws securing the reaction triangle to the bodywork
39 thru 45 N·m
(4 thru 4.6 kg·m)
(28.8 thru 33.2 ft·lb)

STABILIZER BAR

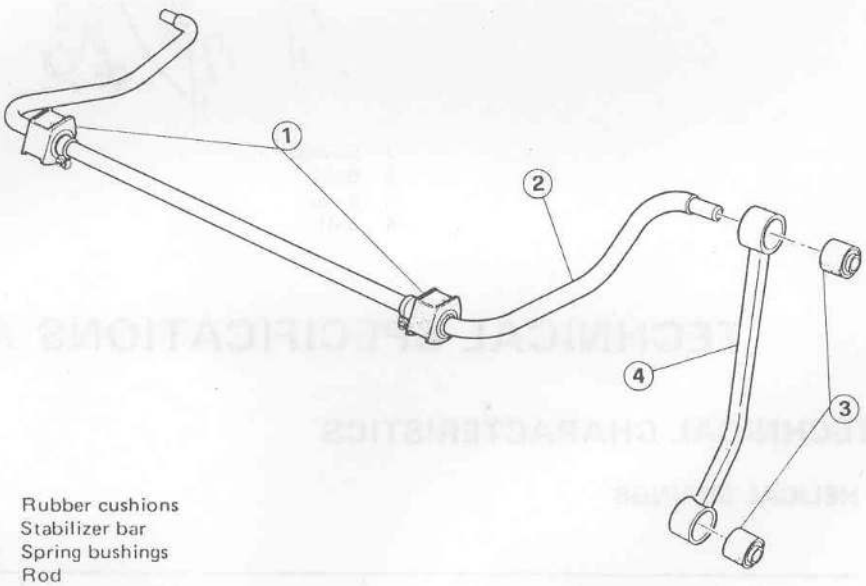
REMOVAL

1. Put the car on the lift and raise.
2. Working from both sides, unscrew the nuts (5) securing the link rods (4) to the trailing arms (6).
3. Unscrew the screws (1) securing the stabilizer bar (2) to the bodywork.
4. Retrieve the supports (3) and slide off the stabilizer bar.



1 Screws
2 Stabilizer bar
3 Support
4 Rod
5 Nut
6 Trailing arm

5. If necessary, extract the link rods (4) and the spring bushings (3).



1 Rubber cushions
2 Stabilizer bar
3 Spring bushings
4 Rod

INSPECTION AND CHECKS

Clean all the parts.

1. Check that the bar and link rods are not damaged or bent and that the housings of the spring bushings are not worn, otherwise replace accordingly.
2. Check that the rubber cushions of the supports, the rubber parts of the spring bushings and the bushings themselves are not worn, otherwise replace the damaged parts.

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INSTALLATION

Reassemble the stabilizer bar by carrying out removal operations in reverse order and following these instructions.

- Lubricate the stabilizer bar rubber cushions with the specified grease.

Grease:
SPCA Spagraph
ISECO Ergon Rubber Grease n. 3

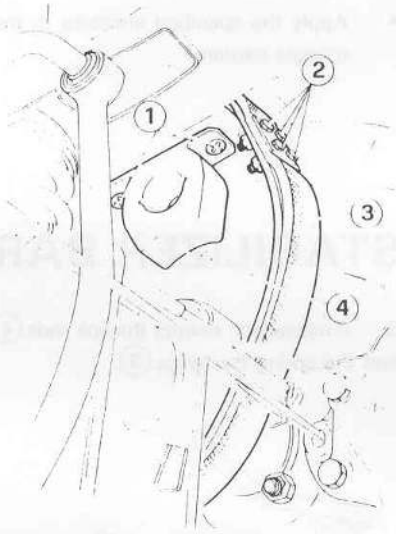
- Observe the following tightening torque.

(T) : Tightening torque
Nuts securing stabilizer bar link rods to the rear axle
32 thru 34 N·m
(3.3 thru 3.5 kg·m)
(23.6 thru 25.1 ft·lb)

LIMIT STOP BUFFERS AND REBOUND STRAPS

REMOVAL

1. Put the car on the lift and raise.
2. Unscrew the two screws (1) securing the buffer (4) and the rebound strap (3) to the bodywork.
3. Unscrew the four bolts (2) and retrieve the buffer, rebound strap and associated coupling plates.



1 Screws
2 Bolts
3 Strap
4 Buffer

INSPECTION AND CHECKS

Visually inspect that the buffers and rebound straps are not damaged and show no signs of excessive wear, otherwise replace them.

INSTALLATION

Reassemble by carrying out removal operations in reverse order, applying the specified antiseize to the rebound strap securing bolts.

Antiseize:
R. GORI Never Seez

TECHNICAL SPECIFICATIONS AND FEATURES

TECHNICAL CHARACTERISTICS

HELICAL SPRINGS

	Spider 1.6	other models
Wire diameter	11 ± 0.05 mm (0.43 ± 0.002 in)	11.9 ± 0.05 mm (0.47 ± 0.002 in)
Average diameter	104 mm (4.1 in)	104 mm (4.1 in)
Free length	437 mm (17.2 in)	457 mm (18 in)
Rigidity	14.7 N/mm (1.49 Kg/mm) (83.7 lb/in)	16.5 N/mm (1.68 Kg/mm) (94 lb/in)
Static load	2717 ± 81 N (277 ± 8.3 kg) (611 ± 18 lb)	3384 ± 98 N (345 ± 10 Kg) (761 ± 22 lb)
Length in static load	252 mm (9.9 in)	252 mm (9.9 in)

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On Spider , provided with hard top, springs featuring as indicated in the following, are installed jointly with a 11.5 mm (0.45 in) shim

Wire diameter	11.9 ± 0.05 mm (0.47 ± 0.002 in)
Average diameter	104 mm (4.1 in)
Free length	476 mm (18.7 in)
Rigidity	16.5 N/mm (1.68 Kg/mm) (94 lb/in)
Static load	3679 ± 111 N (375 ± 11.3 Kg) (827 ± 25 lb)
Length in static load	252 mm (9.9 in)

Distinctive numbers and load classes

Only springs of the same load class are to be assembled on any one axle.
The springs should reach assembly already selected, in appropriate countermarked containers and divided into four classes each of these having a tolerance range of approximately 49 N (5 kg) on the static load.

Distinctive number	Load class		
	N	Kg	lb
69	3286 thru 3326	335 thru 339	739 thru 748
70	3335 thru 3375	340 thru 344	749 thru 759
71	3384 thru 3424	345 thru 349	760 thru 770
72	3433 thru 3483	350 thru 355	771 thru 783
16	2639 thru 2688	269 thru 274	592 thru 604
17	2698 thru 2747	275 thru 280	606 thru 618
8	2757 thru 2796	281 thru 285	620 thru 628
73	358 thru 3620	365 thru 369	805 thru 814
74	3630 thru 3670	370 thru 374	815 thru 825
75	3679 thru 3718	375 thru 379	826 thru 836
76	3728 thru 3777	380 thru 385	837 thru 849

Note for vehicles with rear axle overload
Should the rear axle be subjected to high over loading; as in the case of a tow bar, it is possible to substitute the rear serial springs with other springs, which have the following features.

Wire diameter	11.9 ± 0.05 mm (0.47 ± 0.002 in)
Average diameter	104 mm (4.1 in)
Free length	415 mm (16.3 in)
Rigidity	20 N/mm (2.04 Kg/mm) (114 lb/in)
Static load	3267 ± 98 N (333 ± 10 Kg) (734 ± 22 lb)
Length in static load	252 mm (9.9 in)

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GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

Application	Type	Denomination	Quantity
Stabilizer bar rubber cushions Reaction triangle securing pin	GREASE	ISECO: Ergon Rubber Grease n° 3 SPCA: Spagraph REINACH: Sferul B2 AR Norm. 3671-69816	Dampen
Shock absorber lower pin Bolts securing the trailing arm to the rear axle and body Reaction triangle spring bushing sheath Screws securing the rebound strap	FLUID	R. GORI: Never Seez - Antiseize Norm. 3671-69850	Dampen
Reaction triangle washers	GREASE	ISECO: Molykote Pasta G Norm. 3671-69840	Dampen

CHECKS AND ADJUSTMENT

SHOCK ABSORBER ADJUSTMENT AND PAIRING

See Unit 21 - Front Suspension - Checks and Adjustment

REAR WHEEL ANGLES AND CAR TRIM

See Unit 00 - Complete Car - Maintenance of Mechanical Components and Body

TIGHTENING TORQUES

Item	N·m	Kg·m	ft·lb
Bolts securing the trailing arms to the bodywork	80 thru 98	8.1 thru 10	59 thru 72.3
Bolts securing the trailing arms to the axle	108 thru 133	11 thru 13.6	79.7 thru 98.1
Nut securing the reaction triangle to the bodywork	100 thru 123	10.2 thru 12.6	73.8 thru 90.7
Screws securing the reaction triangle to the bodywork	39 thru 45	4 thru 4.6	28.8 thru 33.2
Nut securing the stabilizer bar link rod to the bodywork	32 thru 34	3.3 thru 3.5	23.6 thru 25.1

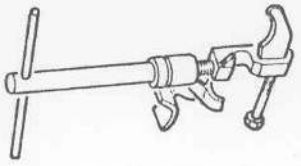
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TROUBLESHOOTING AND CORRECTIVE ACTIONS

If noise presumed to originate at the rear suspension is encountered, carry out a thorough check to determine whether the noise in fact derives from the rear suspension or is due to the tires, road surface, exhaust system, transmission or wheel bearings.

Trouble	Probable cause	Corrective action
Noise	• Wheel screws loose	Tighten to specified torque
	• One or more anchor bolts loose	Tighten to specified torque
	• Faulty shock absorber	Replace
	• Wheel bearing worn or damaged	Replace
	• Wheels and tires unbalanced	Balance
	• Damage to rubber parts	Replace damaged parts
Instability during driving. This problem is also connected with the front suspension. As regards troubleshooting, reference should also be made to Unit 21.	• Wheel screws loose	Tighten to specified torque
	• Shock absorber defective operation	Repair or replace
	• Helical springs yielded	Replace
	• Trailing arm spring bushings damaged	Replace
	• Trailing arm connections loose	Tighten or replace
	• Incorrect wheel angles	Reset

SPECIAL TOOLS

Identity N°	Denomination	Reference page
A.2.0143	Tool for rear spring assembly and disassembly 	25.4

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UNIT 40

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ELECTRIC COMPONENTS

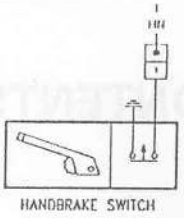
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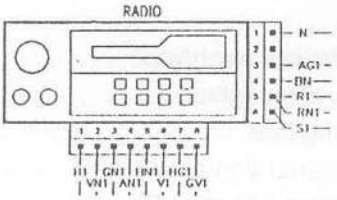
WIRING DIAGRAMS

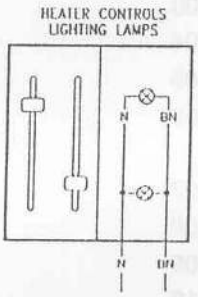
HOW TO READ THE WIRING DIAGRAM

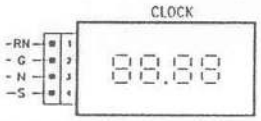
The wiring diagram arrangement is conceived to make easier the connection and the component location.
Components are aligned on the outerr sides of the diagram, and are joined to symbols which identifies the relevant function.
Example:



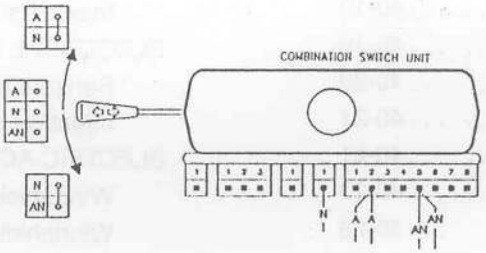
The diagram subdivision is conceived to ease the location of the involved component. In fact each diagram groups all components which are part of the same system.

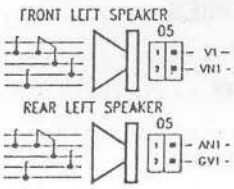




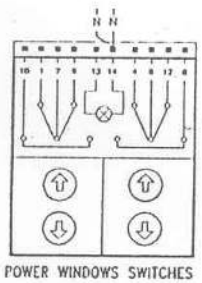


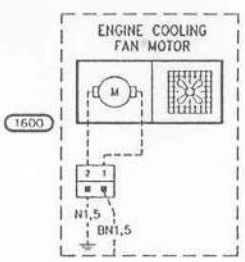
For the Combination switch Unit are drawed the cable connection relevant to lever position.





The diagrams on this manual basically represent the electric system of 2000 version fully equipped with optionals.
Variations for 1600 model are pointed out by a writing and a dashed line around the involved component, whereas cables are only dashed.
Example:





CABLE IDENTIFICATION

Each cable is marked by a reference designation composed by one or two letters and a number (eg. BN1). The letters identify the cable colour, whereas numbers indicate the thickness (N.B.: where not indicated, cable thickness is 0,5 mm^2).
The colour name has been shortened for convenience. The acronym list is herewith reported.

CABLE DENOMINATION

N	BLACK	AN	BLUE-BLACK
B	WHITE	AB	BLUE-WHITE
A	BLUE	AR	BLUE-RED
M	BROWN	AG	BLUE-YELLOW
G	YELLOW	GN	YELLOW-BLACK
R	RED	GV	YELLOW-GREEN
V	GREEN	GR	YELLOW-RED
S	PINK	VB	GREEN WHITE
H	GREY	VN	GREEN-BLACK
C	ORANGE	RN	RED-BLACK
Z	PURPLE	CN	ORANGE-BLACK
SN	PINK-BLACK	CB	ORANGE-WHITE
SB	PINK-WHITE	ZN	PURPLE-BLACK
HN	GREY-BLACK	ZB	PURPLE-WHITE
HR	GREY-RED	MB	BROWN-WHITE
HG	GREY-YELLOW	HV	GREY-GREEN
BN	WHITE-BLACK	NO	HAZEL BROWN
BR	WHITE-RED		

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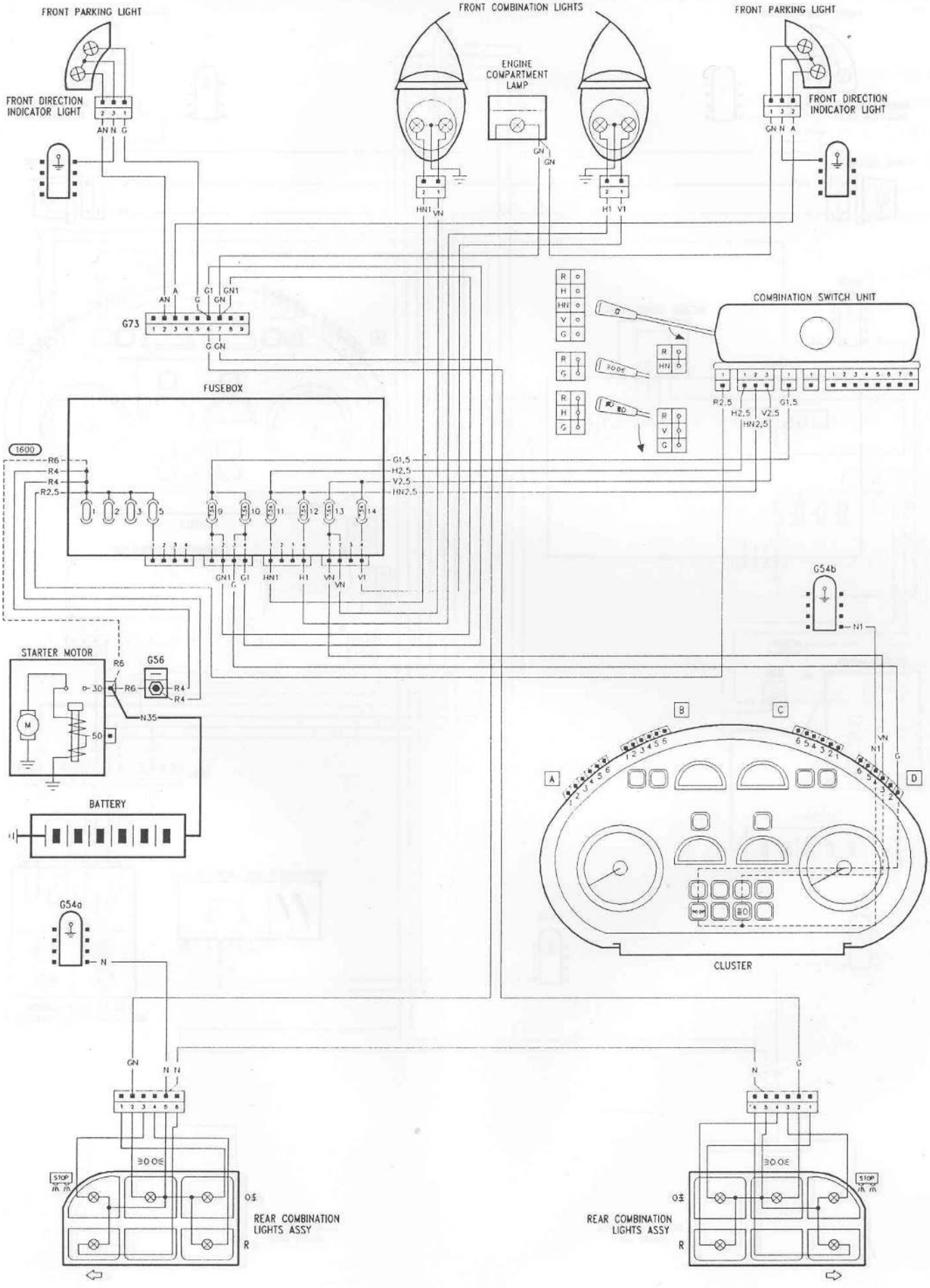
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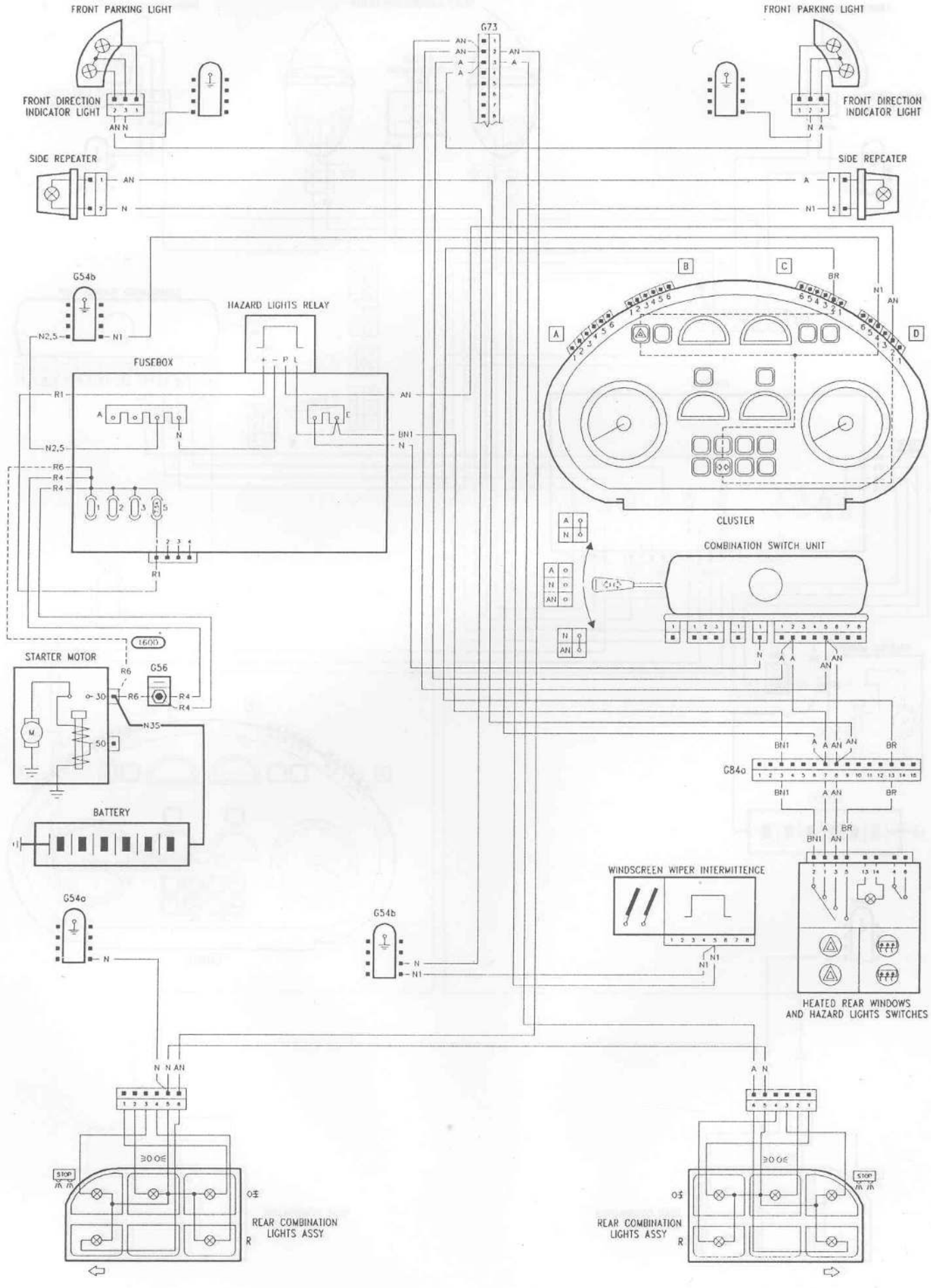
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PARKING LIGHTS, LOW BEAMS, HIGH BEAMS



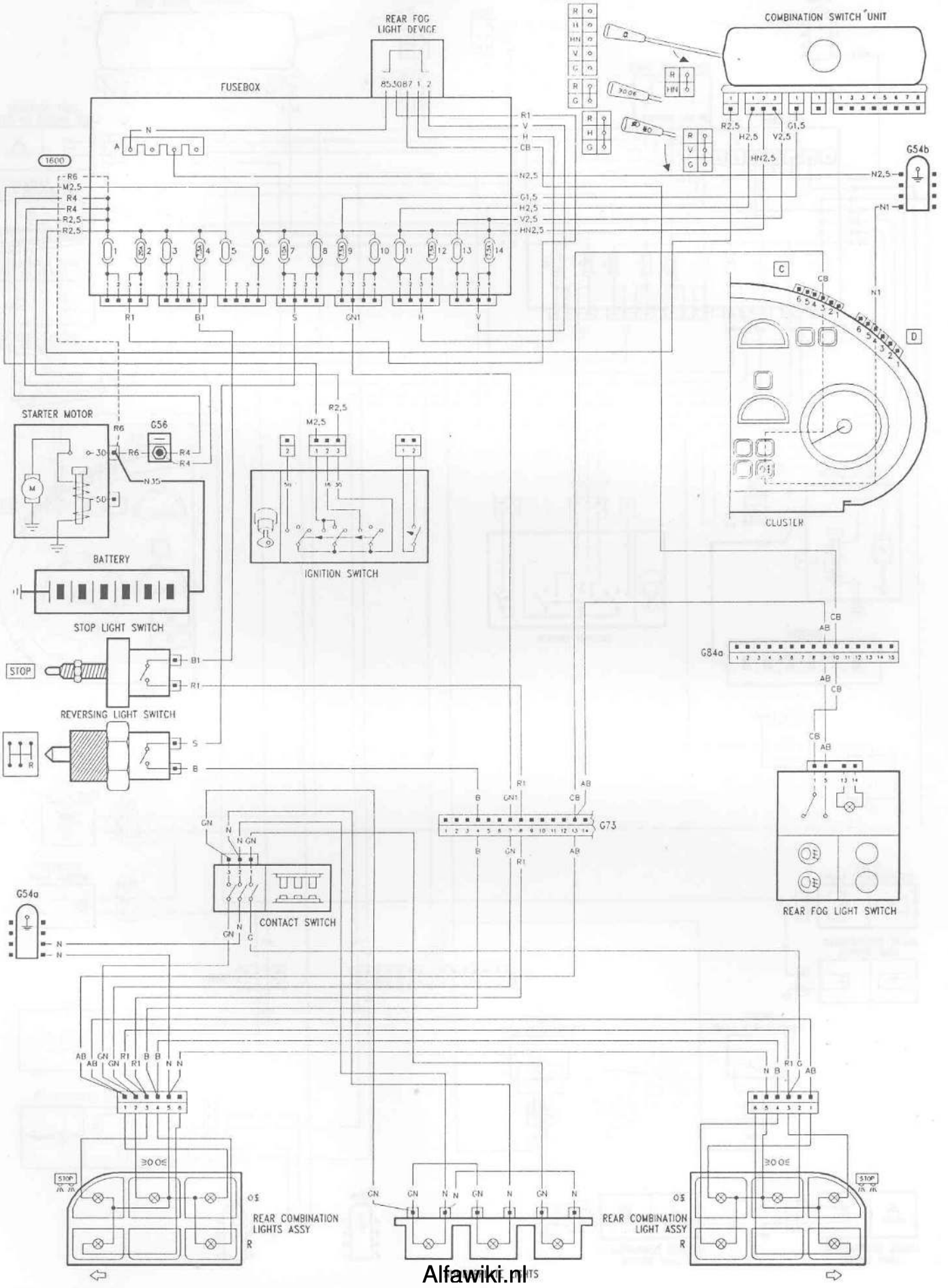
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DIRECTION LIGHTS, HAZARD LIGHTS



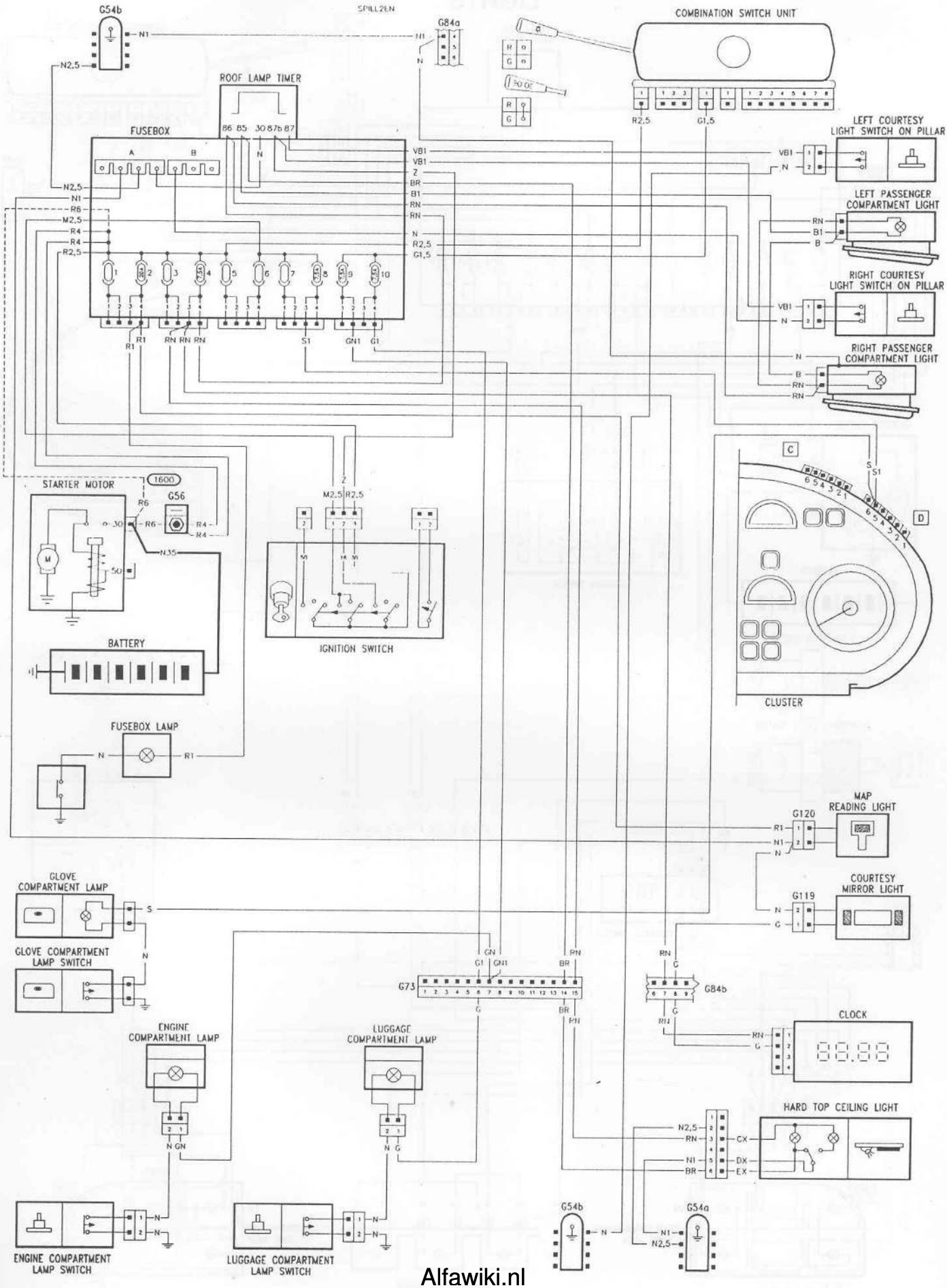
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NUMBERPLATE LIGHTS, BACK-UP LIGHTS, REAR FOG LIGHTS, STOP LIGHTS



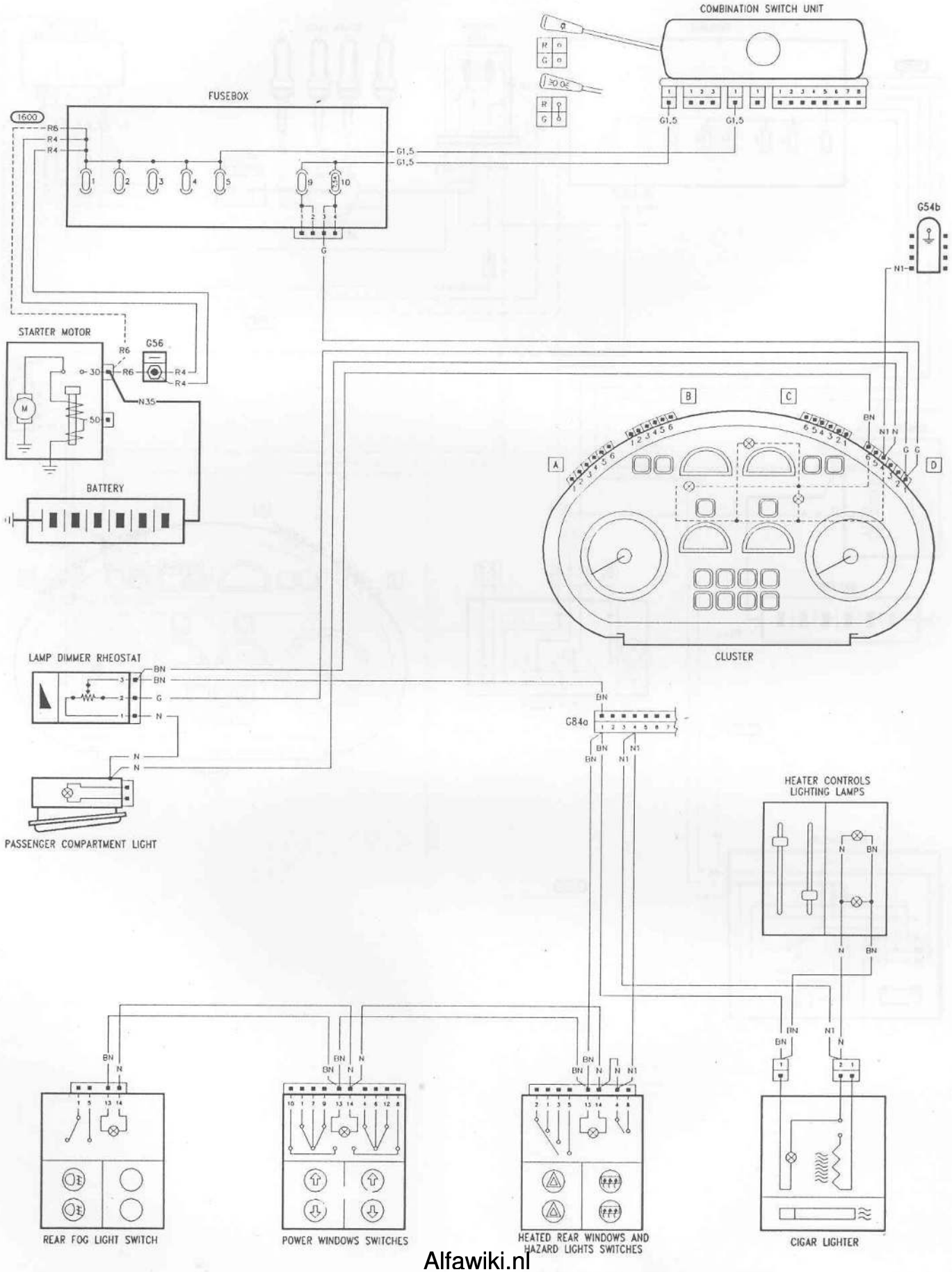
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INSIDE LIGHTING



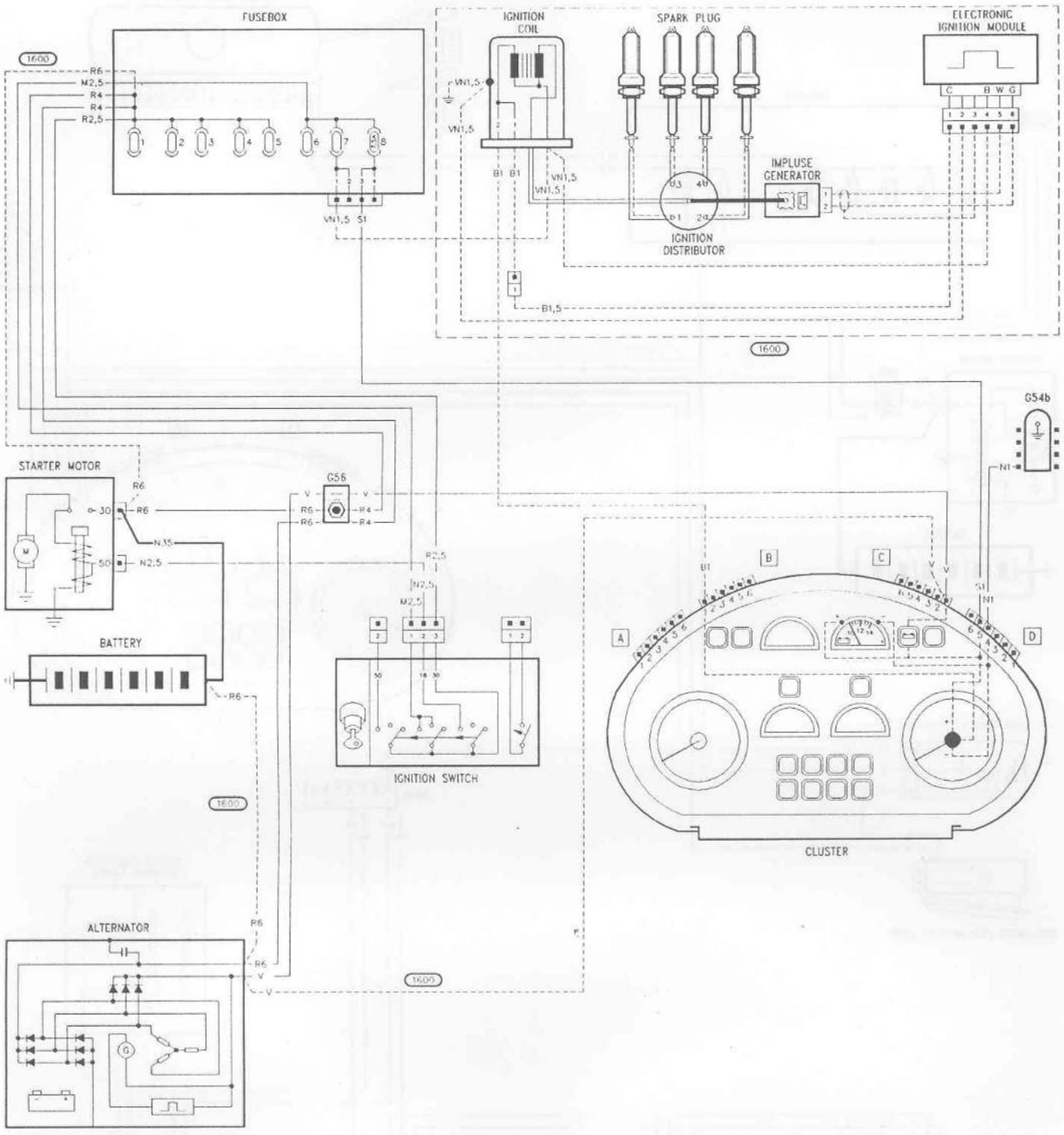
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LAMPS UNDER RHEOSTAT



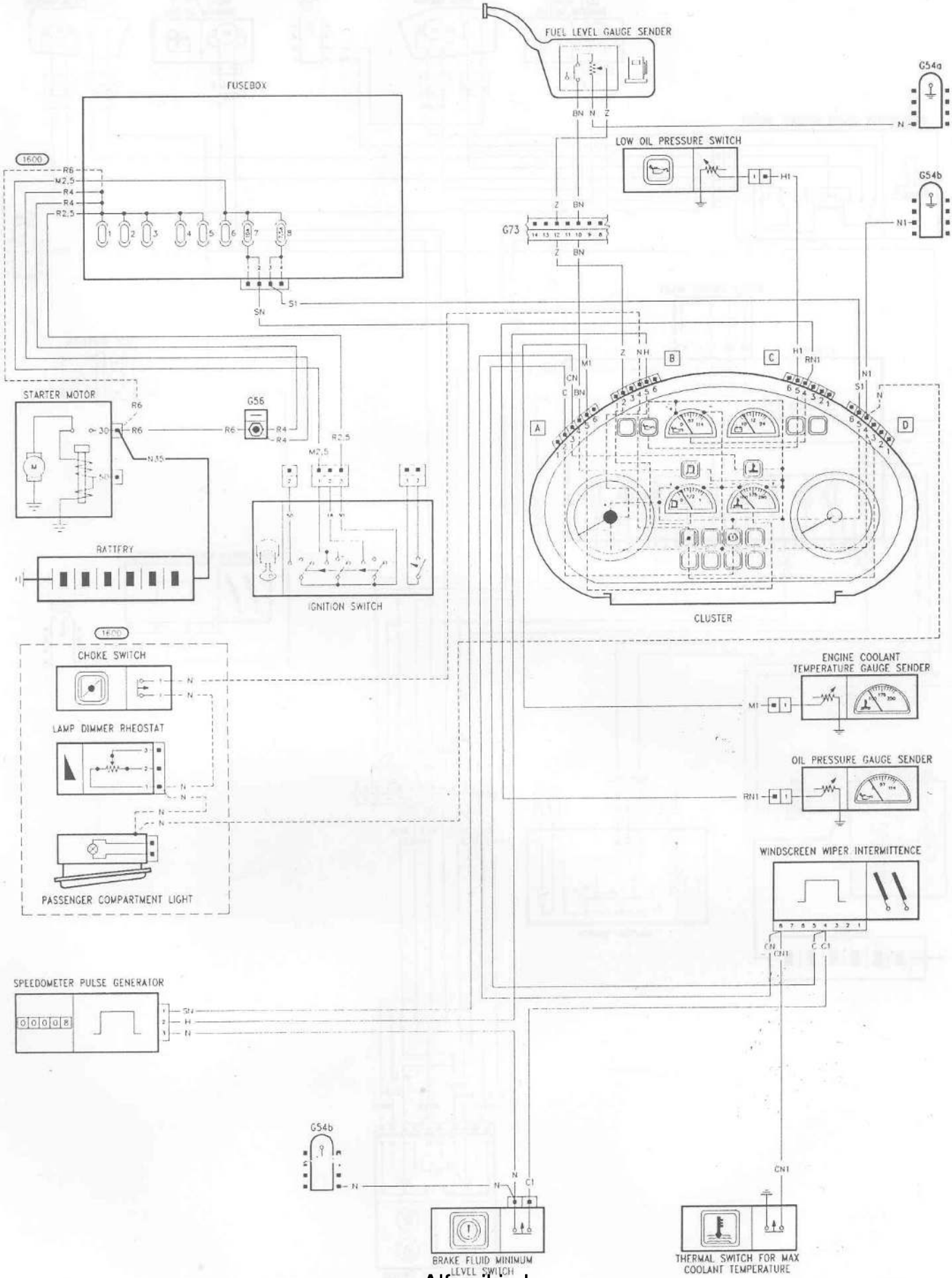
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ENGINE IGNITION, STARTING AND CHARGING



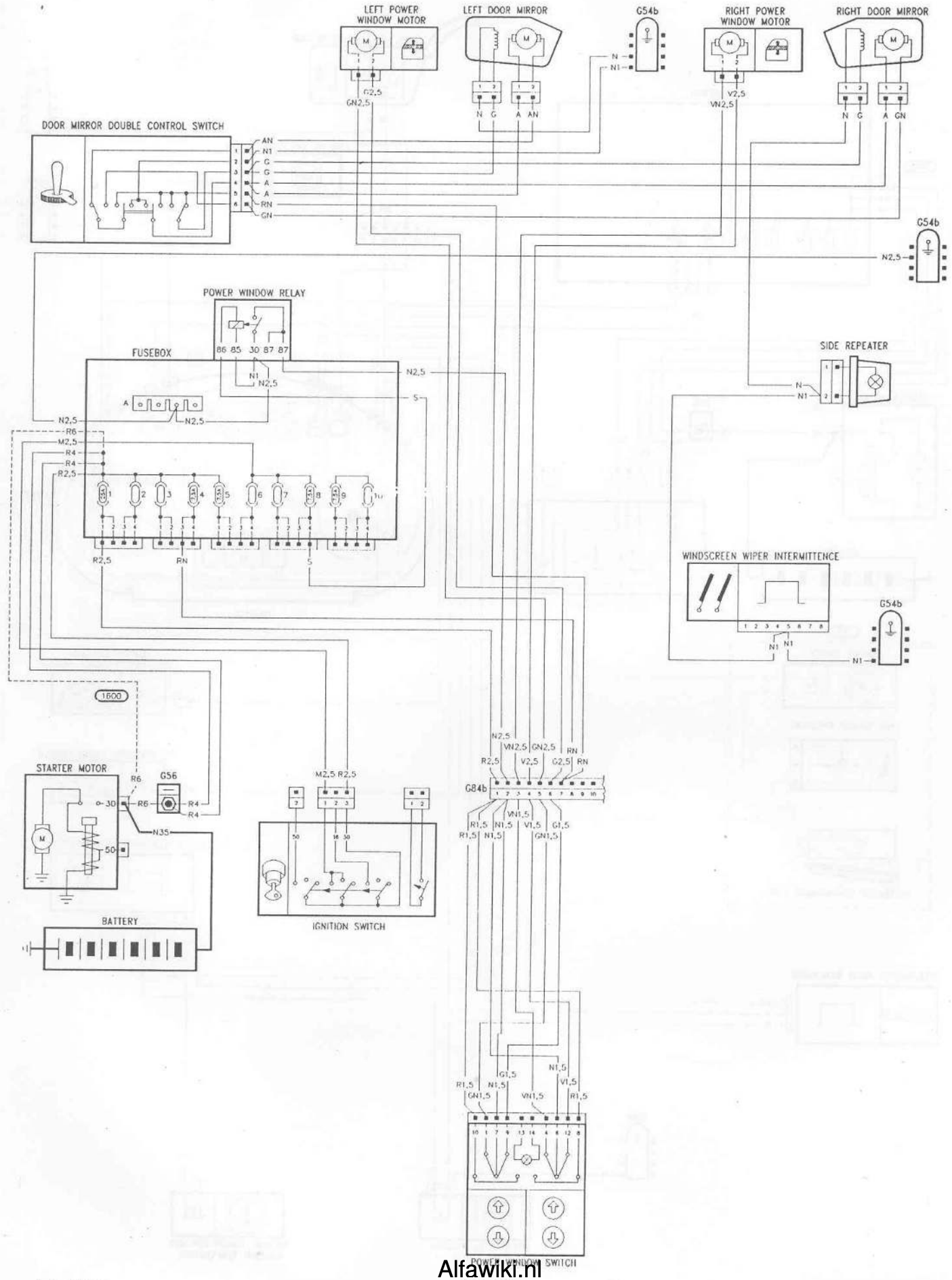
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SENSORS, SENDERS AND WARNING LIGHTS



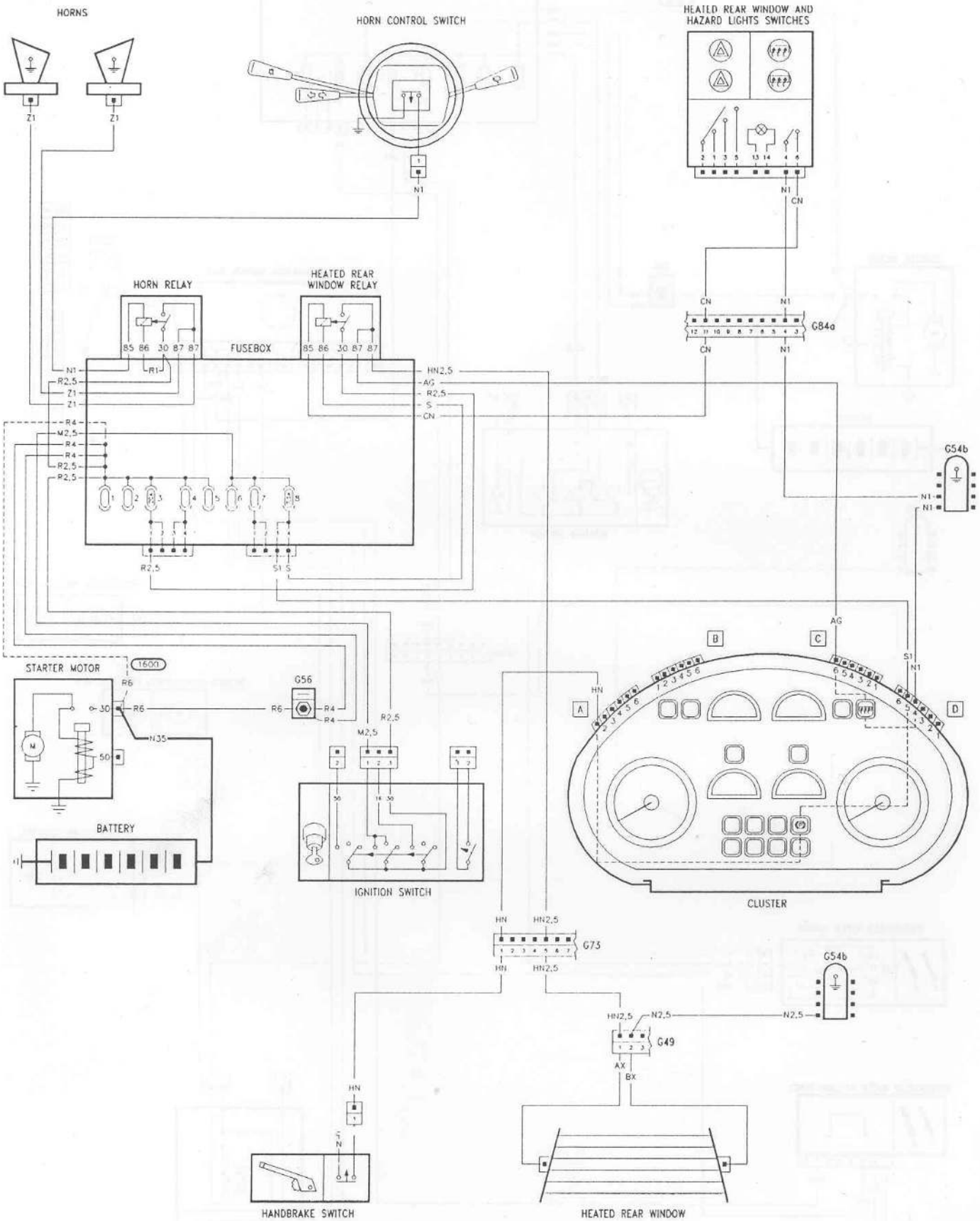
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POWER WINDOWS, MIRRORS



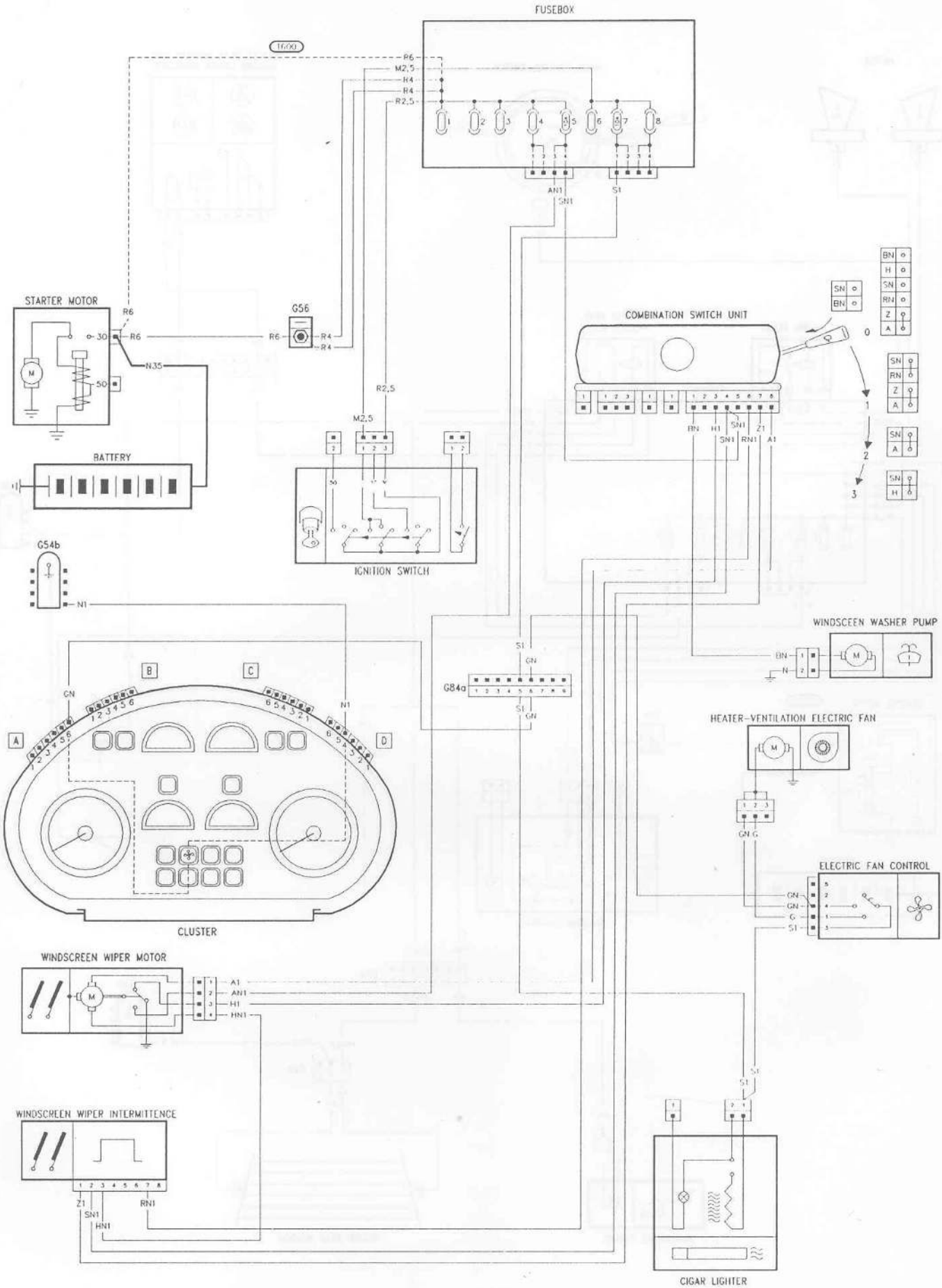
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HORNS, HEATED REAR WINDOW, PARKING BRAKE



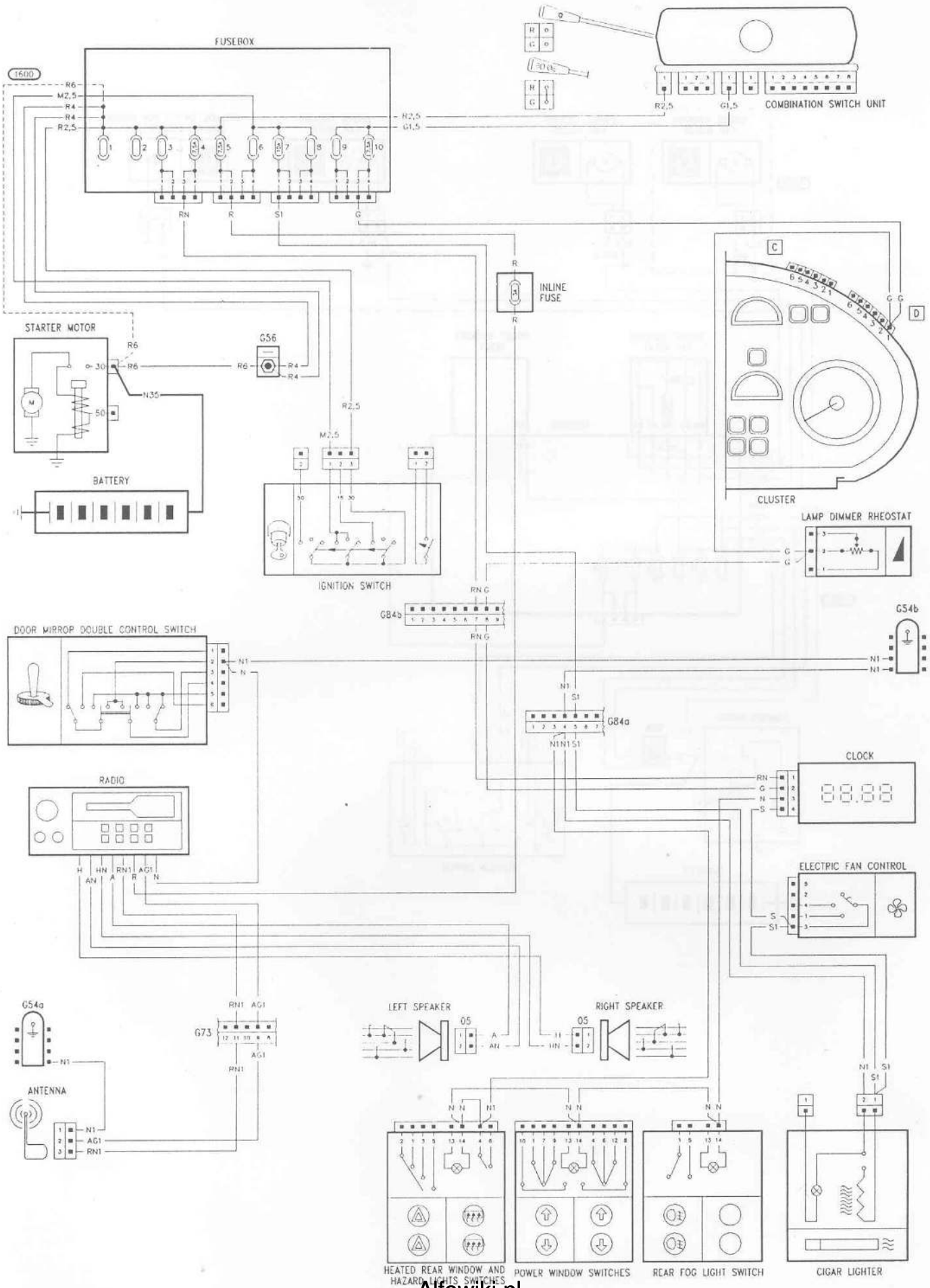
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HEATER, WINDSHIELD WASH/WIPE



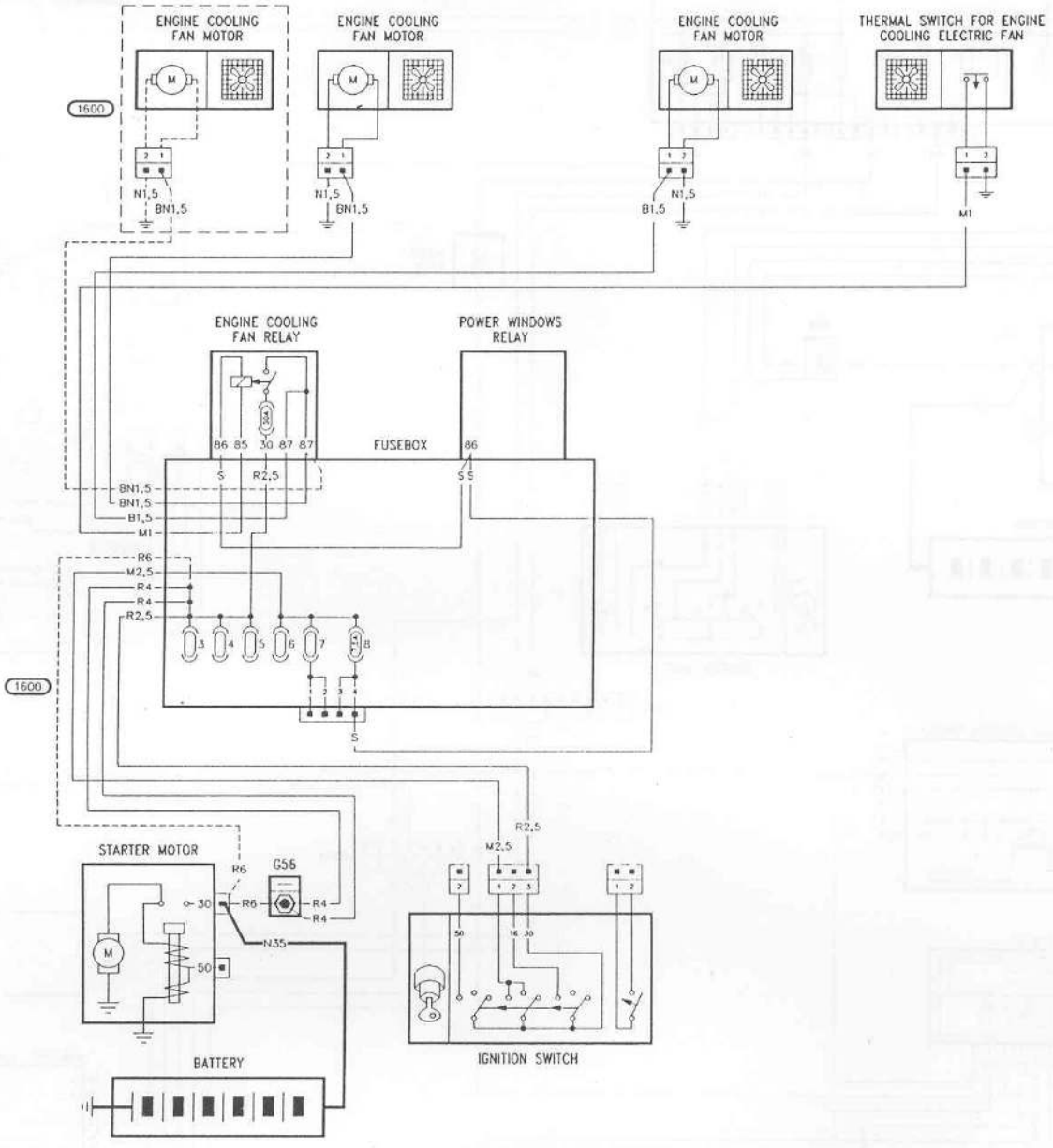
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CLOCK, RADIO, CIGAR LIGHTER

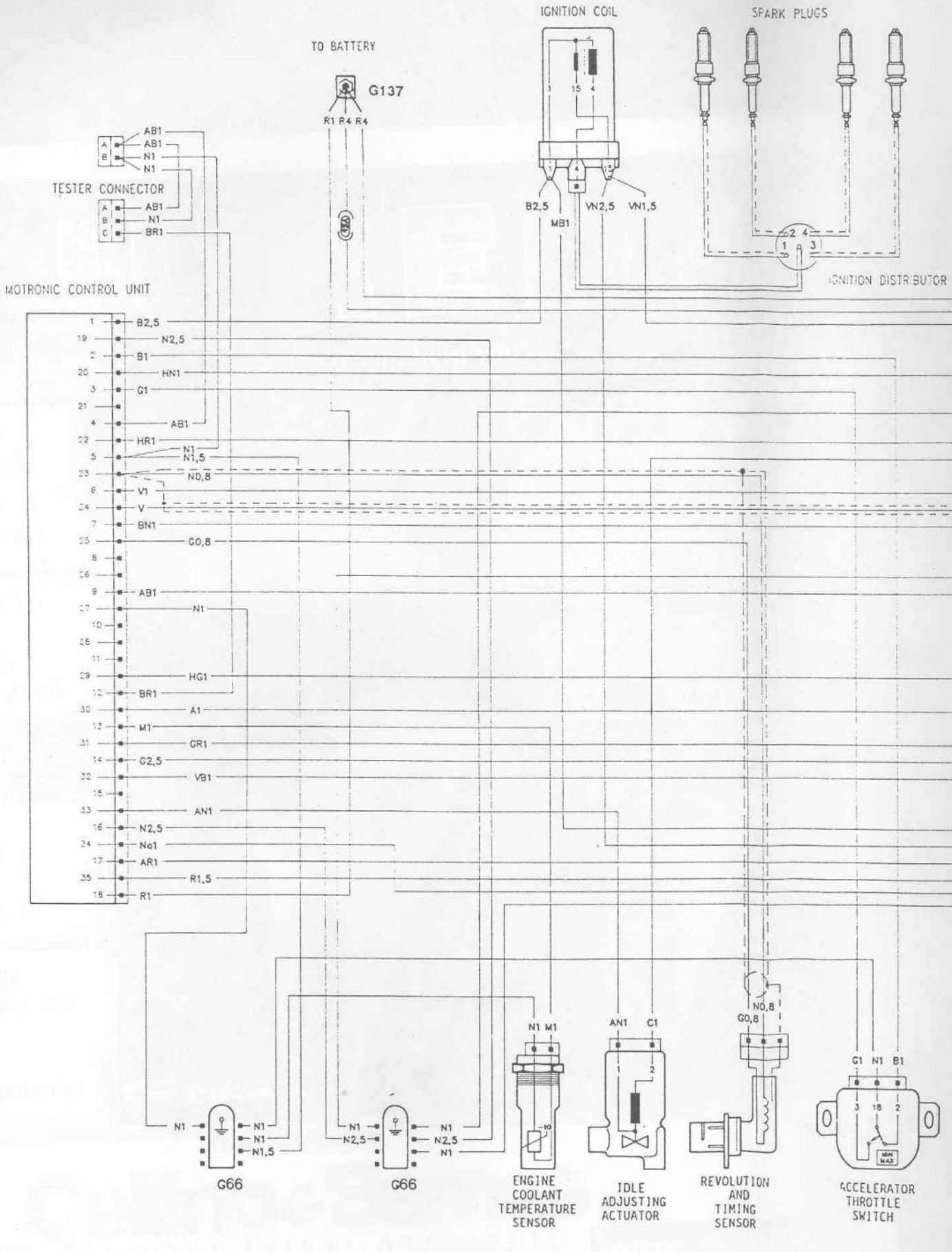


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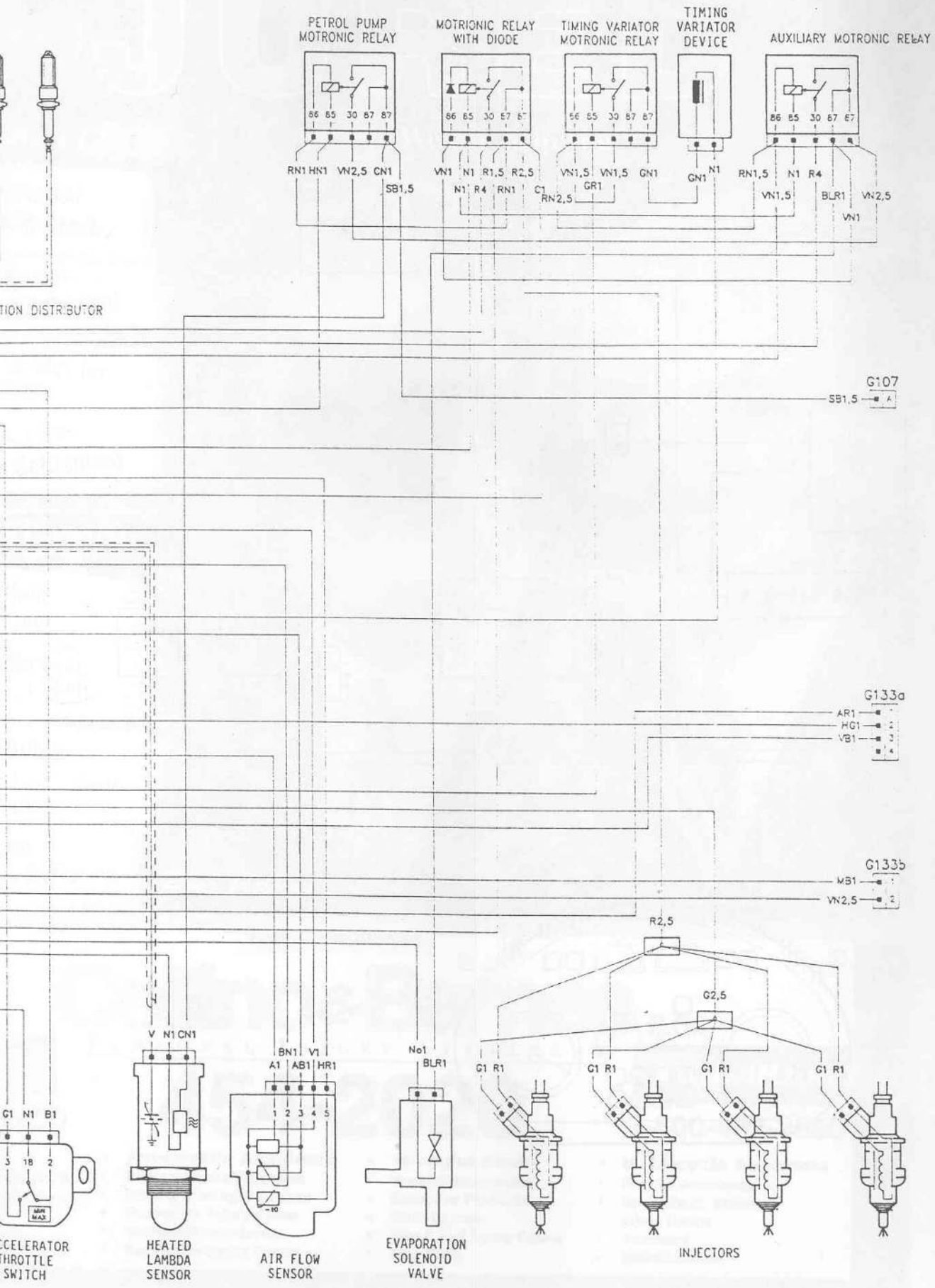
ENGINE COOLING FANS



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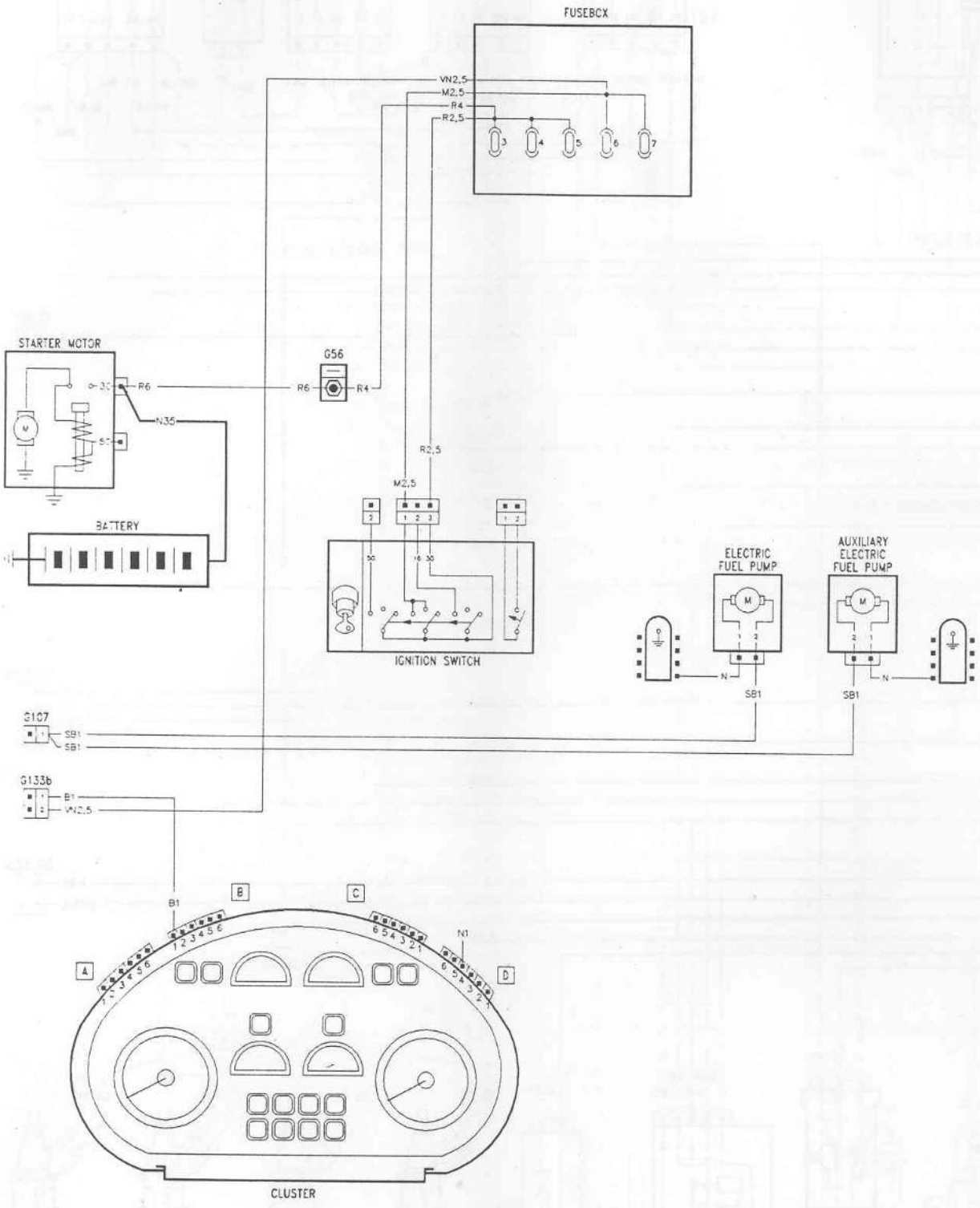

IGNITION COIL
SPARK PLUGS
TO BATTERY
G137
R1 R4 R4
AB1
AB1
N1
N1
TESTER CONNECTOR
AB1
N1
BR1
B2,5
MB1
VN2,5
VN1,5
IGNITION DISTRIBUTOR
MOTRONIC CONTROL UNIT
B2,5
N2,5
B1
HN1
G1
AB1
HR1
N1
N1,5
N0,8
V1
V
BN1
G0,8
AB1
N1
HG1
BR1
A1
M1
GR1
G2,5
VB1
AN1
N2,5
No1
AR1
R1,5
R1
N1
N1
N1,5
G66
N1
N2,5
N1
G66
N1 M1
ENGINE COOLANT TEMPERATURE SENSOR
AN1
C1
IDLE ADJUSTING ACTUATOR
N0,8
G0,8
REVOLUTION AND TIMING SENSOR
G1
N1
B1
ACCELERATOR THROTTLE SWITCH

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PETROL PUMP MOTRONIC RELAY
MOTRONIC RELAY WITH DIODE
TIMING VARIATOR MOTRONIC RELAY
TIMING VARIATOR DEVICE
AUXILIARY MOTRONIC RELAY
86 85 30 87 87
RN1 HN1 VN2,5 CN1 SB1,5
VN1 N1 R1,5 R2,5 C1 RN2,5
VN1,5 VN1,5 GN1 GR1
GN1 N1
RN1,5 N1 R4 VN1,5 BLR1 VN2,5 VN1
TION DISTRIBUTOR
G107
SB1,5
A
G133a
AR1
HG1
VB1
G133b
MB1
VN2,5
R2,5
G2,5
G1 R1
V N1 CN1
BN1 V1 A1 AB1 HR1
1 2 3 4 5
No1 BLR1
G1 N1 B1
3 18 2
MIN MAX
CCELERATOR THROTTLE SWITCH
HEATED LAMBDA SENSOR
AIR FLOW SENSOR
EVAPORATION SOLENOID VALVE
INJECTORS

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MOTRONIC SYSTEM (DIAGRAM B)

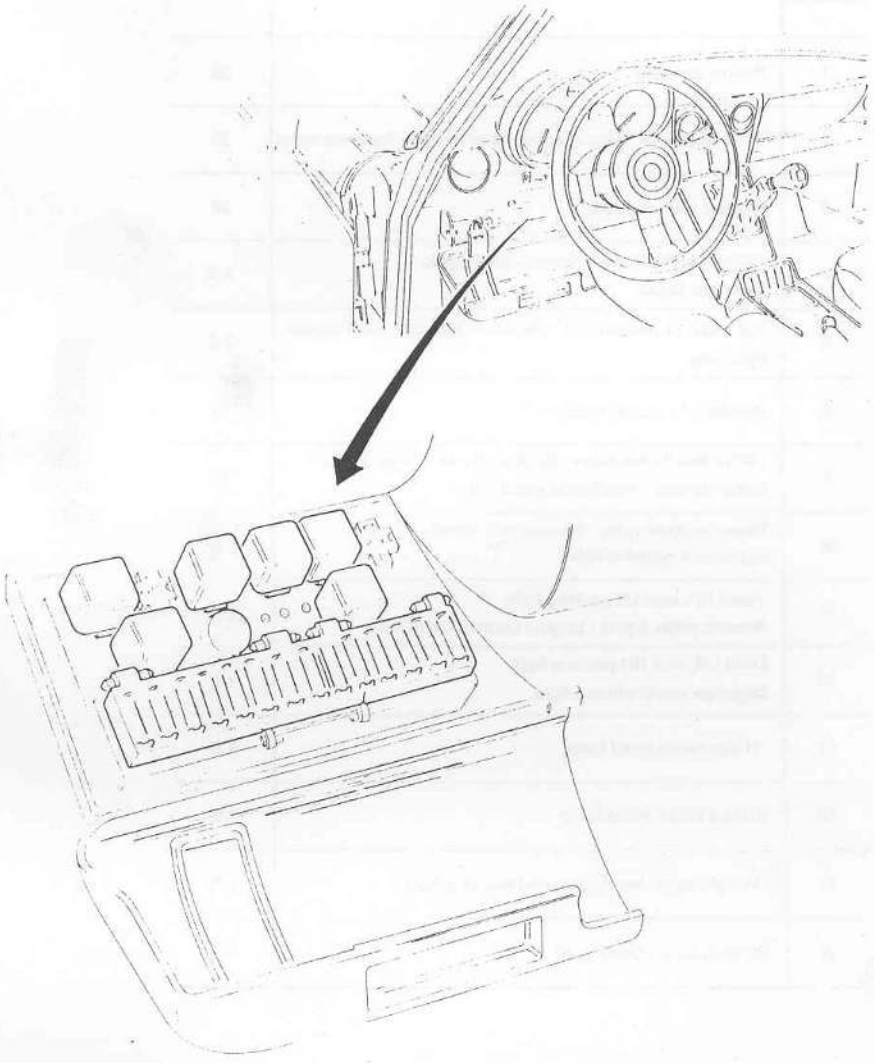


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ELECTRIC COMPONENTS

POWER SUPPLY DISTRIBUTION

FUSES



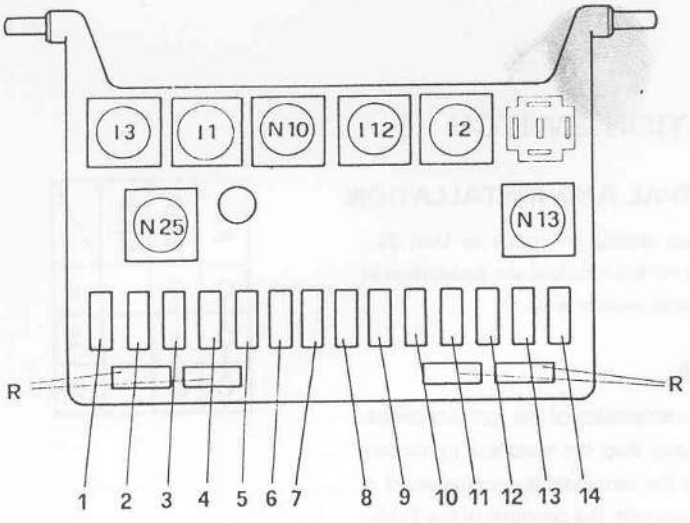
WARNING:

a. If a fuse blows, check that the cause has been eliminated prior to replacing the fuse.
b. Use fuses with stipulated amperage only. Never use a fuse which has a higher amperage than that specified.
c. Insert the fuse correctly in its housing.

LOCATION

The fuses are housed in the central fusebox located in the drawer designed for this purpose on the instrument panel to the left of the steering column.

SERVICES PROTECTED BY FUSES



R : Spare fuses
I1 : Engine cooling fan relay
I2 : Heated rear window relay
I3 : Horn relay
I12 : Power windows relay
N10 : Light timer
N13 : Direction indicator lights and hazard lights intermittence
N25 : Rear fog light device

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The following table indicates, for each model, the services protected by each fuse.

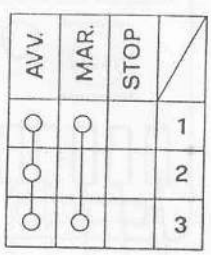
Fuse Table

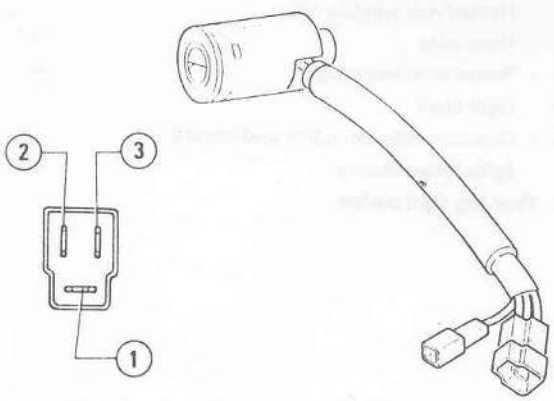
Fuse Number	Service Protected	Ampere
1	Power window	25
2	Rear fog device - Map reading lamp device - Fusebox lamp	20
3	Heated rear window	20
4	Digital clock - Power mirrors - Stop lights - Courtesy lights	7.5
5	Car radio (if assembled) - Direction indicator and hazard light relay	7.5
6	Windshield wiper/washer	10
7	Instrument illumination - Back-up lights - Cigar lighter- Speedometer - Ventilation electric fan	10
8	Power window relay - Heated rear window relay - Instrument warning lights	7.5
9	Front RH, rear LH parking light licence plate lights - Engine compartment light	7.5
10	Front LH, rear RH parking light Baggage compartment light	7.5
11	H low beam head lamp	7.5
12	RH low beam head lamp	7.5
13	LH high beam head lamp and warning light	7.5
14	RH high beam head lamp	7.5

IGNITION SWITCH

REMOVAL AND INSTALLATION

Reference should be made to Unit 23 - Steering for the removal and installation of the ignition switch assy.





CHECK

Check functionality of the ignition switch by verifying that the electrical continuity between the terminals is accomplished in accordance with the contents of the Table.

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LIGHTING SYSTEM

CAUTION:
Prior to commencing work on the lighting system, check that the ignition key is in the "STOP" position and that the battery ground wire is disconnected.

LAMPS

LAMP TYPES

WARNING:
When replacing be sure to use original ALFA ROMEO spare parts.

Three types of lamps are used in the car; it is advisable to follow these instructions for disassembly.

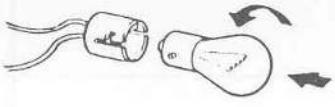
1 All glass lamp - type H

This is snap inserted; to extract, pull the bulb out from the lampholder.



2 Bayonet lamp - type I

To extract from the lampholder, press the bulb in, rotate it ccw and remove.



3 Cylindrical lamp - type L

To extract from the lampholder; disengage it from its contacts by pulling away from the holder.



To reassemble the lamps and bulbs operate in reverse order of disassembly.

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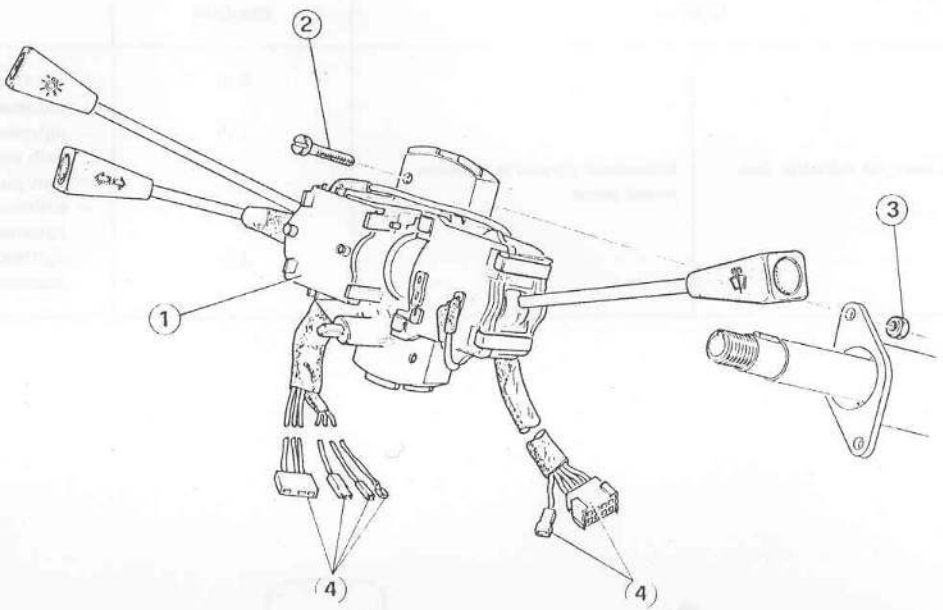
"Lamps" Table

The following table lists the features of the lamps (type and electrical power absorbed)

Lamps	Electrical power (W)	Type
Front combination lamps:		
— Low - full beam (halogen lamp)	55/60	halogen lamp
— Front parking light	5	I
— Front direction light	21	I
Direction side indicator lamp	10	H
Rear combination lamps:		
— Rear direction light	21	I
— Rear parking light	5	I
— Stop light	21	I
— Rear fog light	21	I
— Back up light	21	I
Licence plate lamps	5	I
Cluster warning lamps	1,2	H
Cluster illumination lamps	1,2	H
Ventilating system illumination lamps	1,2	H
Passenger compartment lamps	10	L
Glove compartment light	10	L
Map reading lamp	5	L
Courtesy mirror lights	5	H
Hard top ceiling light	10	L
Hard top reading light	5	H
Engine compartment light	10	L
Luggage compartment light	10	L

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COMBINATION SWITCH UNIT



1 Combination switch unit
2 Screw
3 Nut
4 Connectors

REMOVAL

1. Remove the steering wheel (see: Unit 23 - Steering).
2. Unscrew the four screws and remove the two upper and lower half casings of the steering column (see: Unit 23 - Steering).
3. Referring to the exploded view, disconnect the connectors (4), from the combination switch unit (1).
4. Remove the combination switch unit by unscrewing the two screws (2) securing it to the steering column, at the same time locking the nuts (3).

CHECK

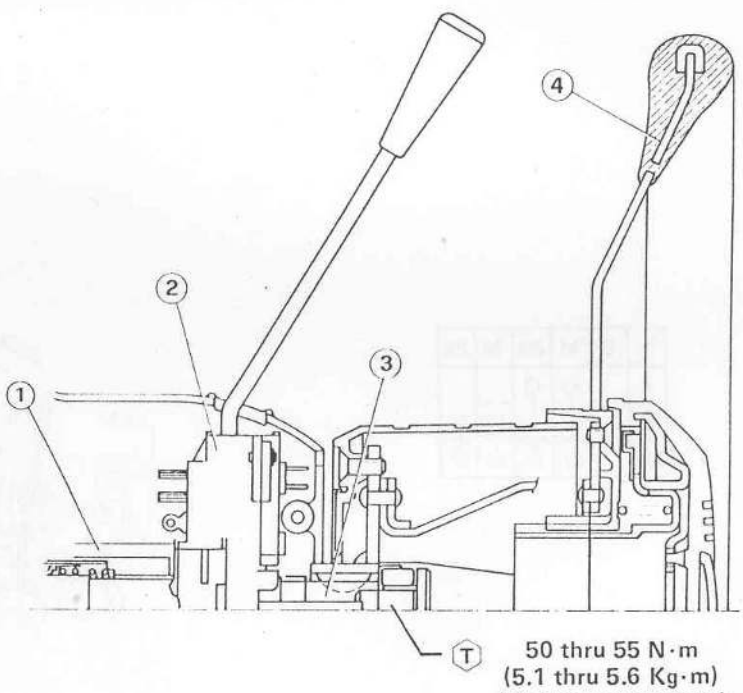
Check wiring is in good condition. Ensure that the combination switch unit is functional by checking with a tester that the continuity between the terminals is achieved in accordance with the tables provided hereafter.

INSTALLATION

Re-install by operating in reverse order of removal and following these instructions.

— Lock the steering wheel clamp unit to the specified torque.

(T) : Tightening torque
Steering wheel nut
50 thru 55 N·m
(5.1 thru 5.6 kg·m)
(36.9 thru 40.6 ft·lb)

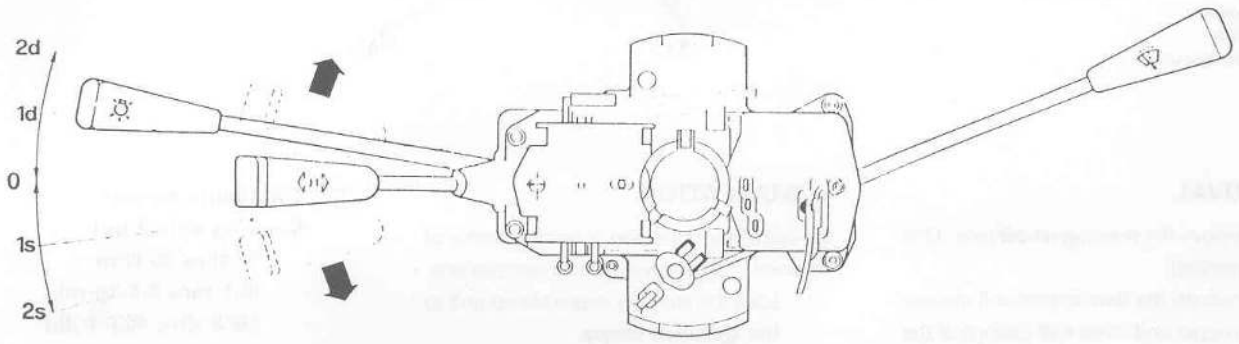


1 Steering column support
2 Combination switch unit
3 Steering column
4 Steering wheel

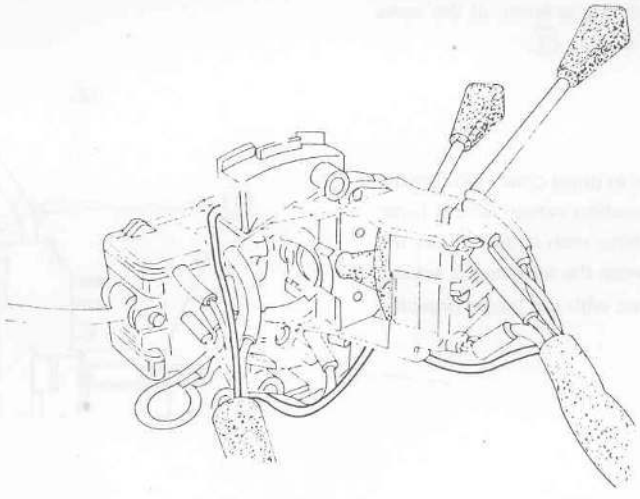
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Indicator controls

Control		Position	Service activated
Lefthand lever for indicator controls	Movement parallel to steering wheel plane	2 rh	– righthand steady indication with automatic release
		1 rh	– righthand indication to change lane, with automatic return
		0	– zero position
		1 lh	– lefthand indication to change lane, with automatic return
		2 lh	– righthand steady indication with automatic release.



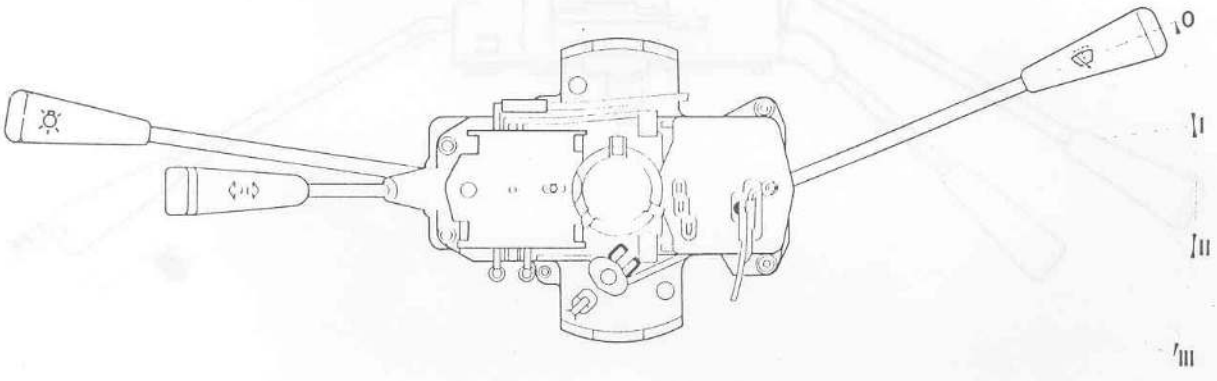
	0	1d	2d	1s	2s
2		○	○		
5				○	○
1		○	○	○	○

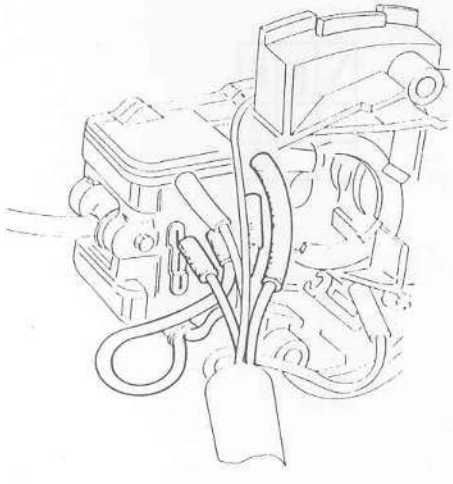


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Windshield wiper control

Control		Position	Service activated
Righthand lever	Movement parallel to steering wheel plane	0 I II III	– zero position (off) – wiper intermittence (int) – 1st wiper speed – 2nd wiper speed



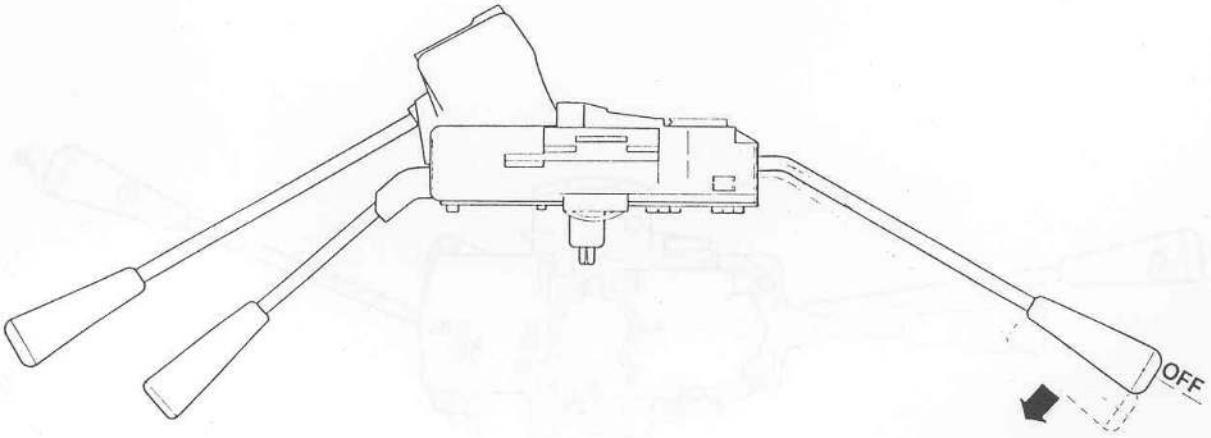


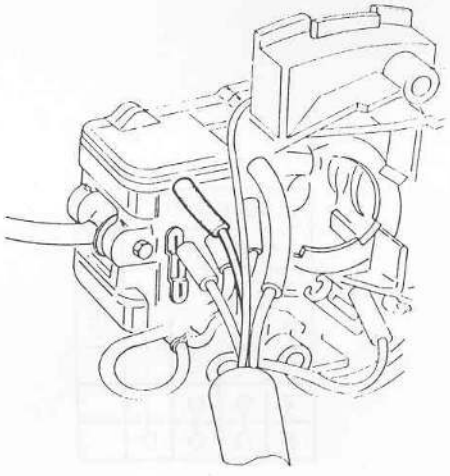
	OFF	INT.	1°V.	2°V.
	0	I	II	III
3				○
4		○	○	○
6		○		
7	○	○		
8	○	○	○	

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Windshield washer control

Control		Position	Service activated
Righthand lever	Movement parallel to steering wheel axis	OFF ON	– zero position – windshield wash



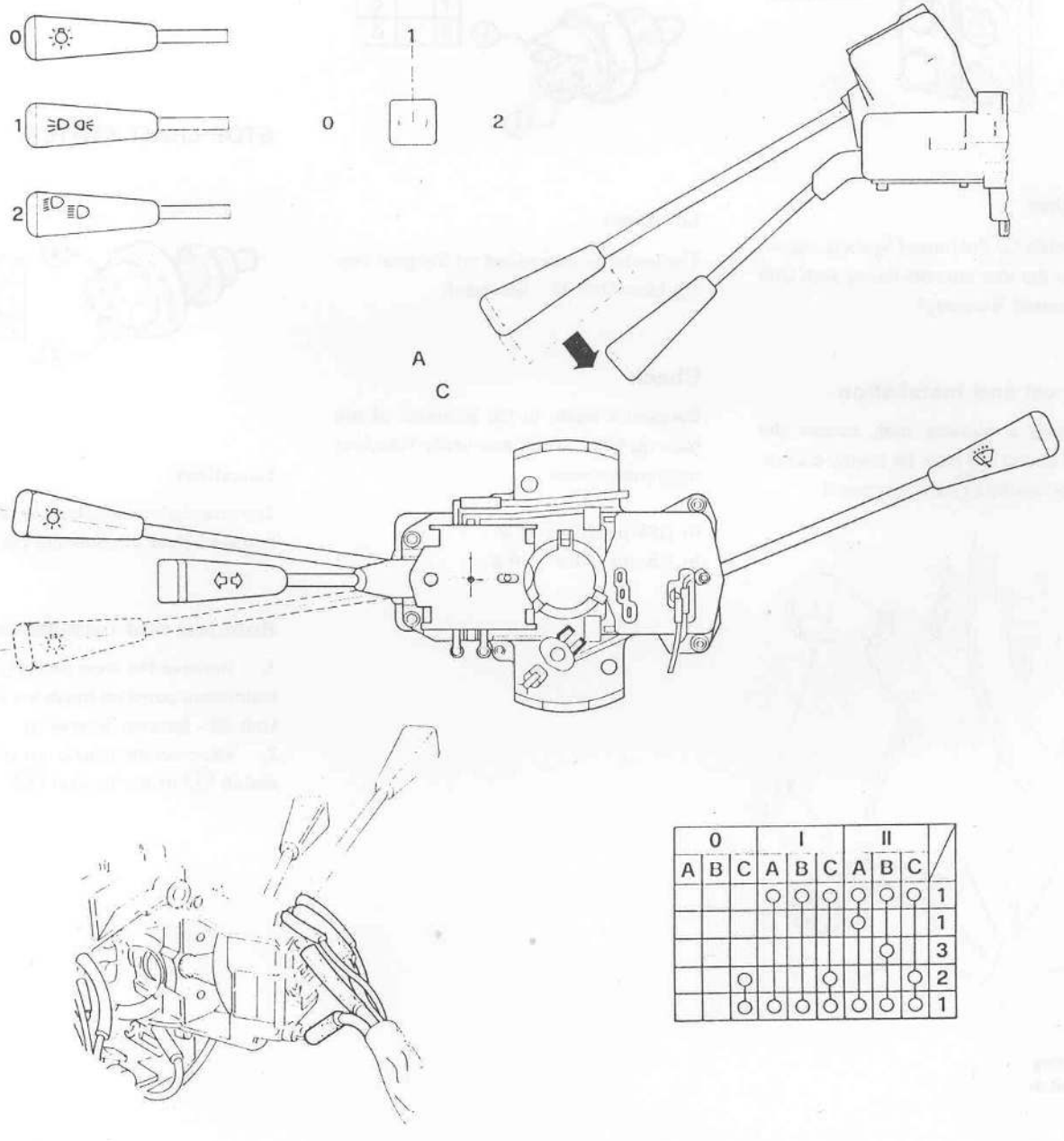


	OFF	ON
1		○
4		○

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External light control

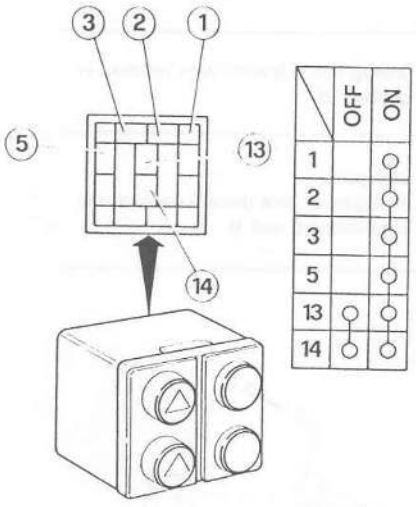
Control		Position	Service activated
Lefthand lever for external light control	Knob rotation	0 1 2	– zero position – parking lights – lower beam; rear fog light
	Movement parallel to steering column plane	B	– driving beam (paired with rotation in position 2)
	Movement parallel to the steering column axis	A C	– zero position – driving beam blink (paired with rotations in positions 0 and 1)



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SWITCHES

HAZARD LIGHT SWITCH

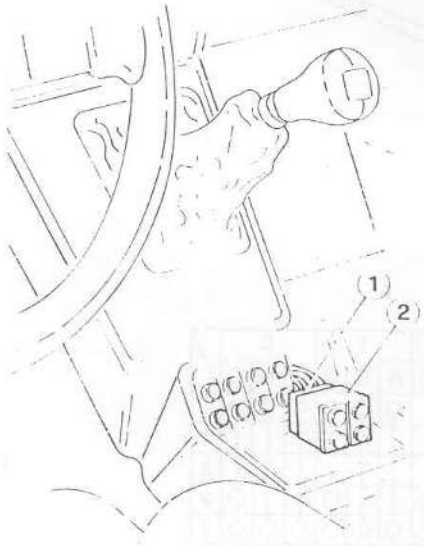


Location

The switch for the hazard lights is assembled on the rear console facing (see Unit 66 - Internal Trimming).

Removal and Installation.

1. Using a suitable tool, extract the switch casing (2) from its cavity, disconnect the wiring (1) and remove it.



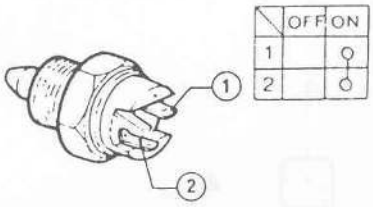
1 Wiring
2 Switch

2. Re-install the switch by operating in reverse order of removal, snapping it into its cavity.

Check

Check that the switch is working by verifying that continuity between the terminals is accomplished in compliance with the indications provided in the table.

BACK-UP LAMP SWITCH



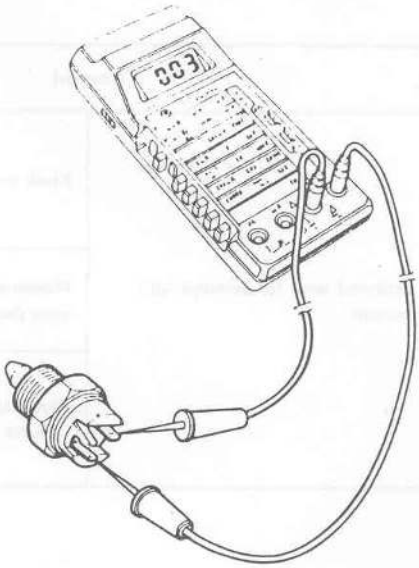
Location

The switch is assembled on the gear casing (see: Unit 13 - Gearbox).

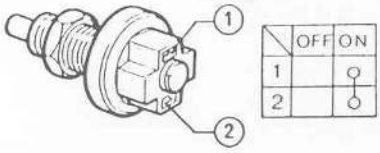
Check

Connect a tester to the terminals of the back-up light switch and verify following resistance values.

In OFF position = ∞
In ON position = 0 Ω



STOP LIGHT SWITCH



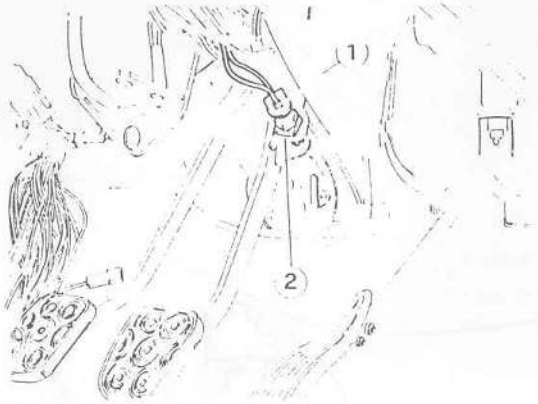
Location

The stop light switch is assembled on the bracket below the steering column.

Removal and installation

1. Remove the knee padding below the instrument panel on the driver's side (see: Unit 66 - Internal Trimming).
2. Unscrew the plastic nut securing the switch (1) to the bracket (2).

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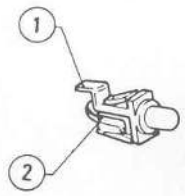
1 Stop light switch
2 Bracket

3. Slide the switch off the bracket and disconnect the wire.
4. Re-install the switch by operating in reverse order of removal.

Check

Check that the switch is functional by verifying that electrical continuity between the terminals is accomplished in compliance with the indications provided in the table.

PARKING BRAKE WARNING LAMP SWITCH



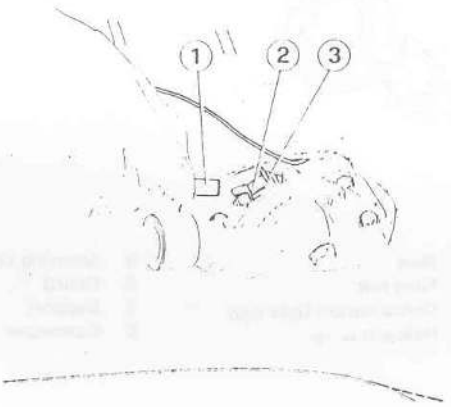
	OFF	ON
1		○
2		○

Location

The switch is assembled on the bracket fixed to the parking brake support (see: Unit 22 - Front and Rear Brakes).

Removal and installation

1. Remove the rear console (see: Unit 66 - Internal Trimming).
2. Disconnect the wire (1) from the parking brake lamp switch (2) and, pressing the clips, remove the switch from the support (3).



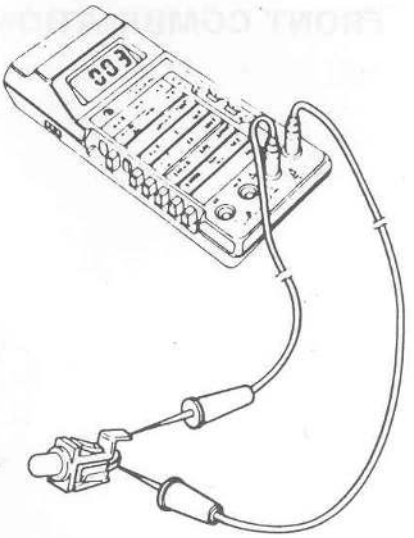
1 Wire
2 Parking brake lamp switch
3 Support

3. Re-install the parking brake lamp switch by operating in reverse order of removal.

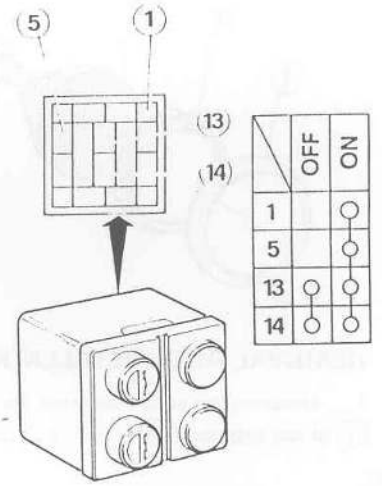
Check

1. Remove the rear console (see Unit 66 - Internal Trimming).
2. Connect a tester to the terminal of the parking brake lamp switch as illustrated in the figure.
3. These resistance values should be recorded.

Brake on = 0 Ω
Brake off = ∞



REAR FOG LIGHT SWITCH



Location

This switch is assembled on the facing of the rear console (see: Unit 66 - Internal Trimming).

Removal and installation

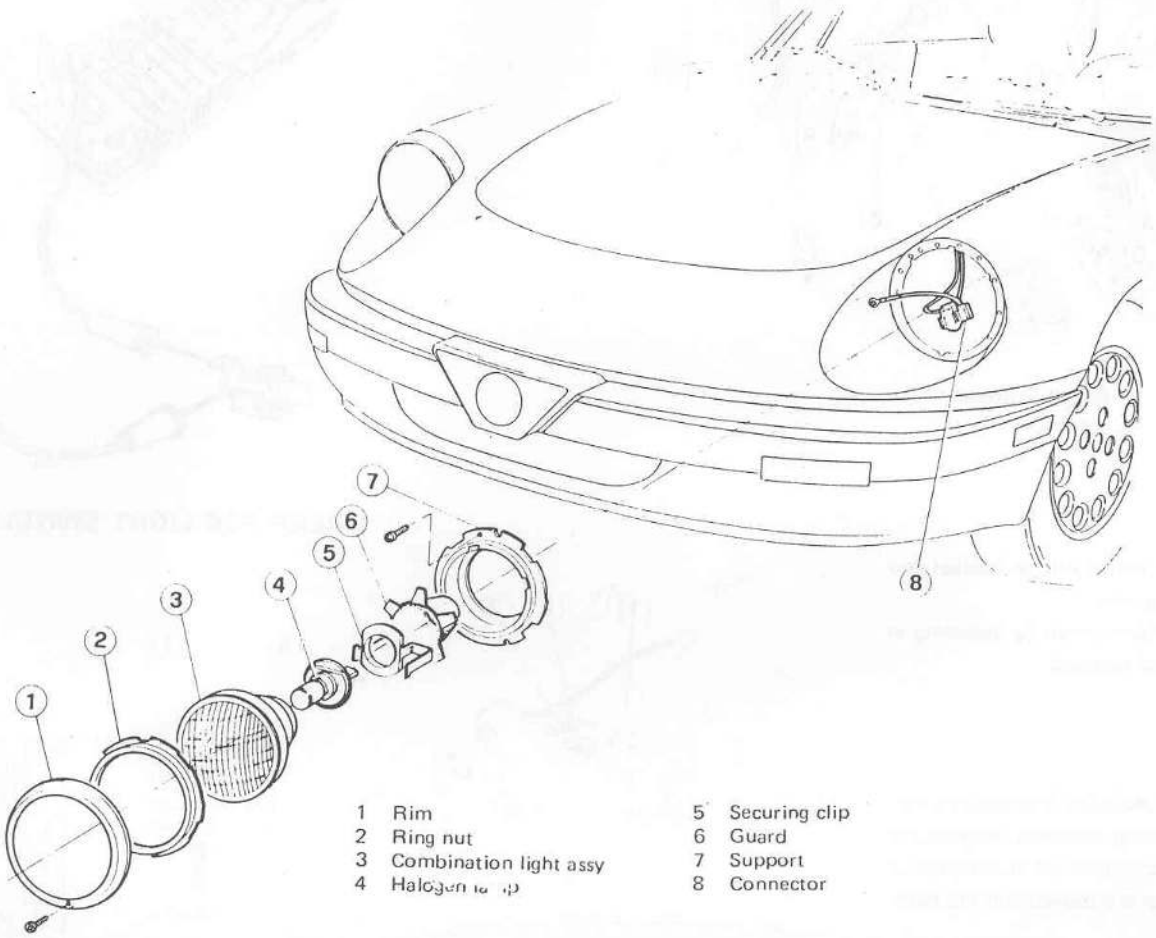
Remove the switch assy (see: Hazard Light Switch - Removal and Installation).

Check

Check functionality of the switch by verifying that the continuity between the terminals is accomplished in compliance with the indications provided in the table.

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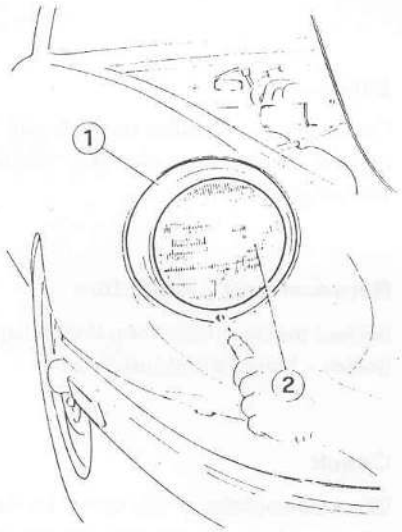
FRONT COMBINATION LIGHTS



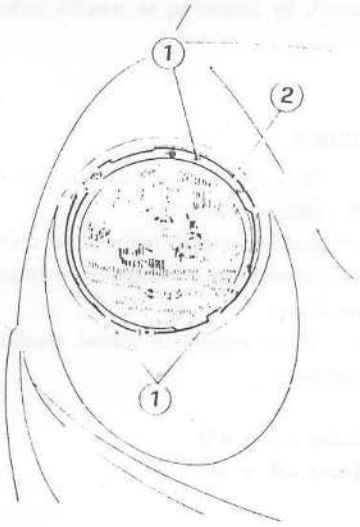
1 Rim
2 Ring nut
3 Combination light assy
4 Halogen lamp
5 Securing clip
6 Guard
7 Support
8 Connector

REMOVAL AND INSTALLATION

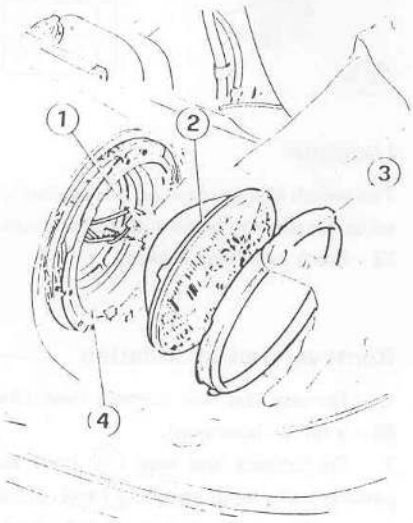
1. Unscrew the screw securing the rim (1) of the light assy (2) to the bodywork.
2. Unscrew the five nuts securing the combination light assy (1) to the body (2)
3. Re-install the combination light assy by operating in reverse order of removal.
4. Partially extract the combination light assy (2) from its support (4) and disconnect the wiring (1).



1 Rim
2 Light assy



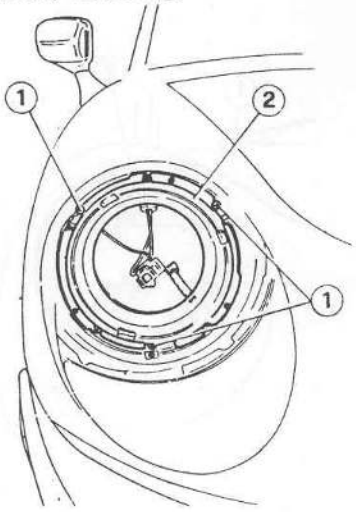
1 Screw holding ring nut
2 Ring nut



1 Wiring
2 Combination light assy
3 Ring nut
4 Support

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5. If necessary, unscrew the three screws (1) and remove the combination light assy support (2).



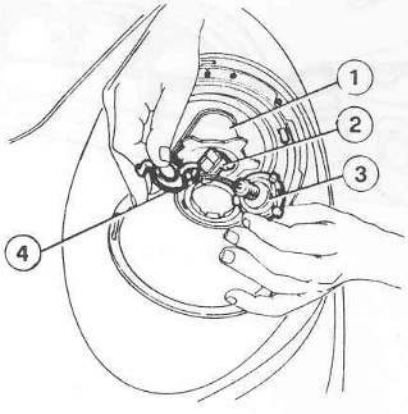
1 Screws holding support
2 Combination light assy support

6. Re-install the combination light assy by operating in reverse order of removal.

LAMP REPLACEMENT

Headlights

1. Remove the front direction indicator and combination lamp as illustrated in Removal and Installation.
2. Remove cover (1) and connector (2). Release clip (4) and extract bulb (3).

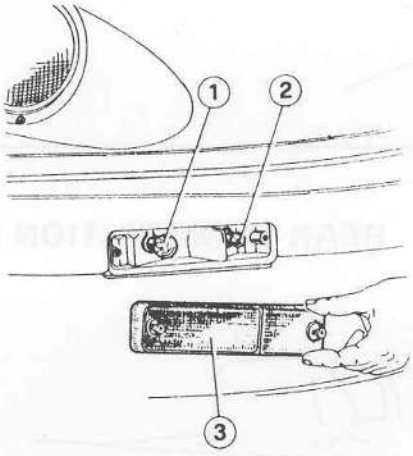


1 Cover
2 Connector
3 Bulb
4 Clip

WARNING:
Never touch the headlight halogen lamp glass with bare hands, if so, wash the lamp with alcohol.

Front parking and direction indicator lights

1. Unscrew the screws and remove the transparent cover (3).
2. Press bulb (1) or bulb (2), turn it ccw and extract.



1 Indicator light lamp
2 Parking light lamp
3 Transparent cover

Replacement of the front parking and direction indicator lights

In order to replace this unit it is necessary to disassemble the front bumper (see: Unit 75 - External Trimming - Front Bumper).

LOWER BEAM PROJECTION

Setting the beam

Follow this procedure to set the headlight beam.

1. Check that all tyres are inflated to the stipulated pressure, that there is no petrol in the car and the latter is load-free.
2. Place the car and testing device (if available) on a horizontal plane.

If no testing device is available, put the car in front of a clear screen.

3. Move the car back 10 m (33 ft) and turn on the lower beam. The luminous beam should adhere to the geometrical distances given in the figure.

A = height from ground at centre of headlight
B = beam height
C = 10 m (33 ft)

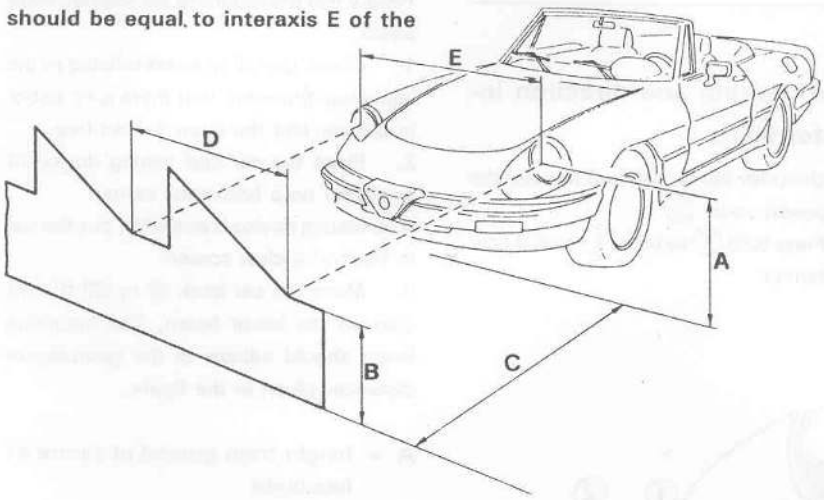
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Direction is correct when the following condition is obtained:

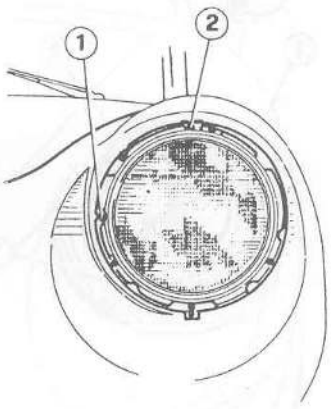
B = 480 mm (18.9 in)

Interaxis D of the luminous beam should be equal to interaxis E of the headlights.

The distances given in the diagram comply with current Italian regulation. In other countries adhere to local standards.



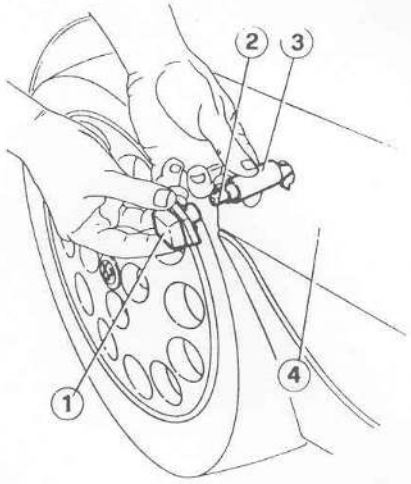
Adjust the headlight screws indicated in the figure to correct any errors of direction.



1 Horizontal adjustment screw
2 Vertical adjustment screw

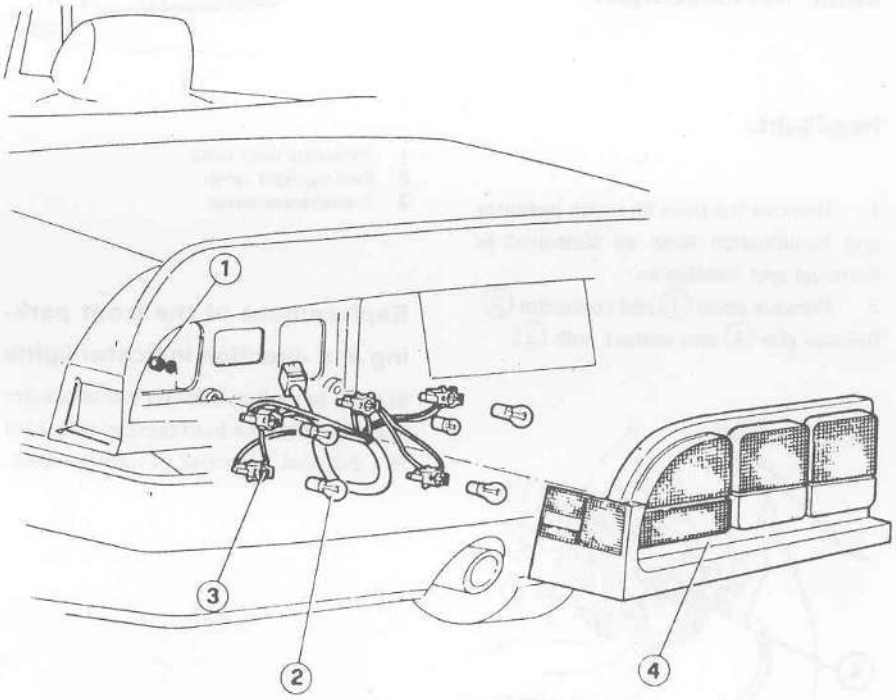
DIRECTION LIGHTS

1. Remove the direction light (1) from the fender by pressing it down and pulling outwards.
2. Remove the lampholder (3) from the direction light (1).
3. Pull and remove bulb (2).
4. Install direction light in reverse order of removal.



1 Direction light
2 Bulb
3 Lampholder
4 Fender

REAR COMBINATION LIGHTS

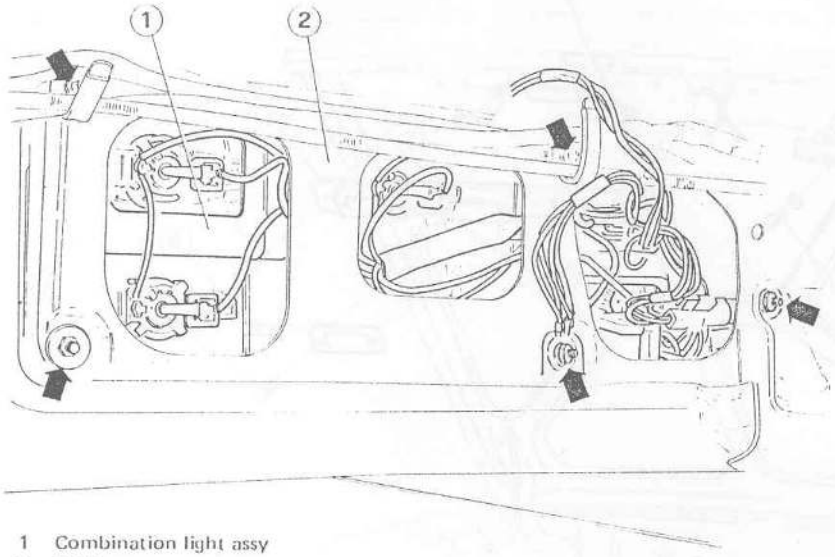


1 Nut
2 Lamp
3 Lampholder
4 Rear combination light assy

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REMOVAL AND INSTALLATION

1. Working inside the luggage compartment, remove the back lining.
2. Unscrew the five nuts securing the combination light assy (1) to the body (2).



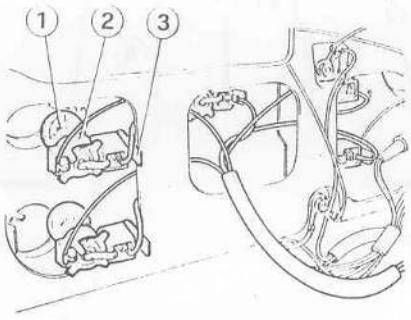
1 Combination light assy
2 Body

3. Re-install the combination light assy by operating in reverse order of removal.

LAMP REPLACEMENT

This procedure is applicable to all lamps and lampholders.

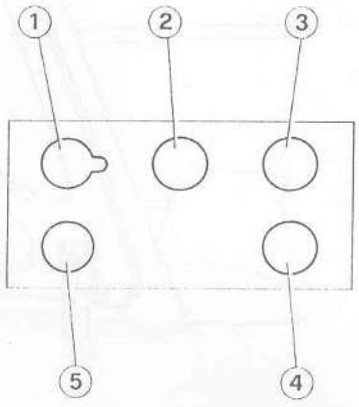
1. Open the trunk lid.
2. Working inside the luggage compartment, remove the back lining.
3. Press hook (3) locking the lampholder (2) of the lamp (1) to be replaced, remove the lampholder.



1 Lamp
2 Lampholder
3 Locking hook

4. Press the bulb of the lamp concerned, rotate it and extract.
5. Replace the lamp with a new one and re-install the lampholder.
6. Reference should be made to the following diagram in order to identify the position of the lamps.

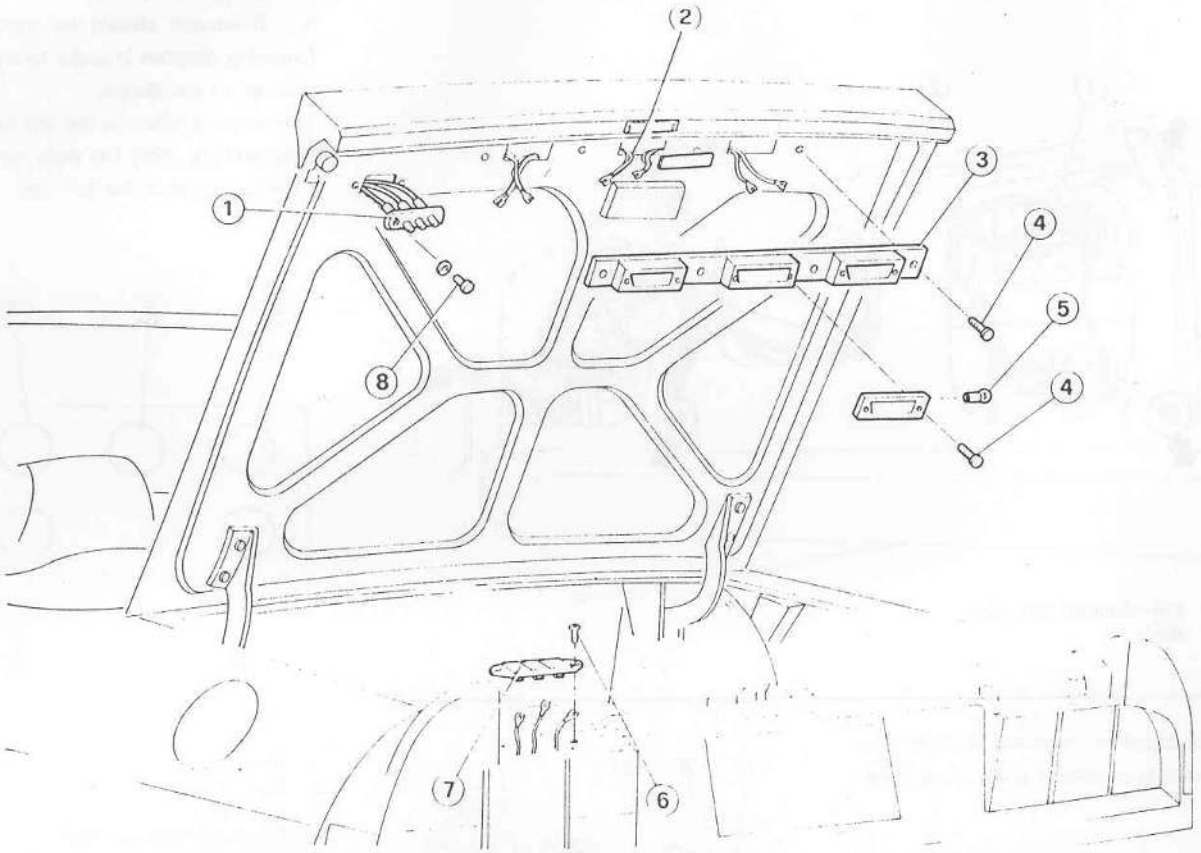
The diagram refers to the left hand combination light assy; the right hand one is a mirror image of the left one.



1 Rear fog light
2 Parking light
3 Stop light
4 Direction indicator and hazard lights
5 Back up light

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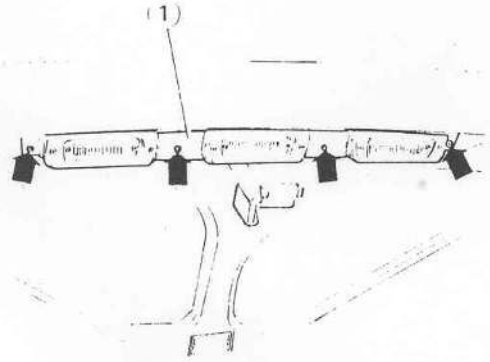
LICENCE PLATE LIGHTS



1 Licence plate light contact switch
2 Licence plate cables
3 Licence plate light transparent cover support
4 Screw
5 Licence plate light lamp
6 Screw
7 Body side licence plate light contact switch
8 Screw

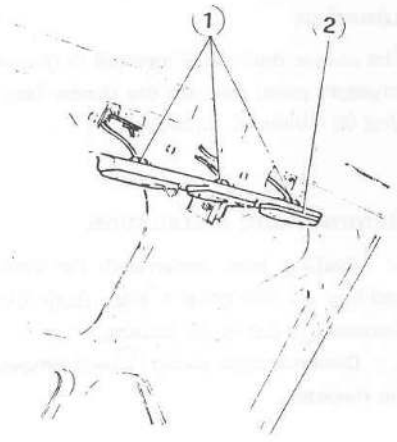
REMOVAL AND INSTALLATION OF THE LICENCE PLATE LIGHT TRANSPARENT COVER SUPPORT

1. Open the trunk lid.
2. Unscrew the four screws securing the licence plate light transparent cover support (1) to the trunk lid.
3. Remove the screws and lower the licence plate light transparent cover support (2).
4. Disconnect the wiring (1) from the licence plate light lampholder.
5. Remove the licence plate light transparent cover support.



1 Licence plate light transparent cover support

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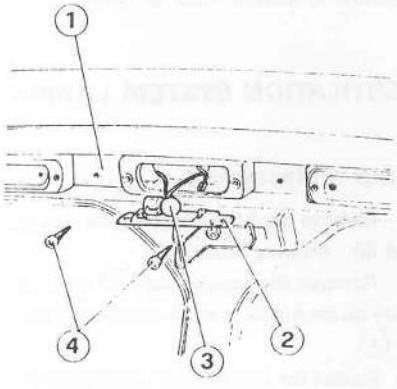


1 Wiring
2 Licence plate light transparent cover support

6. Re-install the licence plate light transparent cover support by operating in reverse order of removal.

LICENCE PLATE LIGHT REPLACEMENT

1. Open the trunk lid.
2. Unscrew the two screws (4) securing the transparent cover (2).
3. Remove the screws and detach the transparent cover from its support (1).
4. Press the bulb of lamp (3), turn it ccw and extract.



1 Support
2 Transparent cover
3 Lamp
4 Screws

5. Replace the lamp with a new one and re-install the transparent cover by operating in reverse order of removal.

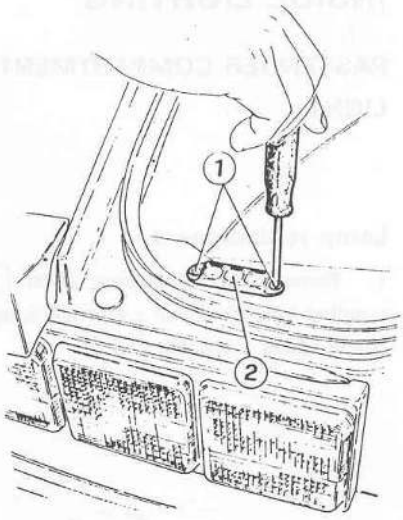
LICENCE PLATE LIGHT CONTACT SWITCH

Location

The switch is installed in the lower lefthand part of the bodywork and inside the trunk lid.

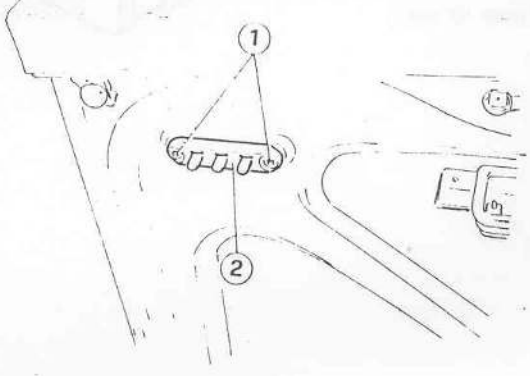
Removal and installation

1. Open the trunk lid.
2. Unscrew the two screws (1) securing the licence plate light and trunk spoiler stop light contact switch (2) to the bodywork.
3. Ease the switch out of its housing and disconnect the wiring; remove the switch.



1 Screws
2 Body side stop light and licence plate light switch

4. Unscrew the two screws (1) securing the switch (2) to the trunk lid.
5. Ease the switch from its housing and disconnect the wiring.



1 Screw
2 Licence plate light contact switch

6. Re-install the switch by operating in reverse order of removal.

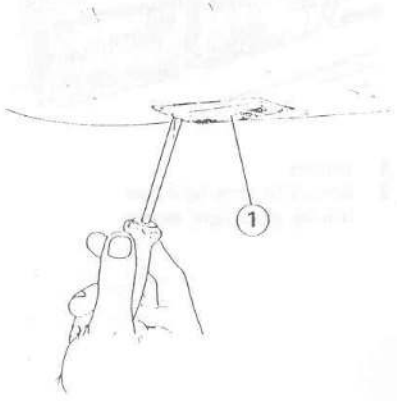
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INSIDE LIGHTING

PASSENGER COMPARTMENT LIGHT

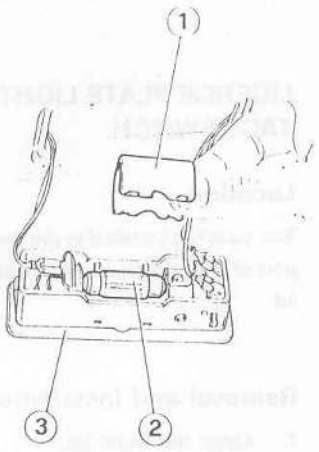
Lamp replacement

1. Remove the transparent cover (1) together with the snap - inserted lampholder, using a suitable tool.



1 Transparent cover

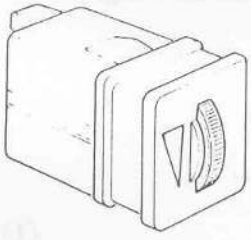
2. Remove the metal guard (1) of the lamp.
3. Remove the lamp (2) from its contacts by pulling outwards.



1 Metal guard
2 Lamp

4. Replace the lamp with a new one and install the lampholder by pressing it in the knee padding.

CLUSTER RHEOSTAT

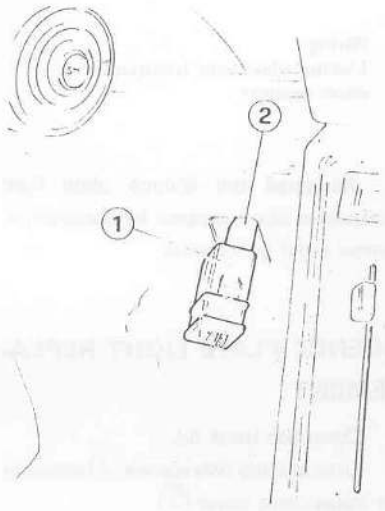


Location

The cluster rheostat is inserted in the instrument panel beneath the cluster (see: Unit 66 - Internal Trimming).

Removal and installation

1. Pushing from underneath the knee padding on the driver's side, push the rheostat (1) out of its housing.
2. Disconnect the wiring (2) and remove the rheostat.



1 Rheostat
2 Wiring

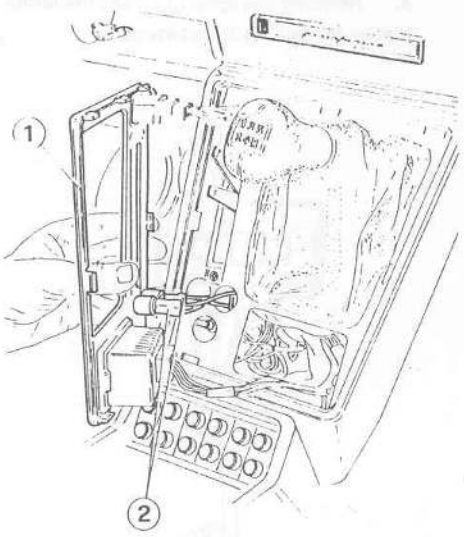
3. Re-install the rheostat by applying pressure, in reverse order of removal.

VENTILATION SYSTEM LAMPS

Lamp replacement

1. Remove the front console facing (see: Unit 66 - Internal Trimming).
2. Remove the lampholder (2) from its cavity on the inside of the front console facing (1).
3. Extract the lamp from the lampholder, pulling the bulb outwards.

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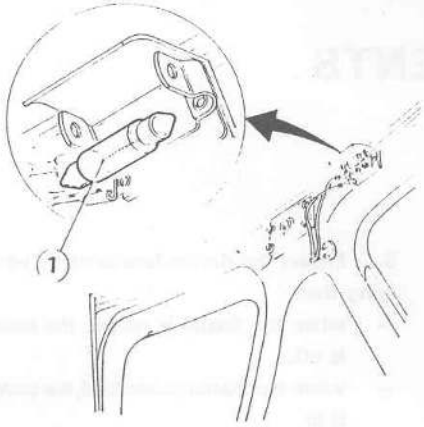
1 Front console facing
2 Lampholder

4. Replace the lamp with a new one and re-install the lampholder by operating in reverse order of removal.

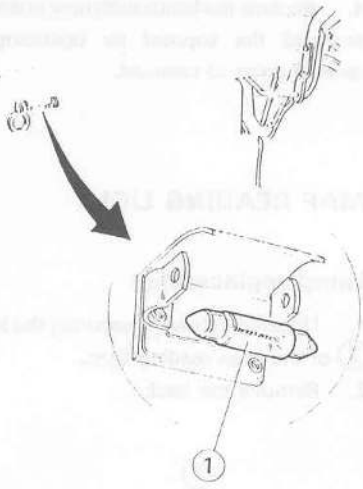
ENGINE COMPARTMENT, LUGGAGE COMPARTMENT AND GLOVE COMPARTMENT LIGHTS

Lamp replacement

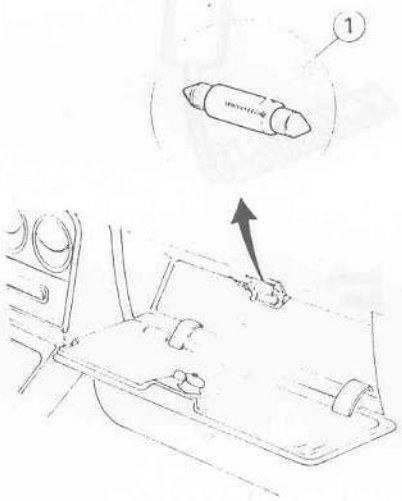
1. Disengage by pulling the light (1) out from the contacts of the lampholder involved.



1 Engine compartment light



1 Luggage compartment light



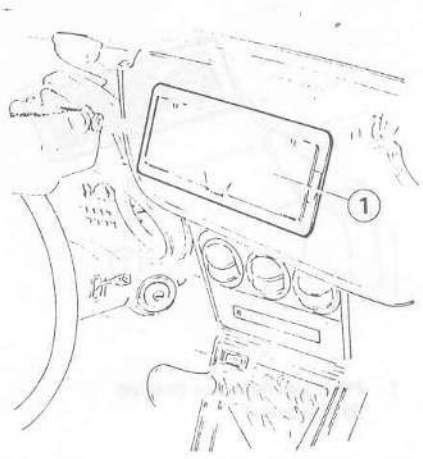
1 Glove compartment light

2. Re-install the lamps in reverse order of removal.

COURTESY MIRROR LIGHTS

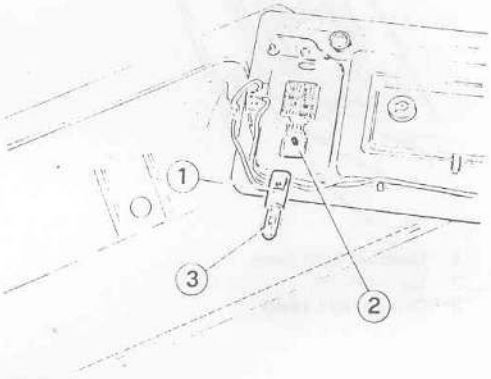
Lamp replacement

1. Using a suitable tool remove the courtesy mirror and light support (1).



1 Courtesy mirror and light support

2. Remove the lampholder (1) from the support and extract the lamp (3).
3. Replace the lamp with a new one and re-install the lampholder, centering it on the pin (2), and support by operating in reverse order of removal.



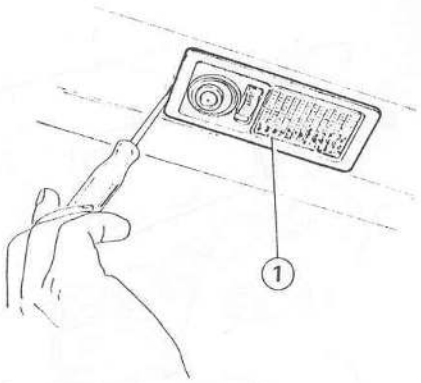
1 Lampholder
2 Centering pin
3 Lamp

HARD TOP LIGHT AND READING LIGHT

Lamp replacement

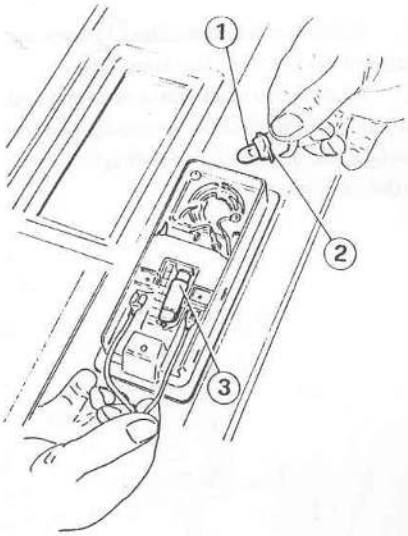
1. Using a suitable tool, remove hard top light and reading light support (1).

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1 Hard top light and reading light support

2. Rotate and slide out the reading light lamp (1) together with its holder (2).
3. Remove the ceiling light lamp (3) from its contacts by pulling it outwards.



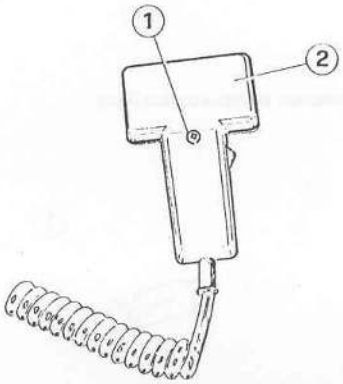
1 Reading light lamp
2 Lampholder
3 Ceiling light lamp

4. Replace the lamps with new ones and re-install the support by operating in reverse order of removal.

MAP READING LIGHT

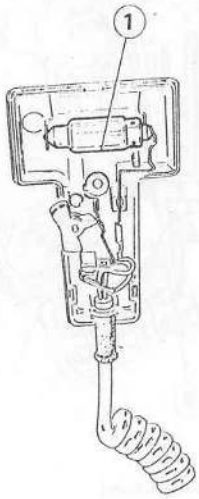
Lamp replacement

1. Unscrew screw (1) securing the back (2) of the map reading light.
2. Remove the back.



1 Screw
2 Back

3. Remove the lamp (1) from the lamp-holder by pulling it outwards.



1 Lamp

4. Re-Install the new lamp by operating in reverse order of removal.

ELECTRICAL COMPONENTS

SENSORS AND SENDERS

MINIMUM BRAKE FLUID LEVEL TRANSMITTER

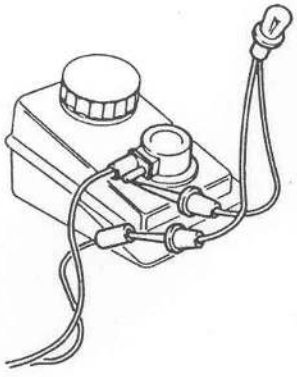
Location

The transmitter is inserted in the brake fluid reservoir.

Check

1. Put the ignition key to run.
2. Connect a warning lamp to the pins of float plug, as shown in the figure.
3. Ensure the device functions by verifying that:
   - when the floater is raised, the lamp is off;
   - when the floater is lowered, the lamp is lit.

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FUEL LEVEL SENSOR

Location

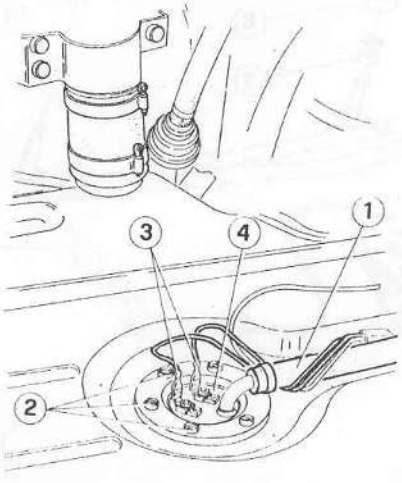
The fuel level sensor is located into the fuel tank at the left side of the luggage compartment.

Removal and installation (injection versions)

Operate as indicated in Unit 04 - Fuel System - Fuel lever sensor and Submerged Pump - Replacement.

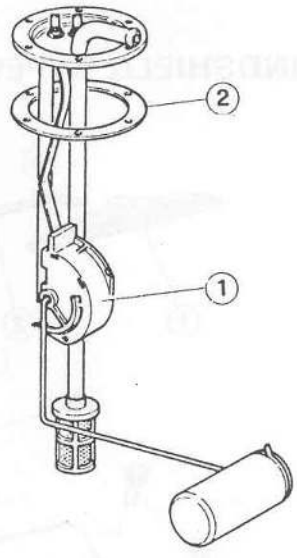
Removal and installation (carburetters versions)

1. Remove luggage compartment floor trim.
2. Remove sensor cover.
3. Loosen clip and slide out fuel hose (1).
4. Slide out the two connections (3), back off six screws (2) and remove fuel level sensor (4).



1 Fuel hose
2 Screws
3 Electrical connections
4 Fuel level sensor

5. Check that fuel level sensor (1) and associated electrical connections are efficient. On re-installing, replace gasket (2) if damaged.



1 Fuel level sensor
2 Gasket

INJECTION CONTROL UNIT

Location

The injection control unit is housed beneath the rear upholstery, behind the passenger seat.

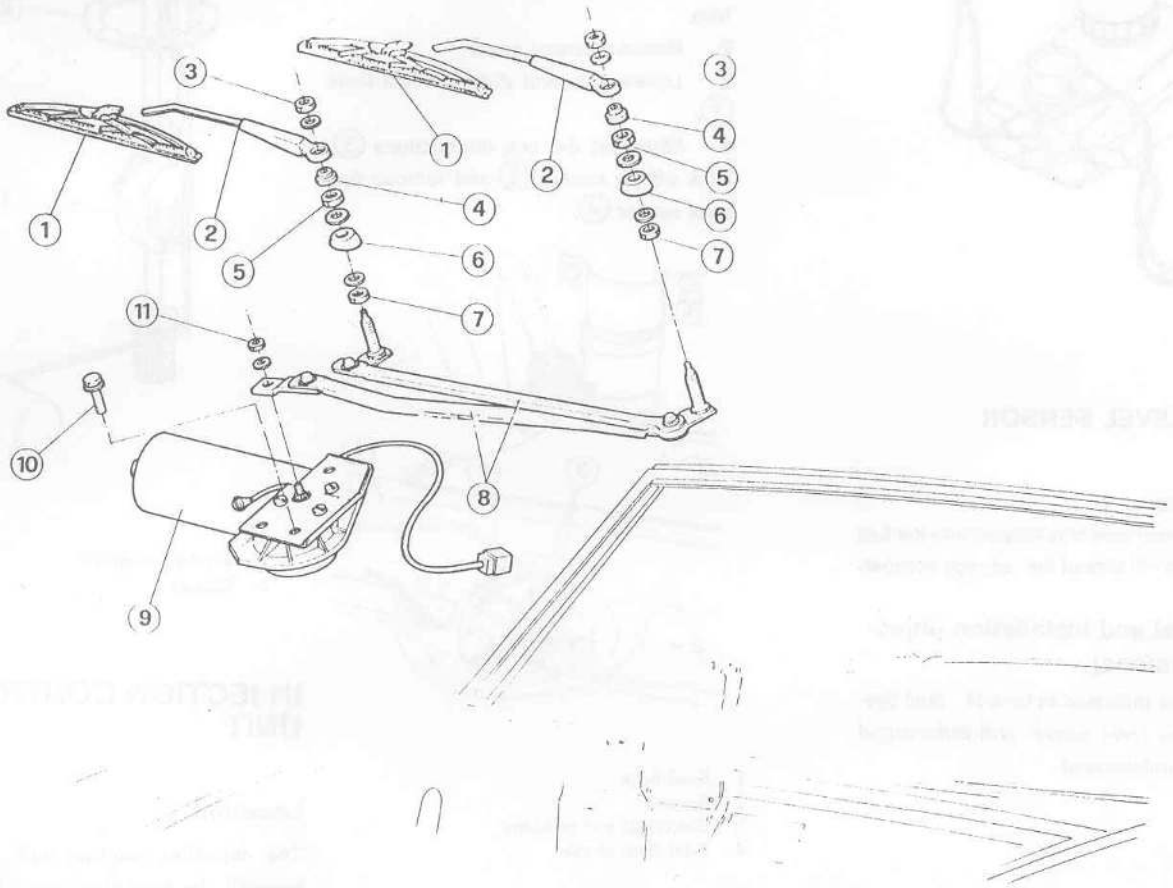
Removal and installation

Operate as indicated in Unit 04 - Fuel System - Ignition and Injection Control Unit - Removal and Installation.

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ELECTRIC ACCESSORIES

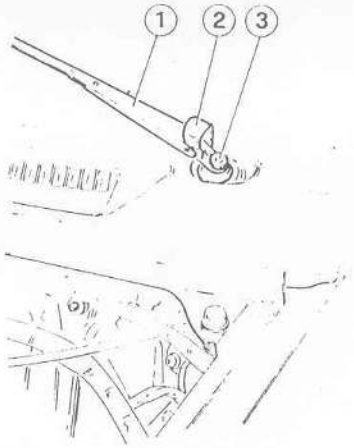
WINDSHIELD WIPER



1 Blade
2 Wiper arm
3 Nut
4 Rubber cushion
5 Ring nut
6 Seal
7 Nut
8 Lever assy
9 Motor
10 Screw
11 Nut

REMOVAL AND INSTALLATION

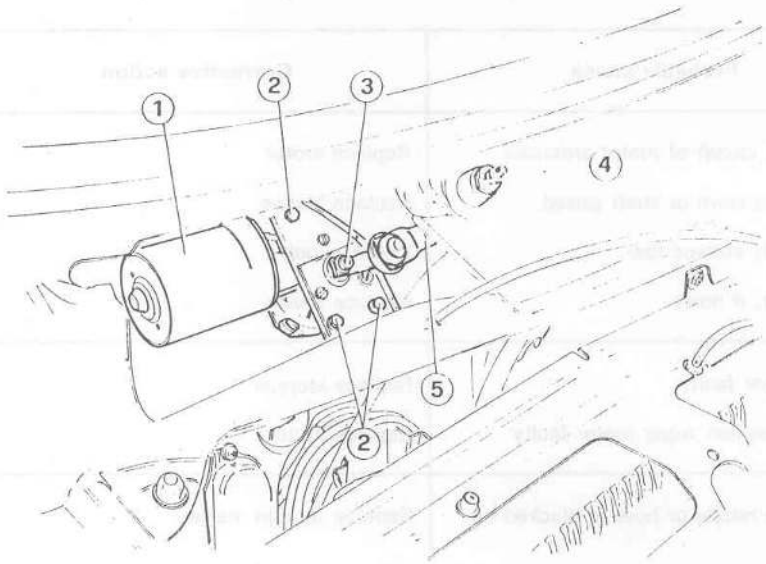
1. Detach the blades from the wiper arms.
2. Lift the cover (2), of the nuts securing the wiper arms (1) and remove the wiper arms having unscrewed nuts (3).



1 Wiper arms
2 Cover
3 Nut

3. Remove the air grating (see: Unit 75 - External Trimming - Air Grating - Removal and Installation).
4. Disconnect motor wiring.
5. Unscrew nut (3) securing the motor pins to the levers.
6. Unscrew the three screws (2) securing the motor support bracket to the body.
7. Unscrew the two ring nuts (4) securing the lever pins of the windshield wiper; remove the motor and levers.

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1 Motor
2 Screws
3 Nut
4 Ring nut
5 Levers

8. Re-install the windshield wipers by operating in reverse order of removal.

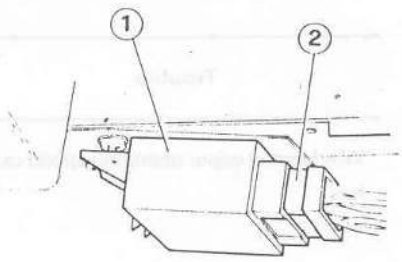
WINDSHIELD WIPER ELECTRONIC INTERMITTENCE

Location

The electronic intermittence of the windshield wiper is located underneath the instrument panel behind the knee padding on the passenger's side.

Removal and installation

1. Remove the knee padding on the passengers side (see: Unit 66 - Internal Trimming).
2. Disconnect the wiring (2) from the windshield wiper electronic intermittence (1) then unscrew the screws securing it to the supporting bracket.
3. Remove the windshield wiper electronic intermittence.



1 Windshield wiper electronic intermittence
2 Wiring

4. Re-install the electronic intermittence of the windshield wiper by operating in reverse order of removal.

TROUBLESHOOTING AND CORRECTIVE ACTIONS

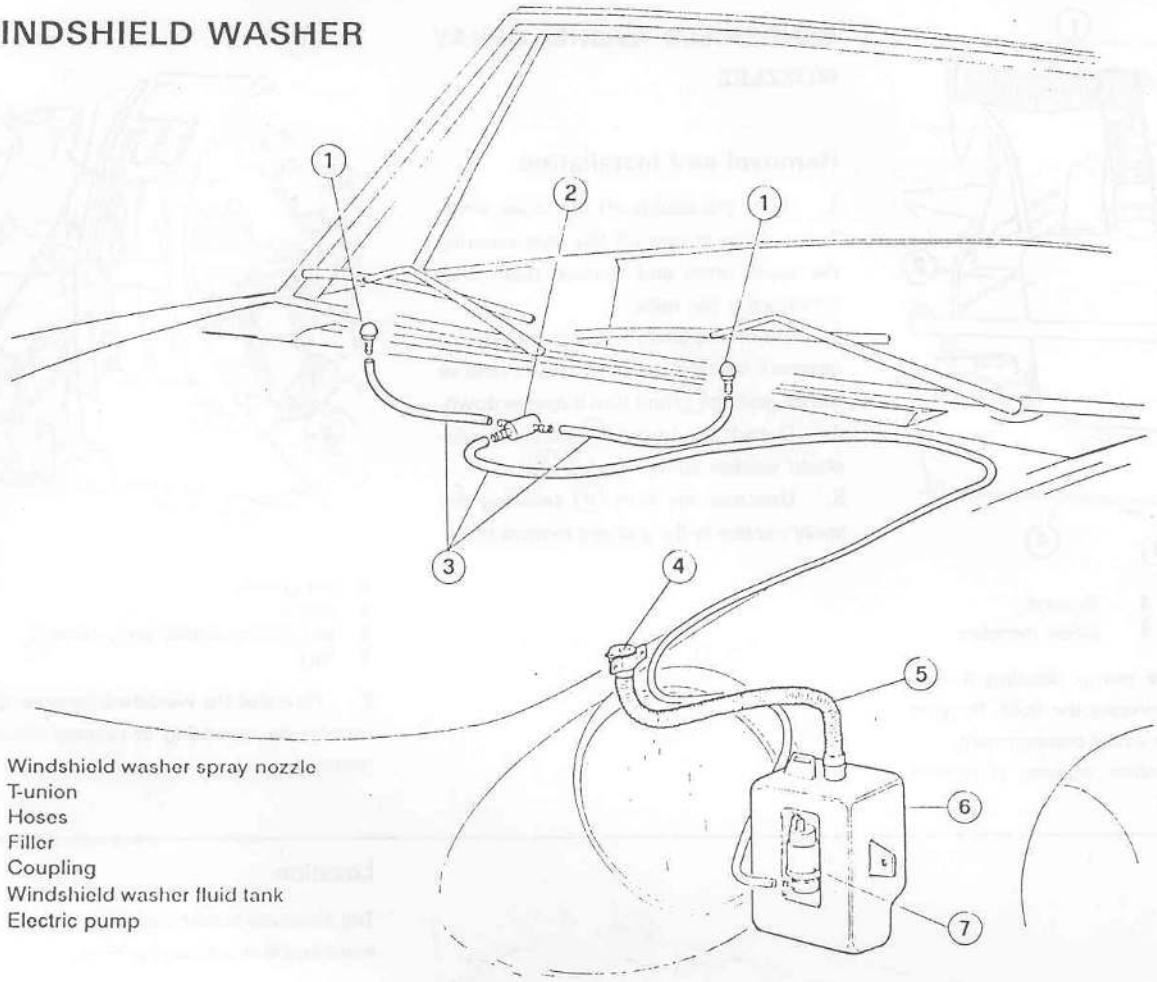
Trouble	Probable cause	Corrective action
Windscreen wiper fails to operate	• Fuse blown	Replace fuse
	• Connection loosened or interrupted	Restore connection
	• Control contact faulty	Check combination switch unit (righthand lever); replace if required
	• Foreign matter interrupts the correct movement of wiper arms control levers	Remove foreign matter
	• Control rod disconnected	Connect control rod
	• Arm shaft seized	Replace arm shaft

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Trouble	Probable cause	Corrective action
Windscreen wiper operating speed too low	• Short circuit of motor armature	Replace motor
	• Blades worn or shaft seized	Replace blades
	• Supply voltage low	Check supply
	• Motor, if noisy	Replace motor
Windscreen wiper fails to stop correctly	• Stopper faulty	Replace stopper
	• Windscreen wiper motor faulty	Replace motor
Washing liquid is not sprayed (sprayer motor fails to operate)	• Spray nozzle or hose is blocked up	Remove foreign matter.
Windscreen wiper fails to operate intermittently but operates at low and high speeds	• Windscreen wiper control faulty	Replace combination switch unit (right-hand lever)
	• Circuit faulty	Check the circuit
	• Intermittence device faulty	Replace intermittence device
Intermittence speed too low for proper wiping	• Stopper faulty	Replace stopper
	• Intermittence device faulty	Replace intermittence device
Intermittence speed too high for proper wiping	• Line voltage lower than 10V	Restore line voltage correct value
	• Intermittence device faulty	Replace intermittence device
Intermittence speed changes incorrectly	• Windscreen wiper switch faulty	Replace combination switch unit (right-hand lever)
	• Circuit faulty	Check circuit
	• Windscreen wiper motor faulty	Replace motor
	• Intermittence device faulty	Replace intermittence device

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WINDSHIELD WASHER



1 Windshield washer spray nozzle
2 T-union
3 Hoses
4 Filler
5 Coupling
6 Windshield washer fluid tank
7 Electric pump

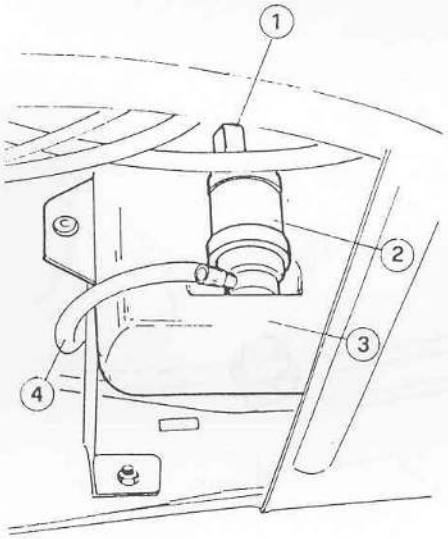
ELECTRIC PUMP

Location

The electric pump is installed in a cavity within the windshield washer fluid tank in the front left hand side of the vehicle.

Removal and installation

1. Raise the vehicle and operating under the bumper, disconnect connector (1) from the pump.
2. Extract pump (2) upwards from tank (3), recovering the fluid.
3. Extract pipe (4) and free the pump.



1 Connector
2 Pump
3 Tank
4 Pipe

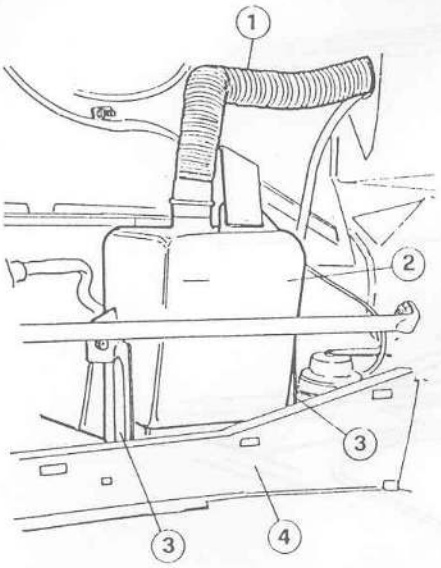
4. For reinstallation, operate in reverse order of removal.

WINDSHIELD WASHER TANK

REMOVAL AND INSTALLATION

1. Raise the vehicle and remove the front left hand wheel lokari (see Group 75 - External Trimming - Lokari).
2. Disconnect coupling (1) from tank (2).
3. Unscrew the nuts securing brakets (3) to the cross member (4) and lift the entire tank.

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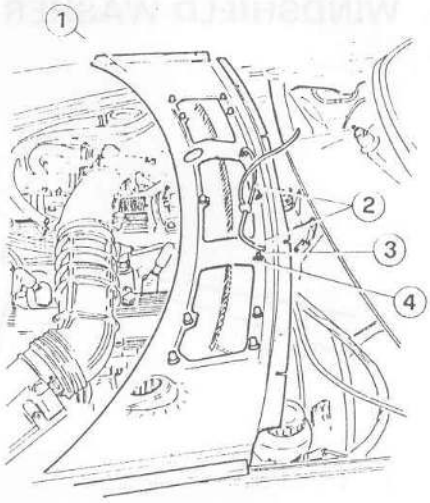
1 Coupling 3 Bracket
2 Tank 4 Cross member

4. Extract the pump, leaving it connected and recovering the fluid. Recover the tank from the wheel compartment.
5. For installation, operate in reverse order of removal.

WINDSHIELD WASHER SPRAY NOZZLES

Removal and installation

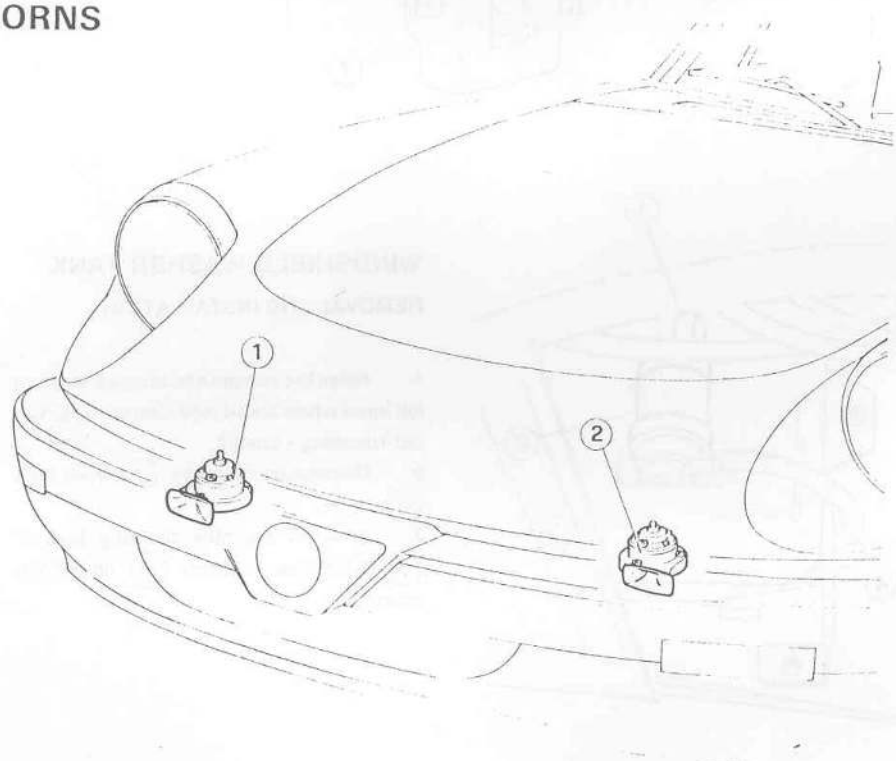
1. Slide the blades off the wiper arms.
2. Lift the covers off the nuts securing the wiper arms and remove them after unscrewing the nuts.
3. Lift off the bush, unscrew the nut and remove it together with the spacer; remove the air grating (1) and turn it upside down.
4. Detach the hoses (2) from the windshield washer spray nozzles (3).
5. Unscrew the nuts (4) securing the spray nozzles to the grill and remove them.



1 Air grating
2 Hoses
3 Windshield washer spray nozzles
4 Nut

6. Re-install the windshield washer spray nozzles by operating in reverse order of removal.

HORNS



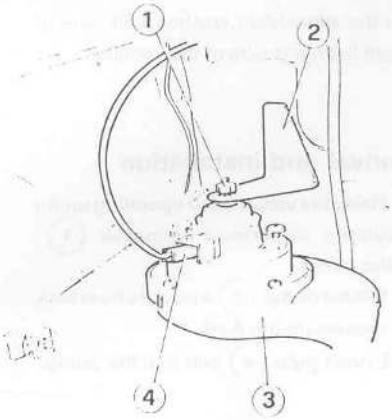
1 Righthand horn
2 Lefthand horn

Location

The horns are assembled on the front right-hand and lefthand skirt jpanels.

Removal and installation

1. To make operations easier, put the car on a lift.
2. Disconnect the wiring (4) of horn.
3. Unscrew nut (1) securing the horn (3) to the bracket (2) and remove the horn.



1 Nut
2 Bracket
3 Horn
4 Wiring

4. Reassemble the horn by operating in reverse order of removal.

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HORN CONTROL PUSHBUTTON

Location

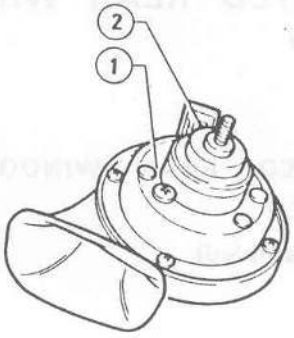
The pushbutton is located at the centre of the steering wheel (see: Unit 23 - Steering).

Check

1. Connect the tester tips to the pushbutton terminals as illustrated in the figure.
2. Check that pushbutton functions by verifying the following resistance values.

Pushbutton released = ∞
Pushbutton pressed = 0 Ω





1 Screw
2 Connector

HORN SETTING

To set the horn, adjust screw (1).
Once set drip a drop of paint on the screw to lock it.

TROUBLESHOOTING AND CORRECTIVE ACTION

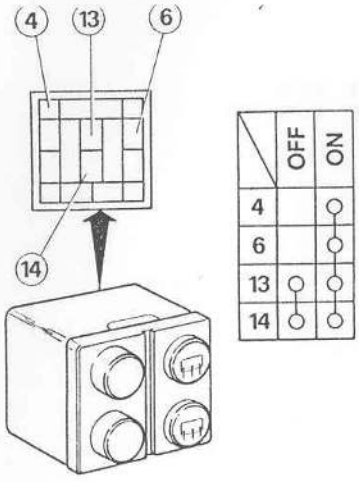
Before starting the trouble diagnosis operations verify proper functioning of both high and low horns.

Trouble	Probable cause	Corrective action
One horn only operates	• One horn faulty	Replace the faulty horn
	• Electric connections loose or faulty	Restore connection continuity
Poor tone quality on one side	• Tone adjustment incorrect	Adjust tone by operating on the associated adjusting screw (Refer to: Horn Setting: item (1))
Volume of both horns is low	• Battery charge poor	Recharge or replace battery
	• Alternator inefficient	Replace alternator
	• Electric connections loose or faulty	Restore connection continuity
Both horns fails to operate	• Wiring interrupted	Restore wiring continuity
	• Control pushbutton faulty	Replace pushbutton
	• Battery discharged	Recharge battery
	• Horns faulty	Replace horns
	• Relay faulty	Replace relay

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HEATED REAR WINDOW

HEATED REAR WINDOW SWITCH (if assembled)



Location

The switch is inserted in the rear console facing (see: Unit 66 - Internal Trimming).

Removal and installation

Remove the switch unit (see: Hazard Lights - Removal and Installation).

Check

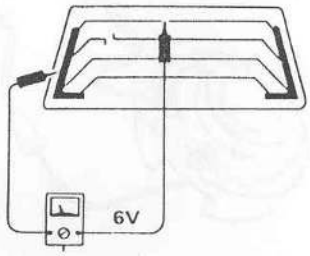
Check the switch functioning verifying that the continuity between terminals takes place in compliance with the indications given in the table.

HEATED REAR WINDOW FILAMENT

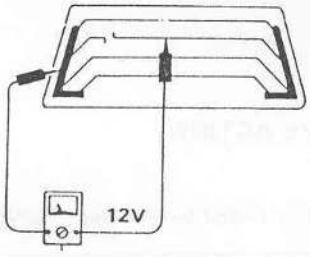
Check

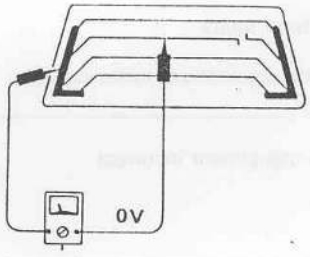
Check filament good conditions by operating as follows.

1. Activate the heated rear window.
2. Set one tester terminal (positioned on the Volt scale (V) at the end and the other in the middle of each filament.
If the filament is in good condition, the voltmeter indication should be **6V**.

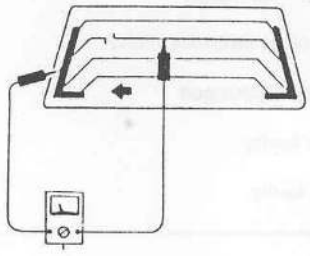


If the filament is interrupted, the voltmeter indication should be **0** or **12 Volt**.





3. To identify the interruption, it is necessary to move the tester tip along the filament, and set in evidence the point in which the instrument index moves abruptly.



Or, after having verified that current flows properly to the heated rear window, check the filament electric continuity via the switching on of a warning lamp parallel-connected to the leads of the filament under test.

Filament repair

Tools and materials for the repair.

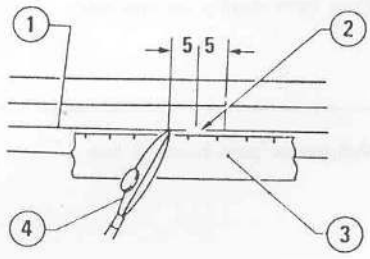
1. Conductor silver compound
2. Ruler (**30 cm (12 in)** length)
3. Ruling pen
4. Heat gun
5. Alcohol
6. Cloth

Repair

1. Clean the wire and the surrounding area with a cloth soaked in alcohol.
2. Put a small amount of conductor silver compound on the ruling pen end.

Shake the silver compound box before use.

3. Position a ruler on the rear window, in correspondence with the interrupted wire and, by means of the ruling pen, lay the silver compound so as to cover the wire in the interrupted area, on both sides, for about **5 mm (0.2 in)**.



1 Filament
2 Interruption
3 Ruler
4 Ruling pen

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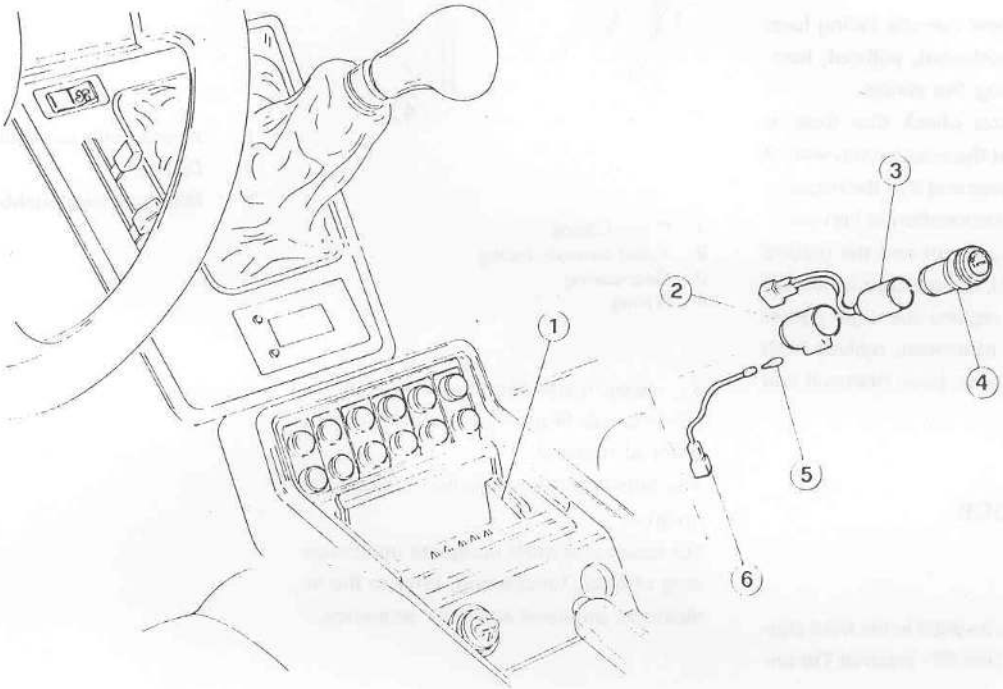
4. Dry the ruling pen end in order to remove the residuous silver compound.
5. Once the repair has been carried out wait for about **10 minutes**, then verify the continuity of the wire concerned.

During the test, do not touch the repaired filament.

6. Heat the repaired area with a hot air jet for about 20 minutes, keeping the heat-gun orifice at about **3 cm (1.2 in)** from the surface. If a heat-gun is not available, allow to dry for **24 hours**.

INTERNAL ACCESSORIES

CIGAR LIGHTER



1 Ashtray
2 Cover
3 Cigar lighter base
4 Cigar lighter
5 Lamp
6 Lampholder

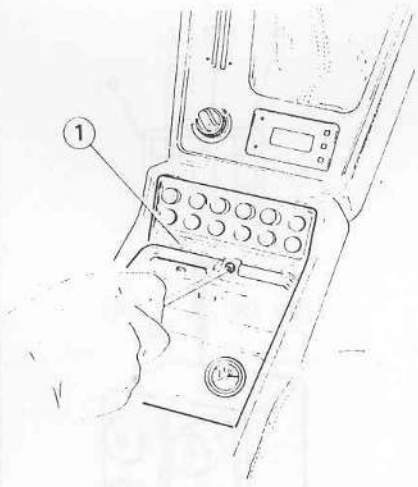
Location

The cigar lighter is assembled on the facing of the rear console (see: Unit 66 - Internal Trimming).

Removal and installation

Refer to the previous exploded view.

1. Remove the cigar lighter (4) from its base on the facing of the rear console and the ashtray (1).
2. Working through the ashtray cavity, unscrew the screw securing the facing to the rear console.



1 Rear console facing

3. Lift off the facing and disconnect the cigar lighter wiring then remove the lampholder (6) from the cover.
4. Remove the cover complete with cigar lighter base from the facing.
5. Release the cigar lighter base (3) from the cover (2) by acting from inside the housing on the two locking teeth provided on the cover.
6. Rotate the cigar lighter base and slide it out of the cover.
7. Re-install by operating in reverse order of removal, ensuring that the locking teeth of the cover co-incide with the corresponding grooves on the cigar lighter base.

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Lamp replacement

Refer to the previous exploded view.

1. Remove the ashtray from the rear console facing.
2. Working through the ashtray cavity, slide out the lampholder (6) from the cover (2).
3. Remove the lamp (5) which illuminates the cigar lighter.
4. Re-install by operating in reverse order of removal.

Check

1. Lift off the rear console facing (see: Removal and Installation), without, however, disconnecting the wiring.
2. Using a tester check that there is voltage present at the positive terminal of the cigar lighter base and that the negative terminal ground connection is correct.
3. If voltage is present and the ground connection correct, but the cigar lighter still fails to operate, replace the cigar lighter with a new one; otherwise, replace both cigar lighter and base (see: Removal and Installation).

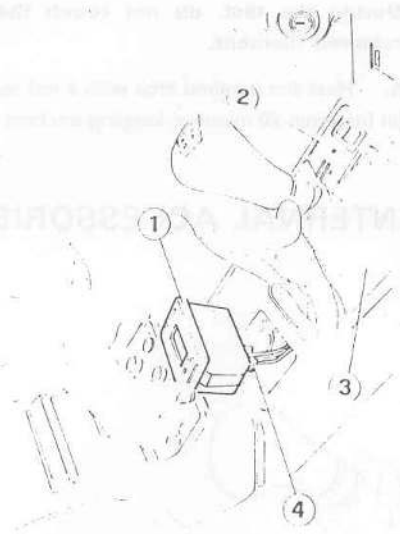
DIGITAL CLOCK

Location

The digital clock is inserted in the front console facing (see: Unit 66 - Internal Trimming).

Removal and Installation

1. Working through the opening in the front console facing (2) without removing the gear casing (3), push the digital clock (1) out from its housing.
2. Disconnect the wiring (4) and remove the digital clock.

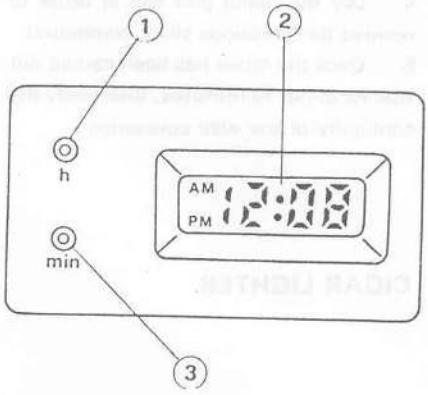


1 Digital clock
2 Front console facing
3 Gear casing
4 Wiring

3. Snap install the digital clock in the front console facing by operating in reverse order of removal.

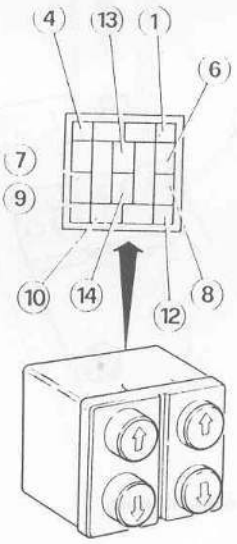
The colour of the indication displayed is green.

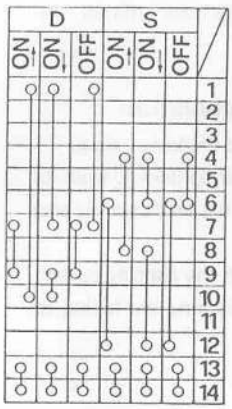
For easier and more complete understanding of clock functioning, refer to the indications provided and their sequence.



1 Hour setting pushbutton
2 Display
3 Minute setting pushbutton

POWER WINDOW SWITCH





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Location

The power window switch is inserted in the rear console facing (see: Unit 66 - Internal Trimming).

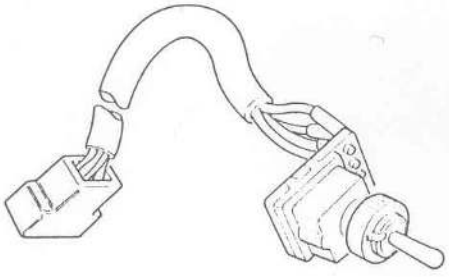
Removal and installation

Remove the switch unit (see: Hazard Light Switch - Removal and Installation).

Check

Check switch functioning by verifying that the electrical continuity between terminals complies with the indications provided in the table.

ELECTRIC MIRROR CONTROL SWITCH

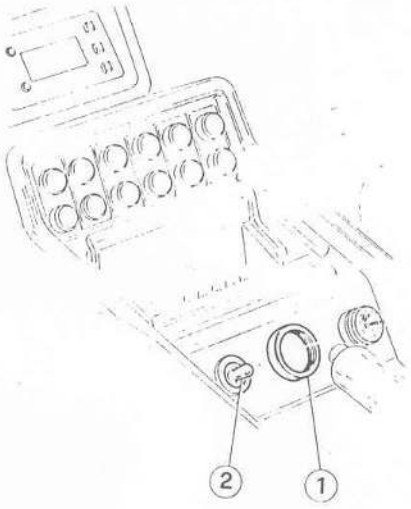


Location

The electric mirror control switch is assembled on the rear console facing (see: Unit 66 - Internal Trimming).

Removal and installation

1. Remove the ashtray from the rear console facing.
2. Unscrew the ring nut (1) securing the switch to the rear console facing.
3. Slide the switch (2) complete with wiring out through the ashtray cavity.
4. Disconnect the wiring and remove the switch.



1 Ring nut
2 Electric mirror control switch

5. Re-install the switch in reverse order of removal.

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UNIT 43

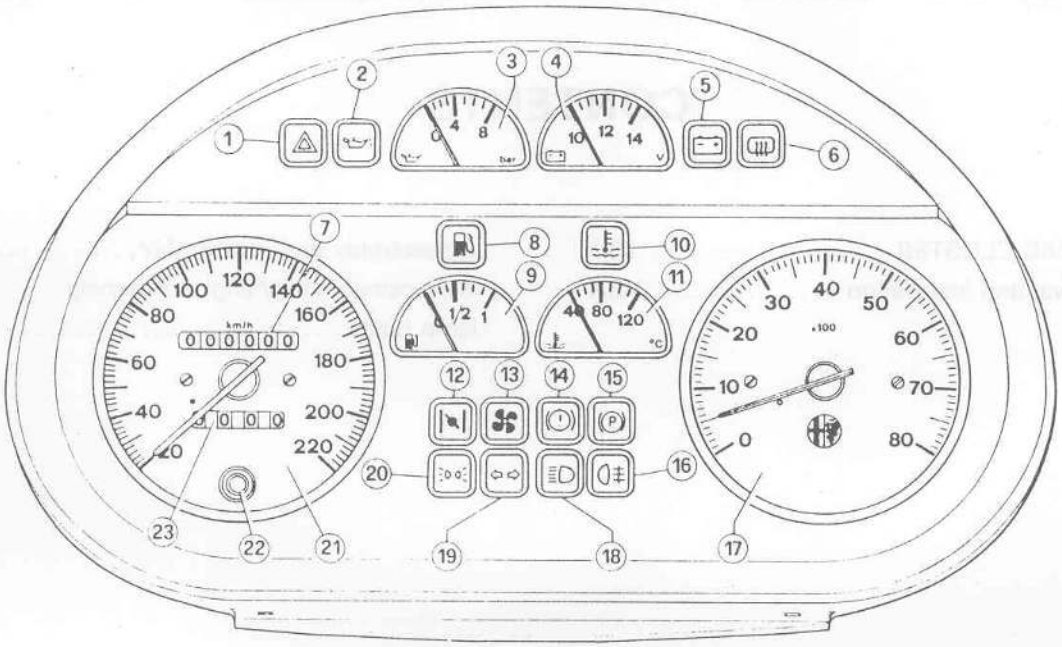
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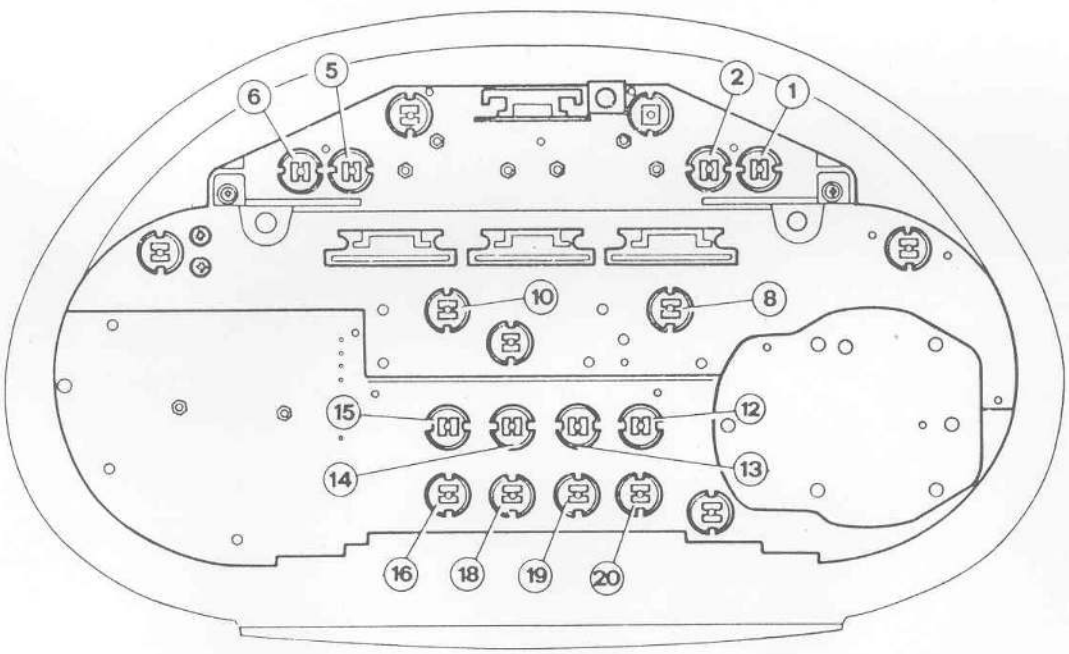
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ELECTRONIC CLUSTER

Frontal view



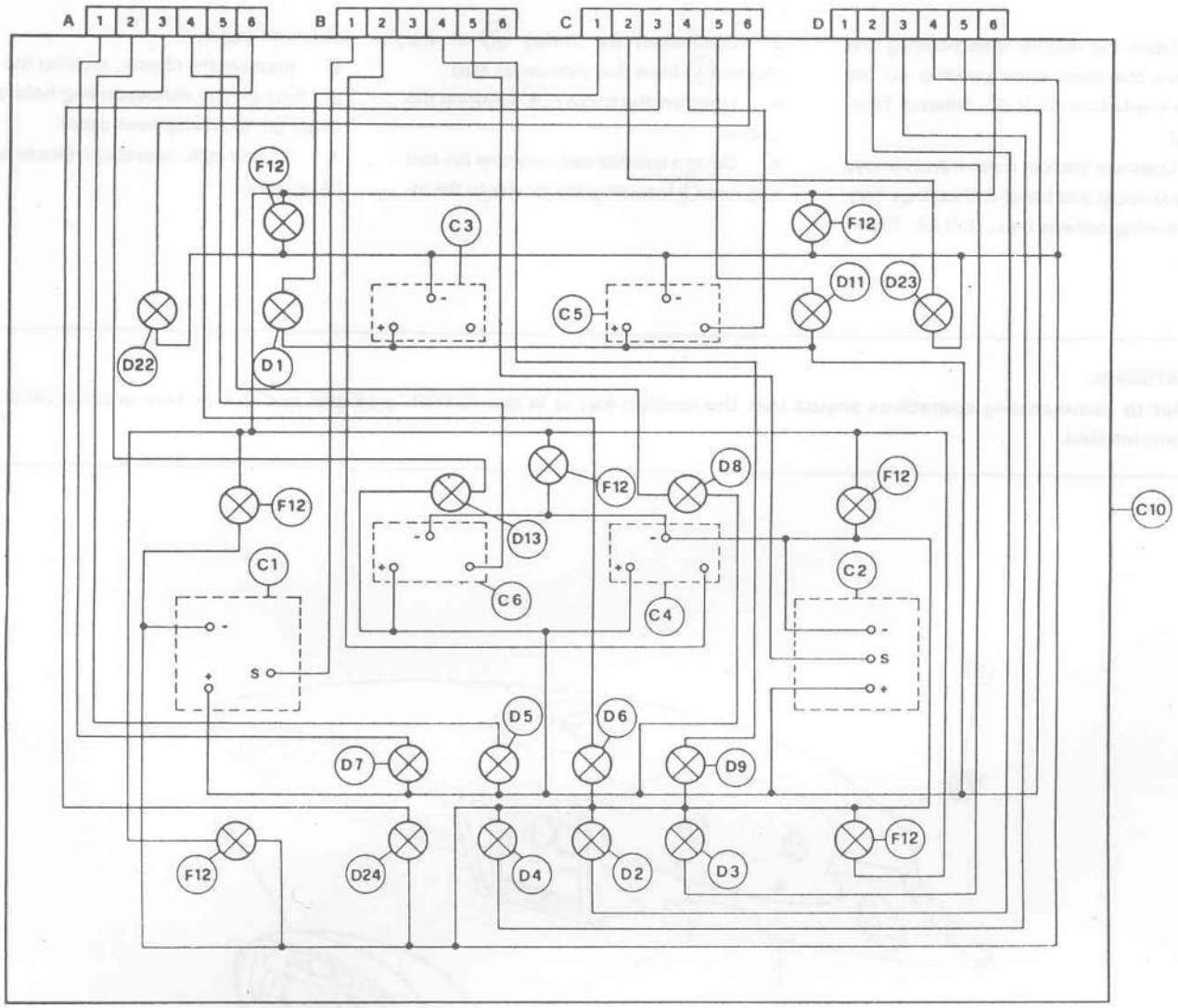
Rear view



1 Hazard light warning lamp
2 Low oil pressure warning light
3 Engine oil pressure gauge
4 Voltmeter
5 Alternator warning light
6 Heated rear window warning light
7 Odometer
8 Fuel reserve warning light
9 Fuel level gauge
10 Coolant maximum temperature warning light
11 Coolant temperature gauge
12 Choke warning light (Spider 1.6 only)
13 Ventilating fan warning light
14 Brake fluid level warning light
15 Parking brake warning light
16 Rear fog lamp warning light
17 Electronic rev. counter
18 Headlamp high beam warning light
19 Direction indicator warning light
20 Parking light warning light
21 Speedometer
22 Tripmeter reset knob
23 Tripmeter

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Wiring diagram



C1 Electronic rev-counter
C2 Electronic speedometer
C3 Voltmeter
C4 Fuel level gauge
C5 Oil pressure gauge
C6 Water temperature gauge
C10 Cluster
D1 Alternator warning lamp
D2 Direction indicator warning lamp
D3 Side light warning lamp
D4 Full beam warning lamp
D5 Brake fluid low level warning lamp
D6 Heater/ventilation warning lamp
D7 Handbrake warning lamp
D8 Fuel reserve warning lamp
D9 Choke warning lamp (Spider 1.6 only)
D11 Engine oil minimum pressure warning lamp
D13 Engine water high temperature warning lamp
D22 Heated rear window warning lamp
D23 Hazard lights warning lamp
D24 Rear fog light warning lamp
F12 Cluster light

Connector A

Pin 1 : Parking brake warning light
Pin 2 : Brake fluid level warning light
Pin 3 : Coolant max. temp. warning light
Pin 4 : Fuel reserve warning light
Pin 5 : Coolant temp. transmitter
Pin 6 : Ventilating fan warning light

Connector B

Pin 1 : Rev counter signal
Pin 2 : Fuel level indicator transmitter
Pin 3 : Free
Pin 4 : Choke warning light (Spider 1.6 only)
Pin 5 : Tachymetric signal
Pin 6 : Free

Connector C

Pin 1 : Alternator warning light
Pin 2 : Hazard light warning light
Pin 3 : Rearfog warning light
Pin 4 : Oil pressure transmitter
Pin 5 : Low oil pressure warning light
Pin 6 : Heated rear window warning light

Connector D

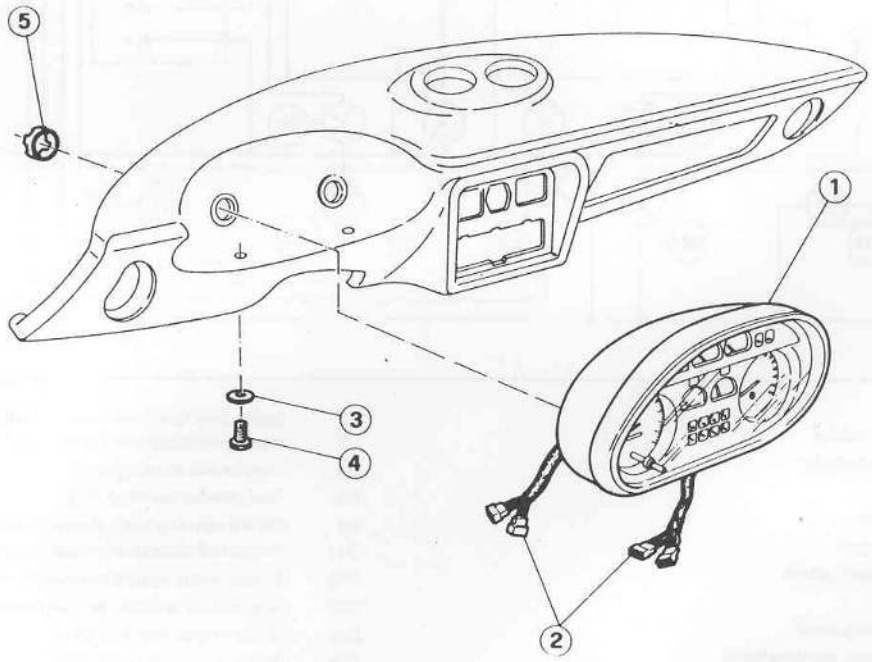
Pin 1 : Parking light warning light
Pin 2 : Direction indicator warning light
Pin 3 : Headlamp high beam warning light
Pin 4 : Common ground
Pin 5 : Common positive
Pin 6 : Illumination

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REMOVAL AND INSTALLATION

1. Open the mobile knee padding and remove the fixed knee padding on the driver's side (see: Unit 66 - Internal Trimming).
2. Unscrew the four screws and remove the two upper and lower half casings from the steering column (see: Unit 23 - Steering).
3. Disconnect the wiring (2) of the cluster (1) from the associated taps.
4. Unscrew the screws (4) securing the cluster.
5. Using a suitable tool, unscrew the two ring nuts (5) securing the cluster to the instrument panel.
6. Remove the cluster, slipping the wiring through the corresponding holes provided on the instrument panel.
7. To re-install, operate in reverse order of removal.

WARNING:
Prior to commencing operations ensure that the ignition key is in the "STOP" position and the battery ground cable is disconnected.



1 Cluster
2 Wiring
3 Washer
4 Screw
5 Ring nut

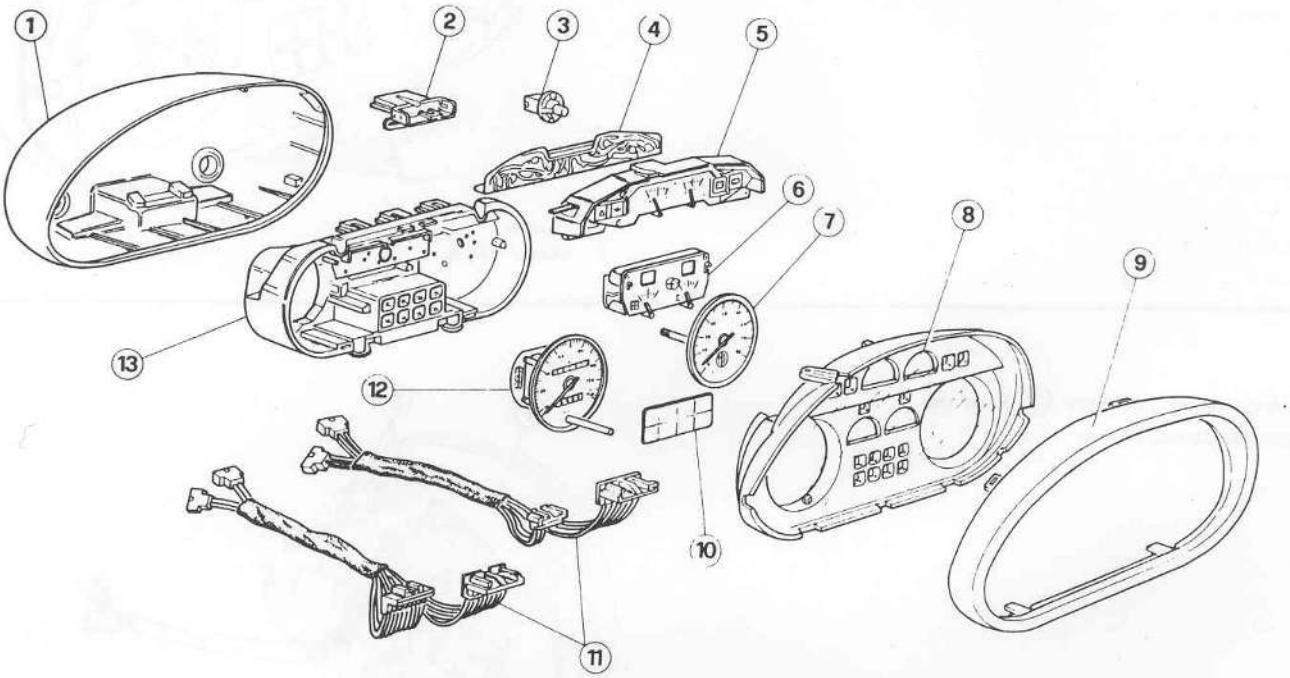
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DISASSEMBLY AND REASSEMBLY

WARNING:

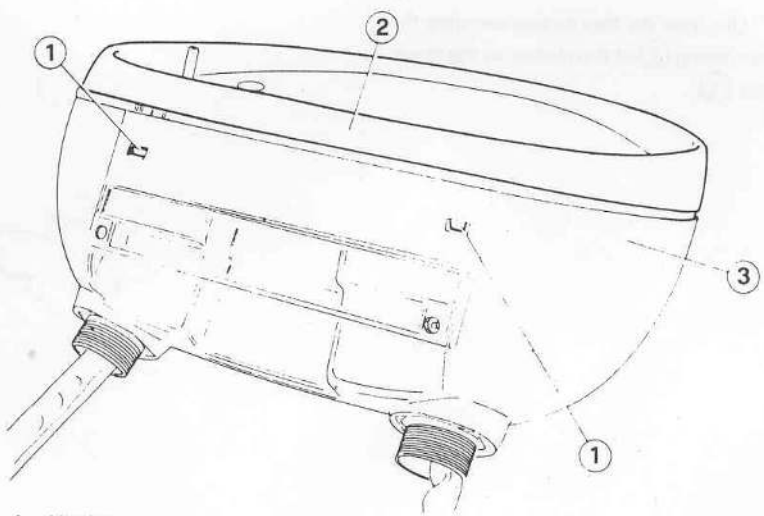
Operate with necessary caution to avoid damaging the electronic components and printed circuit boards.

Furthermore, the following procedures of disassembly may be carried out with the cluster installed in the car.



1 Cluster casing
2 Connection
3 Cluster lighting lamp (complete with lampholder)
4 Instrument supply circuit
5 Engine oil pressure gauge and voltmeter
6 Fuel level and coolant fluid temperature indicator
7 Rev counter
8 Cover frame
9 Outer case
10 Warning lamp panel
11 Wiring
12 Speedometer - odometer
13 Cluster lower casing

1. Release the two hooks (1) locking the outer case (2) to the cluster casing (3) and remove the outer case.

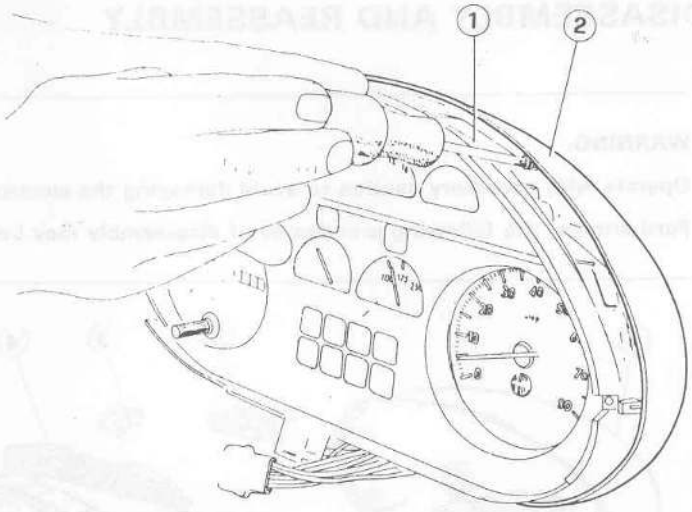


1 Hooks
2 Outer case
3 Cluster casing

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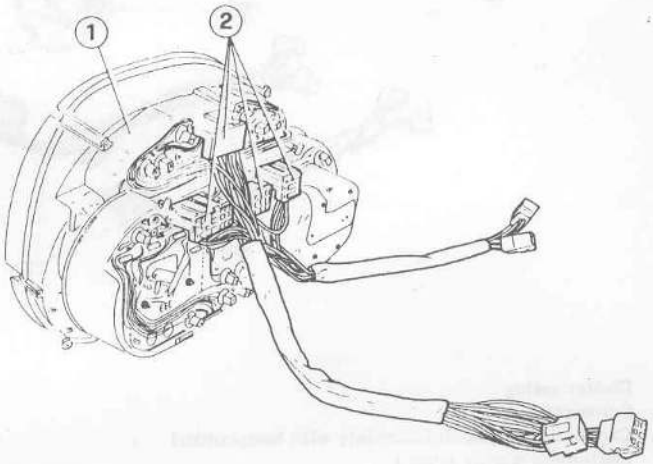
2. Unscrew the four screws securing the cluster (1) to the cluster casing (2).

3. Remove the screws and separate the cluster from the casing.



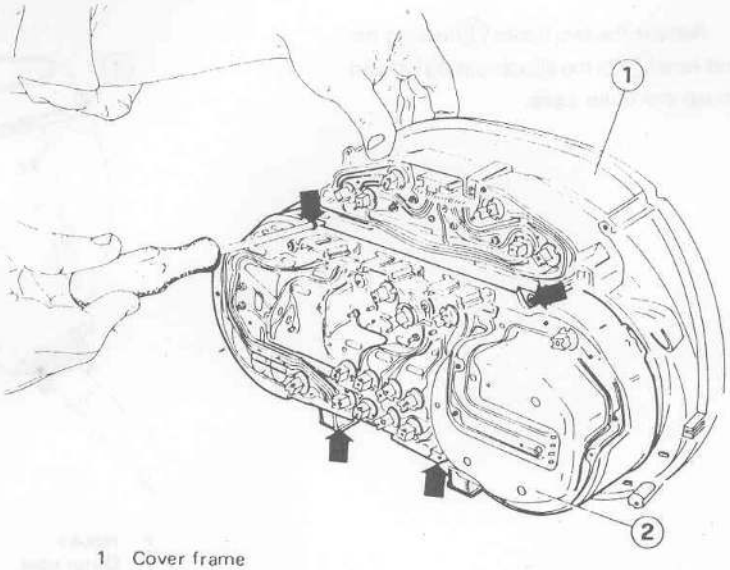
1 Cluster
2 Cluster casing

4. Disconnect the wires (2) from the cluster and remove them.



1 Cluster
2 Wires

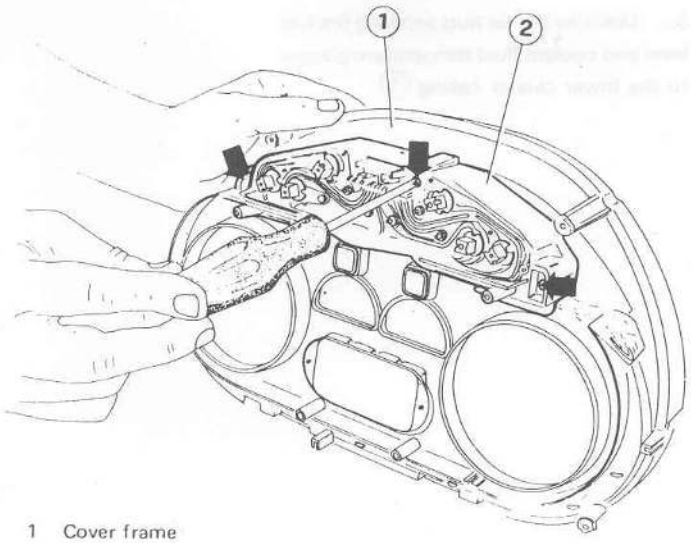
5. Unscrew the four screws securing the lower casing (2) of the cluster to the cover frame (1).



1 Cover frame
2 Lower casing, cluster

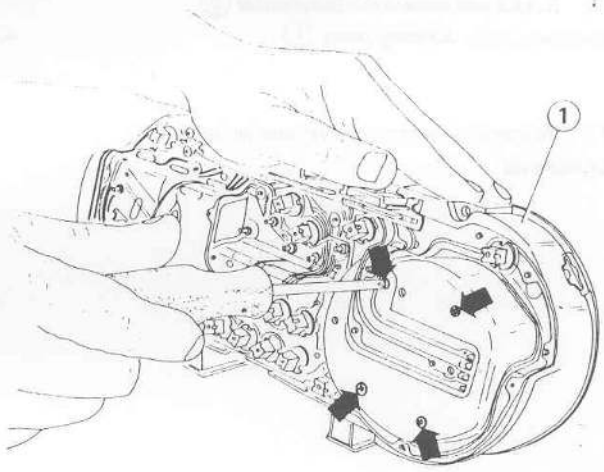
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6. Unscrew the three screws securing the engine oil gauge and voltmeter (2) to the cover frame (1).



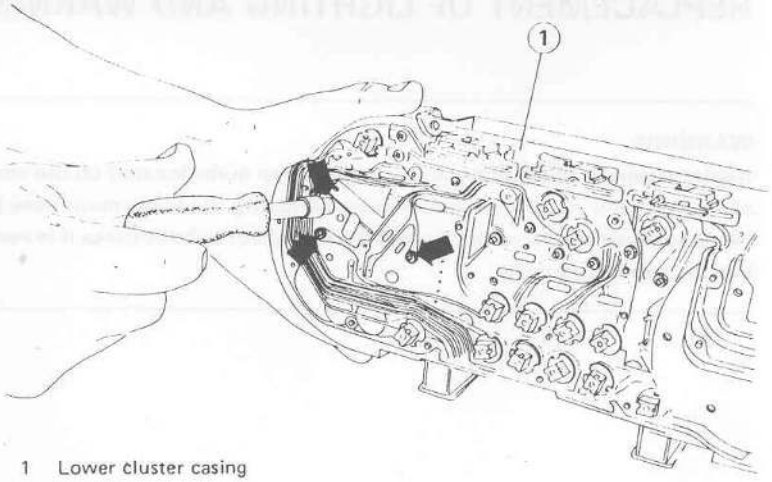
1 Cover frame
2 Upper cluster

7. Unscrew the four screws securing the speedometer to the lower cluster casing (1).



1 Lower cluster casing

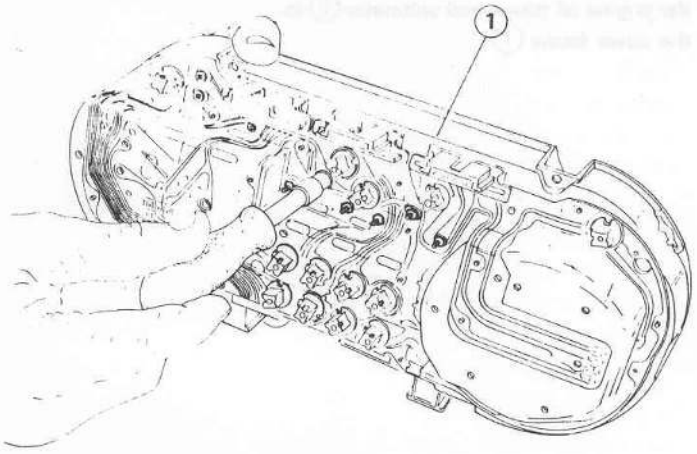
8. Unscrew the nuts securing the rev counter to the lower cluster casing (1).



1 Lower cluster casing

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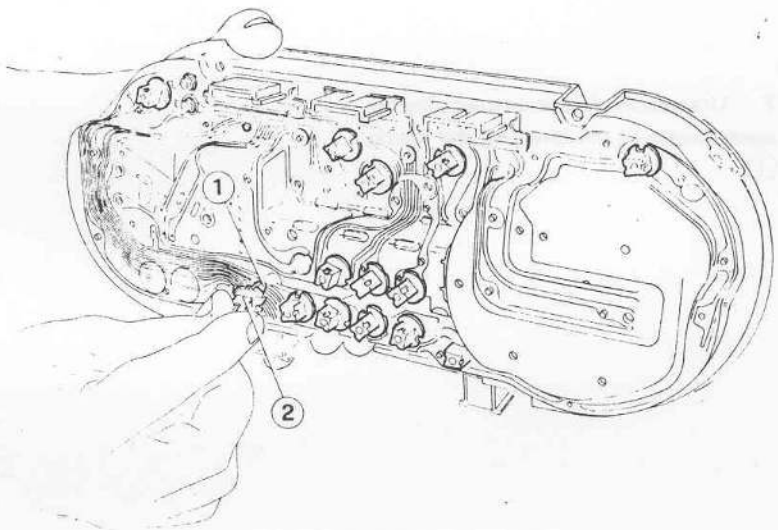
9. Unscrew the six nuts securing the fuel level and coolant fluid temperature gauges to the lower cluster casing (1).



1 Lower cluster casing

10. Rotate and extract the lampholder (2) complete with warning lamp (1).

11. Re-install by operating in reverse order of removal.



1 Lamp
2 Lampholder

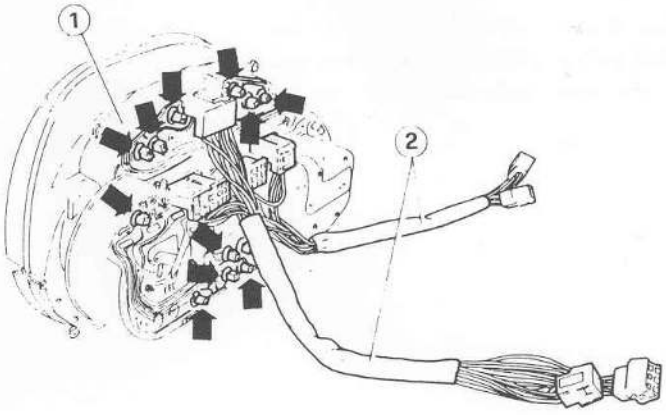
REPLACEMENT OF LIGHTING AND WARNING LAMP BULBS

WARNING:
Replacement of the lighting and warning lamp bulbs located on the cluster may be carried out both by removing the cluster alone from the instrument panel or by removing the instrument case from its outer frame. To avoid confusion the following procedure concerns the former case only but in both cases it is necessary to operate with due caution to avoid damaging the printed circuits.

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1. Remove the cluster (see: Removal and Installation).
2. Separate the instrument case (1) from the casing (see: Removal and Installation - Steps 1, 2 and 3).
3. Turn and extract the lampholder then slide the lamp out from the same (when necessary, move the wiring (2) without, however, disconnecting it).
4. Replace the lamp with a new one of the same type and re-install by operating in reverse order of removal.

WARNING:
Use ALFA ROMEO original spare parts only.



1 Instrument case
2 Wiring

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UNIT 49

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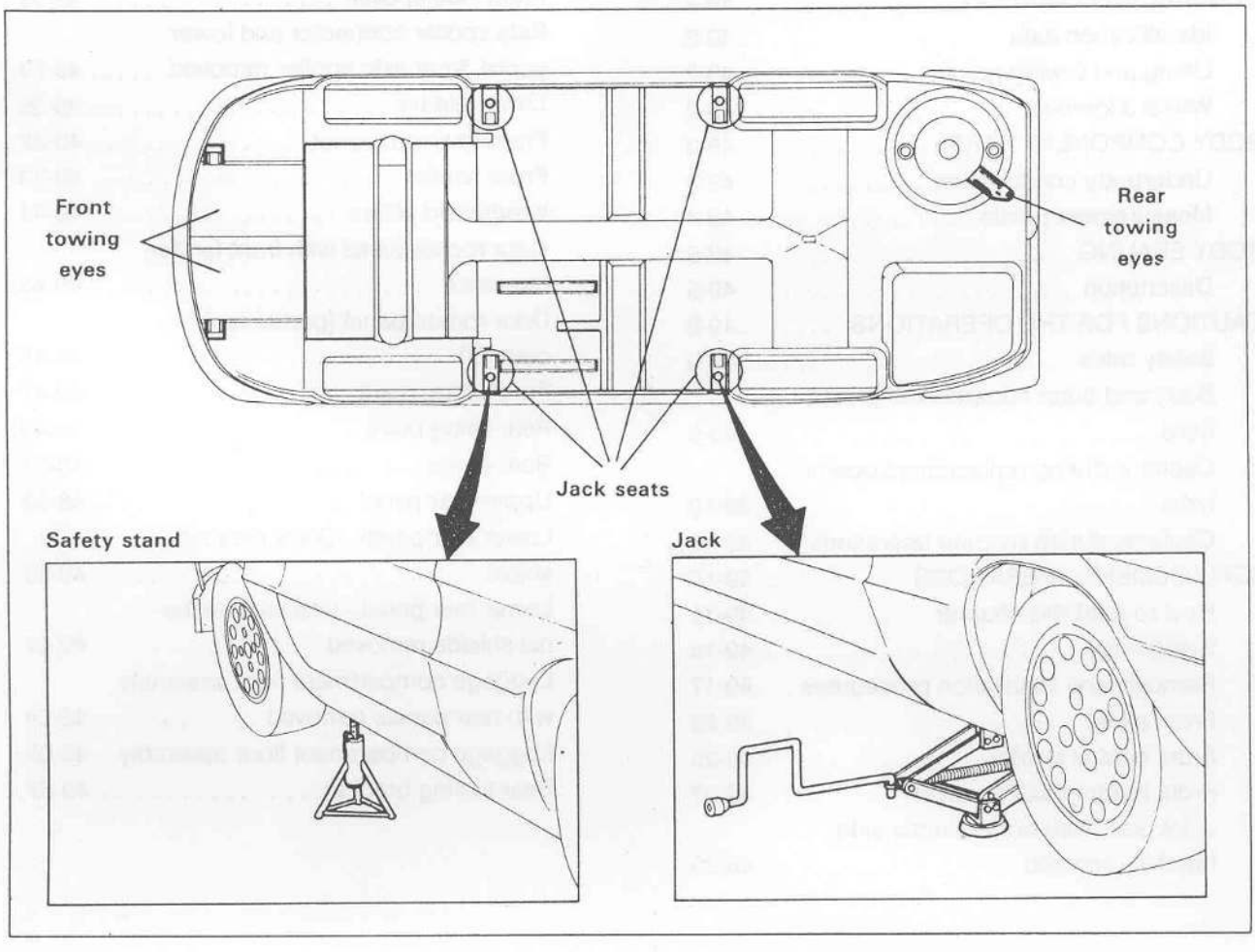
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GENERAL INFORMATION

IDENTIFICATION DATA

Refer to Unit 00 - Complete Car - Identification Data and Vehicle Assistance.

LIFTING AND TOWING POINTS



Jack and safety stands

WARNING:

a. After lifting the car by means of hydraulic jack, support car weight by means of safety stands.

b. Before lifting car rear (front) side place wheel chocks by positioning them at front (rear) wheels.

Securely position hydraulic jack and safety stands in the points identified in figure.

WHEEL ALIGNMENT

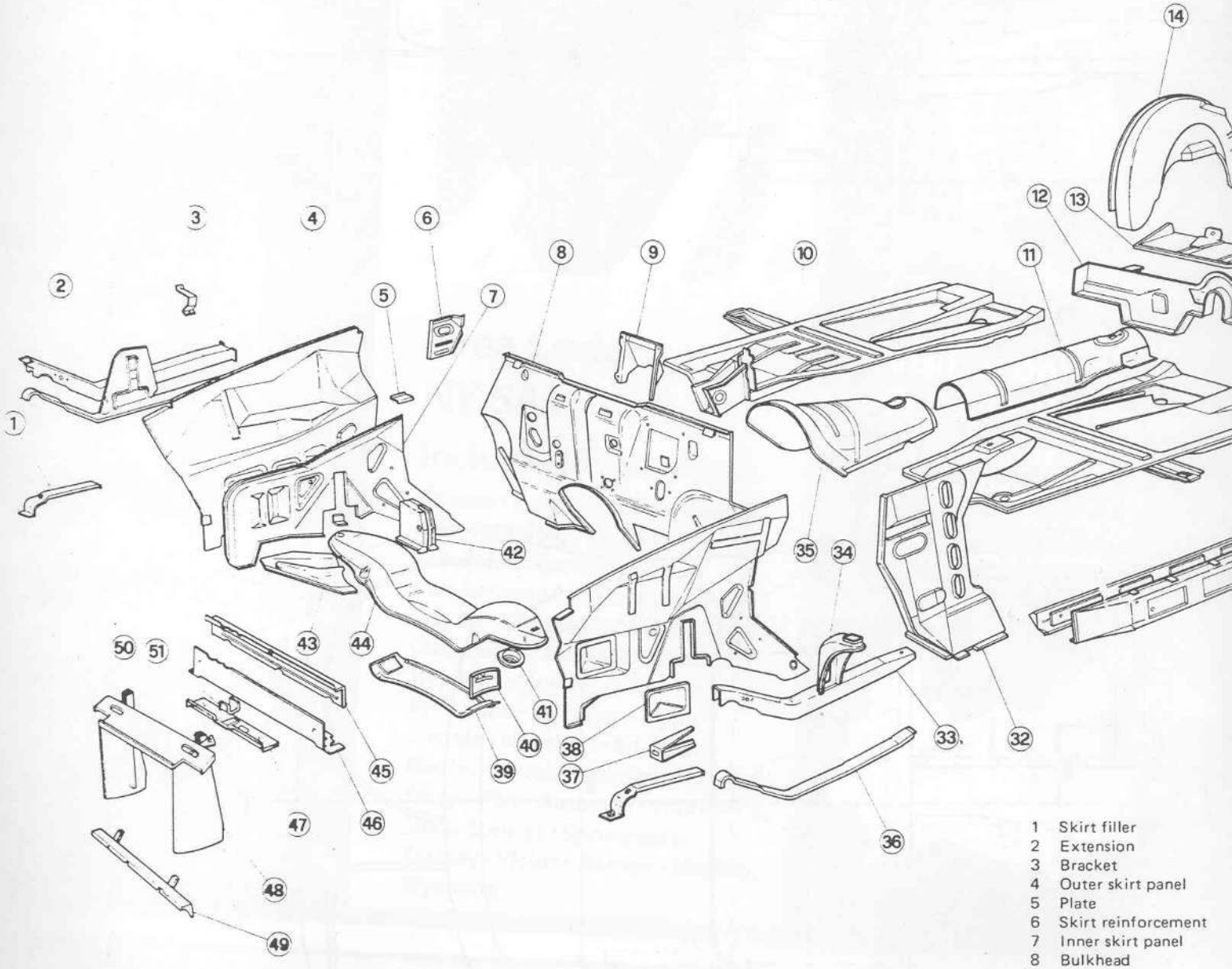
CAUTION:

The technicians assigned to the repair and replacement operations of sheet panels shall always take into account the content of the remaining part of the "Workshop Manual" in order always to maintain original quality and functioning conditions of car as a whole. As restoration of car correct alignment is of particular importance, refer to Unit 00 - Complete Car - Maintenance of Mechanical Componentes and Body.

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BOD

UNDERBODY CONSTRUC

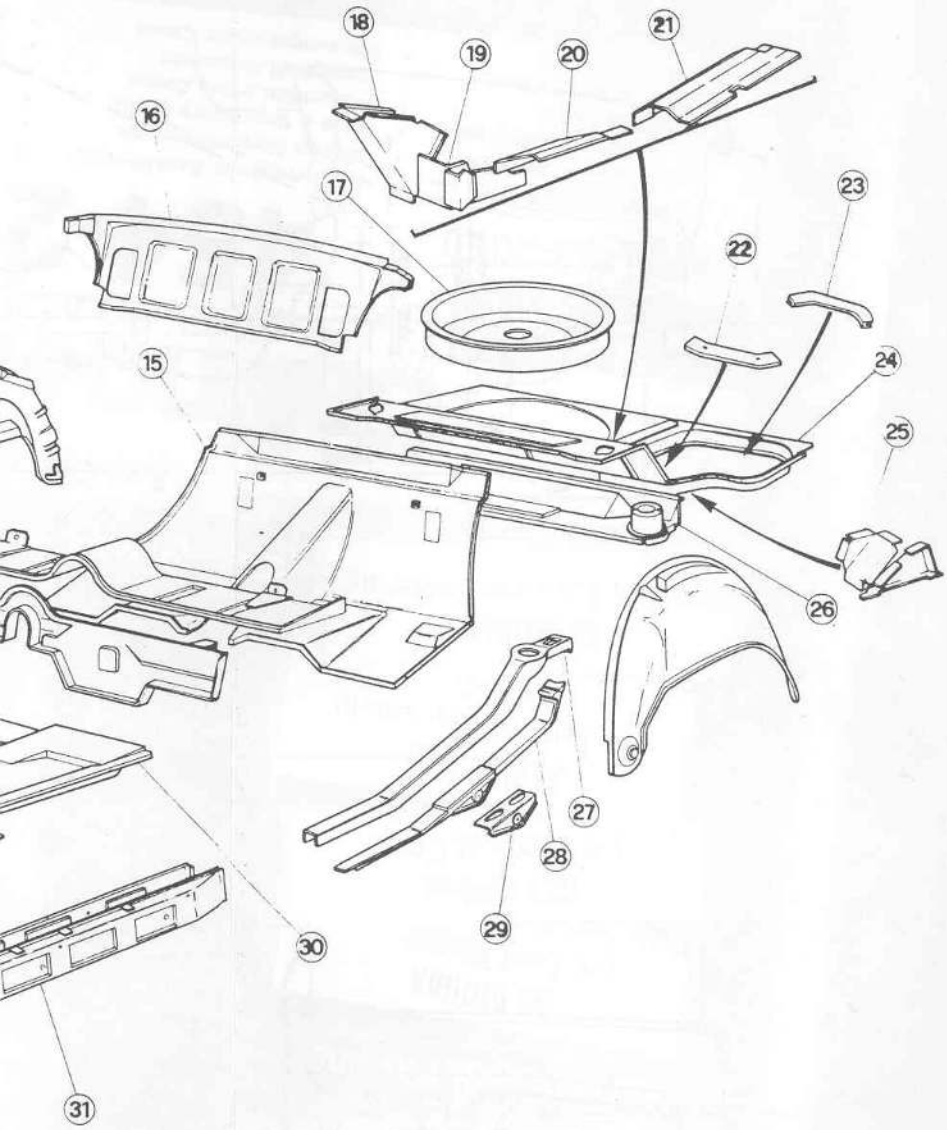


1 Skirt filler
2 Extension
3 Bracket
4 Outer skirt panel
5 Plate
6 Skirt reinforcement
7 Inner skirt panel
8 Bulkhead
9 Column bracket
10 Pan
11 Propeller shaft cover
12 Reinforcement
13 Upper cross member
14 Wheelhouse
15 Tonnean floor
16 Cross member
17 Spare wheel compartm

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DY COMPONENT PARTS

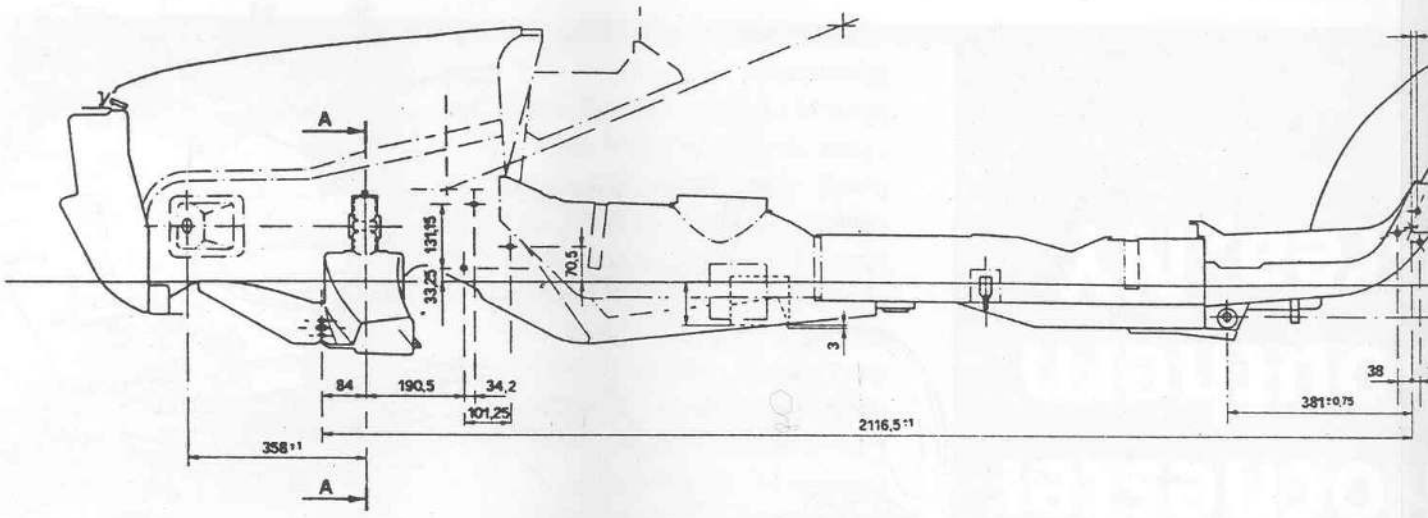
UCTION

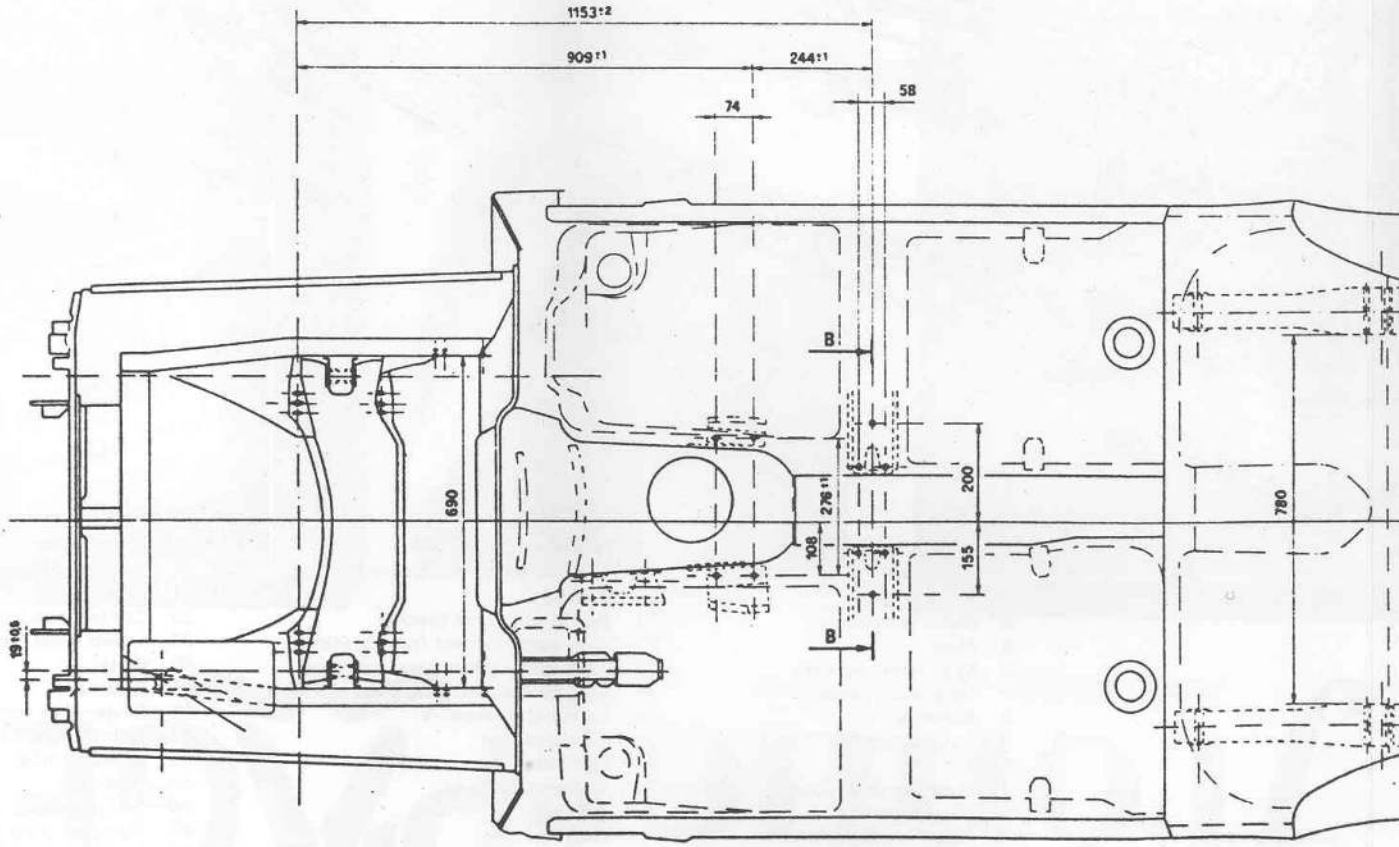


	18	Righthand framework	35 Upper extension
	19	Spare wheel compartment bracing	36 Lower extension
	20	Bracing	37 Bracket
	21	Bear longitudinal bracing	38 Control arm support
	22	Tank compartment front bracing	39 Lower cross member
t	23	Tank compartment rear bracing	40 Plate
	24	Luggage compartment floor assembly	41 Bracing
	25	Lefthand framework	42 Suspension arm support
	26	Cross member	43 Reinforcement
	27	Rear side rail	44 Cross member
er	28	Framework	45 Inner rail
	29	Bracing	46 Outer rail
er	30	Pan	47 Radiator cross member bracket
	31	Rail	48 Fender
	32	Rocker panel	49 Front brace
	33	Gearbox cover	50 Joint plate
artment	34	Shock absorber support	51 Radiator bracket

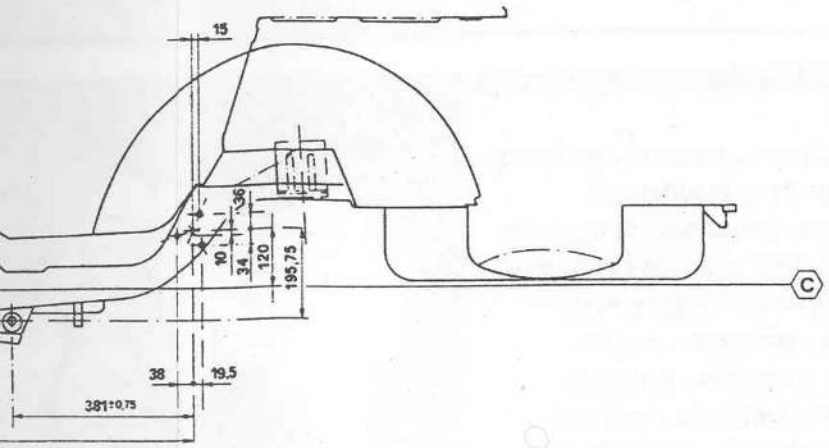
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MEASUREMENT POINTS

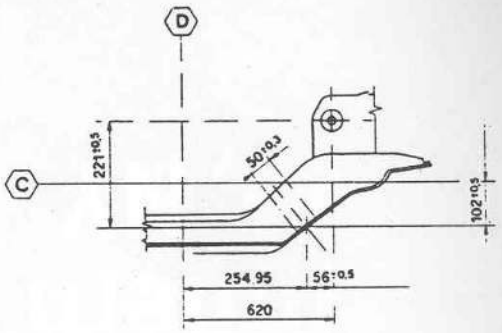


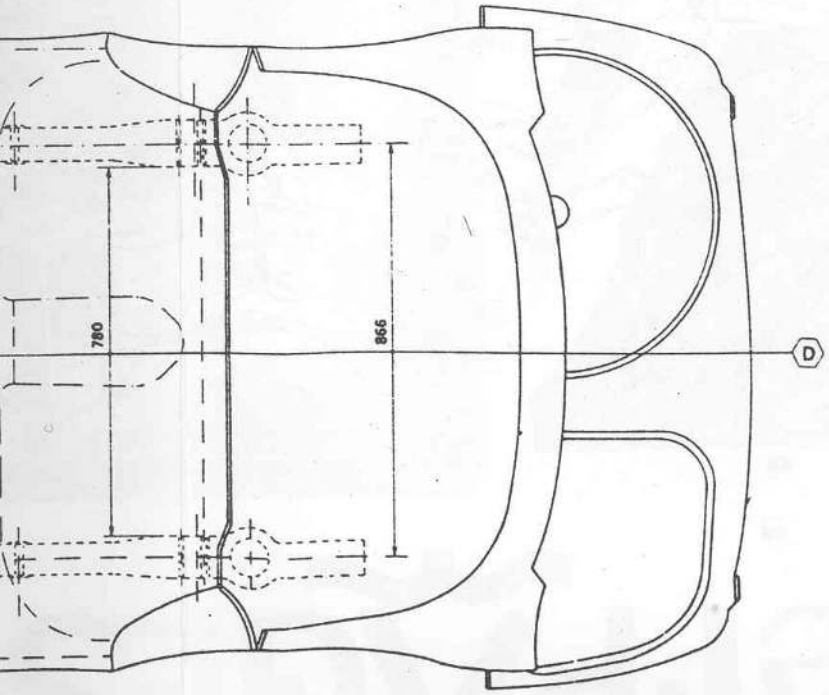


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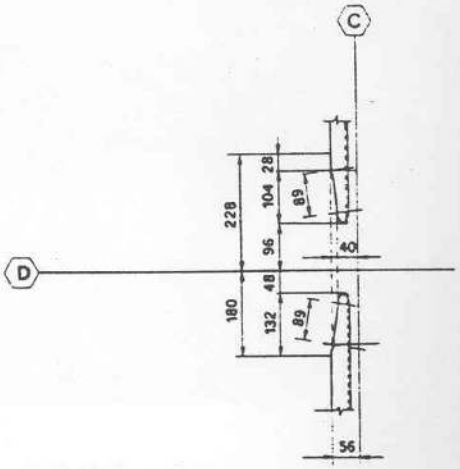


Sect.view A.A.





Sect.view B.B.



C - Longitudinal reference Axis

D - Vehicle center line

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BODY SEALING

DESCRIPTION

The following figures, show the body areas which are sealed by Manufacturer.
The sealings applied to these areas, must be smooth and free from scratches or gaps.

Take care not to apply too much sealing and not to allow other unaffected parts to come in contact with the sealing.

Body components sealing

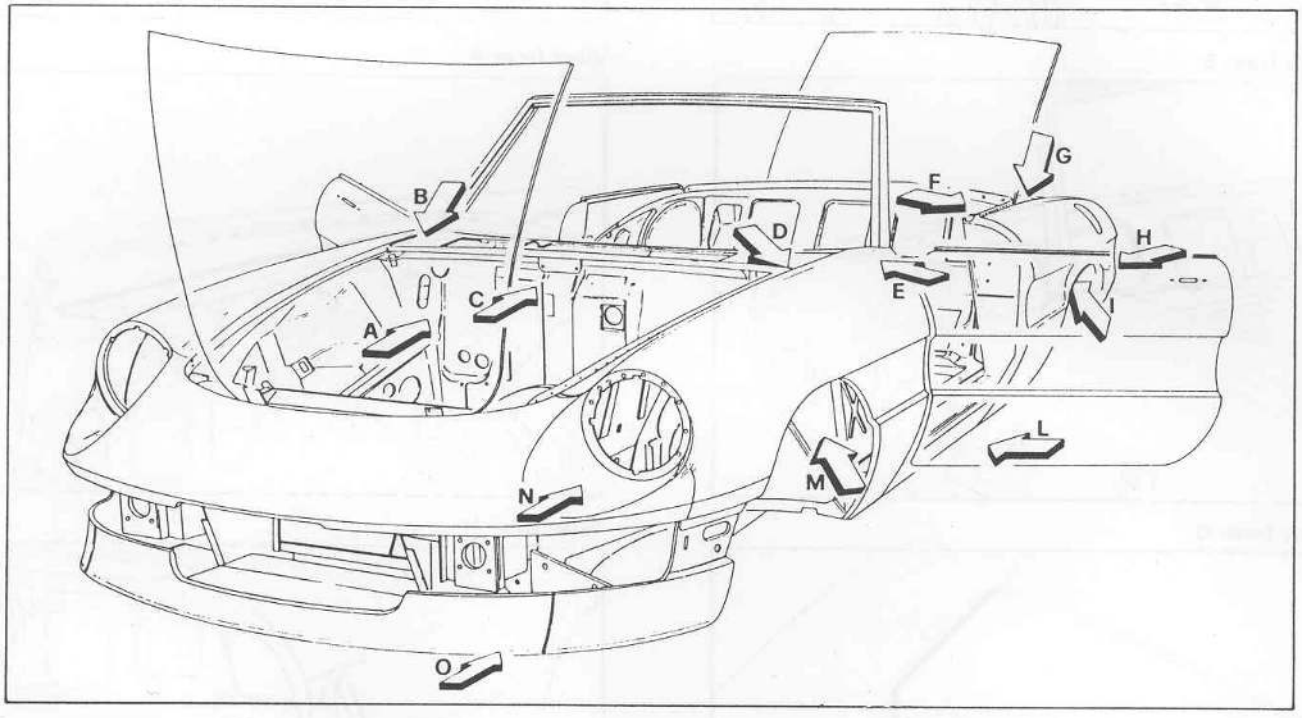
Paint seal, after priming or painting, and then sleek by means of a brush along all sheet joints in order to remove possible sealing faults.

ICIR: Paraflex Alpha 3M
8531/E
8536/E
Alternative: Std.no 3522-00014

Sealant for bolted joints

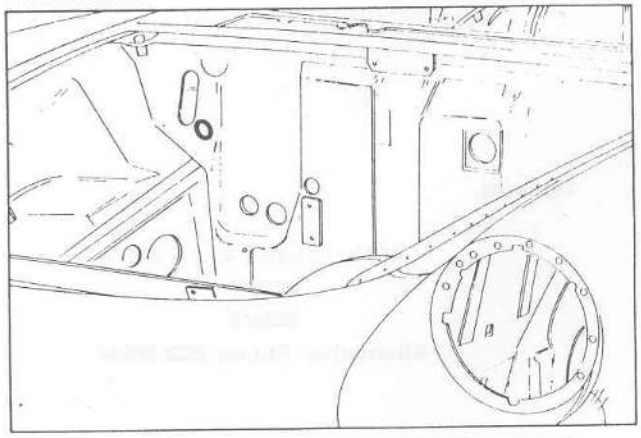
Sealant for joints between panels assembled by bolting.

3M - Autosealer 8573E - Std.no 3522-00045

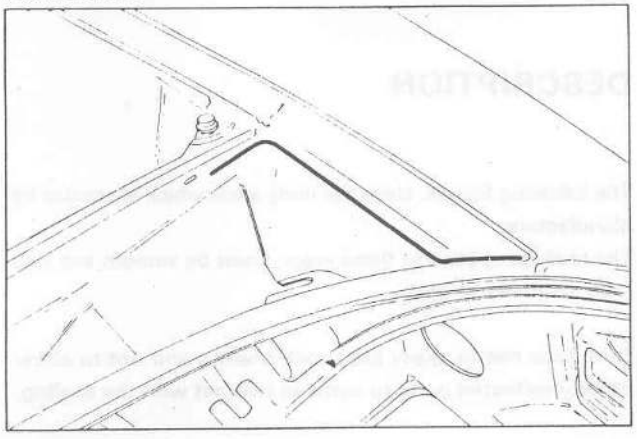


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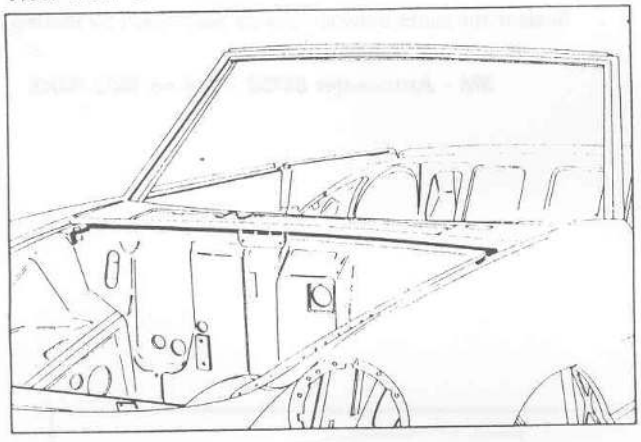
View from A



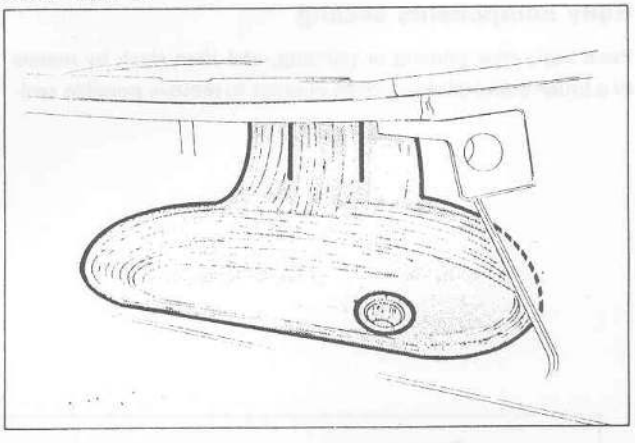
View from B



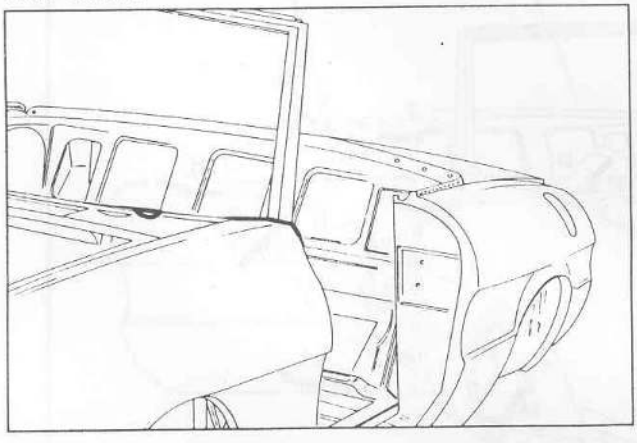
View from C



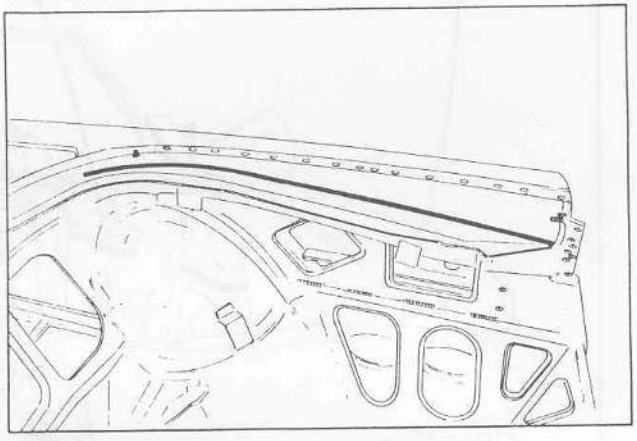
View from D



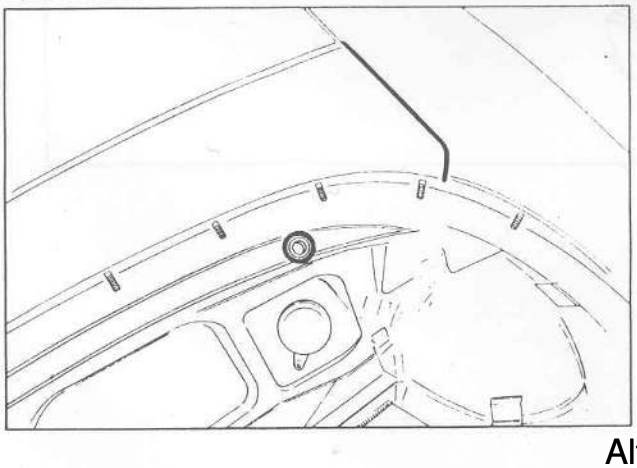
View from E



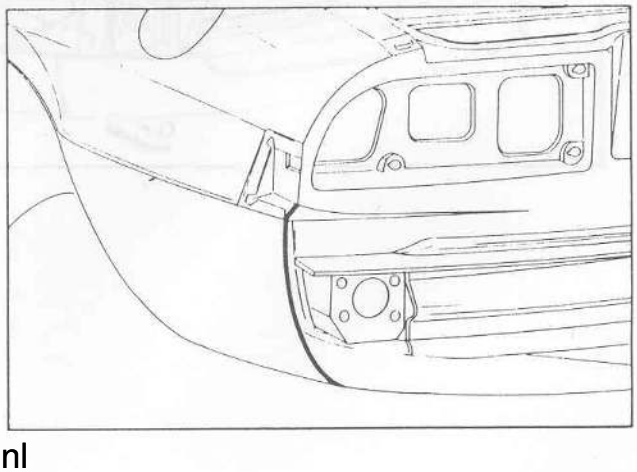
View from F



View from G

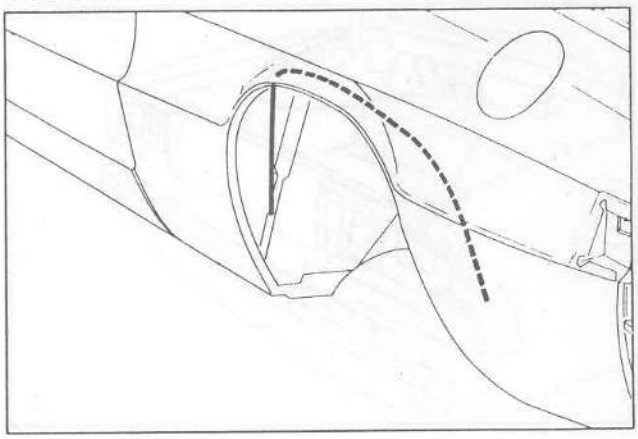


View from H

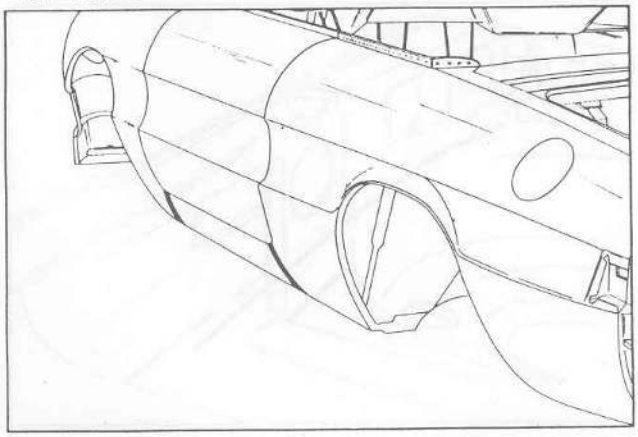


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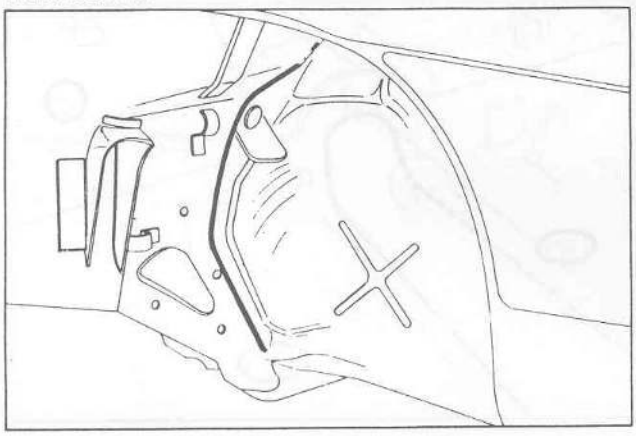
View from I



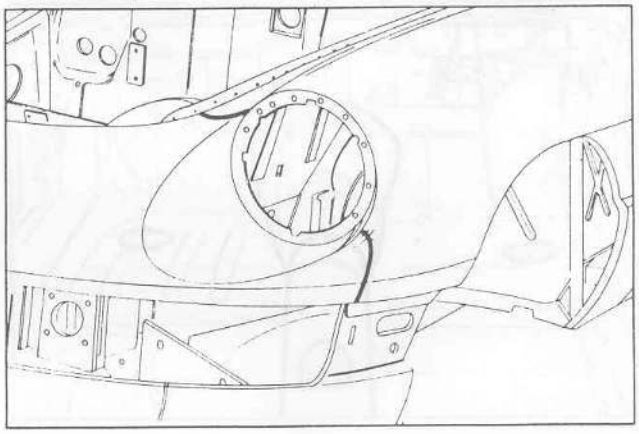
View from L



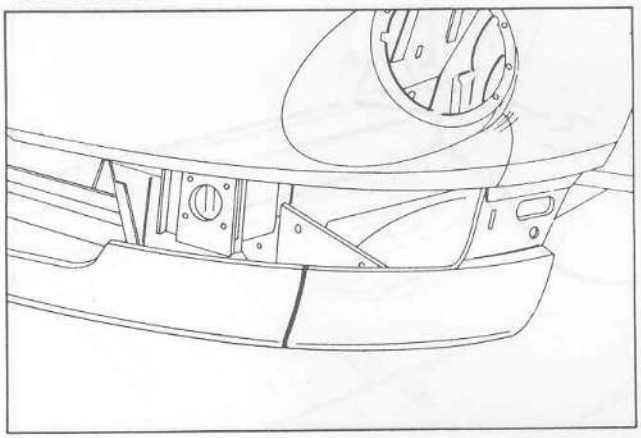
View from M



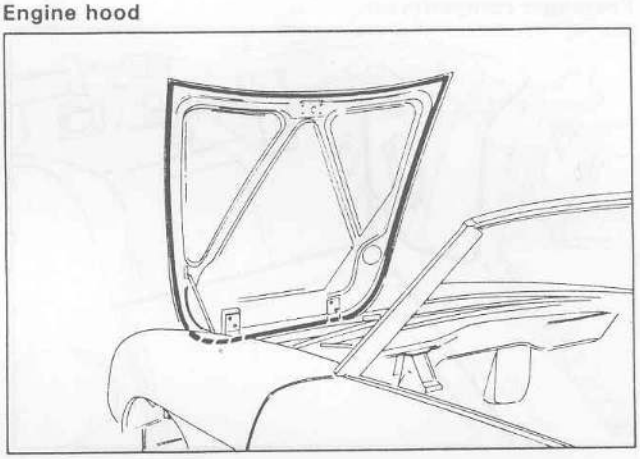
View from N



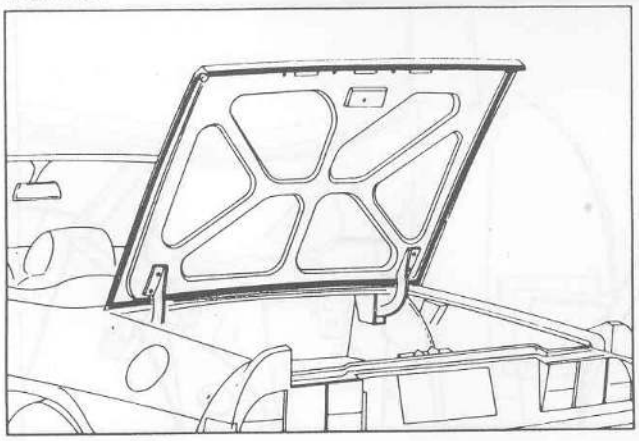
View from O



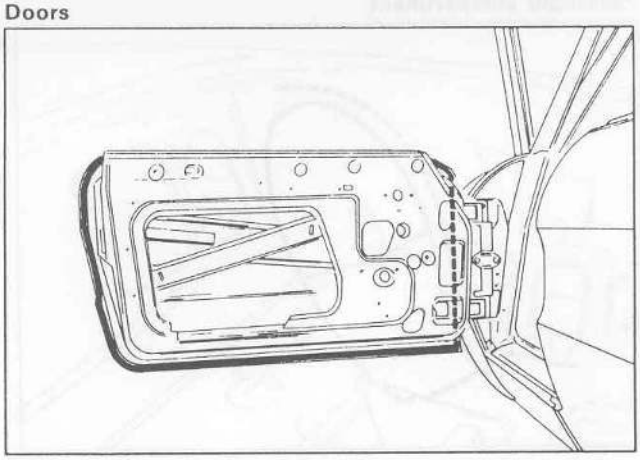
Engine hood



Trunk lid



Doors

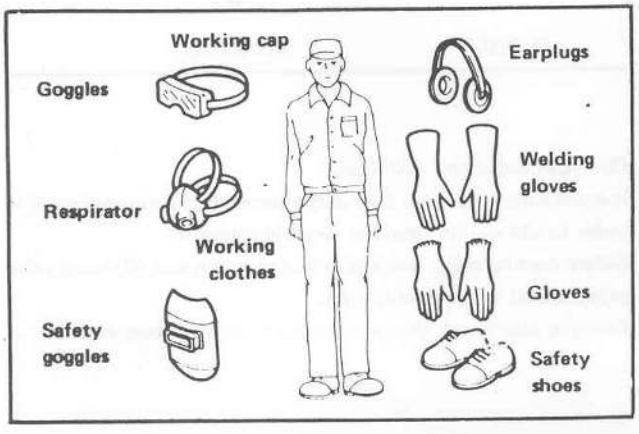


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CAUTIONS FOR THE OPERATORS

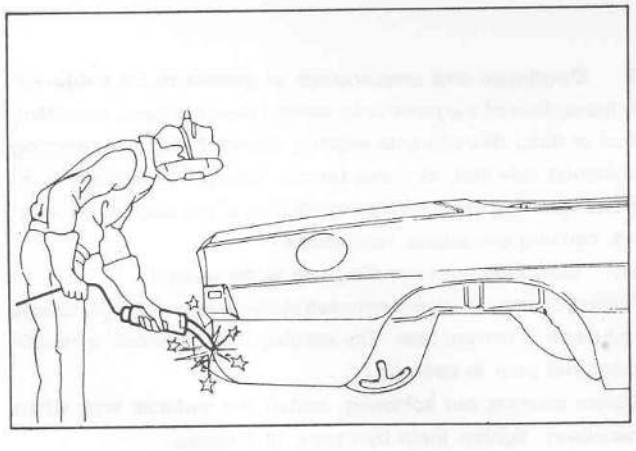
SAFETY RULES

1. **Wear protectors.**
- Depending on the work to be carried out, be sure to wear goggles, earplug, respirator etc.
  Always wear working clothes, safety shoes and working cap.



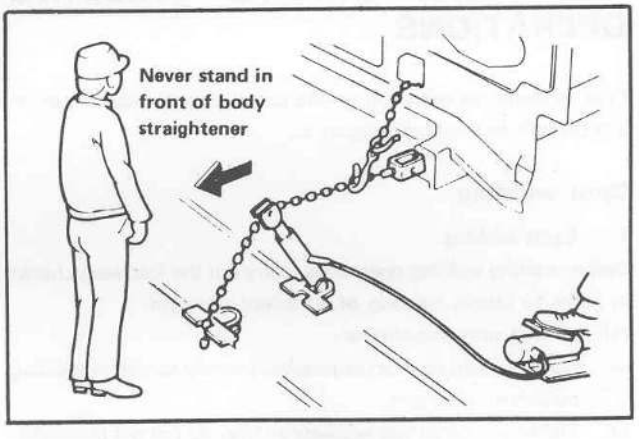
2. **Safety stands.**
- After jacking up the vehicle, support it by means of suitable safety stands. For identification of face points, refer to "Lifting Points".

3. **Inflammable.**
- Before starting any operation, make sure that battery ground cable has been disconnected.
- In case welding operations in proximity to tank are to be carried out, remove it from its compartment and plug the filler.
- When removing unions, plug the previously released connections of fuel pipings and of brake fluid.



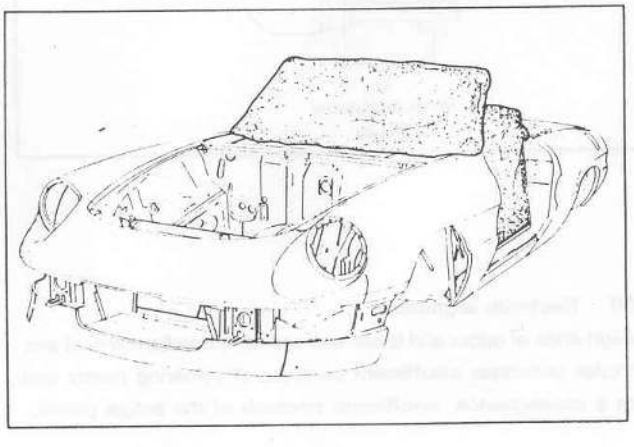
4. **Working environment.**
- The working environment must be well ventilated and illuminated, in order to ensure operator safety.
- Paints and sealants, when heated, may generate poisonous gases. In order to prevent this, when cutting and removing damaged sheets use an air saw or an air chisel instead of a gas welder.
- For removal of paint from sheet make use of a belt sander or rotary wire brush.

5. **Vehicle body straightener.**
- Make sure that body straightener is properly used in accordance with procedures of Instruction Manual of equipment manufacturer.
  During straightening operations of the damaged body, never stand in front of the machine in the direction towards which it is straightening.



BODY AND OUTER COMPONENTS PROTECTIONS

1. **Body protection.**
- Remove or cover vehicle trim (upholstery, instruments, carpets).
- Before soldering operations cover glass, upholstery and carpets, with heat-resistant materials (this protection is highly recommended especially for CO_2 arc welding).



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2. **Outer parts protection.**

- When removing external parts (hood, back door, moldings, finishings) it is necessary to protect body surfaces with clothes, protection tape or other materials, in order not to damage or scratch vehicle body.
- The scratched painted surfaces must be repaired: even a slight scratch may cause corrosion.

CAUTIONS DURING REPLACEMENT OPERATIONS

It is recommended always to use genuine spare parts.
This allows perfect repair and restoration of vehicle original functioning.

CAUTIONS DURING WELDING OPERATIONS

Prior to electrical soldering on the car remove the electronic injection unit to avoid damaging it.

Spot welding

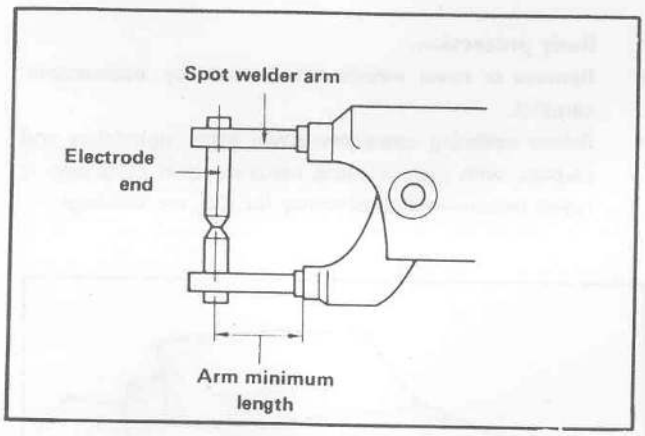
1. **Spot welder.**

Before starting welding operations, carry out the following checks in order to obtain welding of sufficient strength:

(1) Welder arm adjustment.

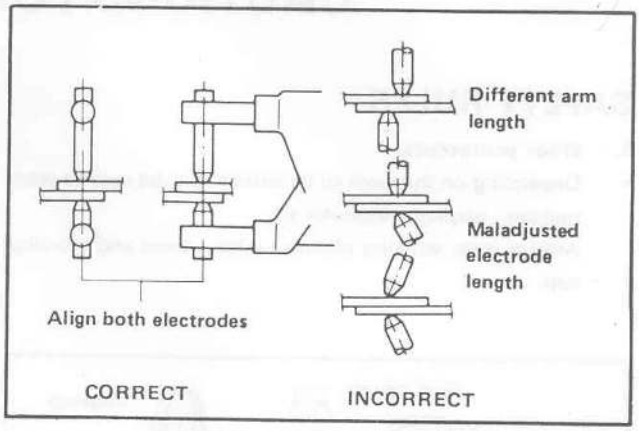
a) Keep the arm as short as possible in order to obtain welding maximum pressure.

b) Tighten arm and tips securely so they do not get loose during soldering operations.



(2) Electrode alignment.

Align ends of upper and lower electrodes. A misalignment of electrodes generates insufficient pressure of soldering points and, as a consequence, insufficient strength of the actual points.

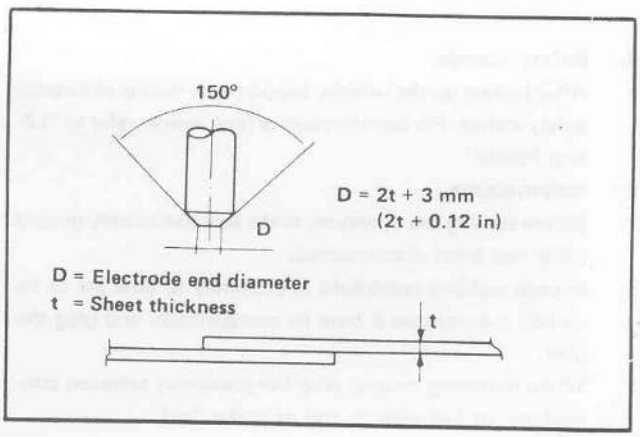


(3) Electrode end diameter.

It is necessary to carefully verify diameter of electrode ends in order to obtain the required welding strength.

Before starting work, make sure that end diameter (D) has a value proportional to sheet thickness.

Remove burnt and foreign matters from electrode ends.



2. **Condition and preparation of panels to be soldered.**

If the surface of the parts to be welded presents gaps, paint film, rust or dust, this prevents welding current flow, thus reducing soldering area and, as consequence, strength of welding spot.

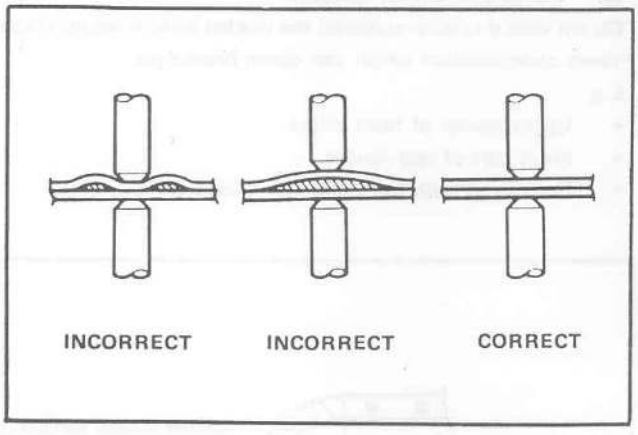
Before starting to weld verify conditions of the parts to be welded, carrying out proper corrections.

(1) Clearance between the parts to be welded.

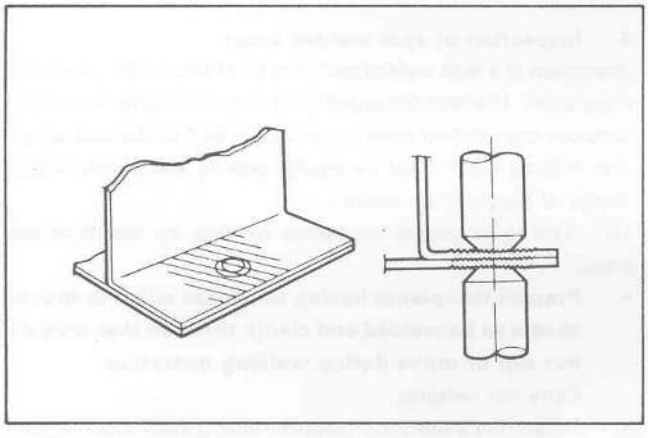
Presence of any clearance between surfaces to be welded, causes reduction of current flow. The welding thus obtained, is insufficient and poor in strength.

Before carrying out soldering, match the surfaces and, when necessary, tighten them by means of a clamp.

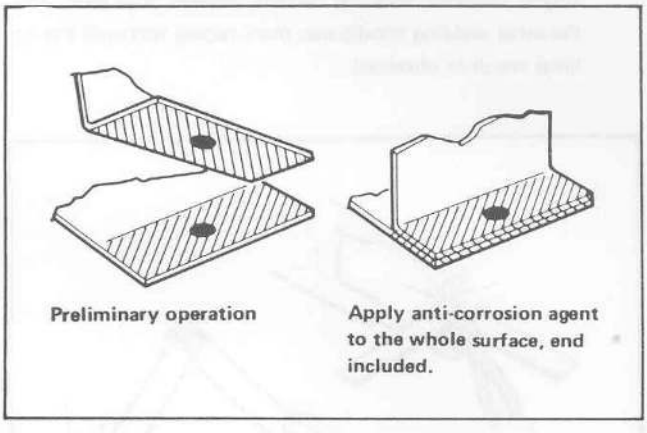
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(2) Welding of metal surfaces.
Prepare the surfaces to be welded, removing all impurities and foreign matters (paint, dust, rust) in order to obtain perfect welding.

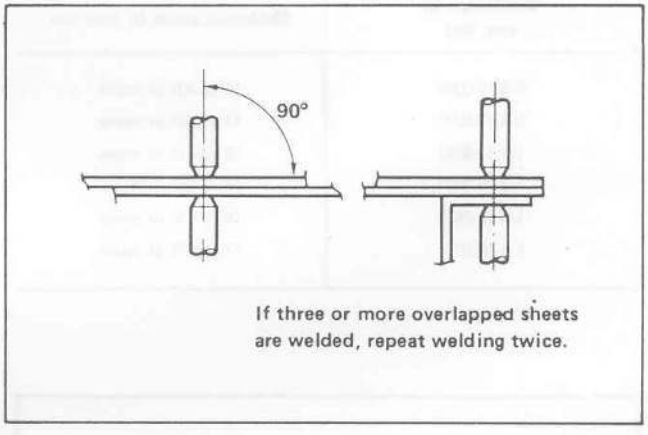


(3) Anti-corrosion procedure applicable to all metal surfaces.
Coat the surface to be welded with a high conductivity anti-corrosion agent. This should also be applied to end of surface to be welded.



3. Cautions during spot welding.
(1) Spot welding selection.
Use the direct welding method (for the parts this method can not be applied to, use the MIG welding method).

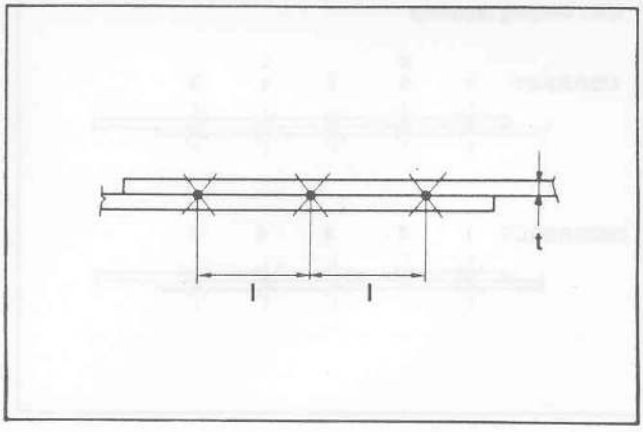
(2) Electrode installment.
Operate so that the sheet forms a right angle with the electrodes, otherwise current flow will be low and the welding strength obtained insufficient.
(3) Welding of three or more overlapped sheets. In the areas where three or more sheets are overlapped, spot welding must be repeated.



If three or more overlapped sheets are welded, repeat welding twice.

(4) Number of spot welding points.
Generally, efficiency of spot welders available in the Repair Shop is lower than efficiency of spot welders used at the Factory. As a consequence, the number of spot welding points performed at the Service Shop should be increased by 20 - 30% with respect to weldings performed at the Factory.
(5) Minimum welding pitch.
The minimum welding pitch depends on the thickness of the sheet to be welded. Generally, the values provided in the following table should be observed.

Thickness (t) mm (in)	Minimum pitch (l) mm (in)
0.6 (0.024)	10 (0.39) or more
0.8 (0.031)	12 (0.47) or more
1.0 (0.039)	18 (0.71) or more
1.2 (0.047)	20 (0.79) or more
1.6 (0.063)	27 (1.06) or more
'1.8 (0.071)	31 (1.22) or more



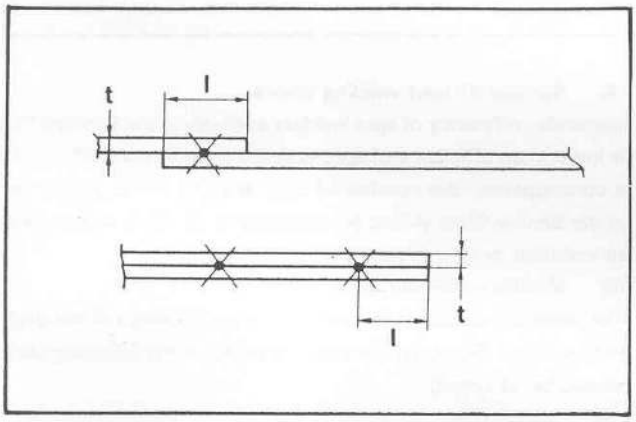
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It is important not to excessively reduce pitch, as this may cause current to flow through the surrounding points and therefore a reduction of welding strength.

(6) Welding spot position from panel edge.

In the event of welding in proximity to panel edge, comply with dimensions provided in the following table.

Thickness (t) mm (In)	Minimum pitch (l) mm (in)
0.6 (0.024)	11 (0.43) or more
0.8 (0.031)	11 (0.43) or more
1.0 (0.039)	12 (0.47) or more
1.2 (0.047)	14 (0.55) or more
1.6 (0.063)	16 (0.63) or more
1.8 (0.071)	17 (1.67) or more

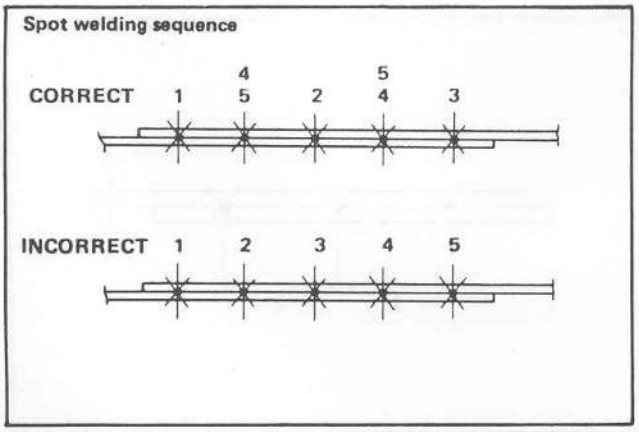


A welding too near the panel edge has not enough strength; besides the sheet can get strained.

(7) Spot welding sequence.

Do not perform continuous spot welding along one direction only. This method generates a weak welding due to the current shunt effect.

Each time electrode ends get overheated or change their color, stop welding and allow ends to cool.

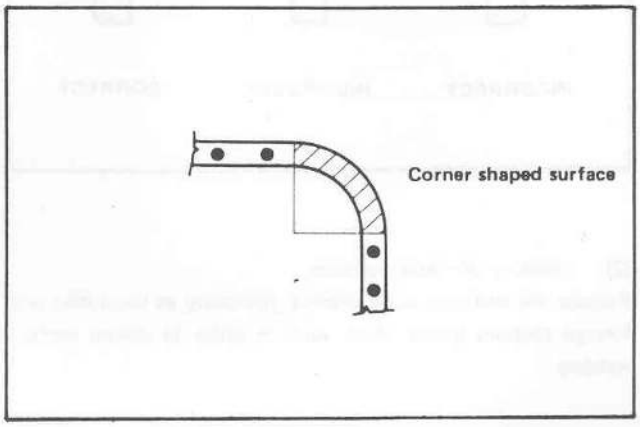


(8) Welding on corner surfaces.

Do not weld on corner surfaces; the welded surface results under stress concentration which can cause breakages.

E.g.:

- Upper corner of front pillars.
- Front part of rear fender.
- Corners of both front and rear windows.



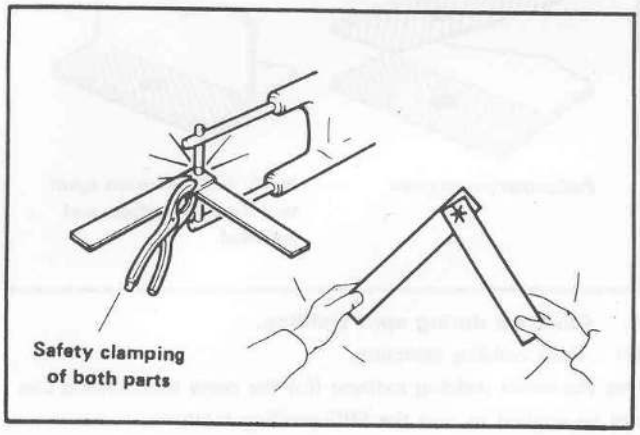
4. Inspection of spot welded areas.

Inspection of a spot welded part, can be of two types: visual and destructive. It is recommended to carry out the latter type of inspection both before welding operation and at the end of it.

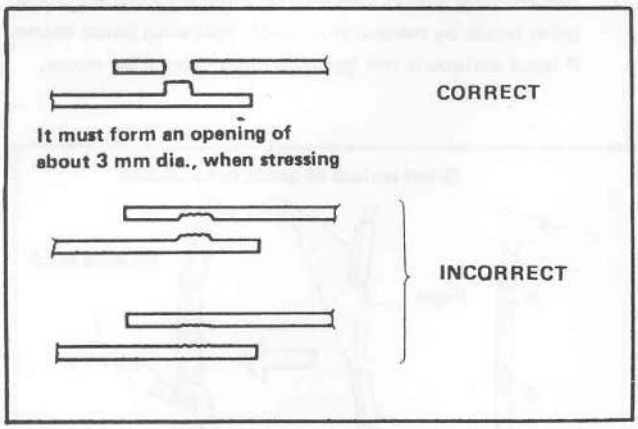
The welding spots must be equally spaced and positioned on center of flange to be welded.

(1) Test to be carried out before welding, by means of test piece.

- **Prepare test pieces having thickness equal to that of sheets to be welded and clamp them so that they do not slip or move during welding operation.**
  Carry out welding.
- Detach the welded test pieces by letting them rotate around welding point and verify the breakage areas. The whole welding spot must remain on one of the two sheets while, in the other corresponding one, there must be a circular opening.
  If not so, welding conditions are incorrect.
  Adjust pressure, welding current, current flow time, and, the other welding conditions; then, repeat test until the optimal result is obtained.

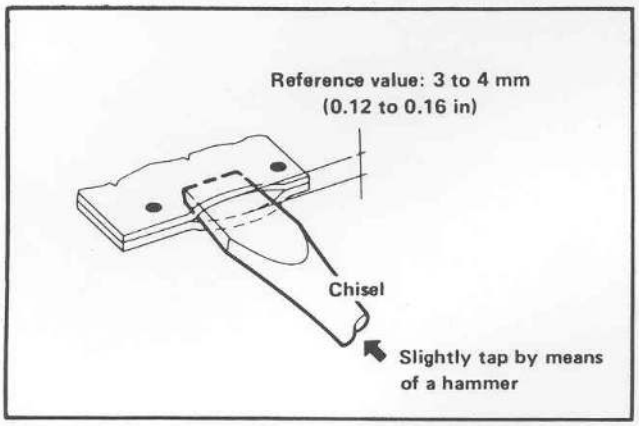


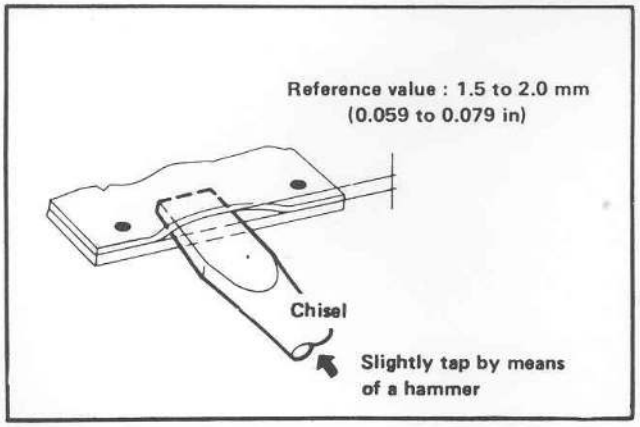
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(2) Test to be carried out after welding, by means of hammer and chisel.

- Insert tip of a chisel between the welded sheets and slightly tap on chisel until, between sheets, a 3 to 4 mm clearance (0.12 to 0.16 in, is obtained); if, on the welded part, no strain is present, test result is then positive.
- If sheet thickness is not equal, clearance between sheets must be limited to 1.5 to 2 (0.059 to 0.079 in).
  Take into account that the above value is only a reference one.
- **The mentioned clearance changes according to position of welding spots, flange length, welding inclination and other factors.**
  Never exceed this limit in order not to cause detachment of welding points.
- After test, make sure that the strained part is repaired.





MIG welding

1. Conditions of panel to be welded.

By means of belt sander or wire brush, remove any foreign matter from surface.

Paint films, rust or oils present on sheet surface, cause a decrease in welding strength, thus generating blow holes.

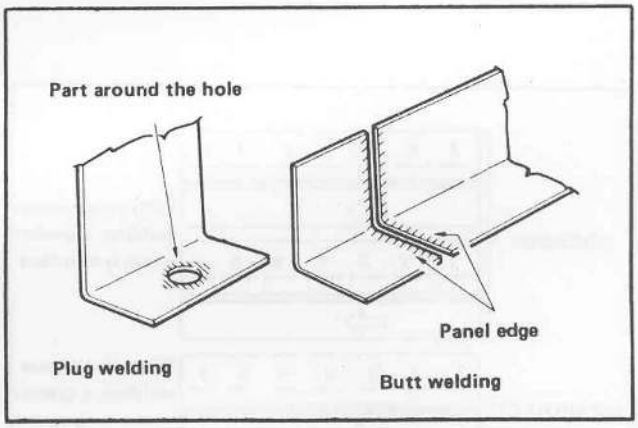
2. Cautions during welding operations.

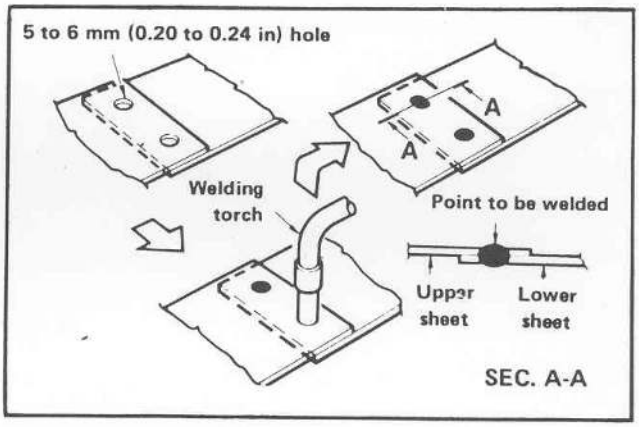
(1) Plug welding (of pre-established holes).

a) Make a hole, having 5 to 6 mm diameter (0.20 to 0.24 in) on one of the two sheets to be welded, then match the two sheets and clamp them.

b) Position the torch at right angles with respect to sheet, then fill metal into the hole.
Each time welding is stopped, on the surface an oxide film is formed which causes blow holes. If this occurs, remove oxide by means of a wire brush.

c) Make sure that welding between upper and lower sheet is perfect.

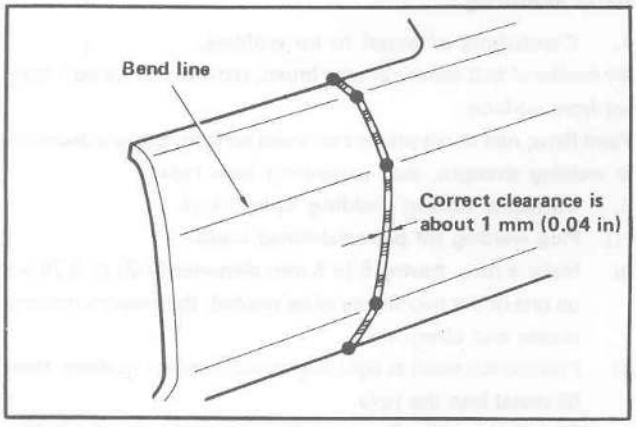




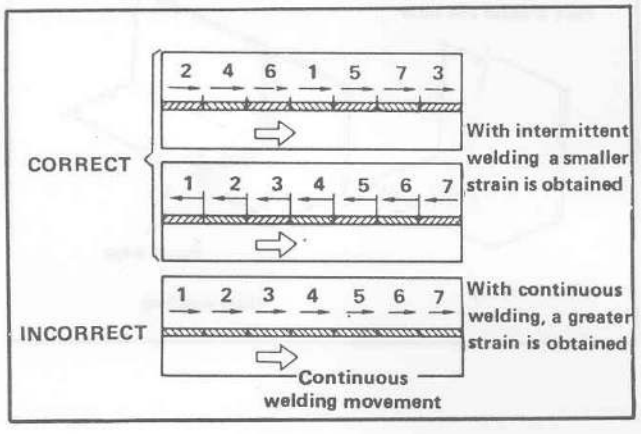
(2) Butt welding.

a) By means of intermittent weld, tack the two surfaces to be welded in order to prevent strains and align the two surfaces, then, fill in the spaces by placing small welding beads.

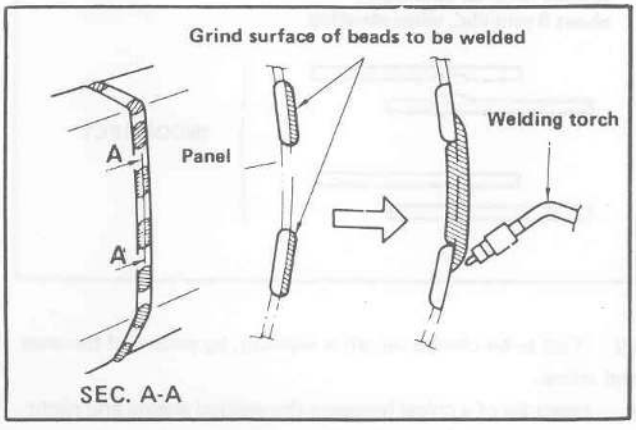
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b) Do not perform long weld line: it may cause strains. Proceed as shown in figure in order to reduce strain.



c) Before filling spaces between intermittently placed beads, grind beads by means of a sander following panel shape. If bead surface is not ground, blow holes may occur.



3. Welding inspection.

The inspection procedure is similar to the spot welding one.

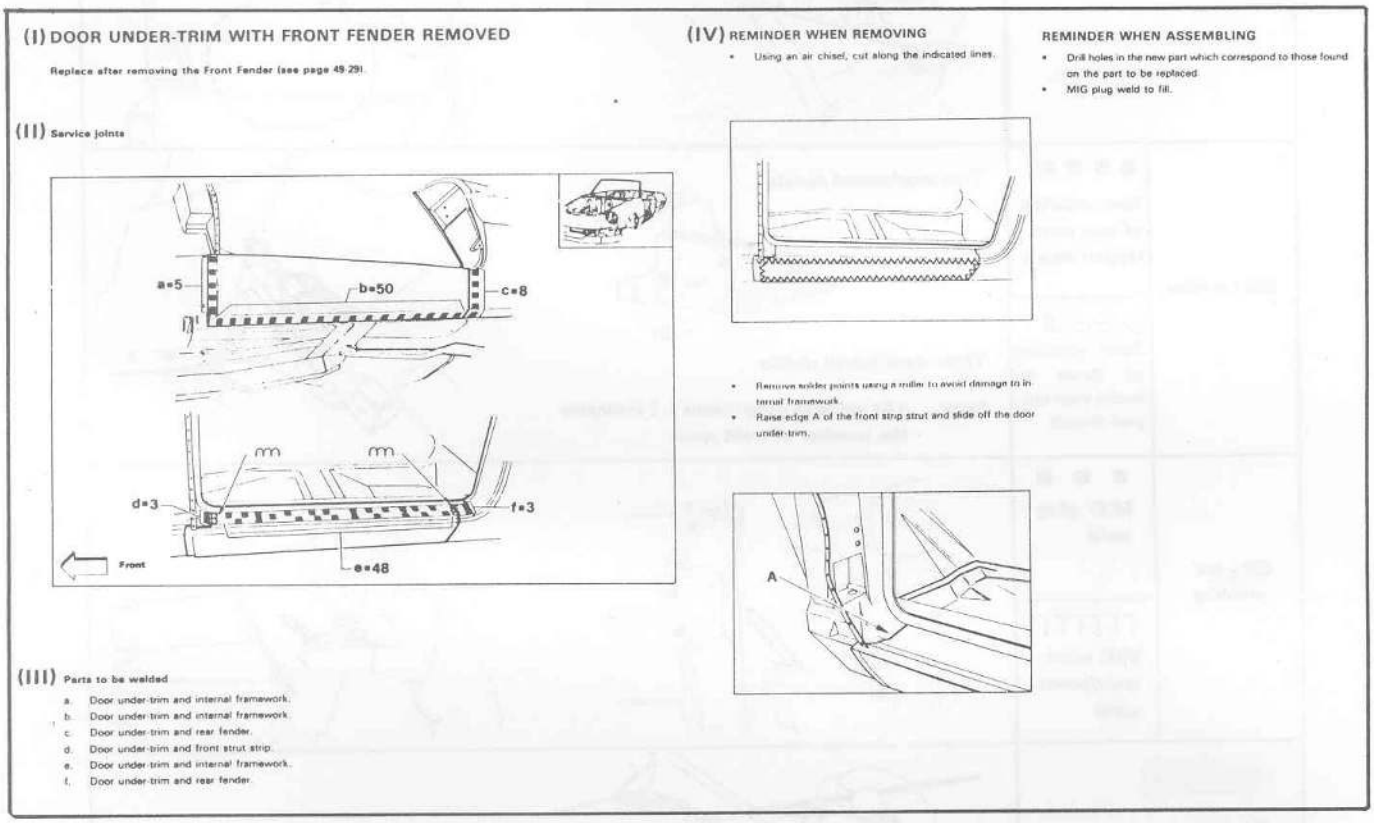
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REPLACEMENT OPERATIONS

HOW TO READ THIS CHAPTER

Spare parts of the sheet metal panels of body, will not necessarily be supplied as shown in the figures below.

The formulation of the present part of the manual is uniform for all the replacement operations. For its structure, refer to the following example.



In detail:

(I) DOOR UNDER-TRIM WITH FRONT FENDER REMOVED.

In the title the element to be removed is indicated (hoodledge) specifying, if required, the operative condition (in this case, radiator on core support removed). If the element is not in the required conditions, it is necessary to execute preliminary removal of the other components; in the present case, it is necessary to remove the radiator core support, referring to the specific replacement procedures.

(II) "SERVICE JOINT"

Any information concerning the welding operations to be carried out is shown in the figure indicating the welding method and the spot numbers, together with accurate location of spots on the elements to be joined.

Example: a • 3 — Welding spot number
- Welding type (spot welding: see symbology on page 49-16)
- Parts to be welded

The parts represented by chain line, point out the components which are to be removed or for which preliminary removal is required according to step (I).

(III) PARTS TO BE WELDED

A list is provided relevant to the components which are to be welded using the methods indicated in step (II).

(IV) REMINDER WHEN REMOVING/ASSEMBLING

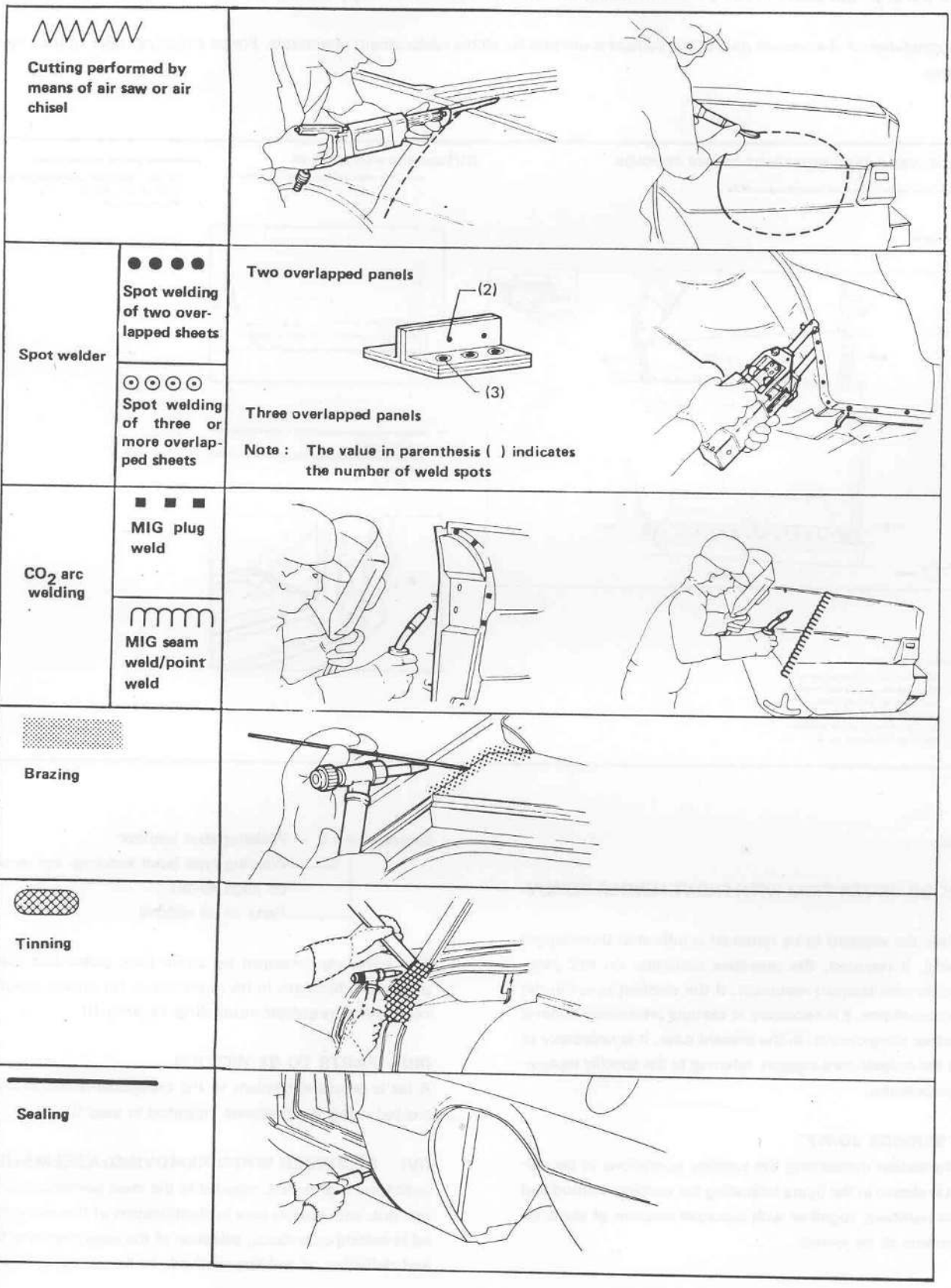
Indication is provided, relevant to the main operations to be carried out, with special care in identification of the areas concerned in cutting operations, selection of the equipments to be used and definition of welding methods to be adopted.

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SYMBOLOGY

CUTTING AND WELDING/BRAZING OPERATIONS

The symbology used for the cutting and welding/brazing operations is shown in the following figures.



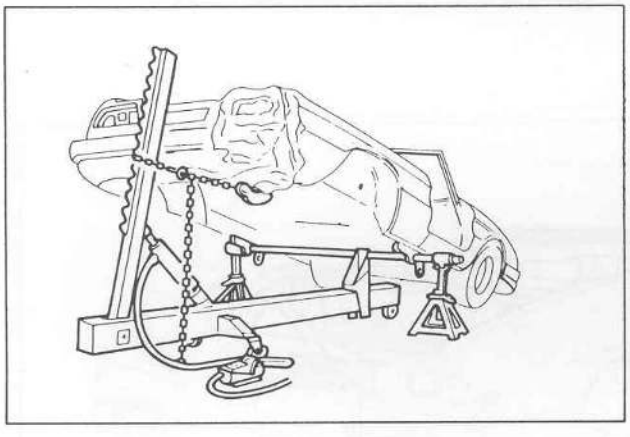
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REMOVAL AND INSTALLATION PROCEDURES

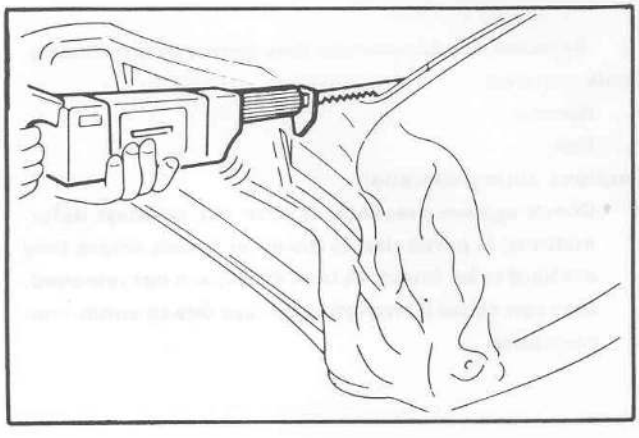
COMPONENT REMOVAL

(1) Make sure that all the damaged parts have been detected, by measuring the installation main dimensions.
Refer to "Body Alignment" drawing.
Tools required:
- Centering gauge
- Tracking gauge
- Convex rule
- Rack-and-lever jack or car lift.

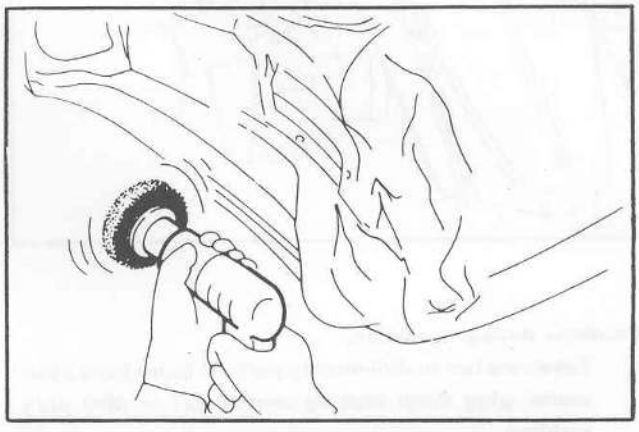
(2) With a body-frame repair system, carry out draw operations, depending on deformation condition. Reuse of the reclaimable parts must be performed in accordance with the figures contained in "Body Alignment".
Caution during operation:
- **Carefully secure drawing chains to body and equipment, so as to prevent accidental release during operation execution.**
- **Apply draw stress in the direction opposite to collision.**



(3) Cut-off damaged parts.
Tools required:
- Air saw
- Air chisel

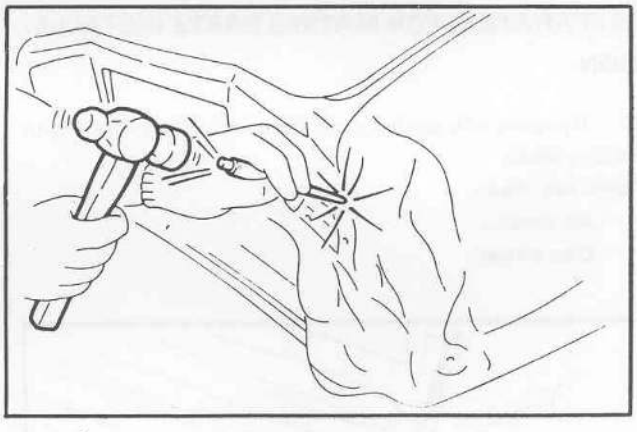


(4) If welding spots are not visible, remove paint by means of rotary wire brush.
Tools required:
- Rotary wire brush.



(5) Punch all the welding spots in order to make centering of a drill.
Tools required:
- Hammer.
- Center punch.

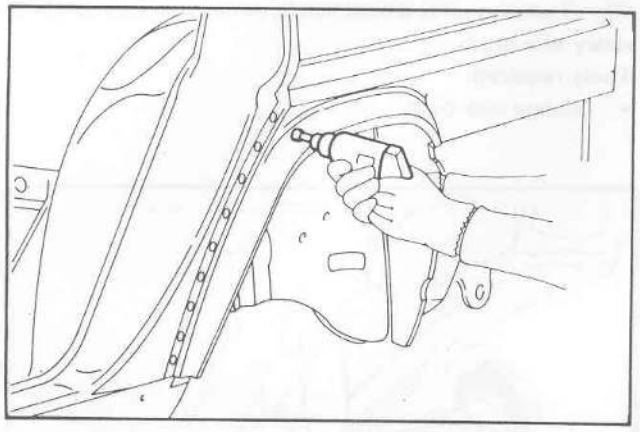
Caution during operation.
- **Punch deeply in the center of each welding spot. A non-centered punch does not allow complete cut of nugget. Besides, a shallow marked hole location does not allow a reliable drive of drill.**
- **As a rule, punching must be executed from sides of the components that are to be removed.**



(6) Remove welding spots by means of a spot cutter or an air drill.
Tools required:
- Spot cutter.
- Air drill.

Caution during operation:
- **Use a drill speed of about 1000 r.p.m. in order to obtain the best results.**

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Cautions during operation:

- Take care not to drill mating parts. If holes have been made, plug them making use of gas or MIG plug welding.
  Presence of holes, decreases strength of the concerned component, besides, it may cause water leakage.
- When, for new components, holes already drilled in welded parts are used (as per those of the spot welding) make use of a drilling machine having small diameter drill (below 8 mm (0.31 in)) and complete welding as soon as possible.

(7) By means of a chisel remove the remaining spot welding parts.

Tools required:

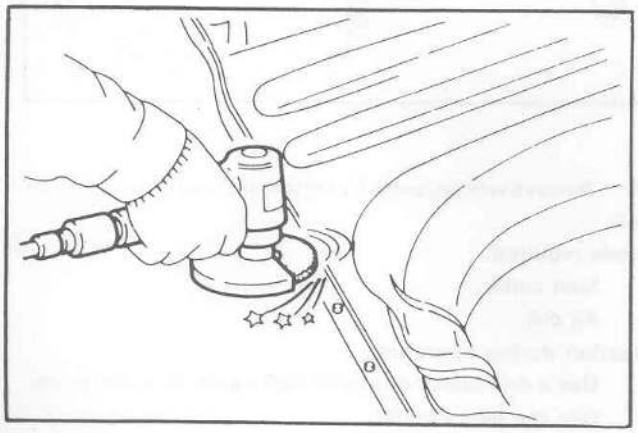
- Chisel.
- Hammer.

PREPARATION FOR MATING PARTS INSTALLATION

(1) By means of a sander, grind sheet in correspondence with welding spots.

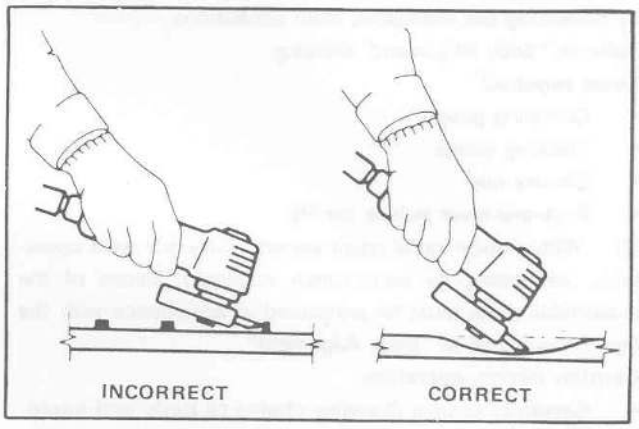
Tools required:

- Air sander.
- Disc sander.



Cautions when grinding.

- Take care not to cut much on base metal: this may cause decrease in sheet thickness and, therefore welding strength.



- Carefully remove iron powder from the surfaces which have been ground and from surrounding areas.
  Presence of iron powder causes decrease of welding efficacy and can also start corrosion.



(2) By means of a hammer and dolly correct deformed areas.

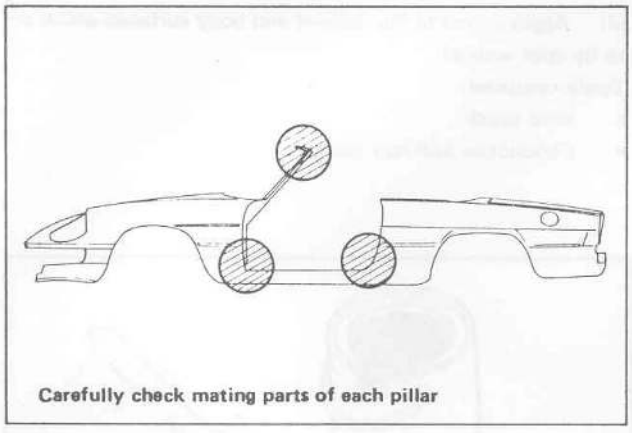
Tools required:

- Hammer.
- Dolly.

Cautions during operation:

- Check against presence of even the smallest deformations, in particular, in the inner panels where they are hard to be found. In fact, if they are not removed, they can cause a strength decrease due to stress concentration.

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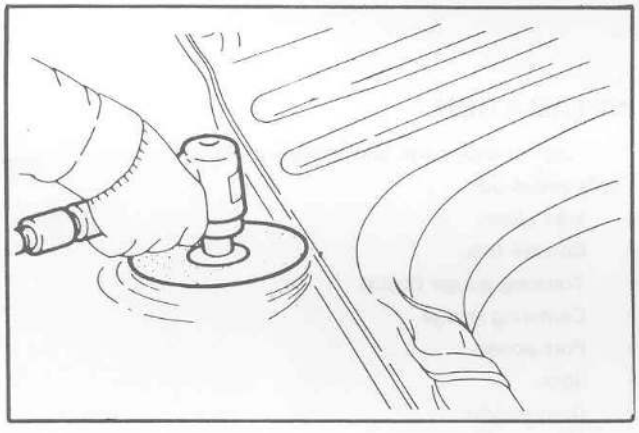


Carefully check mating parts of each pillar

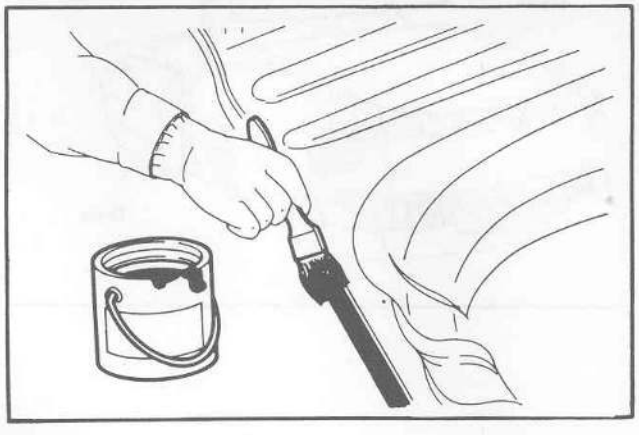
(3) Remove paint from welding edges.

Tools required:

- Belt sander.
- Disc sander.



(4) Apply primer to edges of new components and of body panels which are to be welded.



Before welding apply conductive antirust paint on edges of all sheet parts which are to be assembled.

Recommended paint:
Norm. 3540-44401
SAVID: Zincovid No. 7949
SCHRAM LACK: Extrinum Punktschweifarbe
GLASURIT: Glassomax 7 F 4625 (red color)*

*** To be used with catalyst Glassomax Harter 965-7/1 in the proportion 1:10 (Norm. 3541-20003).**

Panels must be welded within 15 minutes of the paint application (air drying time of paint film).

The film thickness after drying must be 0.005 to 0.025 mm (2 to 9.8) 10^{-4} in.

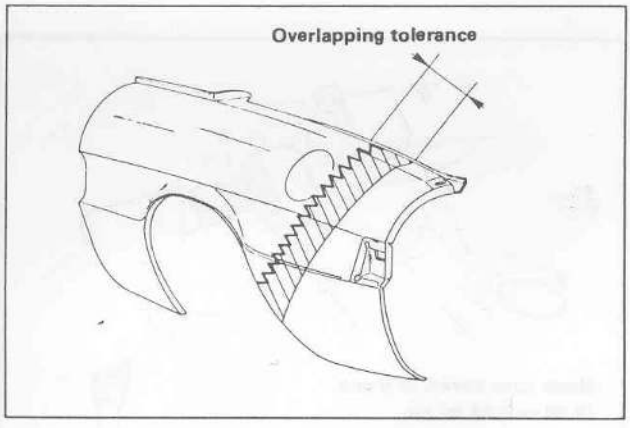
PREPARATION FOR NEW COMPONENT INSTALLATION

(1) If a partial replacement is to be carried out, it is necessary to maintain an overlapping tolerance of about 50 mm (1.97 in) during cut off non-usable sheets, in order to have a sufficient mating surface.

Tools required:

- Air saw.
- Hack saw.
- Tracking gauge.
- Convex rule (or equivalent).

It is recommanded always to use genuine spare parts. This ensures a perfect repair and restoration of vehicle functioning.



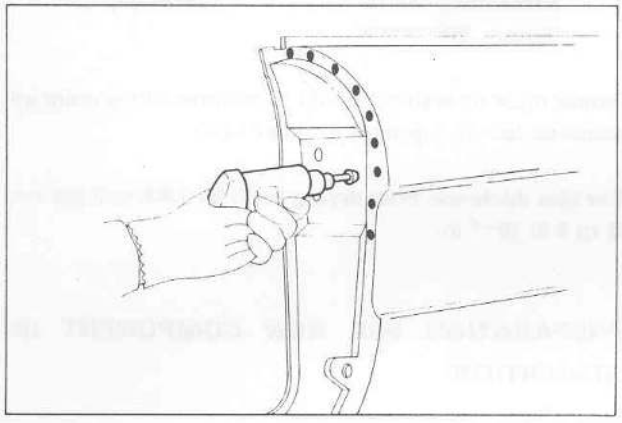
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(2) MIG plug weld.

This method must be used for those areas which can not be reached by spot welder. To carry out this operation, drill, in the welding spots, making holes having 5 to 6 mm (0.20 to 0.24 in) dia.

Tools required:

- Puncher.
- Air drill.



(3) Remove paint from components to be welded.

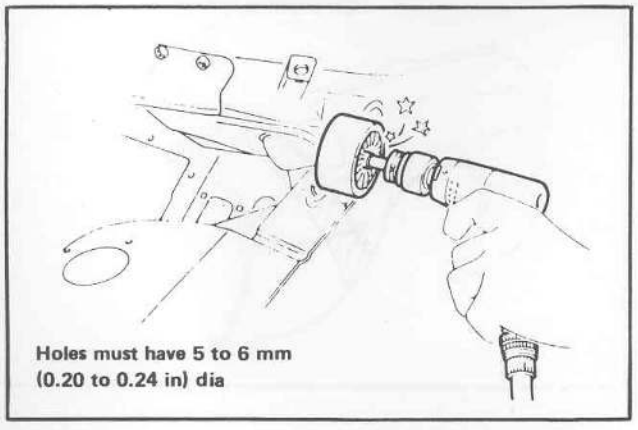
Tools required:

- Belt sander.
- Disc sander.

Cautions during operation:

- **Remove paint from both sides of components that are to be welded, such as the surfaces to be spot welded, spot welding rims and edges of surfaces to be butt welded.**

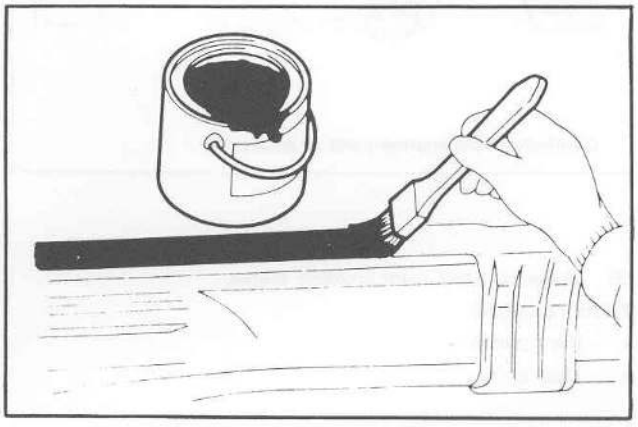
  Residual paint prevents current flow into spot weldings, with consequent poor strength of spot. It can also cause depressions in the plug MIG welding.



(4) Apply primer to component and body surfaces which are to be spot welded.

Tools required:

- Wire brush.
- Conductive anti-rust paint.

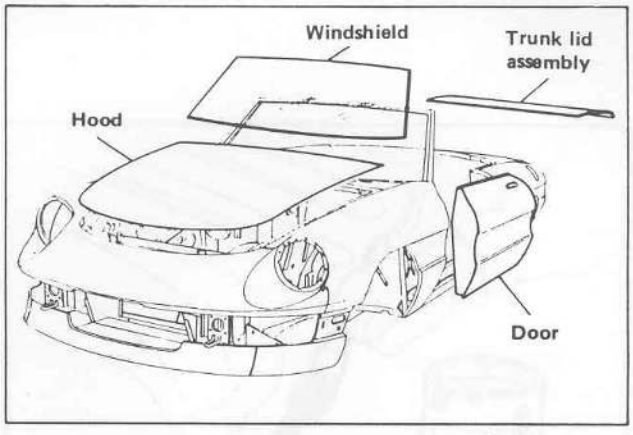


INSTALLATION

(1) New service parts temporary installation.

Tools required:

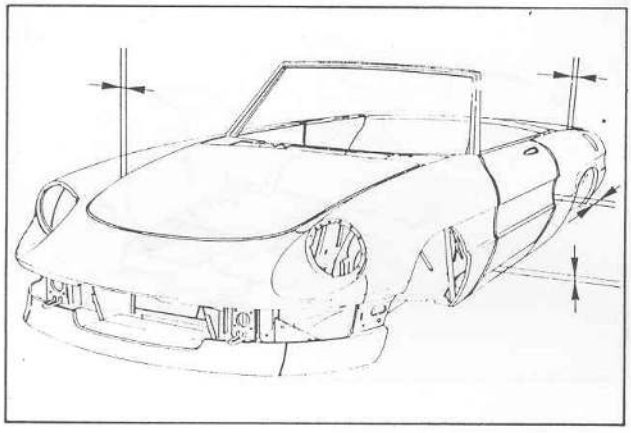
- Vise pliers.
- Convex rule.
- Tracking gauge (sight).
- Centering gauge.
- Port power.
- Jack.
- Spot welder.
- Mig welder.



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Cautions during operation:

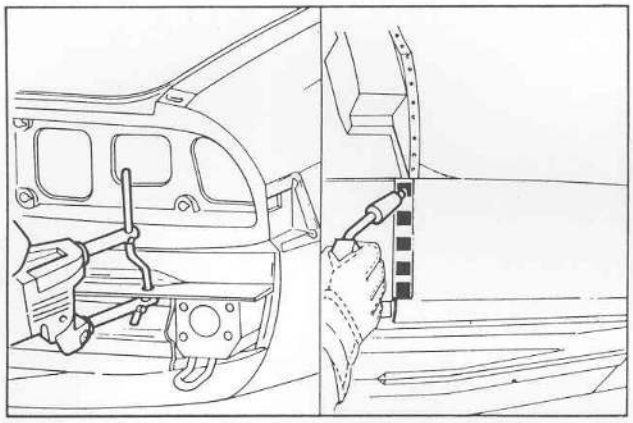
- **Position components as per figures provided in "Body Alignment". Into body compartments, install the movable parts (i.e. windshield, doors, hood, backdoor) in order to carry out check of clearances, grades and parallelism. If necssary, adjust sheets until correct alignment is obtained.**
- **Clamp parts to be welded by means of pliers and some welding spots.**



(2) Execution of the required weldings.
Carry out welding complying with specifications provided in "Cautions during Welding".

Tools required:

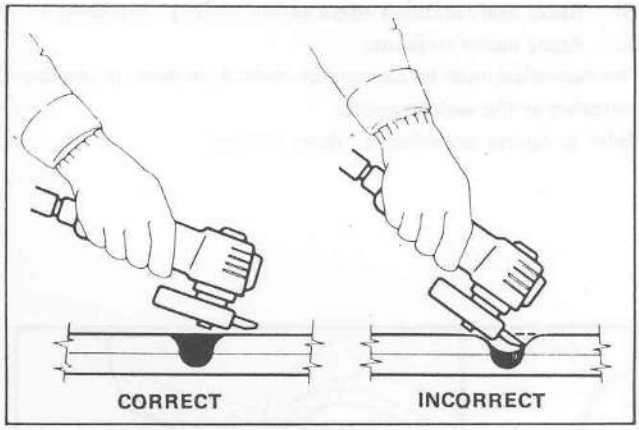
- Spot welder.
- MIG welder.
- Autogenous welder.



(3) Grind MIG welding by means of a sander machine.

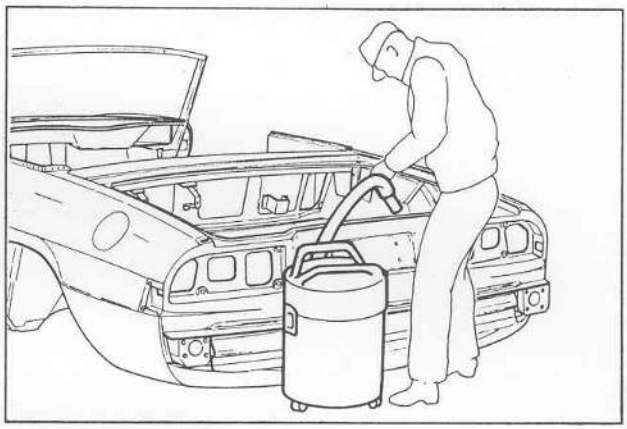
Tools required:

- Air sander.
- Disc sander.

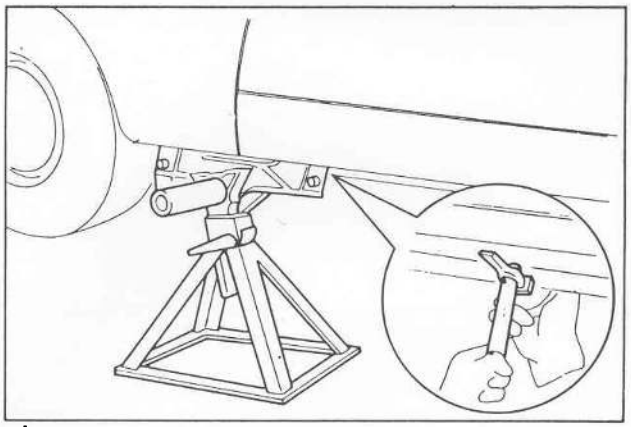


Cautions during operation:

- **Take care not to grind excessively on spot weldings: this may cause a decrease in sheet thickness and, consequently, welding strength.**
- **Remove iron powder from ground surfaces and surrounding areas.**
  Presence of iron powder causes decrease in welding efficacy and can also generate corrosion.



(4) After welding execution, remove clamps used for securing edges and remove possible dinging.

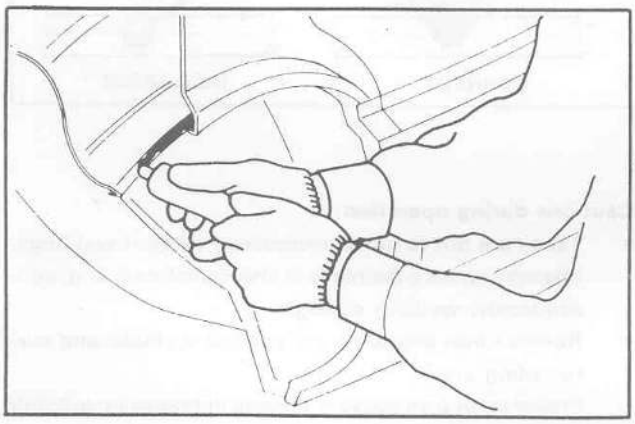


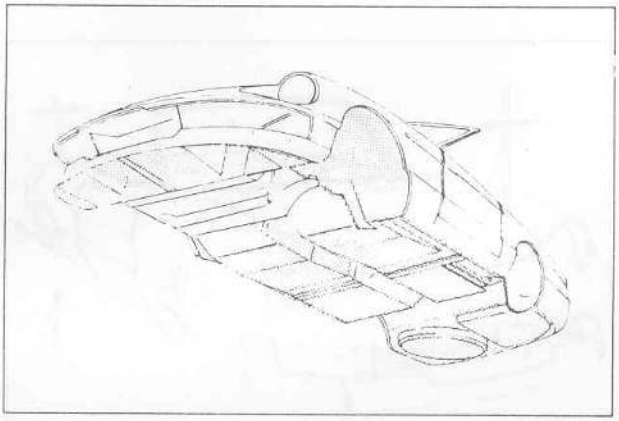
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(5) Apply anti-corrosion agent to the welded components.
(6) Apply sealer to joints.
This operation must be carried out carefully in order to prevent corrosion in the welded joints.
Refer to figures provided in "Body Sealing".

(7) For under body protection, apply a coat having 4 mm (0.16 in) thickness.

Antidrum: Norm. 3523-00001
Alternatives: 3M
Body Plast 8874 E
Body Schutz 8864 E
IVI Grey protective acrylic 854751

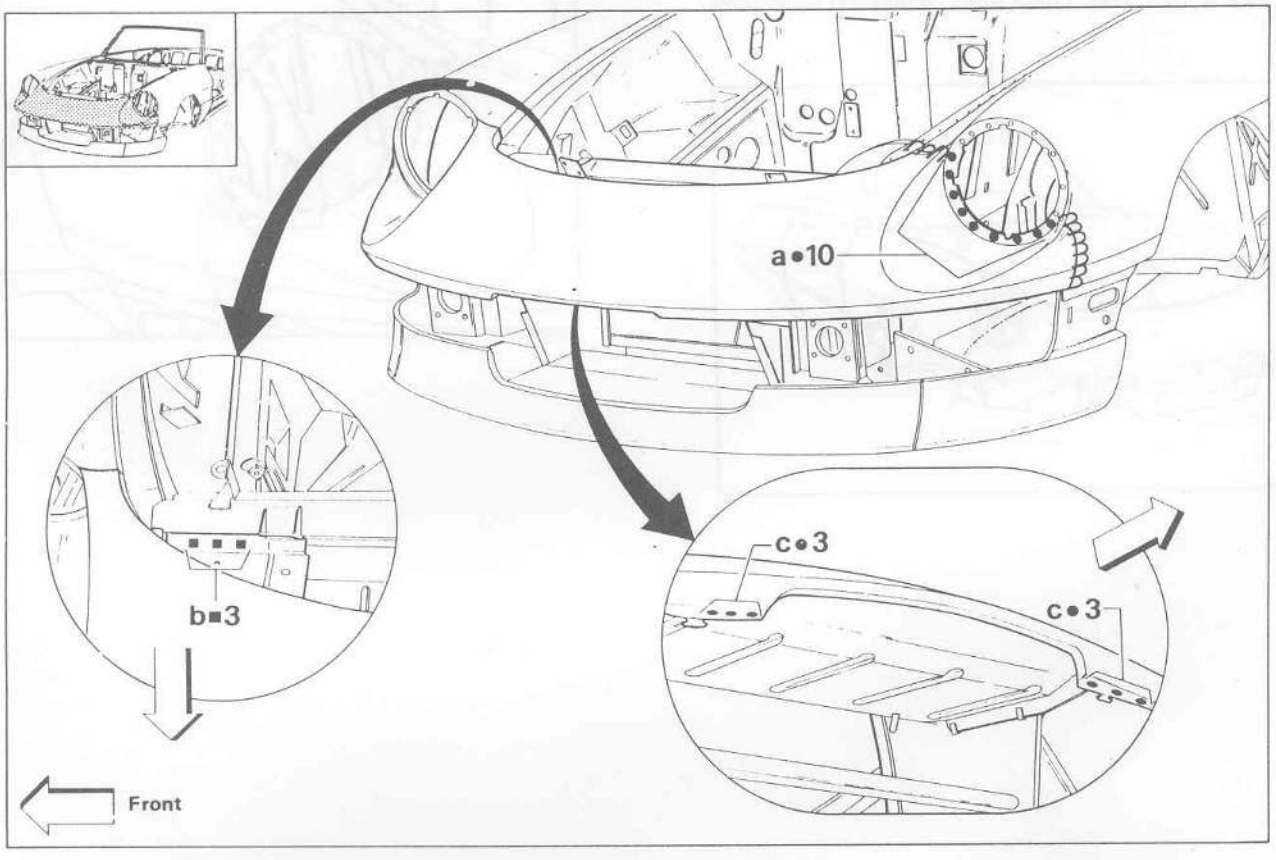




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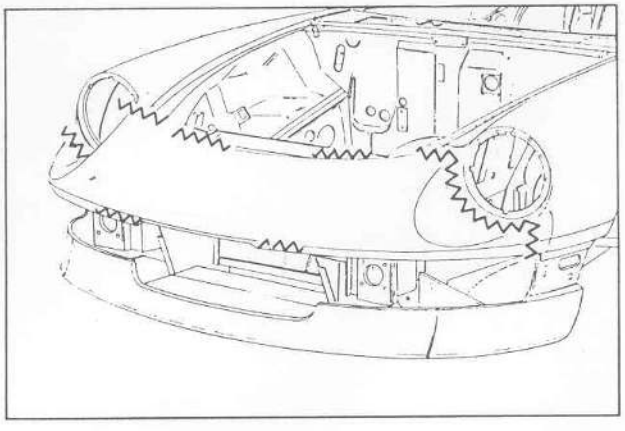
FRONT PANEL

Service joints



Parts to be welded

a. Front panel and headlight rim.
b. Front panel and cross bar.
c. Front panel and upper feeder.



REMINDER WHEN REMOVING

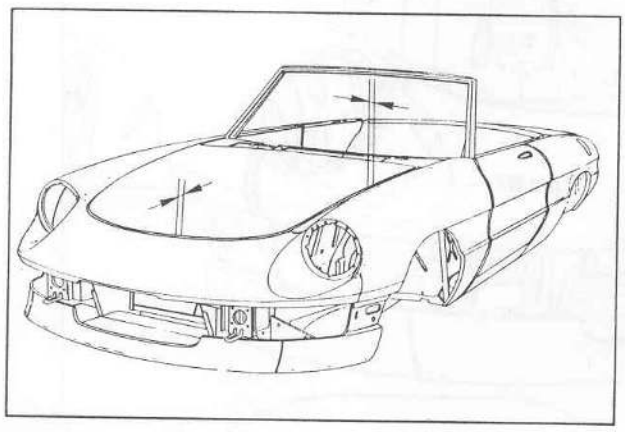
- Cut along the lines indicated using an air saw or chisel.

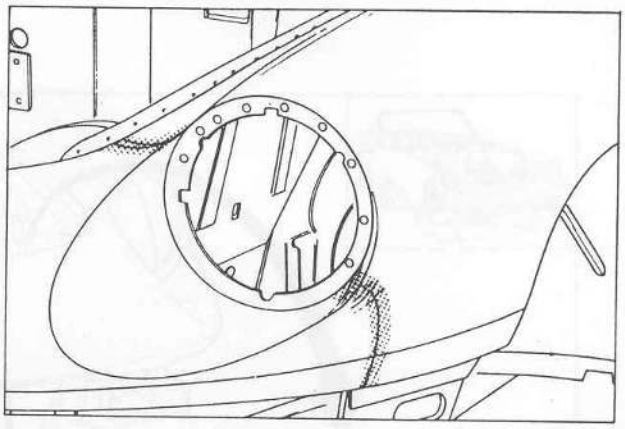
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- When cutting in the areas adjacent to the headlight housing maintain a slight distance from the front fender.
- Copper wire solder the areas indicated, tin and finish off.

REMINDER WHEN ASSEMBLING

- Temporarily secure the front panel with holdfasts and assemble the front hood. Check lights, angles and parallelisms.

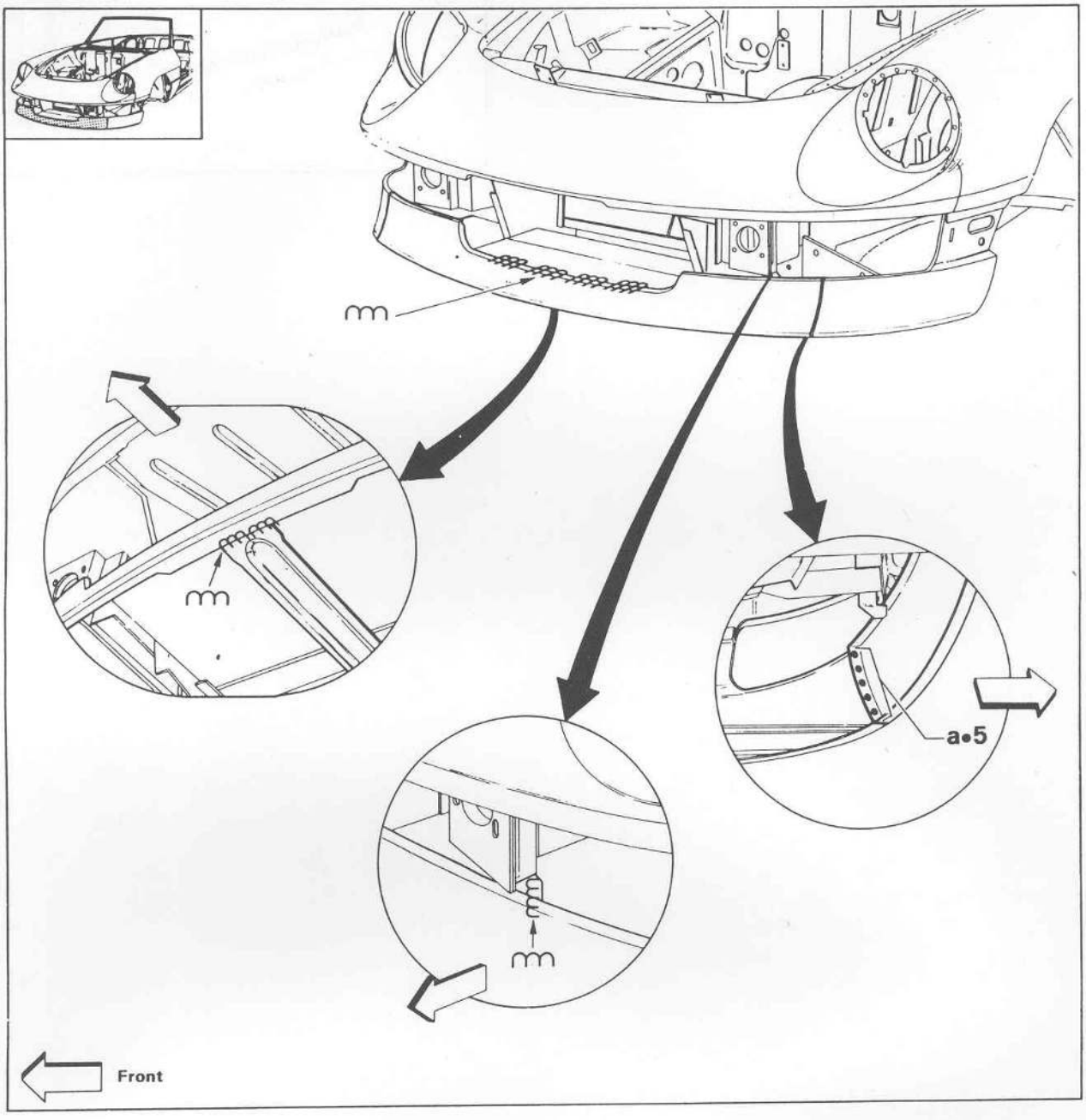




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FRONT CENTRAL SPOILER

Service joints



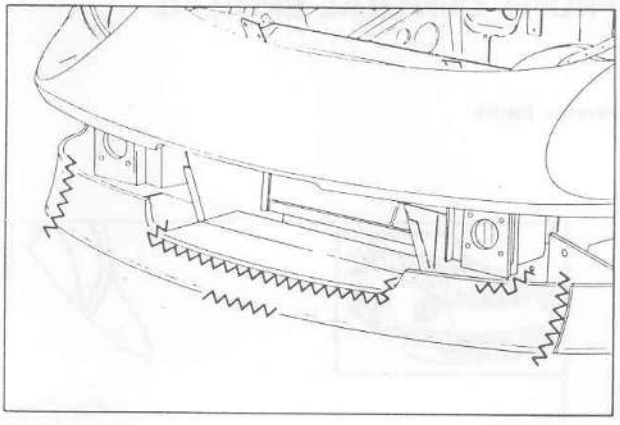
Parts to be welded

a. Front central spoiler and front side spoiler.

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REMINDER WHEN REMOVING

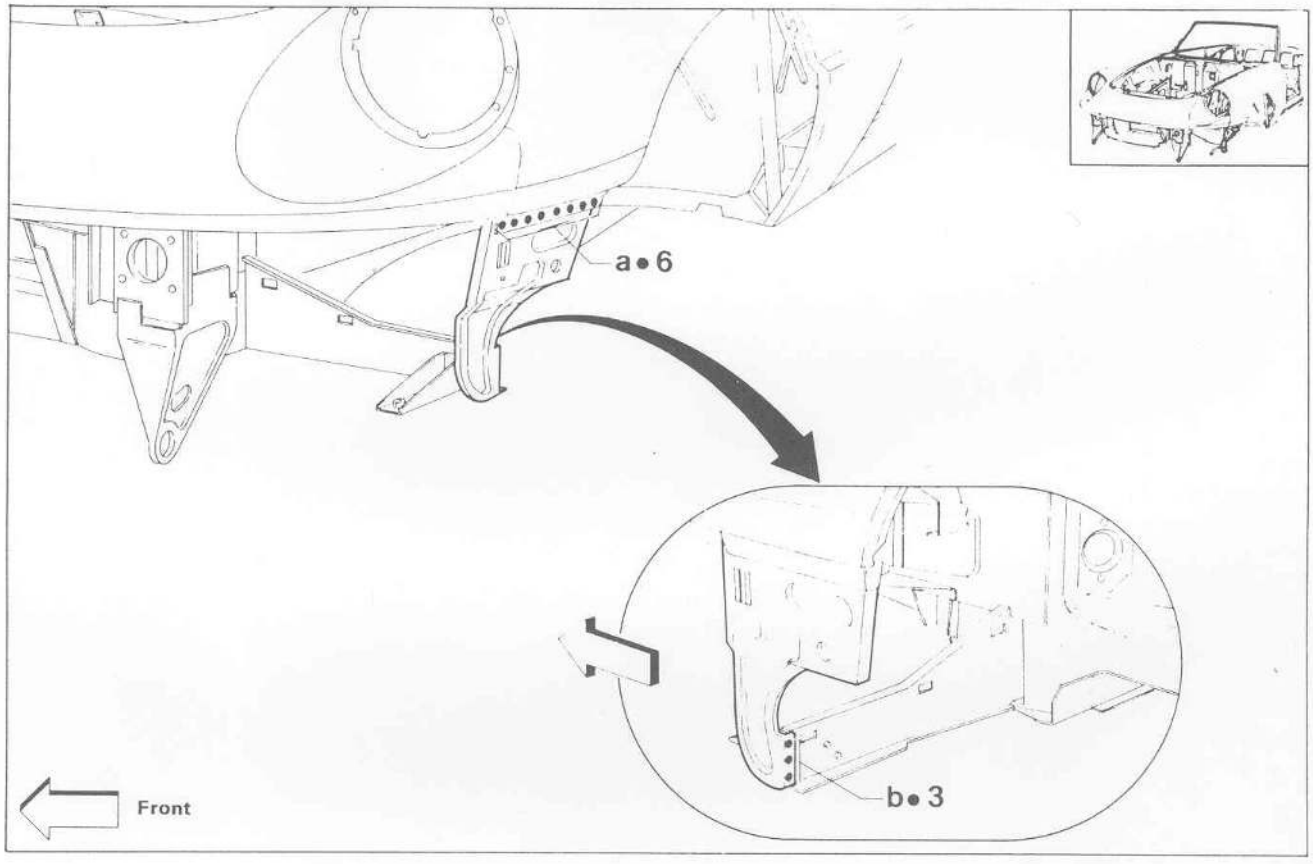
- Cut along the lines indicated using an air saw or chisel.



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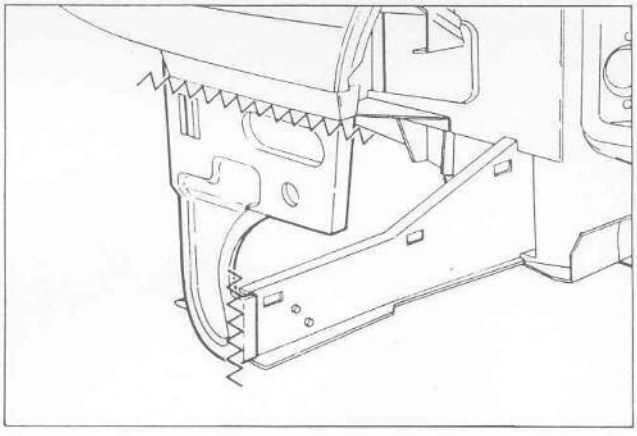
FRONT BUMPER SIDE BRACKET Spider

Service joints



Parts to be welded

a. Bumper side bracket and front fender.
b. Bumper side bracket and joint plate.



REMINDER WHEN REMOVING

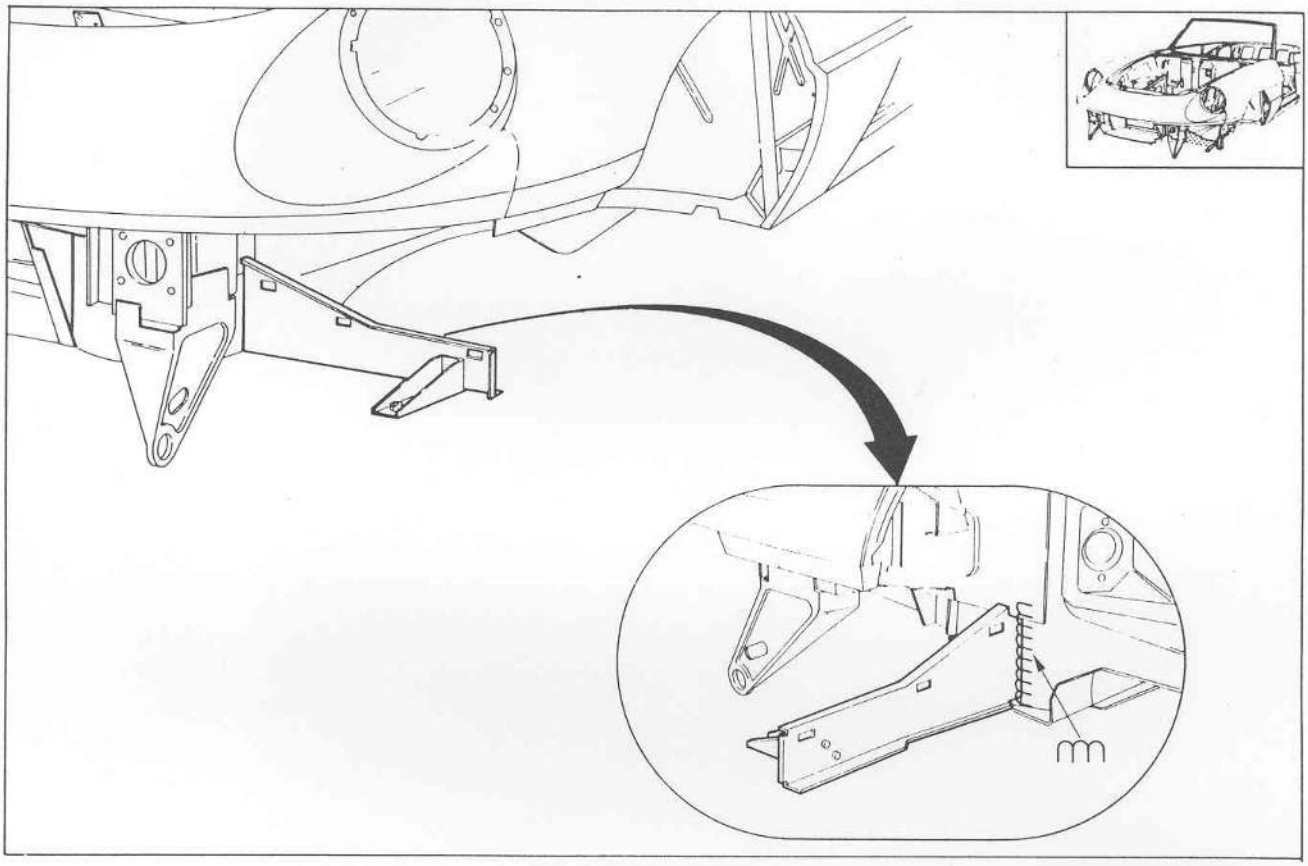
- Cut along lines indicated using an air saw or chisel.

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JOINT PLATE WITH FRONT BUMPER SIDE BRACKET REMOVED

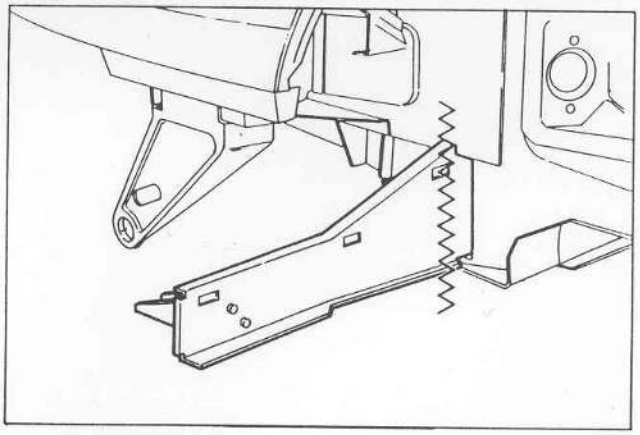
Spider

Service joints



REMINDER WHEN REMOVING

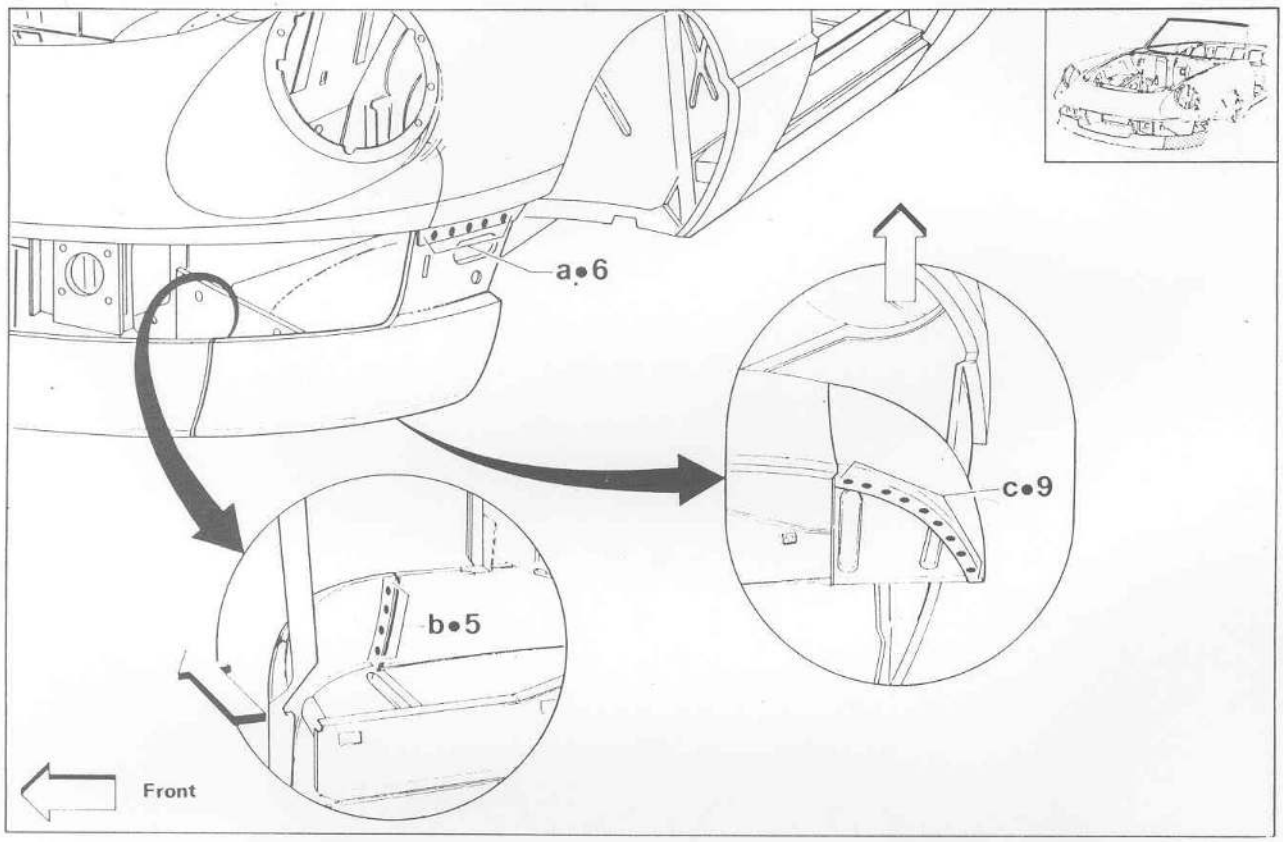
- Cut along lines indicated using an air saw or chisel.



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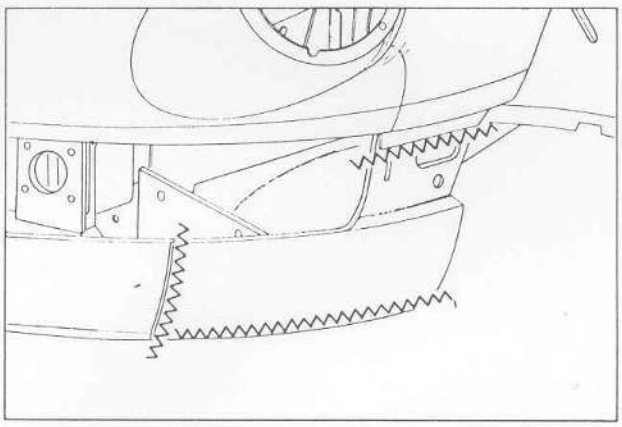
FRONT SIDE SPOILER

Service joints



Parts to be welded

a. Front side spoiler and front fender.
b. Front side spoiler and front central spoiler.
c. Front side spoiler and lower guard.



REMINDER WHEN REMOVING

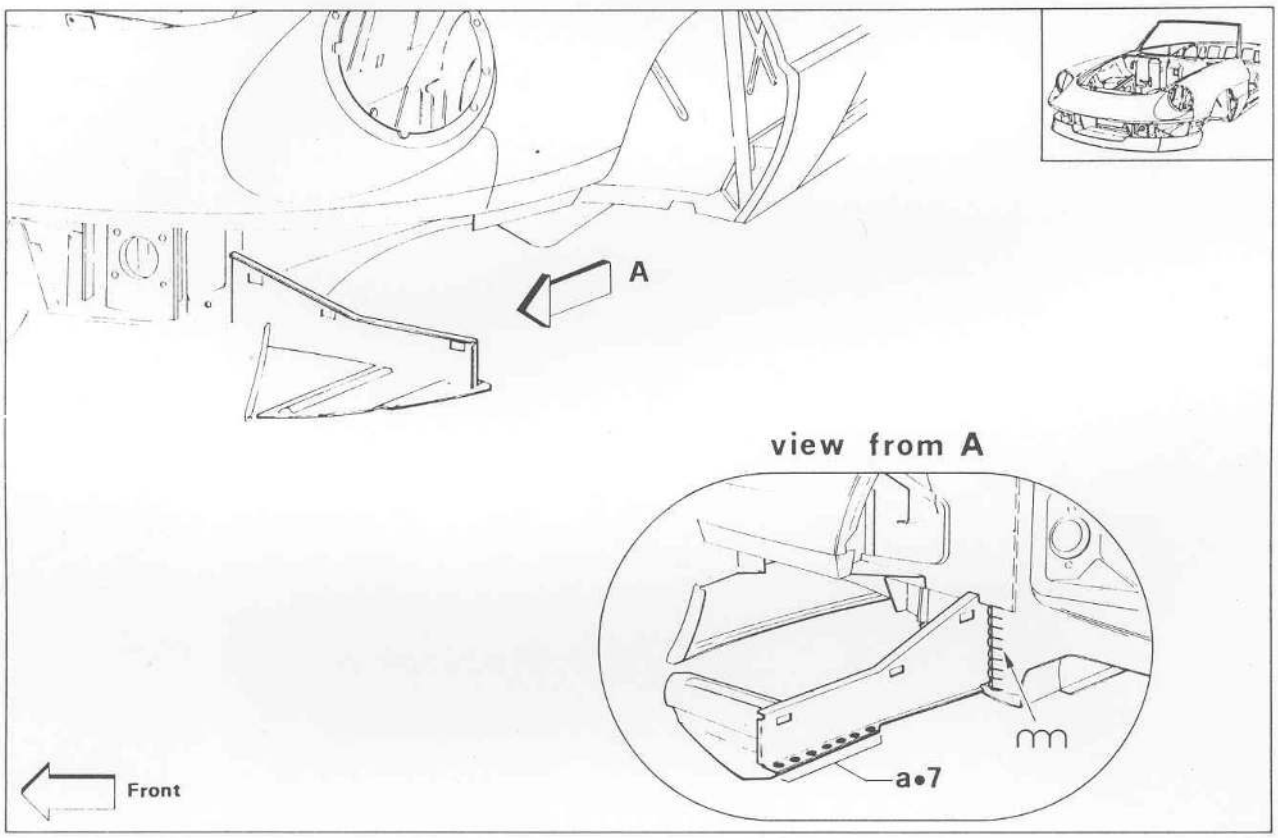
- Cut along the lines indicated using an air saw or chisel.

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SIDE SPOILER CONNECTOR AND LOWER GUARD, FRONT SIDE SPOILER REMOVED

Replace after having removed the Front Side Spoiler (see page 49-31)

Service joints

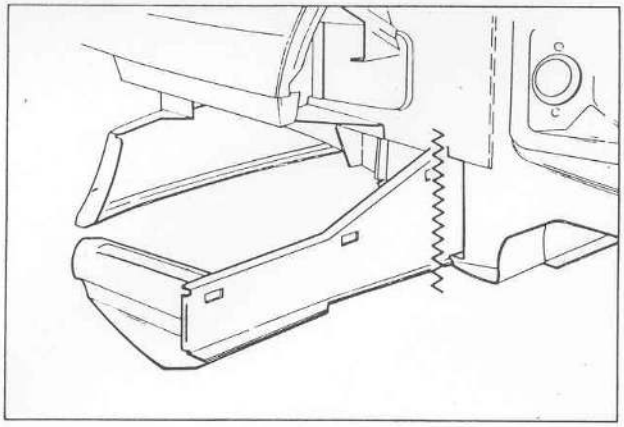


Parts to be welded

a. Side spoiler connector and lower guard.

REMINDER WHEN REMOVING

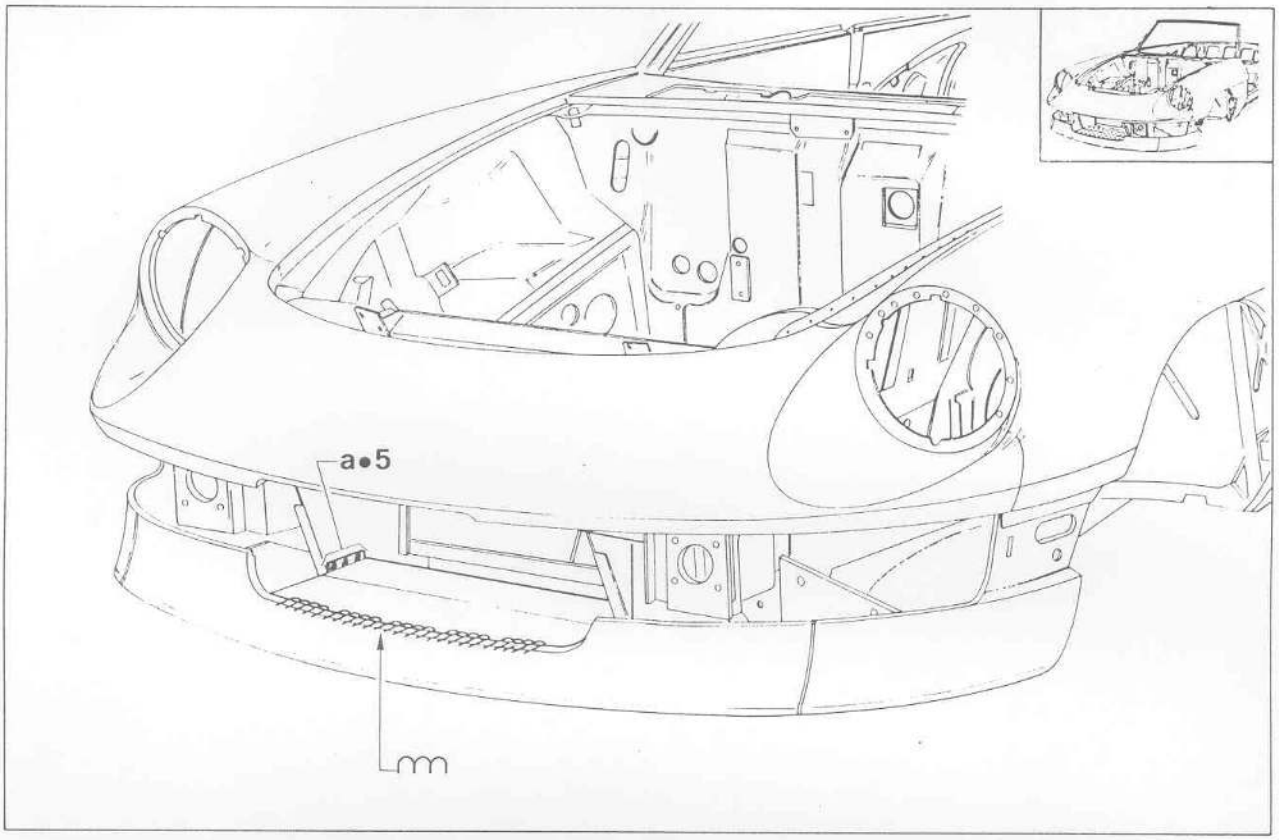
- Cut along the line indicated using an air saw.



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LOWER FEEDER

Service joints

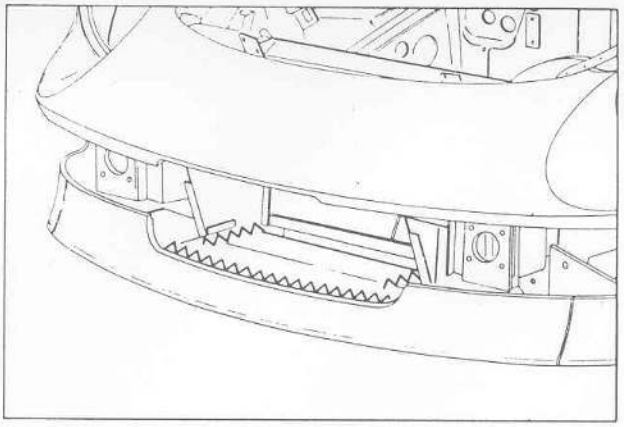


Parts to be welded

a. Lower feeder and side guard.

REMINDER WHEN REMOVING

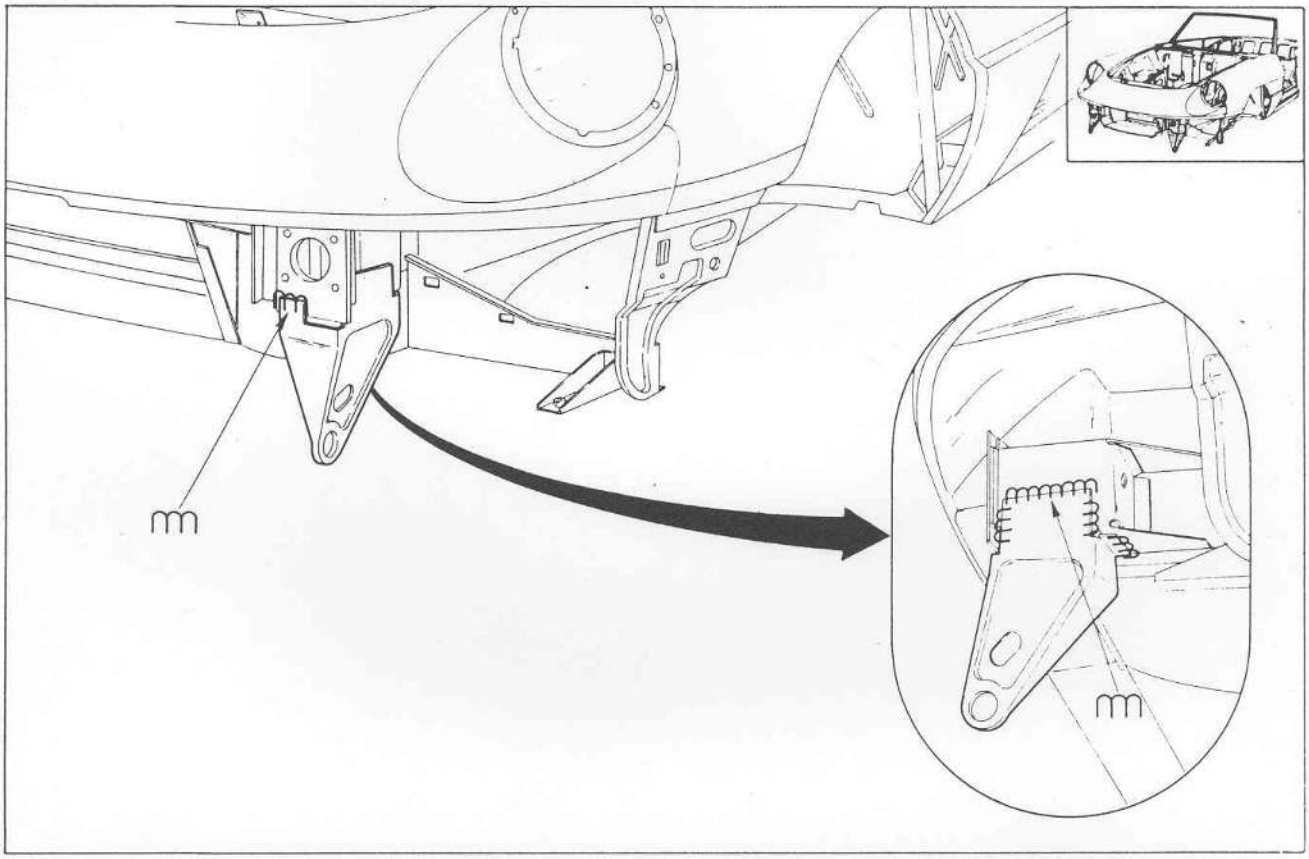
- Cut along the lines indicated using an air saw or chisel.



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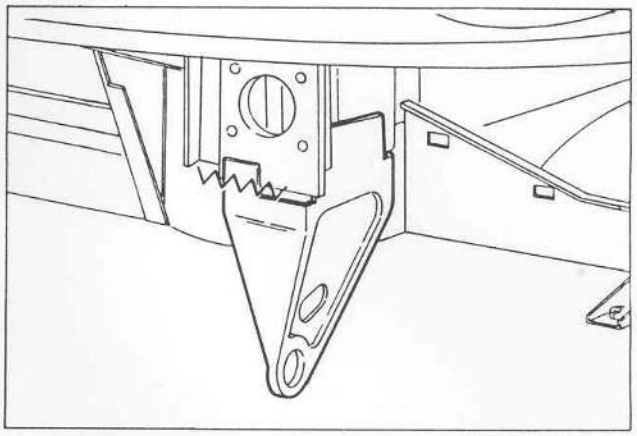
FRONT TOWING BRACKET

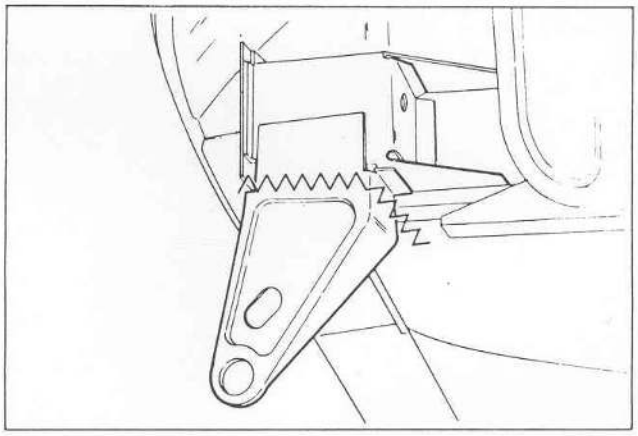
Service joints



REMINDER WHEN REMOVING

- Cut along lines indicated using an air saw or chisel.

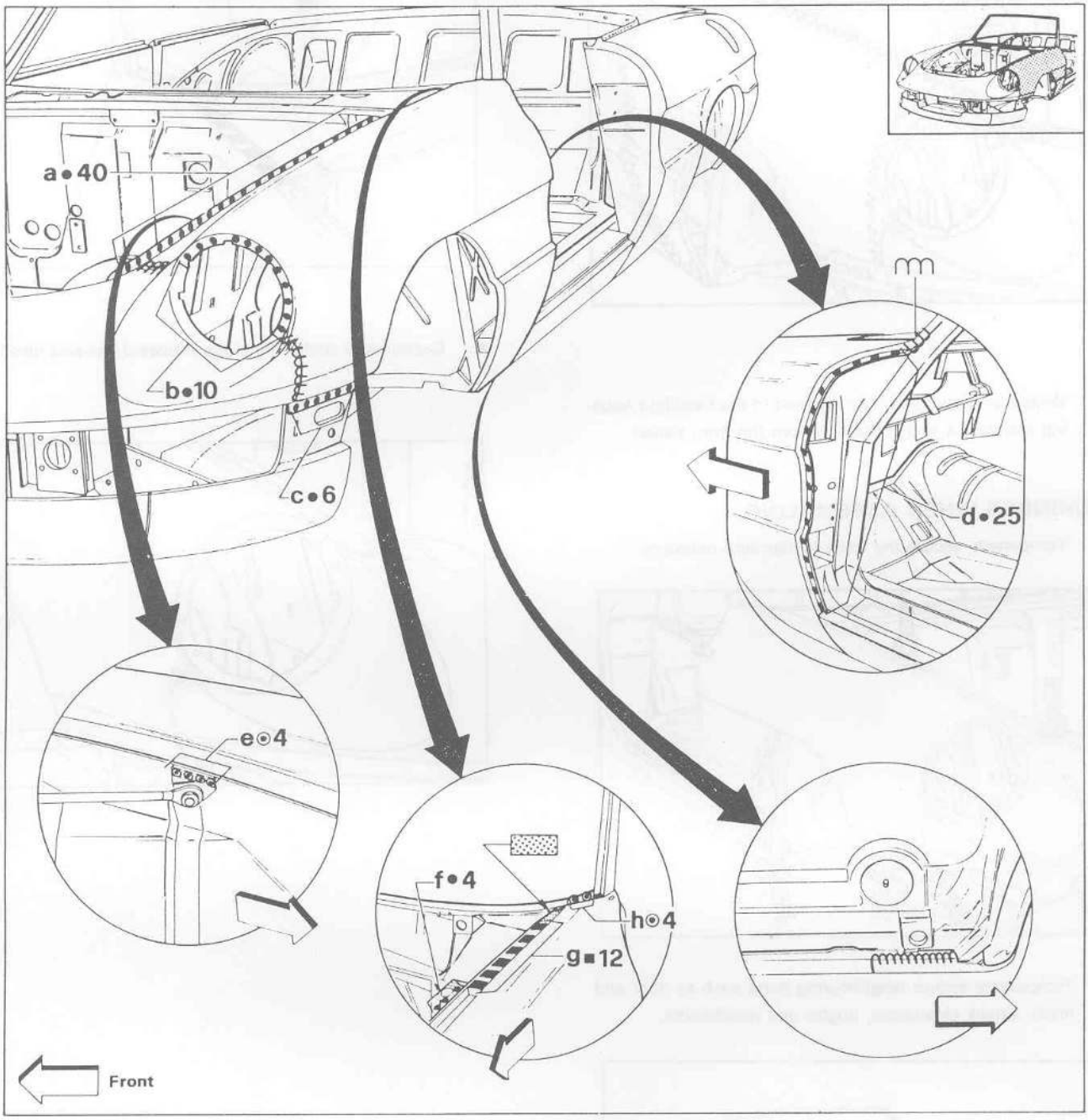




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FRONT FENDER

Service joints



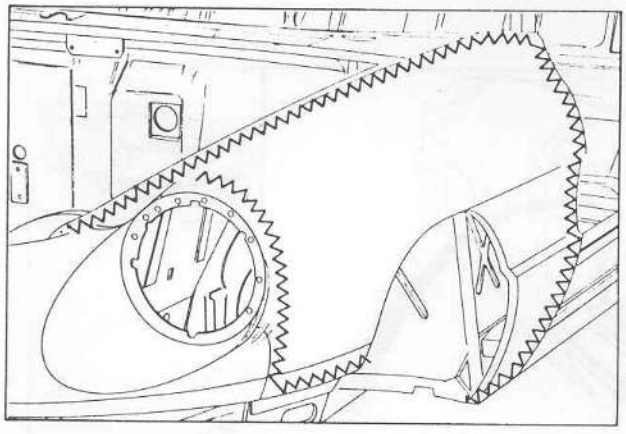
Parts to be welded

a. Front fender and engine compartment side valance.
b. Front fender and headlight rim.
c. Front fender and front side spoiler.
d. Front fender and front strut strip.
e. Front fender, hood support rod carrier and engine compartment side valance.
f. Front fender and bracing member beneath windscreen.
g. Front fender and cross member beneath windscreen.
h. Front fender and windscreen frame.

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REMINDER WHEN REMOVING

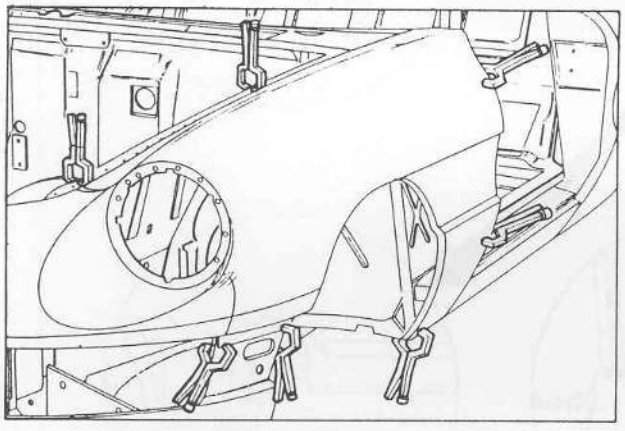
- Cut along lines indicated using an air saw or chisel.



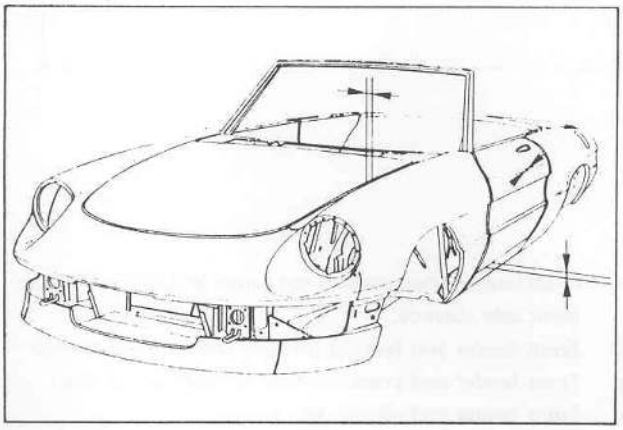
- When cutting in the areas adjacent to the headlight housing maintain a slight distance from the front panel.

REMINDER WHEN ASSEMBLING

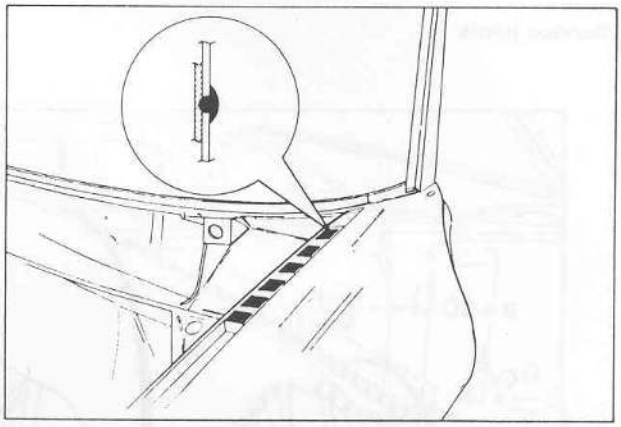
- Temporarily secure the front fender with holdfasts.



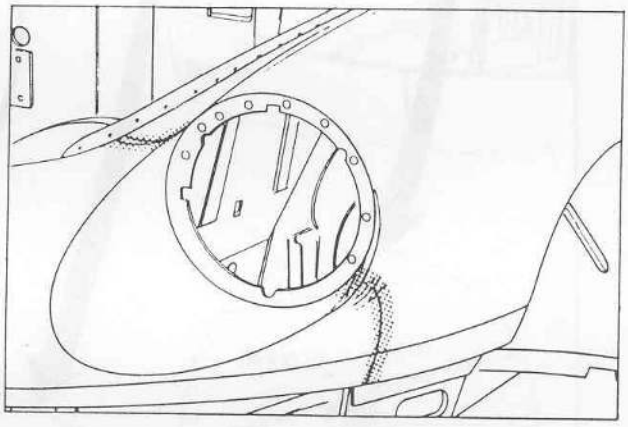
- Temporarily secure neighbouring parts such as door and hood. Check clearances, angles and parallelisms.



- MIG weld to fill indicated area.



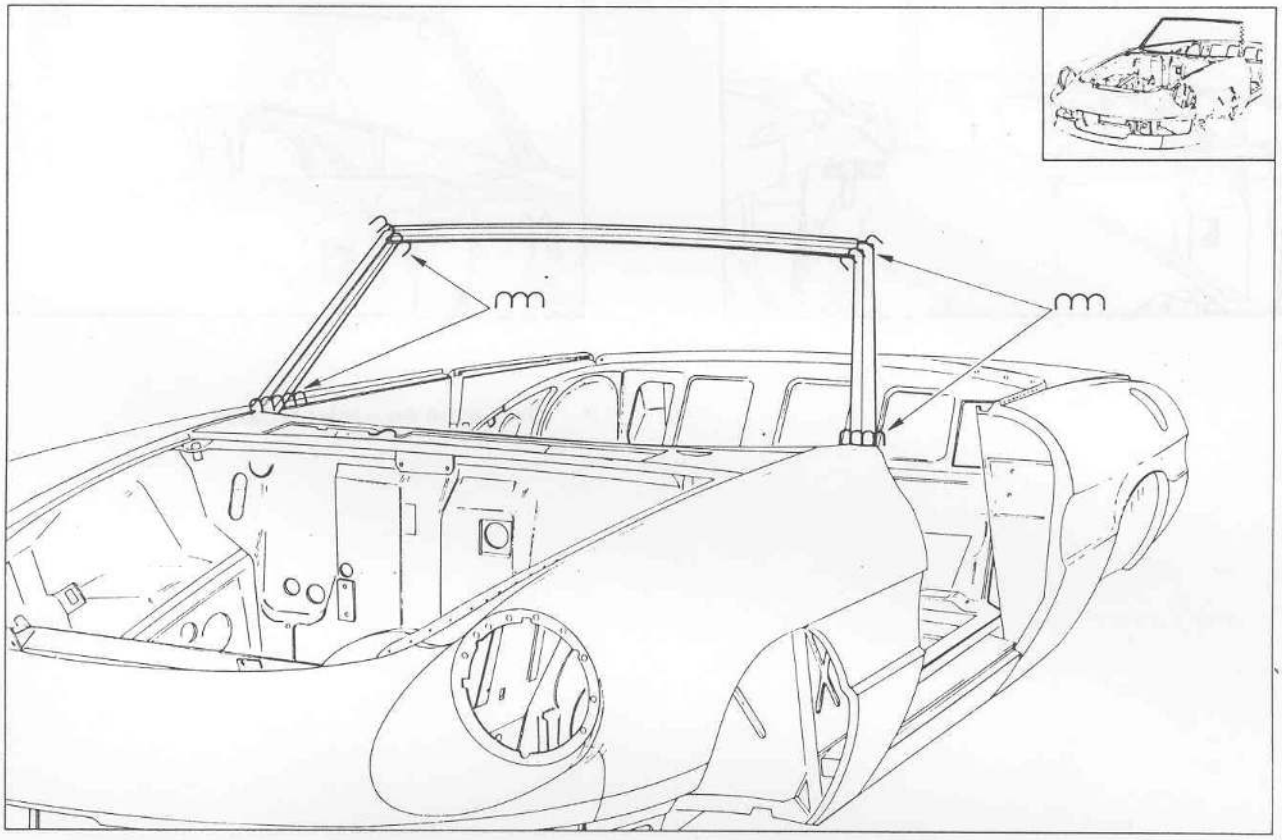
- Copper wire solder the areas indicated, tin and finish off.



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WINDSHIELD PILLARS

Service joints

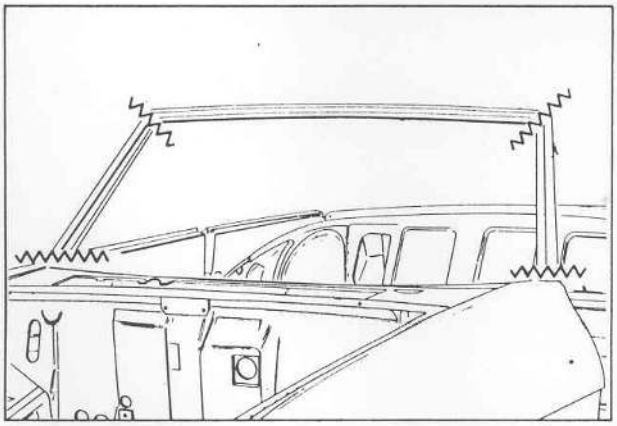


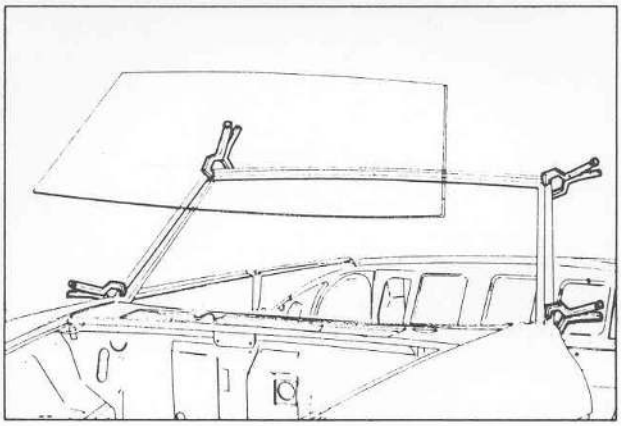
REMINDER WHEN REMOVING

- Cut along the indicated lines as required, using an air saw.

REMINDER WHEN ASSEMBLING

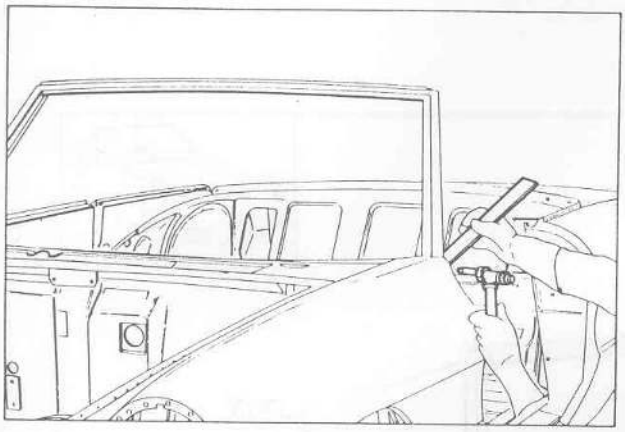
- Temporarily secure the central and side pillars, install the windshield and check that the parts are exactly in place.



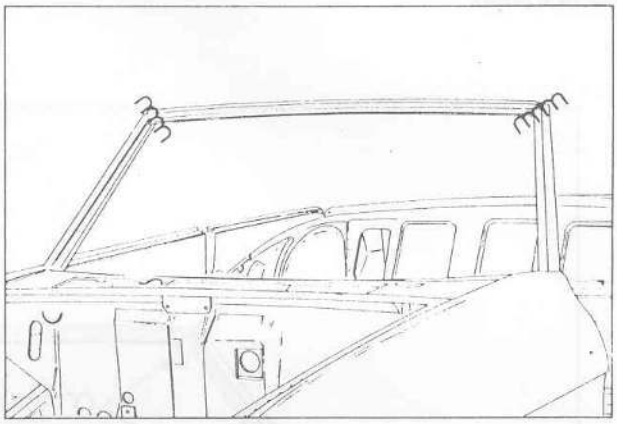


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- Join the side pillars to the body by torch welding with welding material.



- Join the central pillar to the side ones by means of continuous MIG plug welding.



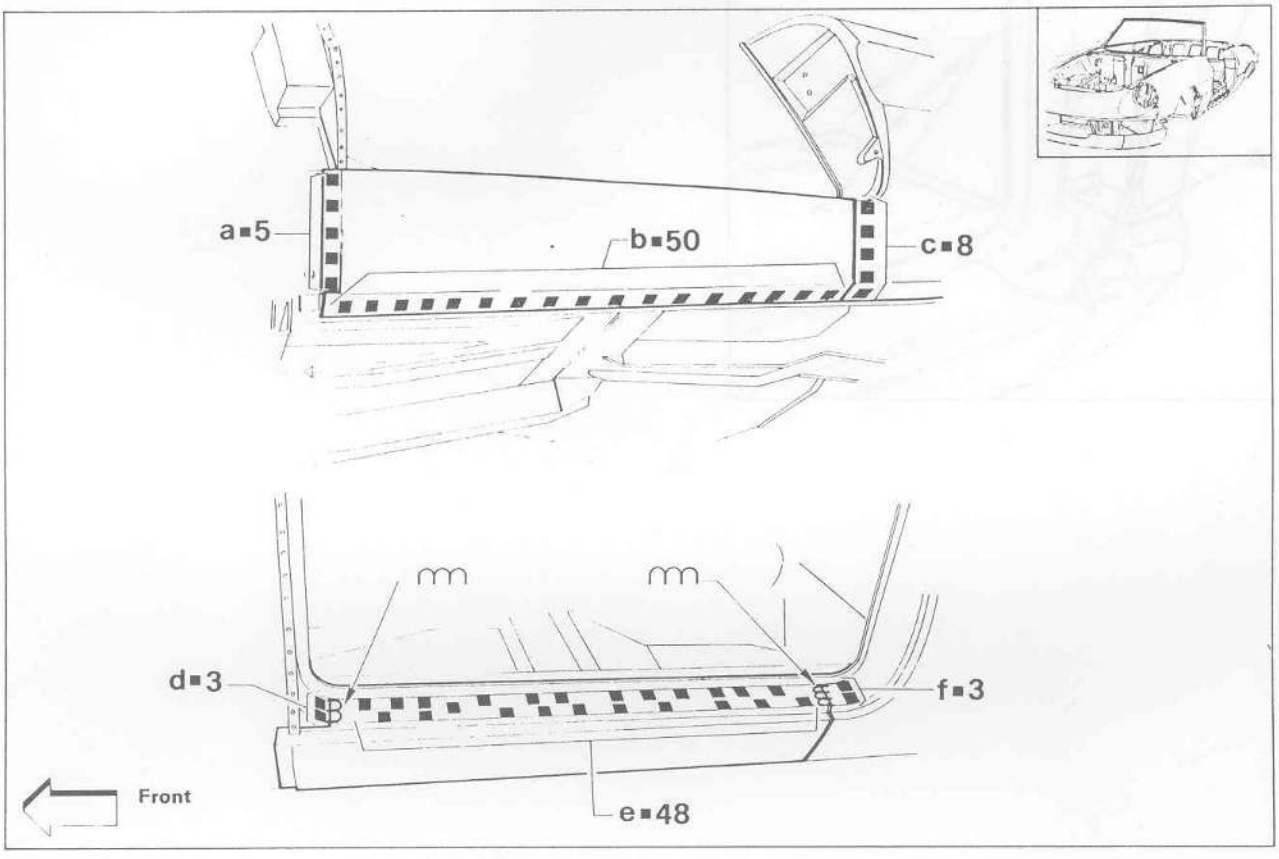
- Sand down the welded surfaces.

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DOOR ROCKER PANEL WITH FRONT FENDER REMOVED

Replace after removing the Front Fender (see page 49-39).

Service joints

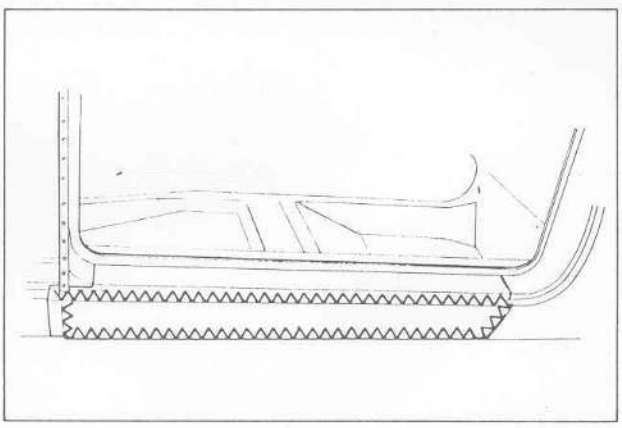


Parts to be welded

a. Door rocker panel and internal framework.
b. Door rocker panel and internal framework.
c. Door rocker panel and rear fender.
d. Door rocker panel and front strut strip.
e. Door rocker panel and internal framework.
f. Door rocker panel and rear fender.

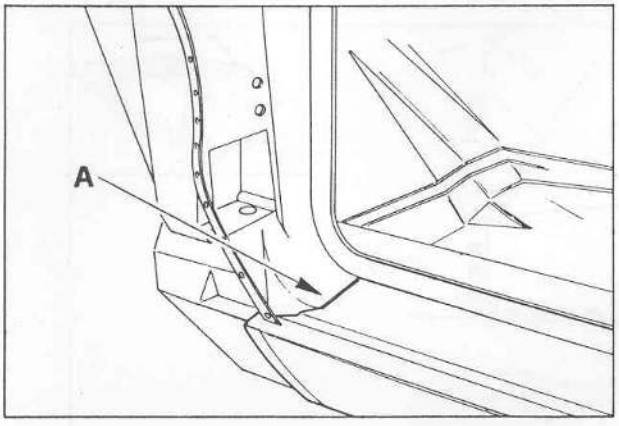
REMINDER WHEN REMOVING

- Using an air chisel, cut along the indicated lines.



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- Remove solder points using a miller to avoid damage to internal framework.
- Raise edge A of the front and slide off the door rocker panel. rocker panel.



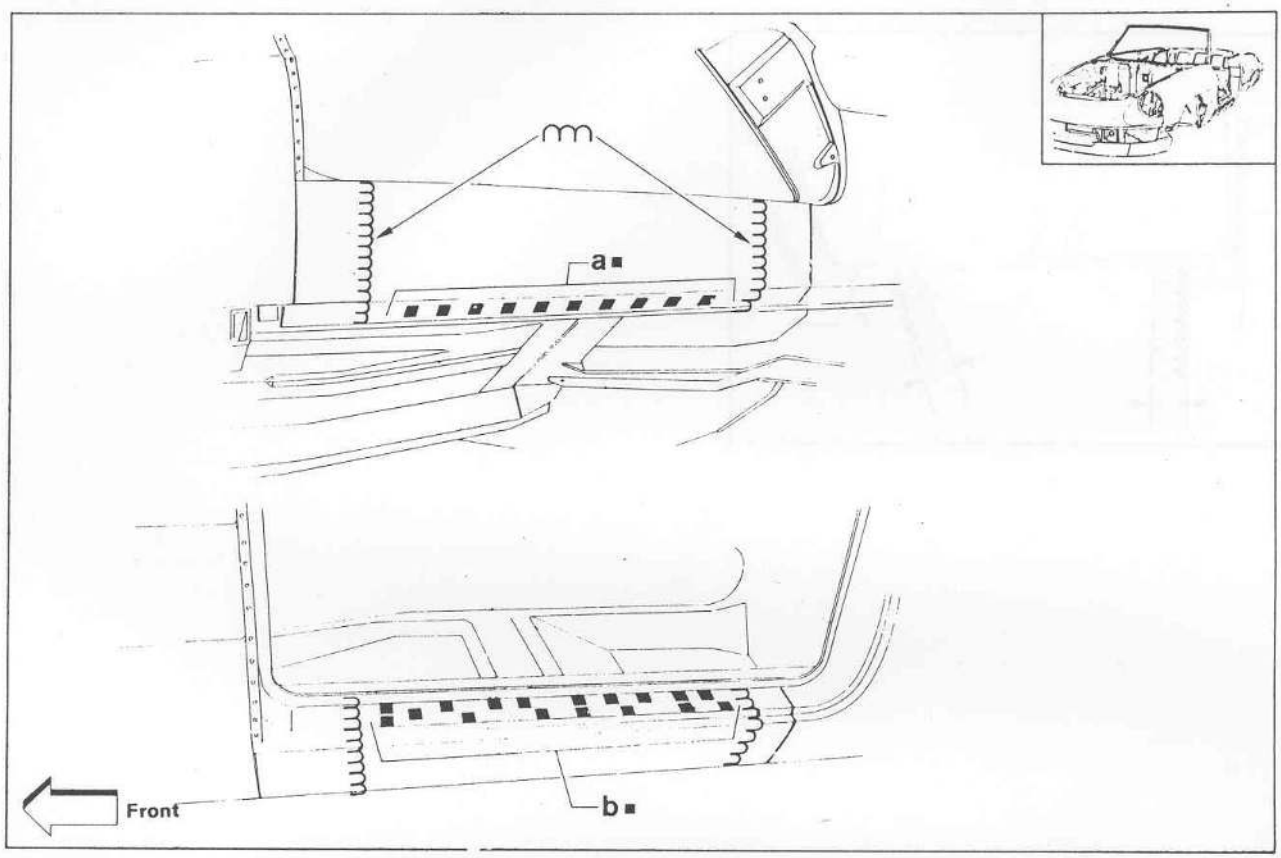
REMINDER WHEN ASSEMBLING

- Drill holes in the new part which correspond to those found on the part to be replaced.
- MIG plug weld to fill.

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DOOR ROCKER PANEL (partial replacement)

Service joints

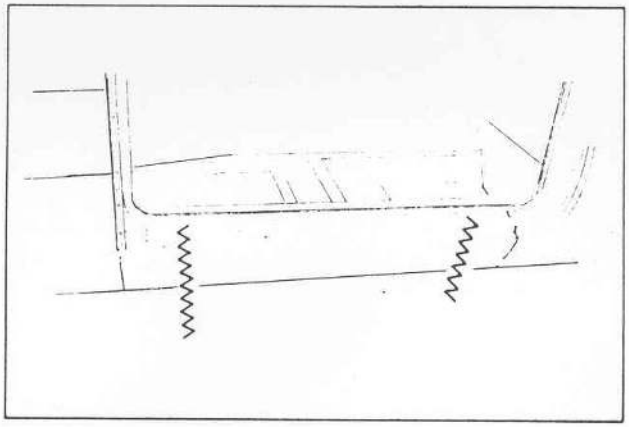


Parts to be welded

a. Door rocker panel and internal framework.
b. Door rocker panel and internal framework.

REMINDER WHEN REMOVING

- Cut along the lines indicated or around the damage located using an air chisel.

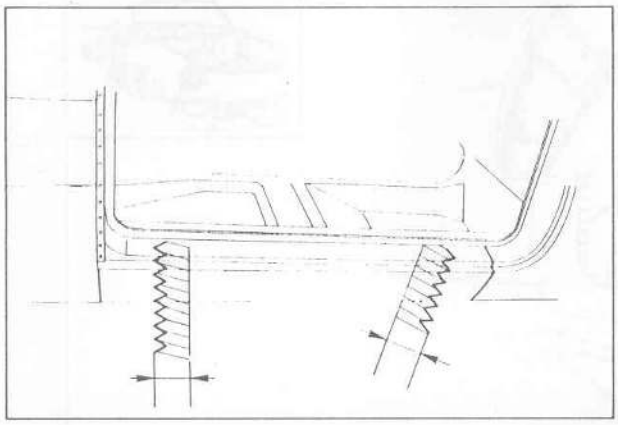


- Remove welding spots, using a miller to prevent damage to internal framework.

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REMINDER WHEN ASSEMBLING

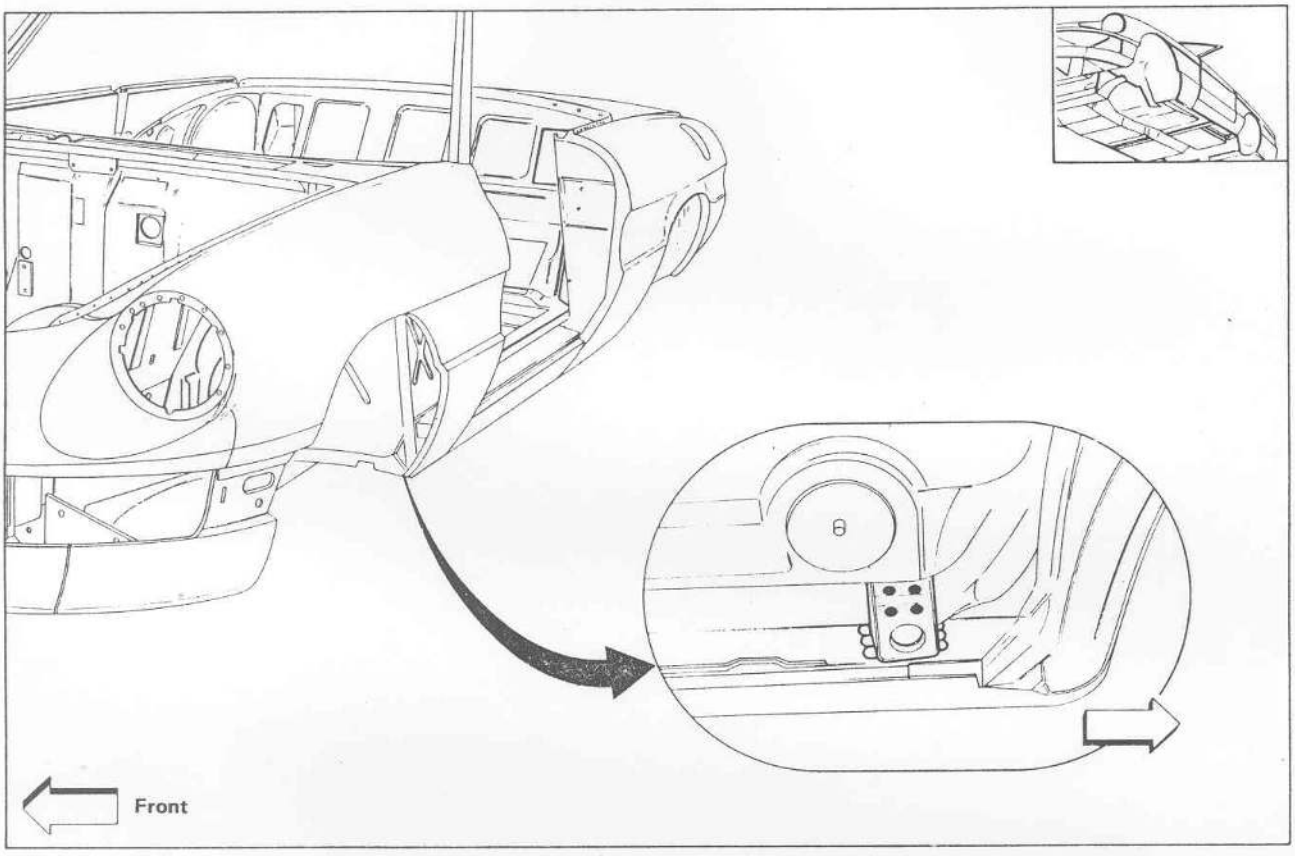
- Cut the spare door rocker panel aligned with the connection edges.
- Drill holes in the spare door rocker panel to correspond with the holes in the part to be replaced.
- Carry out continuous and MIG plug welding according to the figure shown on the previous page.



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FRONT LIFTING POINT

Service joints



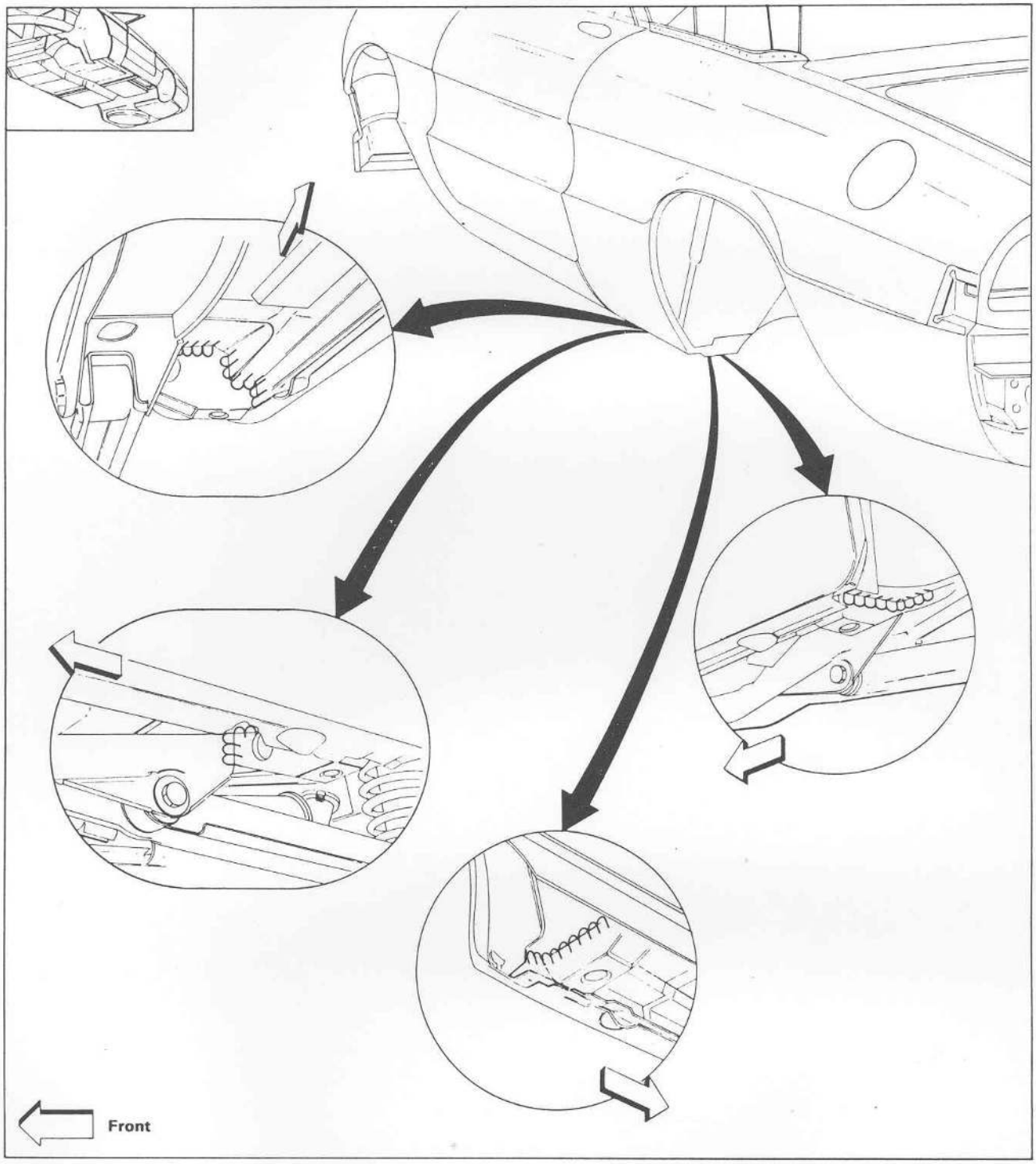
REMINDER WHEN REMOVING

- Use an air chisel in order to not damage the adjoining parts.

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REAR LIFTING POINT

Service joints



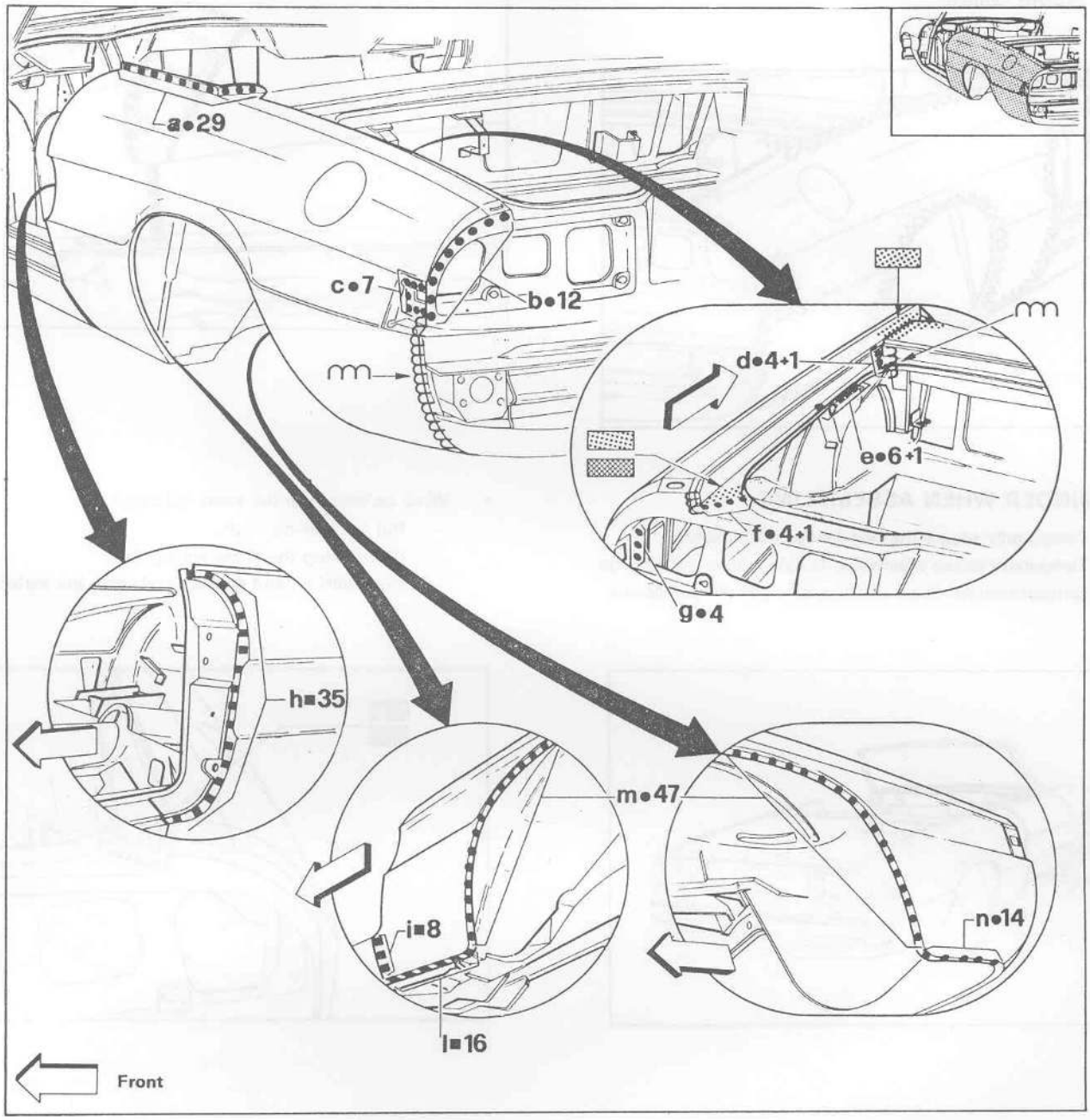
REMINDER WHEN REMOVING

- Use an air chisel in order to not damage the adjoining parts.

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REAR FENDER

Service joints



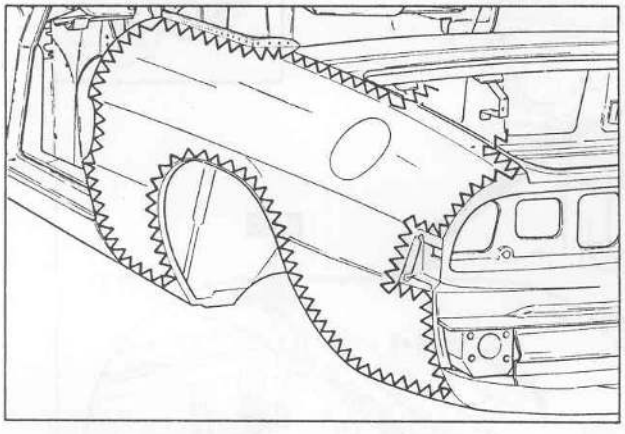
Parts to be welded

a. Rear fender and valance underbody.
b. Rear fender and upper rear panel.
c. Rear fender and upper rear panel.
d. Rear fender and upper cross bar member.
e. Rear fender and side bracing.
f. Rear fender and upper rear panel.
g. Rear fender and upper rear panel.
h. Rear fender and rear strut strip.
i. Rear fender and door rocker panel.
j. Rear fender and internal framework.
k. Rear fender and wheel house.
l. Rear fender and inner framework.

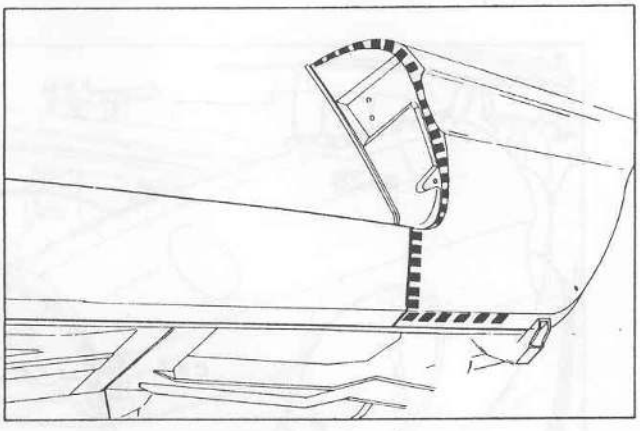
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REMINDER WHEN REMOVING

- Using an air chisel, cut along the indicated lines so as not to damage the internal framework.
- It is possible to cut along line B using an air saw, but with extreme caution.

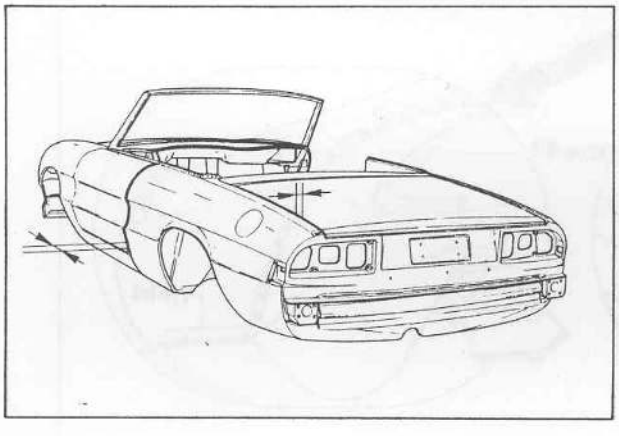


- Weld indicated areas with MIG plug method.

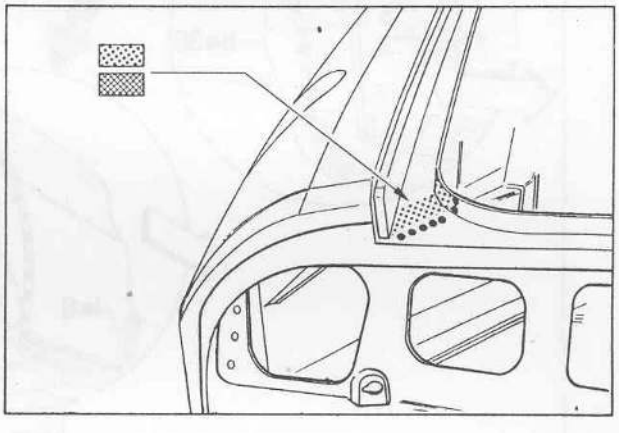


REMINDER WHEN ASSEMBLING

- Temporarily secure the rear fender with holdfasts.
- Temporarily secure adjacent parts such as door and luggage compartment lid. Check clearances, angles and parallelisms.



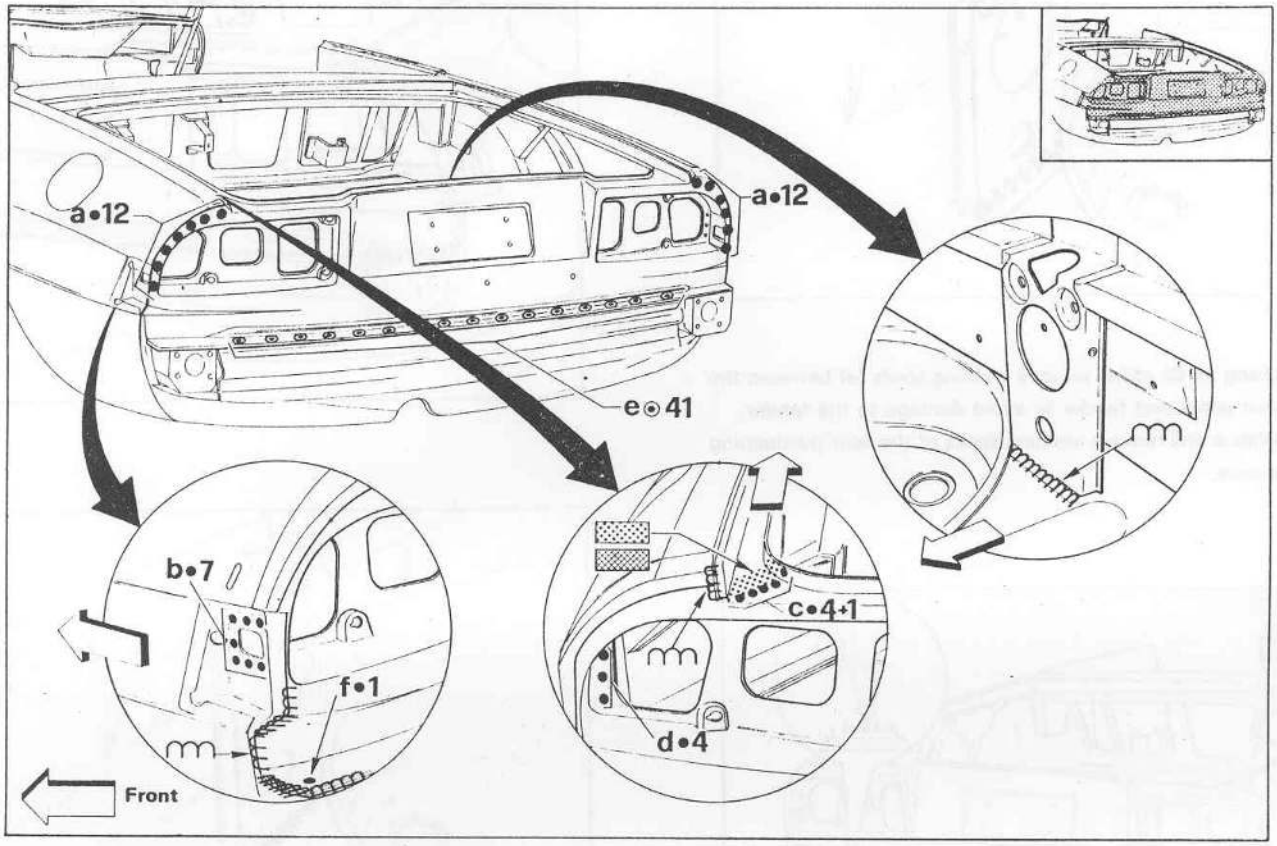
- Work as follows in the areas indicated.
  - Put on welding spots.
  - Braze along the sheet joining line.
  - Coat with tin and subsequently trim the surfaces.



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UPPER REAR PANEL

Service joints

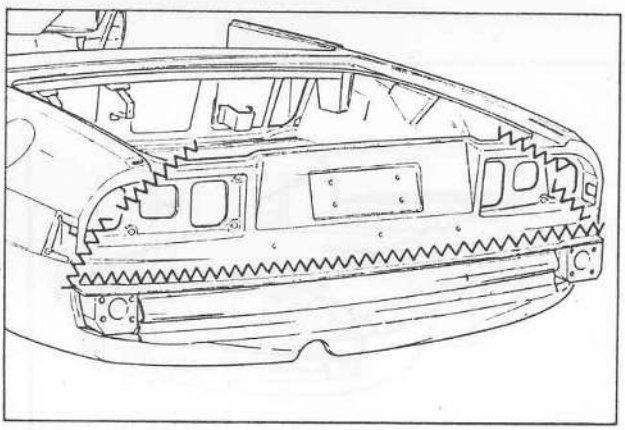


Parts to be welded.

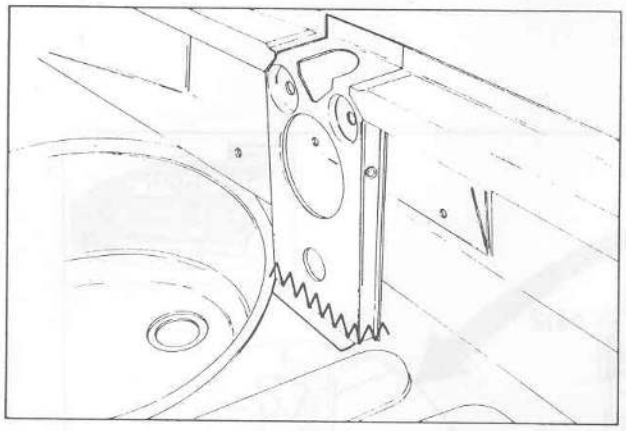
a. Upper rear panel and rear fender.
b. Upper rear panel and rear fender.
c. Upper rear panel and rear fender.
d. Upper rear panel and rear fender.
e. Upper rear panel, luggage compartment floor and lower rear panels.
f. Upper rear panel and luggage compartment floor.

REMINDER WHEN REMOVING

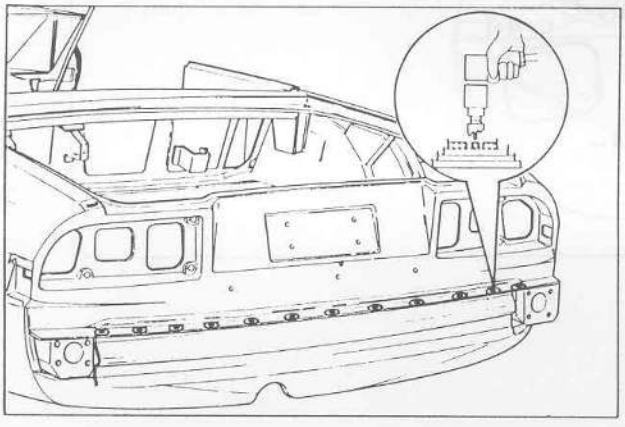
- Cut along the indicated lines with an air saw.



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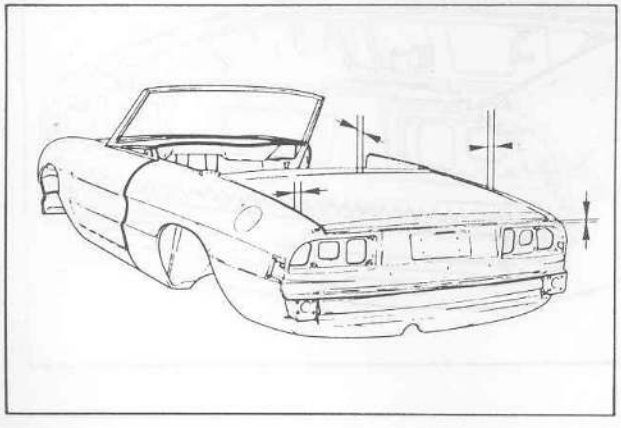


- Using an air chisel remove welding spots (a) between the rear panel and fender to avoid damage to the fender.
- With a drill remove welding spots of the four overlapping sheets.

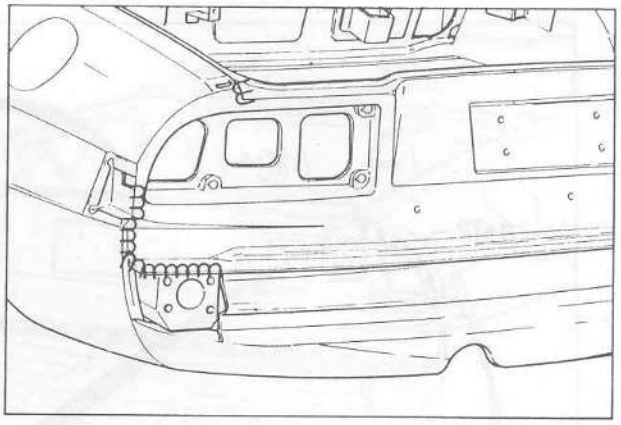


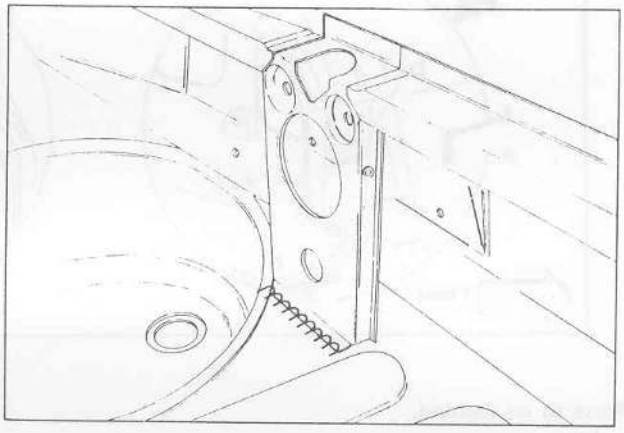
REMINDER WHEN ASSEMBLING

- Temporarily secure the luggage compartment lid assembly and check clearances, angles and parallelisms.

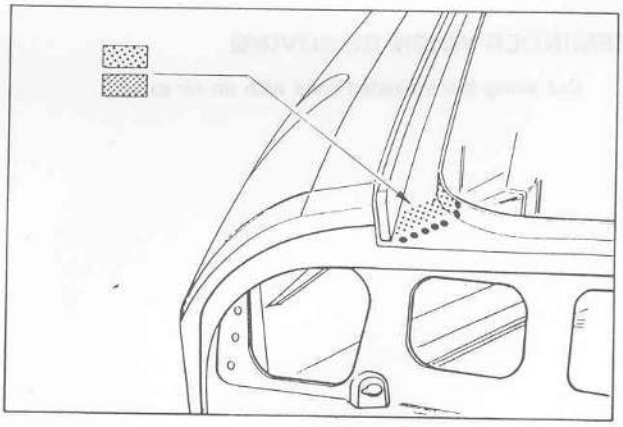


- Carry out continuous welding, MIG method, in area S shown in the figure.





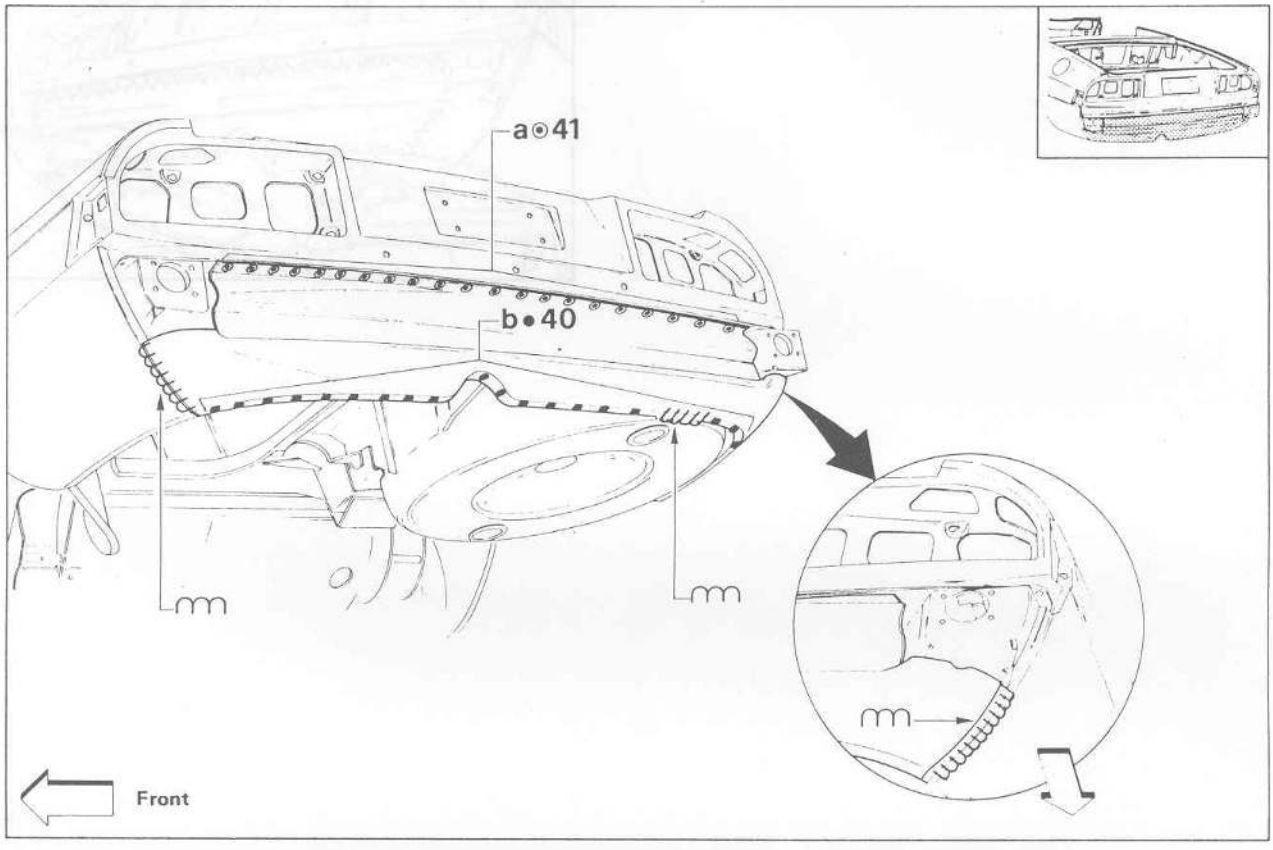
- Work as follows in the area indicated.
  - Put on the welding spots.
  - Braze along the sheet joining line.
  - Coat with tin and subsequently trim the surfaces.



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LOWER REAR PANEL - OUTER EXTERNAL SHIELD

Service joints



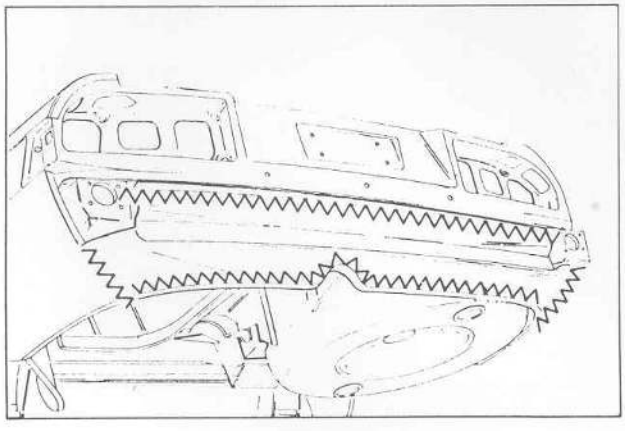
Parts to be welded

a. Lower external rear panel, lower internal rear panel, luggage compartment floor and upper rear panel.

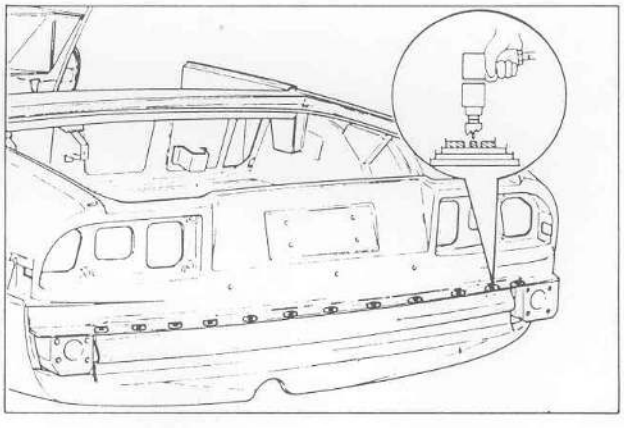
b. Lower external rear panel and lower internal rear panel.

REMINDER WHEN REMOVING

- Taking care not to damage the upholstery below, cut along the indicated lines with an air chisel.

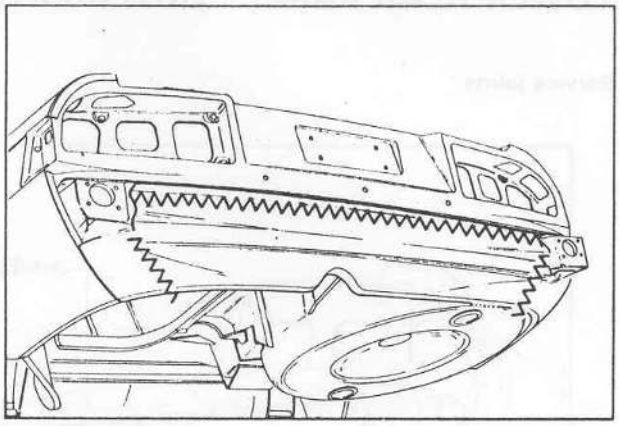


- Using a drill, remove the welding spots from the overlapping sheets.



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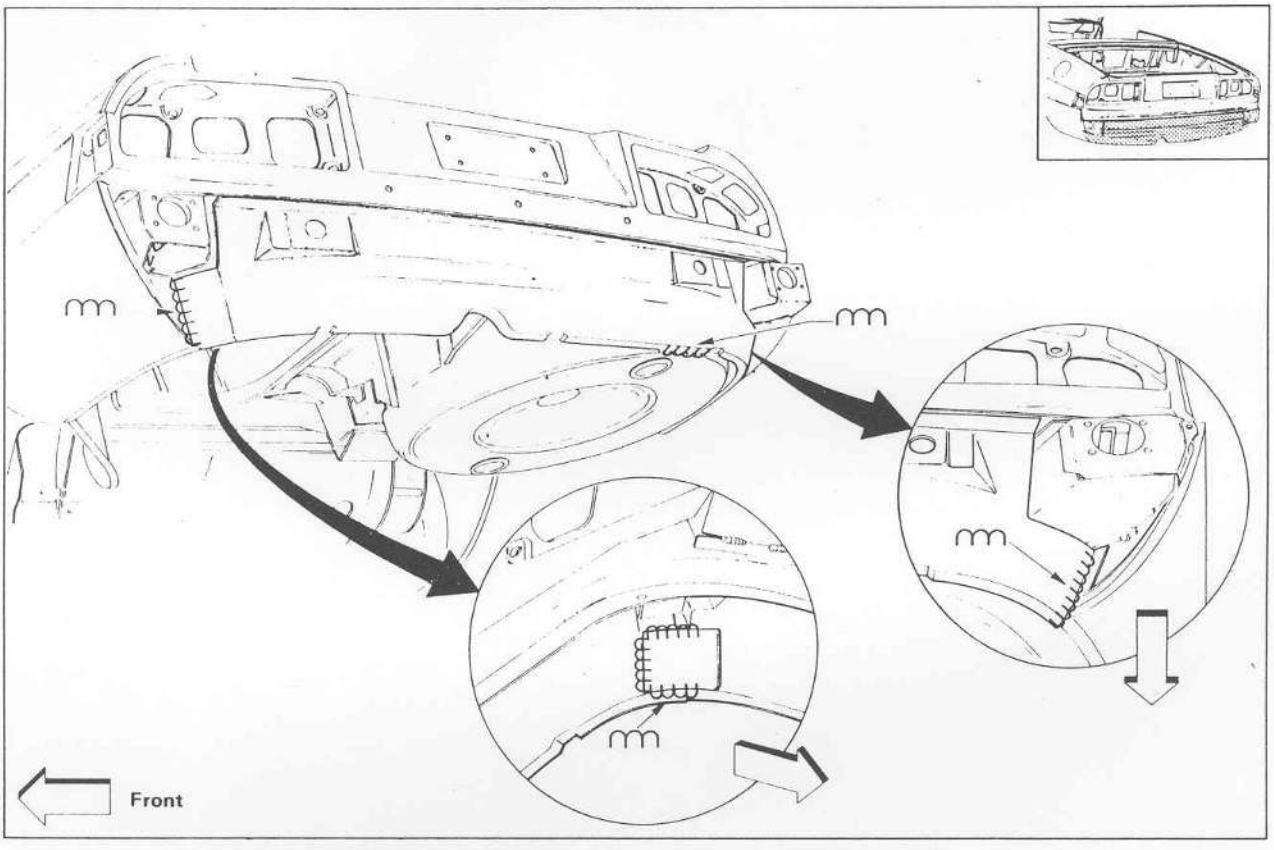
- If both internal and external shields need replacing, it is not necessary to remove the lower spots joining the two shields just cut along the indicated lines.



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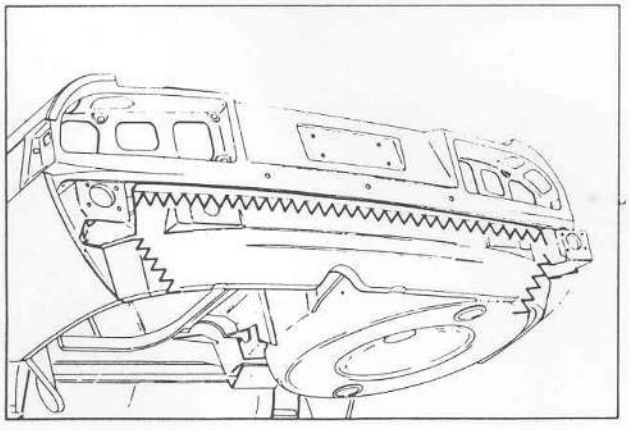
LOWER REAR PANEL - INTERNAL TO EXTERNAL SHIELDS REMOVED

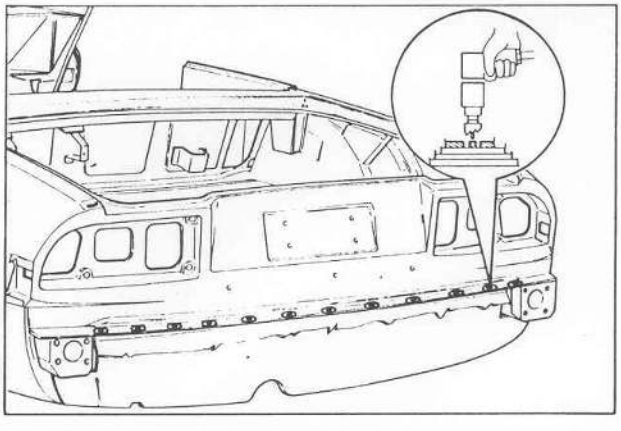
First remove the Lower Rear Panel - External Shield (see page 49-55), then carry out replacement.



REMINDER WHEN REMOVING

- Using an air saw cut along the indicated lines.
- Using a drill remove welding spots from four overlapping sheets.



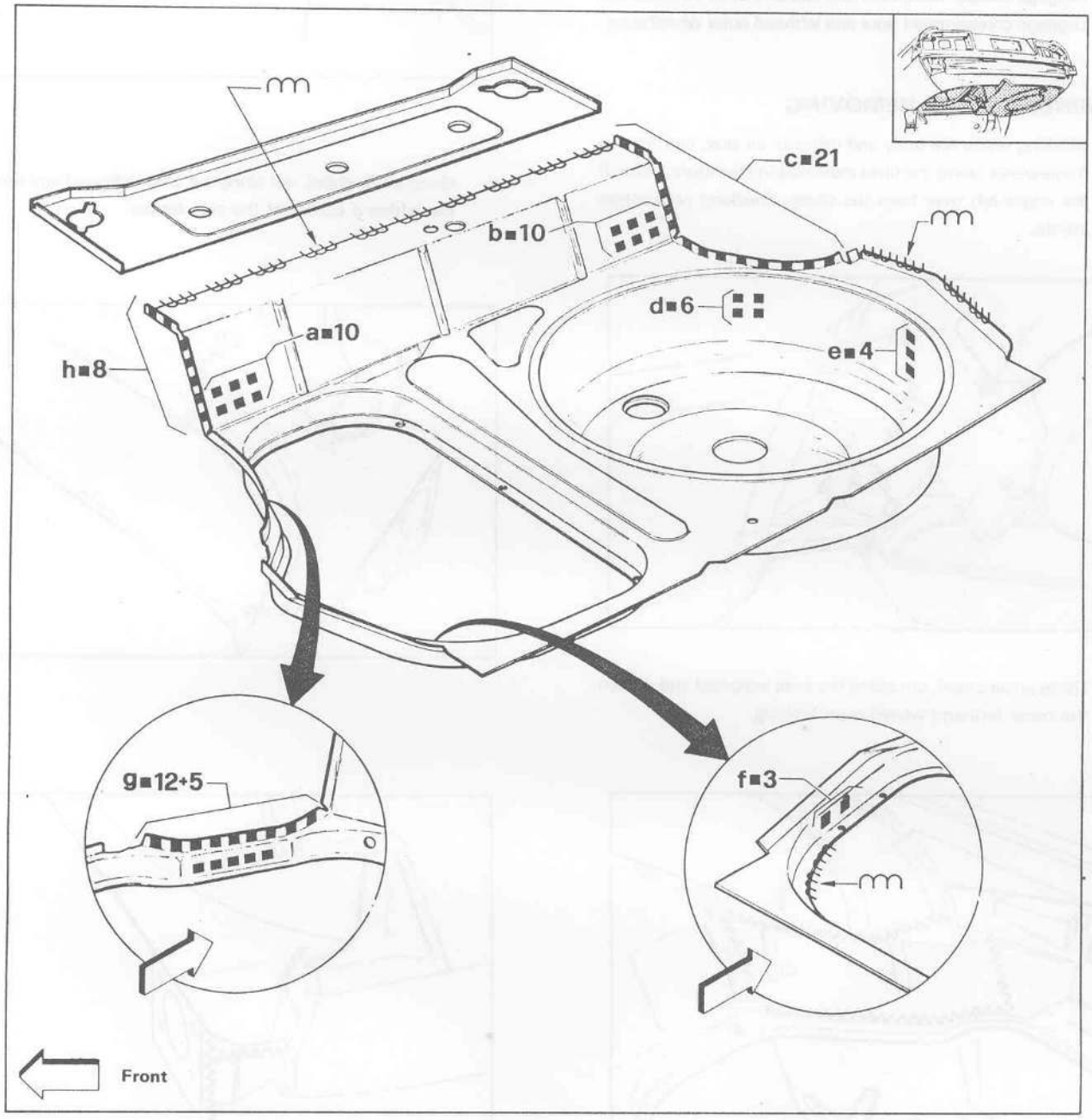


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LUGGAGE COMPARTMENT FLOOR ASSEMBLY WITH REAR PANELS REMOVED

First remove the Upper Rear Panel (see page 49-53), the Lower Rear Panel - External Shield (see page 49-55) and Lower Rear Panel - Internal Shield (see page 49-57) then carry out replacement.

Service joints



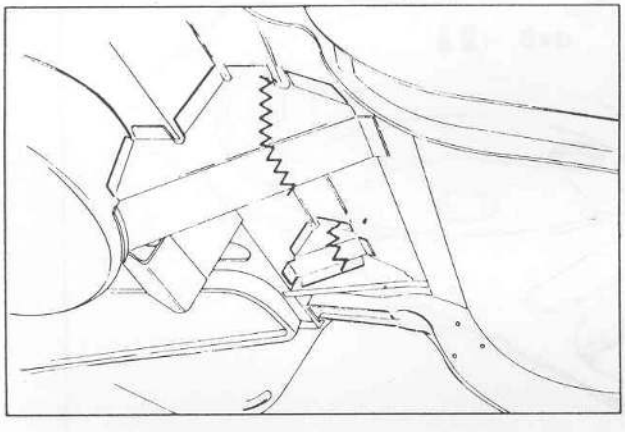
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Parts to be welded

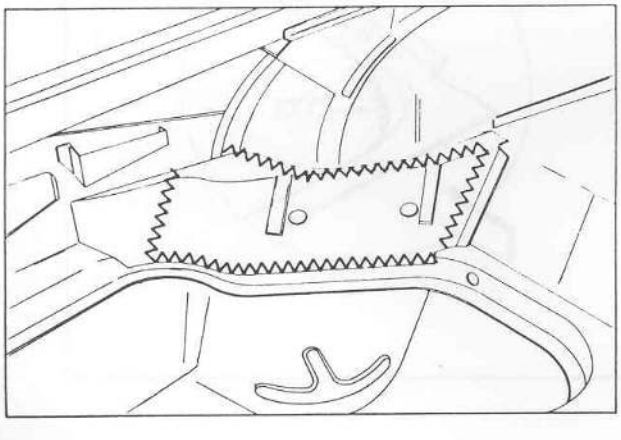
a. Luggage compartment floor and underbody bracing (lefthand side).
b. Luggage compartment floor and underbody bracing (righthand side).
c. Luggage compartment floor and righthand rear outer wheelhouse.
d. Luggage compartment floor and righthand rear outer wheelhouse.
e. Luggage compartment floor and righthand carrier of rear fender.
f. Luggage compartment floor and lefthand carrier of rear fender.
g. Luggage compartment floor and lefthand outer wheelhouse.
h. Luggage compartment floor and lefthand outer wheelhouse.

REMINDER WHEN REMOVING

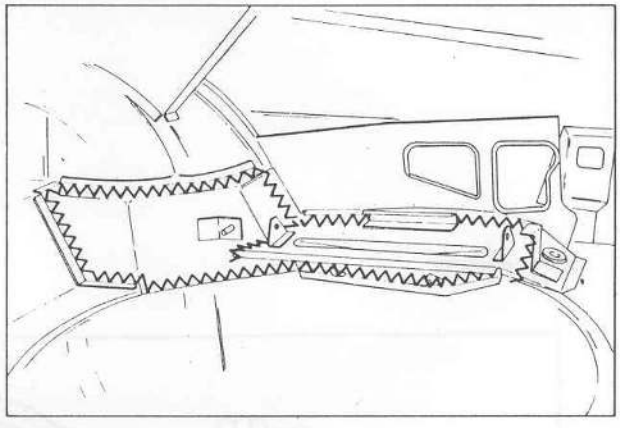
- Working under the body and using an air saw, cut the two frameworks along the lines indicated in the figure. Detach the edges left over from the sheet, checking connection points.



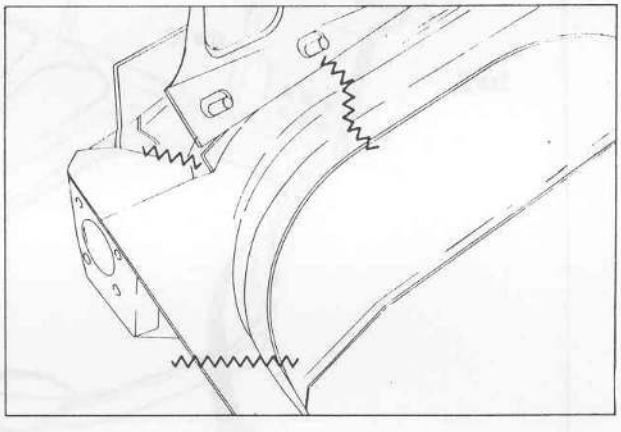
- Using an air chisel, cut along the lines indicated and detach the outer lefthand wheelhouse bracing.

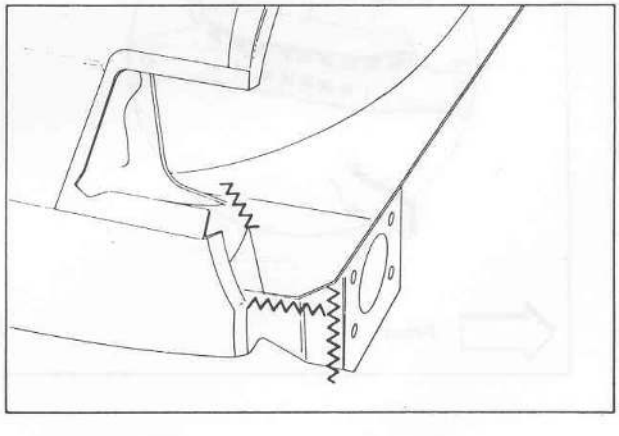


- Using an air chisel, cut along the lines indicated and remove the outer righthand wheelhouse bracing together with the battery carrier.

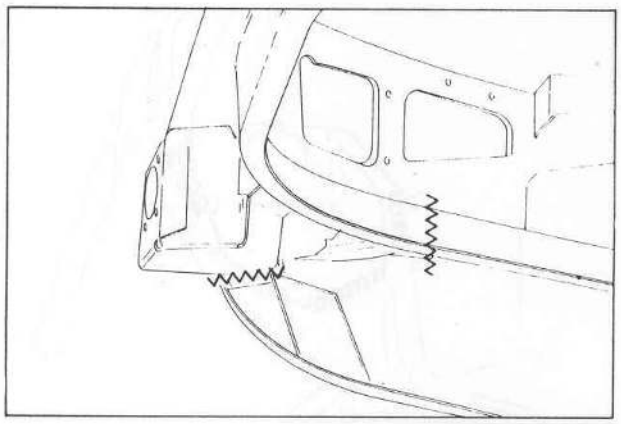


- Using an air chisel, cut along the lines indicated and remove the lefthand carrier of the rear fender.

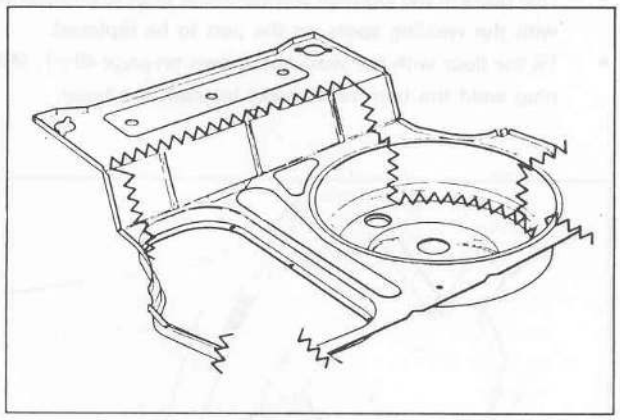




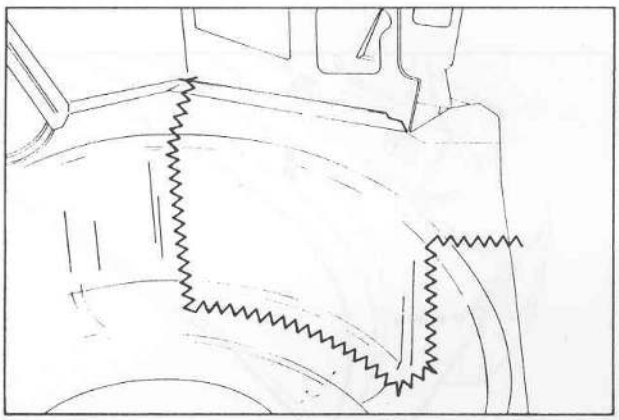
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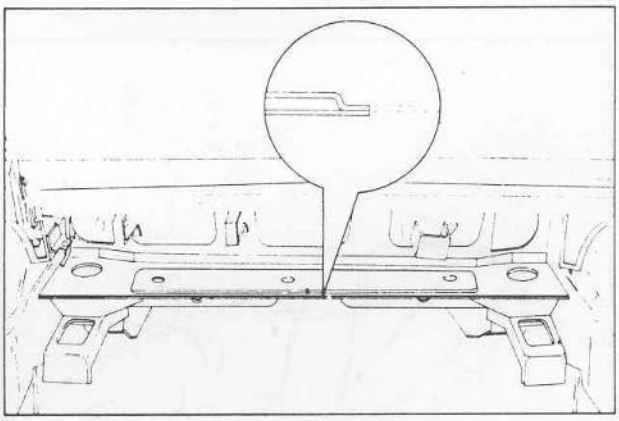


- In a similar manner remove the righthand carrier of the rear fender.



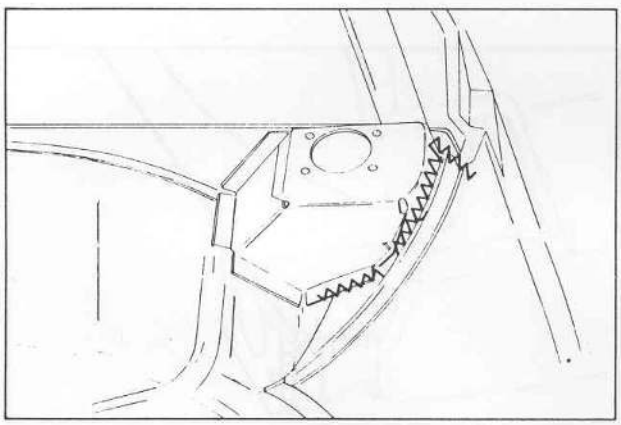
- Trim the front edge of the luggage compartment floor, aligning it with the sheet plate beneath.



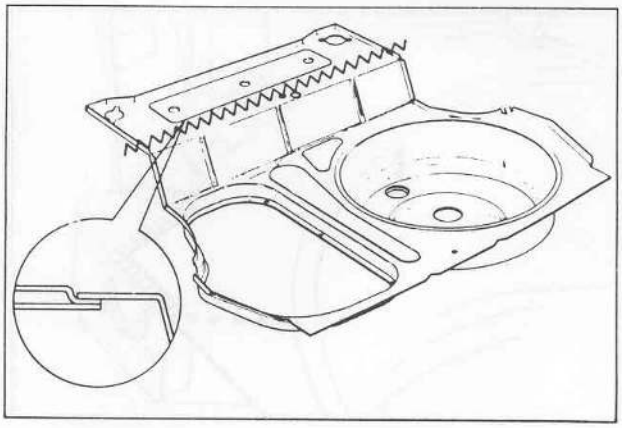


REMINDER WHEN ASSEMBLING

- Assemble the various component parts of the luggage compartment floor (refer to Luggage Compartment Floor Assembly page 49-51).
- Cut the front part of the luggage compartment floor so that the new part overlaps the edge of the old part as shown in the figure.

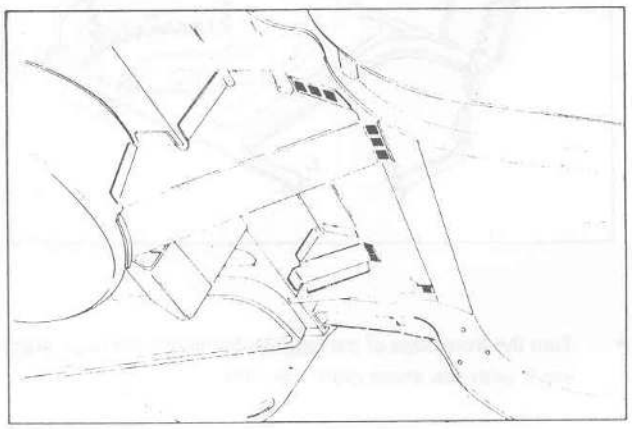


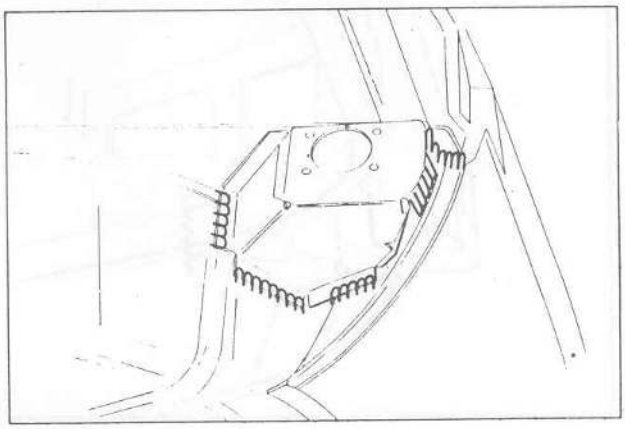
- Using an air chisel cut along the lines indicated.



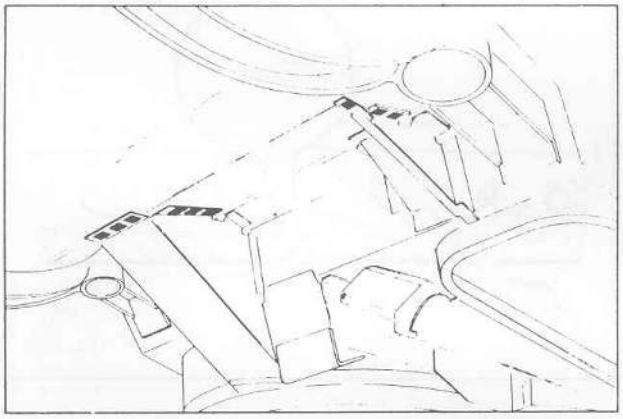
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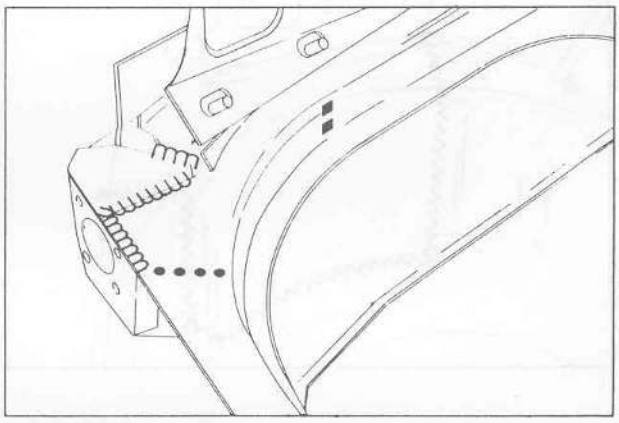
- Drill holes in the luggage compartment floor to correspond with the welding spots on the part to be replaced.
- Fit the floor with the weldings shown on page 49-51; MIG plug weld the two frameworks beneath the body.





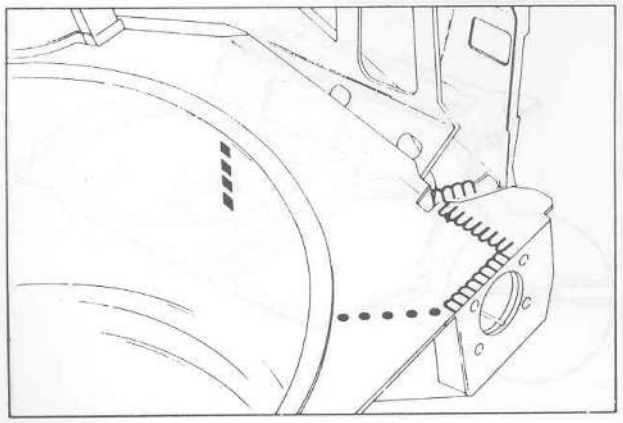
Lefthand carrier

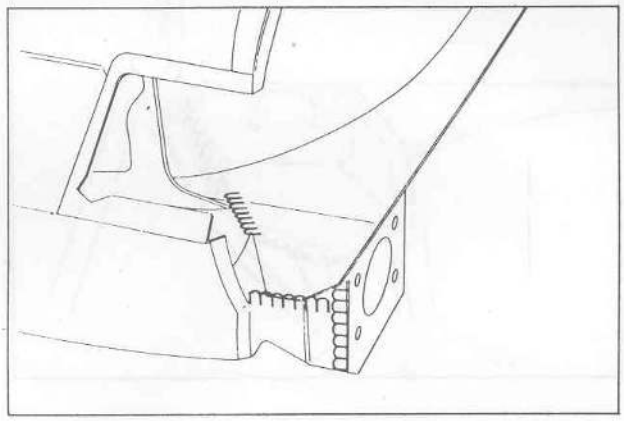




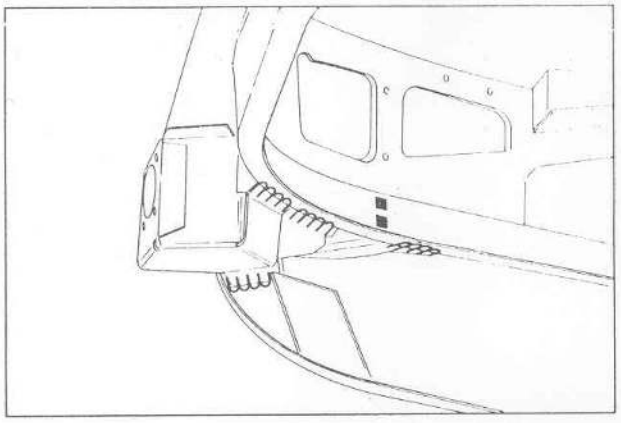
- Using a suitable template, assemble the two rear fender carriers and weld as indicated in the figures below.

Righthand carrier

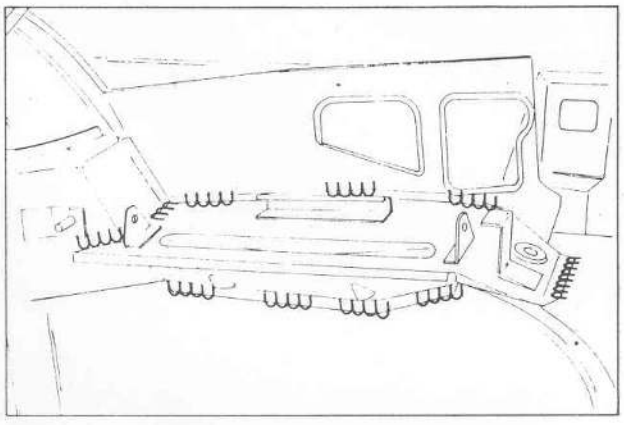




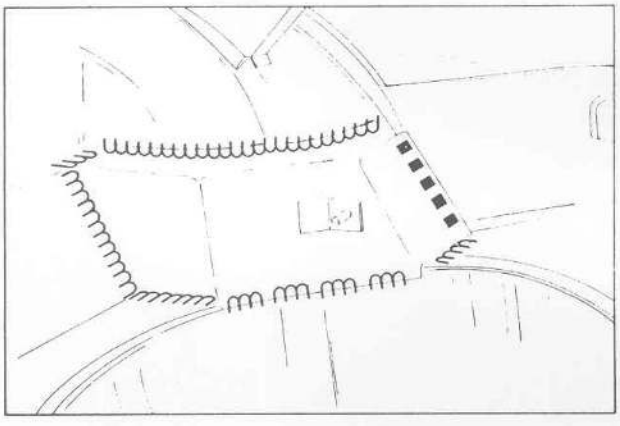
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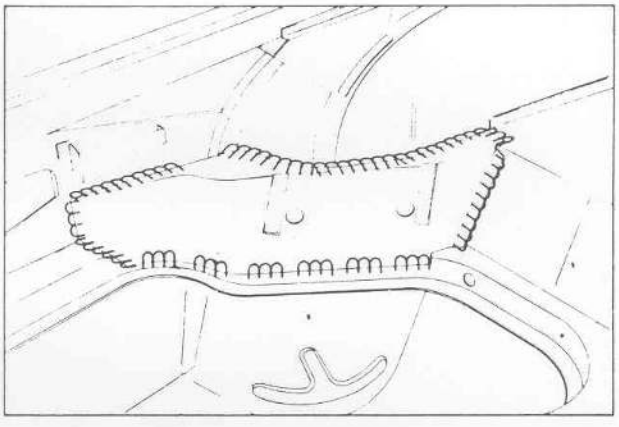
- Fit the battery carrier and weld as indicated.



- Fit the outer righthand wheelhouse bracing into place and weld as indicated in the figure.



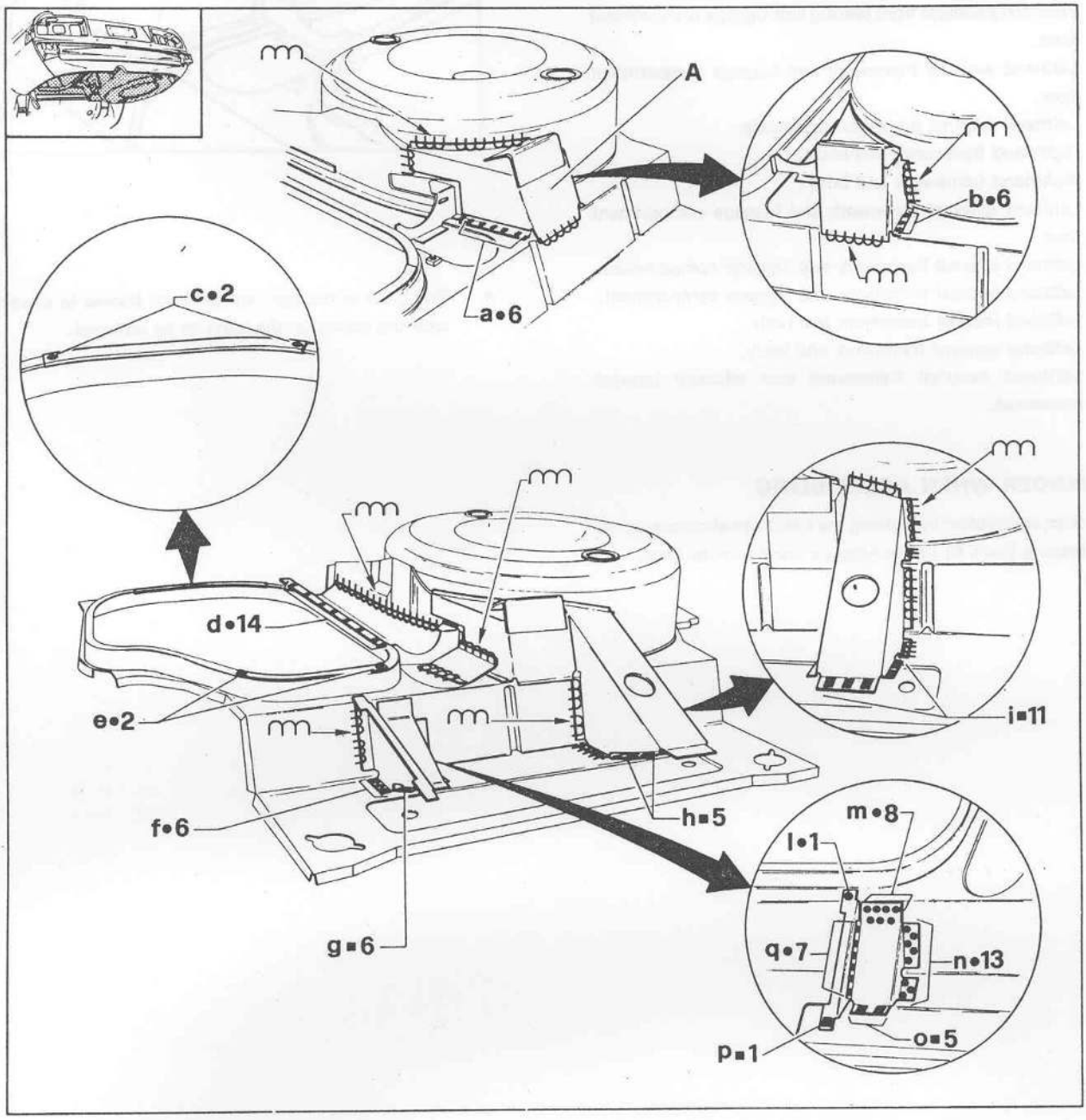
- Similarly, fit the outer lefthand wheelhouse bracing.



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LUGGAGE COMPARTMENT FLOOR ASSEMBLY

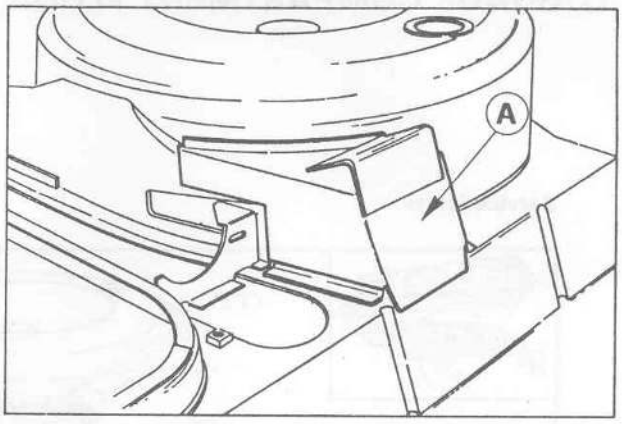
Service joints



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Parts to be welded

a. Spare wheel compartment bracing and luggage compartment floor.
b. Spare wheel compartment bracing and luggage compartment floor.
c. Tank compartment rear bracing and luggage compartment floor.
d. Rear longitudinal bracing and luggage compartment floor.
e. Tank compartment front bracing and luggage compartment floor.
f. Lefthand external framework and luggage compartment floor.
g. Lefthand external framework and body.
h. Righthand framework and body.
i. Righthand framework and body.
j. Lefthand external framework and luggage compartment floor.
k. Lefthand internal framework and luggage compartment.
l. Lefthand internal framework and luggage compartment.
m. Lefthand internal framework and body.
n. Lefthand external framework and body.
o. Lefthand external framework and lefthand internal framework.



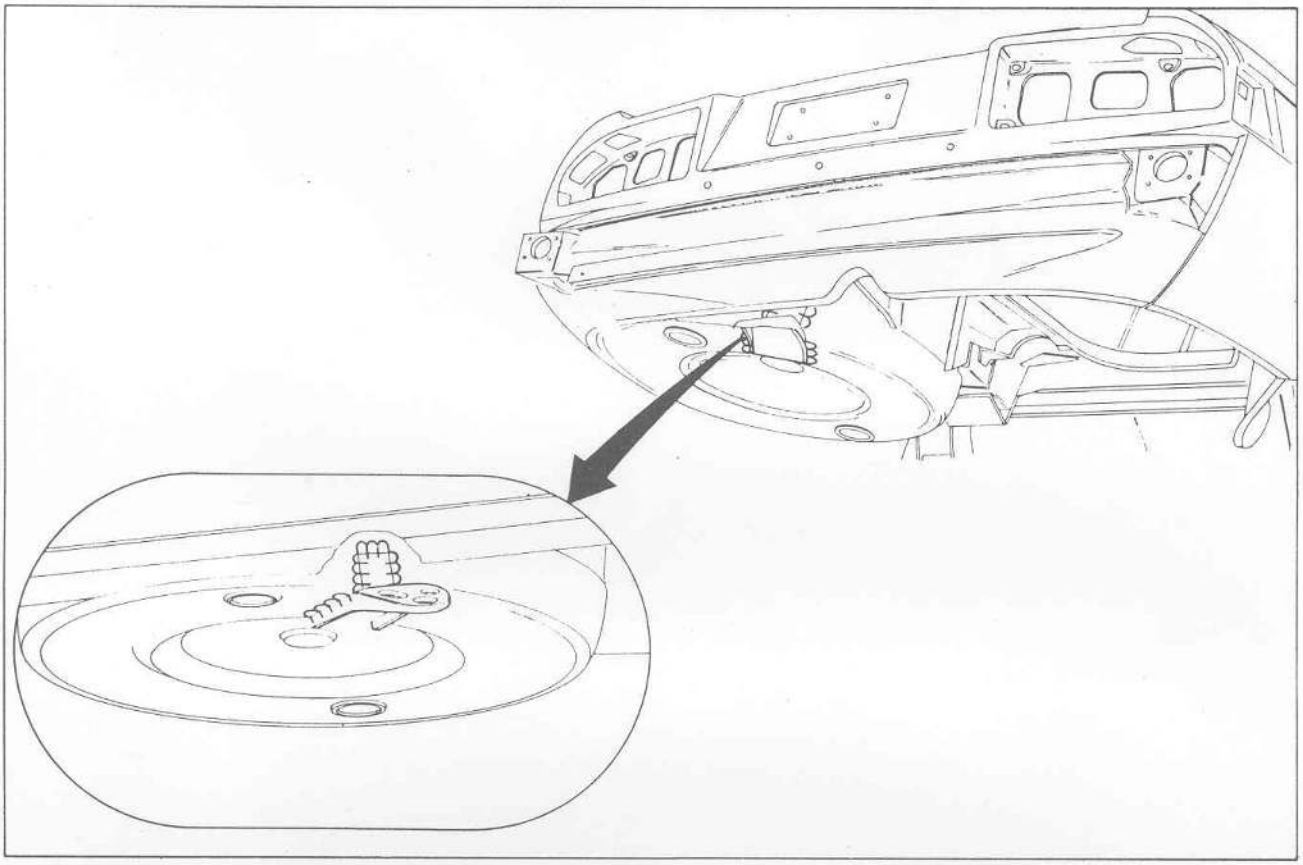
REMINDER WHEN ASSEMBLING

- Start assembling by welding the spare wheel compartment bracing (item A) to the luggage compartment floor.
- Drill holes in the right and lefthand frames to correspond with the points on the parts to be replaced.

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REAR TOWING BRACKET Spider

Service joints



REMINDER WHEN REMOVING

- Use a grinder in order to not damage the spare wheel compartment.

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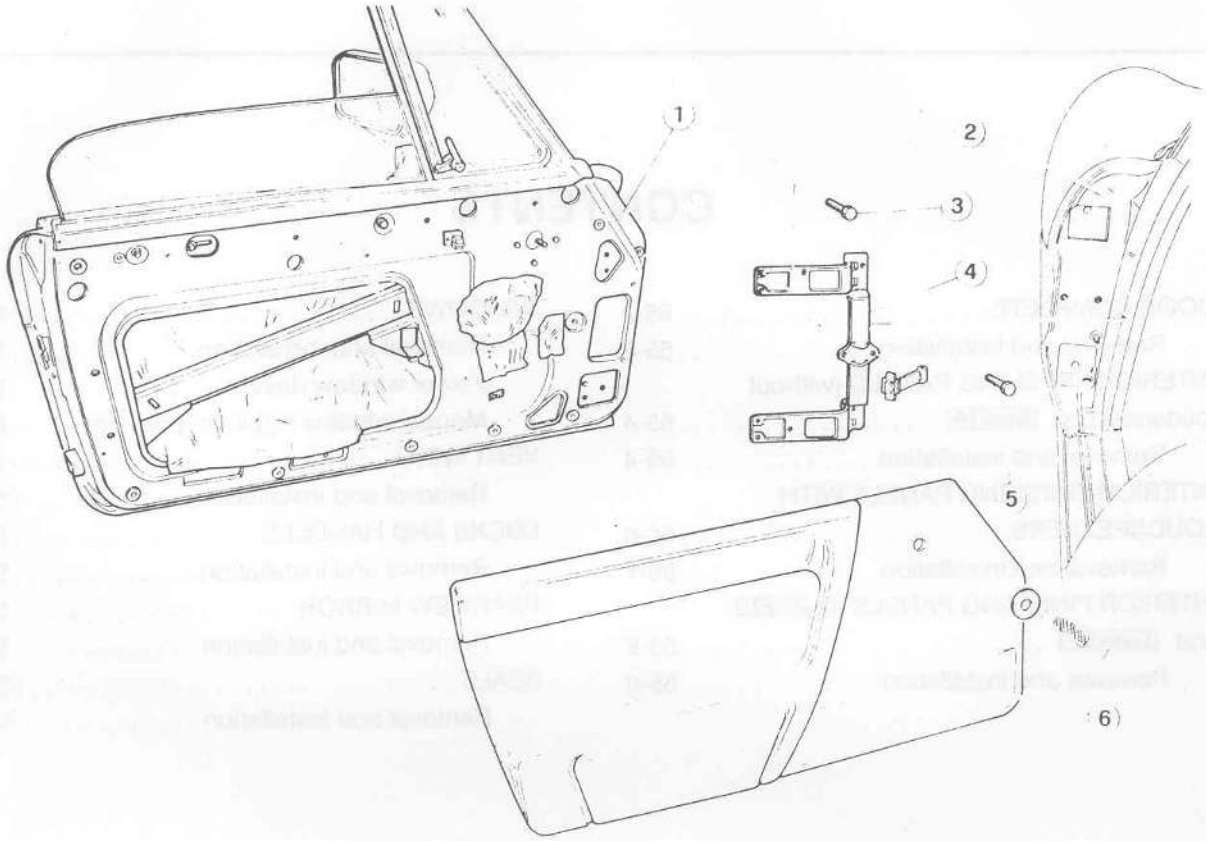
UNIT 55

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INTERIOR FINISHING PANELS WITH LOUDSPEAKERS 55-6
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Removal and installation 55-16

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DOOR, COMPLETE



1 Door
2 Door posts
3 Screw fixing door to hinge
4 Hinge support
5 Screw fixing hinge to post
6 Door panel

REMOVAL AND INSTALLATION

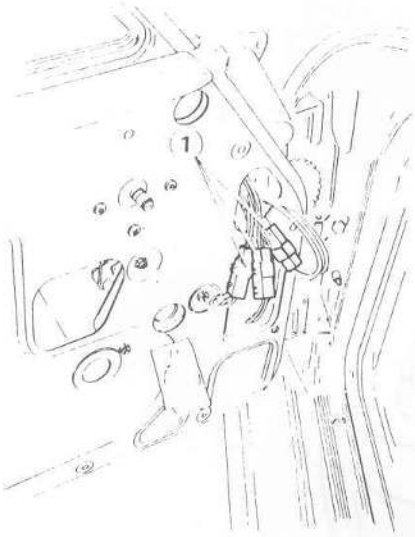
1. Detach the door panel as instructed in Interior Finishing Panels - Removal and Installation.
2. Remove the protection (1) and detach the casing (2) of the electric wiring from the door.



1 Protection
2 Casing

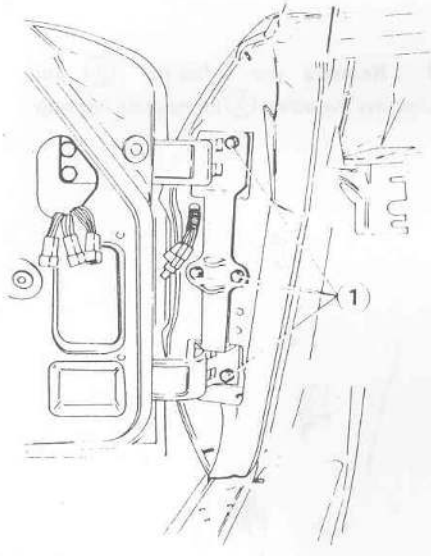
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3. Disconnect the connectors (1) of the rear view mirror control cables and, if assembled, those of the power window.



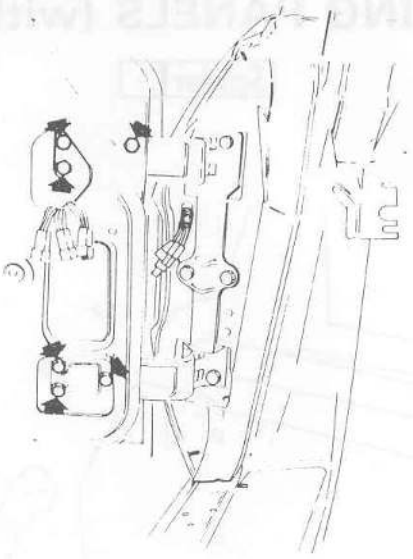
1 Connectors

4. Free the electric wiring from the door, uscrew the four screws (1) securing the door to the post and remove the complete door.

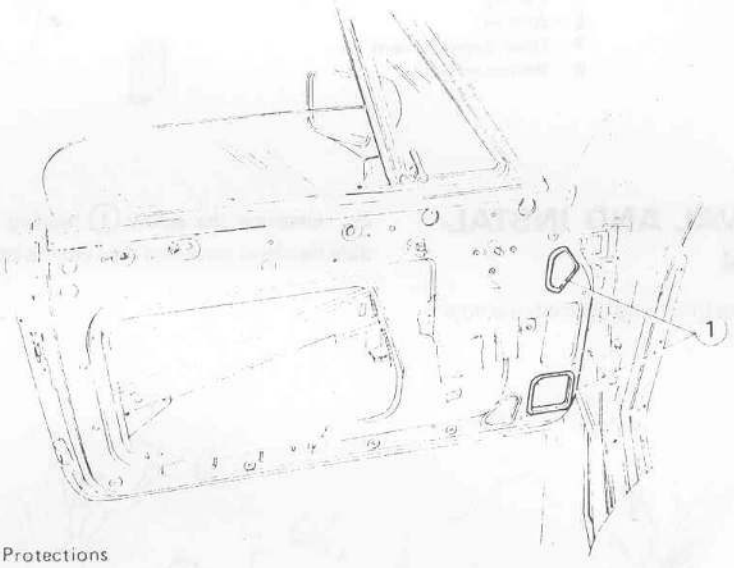


1 Screws

WARNING:
If it is not necessary to retain door adjustment it is possible to remove the door by unscrewing the six screws holding the door to the hinges.



5. Re-install the door by operating in reverse order of removal.
6. Prior to assembling the door panel, check the lights and door alignment with the car body. If necessary, adjust door position and remove the protections (1) so as to reach the six screws which couple and adjust the door and hinges.

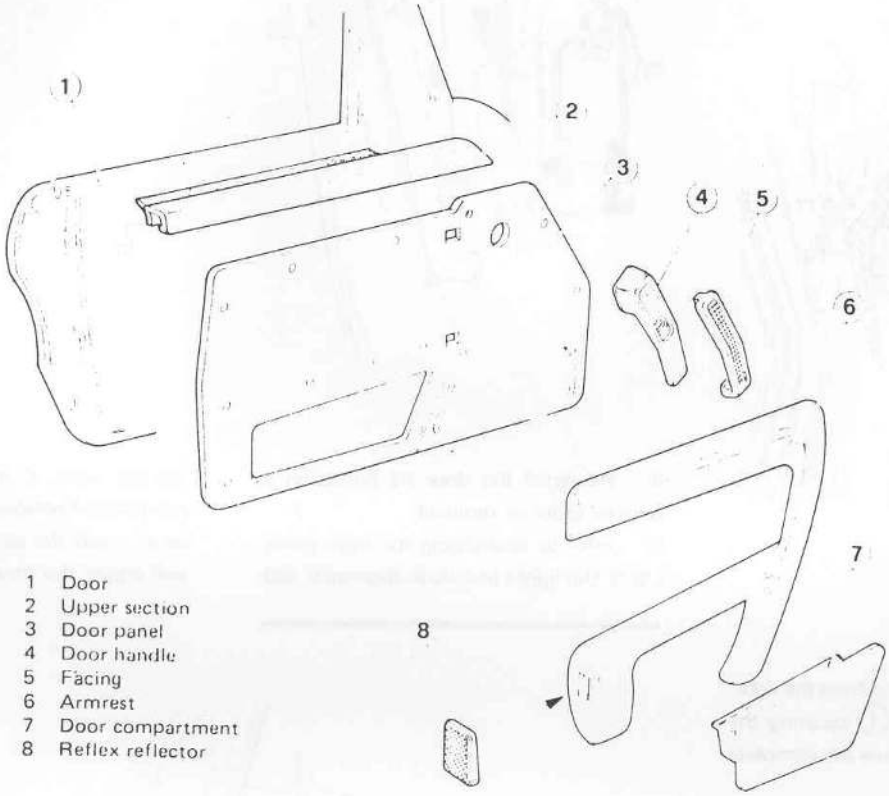


1 Protections

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INTERIOR FINISHING PANELS (without loudspeaker)

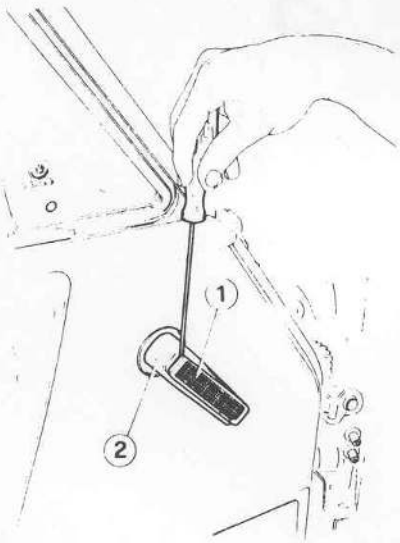
Spider



1 Door
2 Upper section
3 Door panel
4 Door handle
5 Facing
6 Armrest
7 Door compartment
8 Reflex reflector

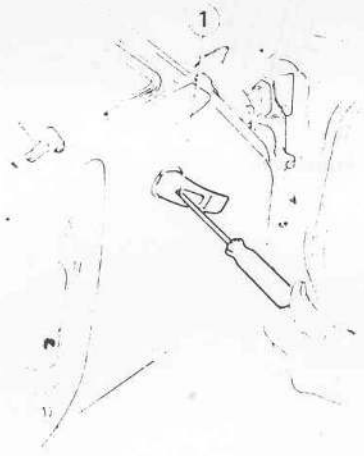
REMOVAL AND INSTALLATION

1. Remove the facing (1) from the door handle (2).



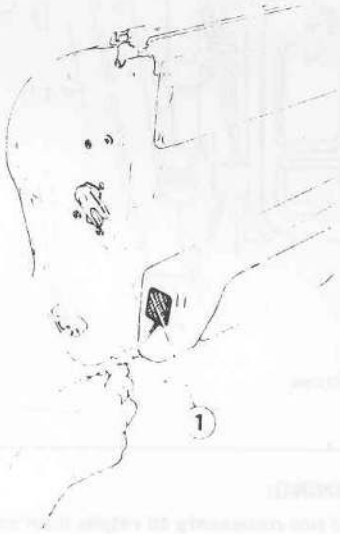
1 Facing
2 Door handle

2. Unscrew the screw (1) holding the door handle in place and slide out the latter.



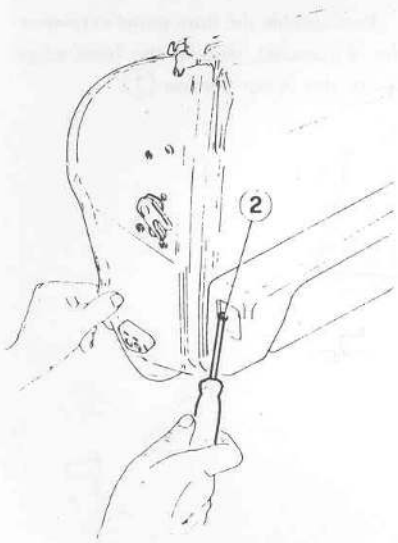
1 Screw

3. Remove the reflector (1) and unscrew the screw (2) in the plate housing.



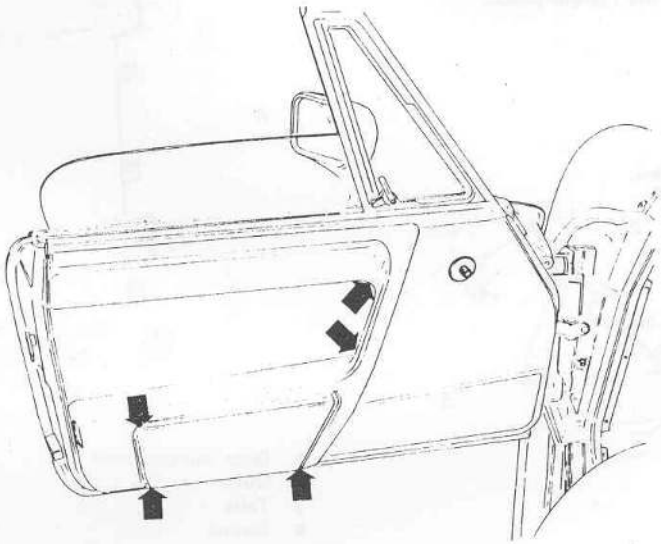
1 Reflector

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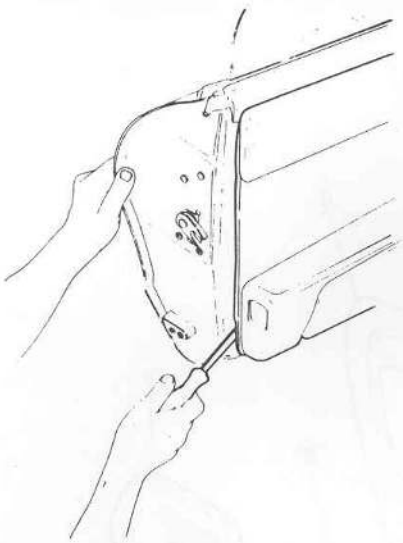


2 Screw

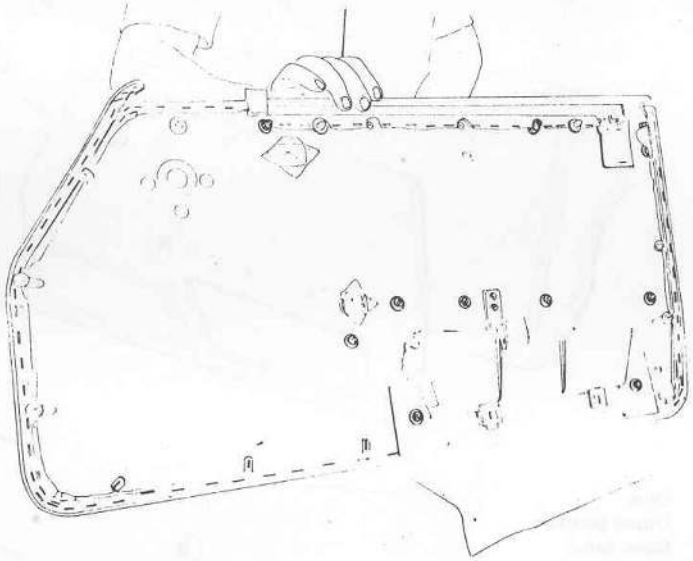
4. Unscrew the five screws securing the panel to the door.



5. Remove the door panel by releasing the coupling pins.

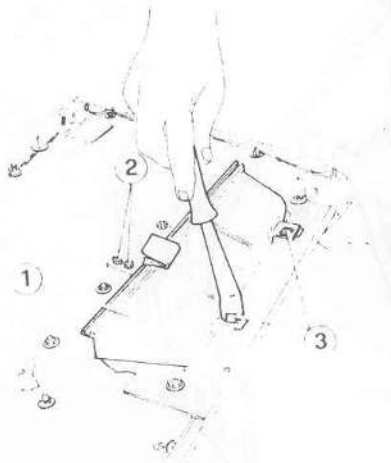


6. If necessary, separate the arm rest from the door panel by unscrewing the nuts on the inner face of the panel.



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7. If necessary, disassemble the door compartment (1), unscrew the two nuts (2), raise the tabs (3), disengage the compartment, unscrew the four screws (4) and get hold of the compartment.





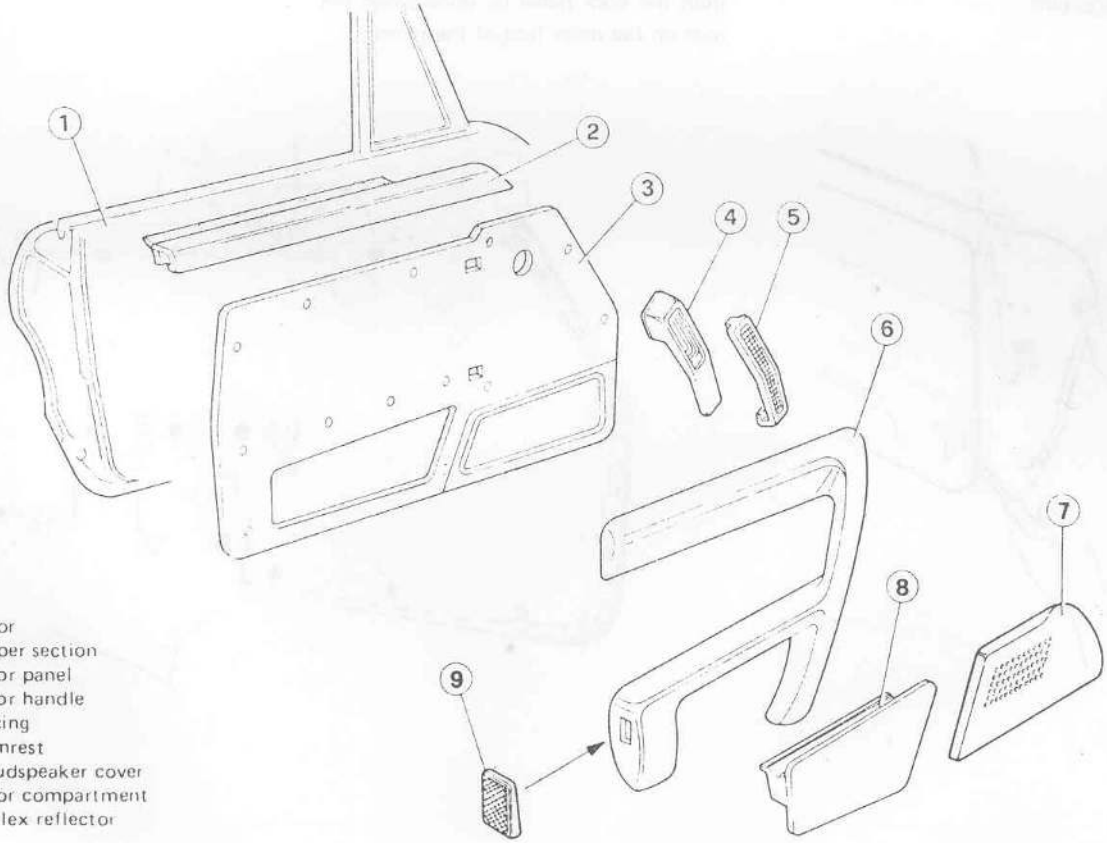
1 Door compartment
2 Nuts
3 Tabs
4 Screws

8. Reassemble the door panel in reverse order of removal, placing the front edge beneath the upper section (1).



1 Upper section

INTERIOR FINISHING PANELS WITH LOUDSPEAKER

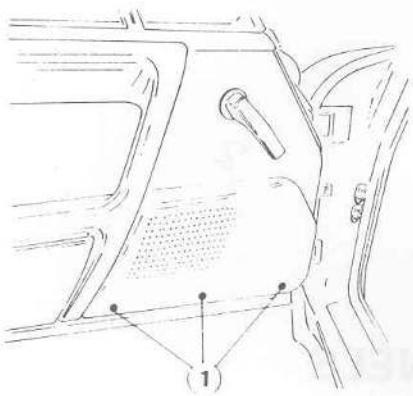


1 Door
2 Upper section
3 Door panel
4 Door handle
5 Facing
6 Armrest
7 Loudspeaker cover
8 Door compartment
9 Reflex reflector

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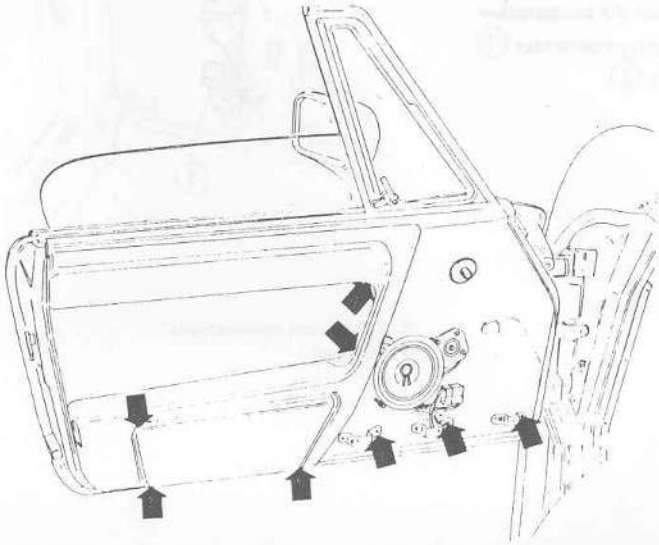
REMOVAL AND INSTALLATION

1. Remove the door handle and reflex reflector (see Interior Finishing Panels-without loudspeaker).
2. Remove the loudspeaker cover by unscrewing screws (1) and withdraw it from the groove turning upwards and forward.

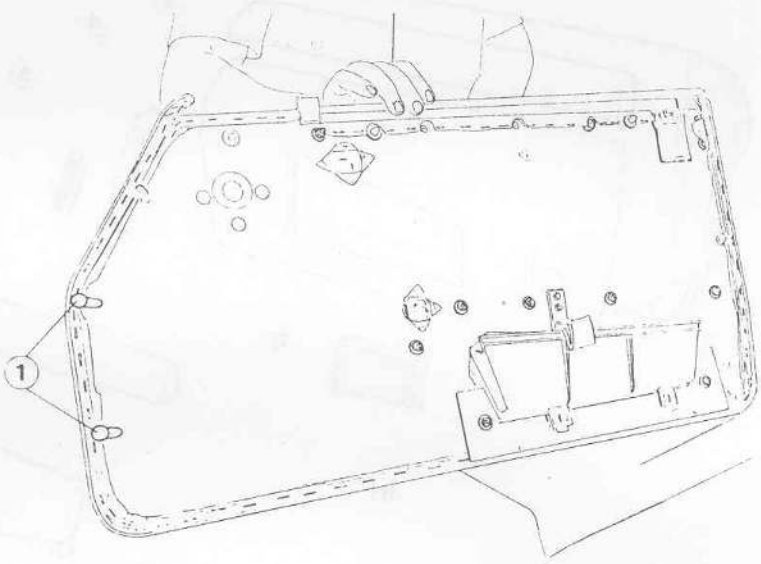


1 Screws

3. Unscrew the 8 screws securing the panel to the door.



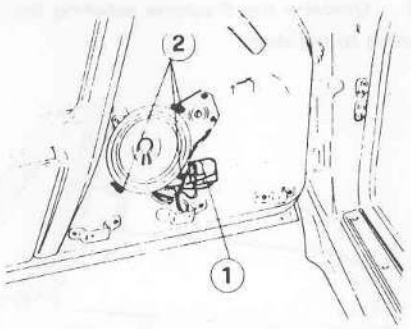
4. Separate the door panel by releasing the coupling pins (1).



1 Coupling pins

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5. If necessary, remove the arm rest and door compartment (see Interior Finishing Panels-without laudspeaker).
6. If necessary, remove the loudspeaker from the panel unplugging connector (1) and unscrewing screws (2).

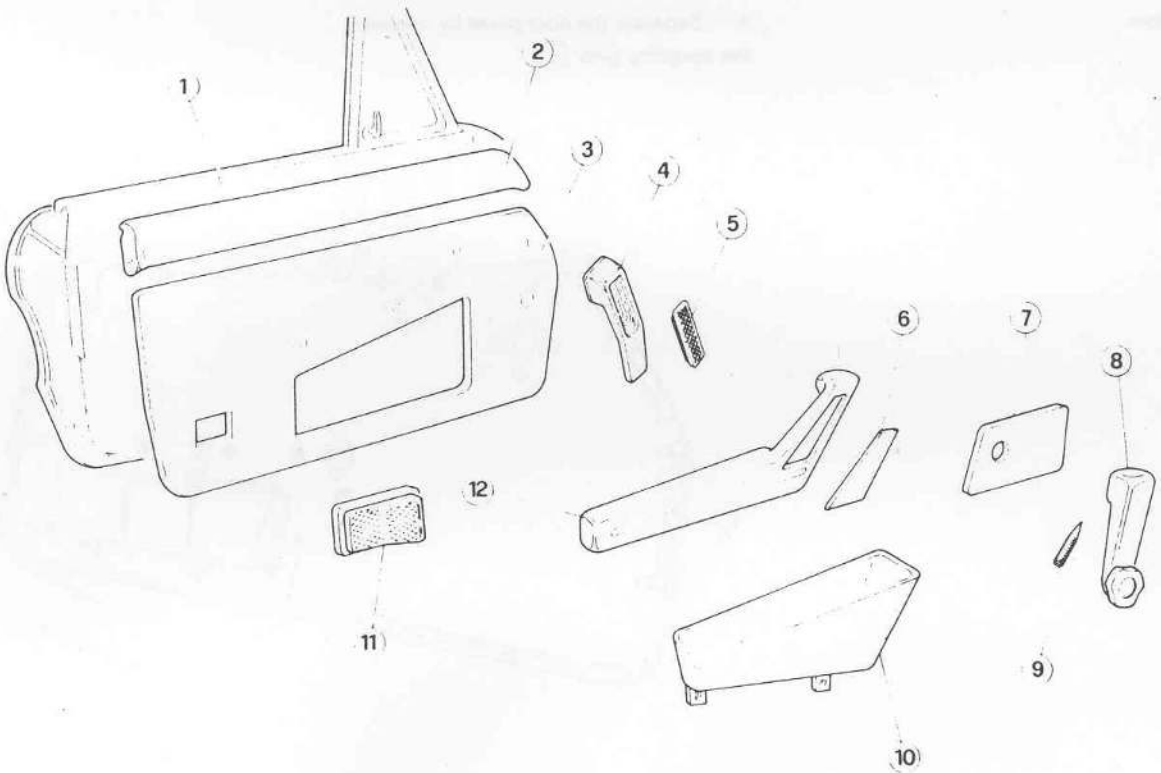


1 Electrical connections
2 Screws

7. Reassemble by reversing the removal procedures.

INTERIOR FINISHING PANELS

Spider 2.0 and Spider 1.6

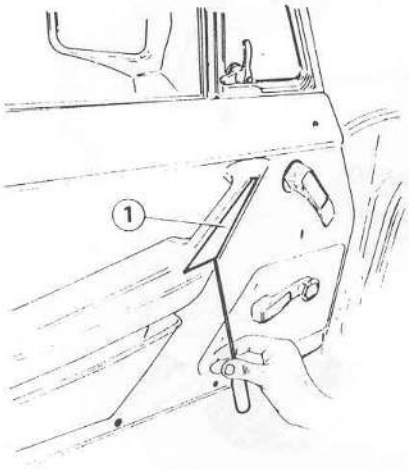


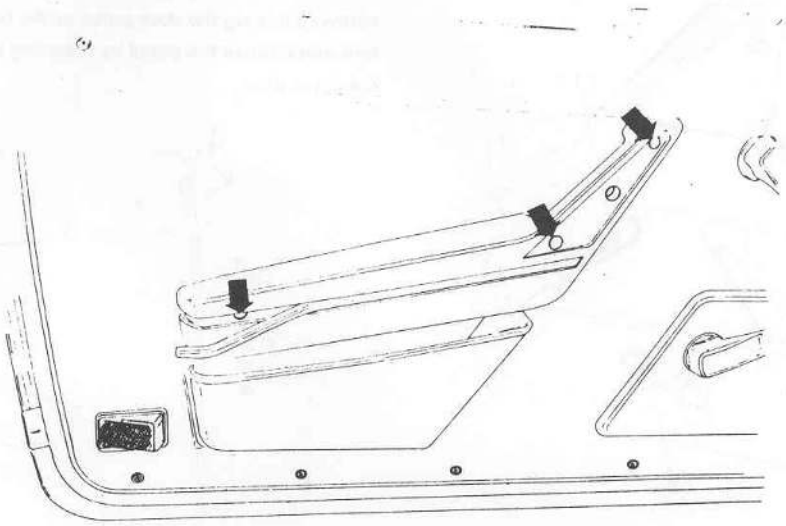
1 Door
2 Upper molding
3 Door panel
4 Door handle
5 Facing
6 Facing
7 Cover
8 Window regulating device
9 Screw
10 Door compartment
11 Reflector
12 Armrest

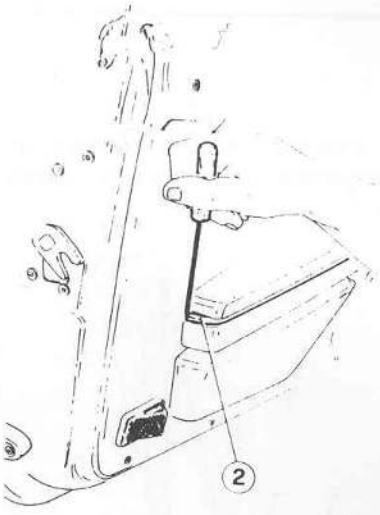
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REMOVAL AND INSTALLATION

1. Remove the handgrip facing (1) and partially detach the armrest trim (2).



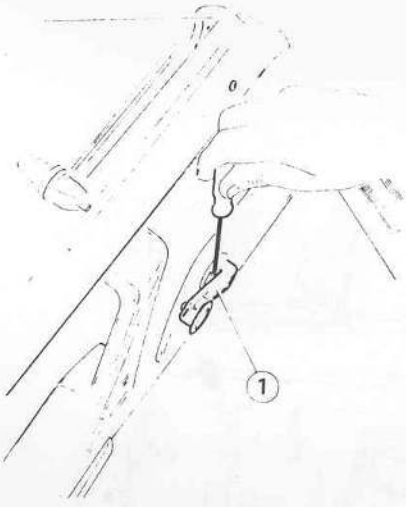




1 Facing
2 Trim

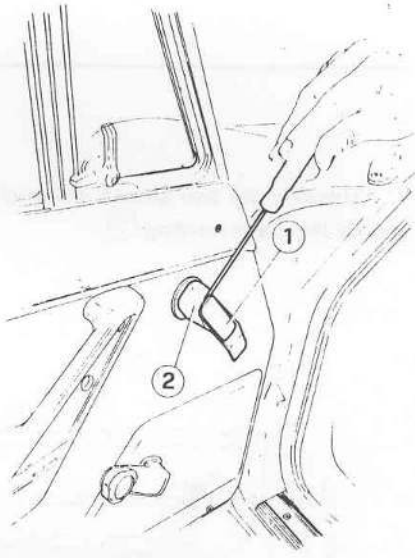
2. Unscrew the three screws shown in the figure.

3. Unscrew the window regulating device screw.



1 Window regulating device

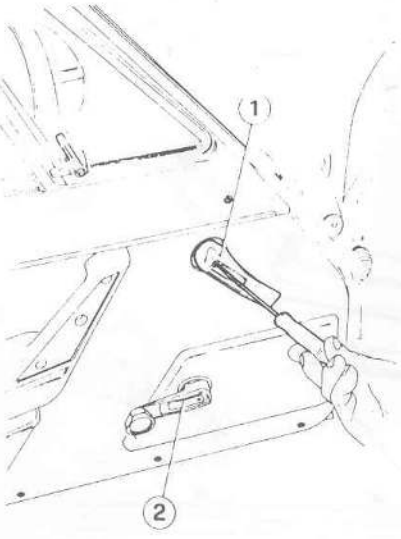
4. Remove the facing (1) from the door handle (2).



1 Facing
2 Door handle

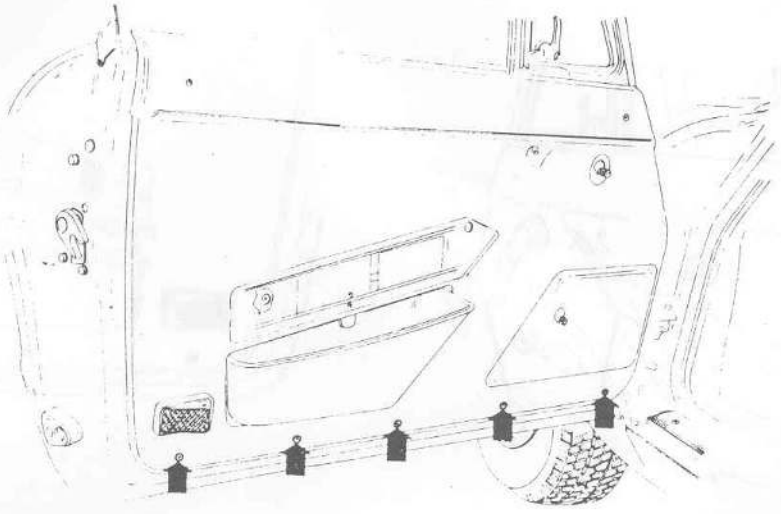
5. Unscrew the screw securing the door handle (1) then remove the handle and window regulating device (2).

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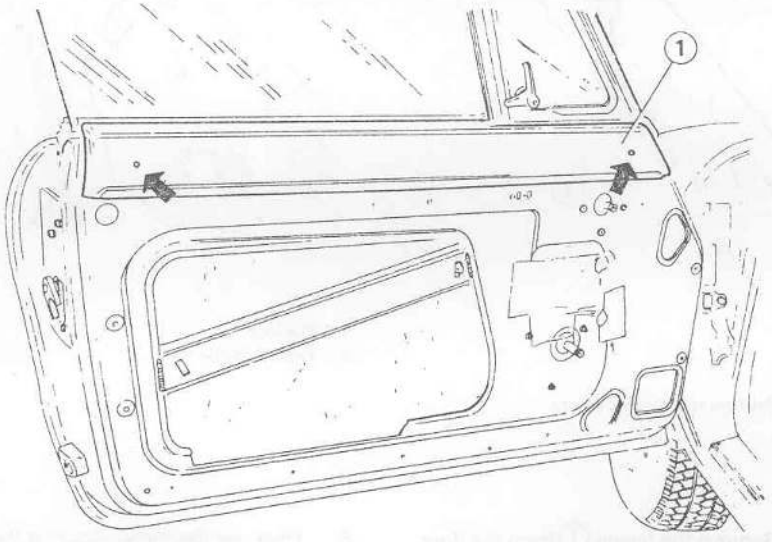


1 Door handle
2 Window regulating device

6. Remove the grip, unscrew the five screws securing the door panel at the bottom and remove the panel by releasing the coupling pins.

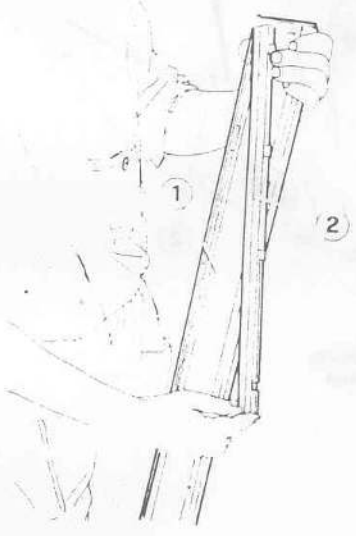


7. Unscrew the two screws indicated and lift the upper molding (1).



1 Upper molding

8. If necessary remove the window supporting section (2) from the upper molding (1).

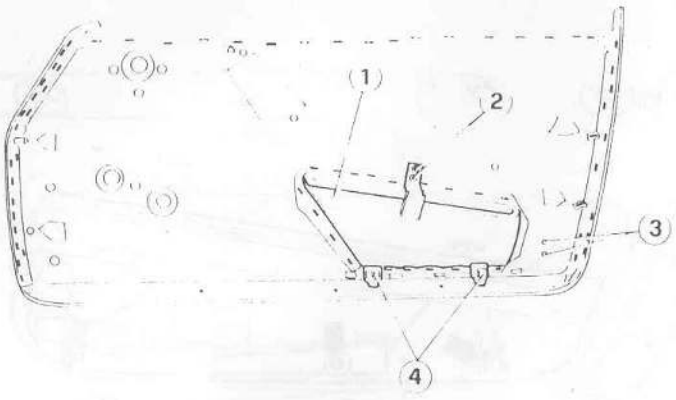


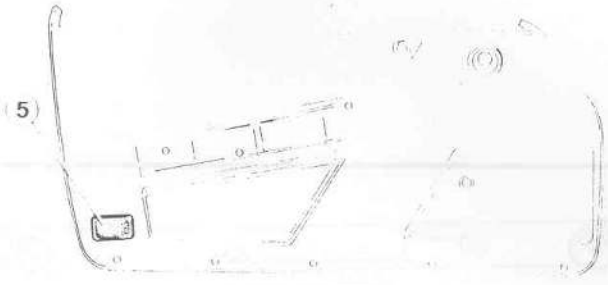
1 Upper molding
2 Section

9. If necessary unscrew the two nuts (2), raise the tabs (4) and remove the door compartment (1).

10. If necessary, unscrew the two screws (3) and remove the reflector (5).

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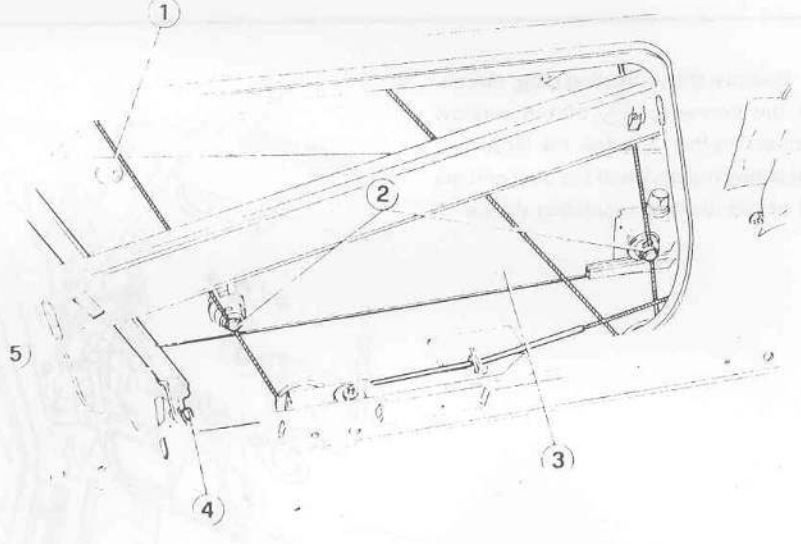
1 Door compartment
2 Nuts
3 Screws
4 Tabs
5 Reflector

11. Reassemble the door panel in reverse order of removal.

WINDOWS

REMOVAL AND INSTALLATION

1. Remove the door panel as indicated in Interior Finishing Panels - Removal and Installation.
2. Remove the sealing screen and lower the window (3) completely then unscrew the two screws (2) securing the window to window regulating device wires (1) and loosen the screw (4) which holds the window guide (5) in place.



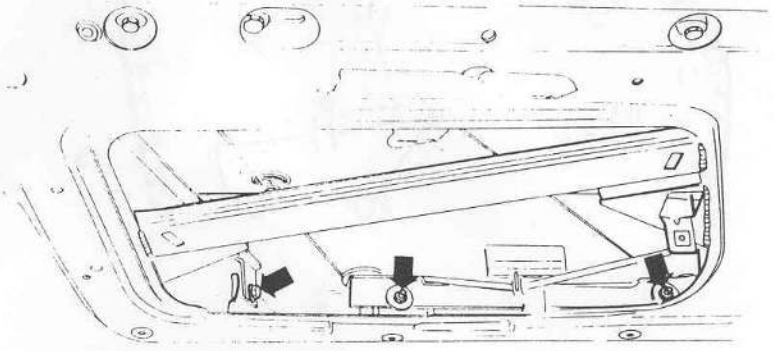
1 Wire
2 Screws
3 Window
4 Screw
5 Window guide

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3. Get hold of the window from above, disengaging it from the control wiring.
4. Reinstall the window by operating in reverse order of removal, observing the following tightening torque.

(T) : **Tightening torque**
Screws securing window to the window regulating device wires
6 N·m
(0.6 kg·m)
(4.4 ft·lb)

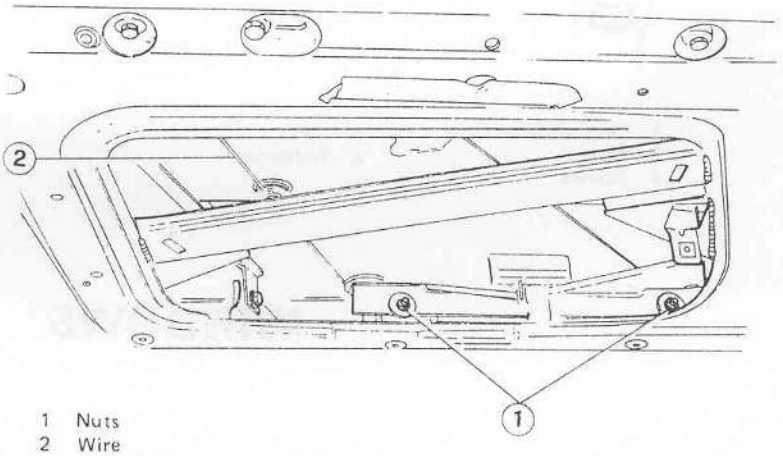
5. If necessary, adjust the angle of the window and the window regulating device by working on the screw and slotted nuts indicated in the figure.



POWER WINDOW DEVICE

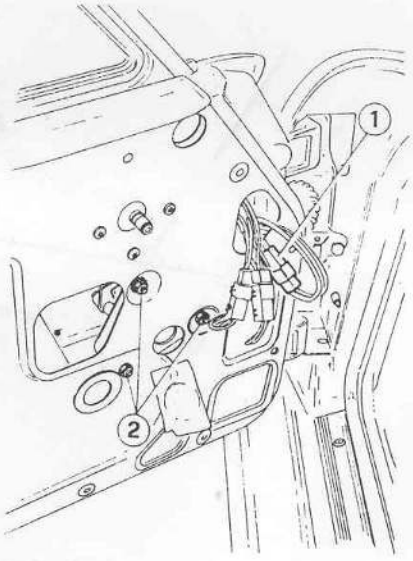
REMOVAL AND INSTALLATION

1. Remove the window by operating as indicated in Windows - Removal and Installation.
2. Loosen the two slotted nuts (1) and release the window motor wire (2).



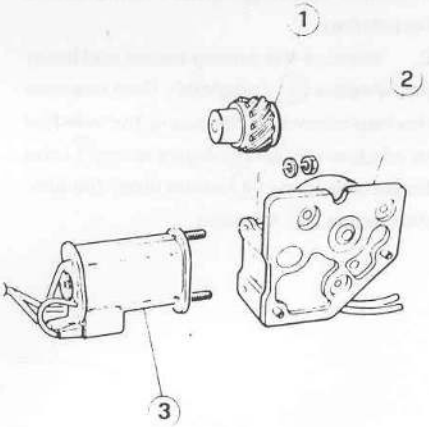
1 Nuts
2 Wire

3. Remove the protecting plug, disconnect the connector (1) of the window motor wiring then unscrew the three nuts (2) securing the device to the door and get hold of the window regulating device.



1 Connector
2 Nuts

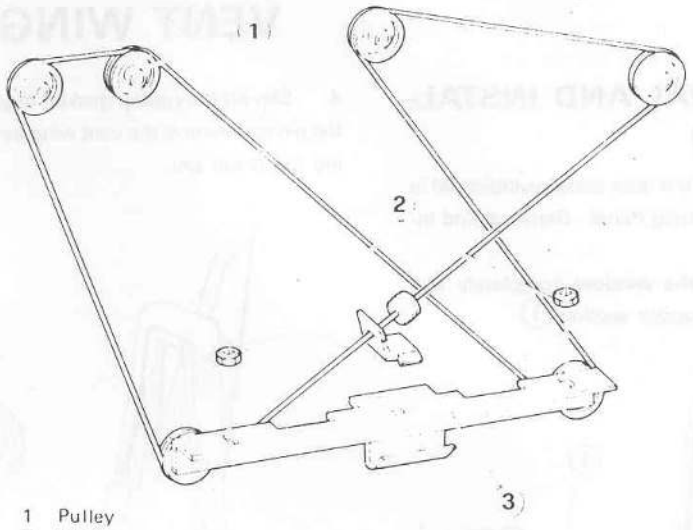
4. If necessary, dismantle the components of the window regulating device



1 Pinion
2 Window regulating device
3 Electric motor

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5. Re-install the window regulating device by working in reverse order of removal and observing the following:
- Assemble the motor wire by following the route marked out in the figure.
- Adjust wire tension by working on the slotted screw which holds the pulley (1) in place and on the nuts (2) adjusting the lower bracket (3).

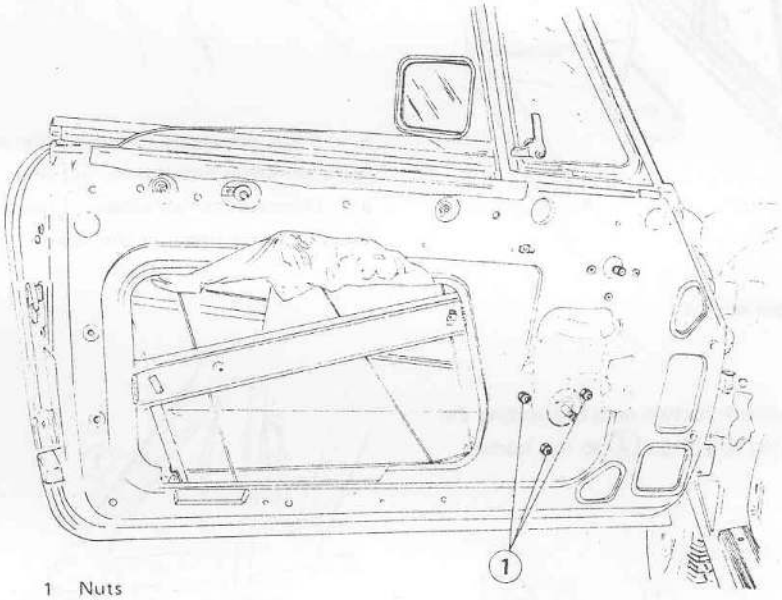


1 Pulley
2 Nuts
3 Lower bracket

MANUAL WINDOW REGULATING DEVICE

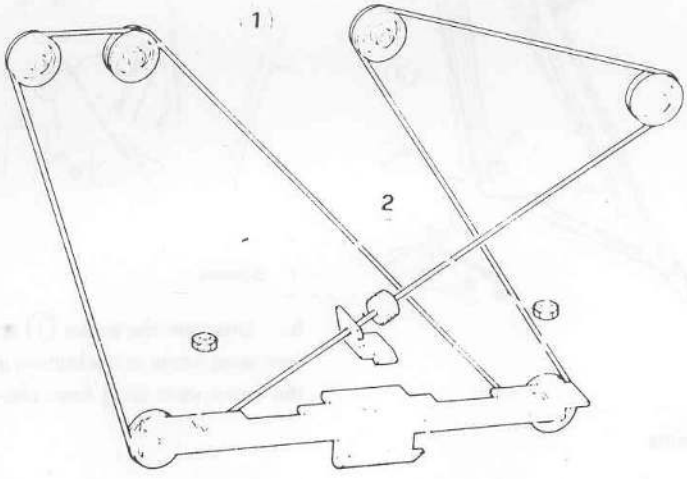
REMOVAL AND INSTALLATION

1. Operate as indicated in Power Window Device - Removal and Installation, steps 1-2.
2. Unscrew the three nuts (1) and get hold of the window regulating device.



1 Nuts

3. Re-install the window regulating device by operating in reverse order of removal and observing the following:
- Assemble the motor wire by following the route marked out in the figure.
- Adjust wire tension by working on the slotted screw which holds the pulley (1) in place and on the nuts (2) adjusting the lower bracket (3).



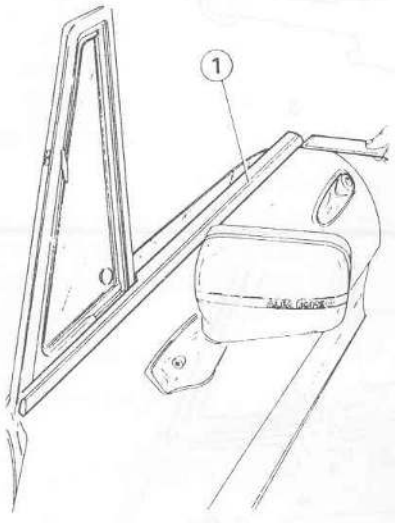
1 Pulley
2 Nuts
3 Lower bracket

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VENT WING

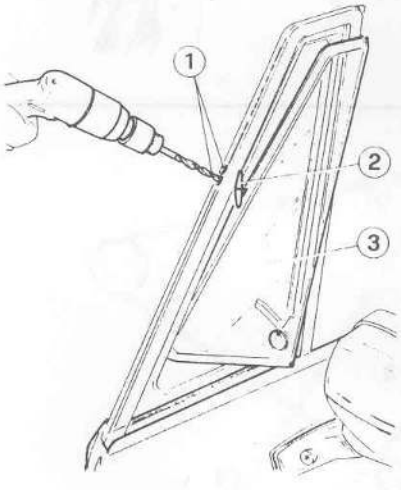
REMOVAL AND INSTALLATION

1. Detach the door panel as indicated in Interior Finishing Panel - Removal and Installation.
2. Lower the window completely and remove the upper section (1).



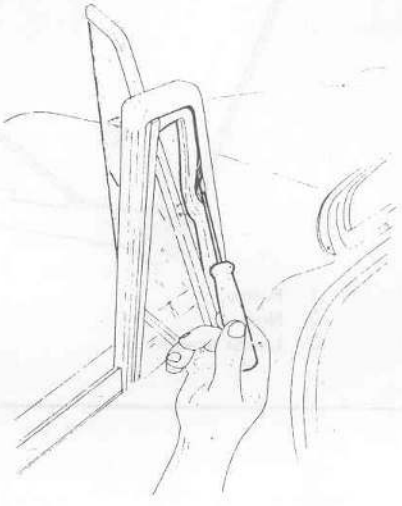
1 Upper section

3. Drill off the two nails (1) holding the vent wing (3) hinge (2) to the frame.

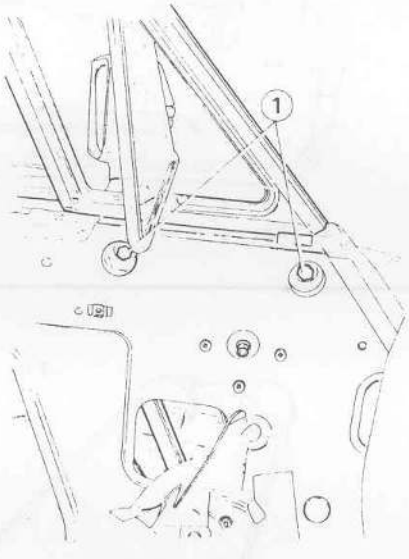


1 Nails
2 Hinge
3 Vent wing

4. Slip off the rubber gasket, disengage the pin and remove the vent wing by releasing the lower pin.

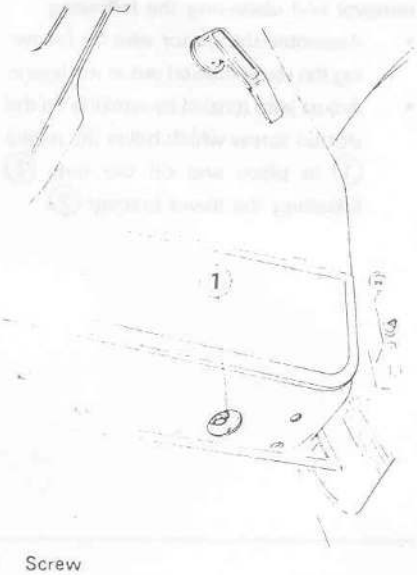


5. If it is necessary to remove the vent wing complete with frame, act thus:
a. Unscrew the two screws (1) securing the vent wing frame at the top.



1 Screws

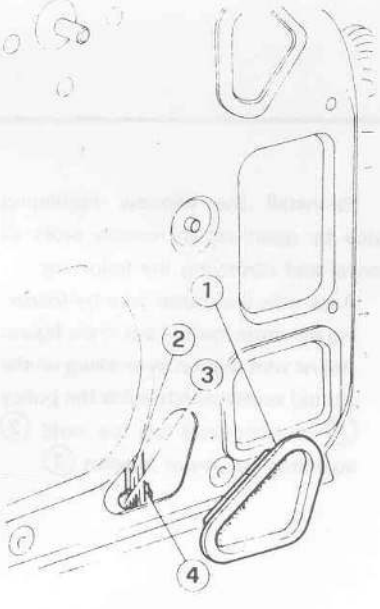
b. Unscrew the screw (1) securing the vent wing frame at the bottom and remove the entire vent wing from above.



1 Screw

c. Reassemble the vent wing, adjust the angle accordingly then tighten the screws.

WARNING:
To adjust the vent wing angle, remove the protective plug (1) and work on the slotted bolt (3) which holds the vent wing column (2) to the coupling square (4).



1 Protective plug
2 Vent wing column
3 Bolt
4 Coupling square

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WARNING:
When assembling or dismantling the hard top it is often necessary to adjust the vent wing and window angles. It is therefore necessary to slacken the screws, adjust the vent wing and window angles then tighten the screws again.

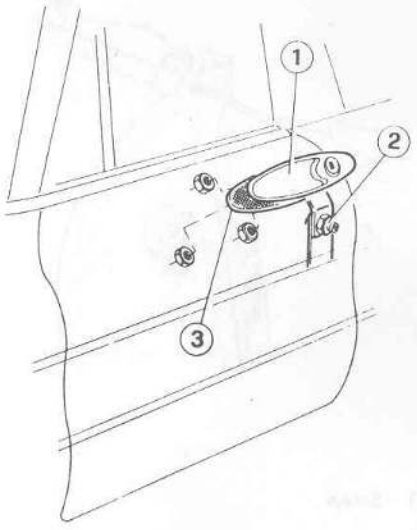
6. Re-install the vent wing by operating in reverse order of removal.

LOCKS AND HANDLES

REMOVAL AND INSTALLATION

WARNING:
When dealing with an internal handle only, work as instructed in Interior Finishing Panels - Removal and Installation at those steps associated with handle removal.

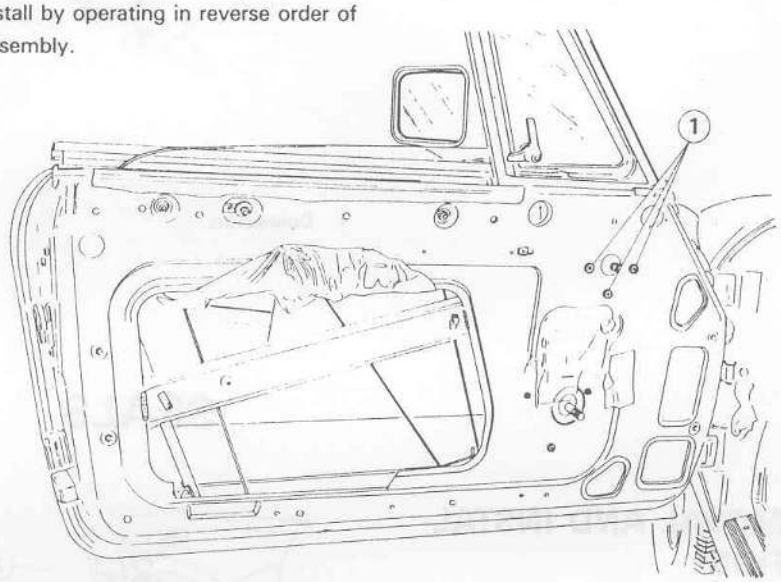
1. Lift off the window and detach the door panel by operating as instructed in Interior Finishing Panels.
2. Unscrew the three nuts securing the external handle assembly (1) and the nut (2) connecting the transmission and extract the assembly.



1 External handle assembly
2 Nut
3 Gasket

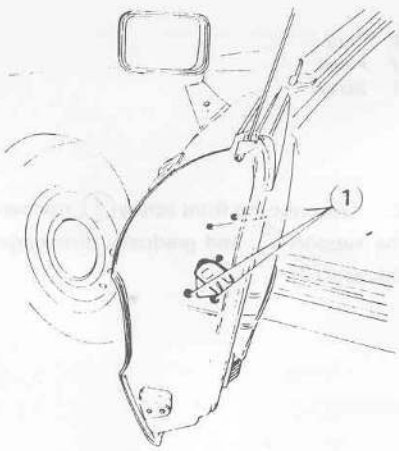
3. When dealing with the external handle assembly only, disassemble the unit and re-install by operating in reverse order of disassembly.

4. Unscrew the three screws (1) securing the internal handle transmission.



1 Screws

5. Unscrew the four screws (1) securing the door lock.



1 Screws

6. Unscrew the screw securing the vent wing column to the door at the bottom then move the column so as to be able to extract the lock and associated control system.
7. Make appropriate replacements and re-install the assembly by operating in reverse order of removal.

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REARVIEW MIRROR

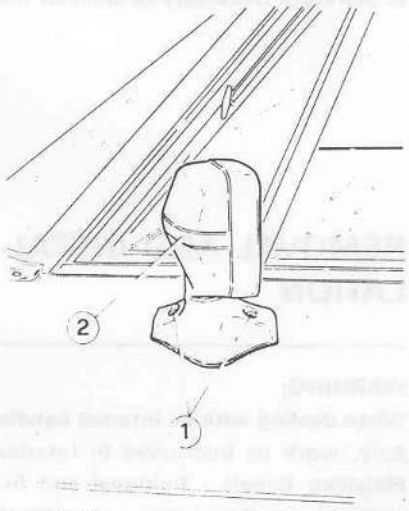
REMOVAL AND INSTALLATION

1. Detach the door panel as instructed in Interior Finishing Panels - Removal and Installation.
2. Remove the rubber protection and disconnect the connectors (1) of the rearview mirror control wiring.



1 Connectors

3. Unscrew the two screws (1) and remove the rearview mirror (2).

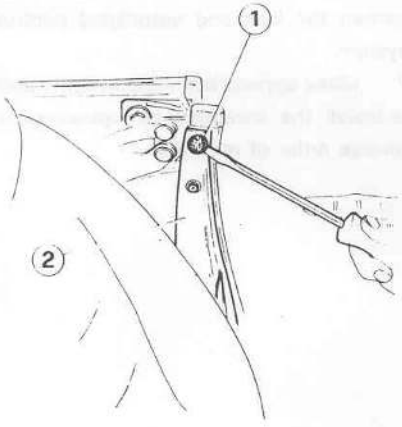


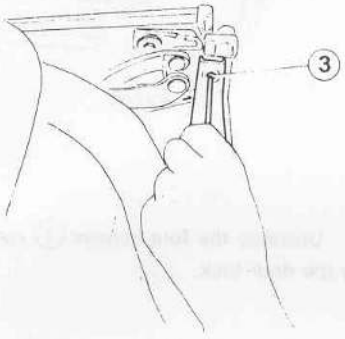
1 Screws
2 Rearview mirror

SEALS

REMOVAL AND INSTALLATION

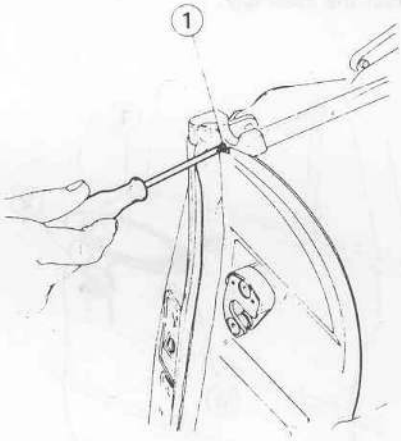
1. Working from the passenger compartment, remove the protection (1) and unscrew the screw (3) securing the panel (2).





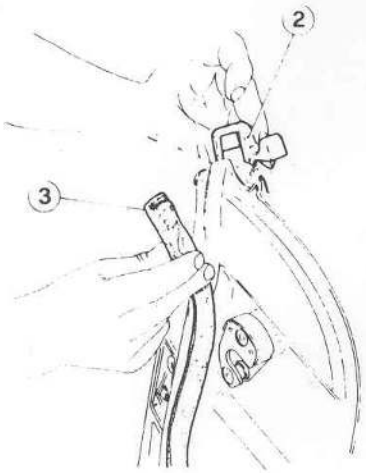
1 Plug
2 Panel
3 Screw

2. Unscrew the front screw (1), remove the support (2) and gradually disengage the seal (3).



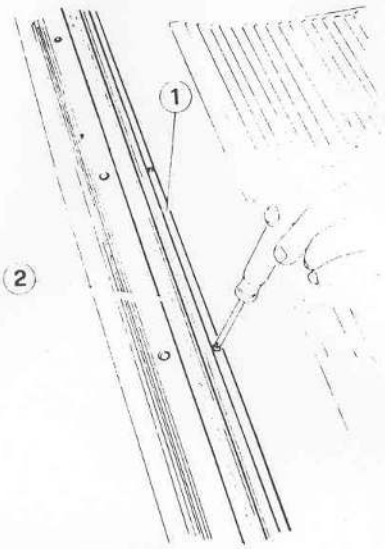
1 Screw

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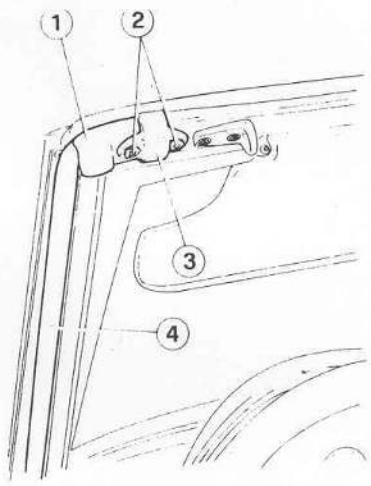
2 Support
3 Seal

3. Unscrew the screws securing the lower internal section (1) and remove the seal (2).



1 Lower internal section
2 Seal

4. Unscrew the two screws (2) holding the roof coupling (3), raise the end of the internal section (1) and remove the seal (4).



1 Internal section end
2 Screws
3 Roof coupling
4 Seal

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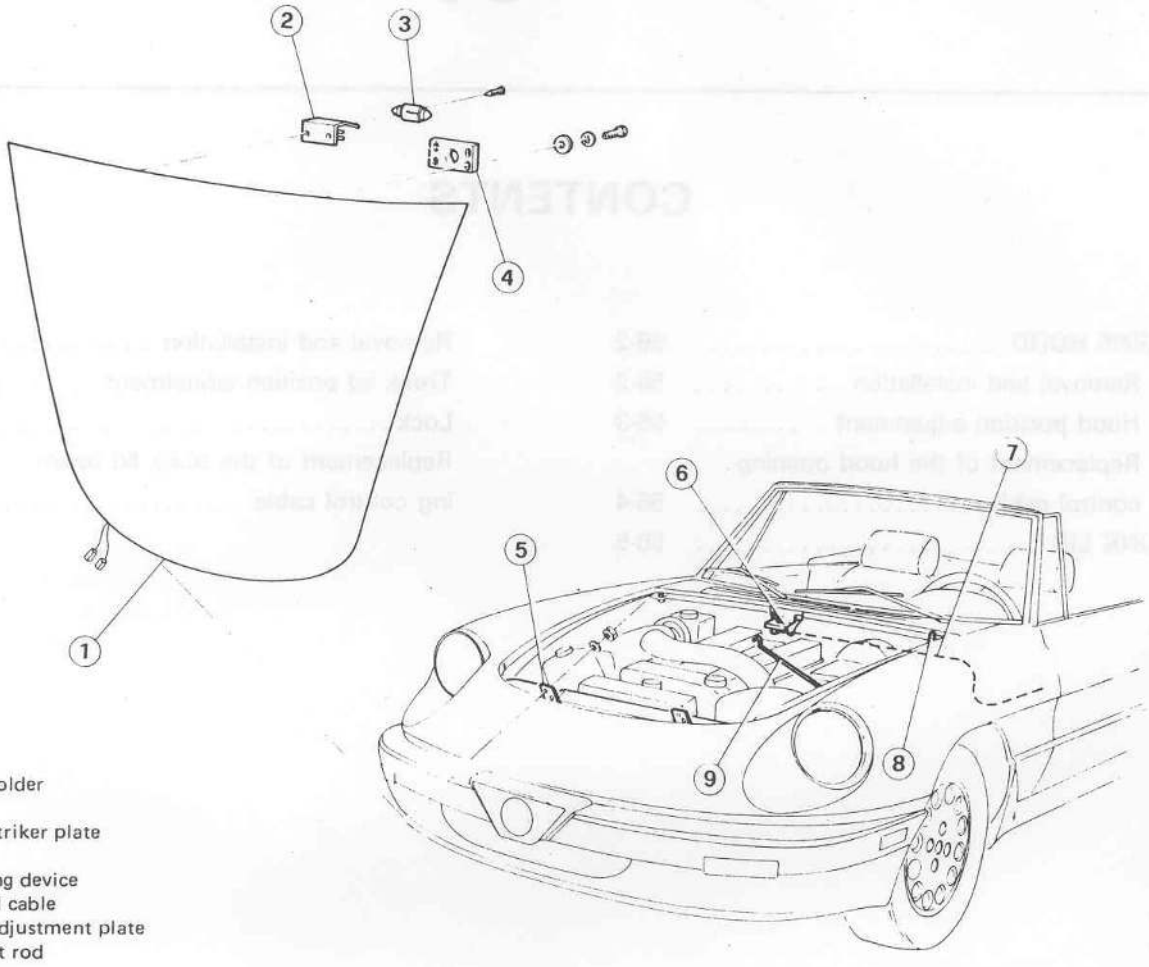
UNIT 56

CONTENTS

ENGINE HOOD 56-2
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Hood position adjustment 56-3
Replacement of the hood opening control cable..... 56-4
TRUNK LID 56-5
Removal and installation..... 56-6
Trunk lid position adjustment 56-6
Lock 56-7
Replacement of the trunk lid opening control cable 56-8

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ENGINE HOOD

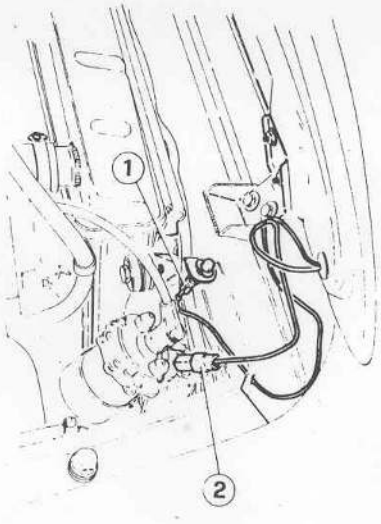


1 Hood
2 Lampholder
3 Lamp
4 Hood striker plate
5 Hinge
6 Coupling device
7 Control cable
8 Hood adjustment plate
9 Support rod

REMOVAL AND INSTALLATION

When removing or installing the hood, place a cloth or similar protection along the edges to prevent damage to the bodywork.

1. Open the hood and prop it up with the side support rod.
2. Disconnect connectors (1) and (2) of the engine compartment lamp.

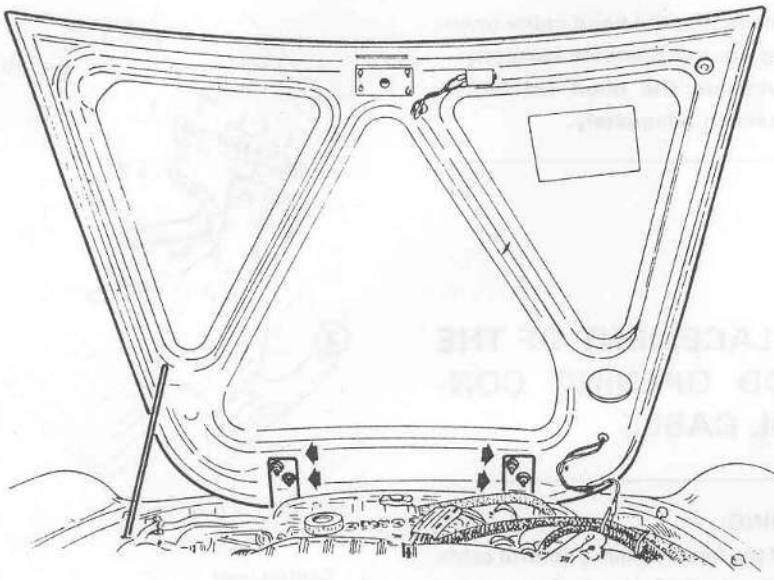


1 Lamp switch connector
2 Lamp connector

CAUTION:
Two mechanics are required to support and remove the hood.

3. Support the hood, unscrew the four nuts securing the hinges to the hood and remove the latter at the same time unhooking it from the support rod.

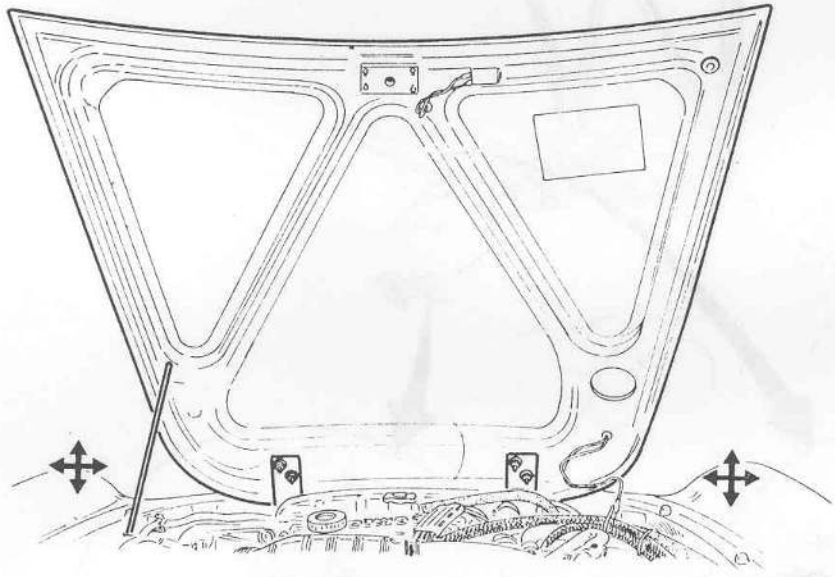
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4. Re-install the hood by operating in reverse order of removal, ensuring that the hood is correctly in place, if necessary adjust the position by operating as per "Hood Position Adjustment".

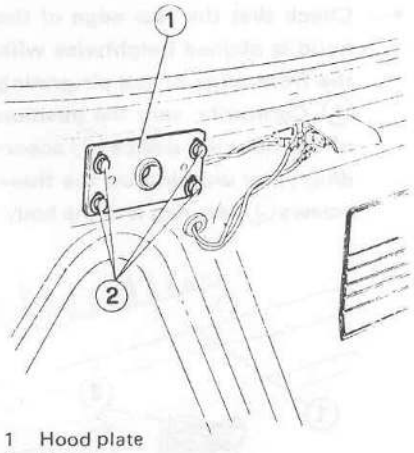
HOOD POSITION ADJUSTMENT

Loosen the four nuts securing the hood to its hinges and move the hood forwards, backwards and sideways until the correct position is attained.
If necessary place suitable shims between the hinges and hood.



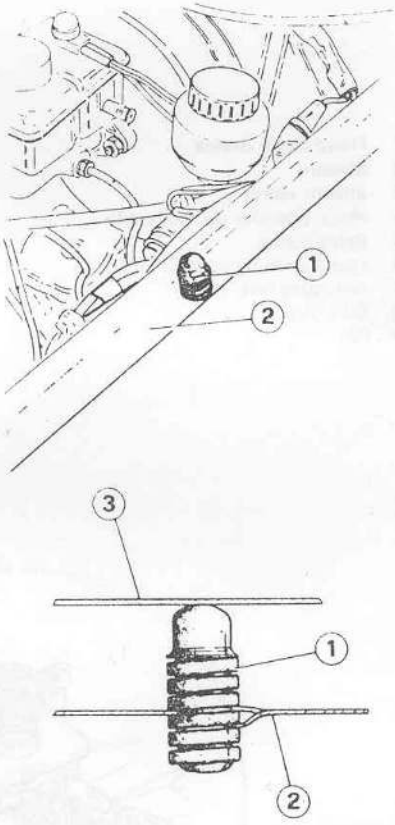
WARNING:
In the event of a replacement of the hood or removal of the striker plate on the hood, operate as follows when re-installing:

- **Work on the four screws (2), ensuring that the plate (1) is correctly positioned with respect to the hooking device located on the body, then tighten the screws.**



1 Hood plate
2 Screws

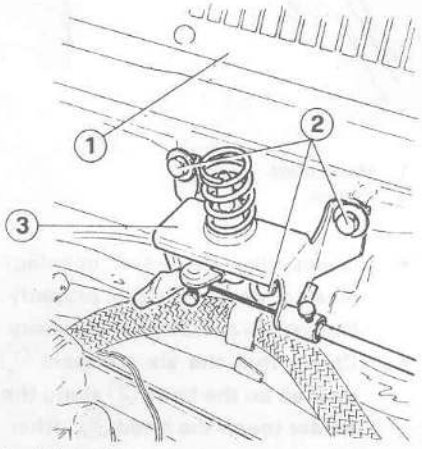
- **Check that the hood opening/closing device works properly. Repeat the operation if necessary.**
- **Check that the six stoppers (1) located on the body (2) along the fender touch the hood (3), otherwise alter the height of the stoppers accordingly by screwing or unscrewing them.**



1 Hood adjustment stopper
2 Body
3 Hood

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- Check that the rear edge of the hood is aligned heightwise with the front edge of the air grating (1). Contrarily, vary the position of the hooking device (3) accordingly, by working on the three screws (2) securing it to the body.



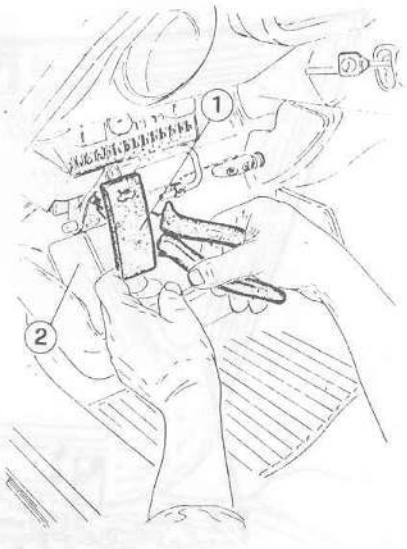
1 Air grating
2 Screws
3 Hooking device

- Check that the hood catch opening control operates correctly.
- Lubricate the hood catch mechanism adequately.

REPLACEMENT OF THE HOOD OPENING CONTROL CABLE

WARNING:
Should the hood opening control cable break the first thing to do is open the hood.

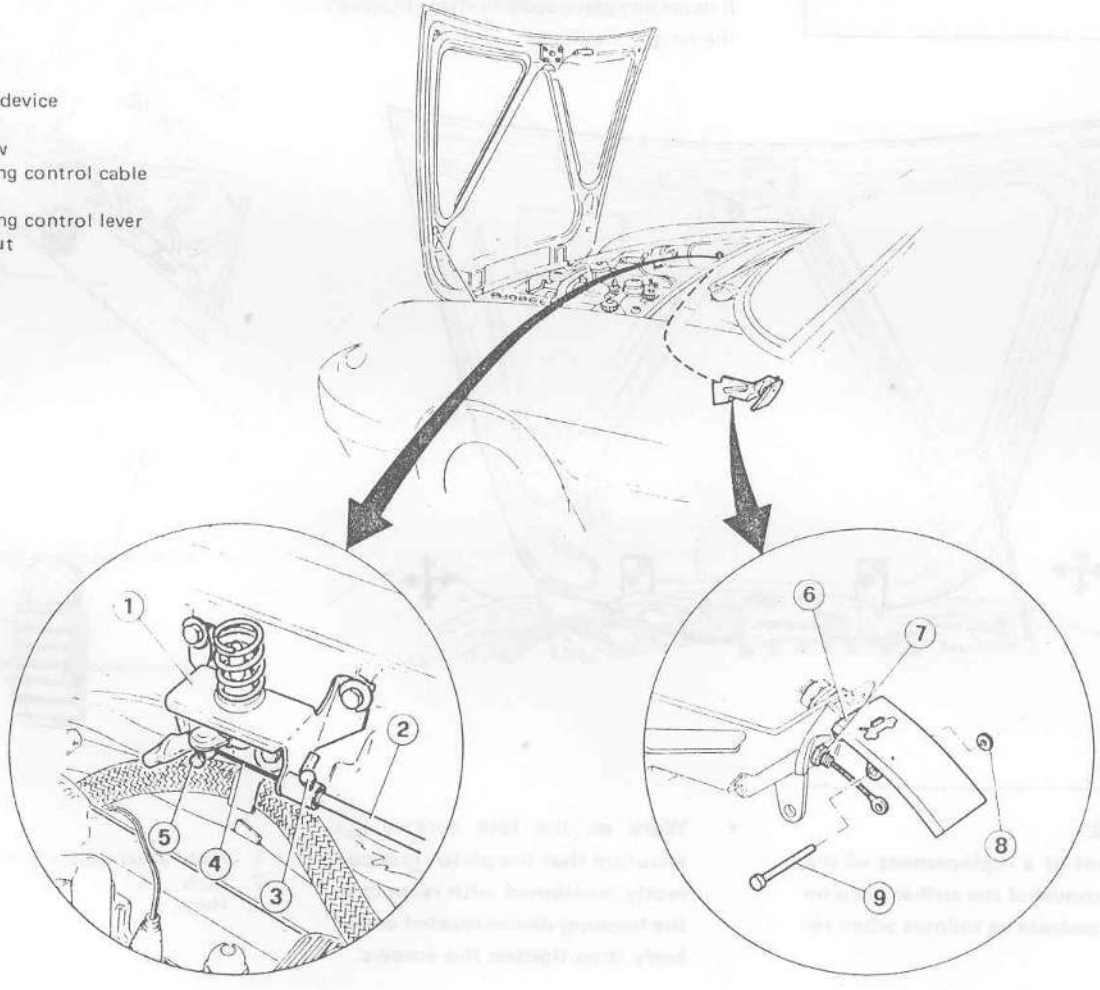
a. If the breakage has occurred in the control lever (1) cable coupling, lift off the fusebox cover (2) and pull the cable edge with pliers until the hood opens.



1 Control lever
2 Fusebox cover

b. If the breakage is in the catch device cable coupling it will be necessary to raise the car and, working from below with a lever, turn the catch device c.c.w. until the hood opens.

1 Hood catch device
2 Sheath
3 Sheath screw
4 Hood opening control cable
5 Cable screw
6 Hood opening control lever
7 Adjusting nut
8 Bull ring
9 Pin



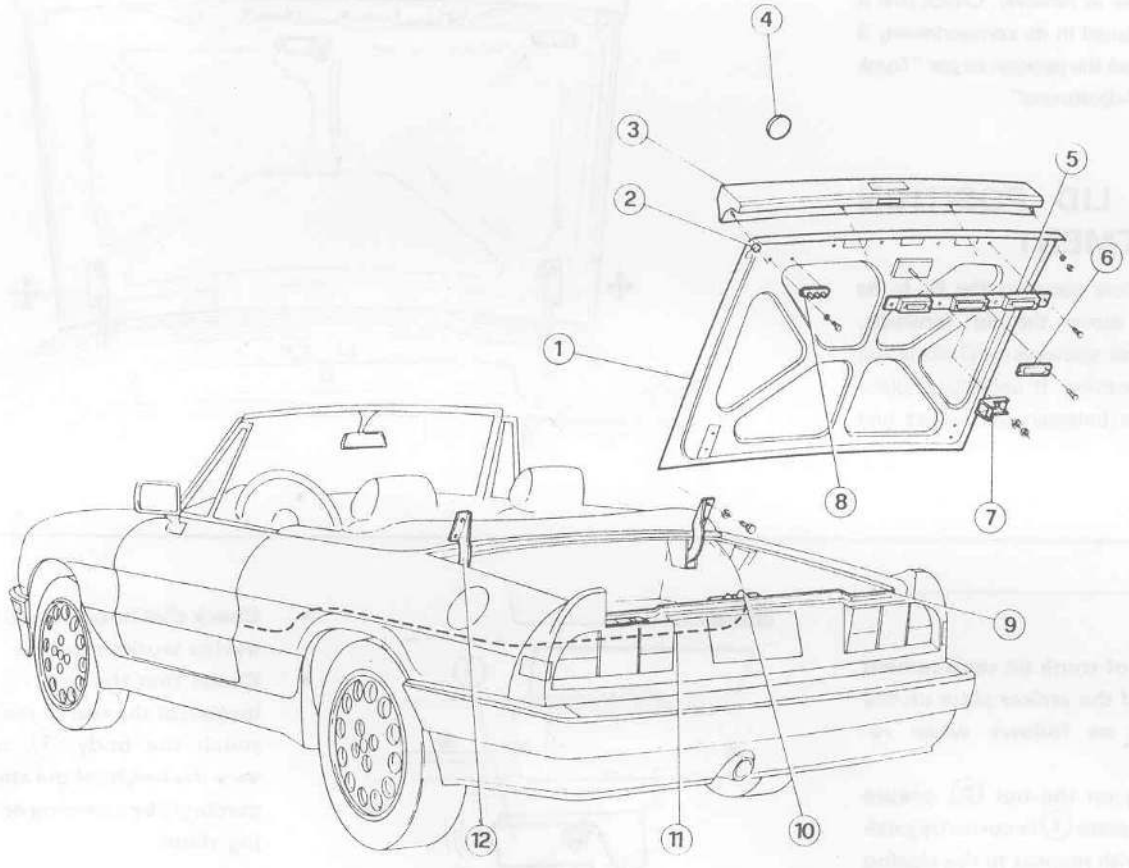
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1. Unscrew the screw (5) securing the cable and slide out the cable. Workng from inside the car, remove the bull ring (8), slide out the pin (9) and associated washers then get hold of the cable by the slotted end.
2. Slide in the new cable and secure the end slot to the control lever with the pin (9). Secure the pin by means of the bull ring (8).

WARNING:
Lubricate the cable with adequate oil, letting it slide into the sheath.

3. Working inside the engine compartment, thread the cable (4) in the eye of device (1) and secure with screw (5).
4. Check that the hood opening control is operating.
5. If necessary, adjust the cable position by working on the appropriate nut (7) and possibly on the screw (3).

TRUNK LID



1 Trunk lid
2 Trunk lid adjustment plate
3 Rear center spoiler
4 Badge
5 Licence plate lampholder
6 Licence plate lamp
7 Trunk lid striker
8 Hot contact electrical connector
9 Trunk lid plate seal
10 Trunk lid closing device
11 Trunk lid opening control cable
12 Hinge

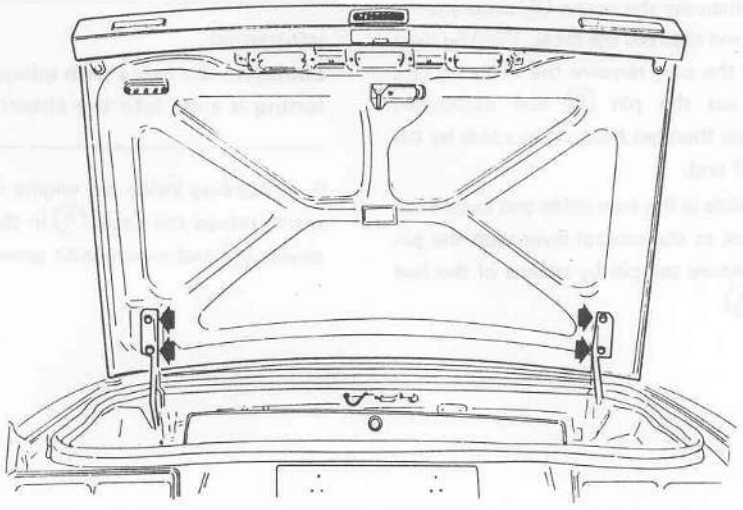
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REMOVAL AND INSTALLATION

When removing or installing the trunk lid place a cloth or similar protection along the edges of the lid to prevent damage to the bodywork.

CAUTION:
Two mechanics are required for trunk lid removal.

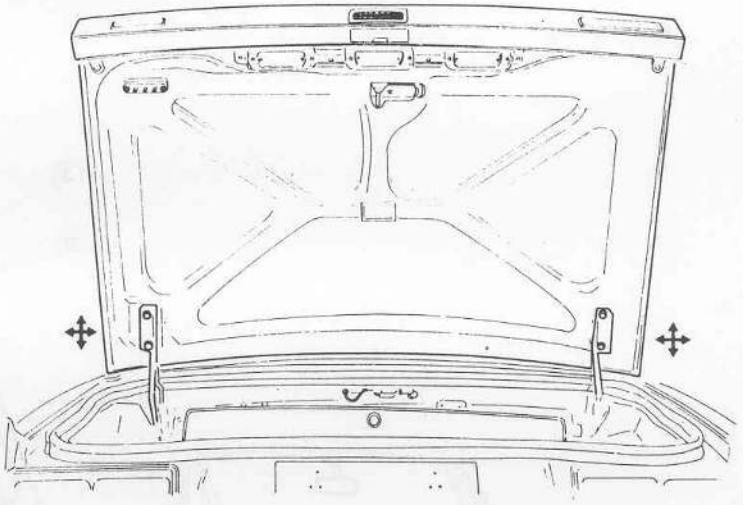
1. Open the trunk lid, unscrew the four nuts securing it to the hinges then remove it.



2. Reassemble the trunk lid on the car in reverse order of removal. Check that it is correctly placed in its compartment; if necessary adjust the position as per "Trunk Lid Position Adjustment".

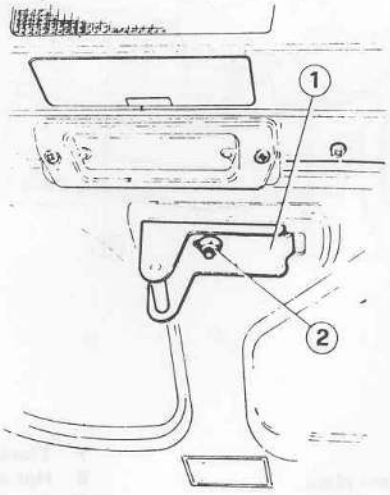
TRUNK LID POSITION ADJUSTMENT

Loosen the nuts securing the lid to its hinges and move the lid forwards, backwards and sideways until achieving the correct position. If necessary, place suitable shims between the hinges and trunk lid.



WARNING:
In the event of trunk lid replacement or removal of the striker plate on the lid, operate as follows when re-installing.

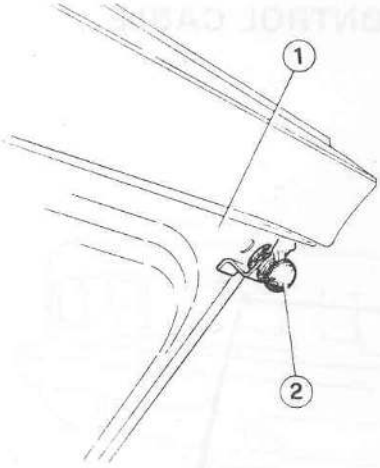
- **Working on the nut (2), ensure that the plate (1) is correctly positioned with respect to the closing device, located on the body, then lock the nut.**

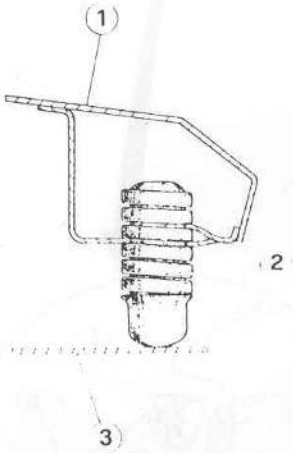


1 Trunk lid plate
2 Nut

- **Check that hood opening/closing device works properly.**
- **Check that the two stoppers (2) located at the rear of the hood (1), touch the body (3), otherwise vary the height of the stoppers accordingly by screwing or unscrewing them.**

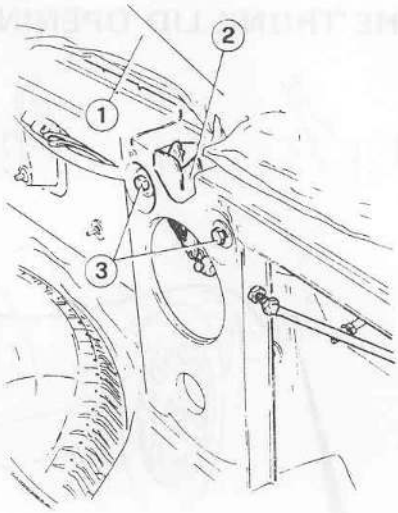
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1 Trunk lid
2 Trunk lid adjustment stopper
3 Body

- **If necessary, the position of the trunk lid closing device may be adjusted. Lift up the luggage compartment rear trimming (1), loosen the two screws (3) and position the closing device (2) correctly. Tighten the screws.**



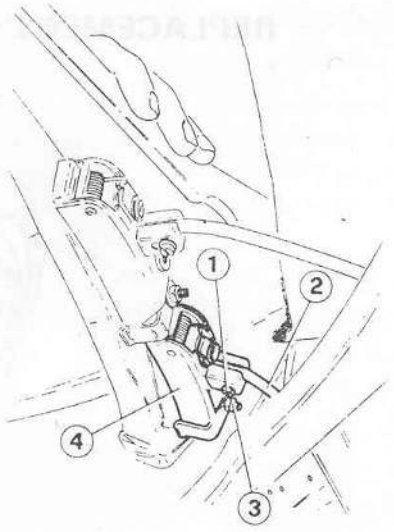
1 Luggage compartment rear trimming
2 Closing device
3 Screws

- **Check that the trunk lid closing device open control operates correctly.**
- **Grease the trunk lid catch mechanism adequately.**

LOCK

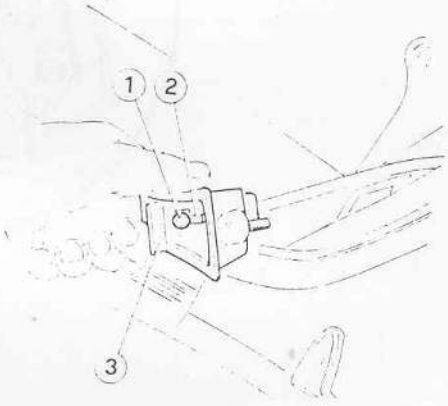
REMOVAL AND INSTALLATION

1. Remove the lefthand pillar panel (see: Unit 66 - Pillar Panels - Removal and Installation).
2. Unscrew the screw (1) fixing the sheath (2) to the control lever - lock assembly (4); unscrew the nut (3) and remove the assembly from the panel.



1 Screw
2 Sheath
3 Nut
4 Control lever-lock

3. Rotate the control lever - lock assembly so as to gain access to the nut (1) securing the cable (2) to the control lever (3) then lift the lever, unscrew the nut and get hold of the control lever - lock assembly.

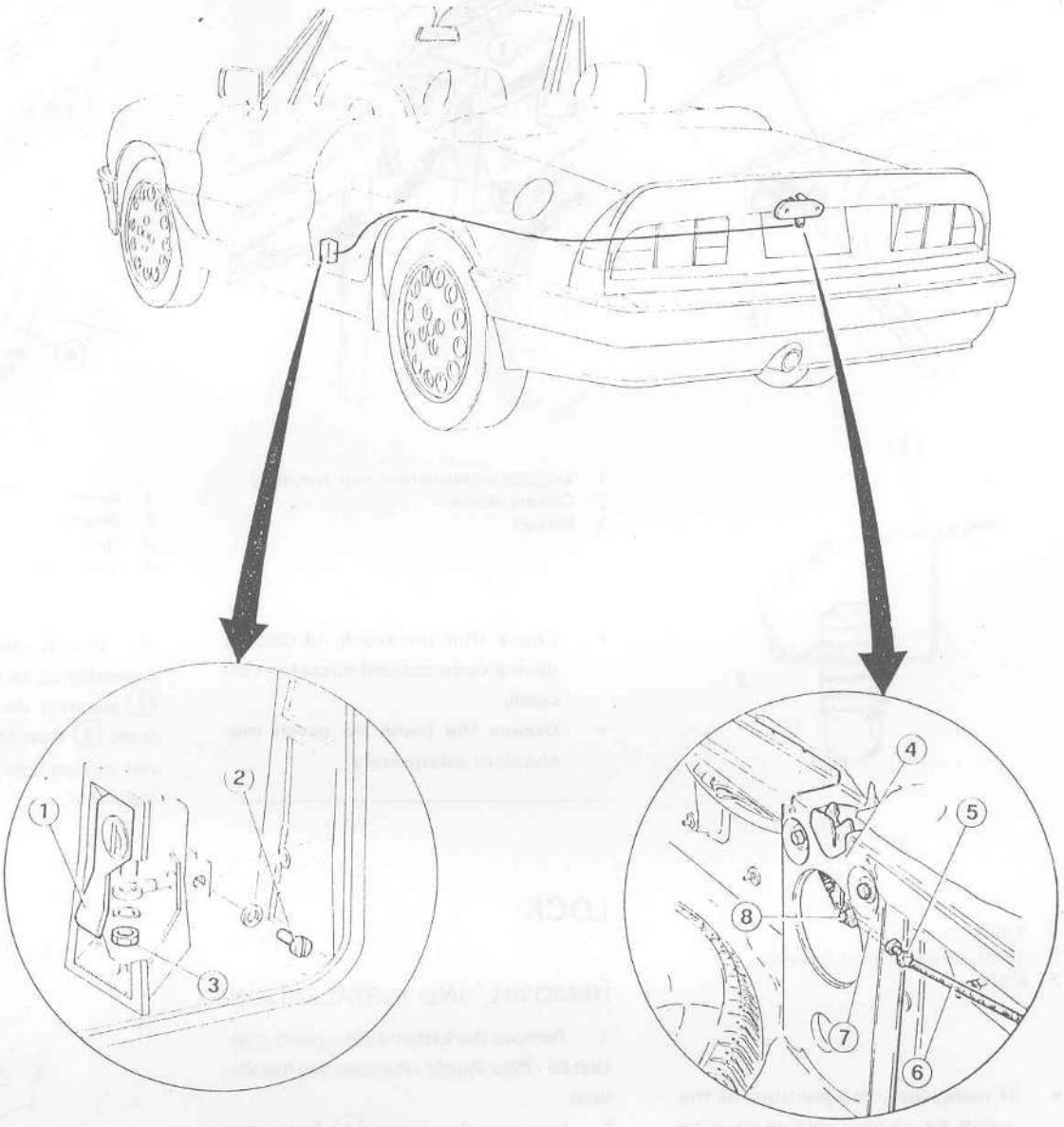


1 Nut
2 Cable
3 Control lever

4. Re-install the control lever - lock assembly by operating in reverse order of removal.
5. Check that the trunk lid opening device works and, if necessary, adjust the cable as indicated in Trunk Lid - Replacement of the Trunk Lid Opening Control Cable at step 6.

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REPLACEMENT OF THE TRUNK LID OPENING CONTROL CABLE



1 Trunk lid opening control lever
2 Screw securing sheath to lever support
3 Nut securing cable to lever
4 Trunk lid closing device
5 Adjusting nut
6 Sheath
7 Trunk lid opening control cable
8 Cable screw

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WARNING:
Should the trunk lid opening control cable break the first thing to do is open the trunk lid.

a. **If the breakage has occurred in the control lever cable coupling, act as instructed in Lock - Removal and Installation, steps 1-3; pull the cable edge with pliers until the lid opens.**

b. **If the breakage is in the closing device cable coupling it will be necessary to raise the car and push the luggage compartment floor rear rubber matting inwards then, using a slightly curved rod work on the closing device until the trunk lid opens.**

1. Lift up the luggage compartment rear trimming, unscrew screw (8) securing the cable and slide out the latter.
2. Working from the passenger compartment, raise the lever (7), unscrew nut (3) and get hold of the cable by the slotted end.
3. Thread the new cable and secure the slotted end to the control lever by means of the nut (3).

WARNING:
Lubricate the cable with adequate oil, letting it slide into the sheath.

4. Working in the luggage compartment, thread the cable in the eyelet of device (4) and secure it, as illustrated in the figure, by means of the screw (8).
5. Check that the hood opening control works.
6. If necessary, adjust the cable position by acting on the appropriate nut (5) and, possibly, on screw (8).

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UNIT 66

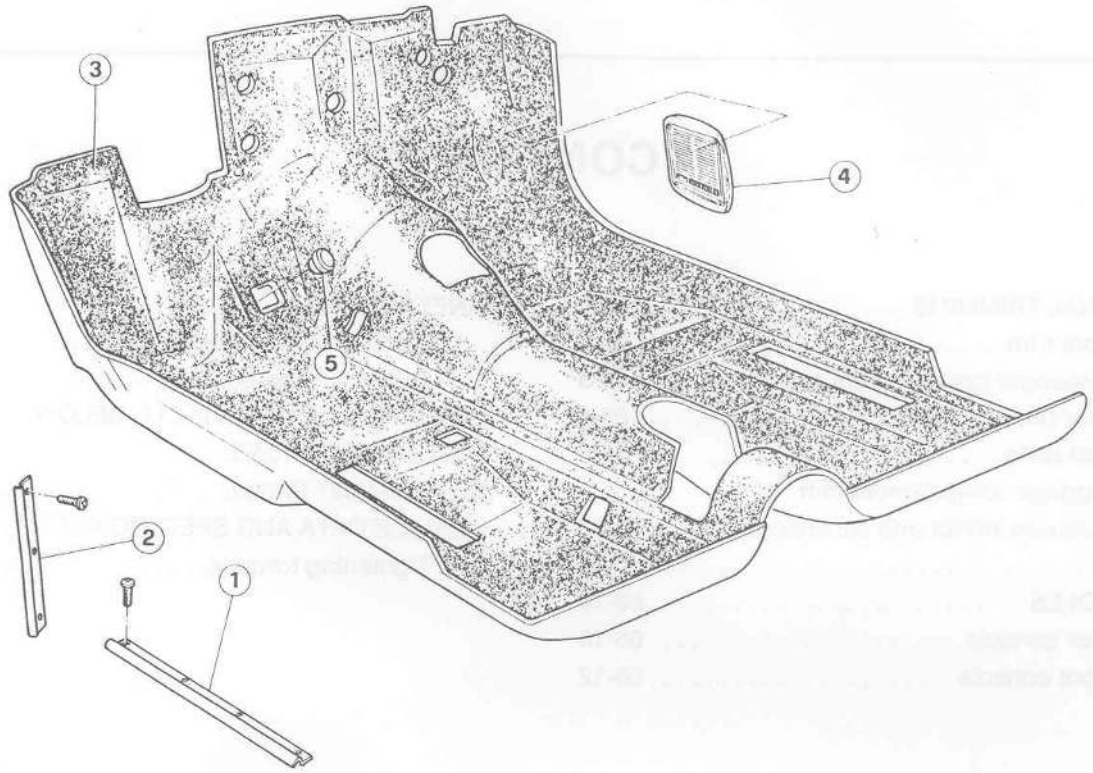
CONTENTS

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INTERNAL TRIMMING

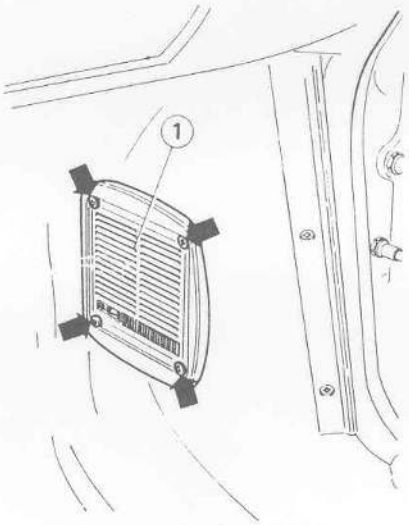
FLOOR TRIM



1 Kick plate
2 Section
3 Floor trim
4 Loudspeaker protective facing
5 Accelerator pedal end of travel

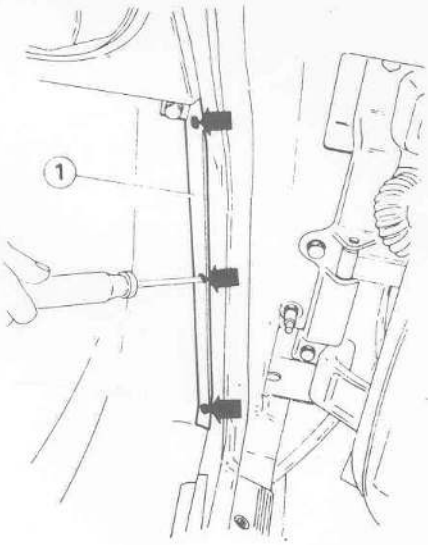
REMOVAL AND INSTALLATION

1. Remove all parts obstructing floor trim removal.
2. Unscrew the four screws and remove the loudspeaker protective facings (1), if installed.



1 Loudspeaker protective facing

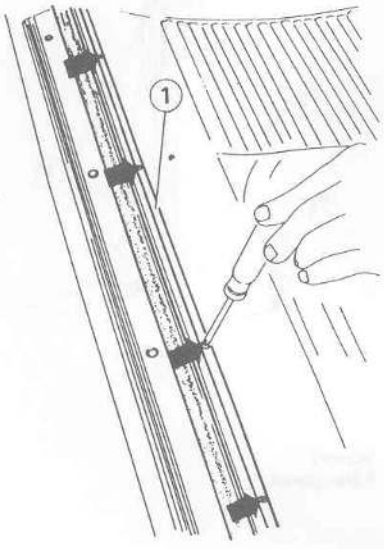
3. Unscrew the three screws and remove the section (1) securing the floor trim.



1 Section securing floor trim

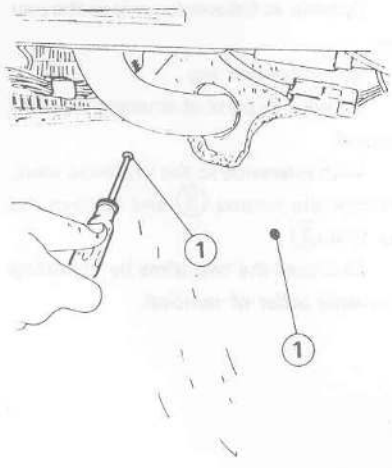
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4. Unscrew the four screws and remove the kick plates (1).



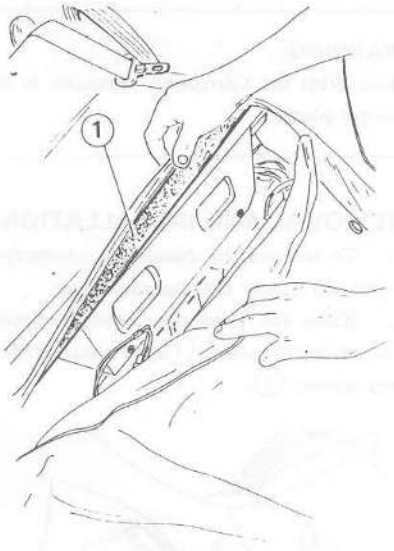
1 Kick plate

5. Unscrew the screws (1) securing the floor trim at the front.



1 Screw

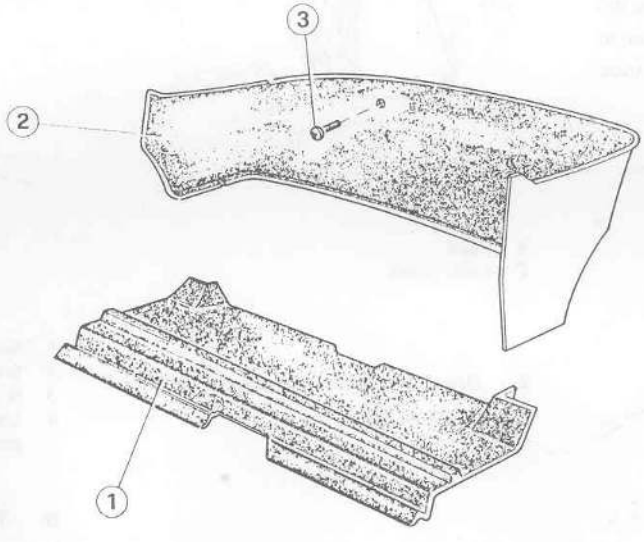
6. Remove the accelerator end of travel.
7. Detach the passenger compartment rear cavity trim velcro (1) and remove the floor trim.



1 Passenger compartment rear cavity trim velcro

8. Re-install the floor trim by operating in reverse order of removal.

PASSENGER COMPARTMENT REAR TRIMS



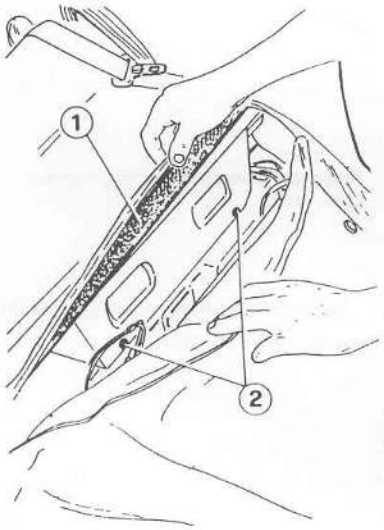
1 Rear cavity trim
2 Rear trim
3 Screw

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WARNING:
Rear trim on European versions is a single piece.

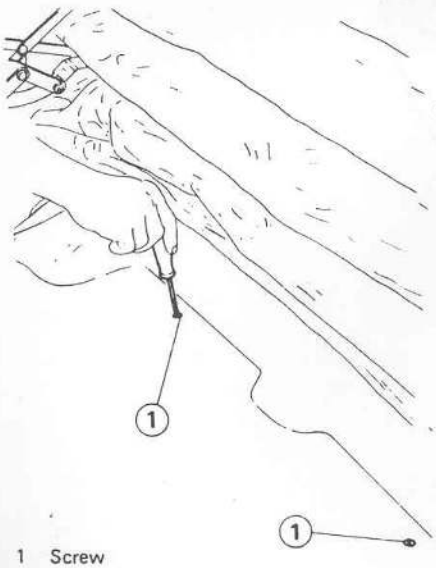
REMOVAL AND INSTALLATION

1. To remove the passenger compartment rear cavity trim operate thus:
a. Raise the passenger compartment rear cavity trim velcro (1) and unscrew the two screws (2).



1 Passenger compartment rear cavity trim velcro
2 Screws

b. Carry out the same operation on the opposite side.
c. Unscrew the screws (1) securing the passenger compartment rear cavity trim at the top to the body and remove the trim.



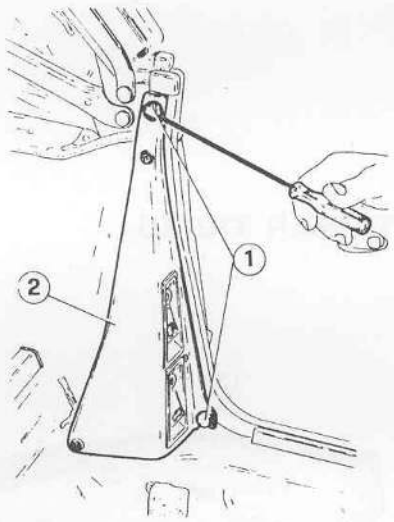
1 Screw

2. Operate as follows to remove the rear trim.
a. Raise the soft top.
b. Remove all parts obstructing rear trim removal.
c. With reference to the exploded view, unscrew the screws (3) and remove the rear trim (2).
3. Re-install the two trims by operating in reverse order of removal.

PILLAR PANELS

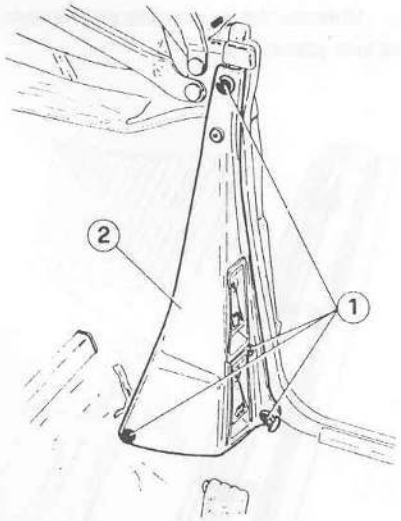
REMOVAL AND INSTALLATION

1. Using a suitable tool, remove the two caps (1) protecting the screws securing the panel (2).



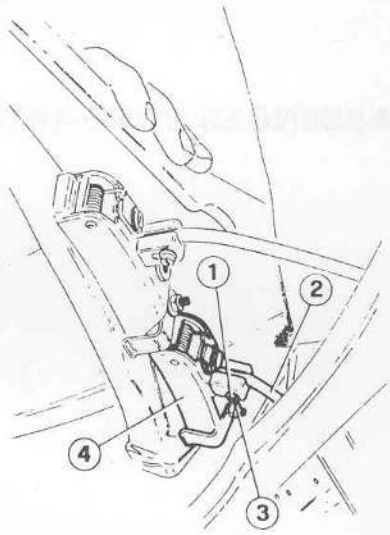
1 Caps
2 Pillar panel

2. Unscrew the four screws (1) securing the panel (2).



1 Screws
2 Pillar panel

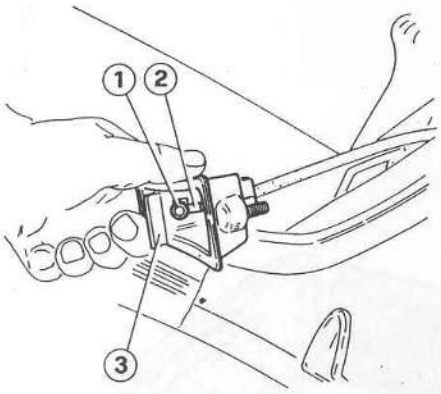
3. Lefthand panel only.
a. Unscrew the screw (1) securing the sheath (2) to the lock control lever assy (4), unscrew the nut (3) and remove the assy from the panel.



1 Screw
2 Sheath
3 Nut
4 Lock control lever (luggage compartment opening)

b. Turn the lock-control lever assy so as to gain access to the nut (1) securing wire (2) to control lever (3); lift up the lever, unscrew the nut and get hold of the lock control lever assy.

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1 Nut
2 Wire
3 Luggage compartment opening lever

c. Similarly, remove the lock control lever assy for tank lid opening as well.

4. Remove the pillar panel.

5. Re-install the pillar panel by operating in reverse order of removal.

SEAT BELTS

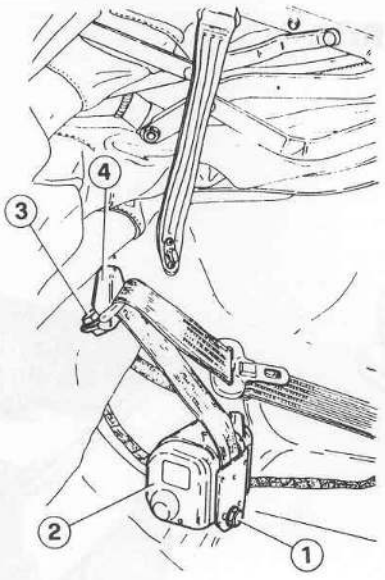
REMOVE AND INSTALLATION

WARNING:
In the event of a violent impact where the seat belts are in use, it is advisable to replace them even if apparently undamaged.

1. Slide the belt out of the support on the seat.

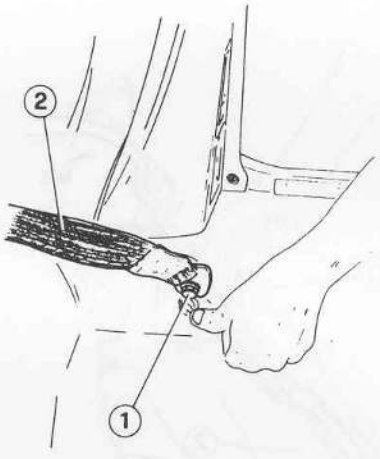
2. Remove the passenger compartment rear cavity trim (see: Passenger Compartment Rear Trims - Removal and Installation).

3. Unscrew the screw (1) securing the retractor (2); unscrew the bolt (3) securing the belt support (4).



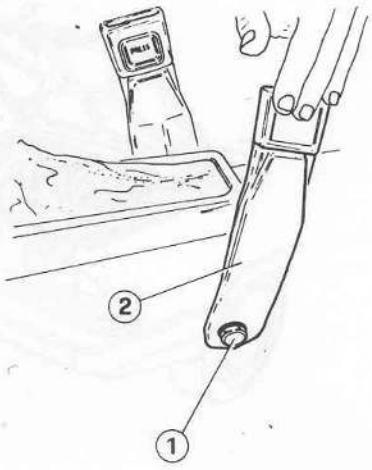
1 Screw
2 Retractor
3 Bolt
4 Belt support

4. Unscrew the screw (1) and remove the belt (2).



1 Screw
2 Seat belt

5. If necessary, unscrew the screw (1) and remove the anchor (2).



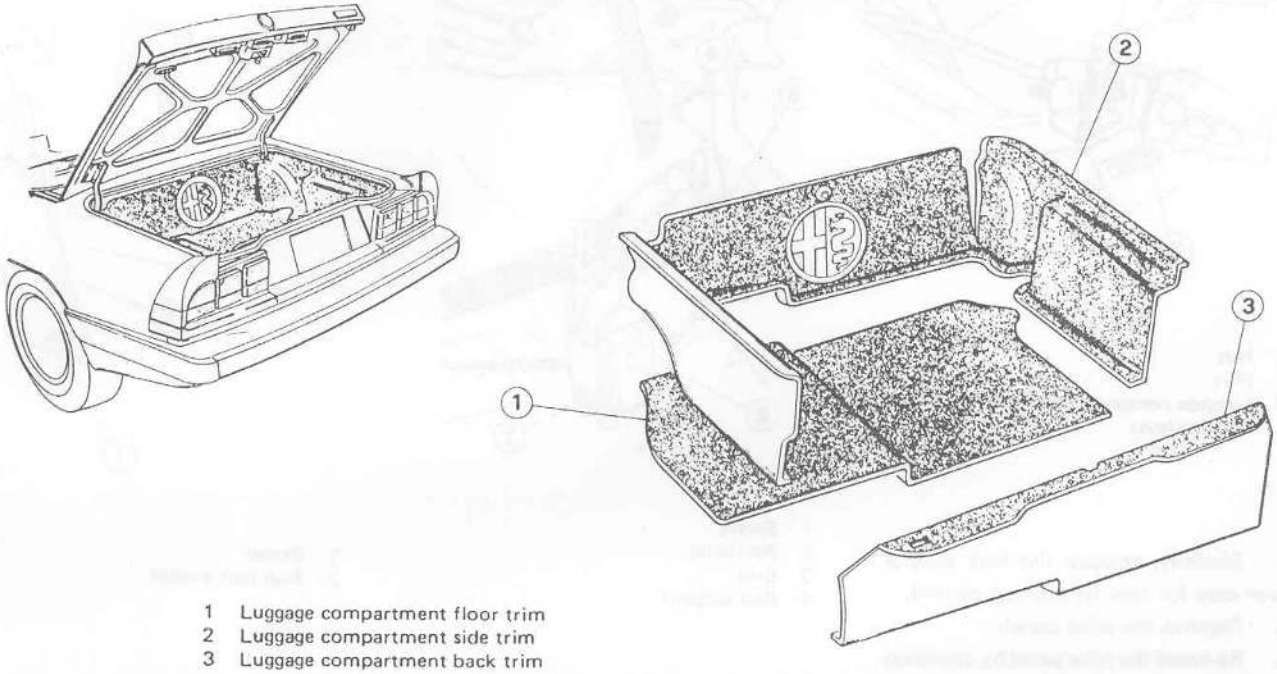
1 Screw
2 Seat belt anchor

6. Re-install the seat belts by operating in reverse order of removal; all the seat belt anchors screws should be locked to the specified torque.

(T) : **Tightening torque**
Seat belt anchor screws:
37 N·m
(3.8 kg·m)
(27.3 ft·lb)

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LUGGAGE COMPARTMENT TRIM



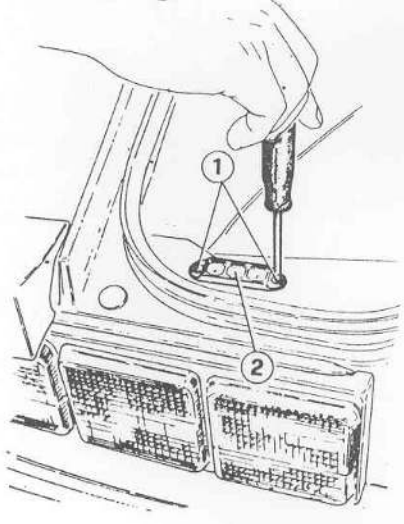
1 Luggage compartment floor trim
2 Luggage compartment side trim
3 Luggage compartment back trim

REMOVAL AND INSTALLATION

WARNING:
Luggage compartment trim on European versions is a single piece.

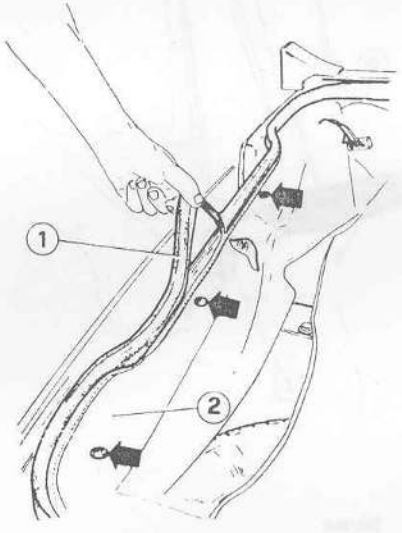
1. Back trim.

a. Unscrew the two screws (1) securing the connector (2).



1 Screws
2 Connector

b. Slip off the seal (1), remove the three plastic nails and take the back trim (2) out from the luggage compartment.



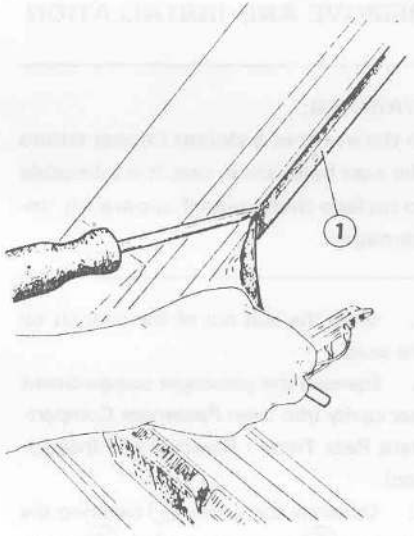
1 Seal
2 Back trim

3. Floor trim.

With reference to the exploded view, remove the floor trim (1), extracting it from the luggage compartment.

4. Side trim.

Carefully remove the seal (1) securing the trim to the body then remove the luggage compartment side trim.



1 Seal

5. Replace the various luggage compartment trim components by operating in reverse order of removal.

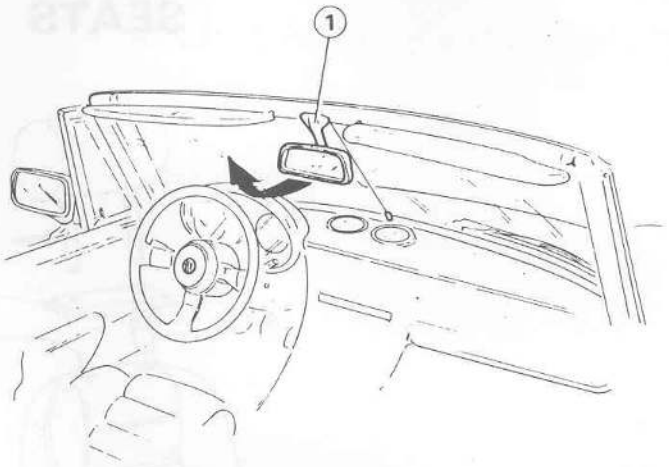
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REARVIEW MIRROR AND SUNSHADES

REMOVAL AND INSTALLATION

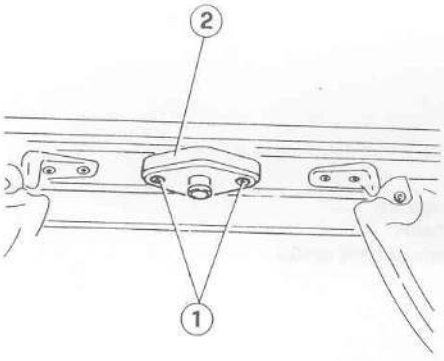
1. Rearview mirror.

a. Remove the rearview mirror (1) as indicated by the arrow.



1 Rearview mirror

b. If necessary, unscrew the two screws (1) and remove the rearview mirror support (2).

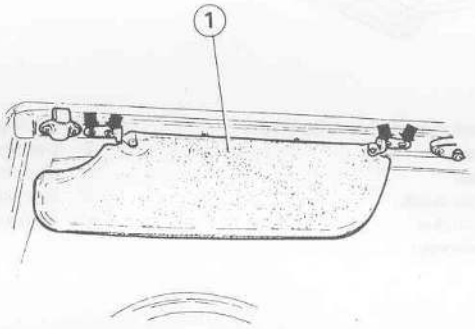


1 Screws
2 Rearview mirror support

c. Re-install the rearview mirror by operating in reverse order of removal.

2. Sunshades.

a. Unscrew the four screws indicated by the arrows and remove the sunshades (1).

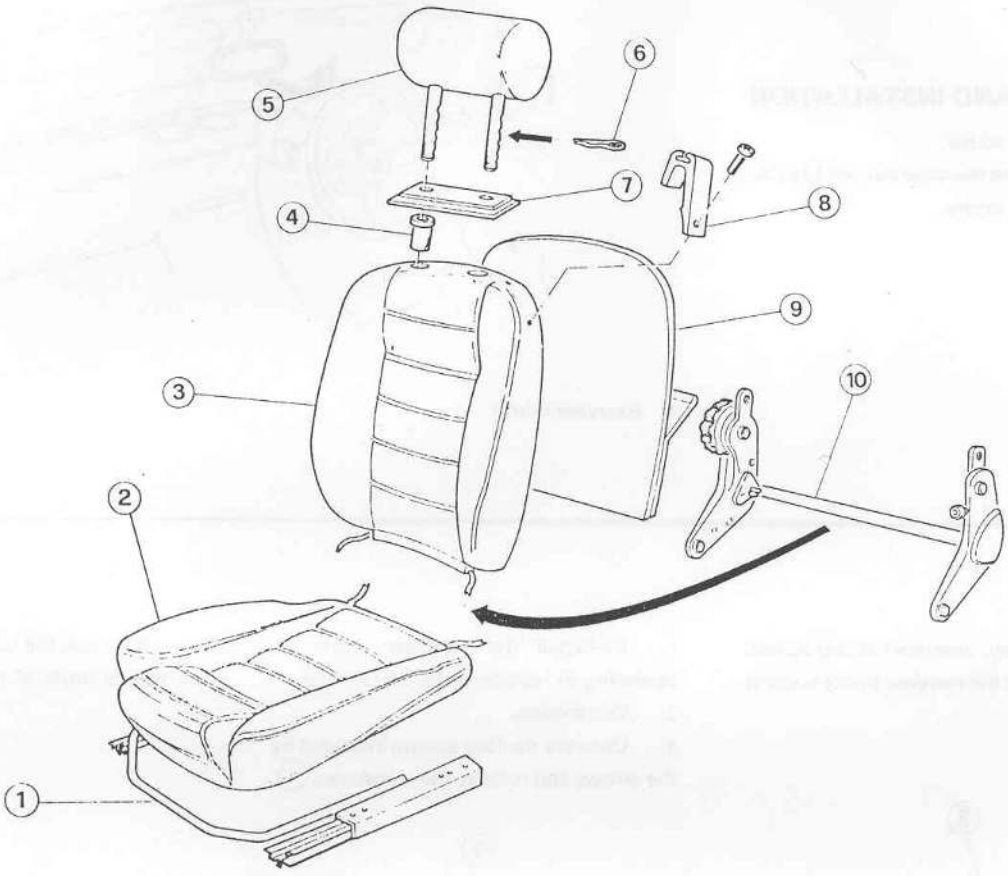


1 Sunshade

b. Re-install the sunshades by operating in reverse order of removal.

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SEATS

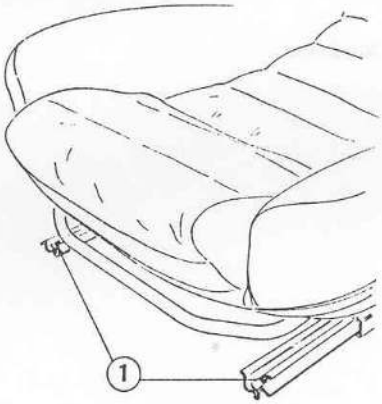


1 Seat runner (with control lever)
2 Seat
3 Seat back
4 Bushing
5 Headrest
6 Spring
7 Support
8 Seat belt support
9 Seat back panel
10 Seat back adjustment device

REMOVAL AND INSTALLATION

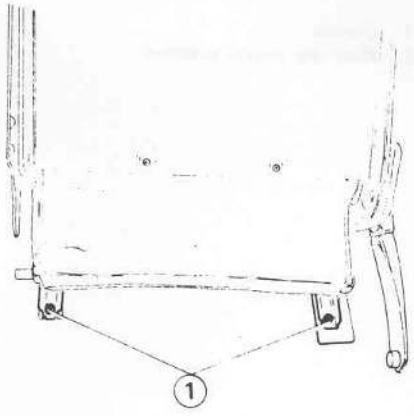
During these operations take care to avoid soiling the seat and seat back upholstery.

1. Slide the belt out of its support on the seat.
2. Move the seat back to its limit and unscrew the two front screws (1) securing the runners to the floor.



1 Front screws securing runners to floor

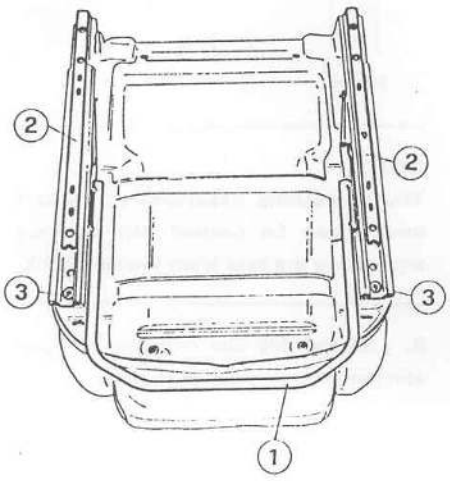
3. Recline the seat back forward, move the seat forward to its limit and unscrew the two rear screws (1) securing the runners to the floor.



1 Rear screws securing runners to floor

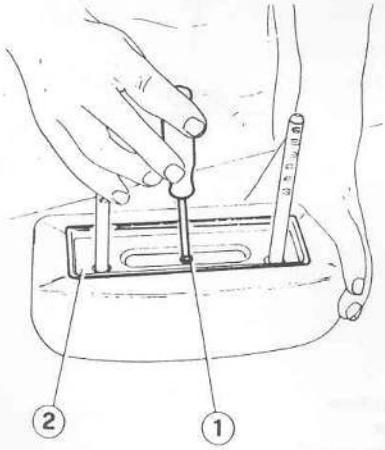
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4. Remove the seat, complete with runners.
5. If necessary, separate the seat from its runners.
a. Using the lever (1), slide the runner (2) rearwards to the limit.
Unscrew the two front screws (3) securing the runners to the seat.



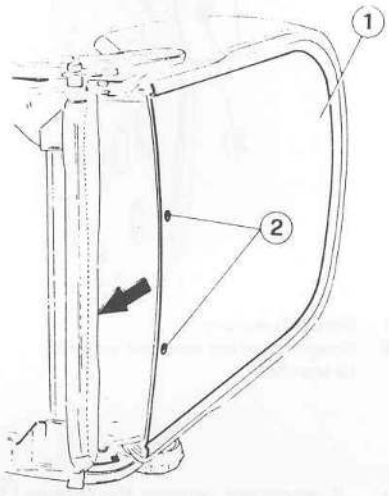
1 Seat slide control lever
2 Seat runners
3 Front screws

b. Slide the runners to the front limit and unscrew the two rear screws securing the runners to the seat.
c. Detach the two runners from the seat.
6. Headrest removal.
a. Detach the headrest from the seat back by pulling it upwards.
b. If necessary, unscrew the screw (1) and remove the support (2) from the headrest.



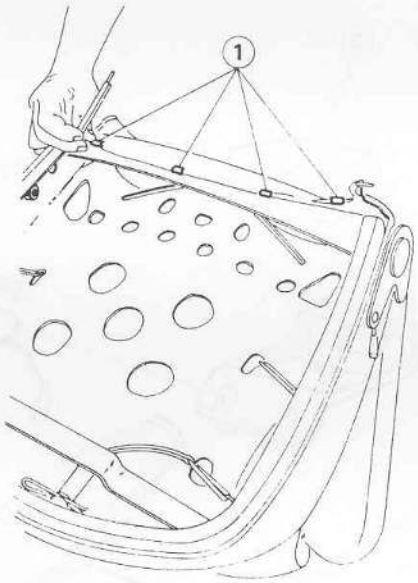
1 Screw
2 Support

7. Separate the seat from the seat back.
a. Unscrew the two screws (2) and slide off the rear panel (1) in the direction indicated in the figure.



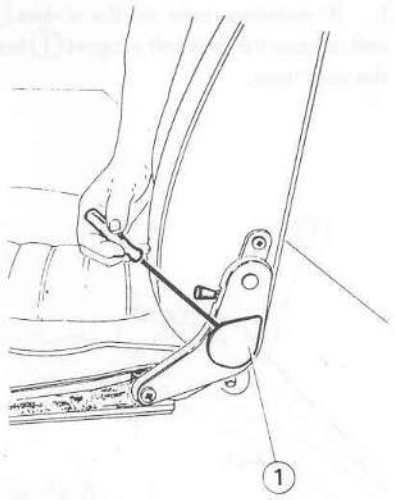
1 Seat back panel
2 Screws

b. Working on the four clips (1), release the upholstery from the lower part of the seat back.



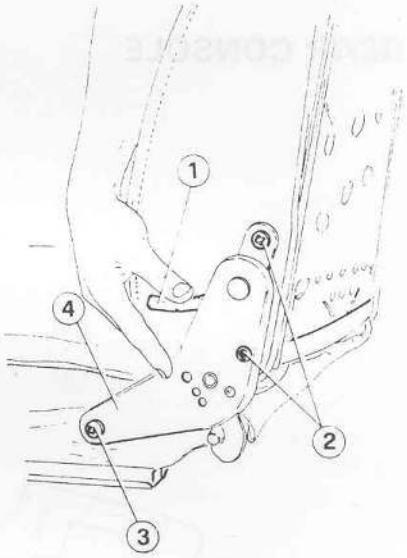
1 Clips securing upholstery to lower part of seat back

c. Using a suitable tool, remove the protective facings (1) from both sides.



1 Protective facing

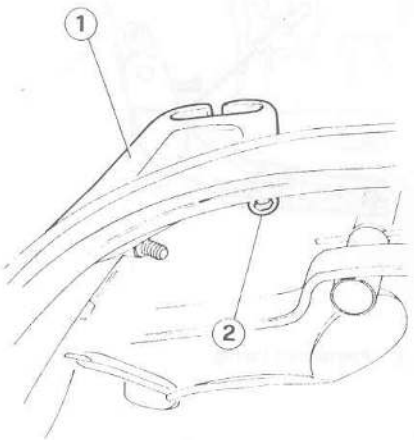
d. Unscrew the four screws (2) and remove the seat back.
e. Unscrew the two screws (3), press the release lever (1) and separate the seat from the seat back inclination adjustment device (4).

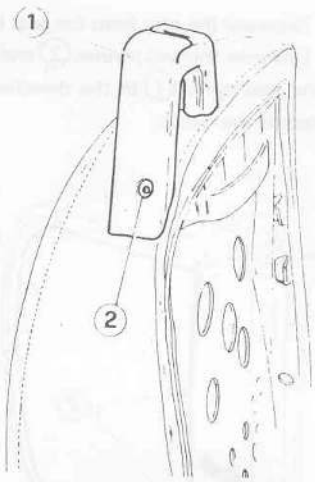


1 Seat back release lever
2 Screws securing seat back to seat back inclination adjustment device
3 Screw securing seat to inclination adjustment device
4 Seat back inclination adjustment device

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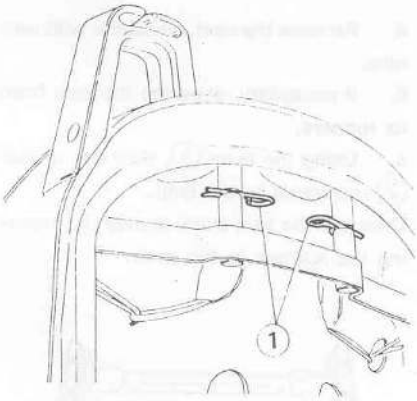
f. If necessary, unscrew the screws (2) and remove the seat belt support (1) from the seat back.





1 Seat belt support
2 Screws securing seat belt support to seat back

g. If necessary, remove the springs (1) from the seat back.



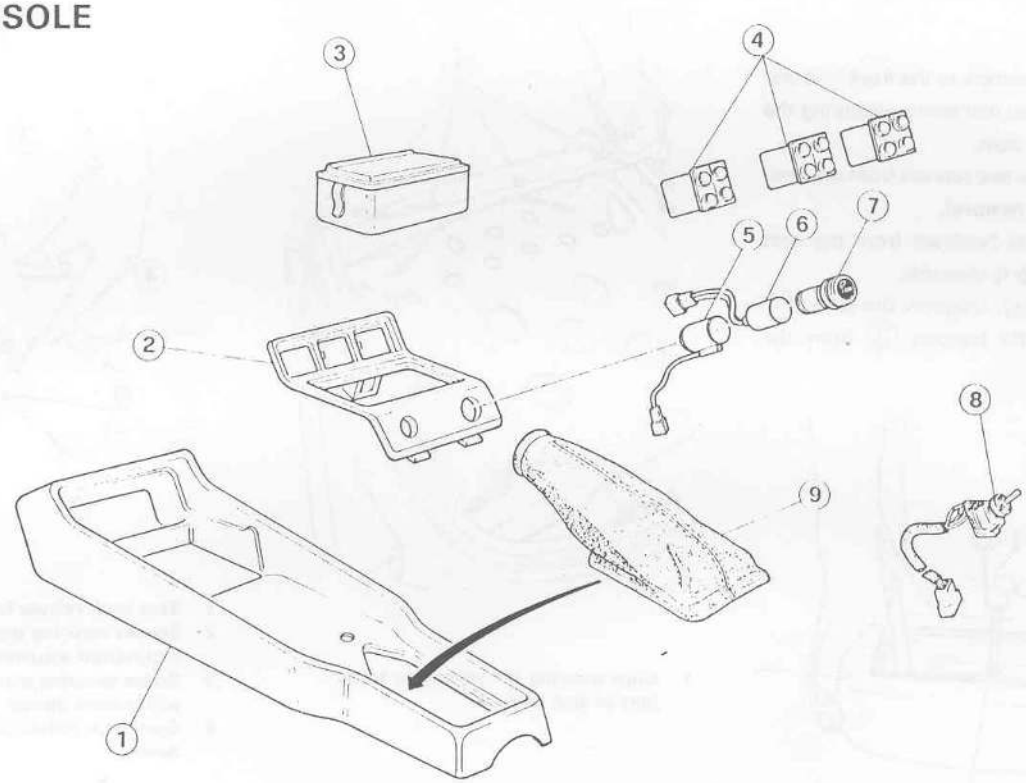
1 Springs

NOTE:
The operations described at steps f and g can be carried out without separating the seat from the seat back.

8. Reassemble and re-install by operating in reverse order of removal.

CONSOLES

REAR CONSOLE

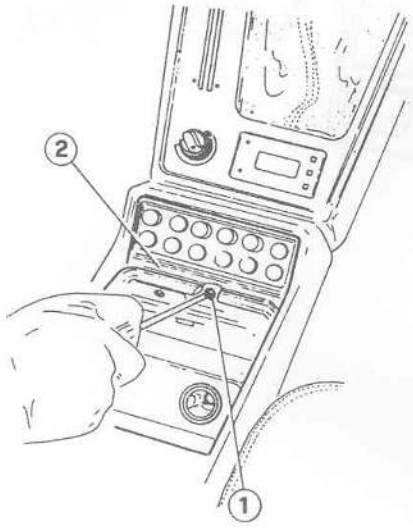


1 Rear console
2 Rear console facing
3 Ashtray
4 Electric control switches
5 Transparent cover
6 Cigar lighter base
7 Cigar lighter
8 Power mirror switch
9 Parking brake jacket

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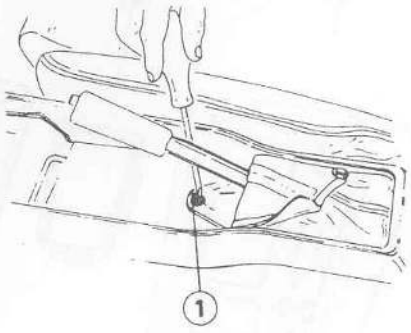
REMOVAL AND INSTALLATION

1. Remove the ashtray from the console.
2. Unscrew the screw (1) and remove the facing (2) complete with power switches.



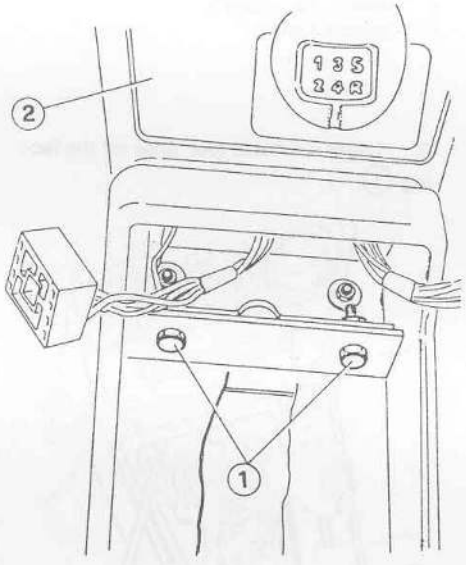
1 Screw
2 Rear console facing

3. Disconnect the power switches, the cigar lighter and the electric mirror switch.
4. Unscrew the screw (1) securing the console to the gearbox cover.



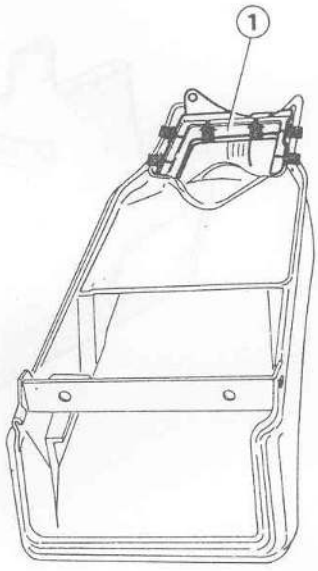
1 Screw securing rear console to gearbox cover

5. Unscrew the two bolts (1) securing the rear console to the front console (2).



1 Bolts securing rear console to front console
2 Front console

6. Activate the parking brake and remove the rear console from the car.
7. If necessary, drill off the nails and remove the bracket (1) then the parking brake jacket.

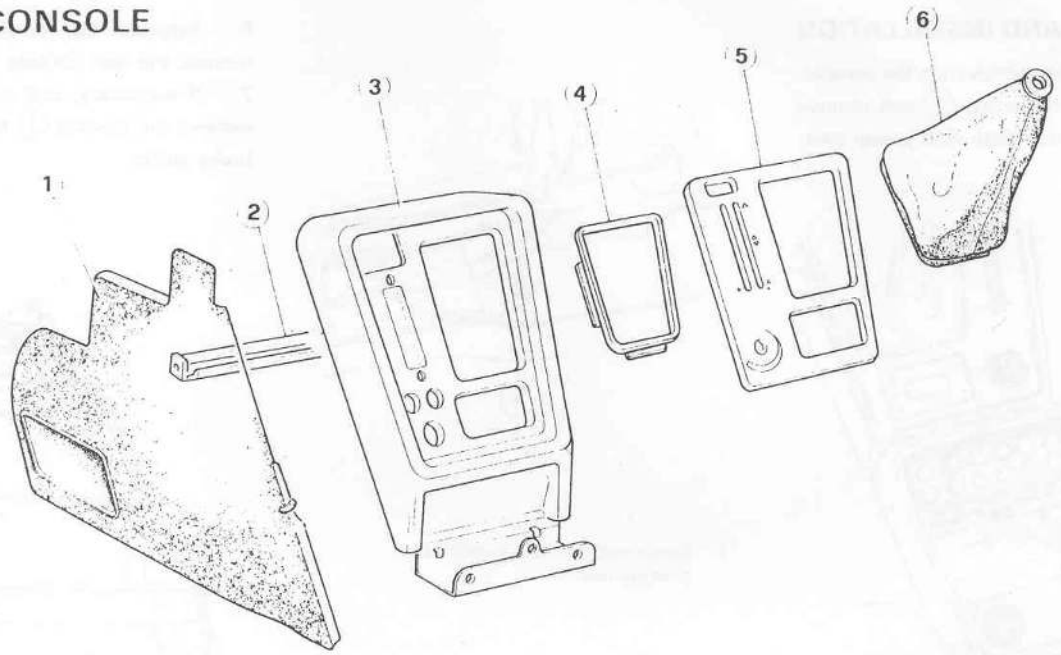


1 Bracket

8. Re-install the rear console by operating in reverse order of removal.

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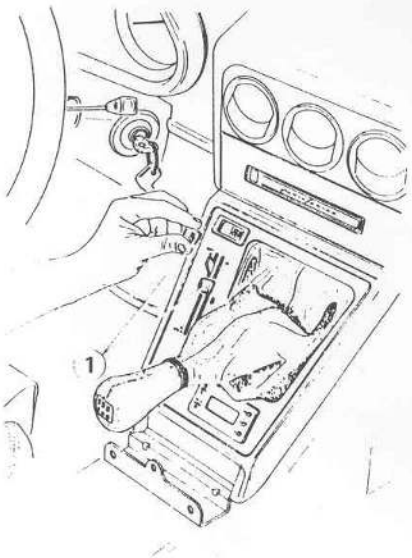
FRONT CONSOLE



1 Side walls for console below instrument panel
2 Side wall connection bar
3 Front console
4 Bracket
5 Front console facing
6 Gearbox jacket

REMOVAL AND INSTALLATION

1. Remove the rear console (see: Consoles - Rear Console - Removal) and the right and lefthand knee padding (see: Knee padding - Removal).
2. Remove the knobs (1) from their levers.



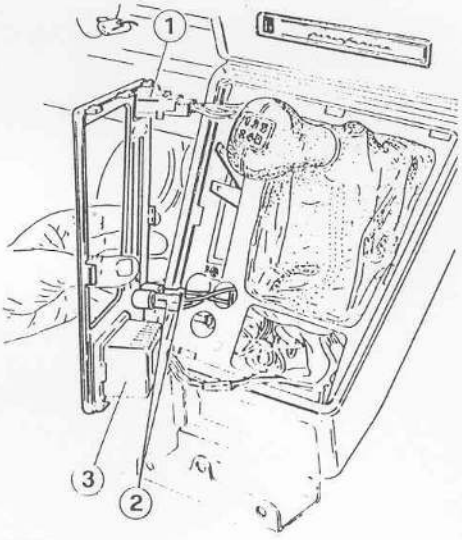
1 Knobs

3. Using a suitable tool, prise off the facing (1).



1 Front console facing

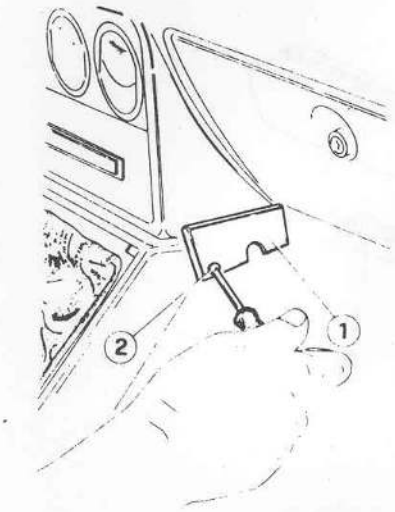
4. Disconnect the ventilating fan switch (1), and the digital clock (3) then disengage the two lamps (2) and remove the facing.



1 Ventilating fan switch
2 Lamps
3 Digital clock

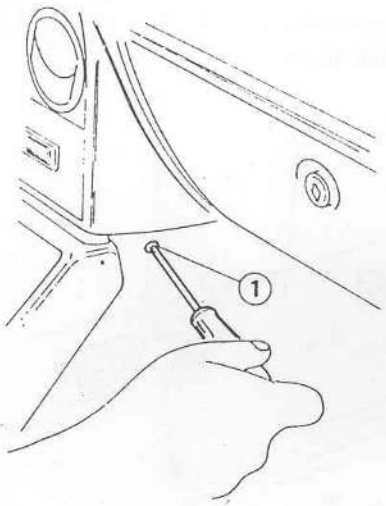
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5. Unscrew the two screws (2) and remove the protecting facings (1).



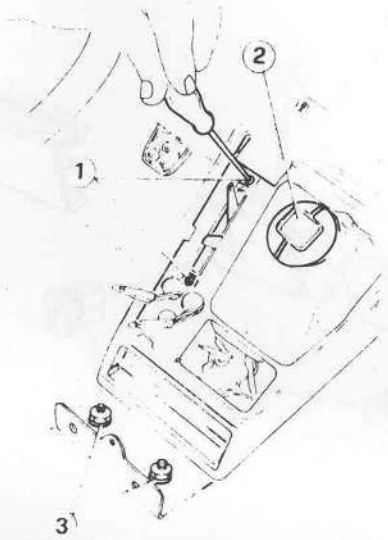
1 Protecting facing
2 Screw

6. Unscrew the two screws (1) securing the upper face of the front console.



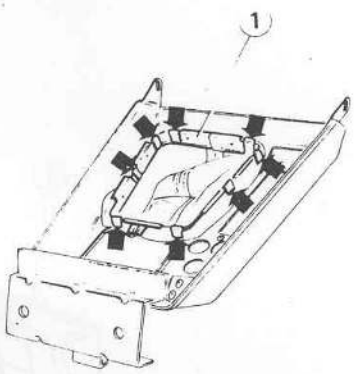
1 Screw

7. Pull the knob (2) off the gearstick, unscrew the two nuts (3), and two screws (1) then remove the front console.



1 Screw securing heater control assy to front console
2 Knob
3 Nuts securing front console to gearbox cover

8. If necessary, work on the clips to remove the bracket (1) and gearstick jacket.

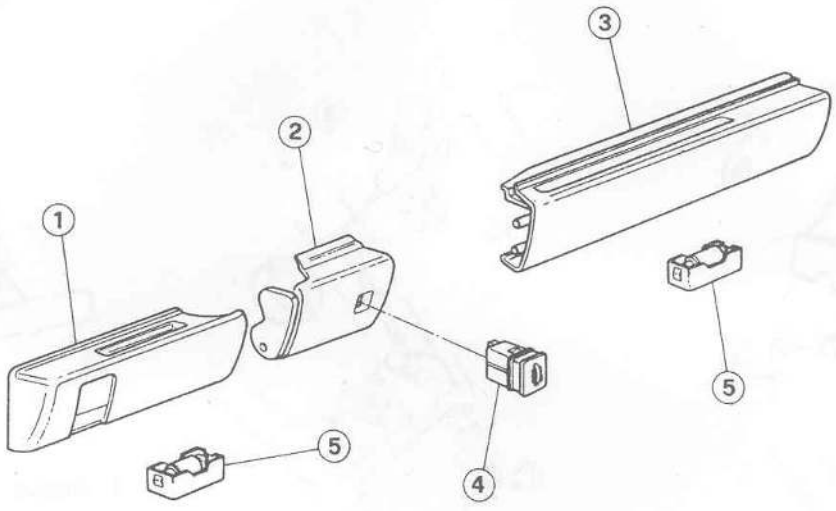


1 Bracket

9. Re-install the front console by operating in reverse order of removal, leaving slightly loosened the lower nuts which shall be tightened after installing the rear console, thus obtaining a better matching.

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KNEE PADDING

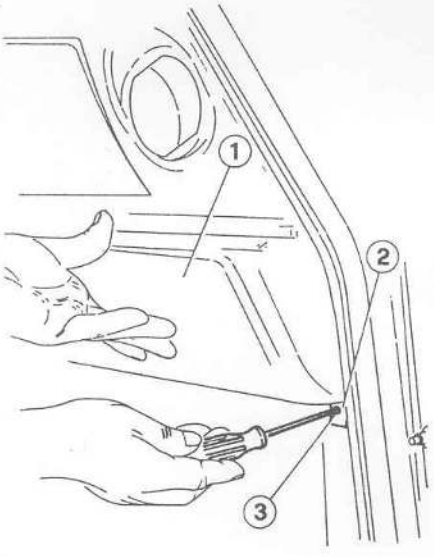


1 Detachable part of L.H. knee padding
2 Fixed part of L.H. knee padding
3 R.H. knee padding
4 Cluster light rheostat
5 Passenger compartment light

RIGHTHAND KNEE PADDING

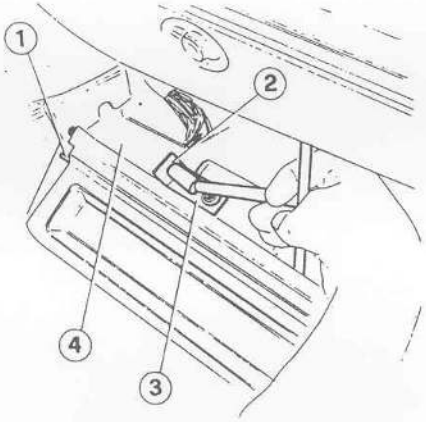
REMOVAL AND INSTALLATION

1. Unscrew the screw (3) securing the square (2) to the body.



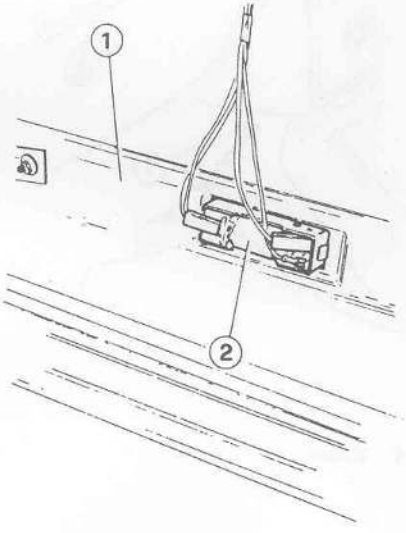
1 R.H. knee padding
2 Square
3 Screw

2. Pull the pin (1) out from the hole on the side walls for console below the instrument panel (4) and unscrew screw (2).



1 Pin
2 Screw securing square to side walls for console below instrument panel
3 Square
4 Side walls for console below instrument panel

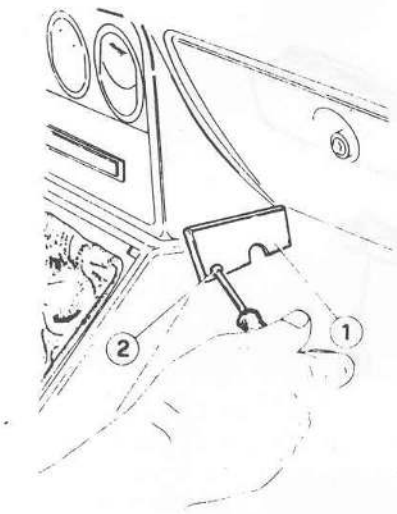
3. Electrically disconnect the light (2) and remove the R.H. knee padding (1) from the car.



1 R.H. knee padding
2 Light

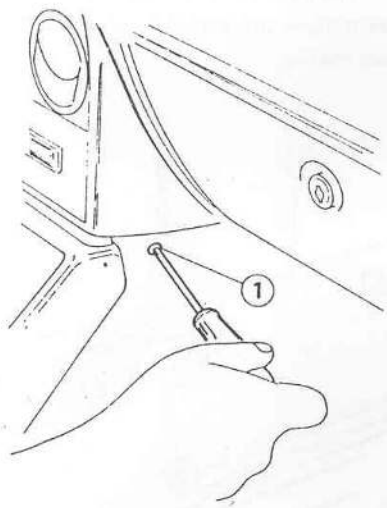
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5. Unscrew the two screws (2) and remove the protecting facings (1).



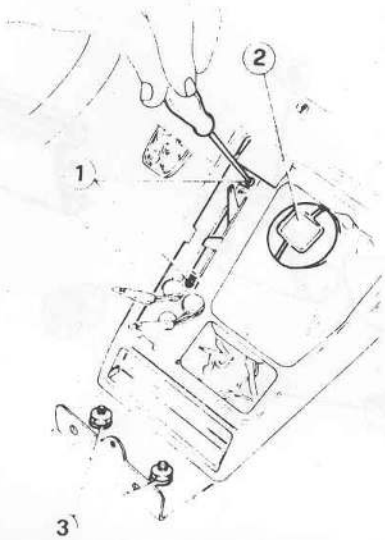
1 Protecting facing
2 Screw

6. Unscrew the two screws (1) securing the upper face of the front console.



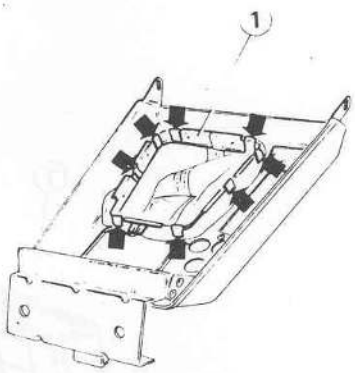
1 Screw

7. Pull the knob (2) off the gearstick, unscrew the two nuts (3), and two screws (1) then remove the front console.



1 Screw securing heater control assy to front console
2 Knob
3 Nuts securing front console to gearbox cover

8. If necessary, work on the clips to remove the bracket (1) and gearstick jacket.

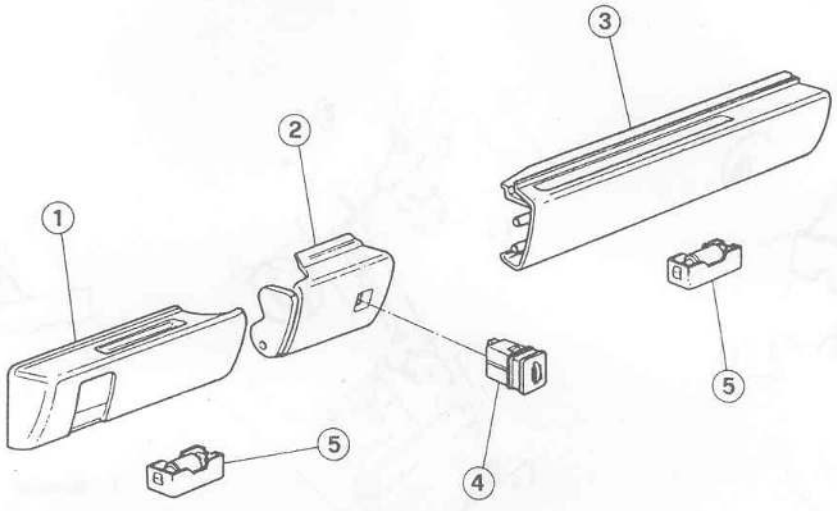


1 Bracket

9. Re-install the front console by operating in reverse order of removal, leaving slightly loosened the lower nuts which shall be tightened after installing the rear console, thus obtaining a better matching.

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KNEE PADDING

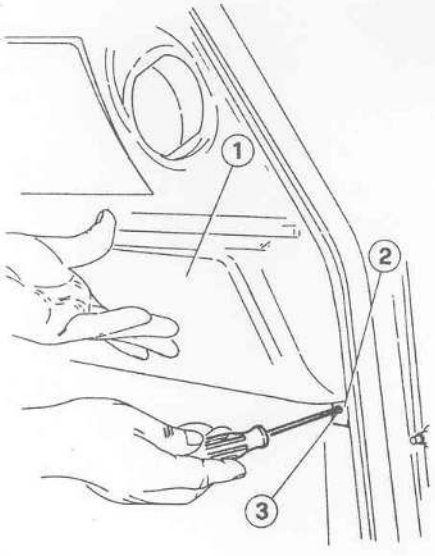


1 Detachable part of L.H. knee padding
2 Fixed part of L.H. knee padding
3 R.H. knee padding
4 Cluster light rheostat
5 Passenger compartment light

RIGHTHAND KNEE PADDING

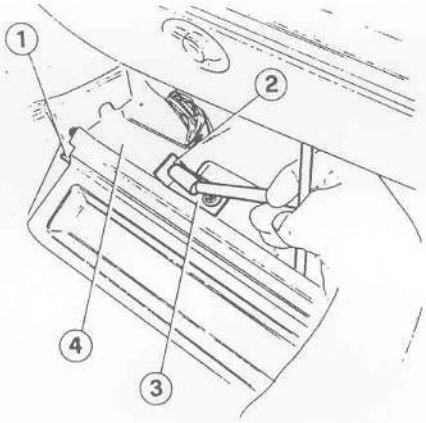
REMOVAL AND INSTALLATION

1. Unscrew the screw (3) securing the square (2) to the body.



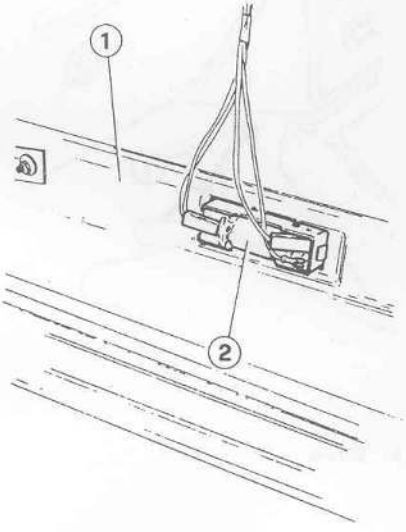
1 R.H. knee padding
2 Square
3 Screw

2. Pull the pin (1) out from the hole on the side walls for console below the instrument panel (4) and unscrew screw (2).



1 Pin
2 Screw securing square to side walls for console below instrument panel
3 Square
4 Side walls for console below instrument panel

3. Electrically disconnect the light (2) and remove the R.H. knee padding (1) from the car.



1 R.H. knee padding
2 Light

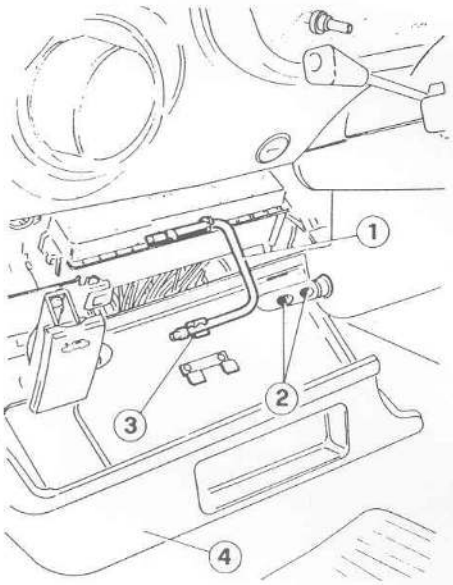
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4. Re-install the R.H. knee padding by operating in reverse order of removal.

LEFTHAND KNEE PADDING

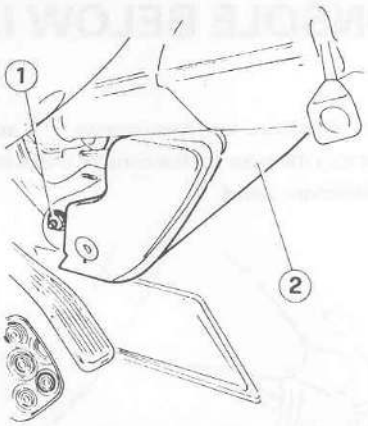
REMOVAL AND INSTALLATION

1. Turn the detachable part (4) of the lefthand knee padding, outwards (as if to gain access to the fusebox); uncouple the shaft (1) from the clip (3), unscrew the two screws (2) and remove the detachable part of the knee padding.



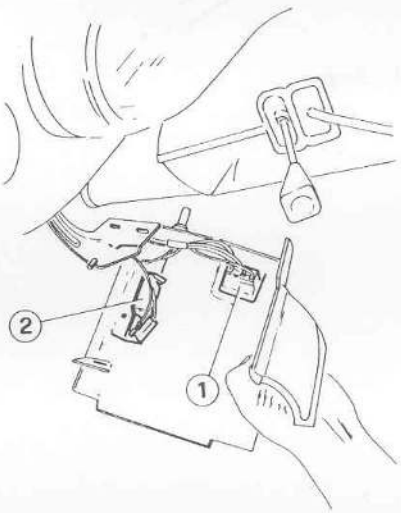
1 Support shaft of detachable part
2 Screws
3 Clip
4 Detachable part of L.H. knee padding

2. Unlock the nut (1) and slide the pin of the fixed part of the knee padding (2) out of the side walls for console below the instrument panel.



1 Nut
2 Lefthand knee padding, fixed part

3. Electrically disconnect the light (2), the cluster light rheostat (1) and remove the fixed part of the knee padding from the car.



1 Cluster light rheostat
2 Light

4. Re-install the L.H. knee padding by operating in reverse order of removal.

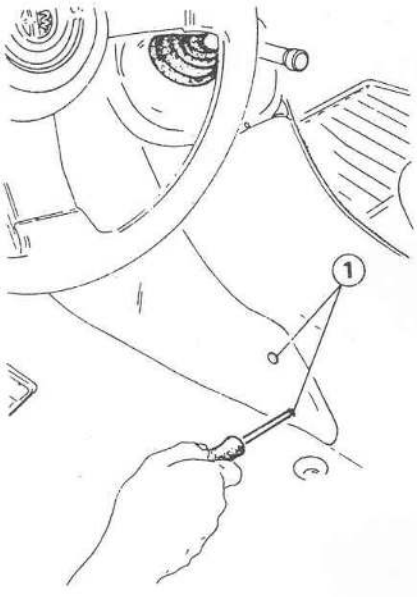
NOTE:
Check that the detachable and fixed strips of the lefthand knee padding are perfectly aligned, otherwise loosen the nut securing the fixed part, align correctly then tighten up the nut.

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SIDE WALLS FOR CONSOLE BELOW INSTRUMENT PANEL

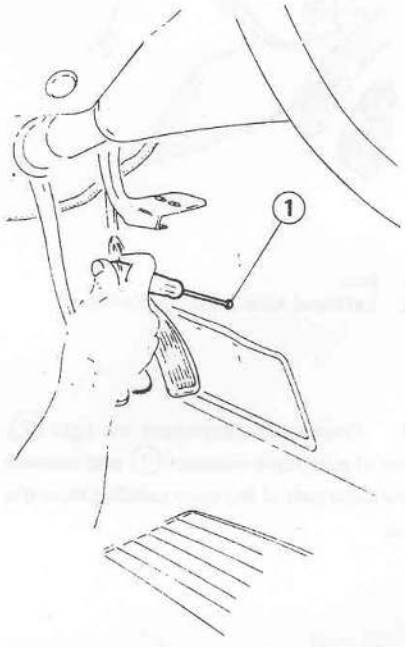
REMOVAL AND INSTALLATION

1. Remove the rear console, the right and lefthand knee padding and front console (see: Removal procedures for parts involved).
2. Unscrew the four screws (1) securing the sides to the gearbox cover.



1 Screws

3. Unscrew the two screws (1) and remove the sides for the console under the instrument panel.



1 Screw

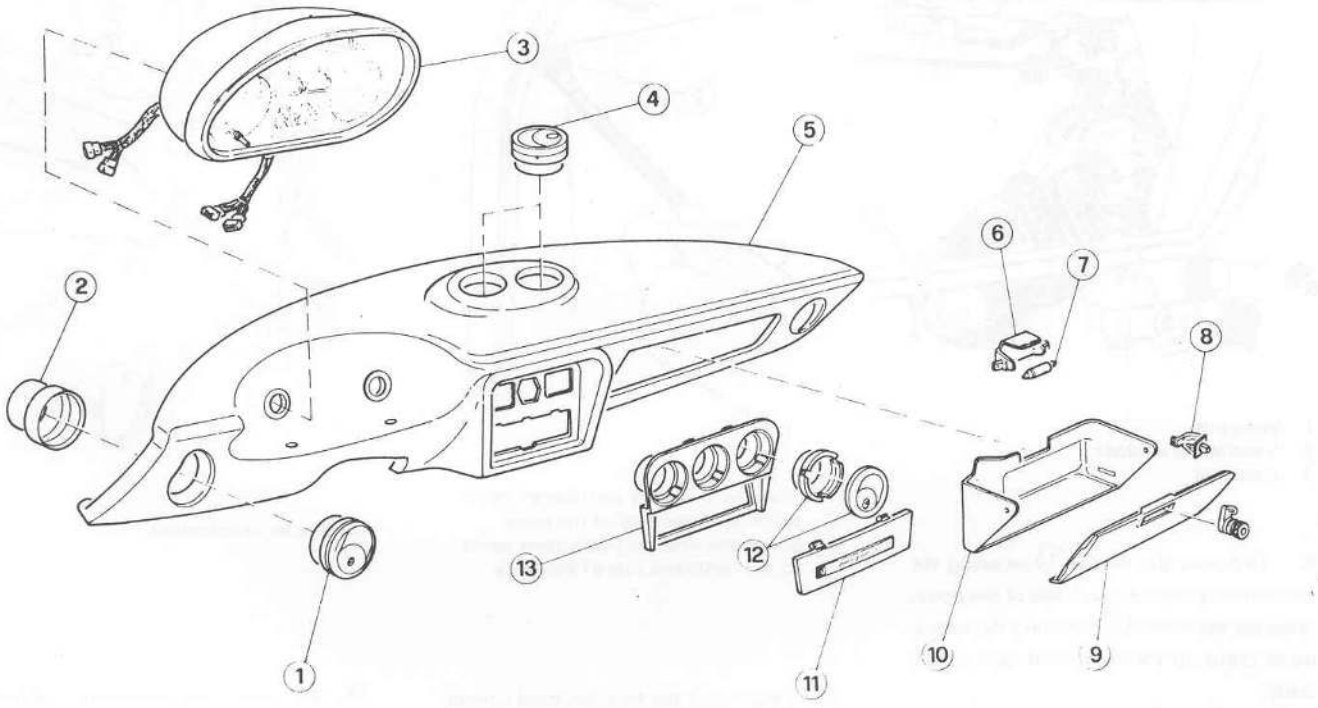
4. Re-install the side walls for console under the instrument panel by operating in reverse order of removal.

U.S.A. Models with enbloc knee padding.

Side walls are removed before consoles (see Knee Padding-enbloc) - Removal and Installation - Step 1).

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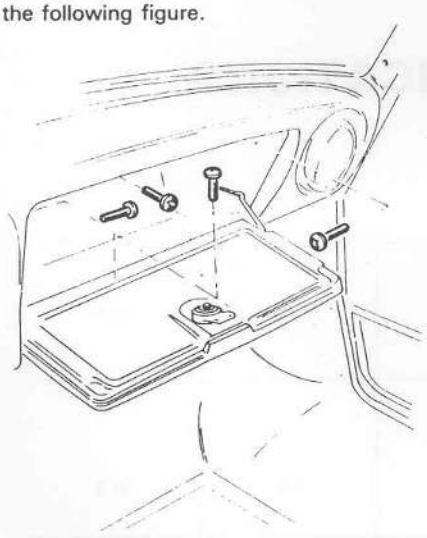
INSTRUMENT PANEL



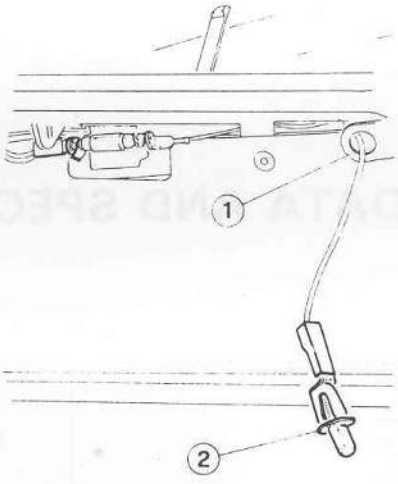
1 Side vent on instrument panel
2 Support
3 Cluster
4 Defrosting vent
5 Instrument panel
6 Lampholder
7 Glove compartment light
8 Switch
9 Glove compartment hatch
10 Glove compartment
11 Radio compartment cover
12 Central vent on instrument panel
13 Central facing on instrument panel

REMOVAL AND INSTALLATION

1. Remove the rear console, the right and lefthand knee padding, the front console and side walls for console under the instrument panel (see: Removal procedures for components involved).
2. Open the glove compartment hatch and unscrew the four screws indicated in the following figure.



3. Slide the switch (2) out from its housing (1) and disconnect it electrically.



1 Switch housing
2 Glove compartment light switch

4. Remove the glove compartment.
5. For vehicles equipped with A/C system only.

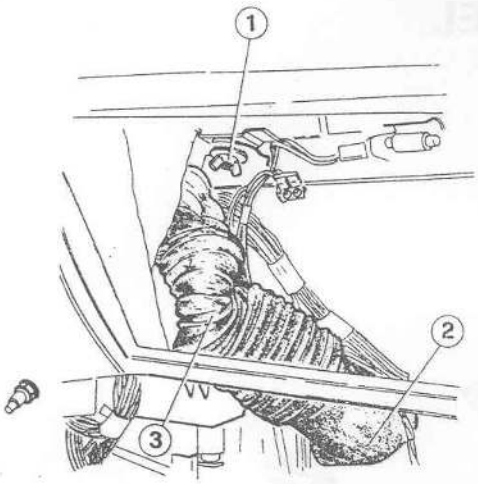
a. Carry out the operations described at steps 5 to 7 - Unit 80 - Ventilation - Heating and Conditioning System - Cooler Unit - Removal.

b. Lower the cooler unit and slide the air hose on the righthand side out of the corresponding vent on the instrument panel.

c. Disconnect the central air hoses from the conveyor box by pulling them from below.

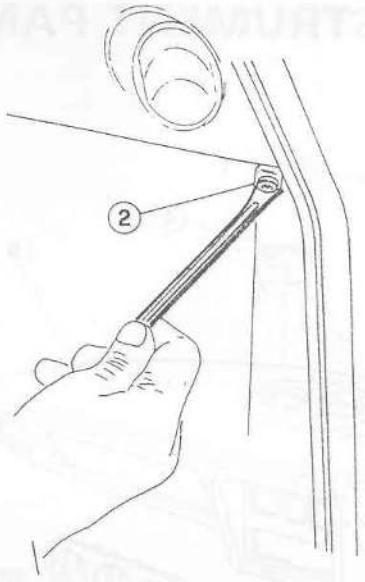
6. Disconnect the side ventilating air hoses from the corresponding vents on the instrument panel.
7. Detach the couplings (3) from their respective ducts (2) and unscrew the two wing nuts (1) securing the instrument panel to the bodywork.

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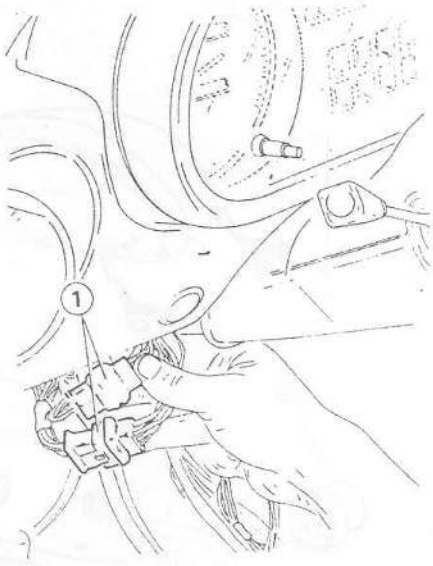


1 Wing nut
2 Ventilating air duct
3 Coupling

8. Unscrew the screw (1) securing the instrument panel lefthand side of the body; unscrew the screw (2) securing the instrument panel to the righthand side of the body.



1 Screw securing the instrument panel to the lefthand side of the body
2 Screw securing the instrument panel to the righthand side of the body



1 Cluster connections

9. Disconnect the four electrical connections (1) of the cluster then remove the instrument panel from the car.

10. Re-install the instrument panel by operating in reverse order of removal.



SERVICE DATA AND SPECIFICATIONS

TIGHTENING TORQUES

Item	N·m	kg·m	ft·lb
SEAT BELTS			
Seat belts anchor screws	37	3.8	27.3

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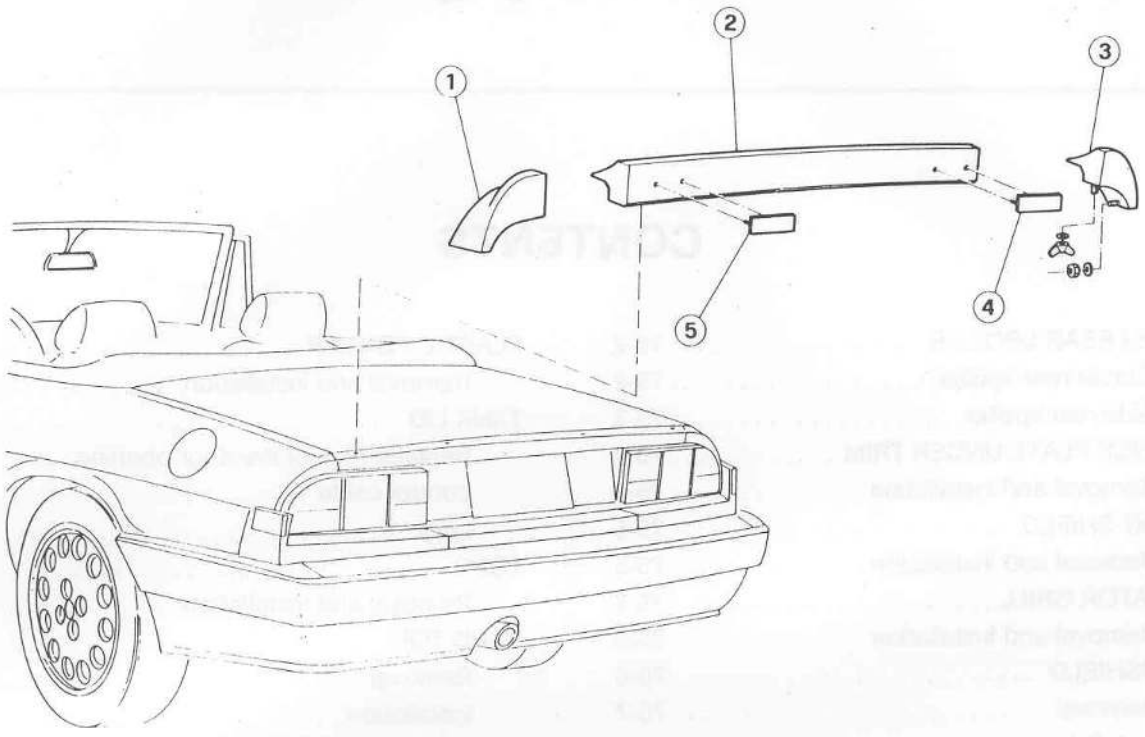
UNIT 75

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UPPER REAR SPOILER

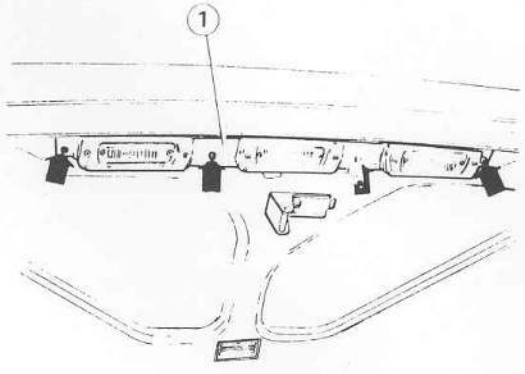


1 L.H. side spoiler
2 Center spoiler
3 R.H. side spoiler
4 Licence plate
5 Licence plate

CENTER REAR SPOILER

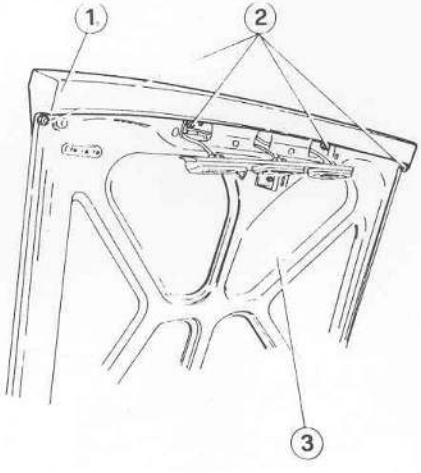
REMOVAL AND INSTALLATION

1. Unscrew the four screws (1) and remove the licence plate lamp holder.



1 Screws

2. Unscrew the four nuts (2) securing the center spoiler (1) to the trunk lid (3).

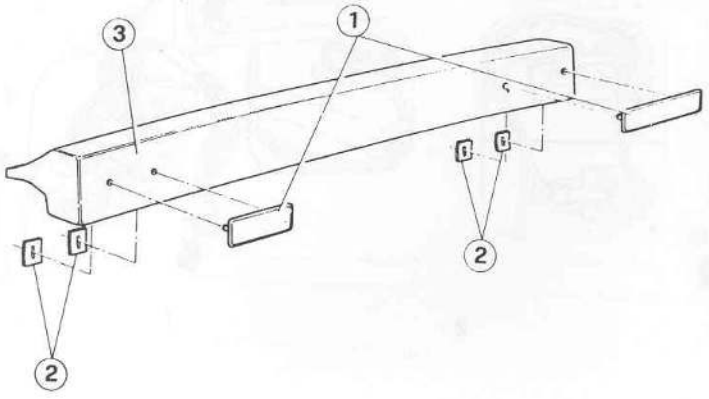


1 Center spoiler
2 Nuts
3 Trunk lid

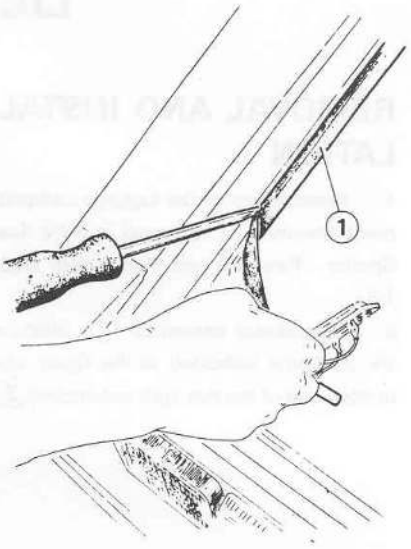
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3. Detach the adhesive edge securing the spoiler to the trunk lid and get hold of the spoiler.

4. If necessary, take off the licence plates (1) by removing the coupling pins (2).



1 Licence plate
2 Pins
3 Center spoiler



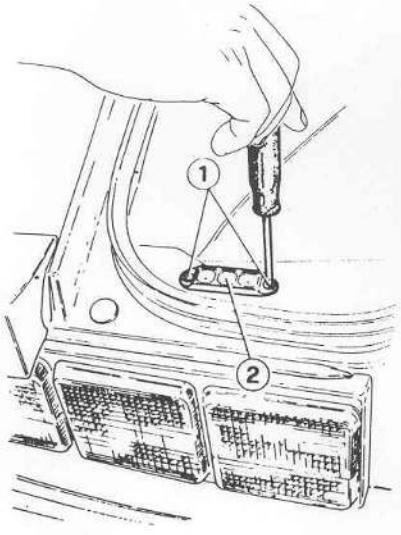
1 Seal

5. Reassemble the center spoiler and reinstall by operating in reverse order of removal.

SIDE REAR SPOILER

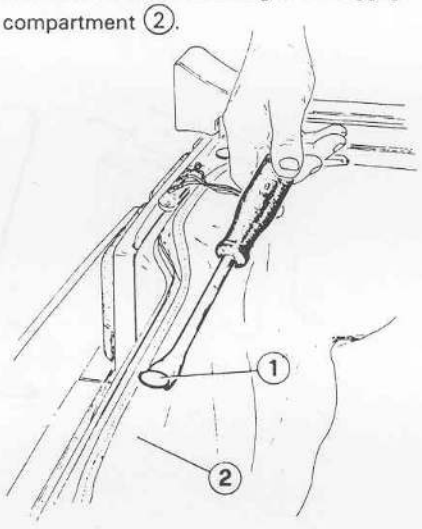
REMOVAL AND INSTALLATION

1. If the LH side spoiler is to be removed only. Unscrew the two screws (1) holding the connector (2) to the bodywork.



1 Screws
2 Connector

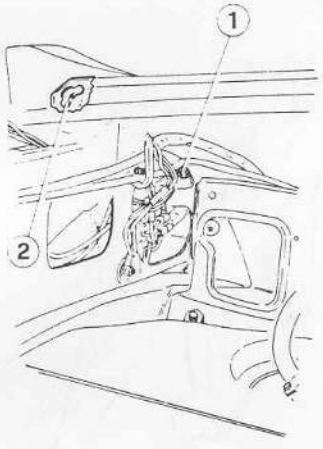
2. Unbutton the three buttons (1) which hold down the rear trimming of the luggage compartment (2).



1 Button
2 Rear trimming of the luggage compartment

3. Remove with care the seal (1) securing the trimming to the bodywork on the side concerned. Continue until reaching the internal area where the side spoiler is attached.

4. Unscrew the nut (1) and wing nut (2) securing the side spoiler to the bodywork.



1 Nut
2 Wing nut

5. Get hold of the side spoiler by detaching the adhesive edge which secures it to the bodywork.

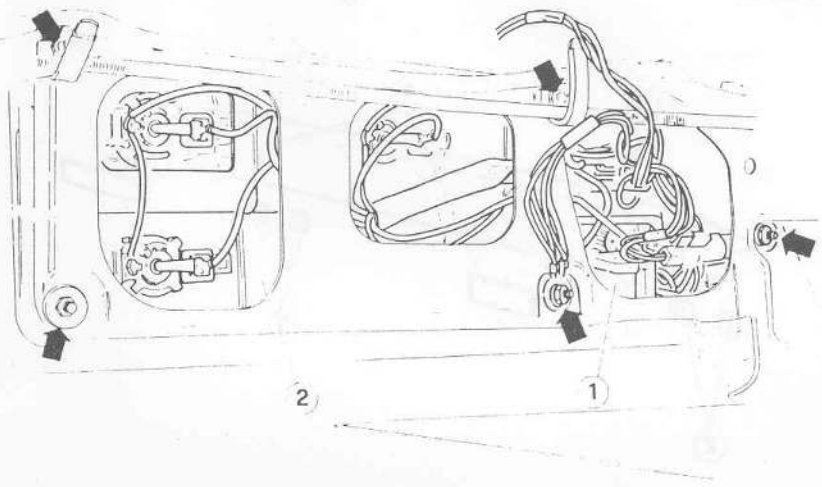
6. Reassemble the side spoiler by operating in reverse order of removal.

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LICENCE PLATE UNDER-TRIM

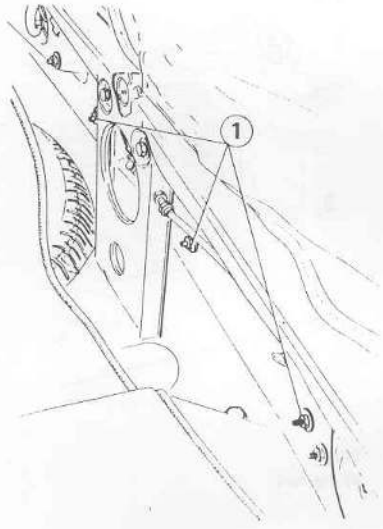
REMOVAL AND INSTALLATION

1. Remove part of the luggage compartment trimming as indicated in Side Rear Spoiler - Removal and Installation, steps 1-3.
2. Disconnect connector (1), unscrew the five nuts indicated in the figure and remove one of the rear light assemblies (2).



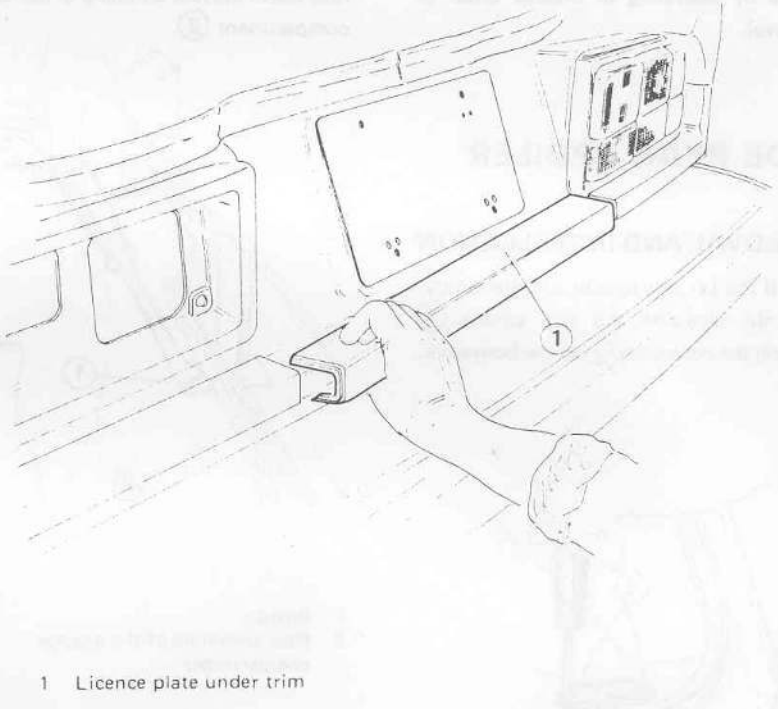
1 Connector
2 Rear light assemblies

3. Unscrew the three nuts (1) securing the licence plate under trim to the bodywork and keep the associated washers.



1 Nuts

4. Get hold of the licence plate (1), slipping it out from the rear light assy still in place.



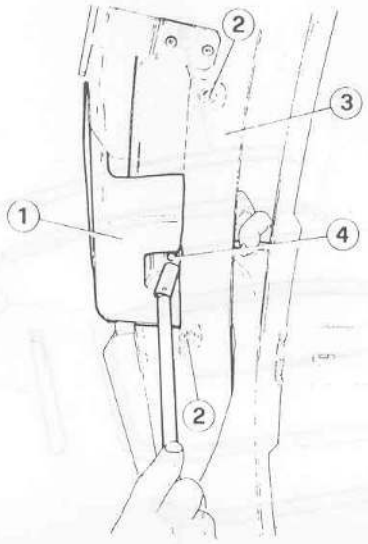
1 Licence plate under trim

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FRONT SHIELD

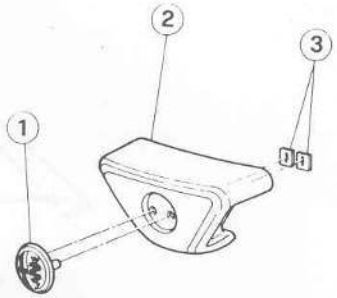
REMOVAL AND INSTALLATION

1. Working from below, unscrew the lower (4) and two upper bolts (2) holding the front shield (1) to the bumper (3).



1 Front shield
2 Upper bolt
3 Bumper
4 Lower bolt

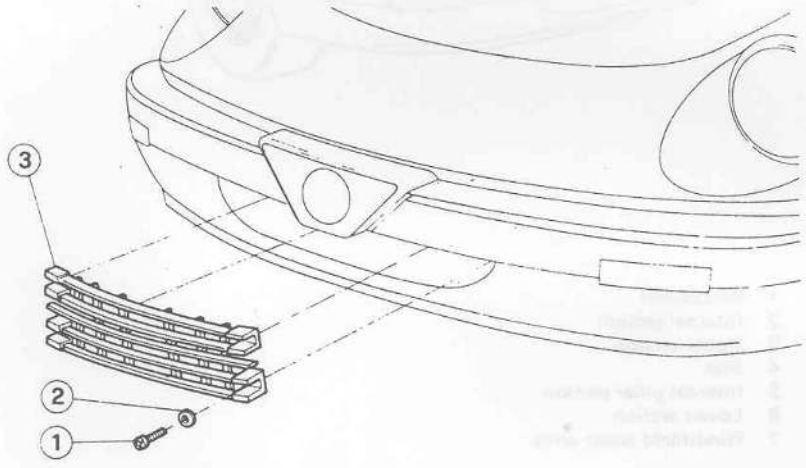
2. If necessary, remove the front motif (1) by taking out the pins (3) which hold it to the front shield (2).



1 Front motif
2 Front shield
3 Pins

3. Reassemble and install the front shield by operating in reverse order of removal.

RADIATOR GRILL



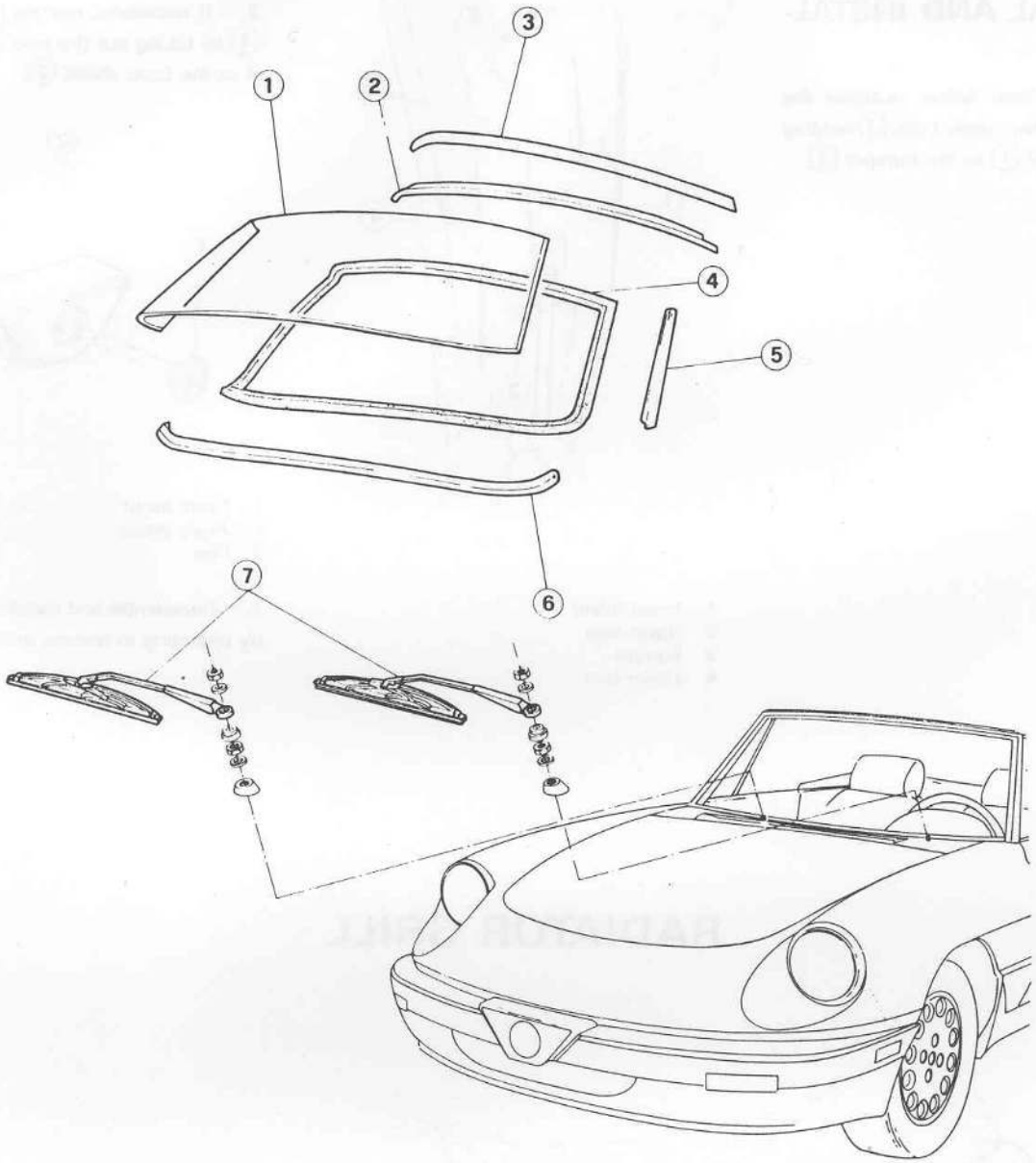
1 Screw
2 Washer
3 Grill

REMOVAL AND INSTALLATION

1. Unscrew the four screws (1) and keep the washers (2).
2. Remove the grill (3), getting hold of it from beneath the bumper.
3. Reassemble the grill by operating in reverse order of removal.

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WINDSHIELD

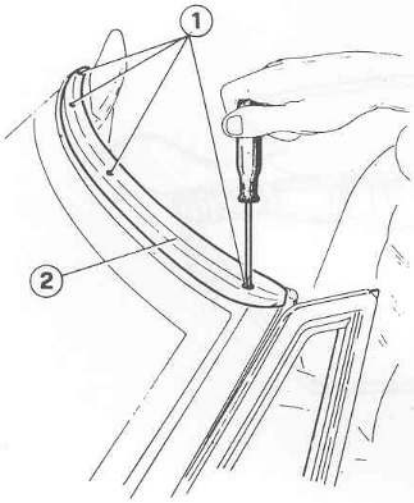


1 Windshield
2 Internal section
3 Upper section
4 Seal
5 Internal pillar section
6 Lower section
7 Windshield wiper arms

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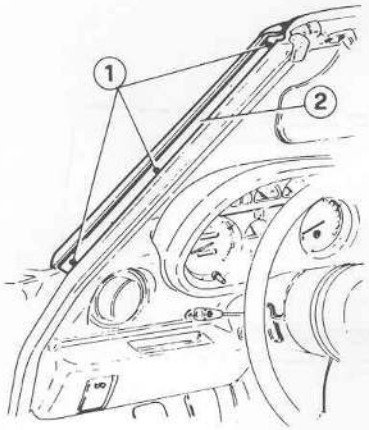
REMOVAL

1. Detach the air grating as instructed in Air Grating - Removal.
2. Open the top, unscrew the four screws (1) and remove the upper section (2).



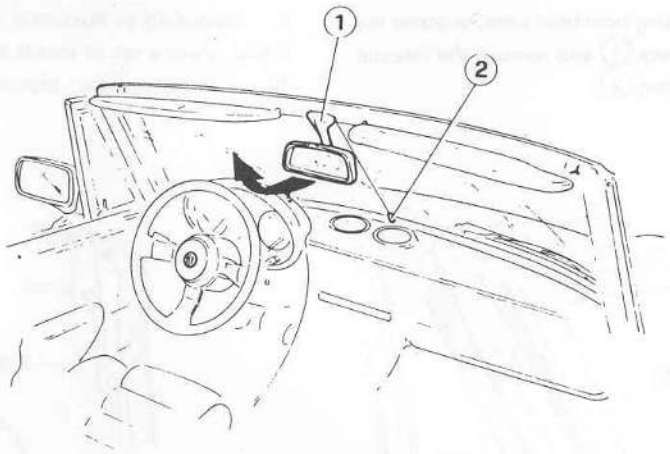
1 Screws
2 Upper section

3. Working from both sides, unscrew the three screws (1) and detach the pillar sections (2).



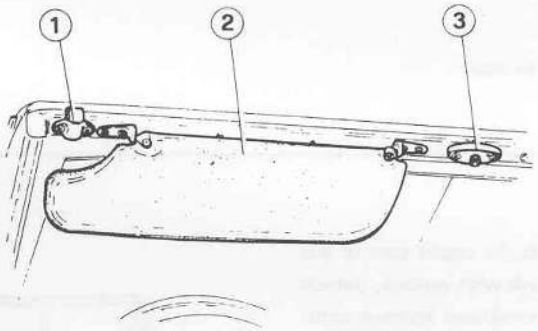
1 Screws
2 Pillar section

4. Working from inside the car, remove the rear view mirror (1) and disconnect the radio antenna connector (2).



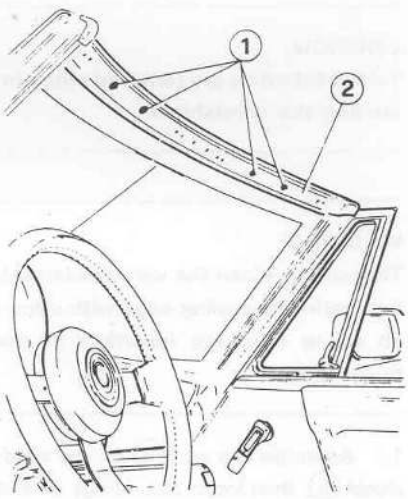
1 Rear view mirror
2 Radio antenna connector

5. Remove the hood hooks (1) by unscrewing the two screws, the sun flaps (2) by unscrewing the four pin screws then remove the mirror support (3) having unscrewed the two screws.



1 Hood hook
2 Sun flap
3 Mirror support

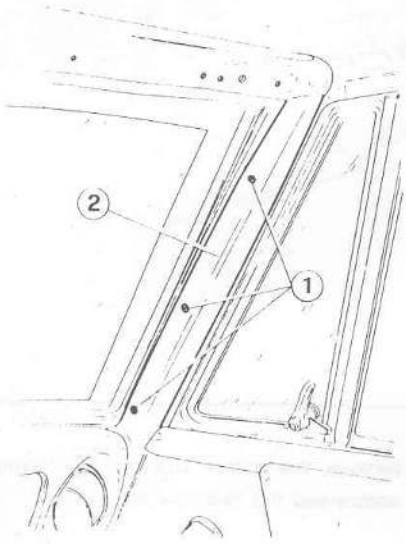
6. Unscrew the four screws (1) and remove the internal section (2).



1 Screws
2 Internal section

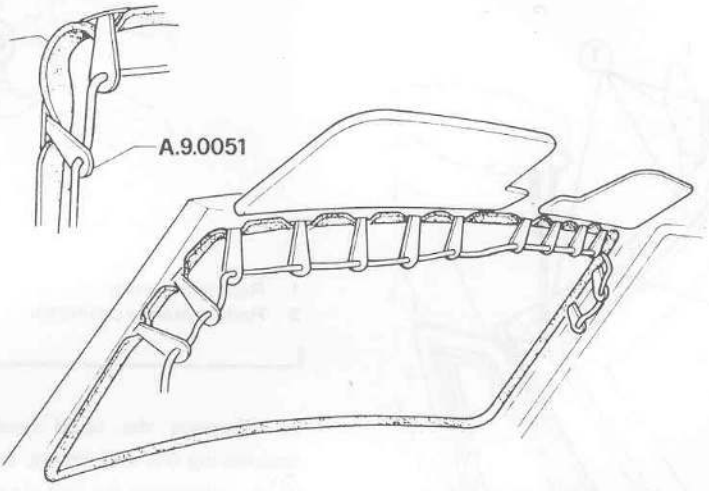
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7. Working from both sides, unscrew the three screws (1) and remove the internal pillar section (2).



1 Screws
2 Internal pillar section

8. Operating as illustrated in the figure below, place a tab of tool **A.9.0051** every 10 cm (4 in) approx., starting from the center of the upper windshield edge between the bodywork and the windshield seal.



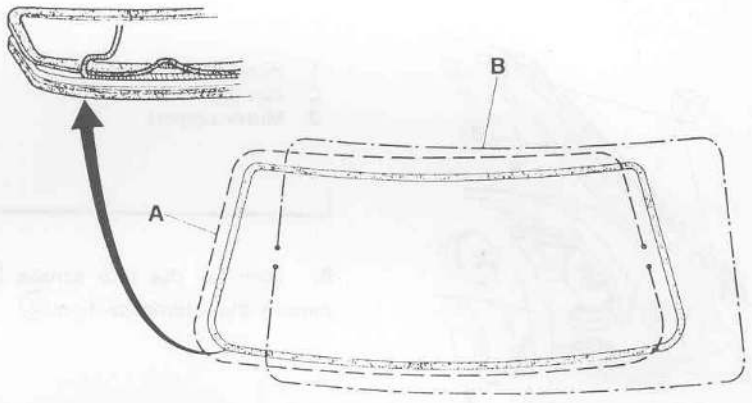
9. Start to push the upper part of the windshield outwards with caution, detach it from the bodywork and remove completely.

INSTALLATION

CAUTION:
Two mechanics are required when installing the windshield

WARNING:
Thoroughly clean the windshield seal, lubricating its sealing edge with silicon so as to facilitate insertion in the bodywork.

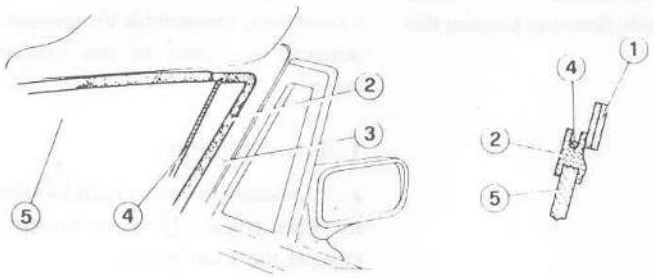
1. Assemble the seal (2) on the windshield (5), then insert two strings (A and B) in the gasket sealing edge as illustrated in the figure to allow correct positioning of the gasket on the body.



2. Rest the windshield on the lower edge of its housing in the bodywork and check that it is centered in the opening with seal (2) assembled at the bottom only.

3. Slowly pull the first string, starting from the upper edge, and follow through the positioning of the gasket sealing edge, patting the whindshield from outside by hand.

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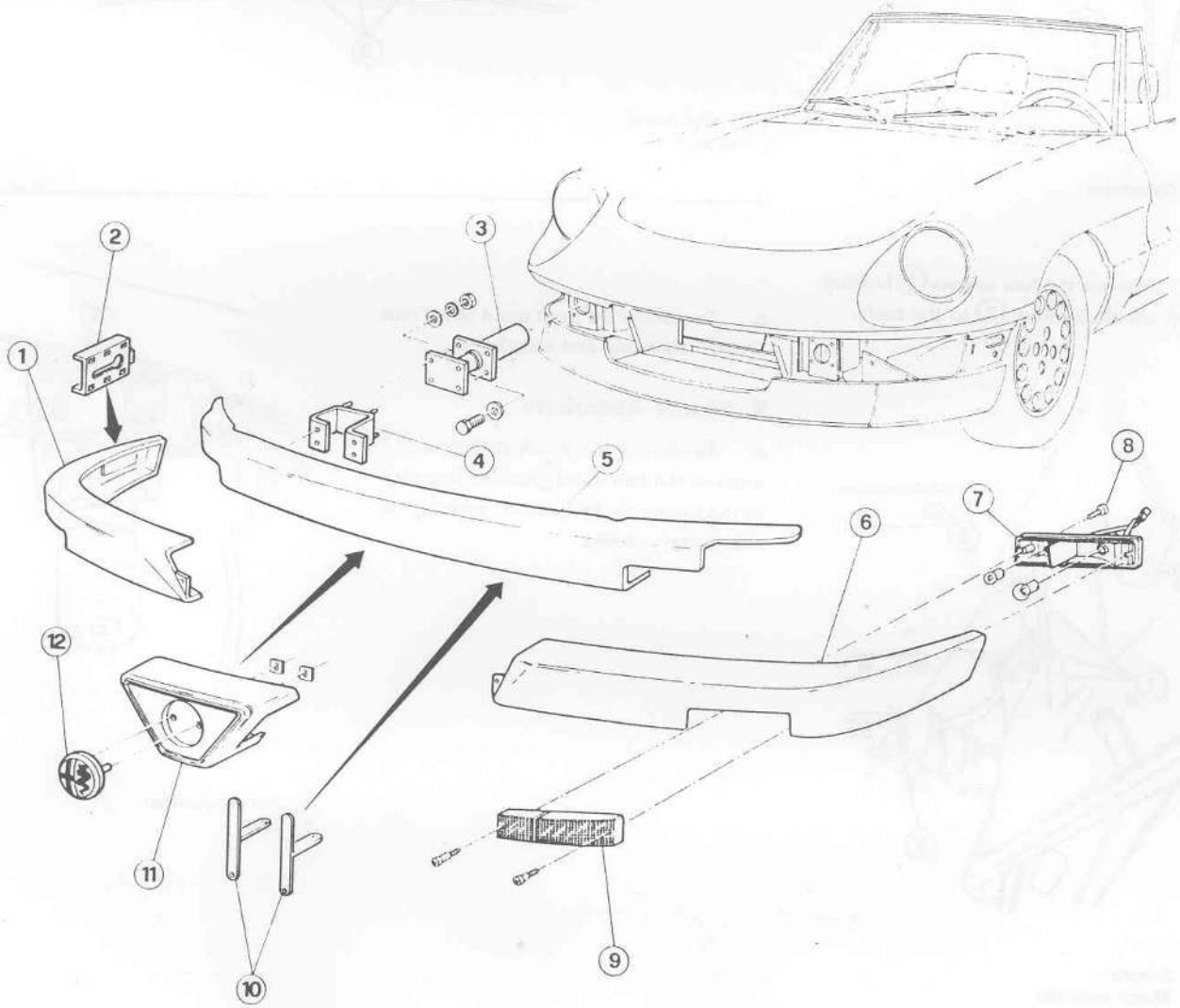
1 Windshield upper pillar
2 Windshield seal
3 Front R.H. pillar
4 String
5 Windshield

4. Repeat using the second string until the windshield is fully installed.
5. Reassemble all parts previously removed, operating in reverse order of removal.

BUMPERS

Note: the bumpers brackets are fitted with shock absorbers on the versions for some states only.

FRONT BUMPER (Except Spider)

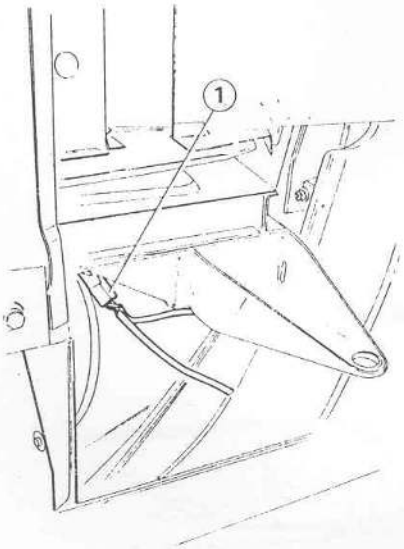


1 Side part of bumper
2 Side slot
3 Shock absorber
4 Shock absorber support
5 Bumber center piece
6 Bumper side part
7 Front parking and indicator lampholder
8 Lampholder fixing screw
9 Transparent cover
10 Licence plate bracket
11 Front shield
12 Front motif

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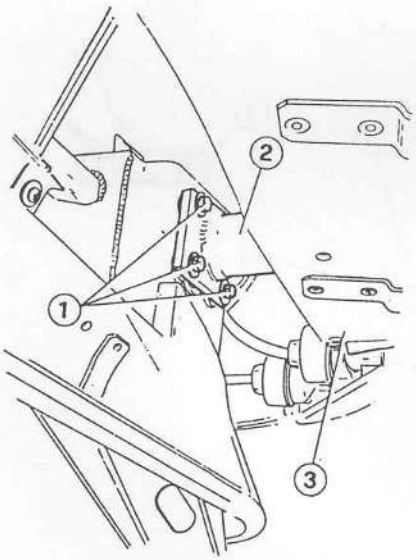
REMOVAL

1. Put the car on the lift and raise it.
2. Detach the connector (1) of the front parking and indicator light assy.



1 Connector

3. Unscrew the four screws (1) holding each shock-absorber (2) to the body.



1 Screws
2 Shock absorber
3 Bumper

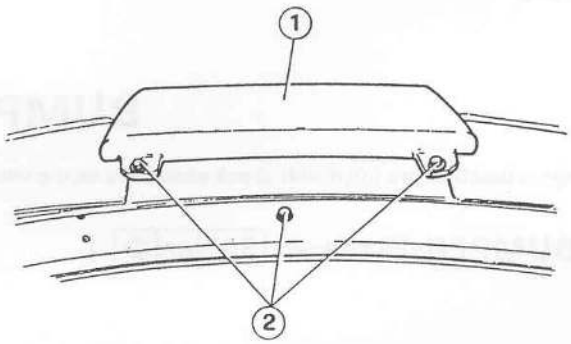
4. Remove the complete bumper, disengaging the side slots and keeping the washers.

DISASSEMBLY

If necessary, disassemble the bumper components according to the instructions below.

1. Front Shield.

a. Unscrew the three bolts (2) securing the front shield (1) to the bumper then remove the front shield.

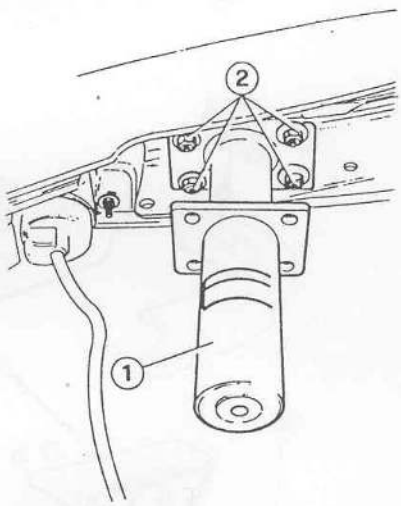


1 Front shield
2 Bolts

b. To replace the front motif see: Front Shield - Removal and Installation.

2. Shock Absorbers.

a. To remove the shock absorbers (1), unscrew the four nuts (2) connecting each of the former to the bumper, keeping the associated washers.

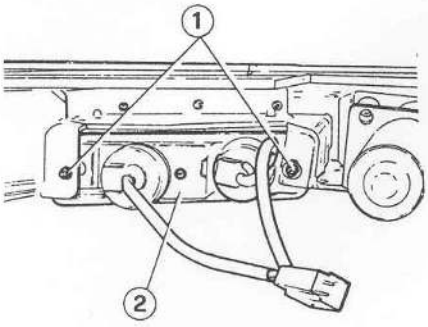


1 Shock absorber
2 Nuts

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3. Front parking and indicator light assy.

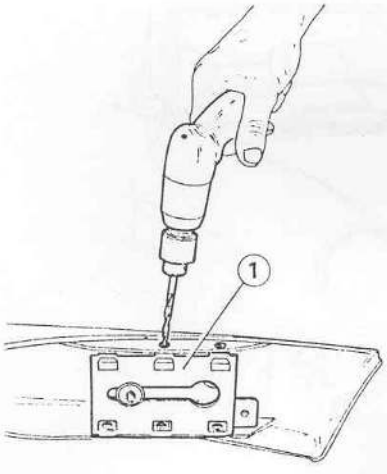
a. Unscrew the two nuts (1) and remove the whole assy (2).



1 Nuts
2 Front parking and indicator light assy

4. Side slot securing bumper.

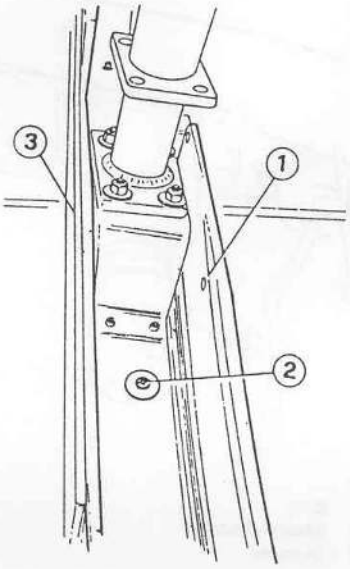
a. Drill off the five nails securing the side slot (1) and remove the latter from the bumper.



1 Side slot

5. Bumper disassembly.

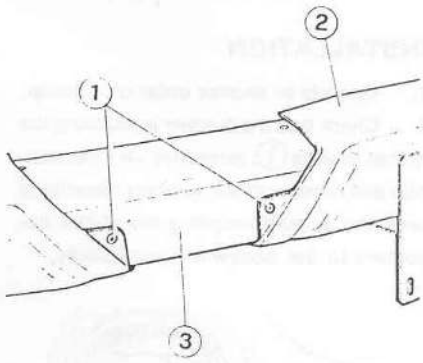
a. Unscrew the two screws with spring (2) securing the side parts (3) to the center piece (1).



1 Center piece
2 Screw with spring
3 Side part

b. Remove the front shield as instructed in step 1.

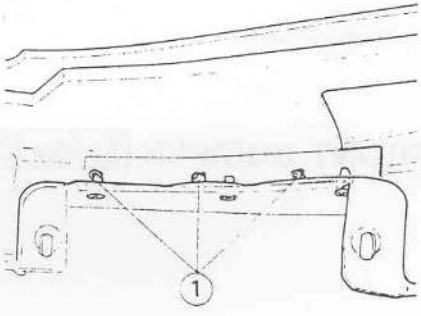
c. Drill off the two nails (1) securing the side parts (2) to the middle of the center piece (3).



1 Nails
2 Side part
3 Center piece

d. Remove the front parking and indicator light assemblies as instructed in step 3.

e. Using a drill, remove the three nails (1) which fix each side part laterally to the center piece.



1 Nails

INSPECTION AND CHECKS

Replace damaged parts and check that the shock absorbers are efficient, otherwise replace them with new ones.

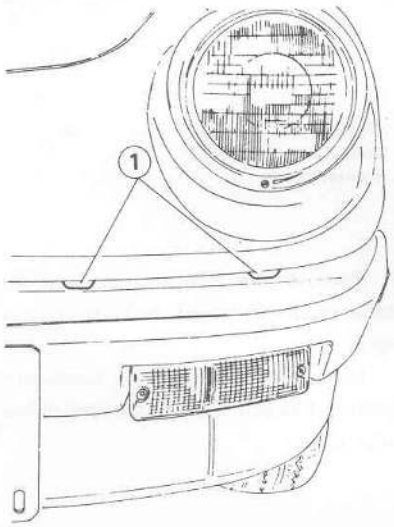
REASSEMBLY

Operate in reverse order of disassembly until the bumper is fully reconstructed.

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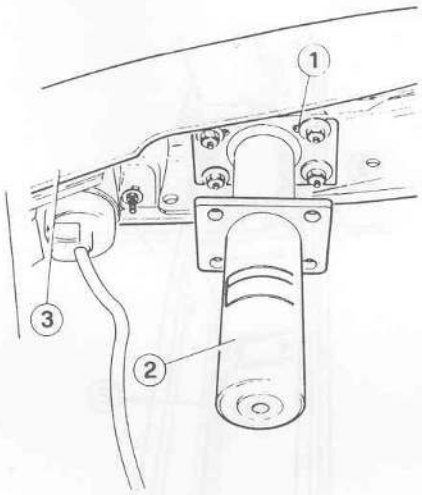
INSTALLATION

1. Operate in reverse order of removal.
2. Check that the bumper is touching the rubber dowels (1), otherwise vary the position and number of the washers associated with the screws coupling the shock absorbers to the bodywork accordingly.



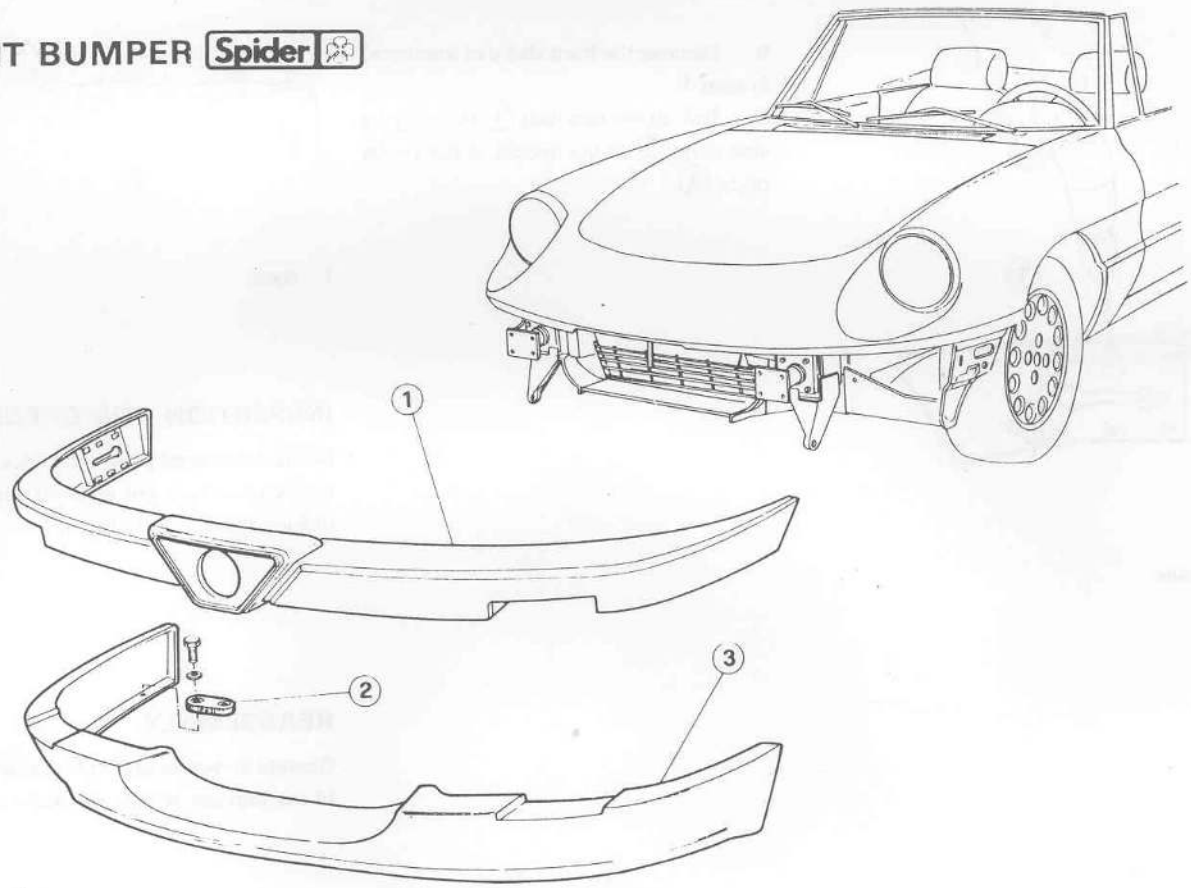
1 Rubber dowels

3. Adjust the horizontal centering of the bumper by acting on the slots (1) on the flange coupling the shock absorbers (2) to the bumper (3).



1 Slot
2 Shock absorber
3 Bumper

FRONT BUMPER Spider

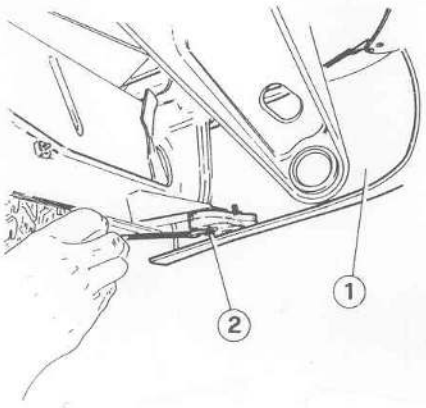


1 Front bumper
2 Antivibration
3 Front spoiler

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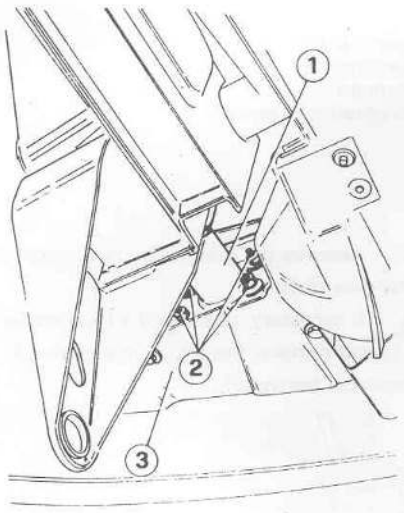
REMOVAL

1. Proceed as for Front Bumper (Except Spider) - Removal, steps 1-3.
2. Unscrews the bolts (2) which hold the front spoiler (1) to the bodywork laterally.



1 Front spoiler
2 Bolt

3. Unscrew the four nuts (2) securing the bumper (3) to each shock absorber (1).

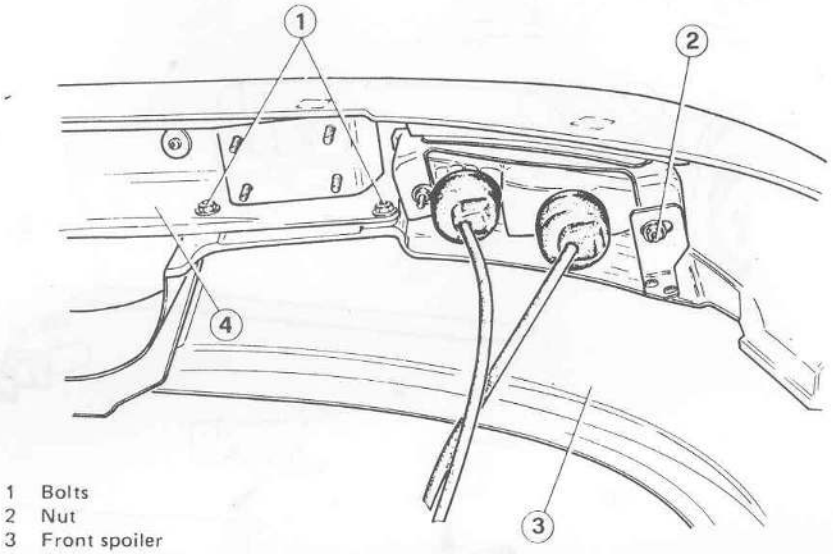


1 Shock absorber
2 Nuts
3 Bumper

4. Remove the bumper as a whole by disengaging it from the side slots.

DISASSEMBLY

If necessary, disassemble the bumper components according to the following instructions.

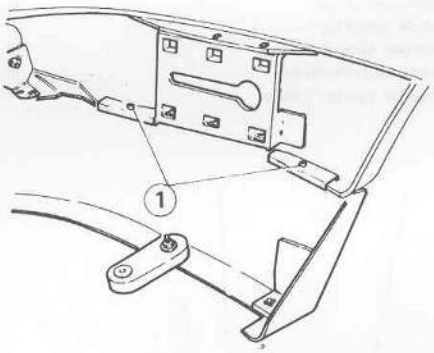


1 Bolts
2 Nut
3 Front spoiler
4 Bumper

1. Front spoiler.

a. Working from both sides of the bumper, unscrew the two bolts (1) and the nut (2) securing the front spoiler (3) to the bumper (4).

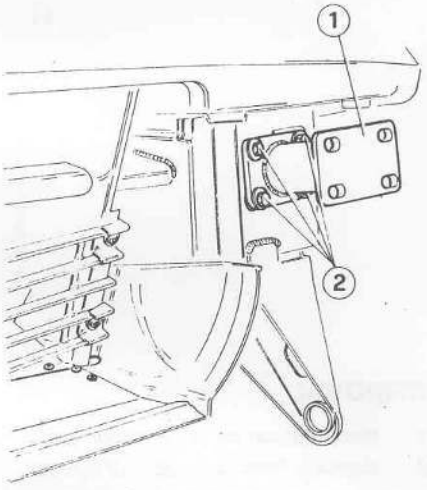
b. Using a drill, remove the two nails (1) holding the spoiler to the bumper laterally and separate the two parts.



1 Nails

2. Shock absorbers.

a. To disassemble the shock absorbers (1), unscrew the four screws (2) holding each one to the bodywork.



1 Shock absorber
2 Screws

3. Other components.

a. To remove the remaining components see Front Bumper (Except Spider) - Removal, steps 1, 3, 4, 5, 6.

INSPECTION AND CHECKS

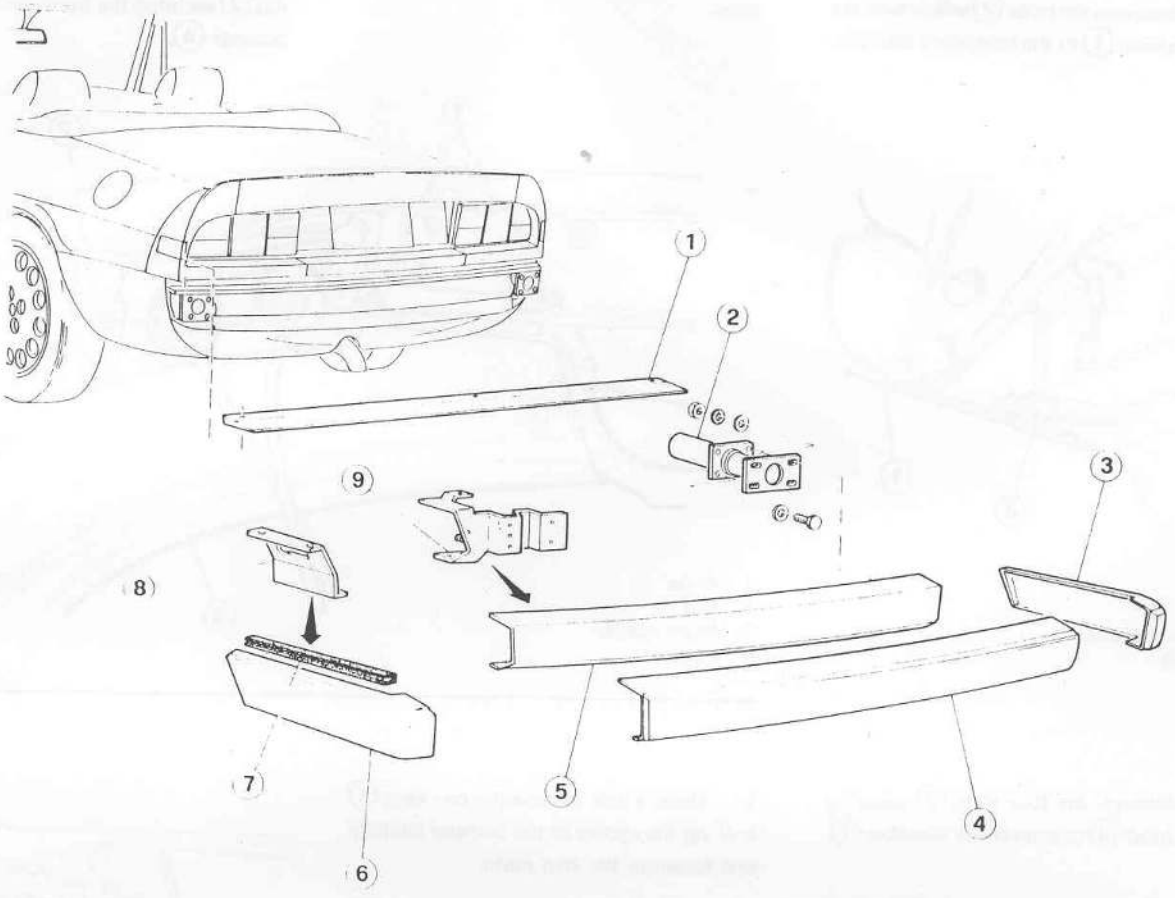
REASSEMBLY

INSTALLATION

See Front Bumper (Except Spider).

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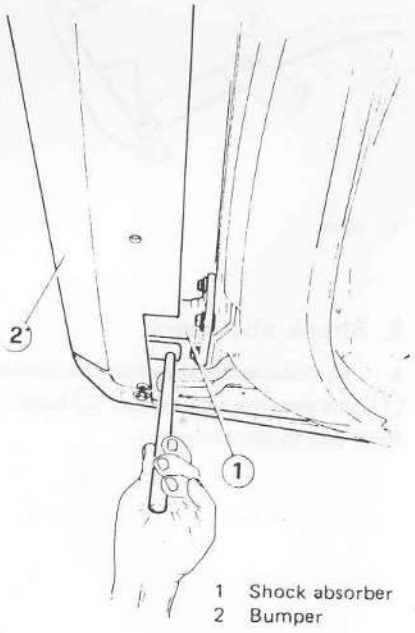
REAR BUMPER (Except Spider)



1 Rebound strap
2 Shock absorber
3 Bumper side part
4 External trimming
5 Bumper center piece
6 Bumper side part
7 Rubber section
8 Slot support
9 Shock absorber support

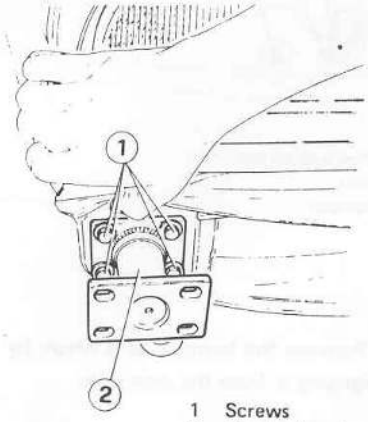
REMOVAL

1. Place the car on the lift and raise.
2. Working from both sides of the car, unscrew the three nuts fixing each shock absorber (1) to the bumper (2).



1 Shock absorber
2 Bumper

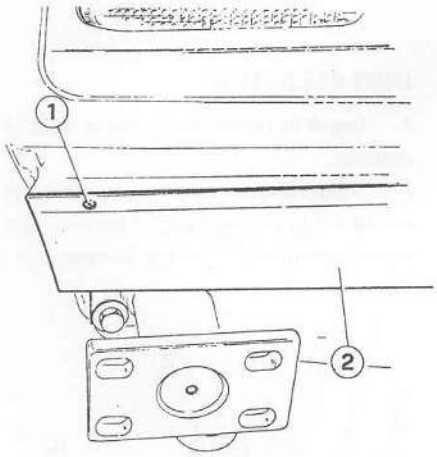
3. Remove the bumper by disengaging the side slots.
4. If necessary, unscrew the four screws (1) and remove the shock absorbers (2) from the bodywork.



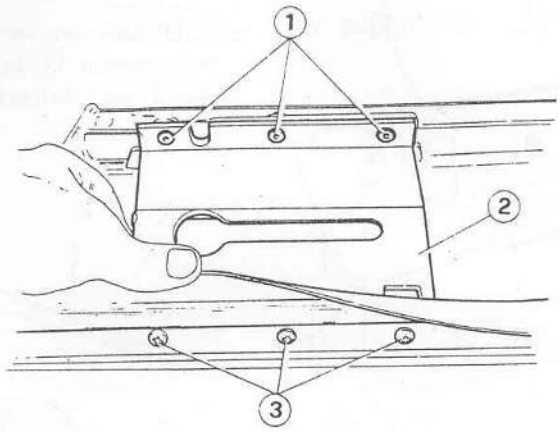
1 Screws
2 Shock absorber

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5. If necessary, drill off the four nails (1) and remove the strap (2).



1 Nails
2 Strap

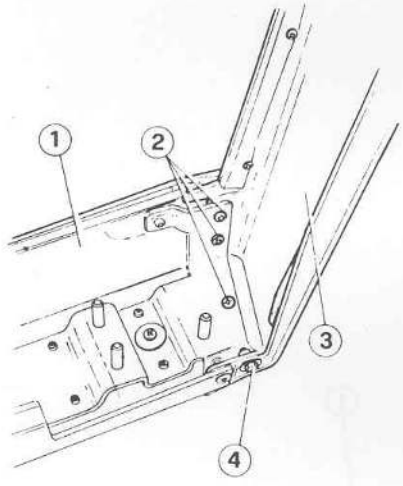


1 Nails
2 Slot support
3 Screws

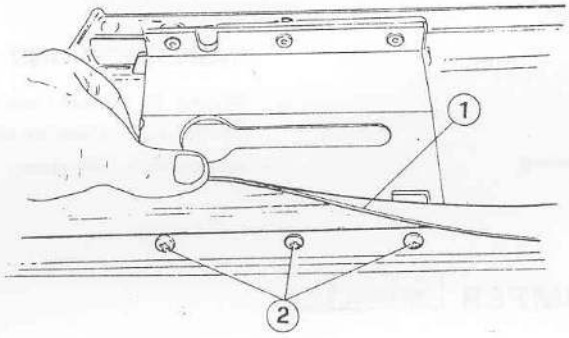
3. If necessary, remove the rubber section (1) by unscrewing the three screws (2) which hold it to the slot support and the side part of the bumper and the three screws (3) along the edge of the bumper side part.

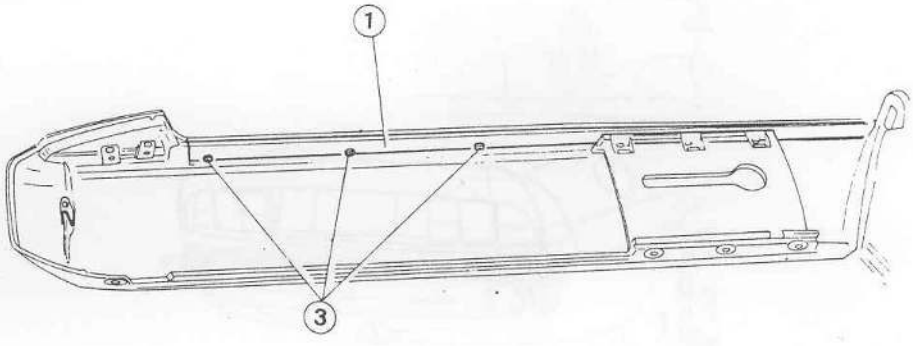
DISASSEMBLY

1. Unscrew the three screws (2) and the bolt (4) then separate the side part (3) from the center piece (1).



1 Center piece
2 Screws
3 Side part
4 Bolt



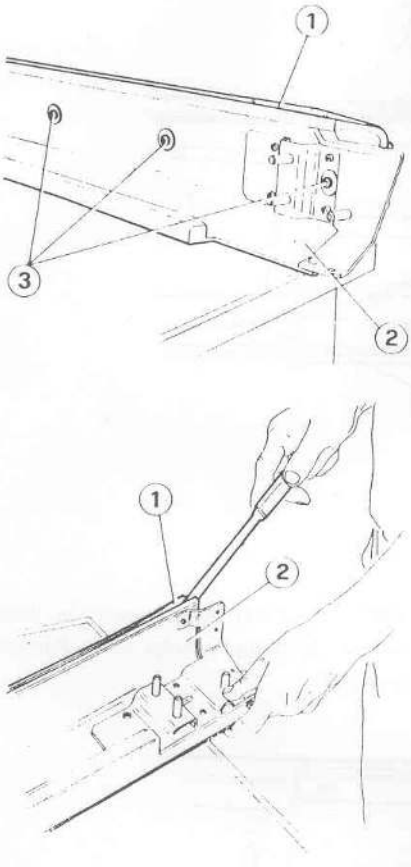


1 Rubber section
2 Screws
3 Screws

2. If necessary, remove the slot support (2) by drilling off the nails (1) and unscrewing the three screws (3).

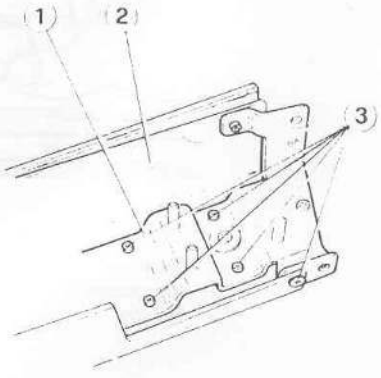
4. If necessary, separate the external trimming (1) from the center piece (2) by unscrewing the seven screws (3), heating the adhesive adjoining part and detaching it as illustrated in the figure.

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1 External trimming
2 Center piece
3 Screws

5. If necessary, remove the shock absorber support (1) by drilling off the six nails (3) which fix it to the center piece (2).



1 Shock absorber support
2 Center piece
3 Nails

INSPECTION AND CHECKS

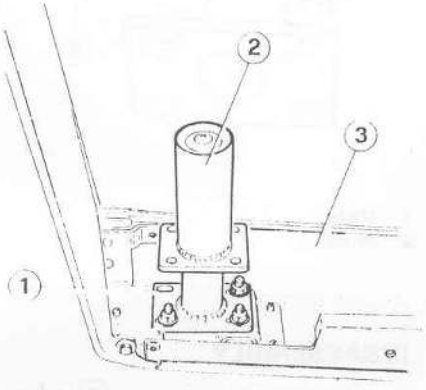
Replace the parts damaged and check that the shock absorbers are efficient otherwise replace with new ones.

REASSEMBLY

Operate in reverse order of disassembly until the bumper is reconstructed.

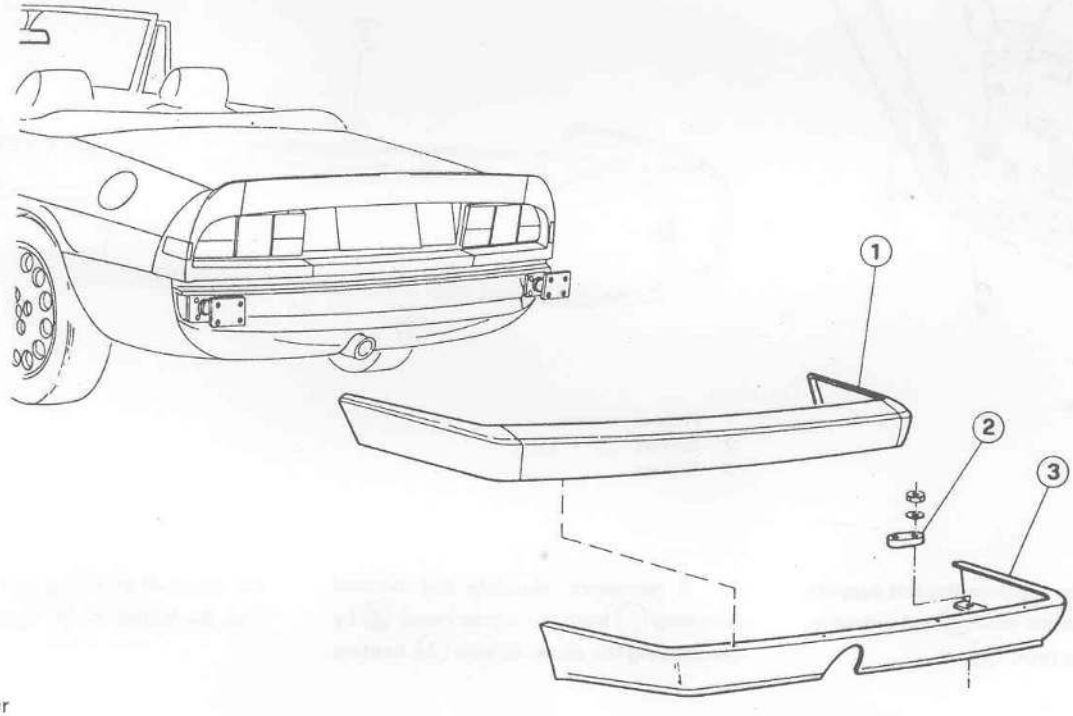
INSTALLATION

1. Install by operating in reverse order of removal.
2. Adjust bumper centering by acting on the slots (1) on the flanges coupling the shock absorbers (2) to the bumper (3).



1 Slots
2. Shock absorbers
3 Bumper

REAR BUMPER Spider

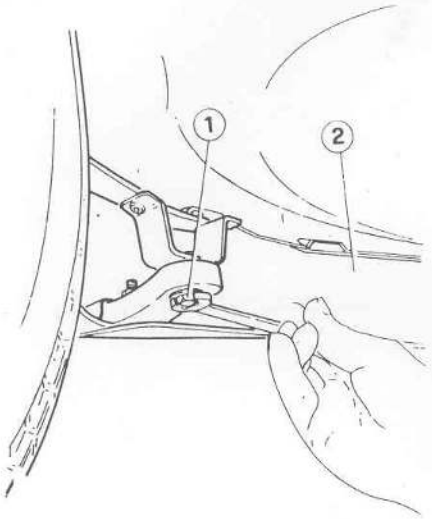


1 Rear bumper
2 Antivibration spacer
3 Rear spoiler

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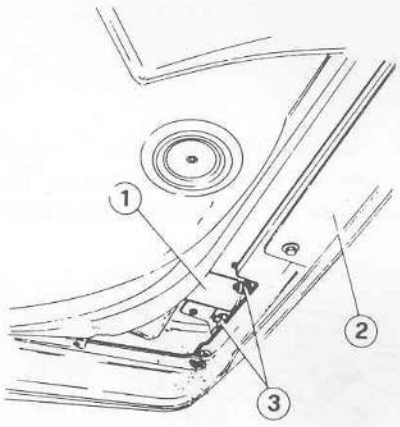
REMOVAL

1. Place the car on the lift and raise it.
2. Unscrew the bolts (1) securing the rear spoiler (2) to the body laterally.



1 Bolt
2 Rear spoiler

3. Unscrew the four nuts (3) holding each shock absorber (1) to the bumper (2).

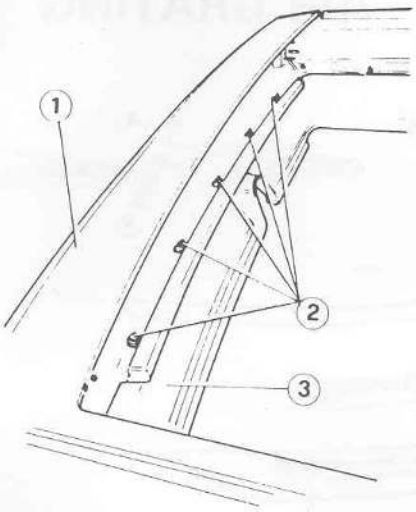


1 Shock absorber
2 Bumper
3 Nuts

4. Proceed as instructed in Rear Bumper (Except Spider) - Removal, steps 3-5.

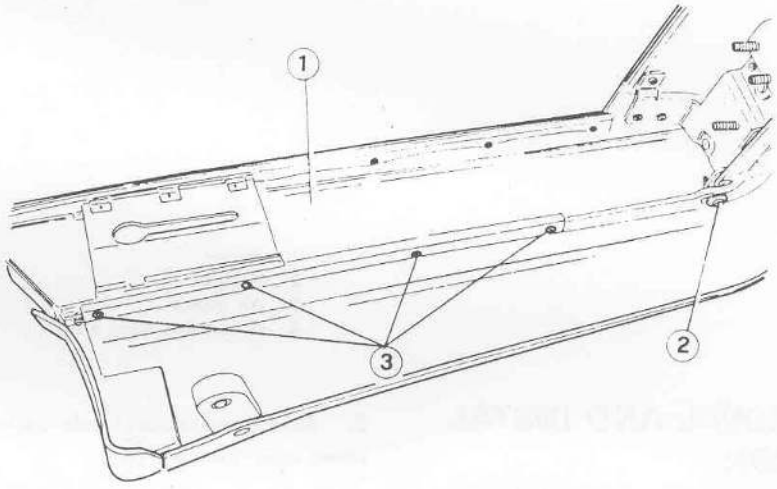
DISASSEMBLY

1. Unscrew the five bolts (2) securing the rear spoiler (3) to the bumper (1) in the center area.



1 Bumper
2 Bolts
3 Rear spoiler

2. Working on every side of the bumper, unscrew the bolt (2), drill off the four nails (3) and separate the spoiler from the bumper.



1 Bumper
2 Bolt
3 Nails

3. Proceed with disassembly as instructed in Rear Bumper (Except Spider) - Disassembly.

INSPECTION AND CHECKS

Replace any damaged parts and check that the shock absorbers are efficient, otherwise replace them with new ones.

REASSEMBLY

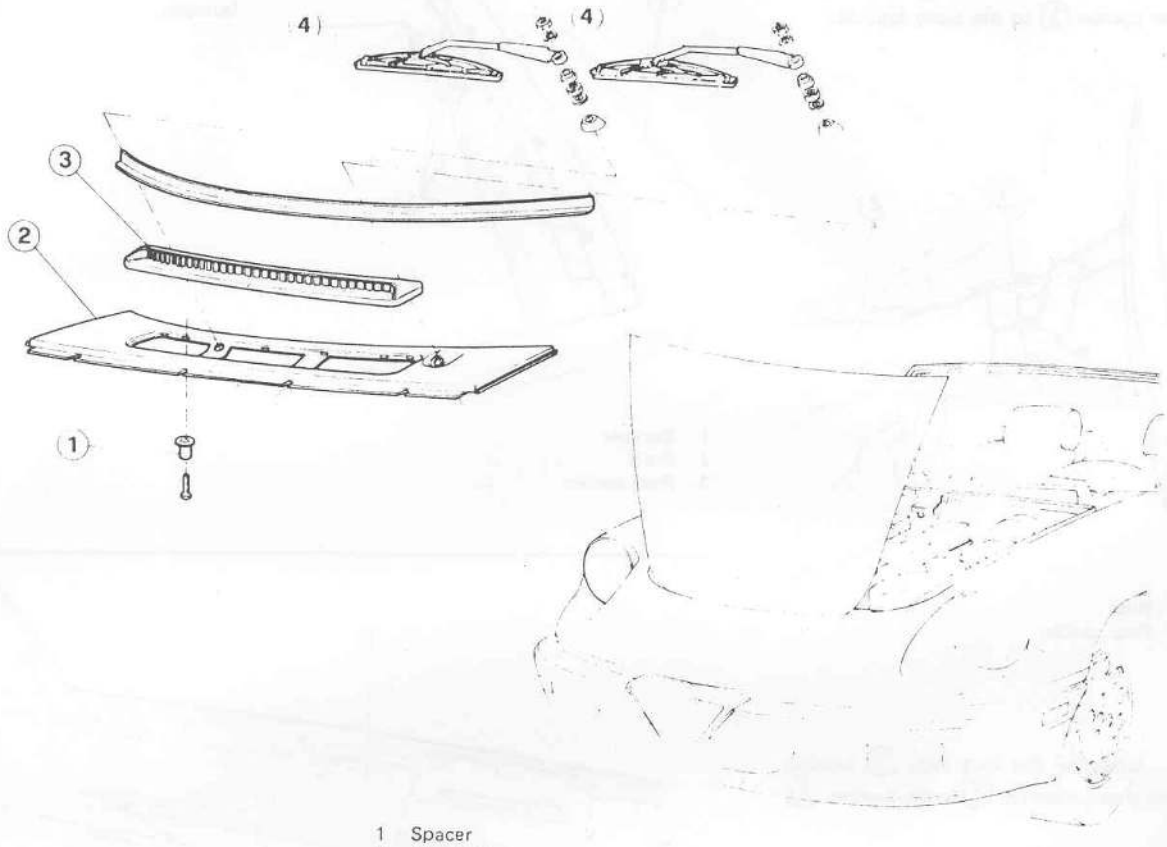
Operate in reverse order of disassembly until the bumper is fully reconstructed.

INSTALLATION

Install by operating as instructed in Rear Bumper (Except Spider) - Installation.

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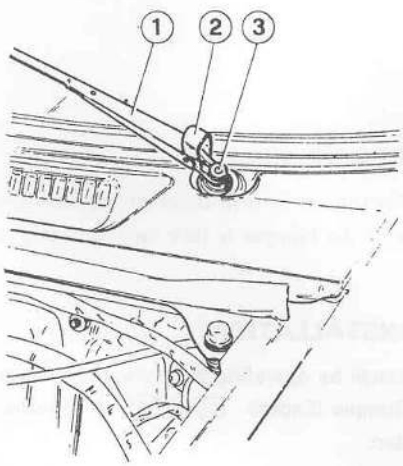
AIR GRATING



1 Spacer
2 Support
3 Air intake
4 Windshield wiper arms

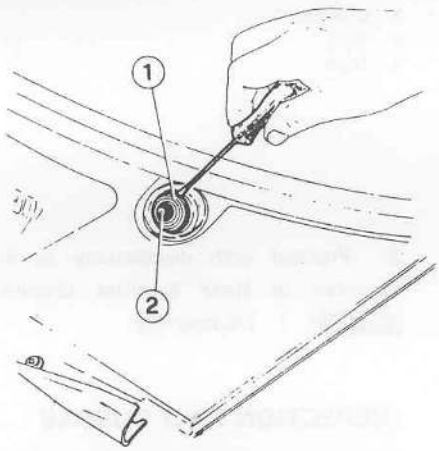
REMOVAL AND INSTALLATION

1. Lift the protective cover (2) off the windshield wiper arm nuts then unscrew the nuts (3) and remove the windshield wiper arms (1).



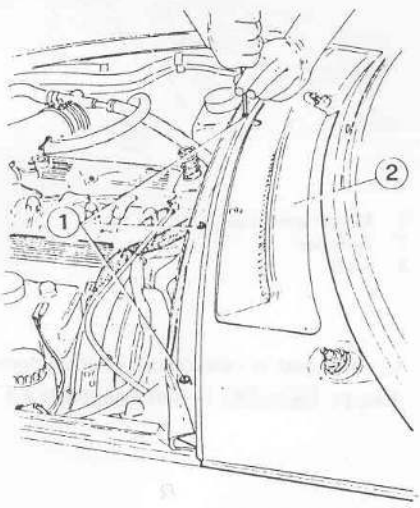
1 Windshield wiper arm
2 Protective cover
3 Nut

2. Extract the casings (1) from the windshield wiper arm pins (2).



1 Casings
2 Pin

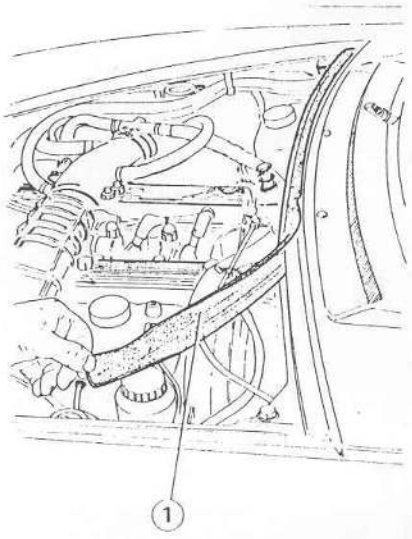
3. Unscrew the four screws (1) which secure the grating (2), keeping the associated washers and plastic nut screws



1 Screws
2 Grating

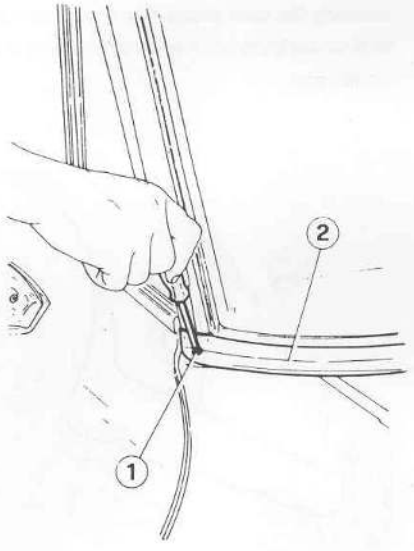
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4. Slip off the engine hood seal (1).



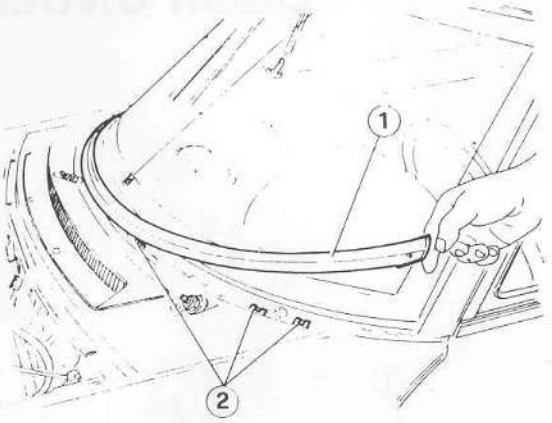
1 Seal

5. Unscrew the two screws (1) holding the section (2) laterally to the windshield base.



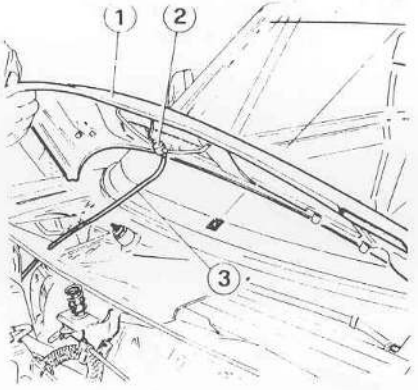
1 Screw
2 Section

6. Remove the section (1) by releasing it from the retainer springs (2) at the windshield base.



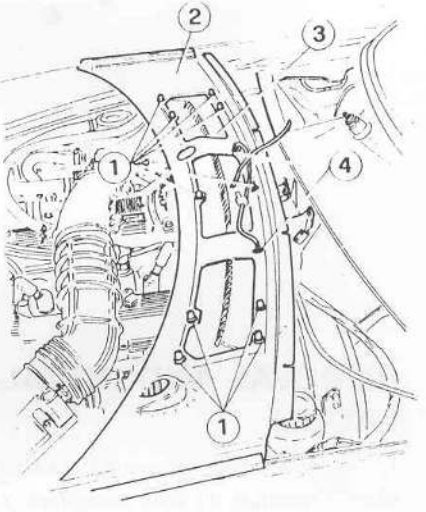
1 Section
2 Retainer springs

7. Raise the grating (1), uncouple windshield washer hose (3) from the union tee (2) and remove the grating altogether.



1 Grating
2 Union tee
3 Windshield washer hose

8. Unscrew the ten screws (1) securing the air intake (3) to the support (2).
If necessary, remove the sprayers from the support by detaching the hoses and unscrewing the nuts (4).

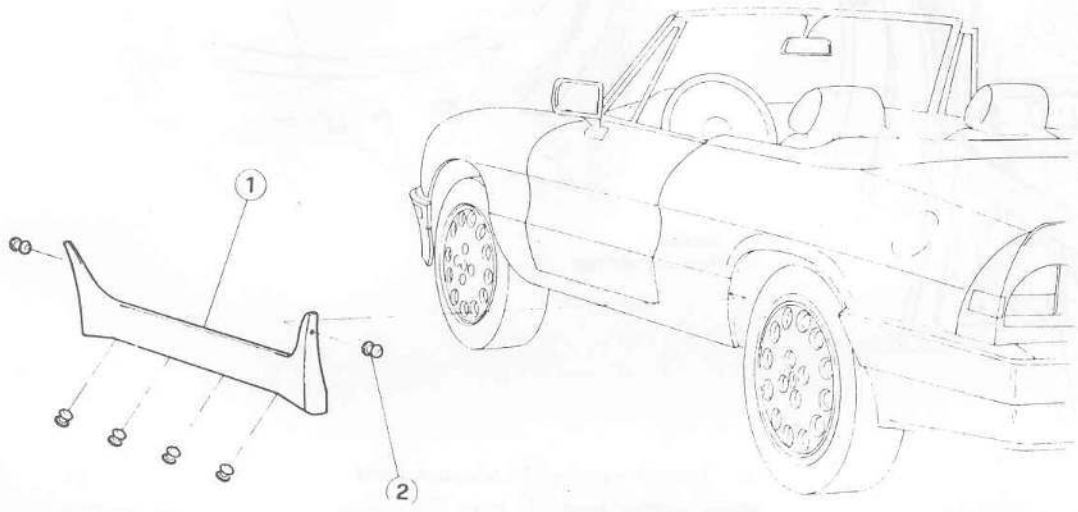


1 Screws
2 Support
3 Air intake
4 Nuts

9. Reinstall the air grating by operating in reverse order of removal. Take particular care when reassembling the section under the windshield to ensure that this part engages the associated retainer springs correctly.

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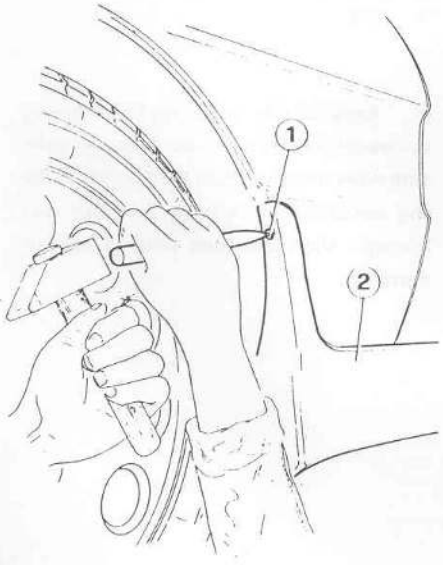
DOOR UNDER-TRIM

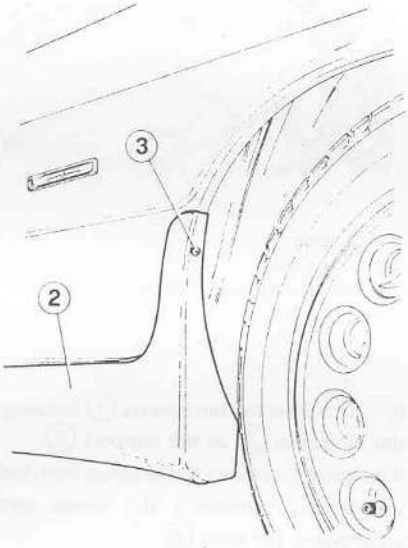


1 Door under trim
2 Screw anchors

REMOVAL AND INSTALLATION

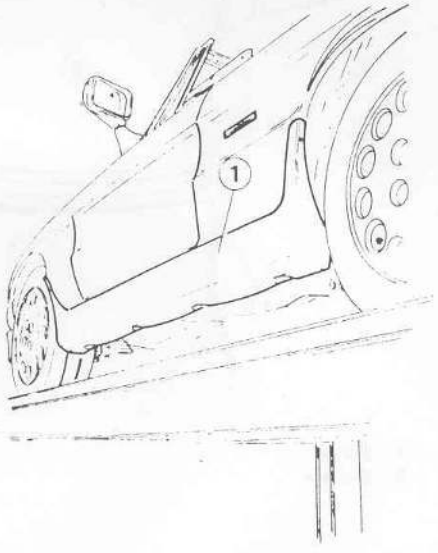
1. Using a punch, remove the screw anchor (1) securing the door under-trim (2) at the front as well as the dowel (3) holding it at the front.



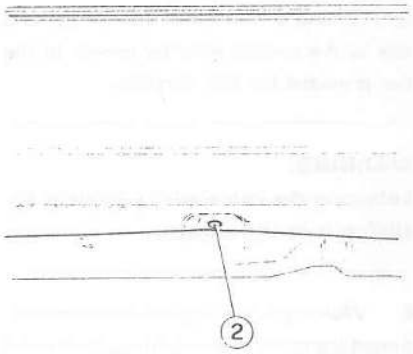


1 Front holding anchor screw
2 Door under-trim
3 Rear holding anchor screw

2. Remove the four anchor screws (2) securing the door under-trim (1) at the bottom to the bodywork and remove the door under-trim.



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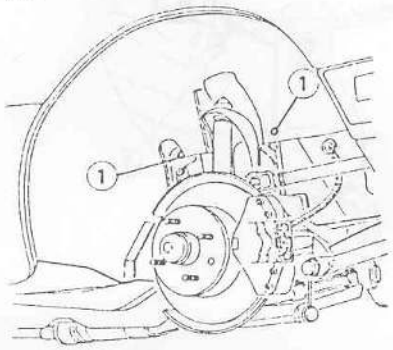
1 Door under-trim
2 Nail

3. Reassemble the door under-trim by operating in reverse order of removal, checking that it adheres to the car body perfectly.

PLASTIC FENDER

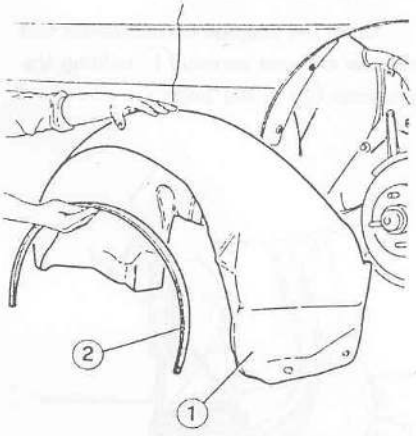
REMOVAL AND INSTALLATION

1. Lift the vehicle on the front side and apply proper stands.
2. Remove the front wheel.
3. Remove the rivets (1) fixing the plastic fender to the body by pushing on central pin.



1 Rivets fixing the plastic fender to the body

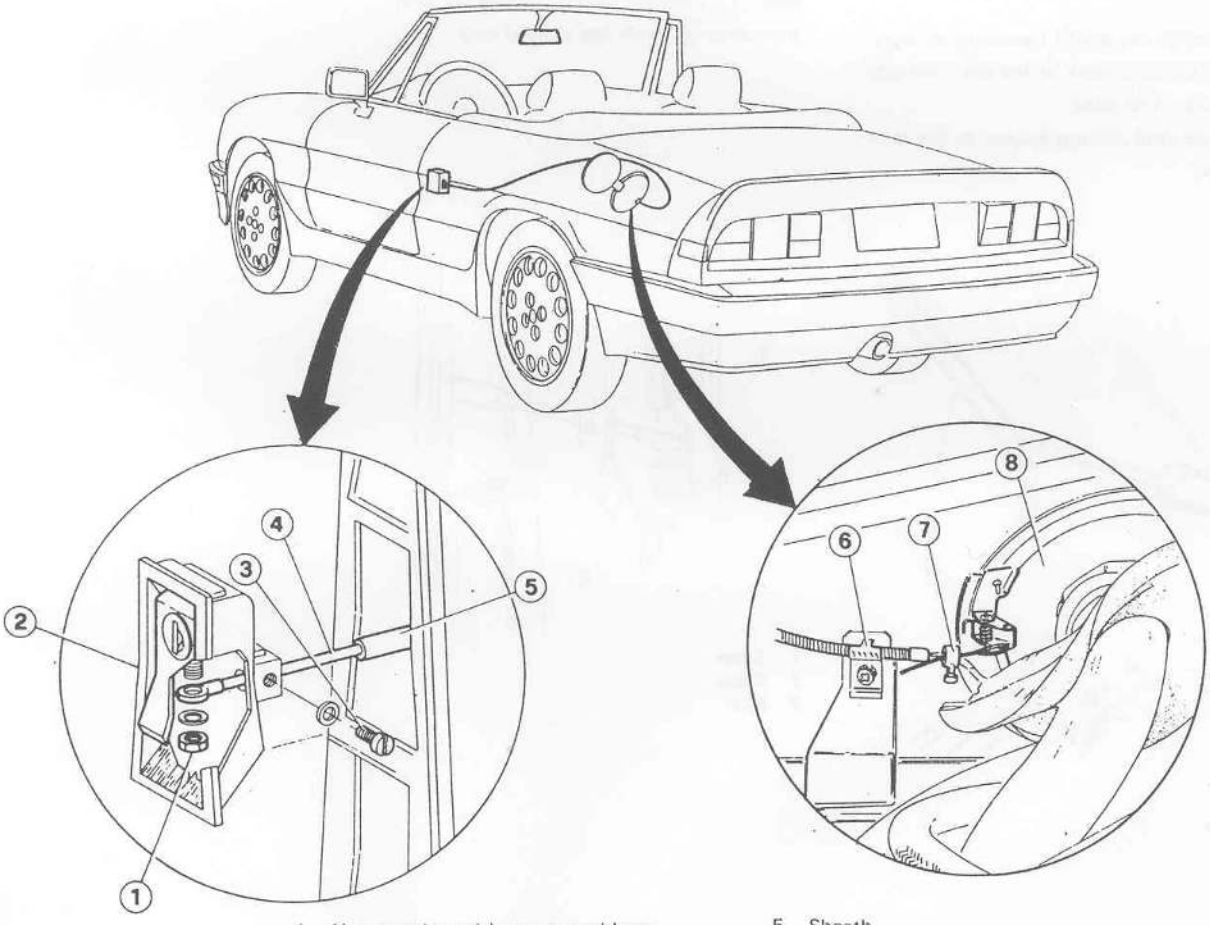
4. Remove the plastic fender (1) and the gasket (2).



1 Plastic fender
2 Gasket

5. Reinstall the plastic fender by operating in reverse order of removal, using new rivets to fix it.

TANK LID

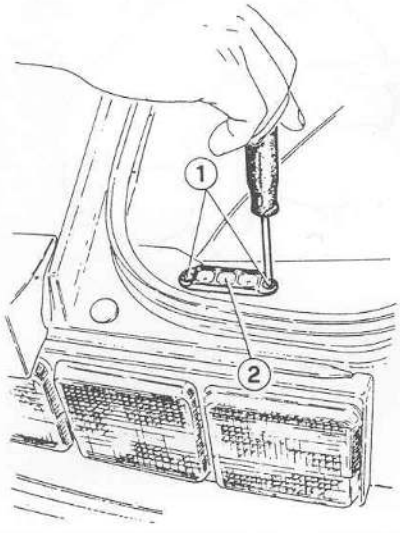


1 Nut securing cable to control lever
2 Control lever
3 Screw securing sheath to control lever
4 Cable
5 Sheath
6 Sheath bracket
7 Cable check
8 Tank lid

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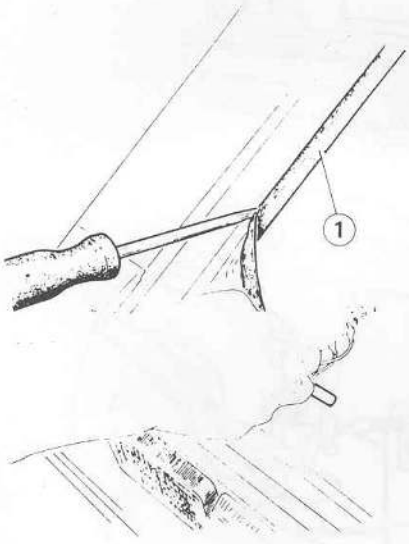
REPLACEMENT OF THE DOOR OPENING CONTROL CABLE

1. Open the luggage compartment and unscrew the two screws (1) holding the connector (2) to the body.



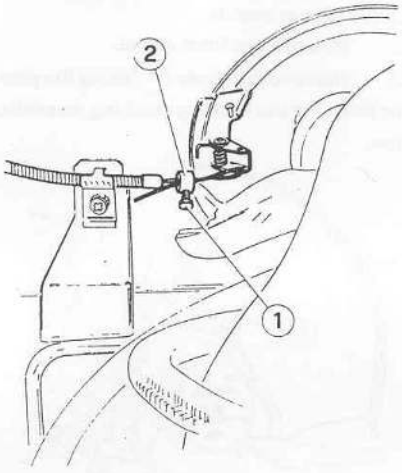
1 Screws
2 Connector

2. Detach the seal (1) securing the trimming to the bodywork on the left hand side of the car with care.
Continue until gaining access to the tank lid area.



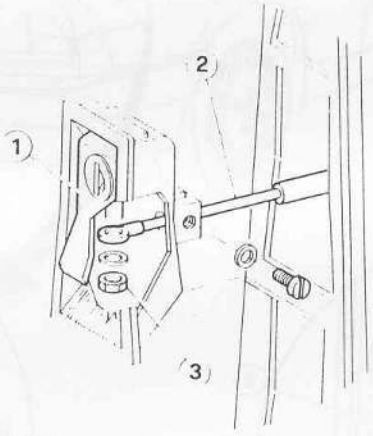
1 Seal

3. Unscrew screw (1) of the cable clip (2) and release the cable.



1 Screw
2 Cable clip

4. Working from inside the car, raise the lever (1), unscrew nut (3), getting hold of the cable (2) with the slotted end.



1 Lever
2 Cable
3 Nut

5. Thread a new cable and fix the end slot to the control lever by means of the nut provided for this purpose.

WARNING:
Lubricate the cable with sufficient oil, sliding it in the sheath.

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6. Working in the luggage compartment, thread the cable in the opening device and hold it in place by means of the cable clip.
7. Check that the lid opens properly and if necessary adjust the cable position by acting on the cable clip.

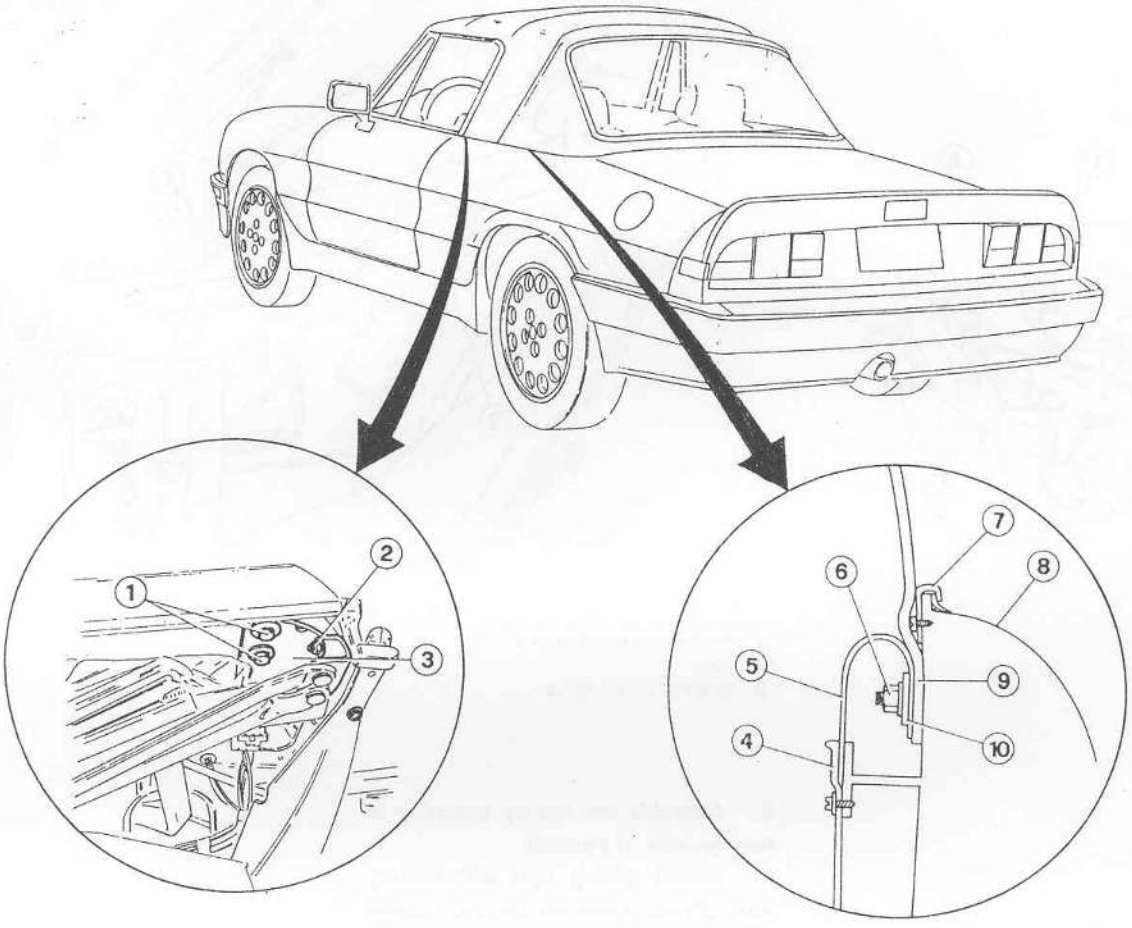
LOCK

REMOVAL AND INSTALLATION

1. Work on the lock control lever assembly for the tank lid in a similar way as instructed in Unit 56 - Front Hood and Trunk Lid - Trunk Lid - Lock - Removal and Installation.

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TOP



1 Screws securing top hinge to body
2 Nut securing top hinge to body
3 Top hinge
4 Internal trimming
5 Protection weatherstrip
6 Nut securing top
7 Upper finishing section
8 Body
9 Top
10 Bracket securing top

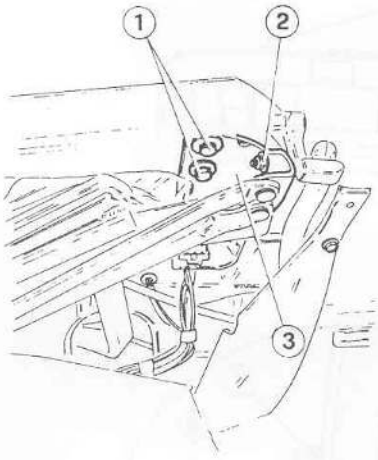
WARNING:
When opening the top take particular care that undesired creases are not formed, especially in the region of the rear window. For best results, guide the folding by hand.

REMOVAL AND INSTALLATION

1. Open the top and, working from the passenger compartment, unscrew the screws securing the pillar panels (see: Unit 66 - Pillar Panels - Removal and Installation).

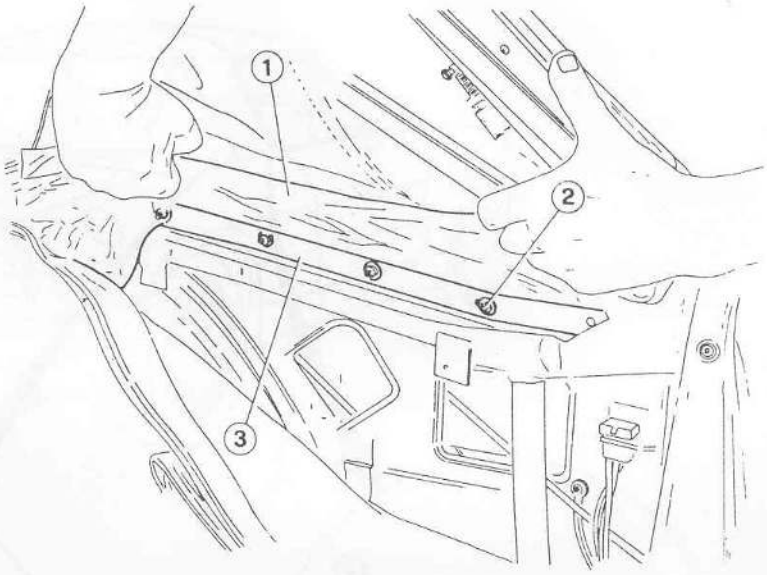
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2. Fold the upper part of the passenger compartment rear trimming towards the car interior, having unscrewed the screws which hold it to the body.
3. Unscrew the two screws (1) and the nut (2) securing the top hinge (3) to the body.



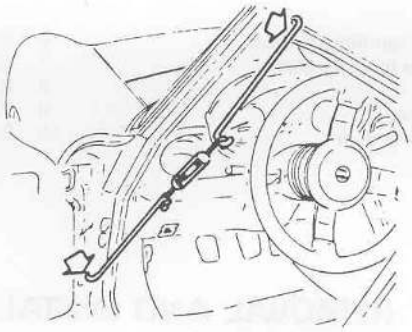
1 Screws
2 Nut
3 Hinge

4. Partially raise the top, lift the weather protection strip (1), unscrew the nuts (2), get hold of the brackets (3) and remove the top.



1 Protection weatherstrip
2 Nut
3 Bracket securing top

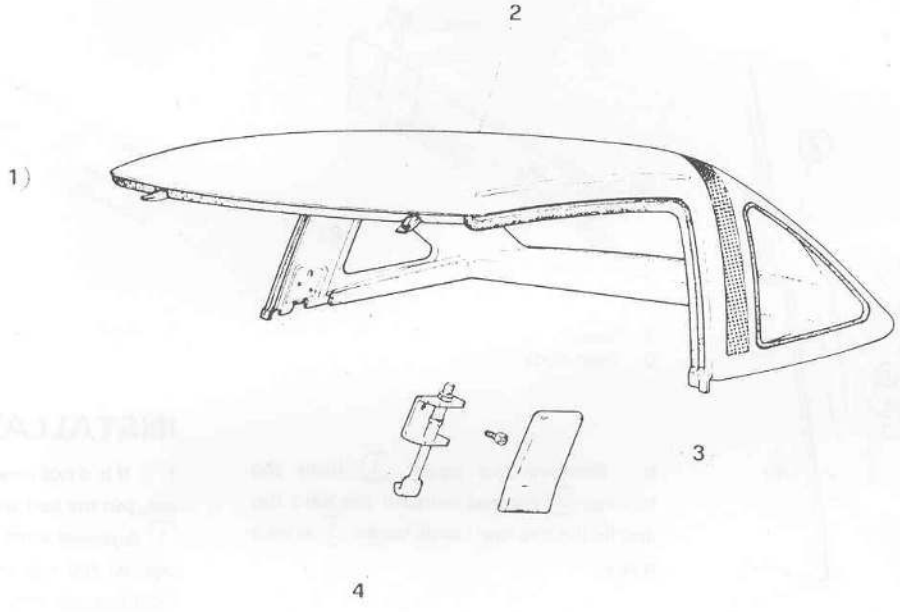
5. Assemble the top by operating in reverse order of removal.
6. Should closing turn out difficult, especially with a new top, use a turn buckle fixed by means of two crooks to the hole on the door pillar, and to the traverse of the top bracket.



7. Close the hook, checking that opening and closing do not cause indesiderable creases.

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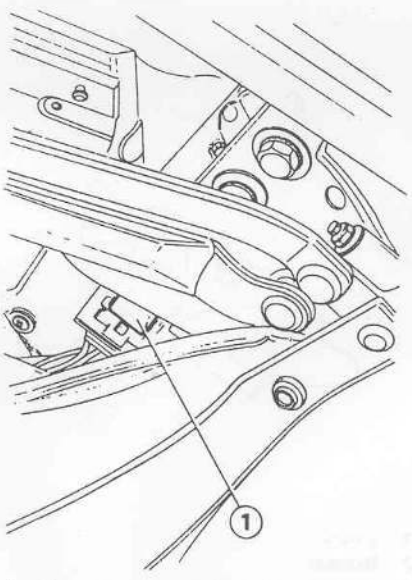
HARD TOP



1 Front hooks
2 Hard top
3 Guard
4 Clamp hook

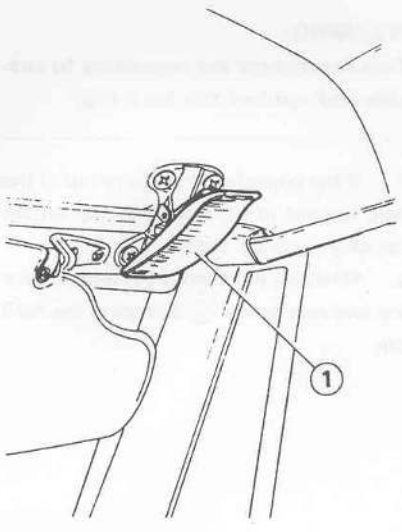
REMOVAL

1. Working from the passenger compartment, move the lefthand skirt panel trimming inwards. If necessary remove also the left side pillar panel (see Unit 66 - Pillar Panels - Removal and Installation). and uncouple the connector (1) for heated rear window and hard top light power supply.



1 Connector

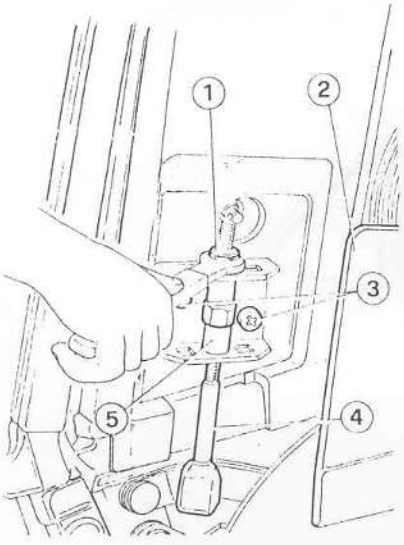
2. Open the front hooks (1).



1 Front hook

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3. Remove the guards (2).
Loosen the tie rods (4) by unscrewing the nut (1) and coupling (5). Unscrew the screws (3) and remove the clamp hooks.



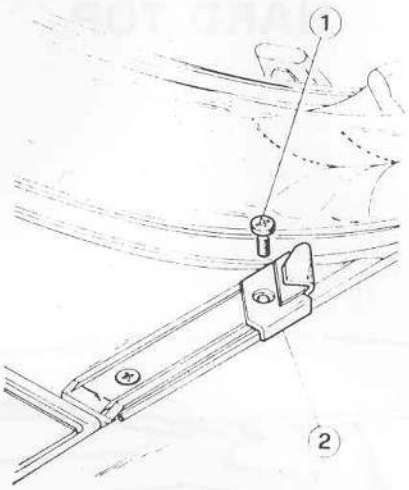
1 Nut
2 Guard
3 Screws
4 Tie rod
5 Coupling

4. Push the hard top towards the rear of the car, raising it slightly so as to disengage the rear clamp hooks.

WARNING:
Two mechanics are necessary to sustain and remove the hard top.

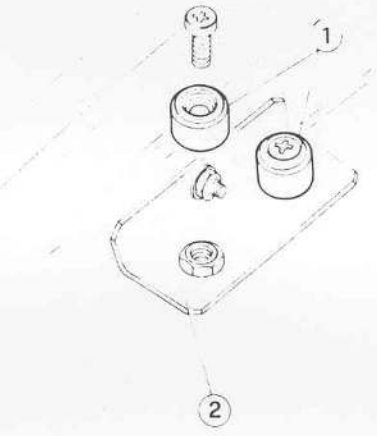
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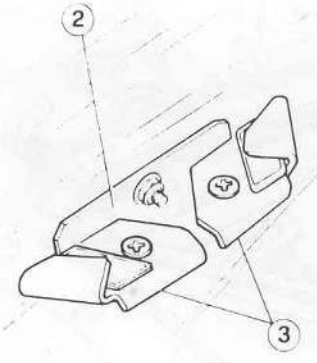
5. If the objective is not to re-install the hard top but to leave the soft top on the car only, operate thus.
a. Unscrew the screws (1) and remove the two rear hooks (2) clamping the hard top.



1 Screw
2 Rear hook

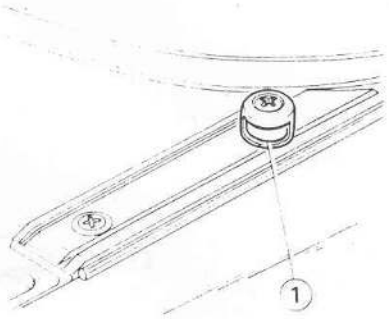
b. Remove the pawls (1) from the bracket (2) located beneath the hard top and fix the two rear clamp hooks (3) in their place.





1 Pawls
2 Bracket
3 Rear clamp hooks

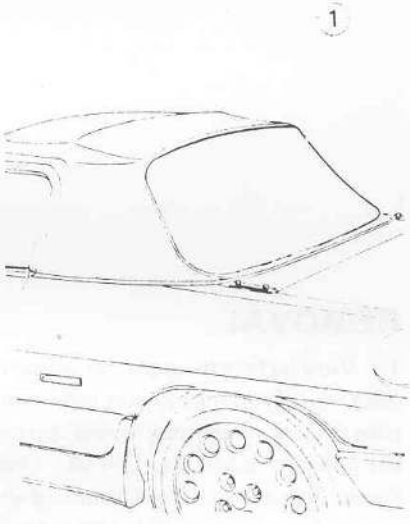
c. Secure the pawls (1) to the body, positioning them correctly.



1 Pawl

INSTALLATION

1. If it is not already closed, raise the soft top, put the soft side of the protecting cloth (1) supplied with the hard top into place against the rear window.
Fold the soft top, aiding the formation of the folds by hand when close to the rear window in order to prevent damage due to incorrect folding.



1 Protecting cloth

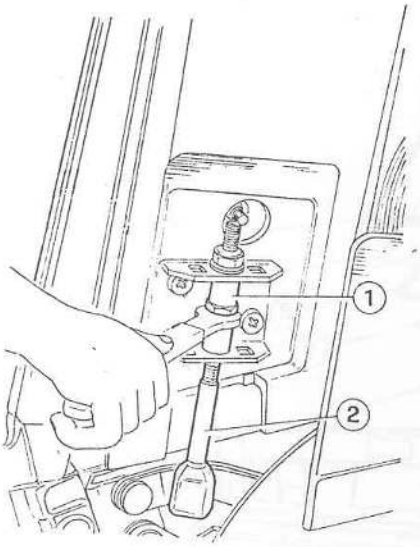
2. Re-install by operating in reverse order of removal and adhering to these instructions.

- Check that the rear hooks fit perfectly into their holes.

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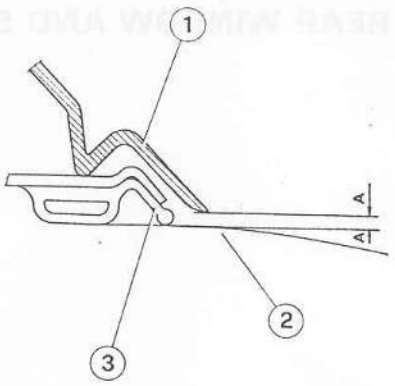
WARNING:
Two mechanics are required to sustain and install the hard top.

- Tension the tie rods (2) by working on the coupling (1).



1 Coupling
2 Tie rod

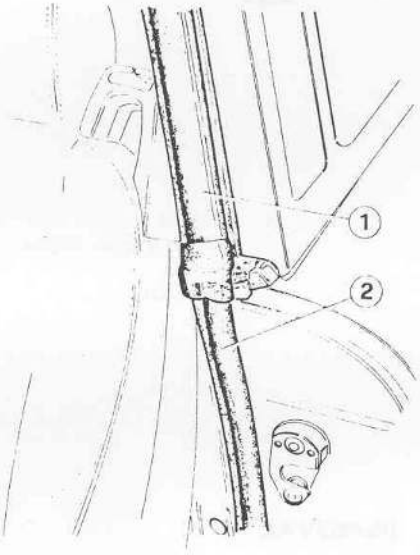
- Work on the coupling until a clearance equal to 8 mm, in the proximity of the clamp hooks, is obtained between the lower edge of the hard top (1) and the upper surface of the body (2).



1 Hard top lower edge
2 Body upper surface
3 Seal

Clearance A between lower edge of hard top and upper surface of body.
A = 8 mm (0,31 in)

- Having confirmed this condition, lock the upper nuts of the tie rods.
- Check that the lower edge of the hard top seal (1) completely covers the upper end of the door seal (2).



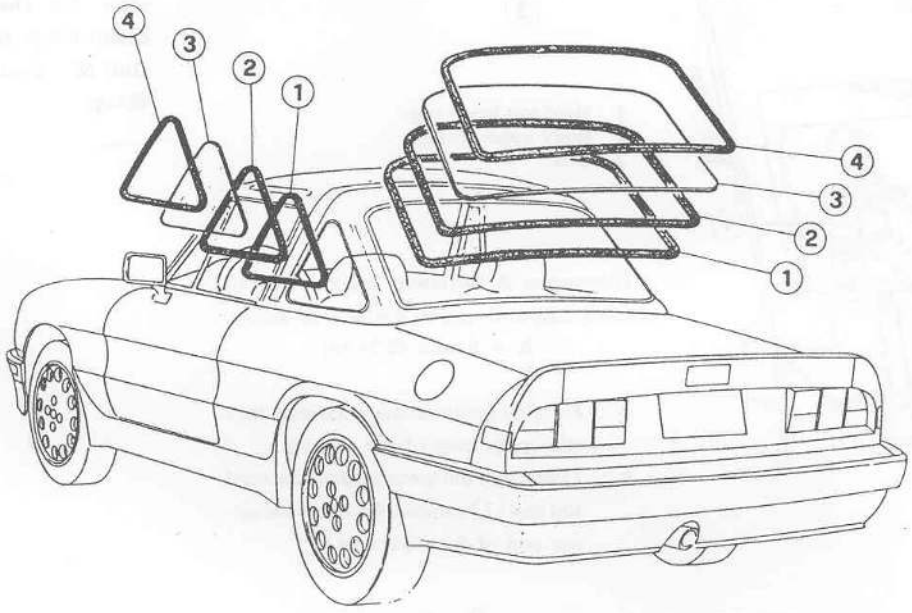
1 Hard top seal
2 Door seal

- Hook the front hooks of the hard top into place and **connect the connector supplying the heated rear window and hard top light.**

WARNING:
In the event of the purchase of a Hard Top subsequent to acquiring the vehicle, the latter should be submitted for a check on the window angle and limit stop for the power windows (if assembled), operating as indicated in Unit 55 - Doors - Windows and Vent Wing.

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REPLACEMENT OF HEATED REAR WINDOW AND SIDE WINDOWS



1 Adhesive
2 Section Rubber edging
3 Window
4 Outer seal

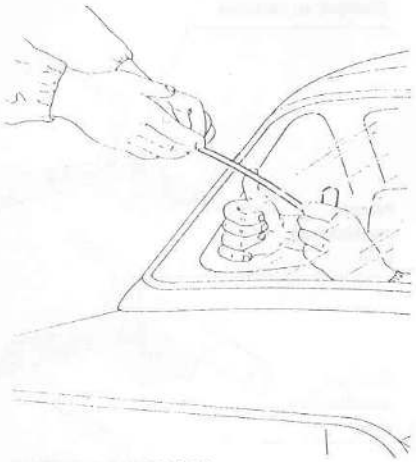
The heated rear window and side windows are of the same type and secured to the hard top in the same way; replacement procedure is therefore applicable to both parts.

REMOVAL

WARNING:
For easier replacement of the windows it is advisable to remove the hard top from the car by operating as instructed in Hard Top - Removal.

1. When working on the heated rear window, disconnect its leads.
2. Remove the internal trim to gain access to the internal coupling surfaces between the window and hard top.
3. Using a suitable tool, remove the outer seal (item (4) of the exploded view).
4. Drill through the sealant and insert a steel wire to correspond with an angular area of the window then lock the end of the wire in a handrip.
5. Cut the sealant along the perimeter of the window, operating as illustrated in the figure. Remove the window with care.

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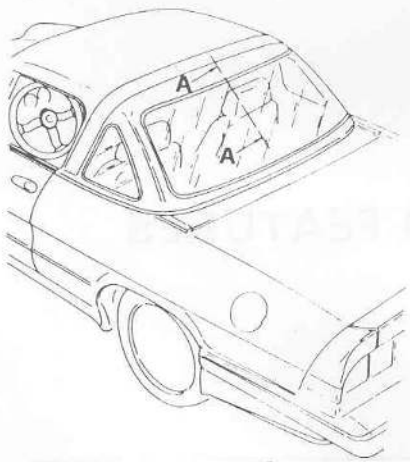


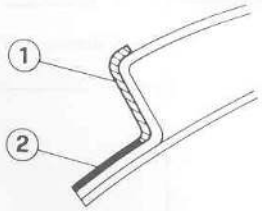
INSTALLATION

WARNING:

- Use the ALFA ROMEO glue kit to secure the window to the hard top.
- Open the kit immediately prior to use only.
- Follow the instructions on the kit box.

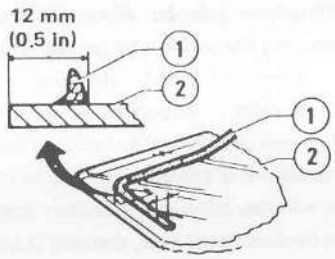
1. Plane the old glue thoroughly to smooth the surface on the base of the window cavity.
2. Carefully eliminate all traces of sealant residual from the previous operation with a dry cloth or a jet of air.
Use of alcohol absolutely prohibited.
3. Apply the adhesive section (1) along the upper edge of the window cavity as illustrated in the figure.

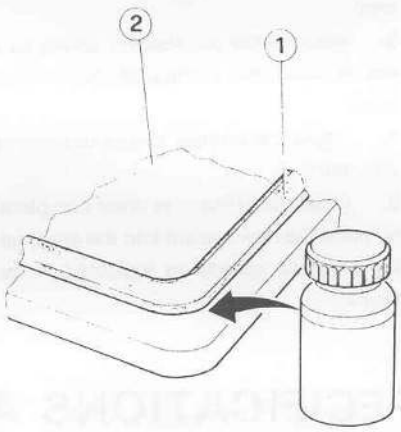




1 Adhesive section
2 Flattened sealant

4. Procedure for new windows.
a. Clean the window rim with the degreaser included in the sealing kit, taking care not to leave finger prints on the surface to be sealed.
b. Apply the edging (1) along the perimeter of the window at a distance of approximately 12 mm (0.5 in) from the edge.
c. Apply the window primer contained in the kit to the area of the window indicated in the figure.
5. Procedure for used windows.
a. Plane the sealant left on the window and eliminate the residue created.
b. Replace the edging with a new one, fitting it as illustrated in the following figure.
c. Apply the window primer to the areas where the window was exposed during the preceding sealant flattening only.

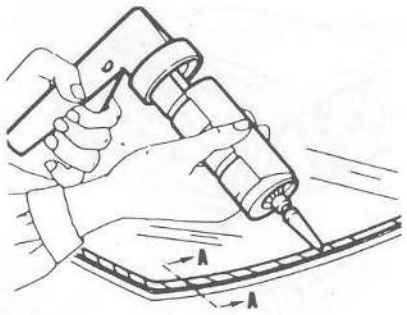




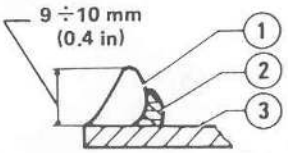
1 Rubber edging
2 Window

WARNING:
Allow the primer to dry prior to continuing.

6. Apply sealant (1) along the window edge as indicated in the figure.

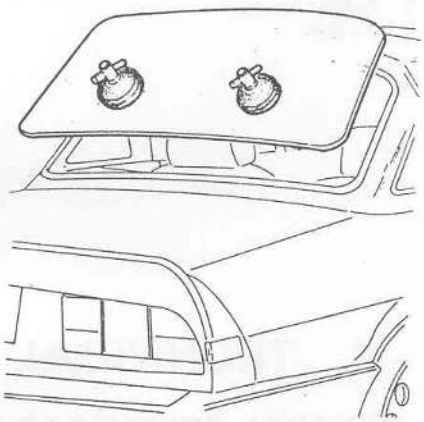


Section A-A



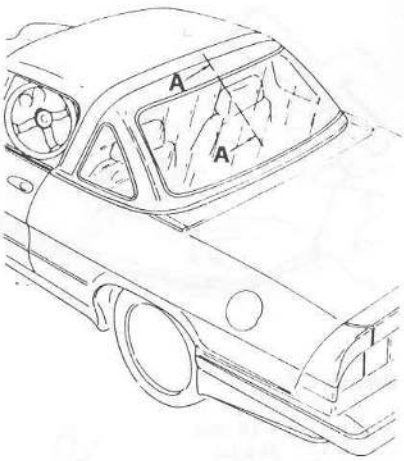
1 Silicon sealant
2 Rubber edging
3 Window

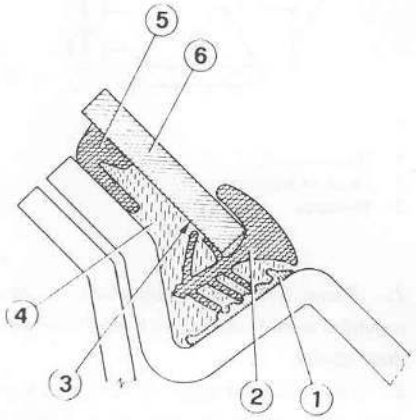
7. Place the three supporting spacers provided with the kit at the base of the window cavity.
8. Using suction cups, fit the window into its housing with caution, exerting slight, even pressure along the edge.



9. Fit a new weatherstrip in place before the sealant dries up.

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1 Adhesive section
2 Weatherstrip
3 Window primer
4 Sealant
5 Rubber edging
6 Window

10. Refrain from using the car, for at least 12 hours then carry out a waterproof test as follows:
- Prepare a car-wash shampoo using enough to form a foamy mixture.
- Using a paint brush, apply the foam along the external perimeter of the window.
- Blowing with compressed air from inside the hard top towards the window perimeter, check that no bubbles form.

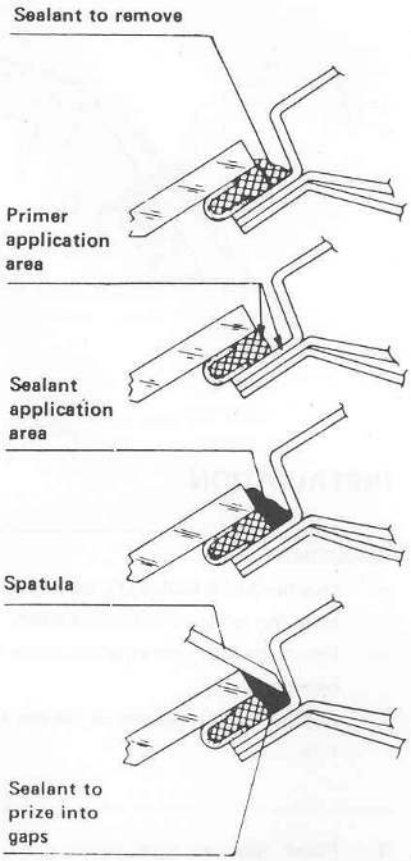
  Otherwise, proceed as instructed in "Infiltration Elimination".

11. Reassemble the trimming and strips taken off during removal operations.

INFILTRATION ELIMINATION

Infiltrations can be eliminated without removing the window by proceeding thus.

1. Remove the seal in the area affected.
2. In order to determine the extent of the infiltration (which may be between hard top and sealant or sealant and window), push the window outwards and pour water on the contaminated area, marking out its extent.
3. Remove the old sealant, taking care not to touch the surface of the window base.
4. Apply the window primer to the area affected.
5. Once the primer has dried completely, press the new sealant into the gaps, using a plastic spatula as indicated in the figure.



6. Complete installation and repeat the waterproof test described in "Installation", step 10, after 12 hours.

TECHNICAL SPECIFICATIONS AND FEATURES

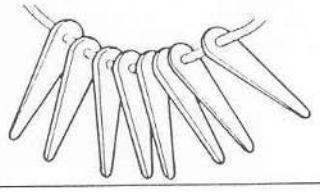
GENERAL SPECIFICATIONS

SEALANTS AND SURFACE FIXING AGENTS

Application	Denomination	Quantity
Body primer	Kit: ALFA ROMEO	–
Window primer		–
Sealant		–

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SPECIAL TOOLS

Identity No.	Description	Reference page
A.9.0051	Tools for windshield removal 	75-8

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UNIT 80

CONTENTS

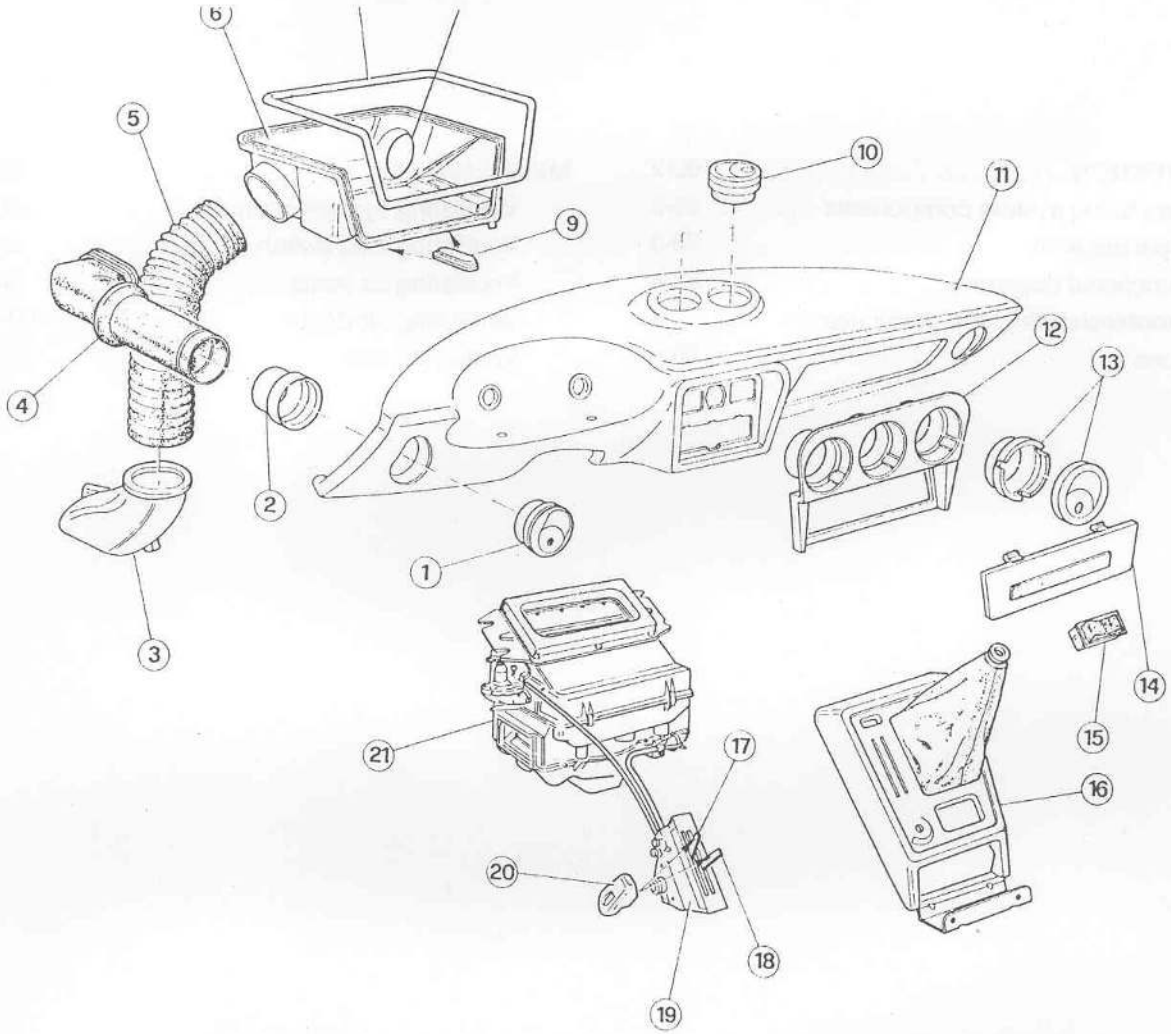
DESCRIPTION 80-2
Ventilating system components 80-2
Flow diagram 80-3
Functional diagrams 80-4
Troubleshooting and corrective actions 80-6

MAINTENANCE 80-8
Ventilating system controls 80-8
Ventilating fans switch 80-8
Ventilating air vents 80-9
Ventilating air ducts 80-10
Ventilating unit 80-11

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DESCRIPTION

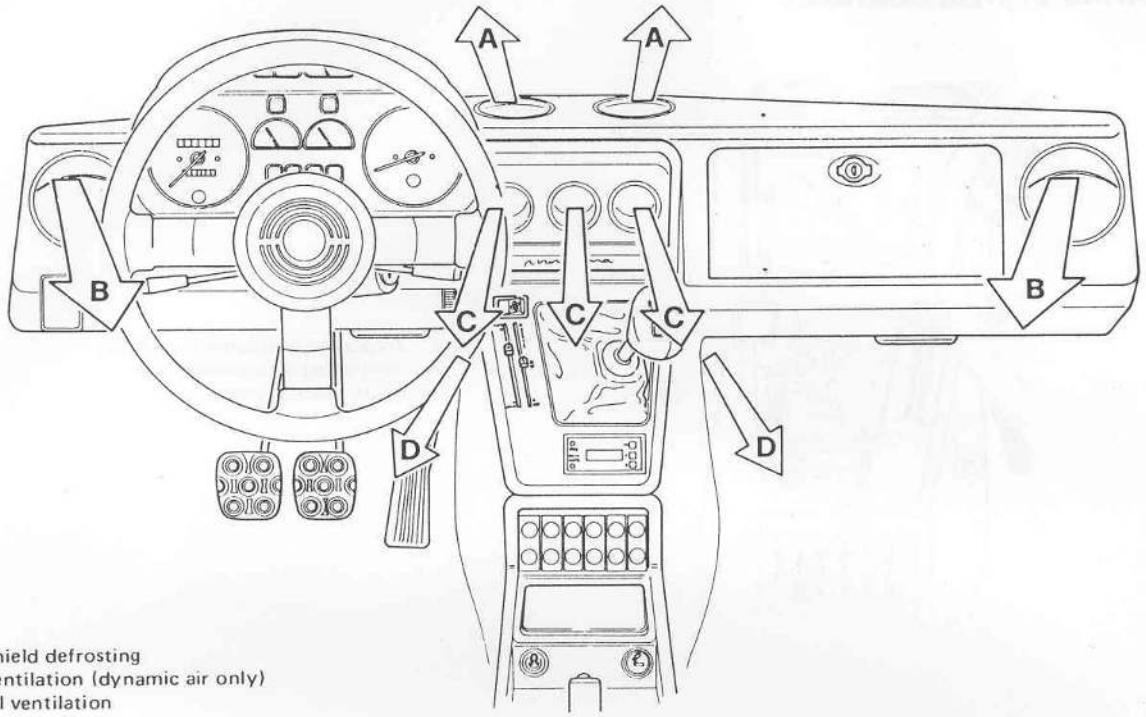
VENTILATING SYSTEM COMPONENTS



1 Side vent on instrument panel
2 Vent coupling
3 Air duct, windshield defrosting and central ventilation (at vents (10) and (13))
4 Dynamic air duct , side ventilating (at vents (1))
5 Coupler joming duct (3) to conveyor box (6)
6 Conveyor box
7 Seal
8 Ducthole
9 Plug
11 Instrument panel
12 Central facing on instrument panel
13 Central vent on instrument panel
14 Radio compartment cover
15 Ventilating fan switch
16 Front console
17 Heater control lever
18 Ventilating air separator lever
19 Heater control assy
20 Knob
21 Ventilating unit

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FLOW DIAGRAM

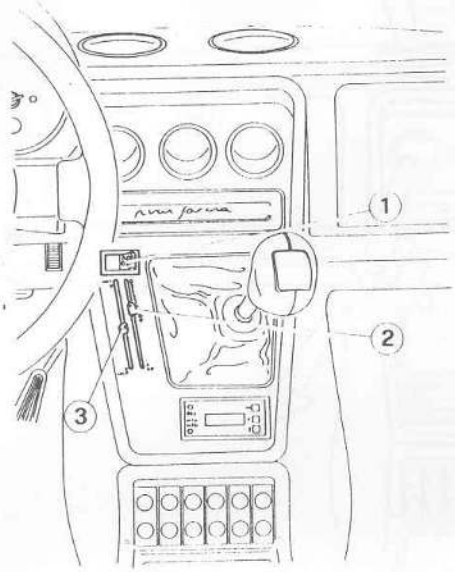


A Windshield defrosting
B Side ventilation (dynamic air only)
C Central ventilation
D Floor

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FUNCTIONAL DIAGRAMS

VENTILATING SYSTEM CONTROLS

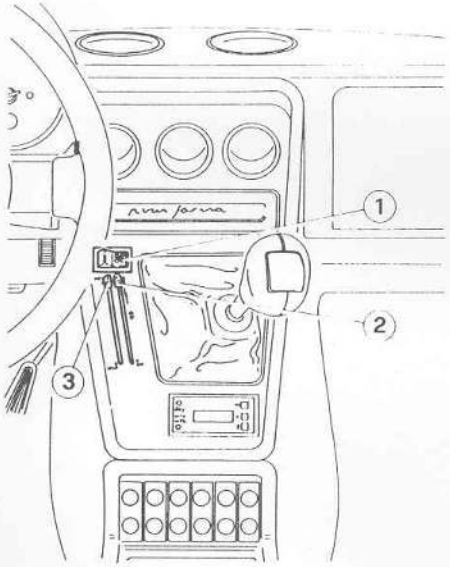


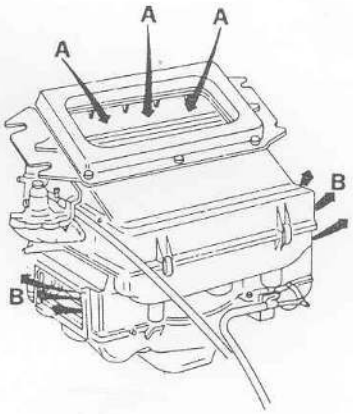
1 Two-speed ventilating fan switch
2 Ventilating air separator lever
3 Heater control lever

1. Defrosting

WARNING:
To obtain maximum flow from defrosting vents, close the side and central vents on the instrument panel.

Position of controls for rapid effective defrosting.





– Ventilating fan switch (1) to 2nd speed
– Ventilating air separator lever (2) to DEFROST
– Heater control lever (3) to HOT

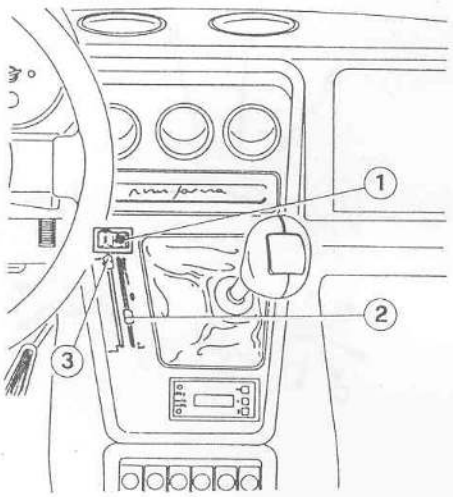
A Dynamic air
B Air to defrost vents and central vents on instrument panel

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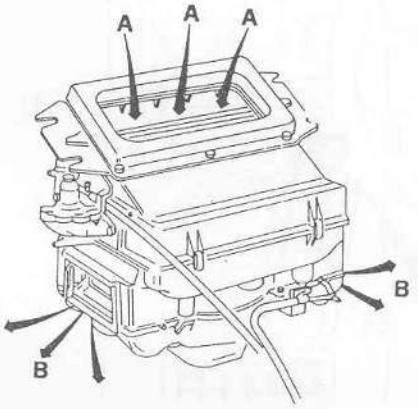
2. Floor

WARNING:
To obtain maximum flow of hot air to floor close the side vents on the instrument panel.

Position of controls for maximum hot air flow to floor.



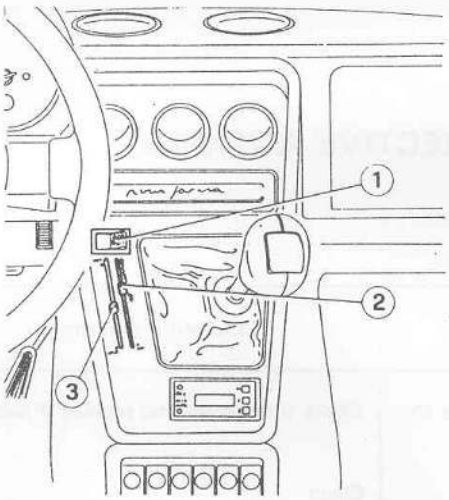
- Ventilating fan switch (1) to 2nd speed
- Ventilating air separator lever (2) between ○ and △▽
  Heater control lever (3) to HOT



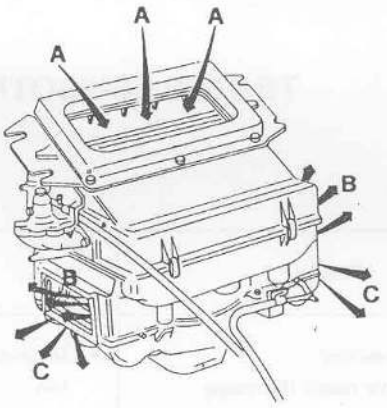
A Dynamic air
B Air to floor

3. Heating

WARNING:
For effective heating of the passenger compartment close the side vents on the instrument panel.



- Move the ventilating air separator lever (2) from the bottom upwards until achieving a satisfactory combined flow from the central vents on the instrument panel, the defrosting ones and those for the floor
- Move the heater control lever (3) from the bottom upwards until desired temperature is attained
- To increase the flow of hot air, activate the ventilating fan switch (1)

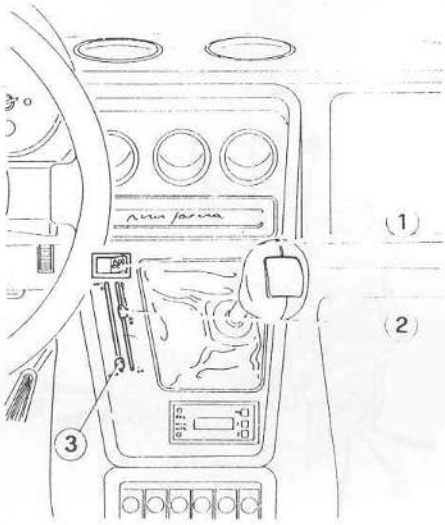


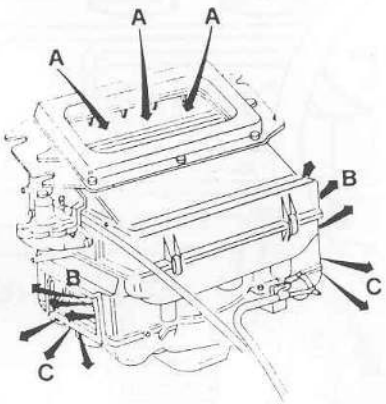
A Dynamic air
B Hot air to defrost vents and central vents on instrument panel
C Hot air to floor

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4. Ventilation

WARNING:
To achieve best possible ventilation open all the ventilating vents on the instrument panel.





- Move the ventilating air separator lever (2) from the bottom upwards until achieving a satisfactory combined flow from the central vents on the instrument panel, the defrost ones and those for the floor
- Put the heater control lever (3) to COLD
- To ventilate when running at low speeds switch on the ventilating fan (1)

A Dynamic air
B Air to defrost vents and central vents on instrument panel
C Air to floor

TROUBLESHOOTING AND CORRECTIVE ACTIONS

Trouble	Probable cause	Corrective action
Insufficient heating. Hot air fails to reach the vents	• Engine cooling fluid temperature too low	Check thermostat and replace if necessary
	• Heater clogged	Clean
	• Cooling fluid level too low	Top up
	• Incorrect operation of the heater tap	Adjust control rod. Check the tap. Replace if necessary

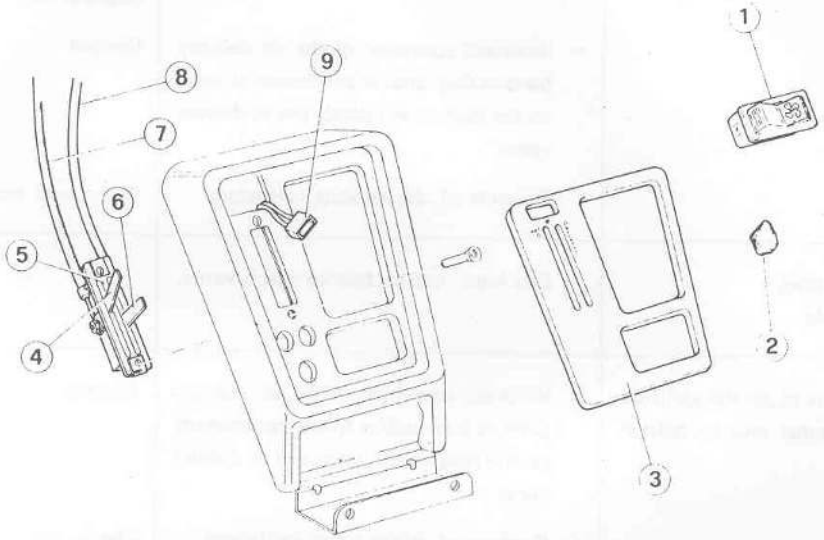
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Trouble	Probable cause	Corrective action
Insufficient air flow to floor	• Electric fan speed too slow	Check fan operation. Repair broken or suspect connections. Replace fan.
	• Incorrect operation of the air delivery ports to floor and/or to the central vents on the instrument panel and to defrost vents	Correct
	• Controls of above ports inefficient	Check and replace if necessary
Insufficient defrosting. Air at vents is cold	• See item: hot air fails to reach vents.	
Insufficient air flow to central vents on the instrument panel and to defrost vents	• Incorrect operation of the air delivery ports to floor and/or to the central vents on the instrument panel and to defrost vents	Correct
	• Controls of above ports inefficient	Check and replace if necessary
	• Leaks at duct-vent couplings	Repair or replace
The air fails to exit from outlets	• Ducts damaged or badly connected	Check and replace if necessary
Controls are jammed	• Control wire bent to excess	Correct
	• Incorrect operation of ports, levers, etc.	Check and correct
The air does not exit the side vents on the instrument panel correctly	• Air ducts for side vents on instrument panel are blocked up, excessively bent or badly connected to the associated vents	Correct
	• Air ducts for side vents on instrument panel are damaged	Replace
Noisy electric fan	• Ventilating unit cowling not perfectly secure	Check and if necessary correct
	• Electric blower rough joints	Check and reset electric blower correct position

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MAINTENANCE

VENTILATING SYSTEM CONTROLS

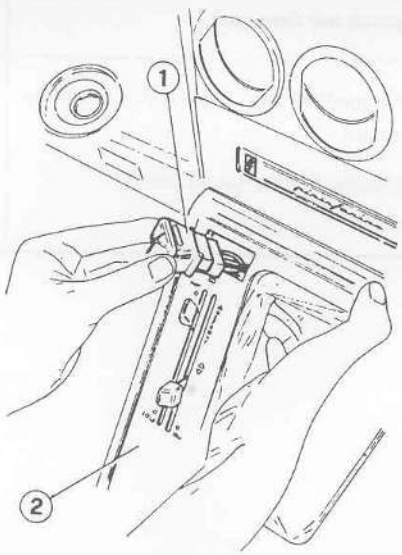


1 Ventilating fan switch
2 Knob
3 Front console facing
4 Heater control lever
5 Heater control assy
6 Ventilating air separator lever
7 Control cable for heater and port conveying dynamic air to heater
8 Control cable for air delivery port to floor and/or to central vents on the instrument panel and to the defrost vents
9 Electrical connection

VENTILATING FAN SWITCH

REPLACEMENT

1. Working as illustrated in the following figure, extract the switch (1) from its housing located on the front console (2).



1 Ventilating fan switch
2 Front console

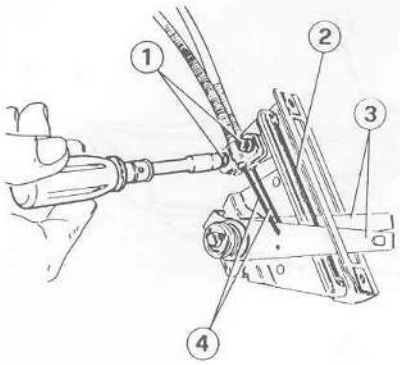
2. Disconnect the switch from the electrical connection and replace.

HEATER CONTROL ASSY

REPLACEMENT

1. Remove the rear console (see: Unit 66 - Internal Trimming - Rear Console - Removal).
2. Remove the front console (see: Unit 66 - Internal Trimming - Front Console - Removal).
3. Unscrew the bolts (1), disconnect the wires (4) from the control levers (3) and remove the heater control assy (2).

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1 Bolts
2 Heater control assy
3 Control levers
4 Wires

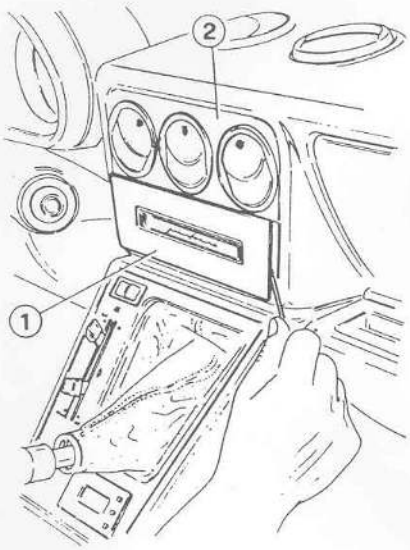
4. Re-install by operating in reverse order of removal.

VENTILATING AIR VENTS

CENTRAL VENTS ON INSTRUMENT PANEL

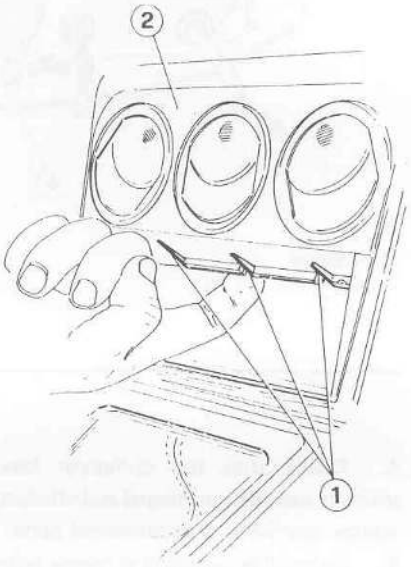
Removal and installation

1. Using a suitable tool, prise the radio compartment cover (1) off the central facing (2) on the instrument panel.



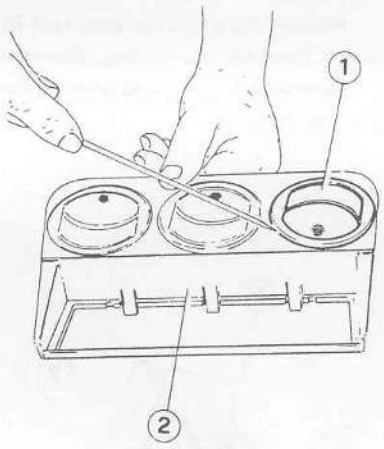
1 Radio compartment cover
2 Central facing on instrument panel

2. Work on the three tabs (1) and remove the central facing (2) from the instrument panel.



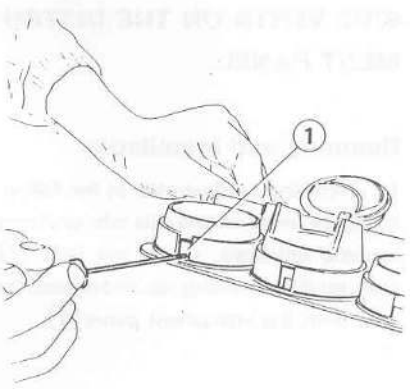
1 Tabs
2 Central facing on instrument panel

3. Working as illustrated in the following figure, remove vent (1) from the central facing (2).



1 Vent
2 Central facing on instrument panel

4. Using a suitable tool, work on the three tabs (1) and remove the housing of the vent previously removed from the central facing in step 3..



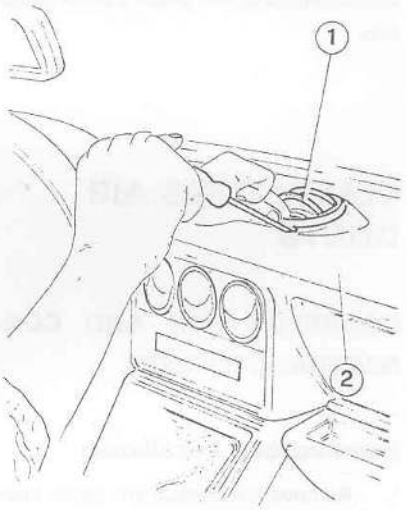
1 Tab

5. Re-install the vent first in its housing then on the central facing, inserting it in the cavity provided.
Check correct operation.
6. Snap-install the central facing on the instrument panel.

DEFROST VENTS

Removal and installation

1. Using a suitable tool, unlock one of the tabs; rotate the vent (1), work on the remaining tabs and extract the vent from the instrument panel (2).



1 Defrost vent
2 Instrument panel

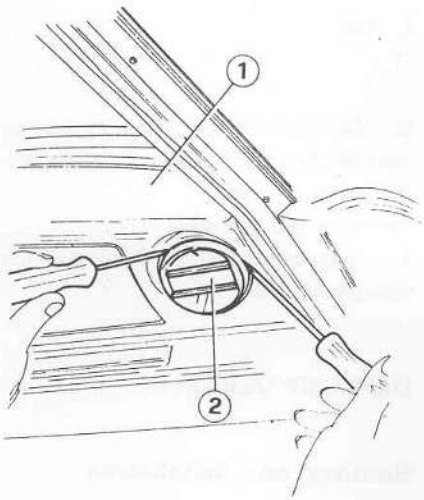
2. Re-install the vent in its cavity on the instrument panel and check correct operation.

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SIDE VENTS ON THE INSTRUMENT PANEL

Removal and Installation

1. Working as illustrated in the following figure, work on two side tabs until they become unlocked, rotate the vent (2), work on the remaining tab and extract the vent from the instrument panel (1).



1 Instrument panel
2 Side vent on instrument panel

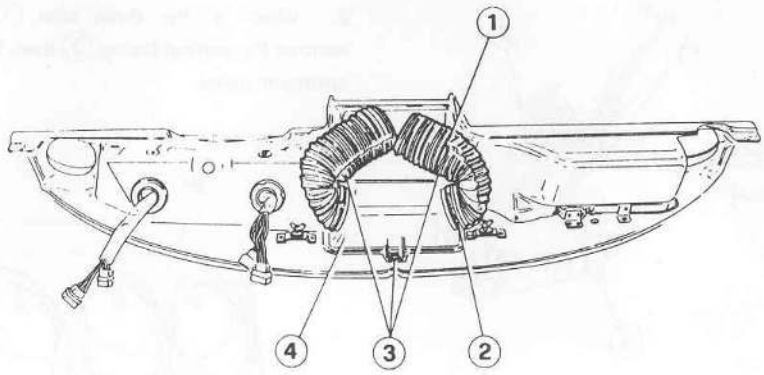
2. Re-install the vent in its cavity on the instrument panel and check correct operation.

VENTILATING AIR DUCTS

CONVEYOR BOX AND CONNECTING COUPLERS

Removal and installation

1. Remove the instrument panel (see: Unit 66 - Internal Trimming - Instrument Panel - Removal).
2. Take off the clips (2) and remove the couplers (1) from the conveyor box (4).
3. Unscrew the three nuts (3), remove the conveyor box from the instrument panel and get hold of the sealing gasket.



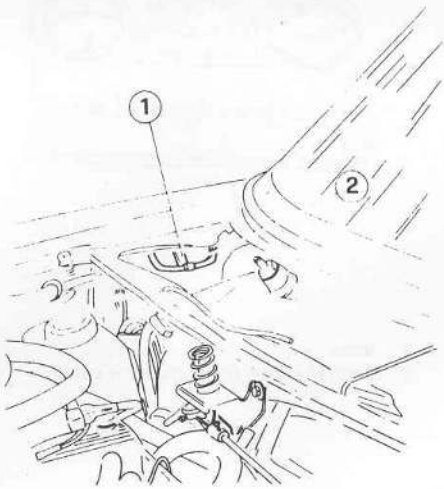
1 Coupler
2 Clip
3 Nuts
4 Conveyor box

4. Check that the conveyor box, couplers and seal are integral and efficient; replace any worn or deteriorated parts.
5. Re-install by operating in reverse order of removal.

DYNAMIC AIR DUCTS FOR SIDE VENTILATION

Removal and installation

1. Remove the air grating (see: Unit 75 - External Trimming - Air Grating - Removal).
2. Remove the clip (1) and push the duct (2) inside the car.



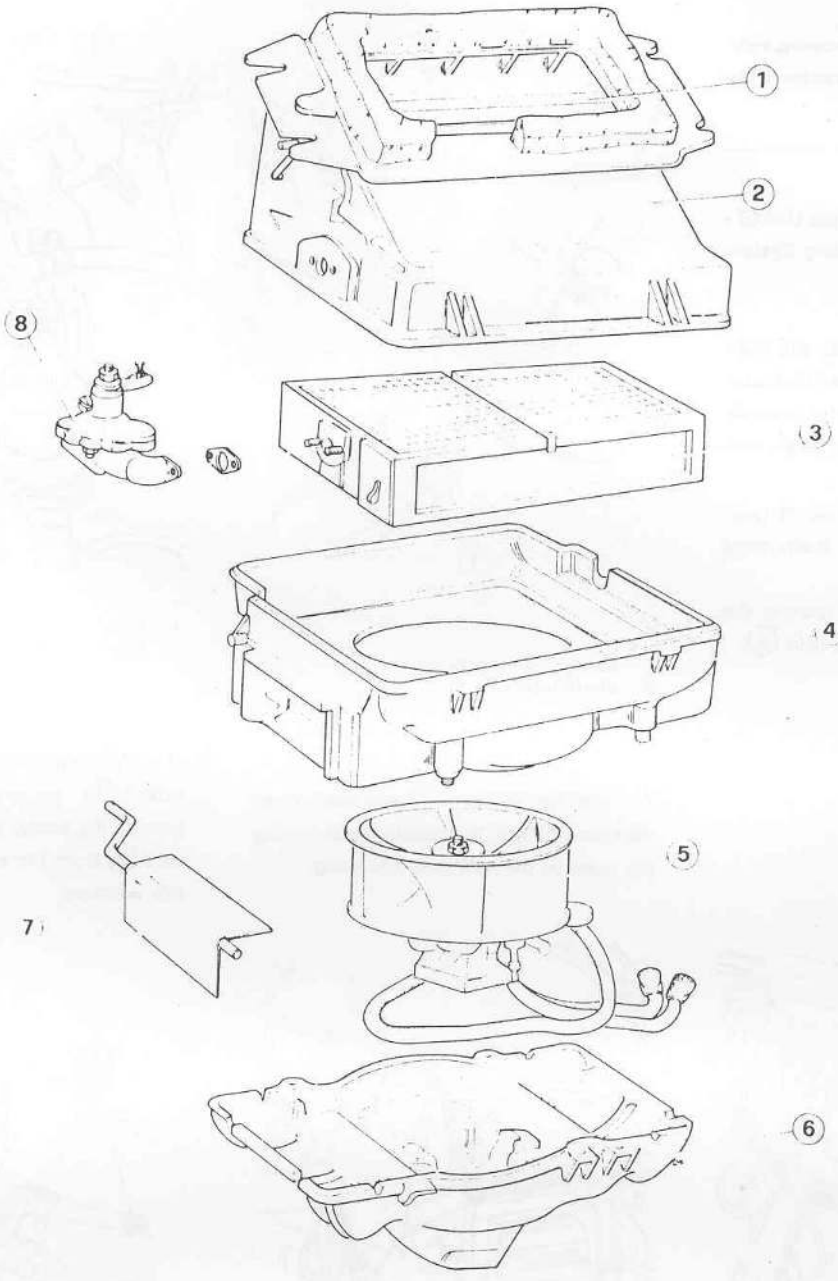
1 Clip
2 Dynamic air duct for side ventilation

3. Working inside the car, disconnect the duct together with coupling from the associated vent; subsequently extract the duct itself from beneath the instrument panel.
4. Inspect the duct visually, replacing it if cut or damaged.
5. Re-install in reverse order of removal, following these instructions.

- Secure the duct with the clip.
- Connect the duct, complete with coupling, to the associated vent.
- Reassemble the air grating.

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VENTILATING UNIT



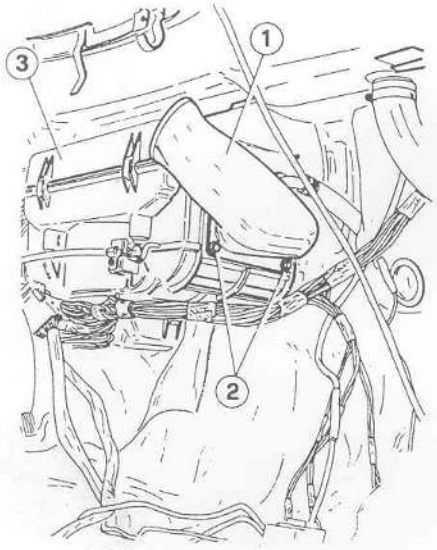
1 Port conveying dynamic air to the heater
2 Upper cowling, ventilating unit
3 Heater
4 Ventilating unit cowling, central part
5 Electric fan
6 Lower cowling, ventilating unit
7 Air delivery port to floor and/or central vents on the instrument panel and to the defrost vents
8 Heater tap

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REMOVAL

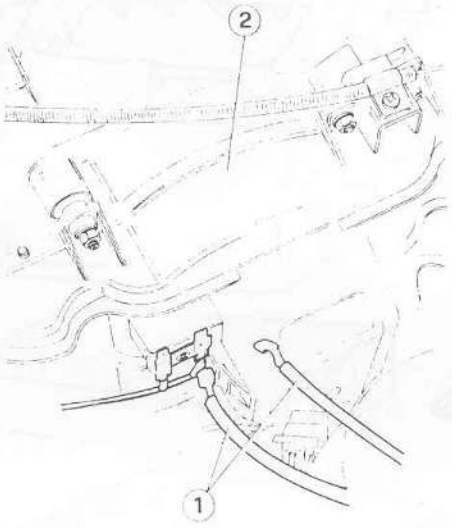
WARNING:
Take special care when removing ventilation unit hoses as the heater may leak fluid.

1. Drain the cooling fluid as per Unit 07 - Engine Cooling System - Cooling System Drainage.
2. Disconnect the battery.
3. Remove the rear console, the right and left hand knee padding, the front console and the side walls of the console beneath the instrument panel (see: Unit 66 - Internal Trimming).
4. Remove the instrument panel (see: Unit 66 - Internal Trimming - Instrument Panel - Removal).
5. Unscrew screws (2) and remove the ducts (1) from the ventilating unit (3).



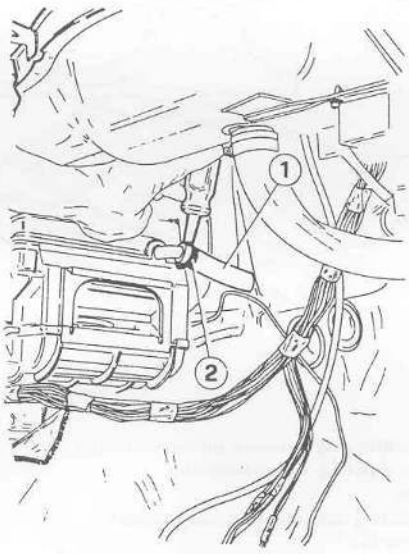
1 Ventilating air duct
2 Screws
3 Ventilating unit

6. Disconnect the electric wires (1) from the ventilating unit (2).



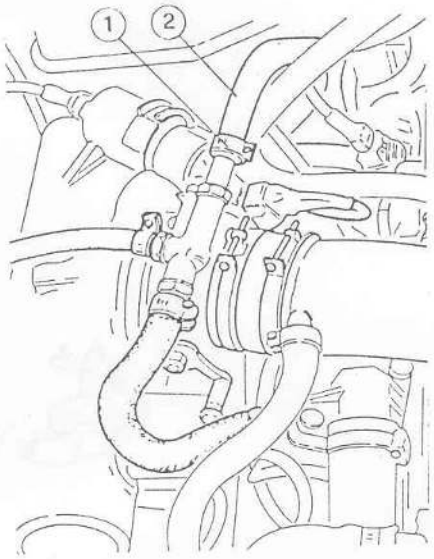
1 Electric fan supply wires
2 Ventilating unit

7. Slacken the clip (2) and disconnect the hose (1) from the ventilating unit; plug the hose to prevent fluid escaping.



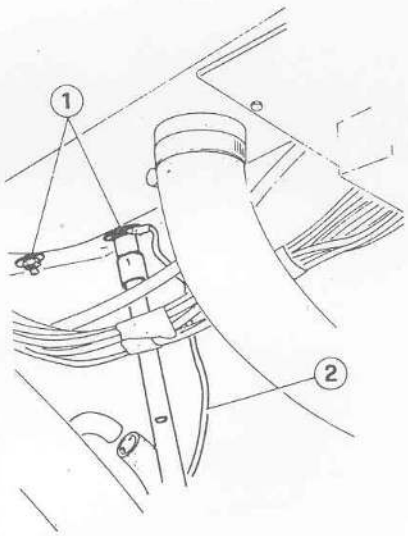
1 Heater fluid outlet hose
2 Clip

8. Working in the engine compartment, slacken the clip (1) and disconnect the heater fluid supply hose (2).



1 Clip
2 Heater fluid supply hose

9. Working inside the car again, unscrew nuts (1) securing the ventilating unit to the body, disconnect the ground wire (2) from the electric fan and retrieve the washers.



1 Nuts securing the ventilating unit to the body-work
2 Electric fan ground wire

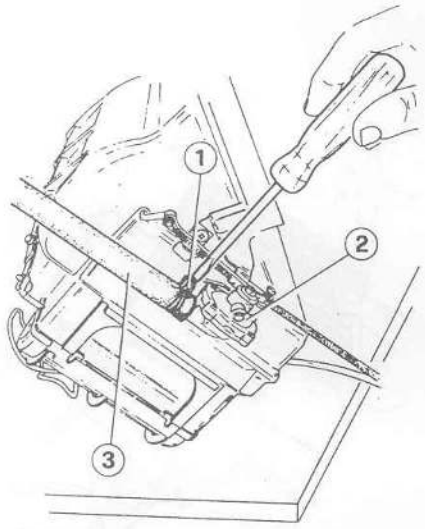
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10. Exercising great care, remove the ventilating unit by moving it downwards and pulling the heater fluid supply hose out from the engine compartment through the hole provided for this purpose.

WARNING:
During this operation take great care to avoid spilling the fluid left in the heater on the car seats and upholstery; it is advisable to cover them with cloths.

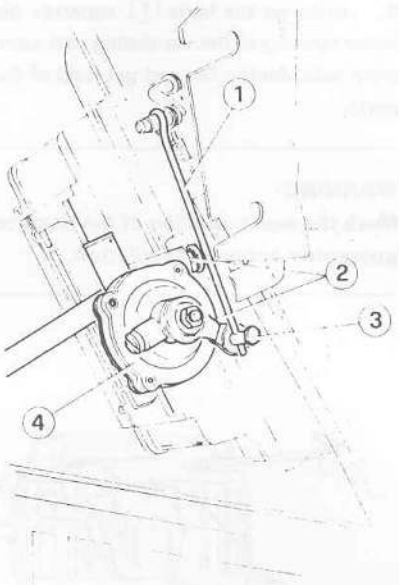
DISASSEMBLY

1. Loosen the clip (1) and detach the heater fluid supply hose (3) from the tap (2).



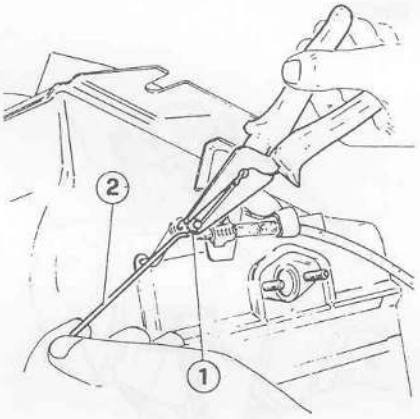
1 Clip
2 Heater tap
3 Heater fluid supply hose

2. Unscrew the nuts (2) securing the tap (4) to the ventilating unit; uncouple the control rod (1) by working on screw (3) then remove the tap and retrieve the washers.



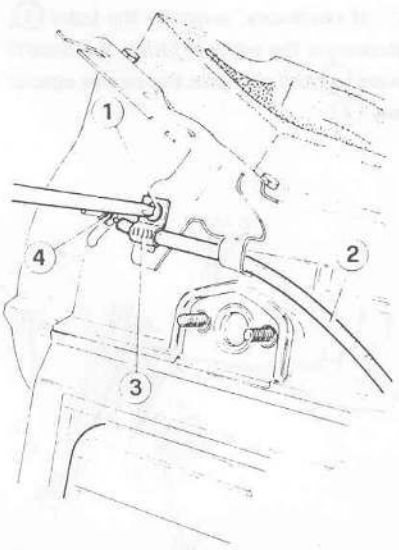
1 Tap control rod
2 Nuts securing the tap to the ventilating unit
3 Screw
4 Heater tap

3. Using a suitable tool, first remove the clip (1) then the tap control rod (2).



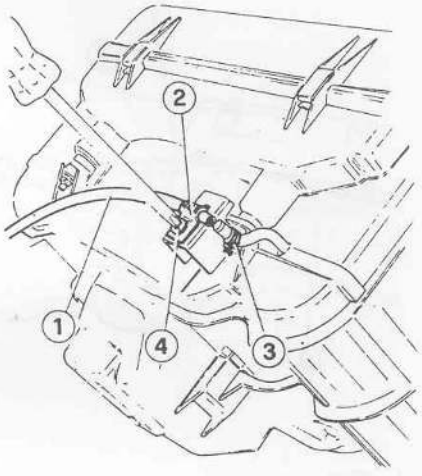
1 Clip
2 Tap control rod

4. Remove the clip (4), unscrew the screw (1) and disconnect the control cable (2) from the heater air delivery port; retrieve the cable bracket (3).



1 Screw
2 Control cable for heater tap and heater dynamic air delivery port
3 Cable bracket
4 Clip

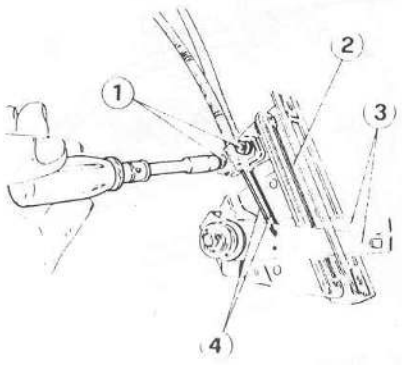
5. Remove the clip (3), unscrew the screw (4) and disconnect the control cable (1), retrieving the cable bracket (2).



1 Control cable for ports delivering air to floor and/or central vents on the instrument panel and to defrost vents
2 Cable bracket
3 Clip
4 Screw

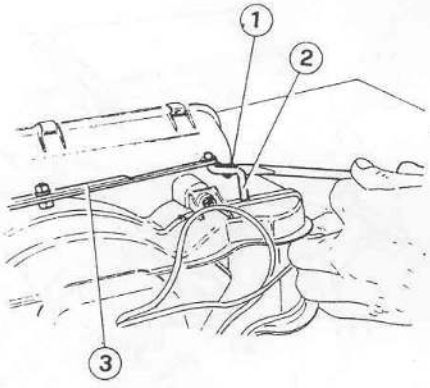
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6. If necessary, unscrew the bolts (1), disconnect the wires (4) from the control levers (3) and separate the heater control assy (2).



1 Bolts
2 Heater control assy
3 Control levers
4 Wires

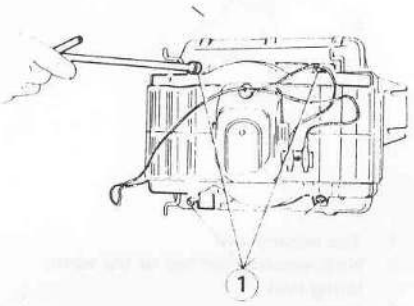
7. Using a suitable tool unhook the clips (1) from the cranks (2) and remove the rod (3).



1 Clip
2 Crank controlling air delivery port to floor and/or central vents on the instrument panel and to defrost vents
3 Simultaneous control rod, ports

8. Unscrew the bolts (1), separate the lower cowling of the ventilating unit complete with electric fan and get hold of the ports.

WARNING:
Mark the exact position of the ports to guarantee correct installation.



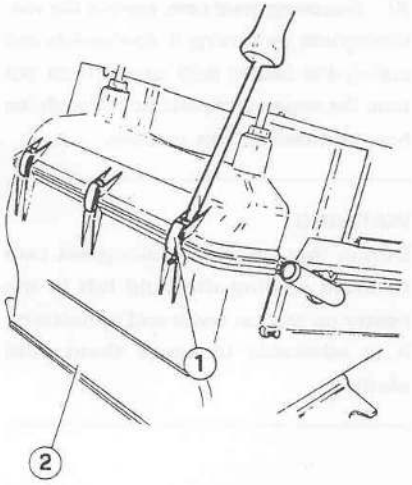
1 Bolts

9. Using a suitable tool, work on the rubber blocks (1) then separate the electric fan from the lower part of the ventilating unit cowling.



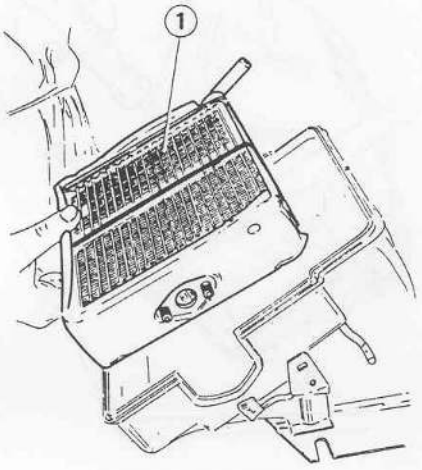
1 Rubber blocks

10. Using a suitable tool, work on the five tabs (1) and separate the upper part (2) of the ventilating unit cowling.



1 Tab
2 Ventilating unit cowling, upper part

11. Remove the heater (1) from its cavity.



1 Heater

REASSEMBLY

Reassemble in reverse order of disassembly, bearing the following in mind.

- Visually inspect all parts, replacing them if worn or deteriorated.
- Thoroughly clean the heater with a jet of compressed air.
- Having assembled the electric fan on the lower part of the ventilating unit cowling, check that the fan rotates silently.

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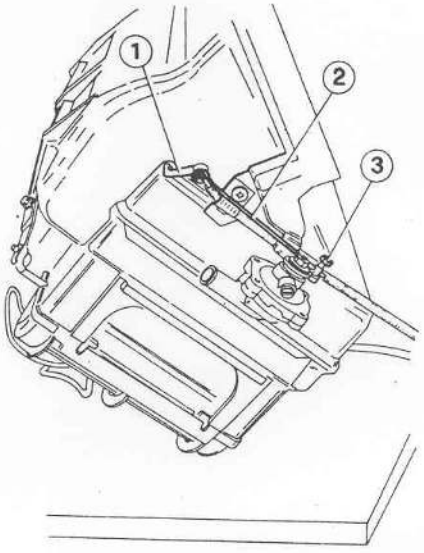
- Reassemble the lower part of the cowling before the upper part, checking the exact position of the ports.

- **Control cables reassembly.**

— Connect the cable to its corresponding port.
— Put the clip in place.
— Secure the sheath with the bracket provided for this purpose so that the sheath does not interface with normal operation of the ports.
— Connect the other end of the cable to the associated control lever.
— Reassemble the remaining control cable.
— Secure the sheath to the heater control assy.
— Check correct operation.

- **Reassembly of the heater tap and control rod adjustment.**

— Fix the tap on the ventilating unit.
— Connect the control rod (2) to the port conveying dynamic air to the heater.
— Insert the control rod in screw (3) but refrain from tightening the latter.
— Place the crank (1) as illustrated in the figure and the tap in the closed position.
— Tighten the screw (3).
— Check correct operation.



1 Control crank for port conveying dynamic air to the heater
2 Tap control rod
3 Screw

INSTALLATION

Install by operating in reverse order of removal.

WARNING:
Prior to filling the radiator with the coolant specified, put the heater control lever in the HOT (open) position.

CLEANING THE HEATER

When the heater or tap is clogged, clean as instructed hereafter without removing the ventilating unit.

- Drain the coolant.
- Disconnect the heater fluid supply hose from the throttle and the return hose from the water pump.
- Open the heater tap by setting the associated control lever to hot.
- Lengthen the heater return and delivery hoses accordingly.
- Connect the heater return hose to a water tap in the workshop.
- Fill the hose with water, making sure that it is drained off via the delivery tube outside the car.
- On concluding the operation, renew the connections and fill with coolant.

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Alfa Romeo

ASSISTENZA TECNICA

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