

# GENERAL INFORMATION

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## HOW TO USE THIS MANUAL

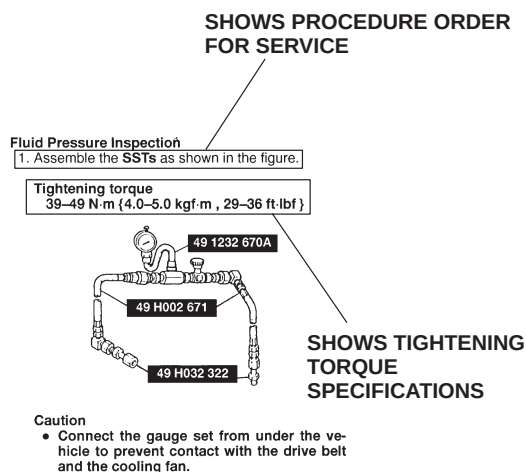
### RANGE OF TOPICS

- This manual contains the procedures for performing all of the required service operations. The procedures are divided into the following five basic operations.
  - (1) Removal/Installation
  - (2) Disassembly/Assembly
  - (3) Replacement
  - (4) Inspection
  - (5) Adjustment
- Simple operations which can be performed easily just by looking at the vehicle, such as removal/installation of parts, jacking, vehicle lift, cleaning of parts, and visual inspection, have been omitted.

## SERVICING PROCEDURE

### Inspection, Adjustment

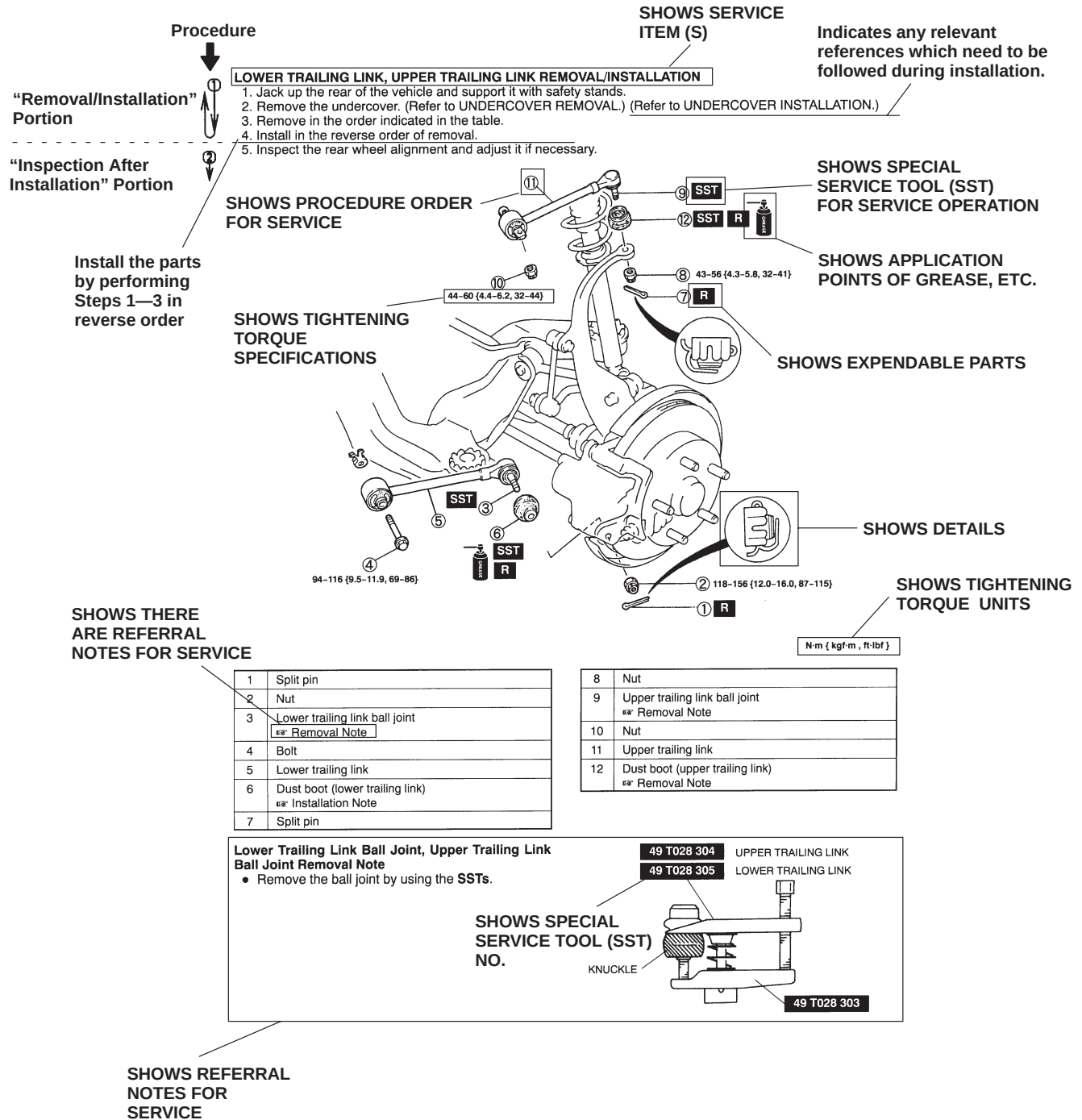
- The procedures for inspections and adjustments are divided into steps. Important points in regard to the location and contents of the procedures are explained in detail and are shown in the illustrations.



# HOW TO USE THIS MANUAL

## Repair procedure

1. Most repair operations begin with an overview illustration. It identifies the components, shows how the parts fit together, and describes visual part inspection. However, only the removal/installation procedures which need to be performed methodically have written instructions.
2. Expendable parts, tightening torques, and symbols for oil, grease, and sealant are shown in the overview illustration. In addition, symbols indicating parts which require the use of special service tools for removal/installation are also shown.
3. The procedures are numbered and the part that is the main point of that procedure is shown in the illustration with the corresponding number. Occasionally, there are important points or information concerning a procedure. Refer to this information when servicing the related part.



# HOW TO USE THIS MANUAL

## SYMBOLS

- There are eight symbols indicating oil, grease, sealant, and the use of **SSTs**. These symbols show the points of applying or using such materials during service.

|                                                                                     |                                              |                                                        |
|-------------------------------------------------------------------------------------|----------------------------------------------|--------------------------------------------------------|
|    | Apply oil                                    | Appropriate new engine oil or gear oil                 |
|    | Apply brake fluid                            | Appropriate new brake fluid                            |
|    | Apply automatic transaxle/transmission fluid | Appropriate new automatic transaxle/transmission fluid |
|    | Apply grease                                 | Appropriate grease                                     |
|    | Apply sealant                                | Appropriate sealant                                    |
|    | Apply petroleum jelly                        | Appropriate petroleum jelly                            |
|  | Replace part                                 | O-ring, gasket, etc.                                   |
|  | Use SST                                      | Appropriate SST                                        |

## ADVISORY MESSAGES

You'll find several **Warnings**, **Cautions**, **Notes**, **Specifications** and **Upper and lower limits** in this manual.

### Warning

- A **Warning** indicates a situation in which serious injury or death could result if the warning is ignored.

### Caution

- A **Caution** indicates a situation in which damage to the vehicle could result if the caution is ignored.

### Note

- A **Note** provides added information that will help you to complete a particular procedure.

## Specification

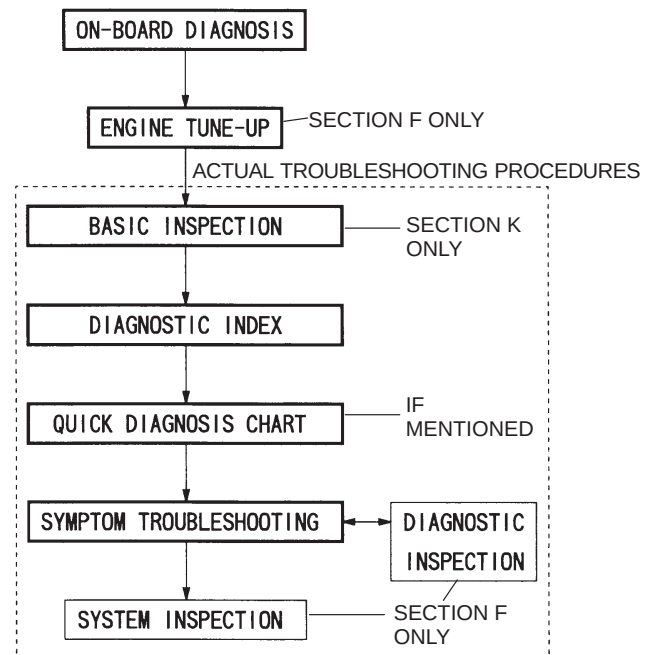
- The values indicate the allowable range when performing inspections or adjustments.

## Upper and lower limits

- The values indicate the upper and lower limits that must not be exceeded when performing inspections or adjustments.

## TROUBLESHOOTING PROCEDURE

### Basic Flow of Troubleshooting



### On-board diagnosis

- The service codes are important hints for repairing malfunctions that are difficult to simulate. By following the service code, perform the inspection to quickly and accurately diagnose the malfunction.
- The self-diagnostic function is used during inspection. When a service code is shown, specifying the cause of a malfunction, continue the inspection according to the items indicated by the self-diagnostic function.

### Engine tune-up (Section F)

- Any necessary adjustments are made after starting the engine.

### Basic inspection (Section K)

- The basic inspection is performed to quickly narrow down the possible causes after a malfunction occurs regardless of the symptoms. The basic inspection is performed to also locate the region of many malfunction symptoms.

### Diagnostic index

- The diagnostic index lists the symptoms of the malfunctions. Select the symptoms pertaining or most closely pertaining to the actual malfunction.

### Quick diagnosis chart (If mentioned)

- The quick diagnosis chart lists the diagnosis and inspection procedures to be performed specifically relating to the cause of the malfunction.

### Symptom troubleshooting

- Symptom troubleshooting quickly determines the location of the malfunction according to the type of symptoms.

## HOW TO USE THIS MANUAL

### Procedures For Use

#### Using the basic inspection

- Perform the basic inspection before the symptom troubleshooting.
- Perform each step in the order shown.
- The reference column lists the location of the detailed procedure for each basic inspection.
- Although inspection and adjustment are performed as according to the procedures referred to in the reference column, if the cause of the malfunction is discovered during the basic inspection, continue the procedures as indicated in the remarks column.

| SHOWS INSPECTION ORDER |                                                                                                                          | SHOWS ITEM NAMES FOR THE DETAILED PROCEDURES |                                                                                                                                                                                                           | SHOW POINTS REQUIRING ATTENTION IN REGARD TO INSPECTION RESULTS |
|------------------------|--------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| STEP                   | INSPECTION                                                                                                               |                                              | ACTION                                                                                                                                                                                                    |                                                                 |
| 1                      | Turn ignition switch to ON<br>Does hold indicator light (illuminate/go out) correspond to hold switch position (ON/OFF)? | Yes                                          | Go to next step                                                                                                                                                                                           |                                                                 |
|                        |                                                                                                                          | No                                           | Perform malfunction diagnosis according to No. 26 "HOLD INDICATOR LIGHT DOES NOT ILLUMINATE WHEN HOLD SWITCH IS TURNED ON" or No. 27 "HOLD INDICATOR LIGHT ILLUMINATES WHEN HOLD SWITCH IS NOT TURNED ON" |                                                                 |
| 2                      | Check the ATF color and condition<br>Are ATF color and odor normal?                                                      | Yes                                          | Go to next step                                                                                                                                                                                           |                                                                 |
|                        |                                                                                                                          | No                                           | Repair or replace any defective parts                                                                                                                                                                     |                                                                 |
| 3                      | Perform the line pressure test<br>(Refer to MECHANICAL SYSTEM TEST, Line Pressure Test)<br>Is line pressure OK?          | Yes                                          | Go to next step                                                                                                                                                                                           |                                                                 |
|                        |                                                                                                                          | No                                           | Repair or replace any defective parts                                                                                                                                                                     |                                                                 |
| 4                      | Perform the stall test<br>(Refer to MECHANICAL SYSTEM TEST, Stall Test)<br>Is stall speed OK?                            | Yes                                          | Go to next step                                                                                                                                                                                           |                                                                 |
|                        |                                                                                                                          | No                                           | Repair or replace any defective parts                                                                                                                                                                     |                                                                 |
| 5                      |                                                                                                                          | Yes                                          | Perform symptom troubleshooting                                                                                                                                                                           |                                                                 |

#### Using the diagnostic index

- The symptoms of the malfunctions are listed in the diagnostic index for system troubleshooting.
- The exact malfunction symptoms can be selected using the details.

| No. | TROUBLESHOOTING ITEM                                       |                       | DESCRIPTION                                                                                                              |
|-----|------------------------------------------------------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------|
| 1   | Melting of main or other fuses                             |                       | —                                                                                                                        |
| 2   | Will not crank                                             |                       | Starter does not work.                                                                                                   |
| 3   | Hard to start / long crank / erratic start / erratic crank |                       | Starter cranks engine at normal speed but engine requires excessive cranking time before starting.                       |
| 4   | Engine stalls.                                             | After start / at idle | Engine stops unexpectedly at idle and/or after start.                                                                    |
| 5   | Crankes normally but will not start                        |                       | Starter cranks engine at normal speed but engine will not run.                                                           |
| 6   | Slow return to idle                                        |                       | Engine takes more time than normal to return to idle speed.                                                              |
| 7   | Engine runs rough / rolling idle                           |                       | Engine speed fluctuates between specified idle speed and lower speed and engine shakes excessively.                      |
| 8   | Fast idle / runs on                                        |                       | Engine speed continues at fast idle after warm-up.<br>Engine runs after ignition switch is turned off.                   |
| 9   | Low idle / stalls during deceleration                      |                       | Engine stops unexpectedly at beginning of deceleration or recovery from deceleration.                                    |
|     | Engine stalls / quits.                                     | Acceleration / cruise | Engine stops unexpectedly at beginning of acceleration or during acceleration. Engine stops unexpectedly while cruising. |
|     | Engine runs rough.                                         | Acceleration / cruise | Engine speed fluctuates during acceleration or cruising.                                                                 |
|     |                                                            |                       | Engine misses during acceleration or cruising.                                                                           |
|     |                                                            |                       | Engine speed fluctuates during deceleration, cruising, or deceleration.                                                  |

# HOW TO USE THIS MANUAL

## Using the quick diagnosis chart

- The chart lists the relation between the symptoms and cause of the malfunction.
- The chart is effective in quickly narrowing down the relation between the symptoms and cause of the malfunction and specifying the region of the common cause when multiple malfunction symptoms occur.
- The appropriate diagnostic inspection relating to the cause of the malfunction as specified by the symptoms can be selected by looking down the diagnostic inspection column of the chart.

### ② PARTS WHICH MAY BE THE CAUSE OF PROBLEMS

ENGINE QUICK DIAGNOSTIC CHART

PART WHICH MAY BE THE SYMPTOM

### ① CHOOSE THE ACTUAL SYMPTOM

| Possible factor      |                                                        |                                   |                                           |              |                    |                                             |                                                                              |                                           |                           |                                                   |                                                        |                                                                                             |                        |                                                               |                                                                |
|----------------------|--------------------------------------------------------|-----------------------------------|-------------------------------------------|--------------|--------------------|---------------------------------------------|------------------------------------------------------------------------------|-------------------------------------------|---------------------------|---------------------------------------------------|--------------------------------------------------------|---------------------------------------------------------------------------------------------|------------------------|---------------------------------------------------------------|----------------------------------------------------------------|
| Troubleshooting Item |                                                        | Cooling fan seated improperly     | Accelerator cable free play misadjustment | Fuel quality | Engine overheating | Air cleaner element clogging or restriction | Air leakage from intake-air system (Tubes looseness, cracks, gaskets broken) | Idle air control valve improper operation | Throttle body malfunction | Vacuum leakage (Vacuum hose damaged, mis-routing) | Ignition coil malfunction (e.g. open, short or cracks) | Initial ignition timing misadjustment (Camshaft position & crankshaft pulley misadjustment) | Spark plug malfunction | High-tension leads malfunction (Cracks, open, low resistance) | Camshaft position sensor damaged (e.g. open or short circuits) |
| 1                    | Melting of main or other fuses                         |                                   |                                           |              |                    |                                             |                                                                              |                                           |                           |                                                   |                                                        |                                                                                             |                        |                                                               |                                                                |
| 2                    | Will not crank                                         |                                   |                                           |              |                    |                                             |                                                                              |                                           |                           |                                                   |                                                        |                                                                                             |                        |                                                               |                                                                |
| 3                    | Hard to start/long crank/erratic start/erratic crank   |                                   |                                           |              | x                  |                                             | x                                                                            | x                                         |                           | x                                                 |                                                        |                                                                                             | x                      | x                                                             | x                                                              |
| 4                    | Engine stalls                                          | After start/at idle               |                                           |              | x                  | x                                           | x                                                                            | x                                         |                           | x                                                 | x                                                      | x                                                                                           | x                      | x                                                             | x                                                              |
| 5                    | Cranks normally but will not start                     |                                   |                                           |              | x                  | x                                           |                                                                              | x                                         |                           | x                                                 | x                                                      | x                                                                                           | x                      | x                                                             | x                                                              |
| 6                    | Slow return to idle                                    |                                   |                                           |              |                    |                                             |                                                                              |                                           | x                         |                                                   |                                                        |                                                                                             |                        |                                                               |                                                                |
| 7                    | Engine runs rough/rolling idle                         |                                   |                                           |              | x                  | x                                           |                                                                              | x                                         |                           | x                                                 |                                                        | x                                                                                           | x                      | x                                                             | x                                                              |
| 8                    | Fast idle/runs on                                      |                                   |                                           | x            |                    |                                             |                                                                              |                                           |                           |                                                   |                                                        |                                                                                             |                        |                                                               |                                                                |
| 9                    | Low idle/stalls during deceleration                    |                                   |                                           |              |                    |                                             | x                                                                            | x                                         |                           |                                                   |                                                        |                                                                                             |                        |                                                               |                                                                |
| 10                   | Engine stalls/quits                                    | Acceleration/cruise               |                                           |              | x                  | x                                           | x                                                                            | x                                         |                           | x                                                 | x                                                      |                                                                                             | x                      |                                                               | x                                                              |
|                      | Engine runs rough                                      | Acceleration/cruise               |                                           |              | x                  | x                                           | x                                                                            | x                                         |                           | x                                                 | x                                                      |                                                                                             | x                      |                                                               | x                                                              |
|                      | Misses                                                 | Acceleration/cruise               |                                           |              | x                  | x                                           | x                                                                            | x                                         |                           | x                                                 | x                                                      |                                                                                             | x                      |                                                               | x                                                              |
|                      | Buck/jerk                                              | Acceleration/cruise/ deceleration |                                           |              | x                  | x                                           | x                                                                            | x                                         |                           | x                                                 | x                                                      |                                                                                             | x                      |                                                               | x                                                              |
|                      | Hesitation/stumble                                     | Acceleration                      |                                           |              | x                  | x                                           | x                                                                            | x                                         |                           | x                                                 | x                                                      |                                                                                             | x                      |                                                               | x                                                              |
|                      | Surges                                                 | Acceleration/cruise               |                                           |              | x                  | x                                           | x                                                                            | x                                         |                           | x                                                 | x                                                      |                                                                                             | x                      |                                                               | x                                                              |
| 11                   | Lack/loss of power                                     | Acceleration/cruise               |                                           |              | x                  | x                                           | x                                                                            | x                                         |                           | x                                                 |                                                        |                                                                                             | x                      |                                                               | x                                                              |
| 12                   | Knocking/pinging                                       | Acceleration/cruise               |                                           |              |                    | x                                           |                                                                              |                                           |                           |                                                   |                                                        |                                                                                             |                        |                                                               |                                                                |
| 13                   | Poor fuel economy                                      |                                   |                                           |              | x                  |                                             | x                                                                            |                                           |                           |                                                   |                                                        |                                                                                             | x                      | x                                                             |                                                                |
| 14                   | Emissions compliance                                   |                                   |                                           |              |                    |                                             | x                                                                            | x                                         |                           | x                                                 |                                                        |                                                                                             | x                      | x                                                             |                                                                |
| 15                   | High oil consumption/leakage                           |                                   |                                           |              |                    |                                             |                                                                              |                                           |                           |                                                   |                                                        |                                                                                             |                        |                                                               |                                                                |
| 16                   | Cooling system concerns                                | Overheating                       |                                           |              |                    |                                             |                                                                              |                                           |                           |                                                   |                                                        |                                                                                             |                        |                                                               |                                                                |
| 17                   | Cooling system concerns                                | Runs cold                         |                                           |              |                    |                                             |                                                                              |                                           |                           |                                                   |                                                        |                                                                                             |                        |                                                               |                                                                |
| 18                   | Exhaust smoke                                          |                                   |                                           |              |                    |                                             | x                                                                            |                                           |                           |                                                   |                                                        |                                                                                             | x                      | x                                                             |                                                                |
| 19                   | Fuel odor (in engine compartment)                      |                                   |                                           |              |                    |                                             |                                                                              |                                           |                           |                                                   |                                                        |                                                                                             |                        |                                                               |                                                                |
| 20                   | Engine noise                                           |                                   |                                           |              |                    |                                             | x                                                                            |                                           |                           | x                                                 |                                                        |                                                                                             |                        |                                                               |                                                                |
| 21                   | Vibration concerns (engine)                            |                                   | x                                         |              |                    |                                             |                                                                              |                                           |                           |                                                   |                                                        |                                                                                             |                        |                                                               |                                                                |
| 22                   | A/C does not work sufficiently.                        |                                   |                                           |              |                    |                                             |                                                                              |                                           |                           |                                                   |                                                        |                                                                                             |                        |                                                               |                                                                |
| 23                   | A/C is always on/A/C compressor runs continuously      |                                   |                                           |              |                    |                                             |                                                                              |                                           |                           |                                                   |                                                        |                                                                                             |                        |                                                               |                                                                |
| 24                   | A/C is not cut off under wide open throttle conditions |                                   |                                           |              |                    |                                             |                                                                              |                                           |                           |                                                   |                                                        |                                                                                             |                        |                                                               |                                                                |
| 25                   | Exhaust sulphur smell                                  |                                   |                                           |              | x                  |                                             |                                                                              |                                           |                           |                                                   |                                                        |                                                                                             |                        |                                                               |                                                                |
| 26                   | Intermittent concerns                                  |                                   |                                           |              |                    |                                             |                                                                              | x                                         |                           | x                                                 | x                                                      |                                                                                             | x                      | x                                                             | x                                                              |
| 27                   | Constant voltage                                       |                                   |                                           |              |                    |                                             |                                                                              |                                           |                           |                                                   |                                                        |                                                                                             |                        |                                                               |                                                                |
| 28                   | Automatic transmission (AT) concerns                   | Upshift/downshift/ engagement     | Section K                                 |              |                    |                                             |                                                                              |                                           |                           |                                                   |                                                        |                                                                                             |                        |                                                               |                                                                |

Section K

## HOW TO USE THIS MANUAL

## Using the symptom troubleshooting

- Symptom troubleshooting shows diagnosis procedure, inspection method, and proper action to take for each trouble symptom.

**TROUBLESHOOTING HINTS** describes possible point of malfunction.

## TROUBLE SYMPTOM

## Symptom Troubleshooting

| 1                                                                                                                                                                                                                                                                                                                                                                             | VEHICLE DOES NOT MOVE IN D, S, L RANGES, OR IN R POSITION                                                                                                                                                                                 |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>TROUBLESHOOTING HINTS</b>                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                           |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| If the vehicle does not move in D, S, L ranges or R position, basically, the malfunction is in the automatic transmission. (Vehicle will move even with a malfunction in the PCM.) Since a malfunction in the sensor circuit or output circuit is the cause of the malfunction in the automatic transmission, inspect the sensors, output circuit, and the related harnesses. |                                                                                                                                                                                                                                           |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| ① Clutch slippage, or worn. (D, S, L ranges-Forward clutch, 4GR clutch, one-way clutch No.0, One-way clutch No.2, R position-1st and reverse brake, 4GR clutch, direct clutch, one-way clutch No.0)                                                                                                                                                                           |                                                                                                                                                                                                                                           |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| STEP                                                                                                                                                                                                                                                                                                                                                                          | INSPECTION                                                                                                                                                                                                                                |     | ACTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 1                                                                                                                                                                                                                                                                                                                                                                             | With vehicle stopped on a flat road and engine off, does vehicle move when pushed? (in D, S range or N, R position and brake released)                                                                                                    | Yes | Go to next step.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                           | No  | Inspect parking mechanism.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 2                                                                                                                                                                                                                                                                                                                                                                             | Does vehicle move when selector lever is between N position and D range?                                                                                                                                                                  | Yes | Go to next step.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                           | No  | Inspect or adjust the selector lever.<br>⇨ SHIFT MECHANISM, SELECTOR LEVER ADJUSTMENT.                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 3                                                                                                                                                                                                                                                                                                                                                                             | Disconnect shift solenoid connector.<br>Turn ignition switch on.<br>Inspect voltages between each shift solenoid connector terminal and ground in D, S and L ranges.<br>⇨ AUTOMATIC TRANSMISSION, TRANSMISSION CONTROL MODULE INSPECTION. | Yes | Inspect for bent, damaged, corroded or loose connection of shift solenoid terminal on automatic transmission.<br>Inspect for mechanically stuck shift solenoids.<br>⇨ AUTOMATIC TRANSMISSION, SOLENOID VALVES INSPECTION, Operating Inspection.<br>If shift solenoids are okay, overhaul control valve body and repair or replace any defective parts.<br>If problem remains, replace or overhaul transmission and repair or replace any defective parts.<br>⇨ Automatic transmission workshop manual SB4A-EL |
|                                                                                                                                                                                                                                                                                                                                                                               | <b>Specification</b><br><b>Terminal B: B+</b><br><b>Terminal A: 0 V</b><br><br>Are voltages okay?                                                                                                                                         | No  | Inspect for open or short circuit between TCM connector terminal and shift solenoid connector terminal.                                                                                                                                                                                                                                                                                                                                                                                                       |

**ACTION** describes the appropriate action to take as a result (Yes/No) of INSPECTION.

**STEP** shows the order of troubleshooting.

**INSPECTION** describes an inspection (method) to quickly determine the failed part.

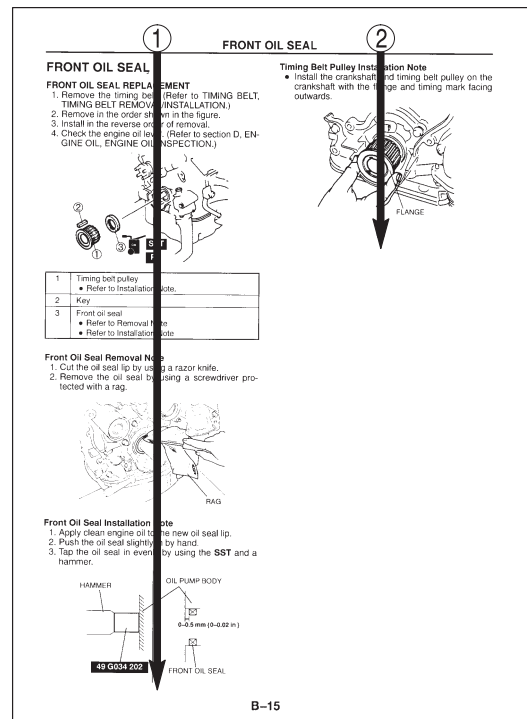
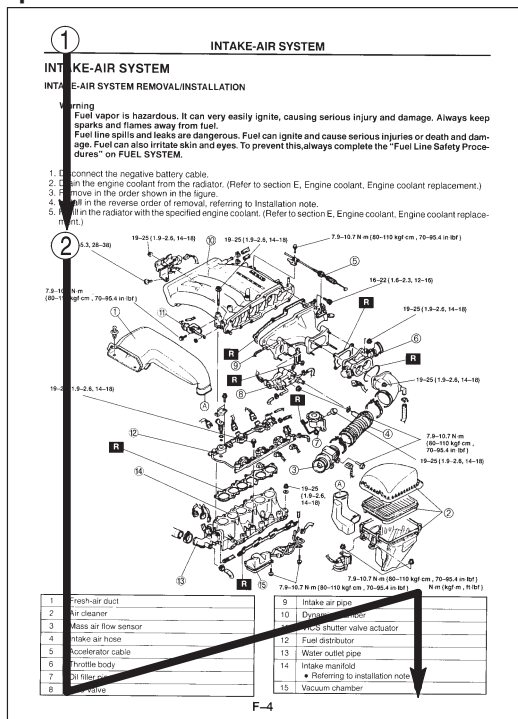
Reference page(s) for the detailed procedure to perform INSPECTION is shown.

**How to perform ACTION**  
is described in the relative  
material shown.

## TEXT SEQUENCE

- The text sequence is as indicated by the arrows shown below.

**Example:**



## UNITS

### UNITS

|                       |                                                            |
|-----------------------|------------------------------------------------------------|
| Electric current      | A (ampere)                                                 |
| Electric power        | W (watt)                                                   |
| Electric resistance   | $\Omega$ (ohm)                                             |
| Electric voltage      | V (volt)                                                   |
| Length                | mm (millimeter)                                            |
|                       | in (inch)                                                  |
| Negative pressure     | kPa (kilo pascal)                                          |
|                       | mmHg (millimeters of mercury)                              |
|                       | inHg (inches of mercury)                                   |
| Positive pressure     | kPa (kilo pascal)                                          |
|                       | kgf/cm <sup>2</sup> (kilogram force per square centimeter) |
|                       | psi (pounds per square inch)                               |
| Number of revolutions | rpm (revolutions per minute)                               |
| Torque                | N·m (Newton meter)                                         |
|                       | kgf·m (kilogram force per meter)                           |
|                       | kgf·cm (kilogram force per centimeter)                     |
|                       | ft·lbf (foot pound) force                                  |
|                       | in·lbf (inch pound) force                                  |
| Volume                | L (liter)                                                  |
|                       | US qt (U.S. quart)                                         |
|                       | Imp qt (Imperial quart)                                    |
|                       | ml (milliliter)                                            |
|                       | cc (cubic centimeter)                                      |
|                       | cu in (cubic inch)                                         |
|                       | fl oz (fluid ounce)                                        |
| Weight                | g (gram)                                                   |
|                       | oz (ounce)                                                 |

- The actual converted values for 2.7 kgf/cm<sup>2</sup> are 264 kPa and 38.4 psi. In the top specification, 2.7 is used as an upper limit, so its converted values are rounded down to 260 and 38. In the bottom specification, 2.7 is used as a lower limit, so its converted values are rounded up to 270 and 39.

### Conversion to SI Units (Système International d'Unités)

- All numerical values in this manual are based on SI units. Numbers shown in conventional units are converted from these values.

### Rounding off

- Converted values are rounded off to the same number of places as the SI unit value. For example, if the SI unit value is 17.2 and the value after conversion is 37.84, the converted value will be rounded off to 37.8.

### Upper and lower limits

- When the data indicates upper and lower limits, the converted values are rounded down if the SI unit value is an upper limit and rounded up if the SI unit value is a lower limit. Therefore, converted values for the same SI unit value may differ after conversion. For example, consider 2.7 kgf/cm<sup>2</sup> in the following specifications:

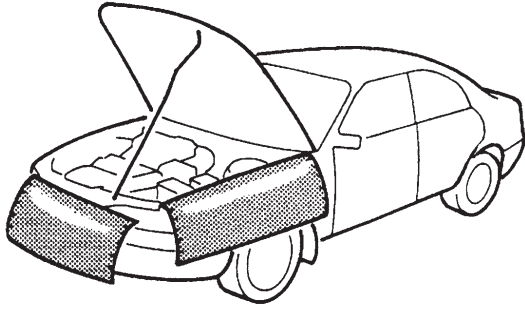
210—260 kPa {2.1—2.7 kgf/cm<sup>2</sup>, 30—38 psi}  
 270—310 kPa {2.7—3.2 kgf/cm<sup>2</sup>, 39—45 psi}

## FUNDAMENTAL PROCEDURES

### FUNDAMENTAL PROCEDURES

#### PROTECTION OF THE VEHICLE

- Always be sure to cover fenders, seats, and floor areas before starting work.



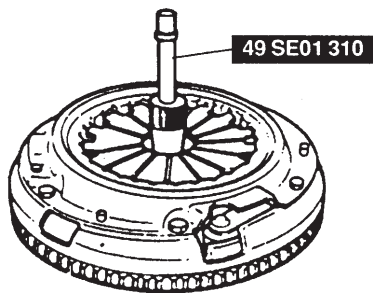
#### PREPARATION OF TOOLS AND MEASURING EQUIPMENT

- Be sure that all necessary tools and measuring equipment are available before starting any work.



#### SPECIAL SERVICE TOOLS

- Use special tools when they are required.



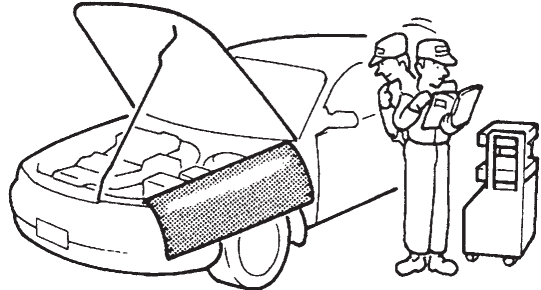
#### DISCONNECTION OF THE NEGATIVE BATTERY CABLE

- Before beginning any work, turn the ignition switch to LOCK, then disconnect the negative battery cable and wait for more than 1 minute to allow the backup power supply of the SAS unit to deplete its stored power.

Disconnecting the battery cable will delete the memories of the clock, audio, and DTCs, etc. Therefore, it is necessary to verify those memories before disconnecting the cable.

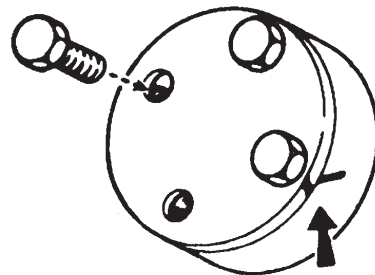
#### REMOVAL OF PARTS

- While correcting a problem, try also to determine its cause. Begin work only after first learning which parts and subassemblies must be removed and disassembled for replacement or repair. After removing the part, plug all holes and ports to prevent foreign material from entering.



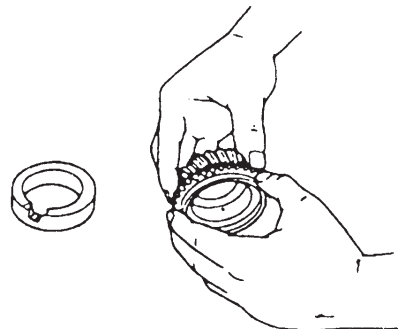
#### DISASSEMBLY

- If the disassembly procedure is complex, requiring many parts to be disassembled, all parts should be marked in a place that will not affect their performance or external appearance and identified so that reassembly can be performed easily and efficiently.



#### INSPECTION DURING REMOVAL, DISASSEMBLY

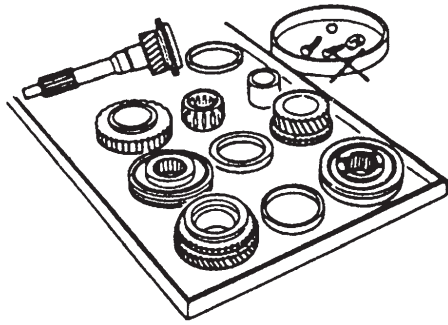
- When removed, each part should be carefully inspected for malfunctioning, deformation, damage, and other problems.



#### ARRANGEMENT OF PARTS

- All disassembled parts should be carefully arranged for reassembly.
- Be sure to separate or otherwise identify the parts to be replaced from those that will be reused.

## FUNDAMENTAL PROCEDURES

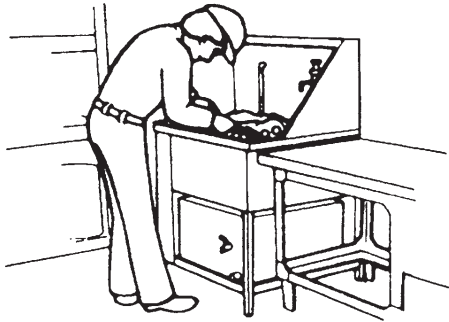


### CLEANING OF PARTS

- All parts to be reused should be carefully and thoroughly cleaned using the appropriate method.

#### Warning

- Using compressed air can cause dirt and other particles to fly out, causing injury to the eyes. Wear protective eye wear whenever using compressed air.

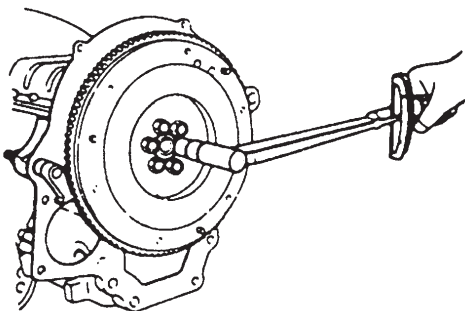


### REASSEMBLY

- Standard values, such as torques and certain adjustments, must be strictly observed in the reassembly of all parts.

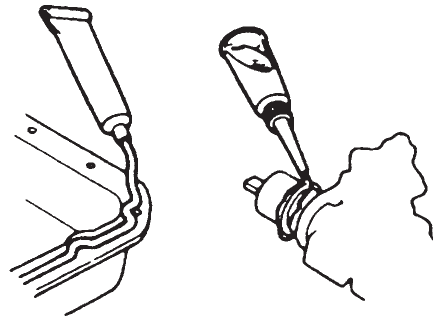
If removed, these parts should be replaced with new ones:

|   |             |   |             |
|---|-------------|---|-------------|
| 1 | Oil seals   | 2 | Gaskets     |
| 3 | O-rings     | 4 | Lockwashers |
| 5 | Cotter pins | 6 | Nylon nuts  |



- Sealant, a gasket, or both should be applied to the specified locations. When sealant is applied, parts should be installed before sealant hardens. Hardened sealant causes leaks.

- Oil should be applied to the moving components of parts.
- Specified oil or grease should be applied at the prescribed locations (such as oil seals) before reassembly.



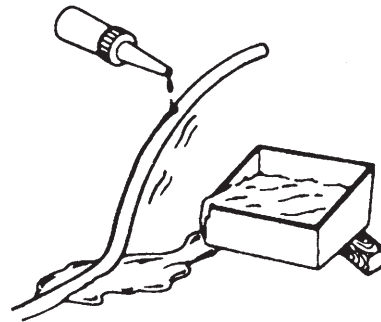
### ADJUSTMENT

- Use suitable gauges and/or testers when making adjustments.



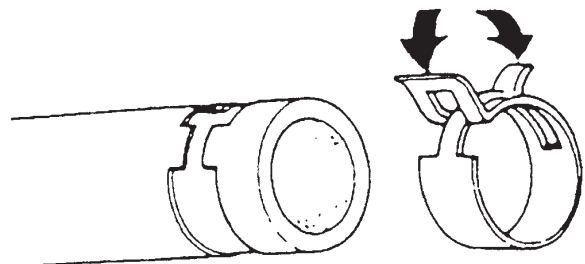
### RUBBER PARTS AND TUBING

- Prevent gasoline or oil from spilling on rubber parts or tubing.



### HOSE CLAMPS

- When reinstalling, position the hose clamp in the original location on the hose, and squeeze the clamp lightly with large pliers to ensure a good fit.



## FUNDAMENTAL PROCEDURES, INSTALLATION OF RADIO SYSTEM

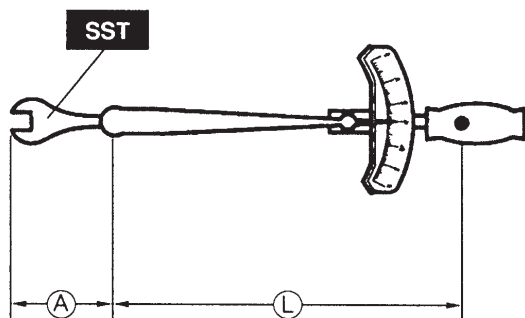
### TORQUE FORMULAS

- When using a torque wrench-SST combination, the written torque must be recalculated due to the extra length that the **SST** adds to the torque wrench. Recalculate the torque using the following formulas. Choose the formula that applies to you.

| Torque Unit | Formula                          |
|-------------|----------------------------------|
| kgf·m       | $\text{kgf·m} \times [L/(L+A)]$  |
| kgf·cm      | $\text{kgf·cm} \times [L/(L+A)]$ |
| ft·lbf      | $\text{ft·lbf} \times [L/(L+A)]$ |
| in·lbf      | $\text{in·lbf} \times [L/(L+A)]$ |

A: The length of the **SST** past the torque wrench drive.

L: The length of the torque wrench.



### INSTALLATION OF RADIO SYSTEM

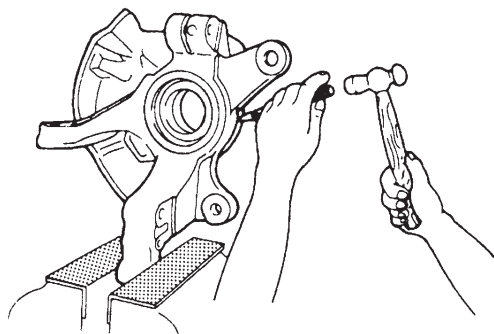
If a radio system is installed improperly or if a high-powered type is used, the CIS and other systems may be affected.

When the vehicle is to be equipped with a radio, observe the following precautions.

1. Install the antenna at the farthest point from control modules.
2. Install the antenna feeder as far as possible from the control modules harness, and perpendicular to wiring harnesses.
3. Do not install a high-powered radio system.
4. After installing the radio system, start and idle the engine, then confirm that the engine is not influenced by output waves from the system.

### WISE

- When using a vise, put protective plates in the jaws of the vise to prevent damage to parts.



### DYNAMOMETER

When test-running a vehicle on dynamometer :

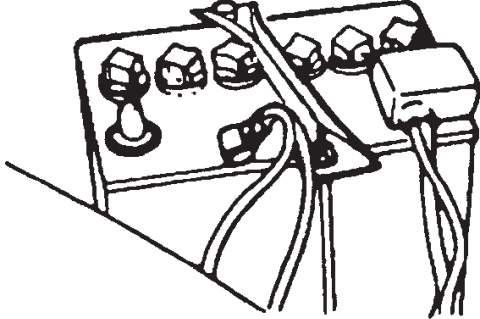
- Place a fan, preferably a vehicle-speed proportional type, in front of the vehicle.
- Connect an exhaust gas ventilation unit.
- Cool the exhaust pipes with a fan.
- Keep the area around the vehicle uncluttered.
- Watch the water temperature gauge.

## ELECTRICAL SYSTEM

### ELECTRICAL PARTS

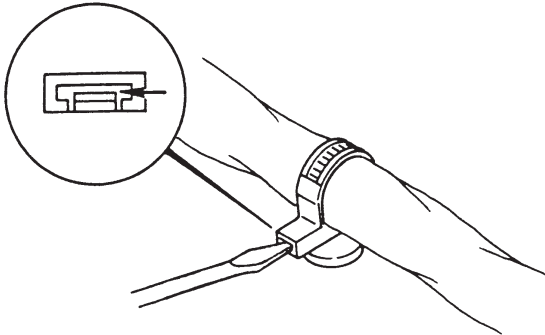
#### Battery Cable

- Before disconnecting connectors or removing electrical parts, disconnect the negative battery cable.



#### Wiring Harness

- To remove the wiring harness from the clip in the engine room, pry up the hook of the clip using a flathead screwdriver.



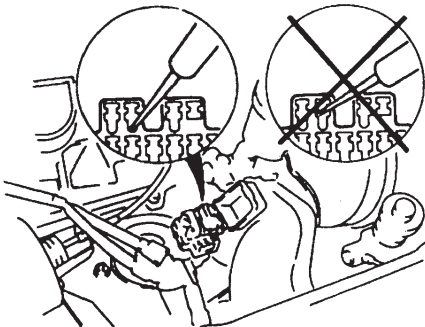
### CONNECTORS

#### Data Link Connector

- Insert the probe into the service hole when connecting a jumper wire to the data link connector.

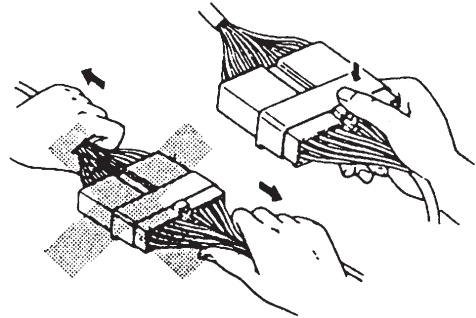
#### Caution

- Inserting a jumper wire probe into the data link connector terminal may damage the terminal.

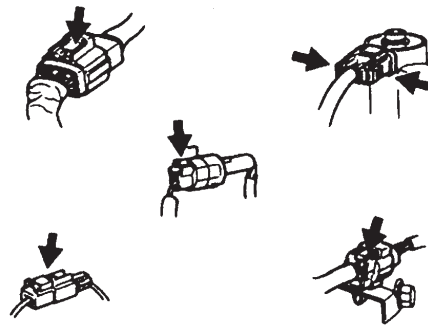


#### Disconnecting Connectors

- When disconnecting two connectors, grasp the connectors, not the wires.

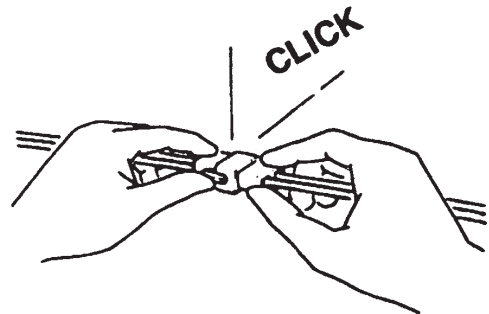


- Connectors can be disconnected by pressing or pulling the lock lever as shown.



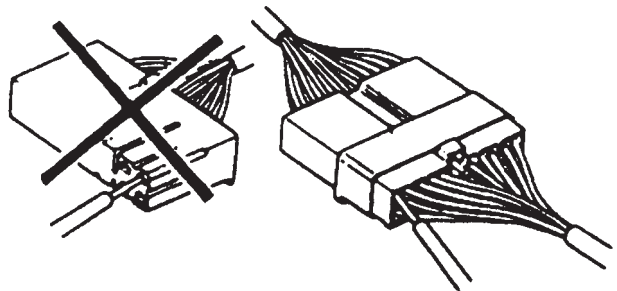
#### Locking Connector

- When locking connectors, listen for a click that will indicate they are securely locked.



#### Inspection

1. When a tester is used to check for continuity or to measure voltage, insert the tester probe from the wiring harness side.

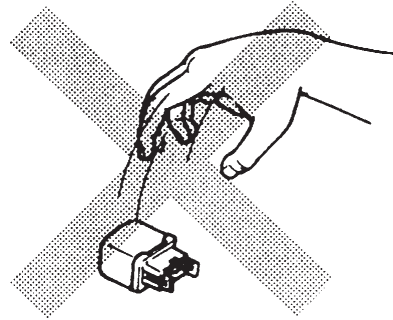
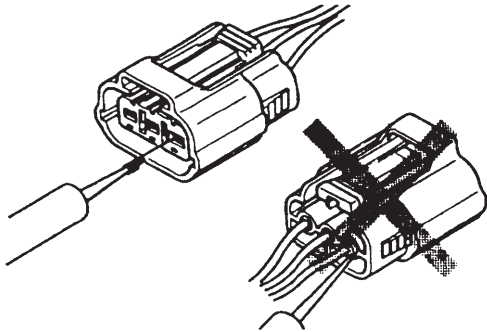


2. Check the terminals of waterproof connectors from the connector side, as they cannot be accessed from the wiring harness side.

## ELECTRICAL SYSTEM

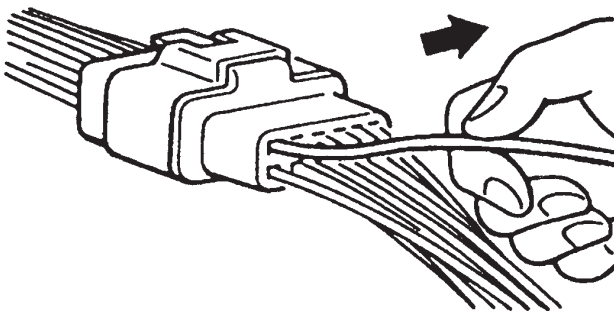
### Caution

- To prevent damage to the terminal, wrap a thin wire around the lead before inserting it into the terminal.



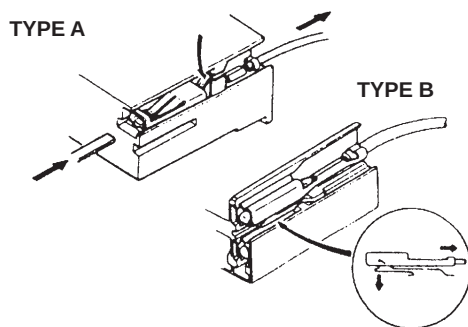
### Terminals Inspection

- Pull lightly on individual wires to check that they are secured in the terminal.



### Replacement

- Use the appropriate tools to remove a terminal as shown. When installing a terminal, be sure to insert it until it locks securely.
- Insert a thin piece of metal from the terminal side of the connector, and then, with the terminal locking tab pressed down, pull the terminal out from the connector.



### Sensors, Switches, and Relays

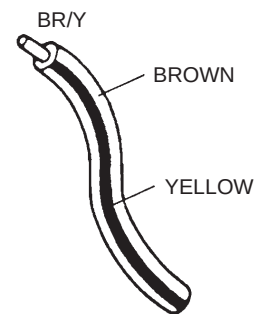
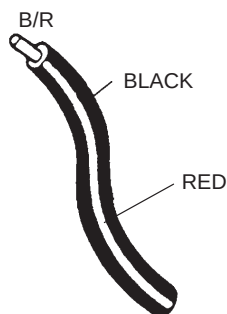
- Handle sensors, switches, and relays carefully. Do not drop them or strike them against other objects.

### Wiring Harness

#### Wiring color codes

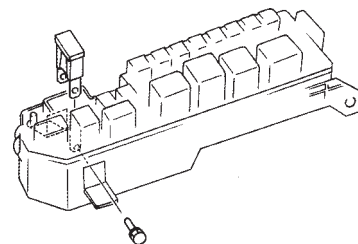
- Two-color wires are indicated by a two-color code symbol.
- The first letter indicates the base color of the wire and the second the color of the stripe.

| CODE | COLOR       | CODE | COLOR  |
|------|-------------|------|--------|
| B    | Black       | O    | Orange |
| BR   | Brown       | P    | Pink   |
| G    | Green       | R    | Red    |
| GY   | Gray        | V    | Violet |
| L    | Blue        | W    | White  |
| LB   | Light Blue  | Y    | Yellow |
| LG   | Light Green |      |        |



### Fuse Replacement

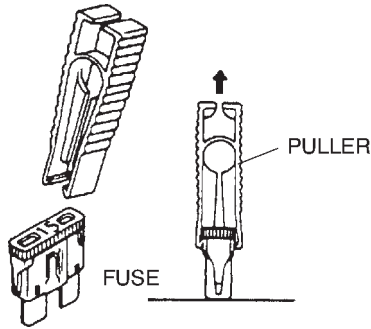
- When replacing a fuse, be sure to replace it with one of the same capacity. If a fuse fails again, the circuit probably has a short and the wiring should be inspected.
- Be sure that the negative battery cable is disconnected before replacing a main fuse.



WGIWXX0049E

# ELECTRICAL SYSTEM

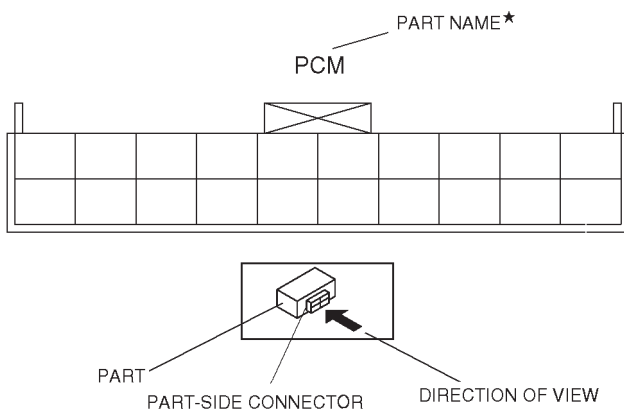
- When replacing a pullout fuse, use the fuse puller.



WGIWXX0050E

## Direction of View for Connector Part-side connector

Direction of view is from the terminal side.

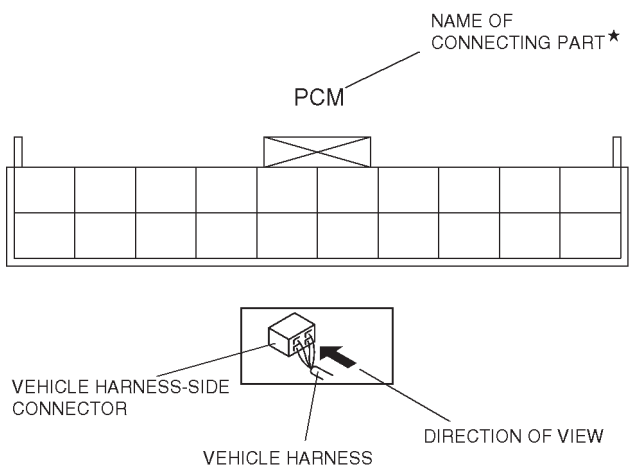


WGIWXX0100E

\* : Part names are shown only when there are multiple connector drawings.

## Vehicle harness side connector

Direction of view is from the harness side.

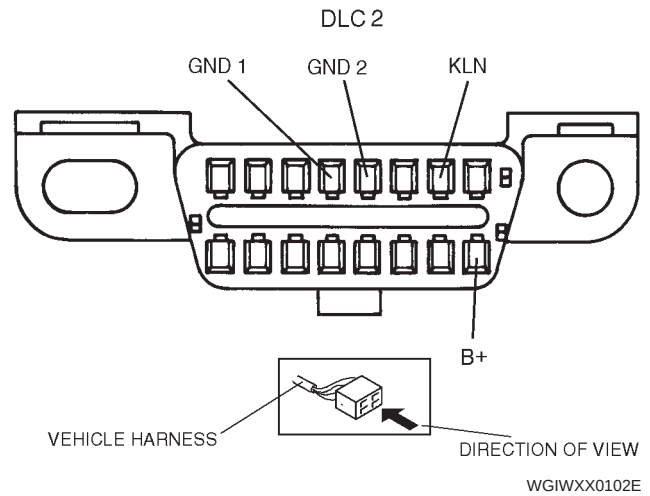


WGIWXX0101E

\* : Part names are shown only when there are multiple connector drawings.

## Other

Vehicle harness-side connectors, such as the DLC2, have to be viewed from the terminal side.



WGIWXX0102E

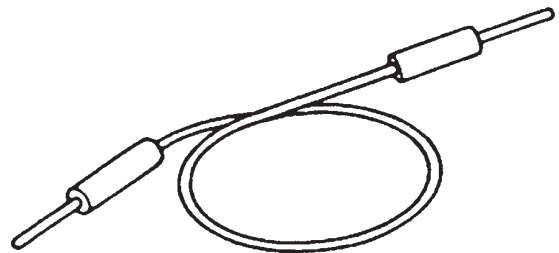
## ELECTRICAL TROUBLESHOOTING TOOLS

### Jumper Wire

- A jumper wire is used to create a temporary circuit. Connect the jumper wire between the terminals of a circuit to bypass a switch.

### Caution

- Do not connect a jumper wire from the power source line to a body ground; this may cause burning or other damage to wiring harnesses or electronic components.

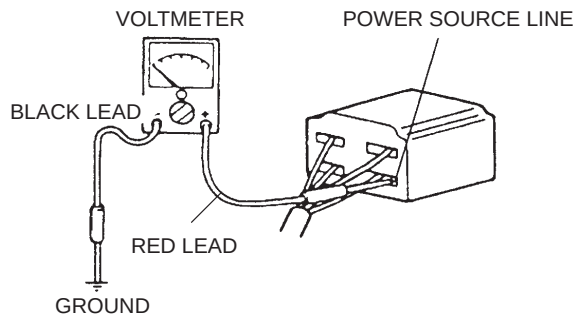


### Voltmeter

- The DC voltmeter is used to measure circuit voltage. A voltmeter with a range of 15 V or more is used by connecting the positive (+) probe (red lead wire) to the point where voltage is to be measured and the negative (–) probe (black lead wire) to a body ground.

## ELECTRICAL SYSTEM

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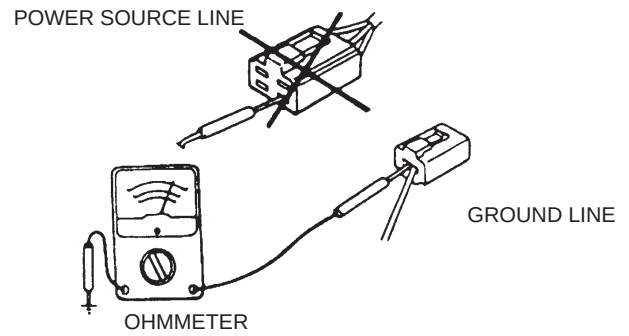


### Ohmmeter

- The ohmmeter is used to measure the resistance between two points in a circuit, and to check for continuity and short circuits.

### Caution

- Do not connect the ohmmeter to any circuit to which voltage is applied. This will damage the ohmmeter.



# JACKING POSITIONS, VEHICLE LIFT (2 SUPPORTS) POSITIONS, SAFETY STAND POSITIONS

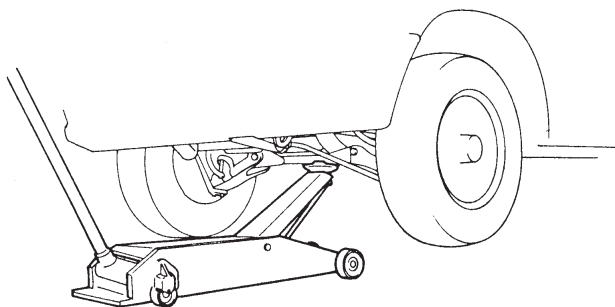
## JACKING POSITIONS

### Warning

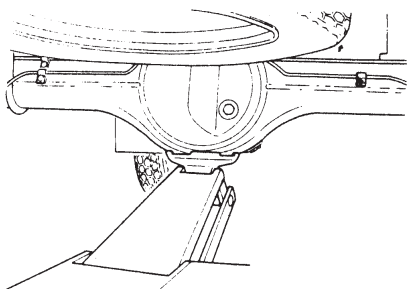
- Improperly jacking a vehicle is dangerous. The vehicle can slip off the jack and cause serious injury. Use only the correct front and rear jacking positions and block the wheels.

Use safety stands to support the vehicle after it has been lifted.

### FRONT

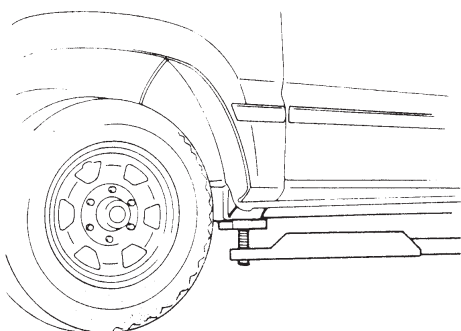


### REAR

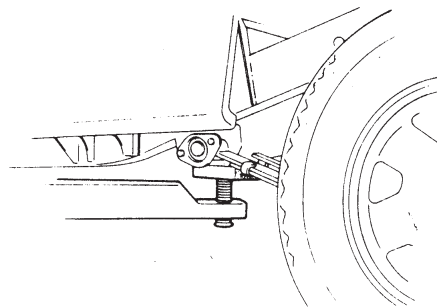


## VEHICLE LIFT (2 SUPPORTS) POSITIONS

### FRONT

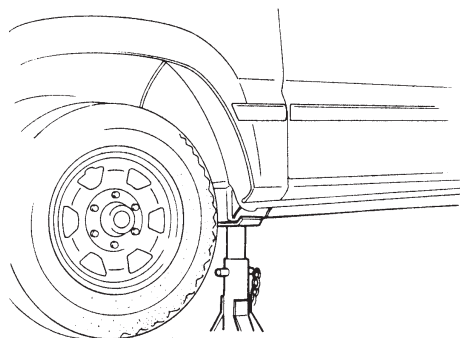


### REAR

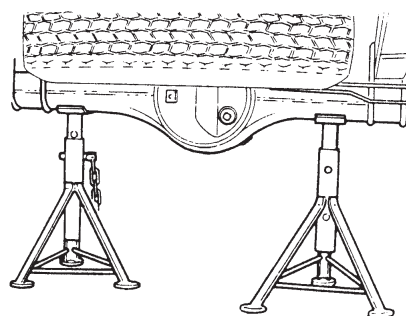


## SAFETY STAND POSITIONS

### FRONT



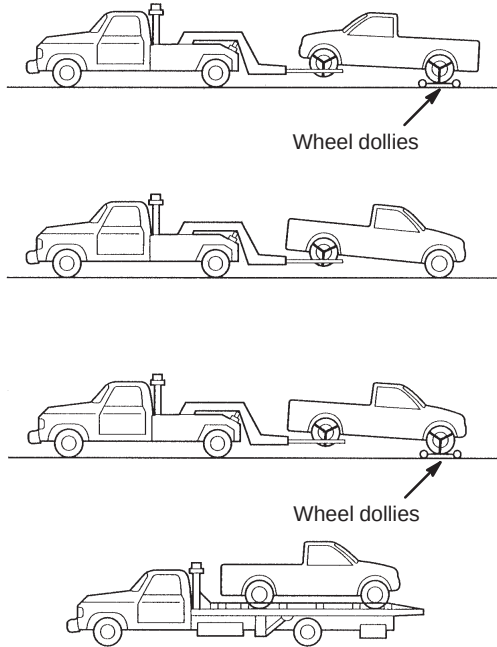
### REAR



## TOWING

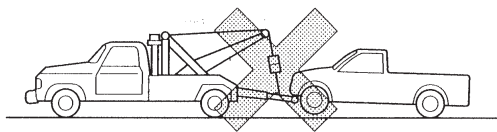
### TOWING

Proper lifting and towing are necessary to prevent damage to the vehicle.  
Government and local laws must be followed.



#### Caution

- Do not tow with sling-type equipment. This could damage your vehicle. Use wheel-lift or flatbed equipment.



#### (With Manual Transmission)

If the transmission, rear axle, and steering system are not damaged, the vehicle may be towed on all four wheels. If any of these components are damaged, use wheel dollies.

If all four wheels are on the ground, the vehicle may be towed only forward. Do not exceed 45 km/h (28 mph) and a distance of 15 km (9.3 miles); you could damage the transmission.

If speed must exceed 45 km/h (28 mph) or a towing distance of 15 km (9.3 miles), use one of these methods:

- Place the rear wheels on dollies.
- Tow with the rear wheels off the ground.
- Disconnect the propeller shaft.

If the transmission or rear axle is inoperative, tow with the rear wheels off the ground.

#### Caution

- Follow these instructions when towing the vehicle with all wheels on the ground or with the front wheels on the ground and the rear wheels raised.

#### (4 × 4 Model)

1. Put the transfer case in 2H.
2. Set the transfer case at 2H and the hubs at FREE.

#### (All Models)

1. Set the transmission in neutral.
2. Turn the engine switch to ACC position.
3. Release the parking brake.

- Remember that power assist for the brakes and steering will not be available when the engine is not running.

If your Ford has 4 × 4, change to 2-wheel drive before having the vehicle towed. If this is not possible, tow with all four wheels raised.

## TOWING

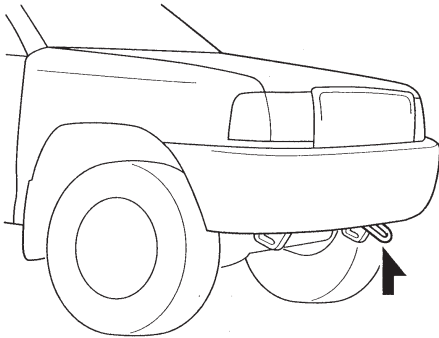
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### TOWING HOOKS

#### Caution

- The towing hooks should be used only in an emergency (e.g. to get the vehicle out of a ditch or a snow bank).
- When using the towing hooks, always pull the cable or chain in a straight direction with respect to the hook. Apply no sideways force.

#### FRONT 4×4

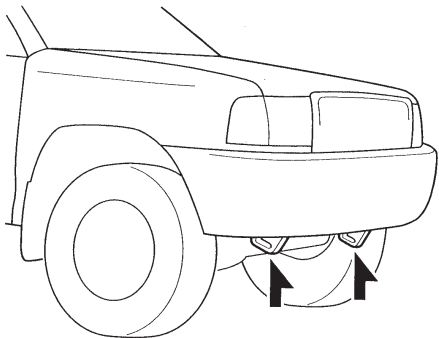


### TIEDOWN HOOKS

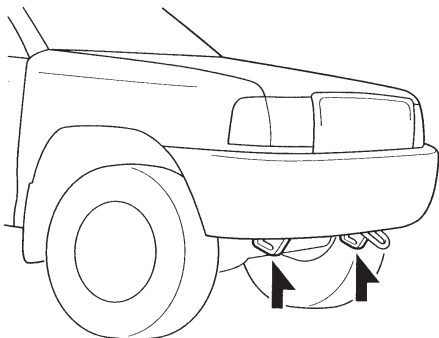
#### Caution

- Do not use the hook loops under the front for towing. They are designed **ONLY** for tying down the vehicle when it is being transported. Using them for towing will damage the bumper.

#### FRONT 4×2



#### 4×4

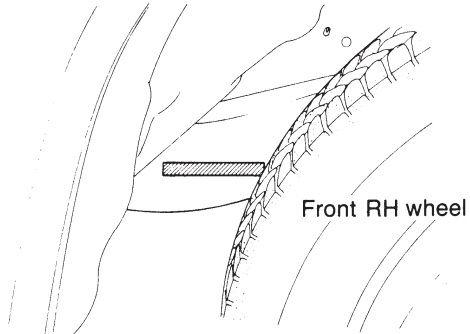


## IDENTIFICATION NUMBER LOCATIONS

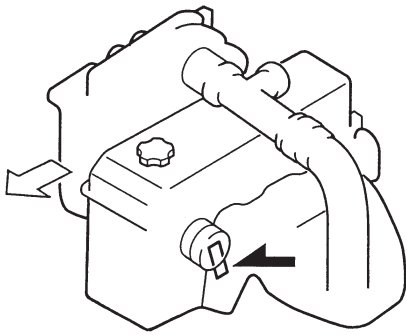
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### IDENTIFICATION NUMBER LOCATIONS

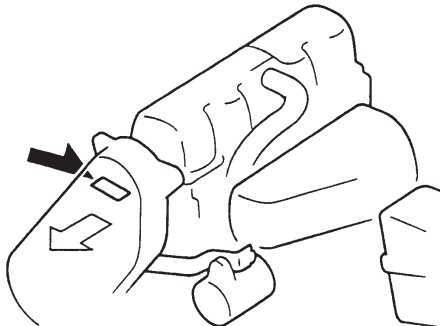
#### VEHICLE IDENTIFICATION NUMBER



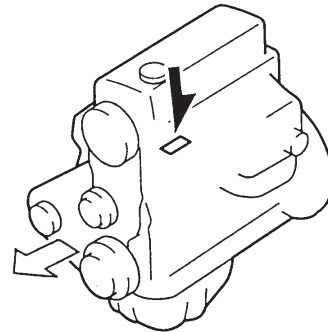
#### ENGINE IDENTIFICATION NUMBER G6



#### WL, WL Turbo

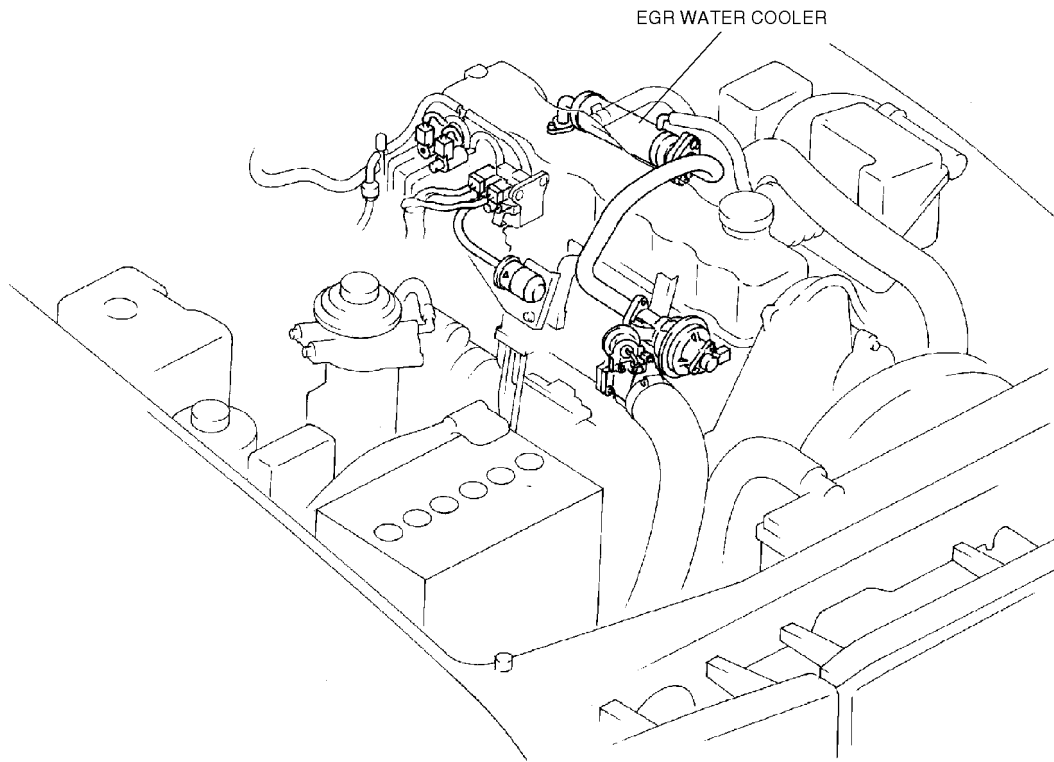


#### F2 CIS F2 CARB



## IDENTIFICATION NUMBER LOCATIONS

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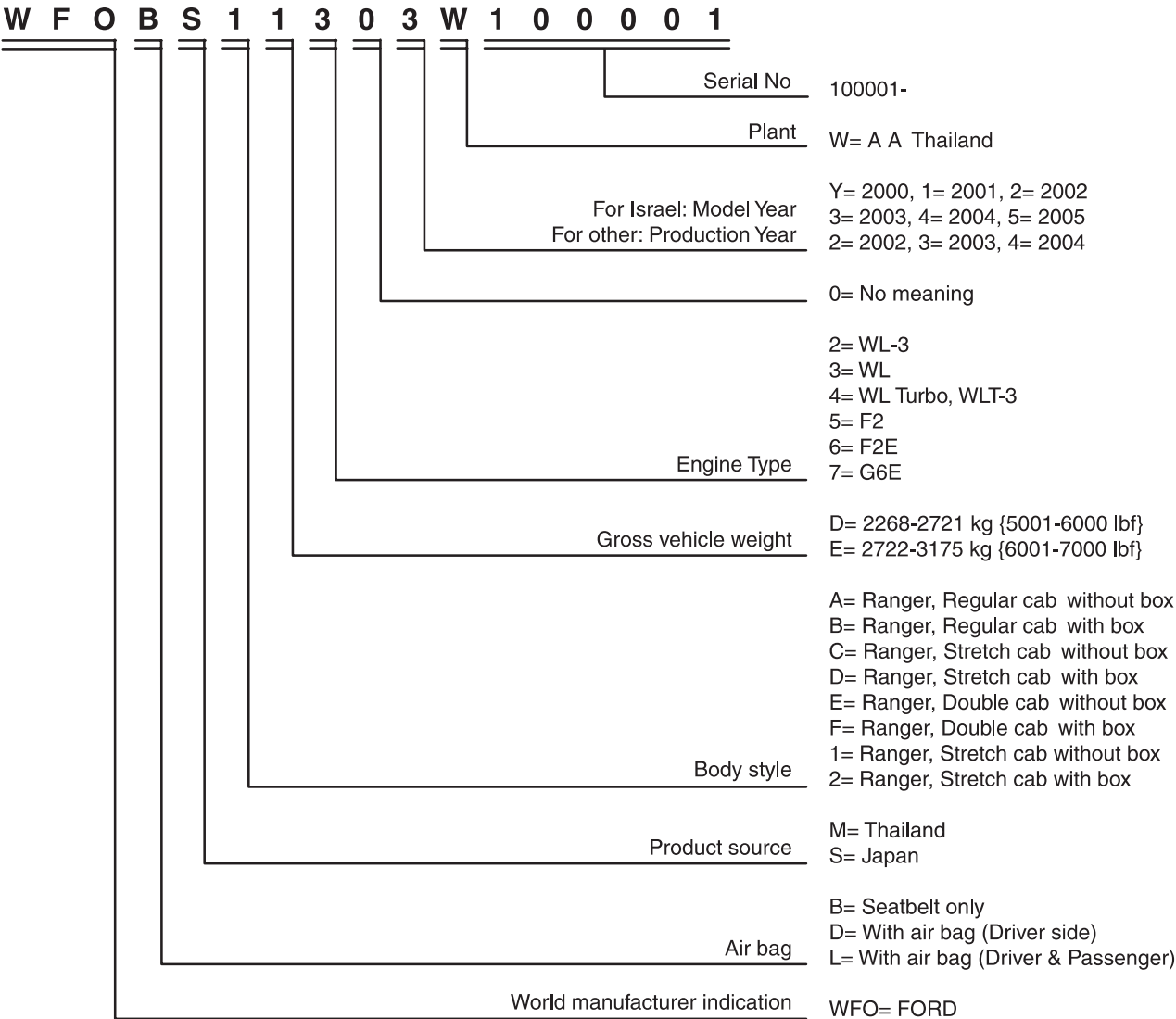
ZCF4016W200

- Euro 3 and non Euro 3 regulation models are distinguished as follows:
  - Euro 3 Regulation models (WL-3, WLT-3) are equipped with an EGR water cooler in the engine room.
  - Non-Euro 3 Regulation models are not equipped with an EGR water cooler in the engine room.

VIN CODE

VIN CODE

VIN CODE



VUE0035456

## NEW STANDARDS

### NEW STANDARDS

- Following is a comparison of the previous standard and the new standard.

| New Standard |                                  | Previous Standard |                                      | Remark      |
|--------------|----------------------------------|-------------------|--------------------------------------|-------------|
| Abbreviation | Name                             | Abbreviation      | Name                                 |             |
| AP           | Accelerator Pedal                | —                 | Accelerator Pedal                    |             |
| ACL          | Air Cleaner                      | —                 | Air Cleaner                          |             |
| A/C          | Air Conditioning                 | —                 | Air Conditioning                     |             |
| BARO         | Barometric Pressure              | —                 | Atmospheric Pressure                 |             |
| B +          | Battery Positive Voltage         | Vb                | Battery Voltage                      |             |
| —            | Brake Switch                     | —                 | Stoplight Switch                     |             |
| —            | Calibration Resistor             | —                 | Corrected Resistance                 | #6          |
| CMP sensor   | Camshaft Position Sensor         | —                 | Crank Angle Sensor                   |             |
| CAC          | Charge Air Cooler                | —                 | Intercooler                          |             |
| CLS          | Closed Loop System               | —                 | Feedback System                      |             |
| CTP          | Closed Throttle Position         | —                 | Fully Closed                         |             |
| —            | Closed Throttle Position Switch  | —                 | Idle Switch                          |             |
| CPP          | Clutch Pedal Position            | —                 | Clutch Position                      |             |
| CIS          | Continuous Fuel Injection System | EGL               | Electronic Gasoline Injection System |             |
| CS sensor    | Control Sleeve Sensor            | CSP sensor        | Control Sleeve Position Sensor       | #6          |
| CKP sensor   | Crankshaft Position Sensor       | —                 | Crank Angle Sensor 2                 |             |
| DLC          | Data Link Connector              | —                 | Diagnosis Connector                  |             |
| DTM          | Diagnostic Test Mode             | —                 | Test Mode                            | #1          |
| DTC          | Diagnostic Trouble Code(s)       | —                 | Service Code(s)                      |             |
| DI           | Distributor Ignition             | —                 | Spark Ignition                       |             |
| DLI          | Distributorless Ignition         | —                 | Direct Ignition                      |             |
| EI           | Electronic Ignition              | —                 | Electronic Spark Ignition            | #2          |
| ECT          | Engine Coolant Temperature       | —                 | Water Thermo                         |             |
| EM           | Engine Modification              | —                 | Engine Modification                  |             |
| —            | Engine Speed Input Signal        | —                 | Engine RPM Signal                    |             |
| EVAP         | Evaporative Emission             | —                 | Evaporative Emission                 |             |
| EGR          | Exhaust Gas Recirculation        | —                 | Exhaust Gas Recirculation            |             |
| FC           | Fan Control                      | —                 | Fan Control                          |             |
| FF           | Flexible Fuel                    | —                 | Flexible Fuel                        |             |
| 4GR          | Fourth Gear                      | —                 | Overdrive                            |             |
| —            | Fuel Pump Relay                  | —                 | Circuit Opening Relay                | #3          |
| FSO solenoid | Fuel Shut Off Solenoid           | FCV               | Fuel Cut Valve                       | #6          |
| GEN          | Generator                        | —                 | Alternator                           |             |
| GND          | Ground                           | —                 | Ground/Earth                         |             |
| HO2S         | Heated Oxygen Sensor             | —                 | Oxygen Sensor                        | With heater |
| IAC          | Idle Air Control                 | —                 | Idle Speed Control                   |             |
| —            | IDM Relay                        | —                 | Spill Valve Relay                    | #6          |
| —            | Incorrect Gear Ratio             | —                 | —                                    |             |
| —            | Injection Pump                   | FIP               | Fuel Injection Pump                  | #6          |
| —            | Input/Turbine Speed Sensor       | —                 | Pulse Generator                      |             |
| IAT          | Intake Air Temperature           | —                 | Intake Air Thermo                    |             |
| KS           | Knock Sensor                     | —                 | Knock Sensor                         |             |
| MIL          | Malfunction Indicator Lamp       | —                 | Malfunction Indicator Light          |             |

## NEW STANDARDS

| New Standard |                                                   | Previous Standard |                                | Remark                  |
|--------------|---------------------------------------------------|-------------------|--------------------------------|-------------------------|
| Abbreviation | Name                                              | Abbreviation      | Name                           |                         |
| MAP          | Manifold Absolute Pressure                        | —                 | Intake Air Pressure            |                         |
| MAF sensor   | Mass Air Flow Sensor                              | —                 | Airflow Sensor                 |                         |
| MFL          | Multiport Fuel Injection                          | —                 | Multiport Fuel Injection       |                         |
| OBD          | On-Board Diagnostic                               | —                 | Diagnosis/Self-Diagnosis       |                         |
| OL           | Open Loop                                         | —                 | Open Loop                      |                         |
| —            | Output Speed Sensor                               | —                 | Vehicle Speed Sensor 1         |                         |
| OC           | Oxidation Catalytic Converter                     | —                 | Catalytic Converter            |                         |
| O2S          | Oxygen Sensor                                     | —                 | Oxygen Sensor                  |                         |
| PNP          | Park/Neutral Position                             | —                 | Park/Neutral Range             |                         |
| —            | PCM Control Relay                                 | —                 | Main Relay                     | #6                      |
| PSP          | Power Steering Pressure                           | —                 | Power Steering Pressure        |                         |
| PCM          | Powertrain Control Module                         | ECU               | Engine Control Unit            | #4                      |
| —            | Pressure Control Solenoid                         | —                 | Line Pressure Solenoid Valve   |                         |
| PAIR         | Pulsed Secondary Air Injection                    | —                 | Secondary Air Injection System | Pulsed injection        |
| —            | Pump Speed Sensor                                 | —                 | NE Sensor                      | #6                      |
| AIR          | Secondary Air Injection                           | —                 | Secondary Air Injection System | Injection with air pump |
| SAPV         | Secondary Air Pulse Valve                         | —                 | Reed Valve                     |                         |
| SFI          | Sequential Multipoint Fuel Injection              | —                 | Sequential Fuel Injection      |                         |
| —            | Shift Solenoid A                                  | —                 | 1–2 Shift Solenoid Valve       |                         |
|              |                                                   | —                 | Shift A Solenoid Valve         |                         |
| —            | Shift Solenoid B                                  | —                 | 2–3 Shift Solenoid Valve       |                         |
|              |                                                   | —                 | Shift B Solenoid Valve         |                         |
| —            | Shift Solenoid C                                  | —                 | 3–4 Shift Solenoid Valve       |                         |
| 3GR          | Third Gear                                        | —                 | 3rd Gear                       |                         |
| TWC          | Three Way Catalytic Converter                     | —                 | Catalytic Converter            |                         |
| TB           | Throttle Body                                     | —                 | Throttle Body                  |                         |
| TP sensor    | Throttle Position Sensor                          | —                 | Throttle Sensor                |                         |
| TCV          | Timer Control Valve                               | TCV               | Timing Control Valve           | #6                      |
| TCC          | Torque Converter Clutch                           | —                 | Lock-up Position               |                         |
| TCM          | Transmission (Transaxle) Control Module           | —                 | EC-AT Control Unit             |                         |
| —            | Transmission (Transaxle) Fluid Temperature Sensor | —                 | ATF Thermosensor               |                         |
| TR           | Transmission (Transaxle) Range                    | —                 | Inhibitor Position             |                         |
| TC           | Turbocharger                                      | —                 | Turbocharger                   |                         |
| VSS          | Vehicle Speed Sensor                              | —                 | Vehicle Speed Sensor           |                         |
| VR           | Voltage Regulator                                 | —                 | IC Regulator                   |                         |
| VAF sensor   | Volume Air Flow Sensor                            | —                 | Airflow Meter                  |                         |
| WU–TWC       | Warm Up Three Way Catalytic Converter             | —                 | Catalytic Converter            | #5                      |
| WOT          | Wide Open Throttle                                | —                 | Fully Open                     |                         |

#1: Diagnostic trouble codes depend on the diagnostic test mode

#2: Controlled by the PCM

#3: In some models, there is a fuel pump relay that controls pump speed. That relay is now called the fuel pump relay (speed).

#4: Device that controls engine and powertrain

#5: Directly connected to exhaust manifold

#6: Part name of diesel engine

## CONVENTIONAL BRAKE SYSTEM

### ABBREVIATIONS

#### ABBREVIATIONS TABLE

|        |                              |
|--------|------------------------------|
| A/C    | Air conditioner              |
| ABDC   | After bottom dead center     |
| ABS    | Antilock brake system        |
| ACC    | Accessories                  |
| ATDC   | After top dead center        |
| ATF    | Automatic transmission fluid |
| BBDC   | Before bottom dead center    |
| BTDC   | Before top dead center       |
| CARB   | Carburetor                   |
| CM     | Control Module               |
| ELR    | Emergency locking retractor  |
| EX     | Exhaust                      |
| FIP    | Fuel injection pump          |
| HI     | High                         |
| HLA    | Hydraulic lash adjuster      |
| HU     | Hydraulic unit               |
| IG     | Ignition                     |
| IN     | Intake                       |
| INT    | Intermittent                 |
| LF     | Left front                   |
| LH     | Left hand                    |
| L.H.D. | Left hand drive              |
| LO     | Low                          |
| LR     | Left rear                    |
| LSD    | Limited slip differential    |

|        |                                  |
|--------|----------------------------------|
| LSPV   | Load sensing proportioning valve |
| M      | Motor                            |
| MAX    | Maximum                          |
| MFW    | Manual freewheel                 |
| MIN    | Minimum                          |
| OFF    | Switch off                       |
| ON     | Switch on                        |
| PCV    | Positive crankcase ventilation   |
| P/S    | Power steering                   |
| PID    | Parameter identification         |
| RF     | Right front                      |
| RFW    | Remote freewheel                 |
| RH     | Right hand                       |
| R.H.D. | Right hand drive                 |
| RR     | Right rear                       |
| SAS    | Sophisticated air bag sensor     |
| SST    | Special service tool             |
| SW     | Switch                           |
| TDC    | Top dead center                  |
| TNS    | Tail number side lights          |
| 2WD    | 2 wheel drive                    |
| WDS    | Worldwide diagnostic system      |
| 4WD    | 4 wheel drive                    |
| 4 × 2  | 4 wheel – 2 drive                |
| 4 × 4  | 4 wheel – 4 drive                |