# GROUP 00 INDEX

# EQUIPMENT TYPE CODES LIST

| Component | Name plate marking | | | | | Code description |
|---|---|---|---|---|---|---|
| Engine | | | | | | |
| 4M50-T | 4 | M | 5 | 0 | T | |
| | | | | | | Turbocharged<br>Order of development within same series<br>Order of development among different series<br>Diesel engine<br>No. of cylinders (4) |
| Clutch | | | | | | |
| C5W33 | C | 5 | W | 33 | | |
| | | | | | | Disc OD<br>Facing material (W: Woven)<br>Load carrying capacity of truck class (tonnage) on which the clutch is primarily used<br>Initial letter of the clutch |
| Transmission | | | | | | |
| M036S5W | M | 036 | S | 5 | W | |
| | | | | | | Variation (W: With directly-mounted transfer)<br>Forward speeds<br>Type of mesh (S: Synchromesh)<br>Load carrying capacity of truck class (tonnage) on which the transmission is primarily used<br>Initial letter of the transmission |
| Propeller shaft (driveshaft) | | | | | | |
| P3 | P | 3 | | | | |
| | | | | | | Load carrying capacity of truck class (tonnage) on which the propeller shaft is primarily used<br>Initial letter of the propeller shaft |
| Front axle | | | | | | |
| F200T | F | 200 | T | | | |
| | | | | | | Vehicle type (T: Truck)<br>Load carrying capacity of truck class (tonnage) on which the front axle is primarily used<br>Initial letter of the front axle |
| Rear axle | | | | | | |
| R033T | R | 03 | 3 | T | | |
| | | | | | | Vehicle type (T: Truck)<br>Order of development within same series<br>Load carrying capacity of truck class (tonnage) on which the rear axle is primarily used<br>Initial letter of the rear axle |
| Reduction and differential | | | | | | |
| D033H | D | 03 | 3 | H | | |
| | | | | | | Tooth profile (H: Hypoid gear)<br>Order of development within same series<br>Load carrying capacity of truck class (tonnage) on which the component is primarily used<br>Initial letter of the reduction & differential |

# POWER TRAIN TABLE

| Vehicle model | Engine | Clutch | Transmission | Propeller shaft | Rear axle | Reduction & differential |
|---|---|---|---|---|---|---|
| FE84DD6SLSUE | 4M50-T8 | Torque converter | M036A6 | P3 | R033T | D033H |
| FE84DE6SLSUE | 4M50-T8 | Torque converter | M036A6 | P3 | R033T | D033H |
| FE84DG6SLSUE | 4M50-T8 | Torque converter | M036A6 | P3 | R033T | D033H |
| FE84DH6SLSUE | 4M50-T8 | Torque converter | M036A6 | P3 | R033T | D033H |
| FE84DDZSLSUE | 4M50-T8 | Torque converter | M036A6 | P3 | R033T | D033H |
| FE84DEZSLSUE | 4M50-T8 | Torque converter | M036A6 | P3 | R033T | D033H |
| FE84DGZSLSUE | 4M50-T8 | Torque converter | M036A6 | P3 | R033T | D033H |
| FE84DHZSLSUE | 4M50-T8 | Torque converter | M036A6 | P3 | R033T | D033H |
| FE85DDZSLSUE | 4M50-T8 | Torque converter | M036A6 | P3 | R035T | D035H |
| FE85DEZSLSUE | 4M50-T8 | Torque converter | M036A6 | P3 | R035T | D035H |
| FE85DGZSLSUE | 4M50-T8 | Torque converter | M036A6 | P3 | R035T | D035H |
| FE85DHZSLSUE | 4M50-T8 | Torque converter | M036A6 | P3 | R035T | D035H |
| FE85DJZSLSUE | 4M50-T8 | Torque converter | M036A6 | P3 | R035T | D035H |

# HOW TO READ THIS MANUAL

This manual consists of the following parts:
- Specifications
- Structure and operation
- Troubleshooting
- On-vehicle inspection and adjustment
- Service procedures

## Specifications

- This section gives crucial dimensions, fluid quantities, or tolerances needed to keep the vehicle in good working order.

## Structure and operation

- This section gives general information about the component or system and explains how the component or system works.

## Troubleshooting

- This section gives specific information about how to read fault codes and correct common service problems.

## On-vehicle inspection and adjustment

- This section contains procedures for inspection and adjustment of individual parts and assemblies, including specific items to check and adjust. Whether specified or not, check for looseness, excessive play, backlash, cracks, damage, etc.
- Service standards are given in the manual to provide criteria for acceptance or rejection of any part.
- Even if not mentioned specifically in the service procedure, always do a routine visual check and cleaning of reused parts before installing them on the vehicle.

## Service procedures

- This section contains procedures for servicing vehicle components and systems, including removal, installation, disassembly, assembly, inspection, etc.

## Alert messages

- This workshop manual contains important hazard messages under the following four headings that identify the nature and importance of the information:

| | |
|---|---|
| **DANGER ⚠** | Imminent hazards that will result in severe personal injury or death. |
| **WARNING ⚠** | Hazards or unsafe practices that could result in severe personal injury or death. |
| **CAUTION ⚠** | Hazards or unsafe practices that could result in minor personal injury and/or damage to products or property. |
| **NOTE** | Relevant information that is helpful or informative but not associated with any risk or hazard. |

## Terms and Units

### ● Front and rear

The front is the forward direction of the vehicle and the rear is the reverse direction.

### ● Left and right

When facing forward, towards the front of the vehicle, objects on the left are on the left-hand side of the vehicle and objects on the right are on the right-hand side of the vehicle.

### ● Standard values

Standard values include the design dimensions of individual parts, the standard clearance between two parts when assembled, and the standard value for a parts assembly.

### ● Limit

Limits indicate wear dimensions of parts that become no longer serviceable when worn and must be replaced or repaired.

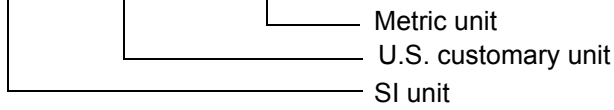
### ● Torque values

- In each section, specific values are given for non-standard fasteners.
- When no torque value is specified, use the “Table of standard torques” in this section. (Values for standard torques are based on thread size and material.)
- When a fastener is to be tightened “wet,” this will be indicated. Where there is no indication, assume it is dry.

### ● Units

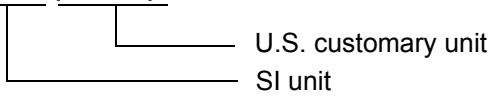
Torque values and other measurements are given in SI* units with U.S. customary and metric units added in brackets { }.
*SI: Le Système International d’Unités

Example: 390 N·m {290 lbf·ft, 40 kgf·m}




| Unit | | SI unit {U.S. customary, metric unit} | Conversion factor |
|---|---|---|---|
| Force | | N {lb, kgf} | 9.80665 N {2.2046 lb, 1 kgf} |
| Moment of force | | N·m {lbf·ft, kgf·m} | 9.80665 N·m {7.2329 lbf·ft, 1 kgf·m} |
| Pressure | Positive pressure | kPa {psi, kgf/cm$^2$} | 98.0665 kPa {14.22 psi, 1 kgf/cm$^2$} |
| | Vacuum pressure | kPa {inHg, mmHg} | 0.133322 kPa {0.03937 inHg, 1 mmHg} |
| Volume | | J {BTU, kcal} | 4186.05 J {3.96825BTU, 1 kcal} |
| Heat quantity | | W {BTU/h, kcal/h} | 1.16279W {3.96825BTU/h, 1 kcal/h} |

Example: 30 mm {1.18 in.}

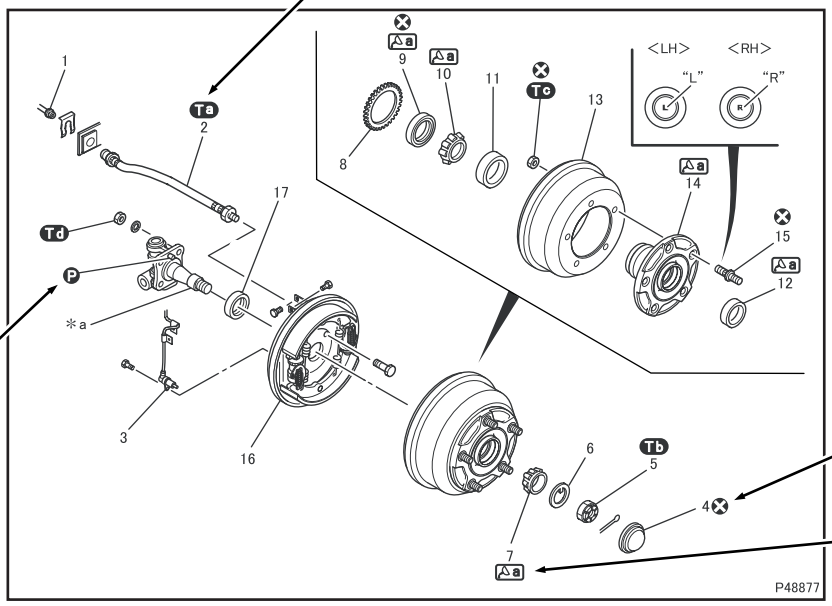



| Unit | SI unit {U.S. customary unit} | Conversion factor |
|---|---|---|
| Length | mm {in.} | 1 mm {0.03937 in.} |
| | m {ft.} | 1 m {3.2808 ft.} |
| | km {mile} | 1 km {0.6214 mile} |
| Weight | kg {lb} | 1 kg {2.2046 lb} |
| | g {oz} | 1 g {0.035274 oz} |
| Temperature (in degree Celsius) | °C {° F} | 1°C {(1°C × 1.8 + 32)° F} |
| Velocity | km/h {mph} | 1 km/h {0.6214 mph} |
| | m/s {ft/s} | 1 m/s {3.281 ft/s} |
| Volume | L {qt}, L {gal} | 1 L {1.05336 qt}, 1 L {0.2642 gal} |
| | cm$^3$ {cu.in.} | 1 cm$^3$ {0.061023 cu.in.} |
| Area | m$^2$ {in$^2$}, m$^2$ {ft$^2$} | 1 m$^2$ {1.550 × 10$^3$ in$^2$}, 1 m$^2$ {1.076 × 10 ft$^2$} |

| Symbol | Denotation | Application | Remarks |
|---|---|---|---|
| Ta | Torque value | Parts not tightened to standard torques (standard torques specified where necessary for servicing) | Specific values are shown in the tables. See Table of Standard Torques for fasteners for which no specific values are specified. |
| P | Locating pin | Parts to be positioned for installation | |
| ⊗ | Expendable part | Parts not to be reused | Replace the part whenever removed. |
| △a | Lubricant and/or sealant | Parts to be coated with lubricant or sealant for assembly or installation | The type of lubricant and/or sealant, and the quantity required, etc. are specified in the table. |
| Ca | Special tool | Parts for which special tools are required for service operation | Tool name/shape and part number are shown in table. |
| *a | Associated part | Parts associated with those removed/disassembled for servicing | |

Denotes that tightening torque is specified.

WHEEL HUB AND BRAKE DRUM




Indicates position of locating pin.

Identifies non-reusable parts.

Denotes that coating with lubricant or sealant is required.

P48877

● Disassembly sequence

1 Brake pipe
2 Brake hose
3 Wheel speed sensor
4 Hub cap
5 Lock nut
6 Lock washer
7 Outer bearing inner race
8 Anti-lock brake system rotor
9 Oil seal
10 Inner bearing inner race
11 Inner bearing outer race
12 Outer bearing outer race
13 Brake drum
14 Wheel hub
15 Hub bolt
16 Front drum brake (See Gr.35A)
17 Spacer

*a: Knuckle
P: Locating pin
⊗: Non-reusable parts

● Assembly sequence

Follow the disassembly sequence in reverse.

Service standards (unit: mm {in.})

| Location | Maintenance item | | Standard value | Limit | Remedy |
|---|---|---|---|---|---|
| 7, 10, 11, 12 | Starting torque of wheel hub bearing (Tangential force at hub bolt position with oil seal fitted in) | | 1 to 3.5 N·m {0.7 to 2.6 ft.lbs, 0.10 to 0.35 kgf·m} (Tangential force:8.8 to 28.4 N {2.0 to 6.4 lbs, 0.9 to 2.9 kgf}) | – | Adjust or replace |
| 14 | Brake drum | Inside diameter | 320 {12.6} | 322 {12.7} | Repair or replace |
| | | Cylindricality | 0.05 {0.0020} | 0.05 {0.0079} | |

These location numbers correspond with disassembly sequence numbers.

P58289N

"Wet" is indicated when part is to be tightened with oil or grease applied to its threaded part.

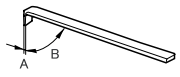
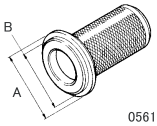
Tightening torque (unit: N·m {ft.lbs, kgf·m})

| Mark | Part to be tightened | Tightening torque | Remarks |
|---|---|---|---|
| Ta | Brake force tightening | 13 to 17 {9.6 to 13, 1.3 to 1.7} | – |
| Tb | Lock nut | 113 ± 15 {83 ± 11, 11.5 ± 1.5} | Wet |
| Tc | Nut (brake drum and wheel hub mounting) | 343 ± 39 {250 ± 29, 35 ± 4} | – |
| Td | Nut (front drum brake mounting) | 118 ± 20 {87 ± 15, 12 ± 2} | – |

Lubricant and/or sealant

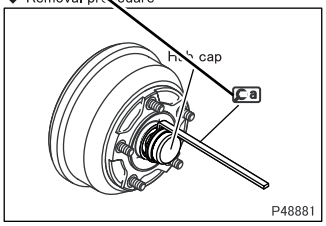
| Mark | Point of application | Specified lubricant and/or sealant | Quantity |
|---|---|---|---|
| Sa | Between rolls of outer bearing inner race and inner bearing inner race | Mitsubishi wheel bearing grease | As required |
| | Inside wheel hub | | 395 ± 40 g {13.9 ± 1.41 oz} |

Special tools (unit: mm {in.})

| Mark | Tool name and shape | Part No. | Application |
|---|---|---|---|
| Ca | Hub Cap Wrench<br>A: 0.5°, B: 78°<br>  <br>P49261 | MB999108 | Removal of hub cap |
| Cb | Oil Seal Installer<br>A: ϕ84 {3.31}, B: ϕ70 {2.76}<br>  <br>05619 | MB999097 | Installation of oil seal |

Identification marks for special tools are the same as used in the text.

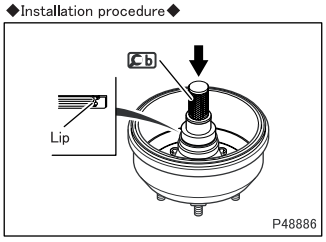
◆ Removal procedure



P48881

■Removal: Hub cap

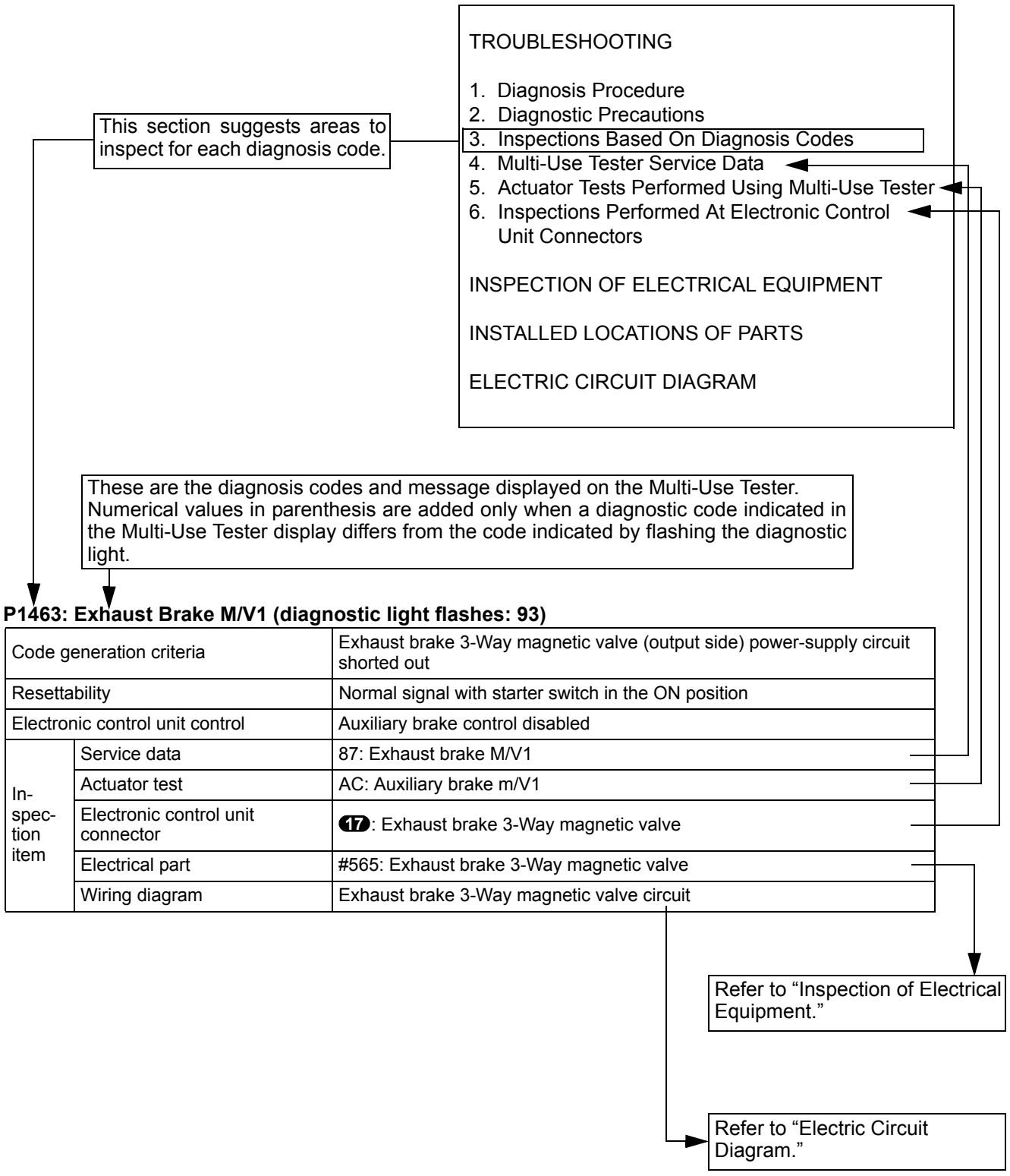
◆Installation procedure◆



P48886

■Installation: Oil seal
Apply grease to the lip of the oil seal, then fit the oil seal onto the wheel huh in the illustrated direction.

P58290N




**P1463: Exhaust Brake M/V1 (diagnostic light flashes: 93)**

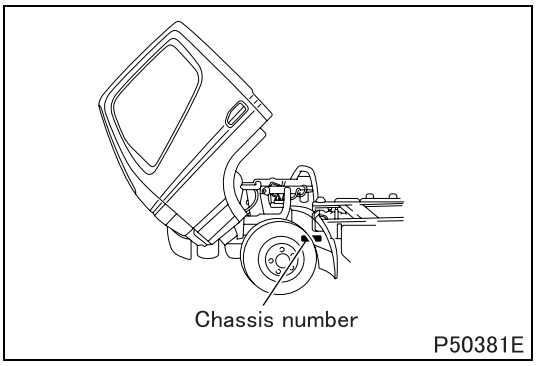
| | | |
|---|---|---|
| Code generation criteria | | Exhaust brake 3-Way magnetic valve (output side) power-supply circuit shorted out |
| Resettability | | Normal signal with starter switch in the ON position |
| Electronic control unit control | | Auxiliary brake control disabled |
| In-spec-tion item | Service data | 87: Exhaust brake M/V1 |
| | Actuator test | AC: Auxiliary brake m/V1 |
| | Electronic control unit connector | ⓱: Exhaust brake 3-Way magnetic valve |
| | Electrical part | #565: Exhaust brake 3-Way magnetic valve |
| | Wiring diagram | Exhaust brake 3-Way magnetic valve circuit |

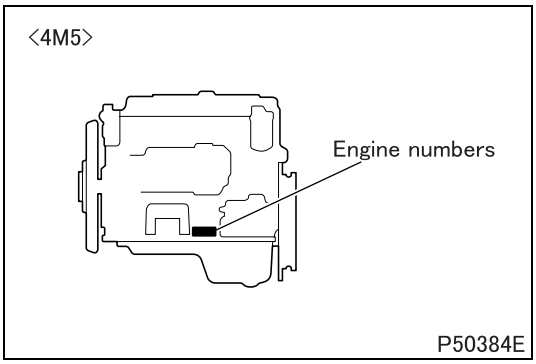
Refer to “Inspection of Electrical Equipment.”

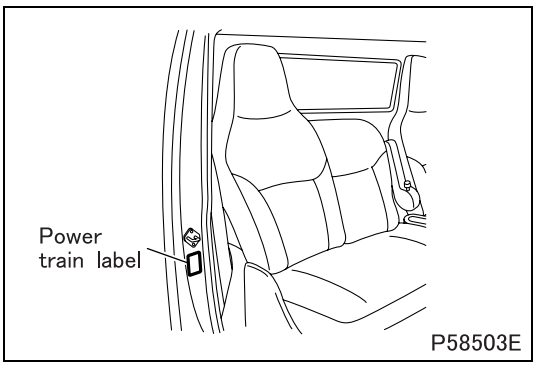
Refer to “Electric Circuit Diagram.”

# CHASSIS NUMBER, ENGINE NUMBER, POWER TRAIN LABEL

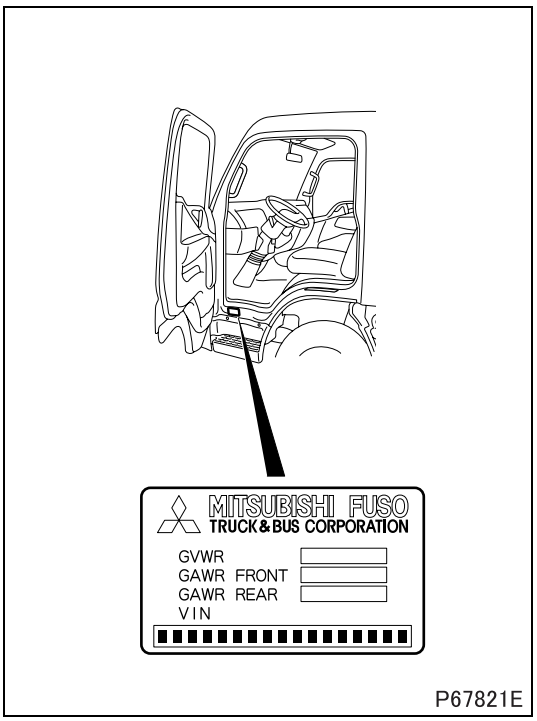
- Chassis and engine numbers are allocated to each vehicle and engine as they are produced. These numbers are required for registration.




- The power train label, located on the passenger door B-pillar, indicates the vehicle model, chassis number and the serial numbers of the vehicle's powertrain components.




- The vehicle identification number is punch-marked on the plate attached inside the driver's door, as shown in the illustration.
  The vehicle identification number consists of a 17-digit set of alphanumeric characters. Each digit represents the following specifications.

| J | L | S | B | B | D | 1 | S | ■ | 9 | K | ■■■■■■ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |

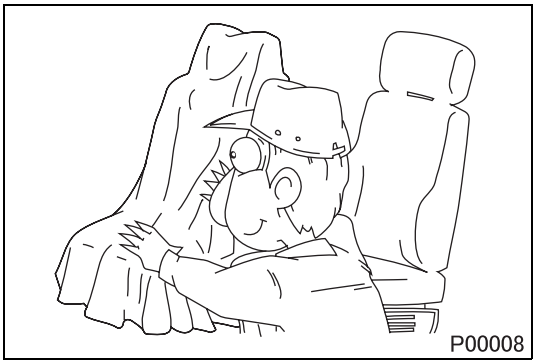
| | | | |
|---|---|---|---|
| (1) | Country | J: | Japan |
| (2) | Make | L: | Mitsubishi Fuso |
| (3) | Type | S: | Sterling incomplete vehicle |
| (4) | Gross vehicle weight / Brake system | | |
| | | A: | 10,001 to 14,000 lb / Hydraulic |
| | | B: | 14,001 to 16,000 lb / Hydraulic |
| | | C: | 16,001 to 19,500 lb / Hydraulic |
| (5) | Line | A: | Sterling 360 COE 30 |
| | | B: | Sterling 360 COE 45 |
| | | C: | Sterling 360 COE 50 |
| (6) | Series (Wheel base) | D: | 2.90 to 3.19 m (9.51 to 10.46 ft.) |
| | | E: | 3.20 to 3.49 m (10.49 to 11.44 ft.) |
| | | G: | 3.80 to 4.09 m (12.46 to 13.41 ft.) |
| | | H: | 4.10 to 4.39 m (13.45 to 14.40 ft.) |
| | | J: | 4.40 to 4.69 m (14.43 to 15.38 ft.) |
| | | K: | 4.7 to 4.99 m (15.41 to 16.37 ft.) |
| (7) | Cab chassis type | 1: | COE 4X2 chassis cab |
| (8) | Engine | S: | Proprietary 4M50 4.9 L inline 4 Diesel |
| (9) | Check digit | | |
| (10) | Model year | 9: | 2009 |
| (11) | Plant | K: | Kawasaki |
| (12) | Plant sequential number | | |

# PRECAUTIONS FOR MAINTENANCE OPERATION

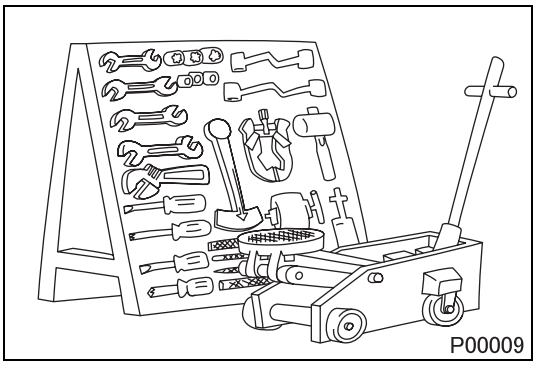
## DANGER ⚠

**This product contains or emits chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.**

- Before performing any service operations, inquire into the customer's complaints, determine the condition of the vehicle, check the distance traveled, look into the severity and type of service it has undergone, and note any other relevant factors. Assemble all the information needed to help you to service the vehicle efficiently.
- Check the location of the fault, and identify its cause. Based on your findings, determine whether parts must be removed or replaced. Follow the service procedures in this manual.


P00008

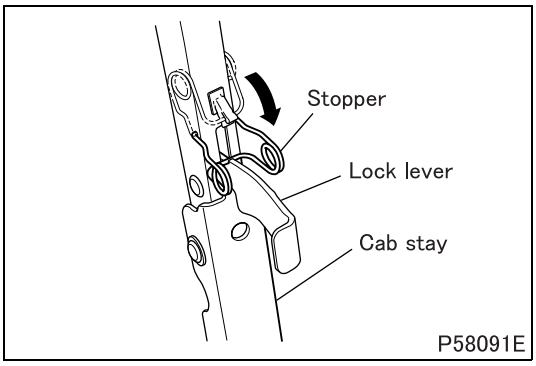
- Perform service operations on a level surface. Before starting, take the following preparatory steps:
  - To prevent soiling and damage, place covers over the seats, trim and floor in the cab and over the paint work of the body.


P00009

- Have ready all the tools necessary for the job, including special tools as required.

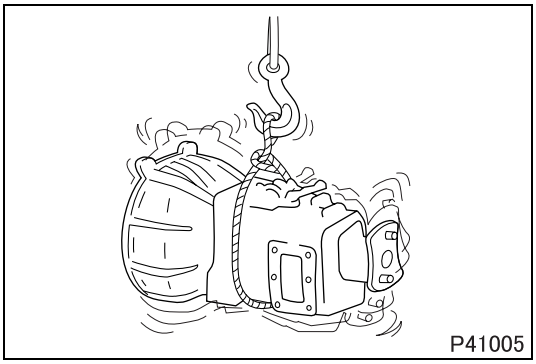
## CAUTION ⚠

- **Special tools must be used whenever this manual requires them. Do not attempt to use other tools since they could cause injuries and/or vehicle damage.**

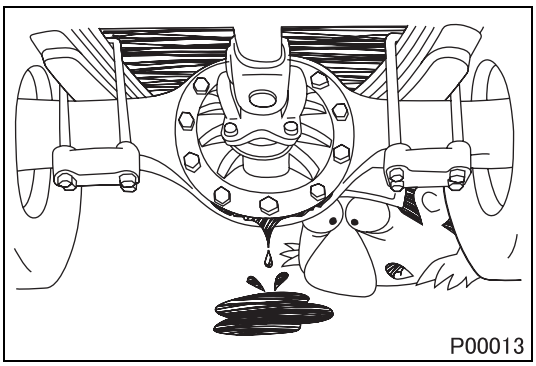


P58091E

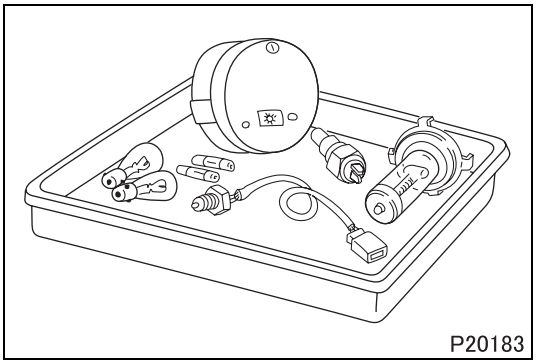
- When tilting the cab, be sure to engage the stopper (hold-down) with the lock lever. This will secure the cab stay and support the cab.
- Take extreme care when removing or installing heavy units such as the engine, transmission, or axle. When lifting heavy units using a cable etc., observe the following precautions.
- Know the weight of the unit being lifted. Use a lifting device and cable that is strong enough to support that weight.


P41005

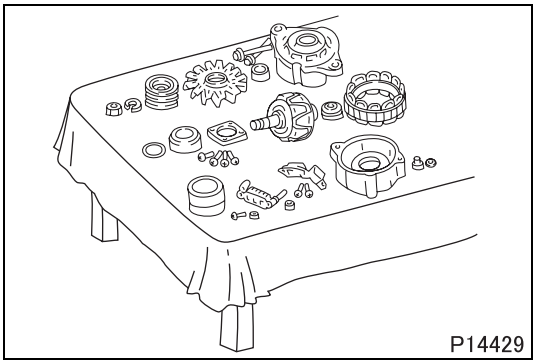
- If lifting eyes are not provided, tie a cable around the unit taking into account the unit's center of gravity.
- Do not allow anyone to walk or stand underneath a unit suspended on a lifting device.
- Never work in shoes with oily soles.
  When working with a partner or in a group, use pre-arranged signals and pay constant attention to safety. Be careful not to touch switches and levers unintentionally.


P00013

- Inspect for fluid leaks before washing the vehicle. Signs of fluid leaks may go unnoticed on a freshly-washed vehicle.


P20183

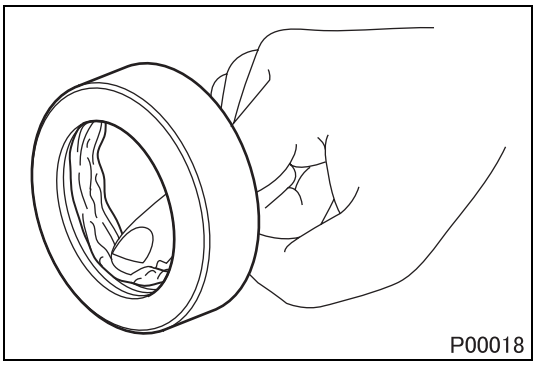
- Have replacement parts ready for installation.
- Oil seals, packings, O-rings and other rubber parts, gaskets, and split pins must be replaced with new ones after removal.
- When disassembling parts, visually check them for wear, cracks, damage, deformation, deterioration, rust, corrosion, defective rotation, fatigue, clogging and any other possible defect.


P14429

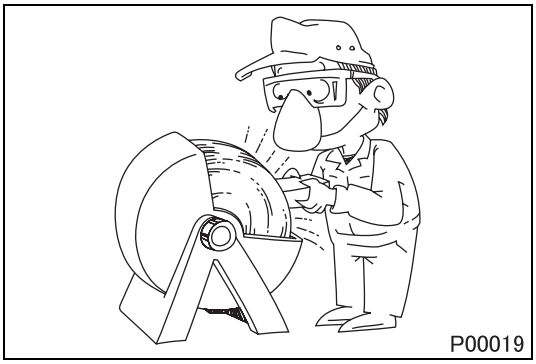
- To facilitate correct reassembly of parts, mark them with a paint pen before disassembly and arrange the disassembled parts neatly. Make alignment marks where they will not detract from parts' functionality and appearance.
- After removing parts from the vehicle, cover the area to keep it free of dust.

**NOTE**

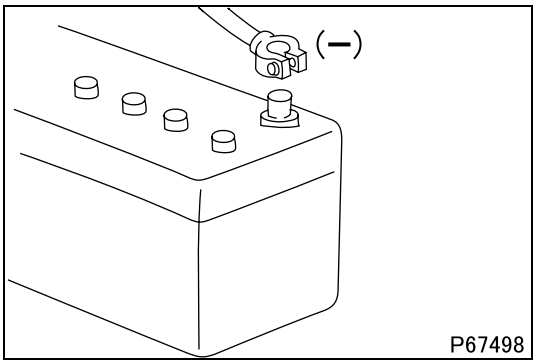
- **Be careful not to mix up identical parts, similar parts and parts that have left/right alignments.**
- **Keep new replacement parts and original (removed) parts separate.**


P00018

- Apply oil or grease as specified to O-rings, oil seals, dust seals and bearings before reassembly.
- Always use the required oils and greases when performing inspection or replacement. Immediately wipe away any excess oil or grease with a shop towel.


P00019

- Wear safety goggles when using power tools or equipment. Wear gloves when necessary, and watch out for sharp edges and other items that might injure your hands.

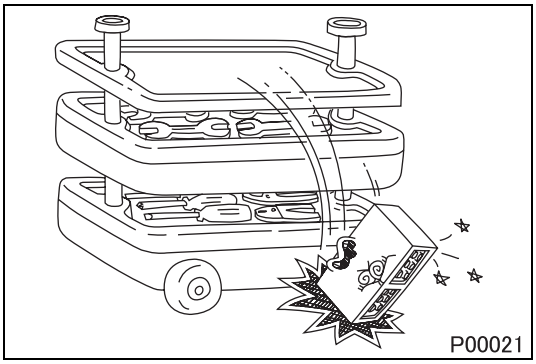


P67498

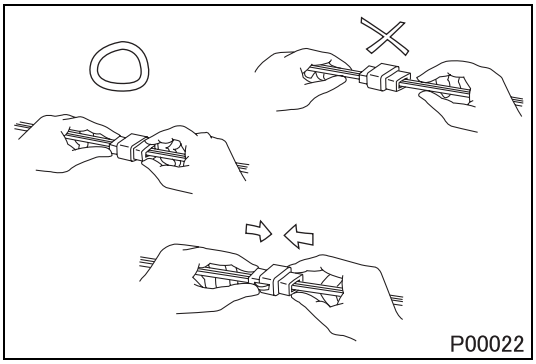
- Before working on the electrical system, disconnect the battery's (–) cable to prevent short circuits.

**CAUTION ⚠**

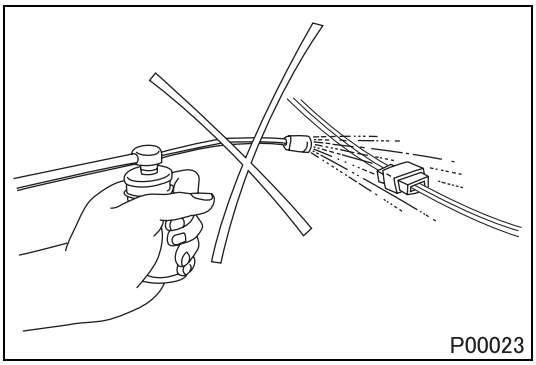
- **Make sure the ignition switch and all light switches are OFF before disconnecting or connecting battery cable. This will prevent damage to semiconductor components.**


P00021

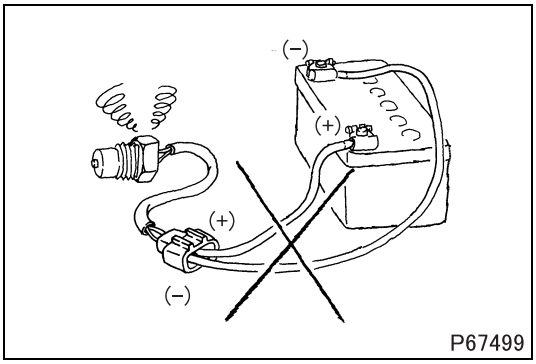
- Carefully handle sensors, relays, and other items that are sensitive to shock and heat. Do not remove or paint the cover of any control unit.


P00022

- When separating connectors, grasp the connectors themselves rather than the harnesses.
- To separate locking connectors, first push them in the direction of the arrows. To reconnect locking connectors, push them together until they click.

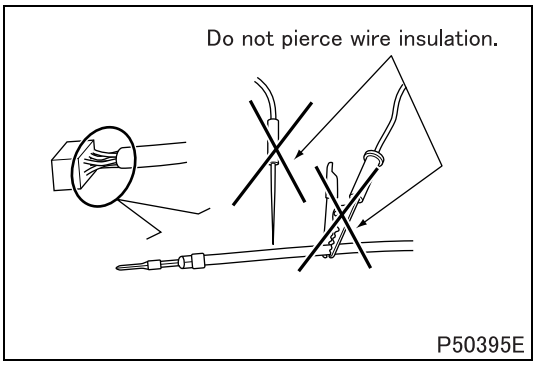

P00023

- Before washing the vehicle, cover all electrical parts to keep them dry. (Use plastic sheets or the like.) Keep water away from harness connectors and sensors and immediately wipe off any water that gets on them.




- When applying a voltage to a part for inspection purposes, check that the (+) and (–) cables are connected properly then gradually increase the voltage from zero. Do not exceed the specified voltage.
  Remember that control units and sensors do not necessarily operate on battery voltage.

## 1. Handling Precautions for Electric Circuits



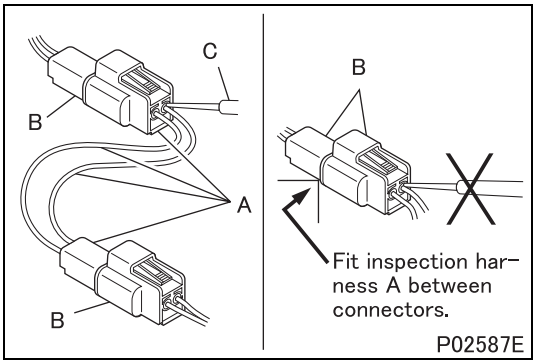

**CAUTION ⚠**

- **Do not pierce wire insulation with test probes or alligator clips when performing electrical inspections. Doing so can hasten corrosion, particularly with the chassis harness.**

### 1.1 Inspection of harnesses

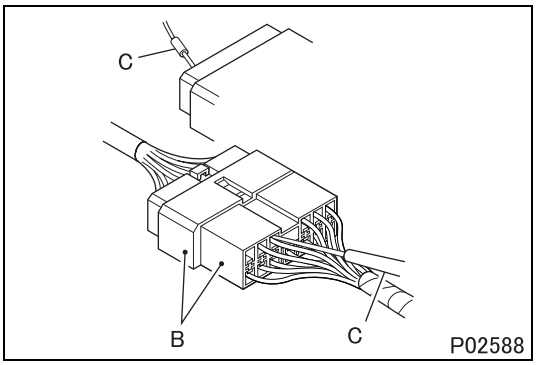
**(1) Inspections with connectors fitted together**

**(1.1) Waterproof connectors**

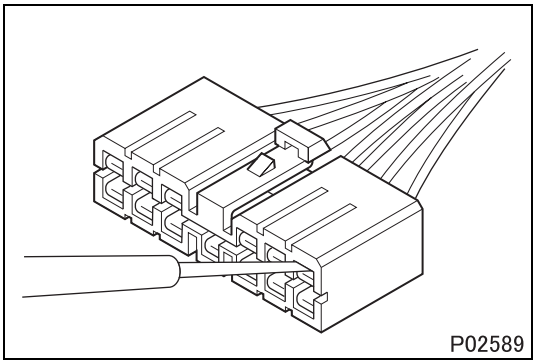



- Connect an inspection harness and connector **A** between the connectors **B** of the circuit to be inspected. Perform the inspection by applying a test probe **C** to the connectors of the inspection harness. Do not insert the test probe **C** into the wire-entry sides of the waterproof connectors since this would damage their waterproof seals and lead to rust.

**(1.2) Non-waterproof connectors**



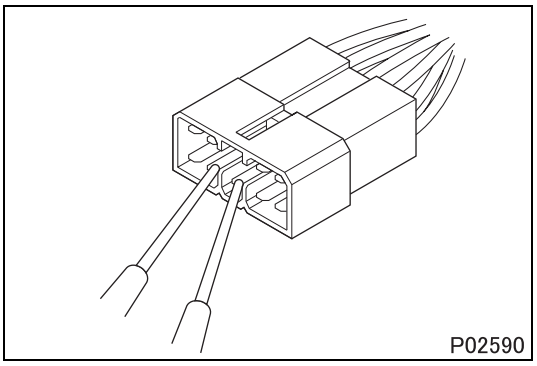

- Perform the inspection by inserting a test probe **C** into the wire-entry sides of the connectors. An extra-narrow probe is required for control unit connectors, which are smaller than other types of connector. Do not force a regular-size probe into control unit connectors since this would cause damage.


P02589

**(2) Inspections with connectors separated**

**(2.1) Inspections on female terminals**

- Perform the inspection by carefully inserting a test probe into the terminals. Do not force the test probe into the terminals since this could deform them and cause poor connections.

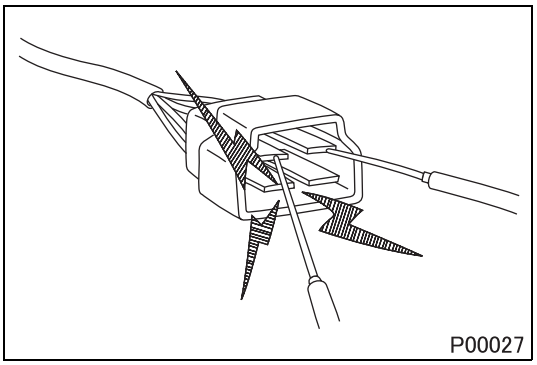

P02590

**(2.2) Inspections on male terminals**

- Perform the inspection by applying test probes directly to the pins.

**CAUTION ⚠**

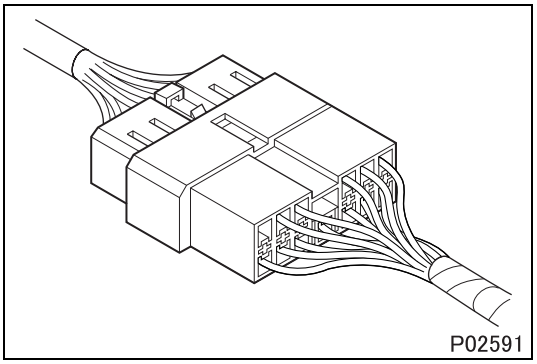
- **Be careful not to short-circuit pins through the test probes. If the pins of a control unit connector become short-circuited, this can cause damage to the control unit's internal circuitry.**


P00027

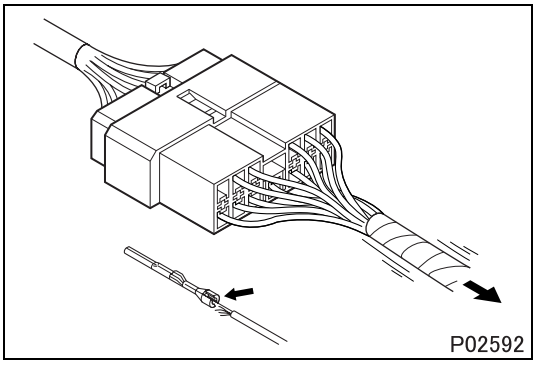
- When using a multimeter to check continuity, do not allow the test probes to touch the wrong terminals.

## 1.2 Inspection of connectors

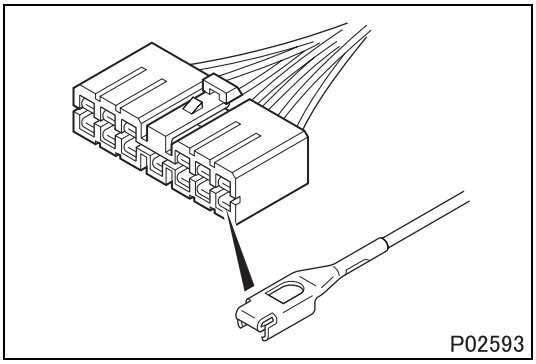
**(1) Visual inspection**


P02591

- Check that the connectors are fitted together securely.

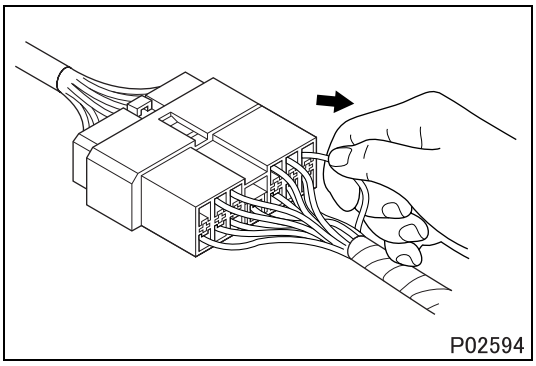

P02592

- Check for wires that have separated from their terminals due to pulling of the harness.


P02593

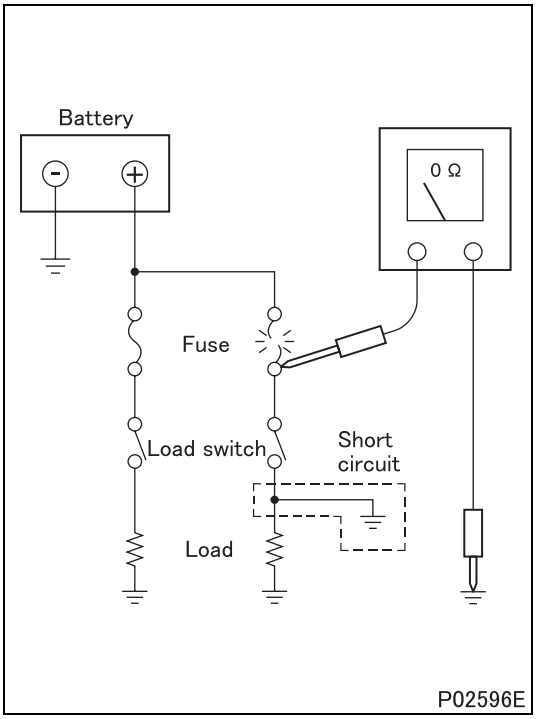
- Check that male and female terminals fit together tightly.

- Check for defective connections caused by loose terminals, by corrosion on terminals, or by contamination of terminals by foreign materials.


P02594

**(2) Checking for loose terminals**

- On a connector, if terminal retainers become damaged, male and female terminals may not mate with each other when the connector bodies are fitted together. To check for such terminals, gently tug on each wire and see whether any terminals slip out of their connector housings.

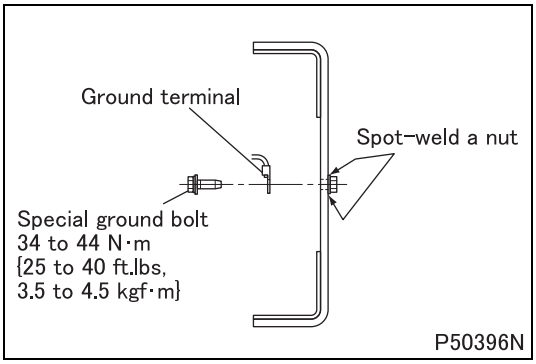


P02596E

### 1.3 Inspections when a fuse blows

- Remove the fuse, then measure the resistance between ground and the fuse's load side.
  Next, close the switch of each circuit connected to the fuse. If the resistance measurement between any switch and ground is zero, there is a short circuit between the switch and the load. If the resistance measurement is not zero, the circuit is not currently short-circuited; the fuse probably blew due to a momentary short circuit.

- The main causes of short circuits are as follows:
  - Harnesses trapped between chassis parts
  - Harness insulation damage due to friction or heat
  - Moisture in connectors or circuitry
  - Human error (accidental short-circuiting of components)




### 1.4 Inspection of chassis ground

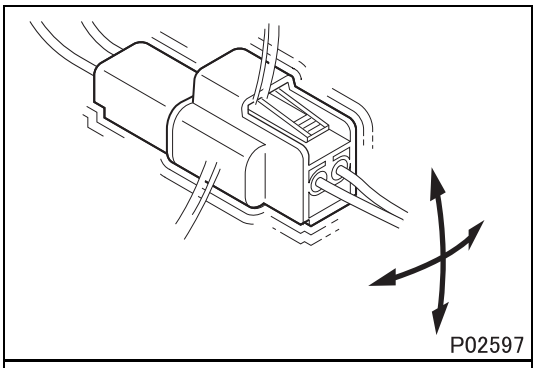
- A special ground bolt is used to tighten a ground terminal. When servicing the ground point, be sure to follow the procedures described below:
  - When reinstalling the ground bolt
    Tighten the ground bolt to the specified torque.
  - When relocating the ground point
    A special ground bolt must be used. Spot-weld a nut to a frame and tighten the ground bolt to the specified torque. Be sure to apply touch-up paint to the welded point.

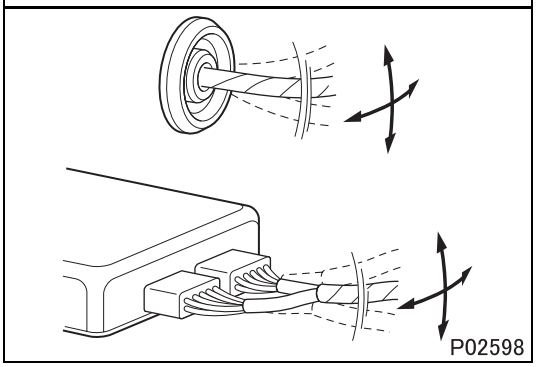
## 2. Service Precautions for Alternators

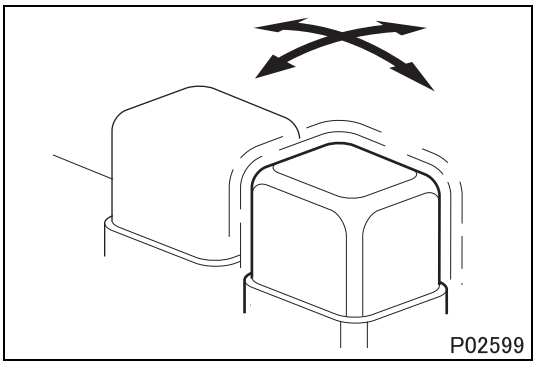
When servicing alternators, observe the following precautions:

- Never reverse the polarity of battery connections.
  If the polarity of the battery connections were to be reversed, a large current would flow from the battery to the alternator, damaging the diodes and regulator.
- Never disconnect the battery cables with the engine running.
  Disconnection of the battery cables during engine operation would cause a surge voltage, leading to damage to the diodes and regulator.
- Never perform inspections using a high-voltage multimeter.
  The use of a high-voltage multimeter could damage the diodes and regulator.
- Keep alternators dry.
  Water on alternators can cause internal short circuits and damage.
- Never operate an alternator with the B and L terminals short-circuited. Operation with the B and L terminals connected together would damage the diode trio.
- Disconnect the battery cables before quick-charging the battery with a quick charger.
  Unless the battery cables are disconnected, quick-charging can damage the diodes and regulator.

## 3. Intermittent Faults




- An intermittent fault typically occurs only under certain operating conditions. Once these conditions have been identified, the cause of the intermittent fault is easy to determine. First, ask the customer about the vehicle operating conditions and weather conditions under which the fault occurs. Also ask about the frequency with which the fault occurs and about the fault symptoms. Then reproduce the fault based on this information.
  Determine in this way if factors such as heat or vibration play a role in producing the fault. If vibration is a possible factor, try to reproduce the fault by doing the following:
  - Gently move connectors up and down and to left and right.
  - Gently move wiring harnesses up and down and to left and right.
  - Gently wiggle sensors and other devices by hand.
  - Gently wiggle wiring harnesses on suspension systems and other moving parts.

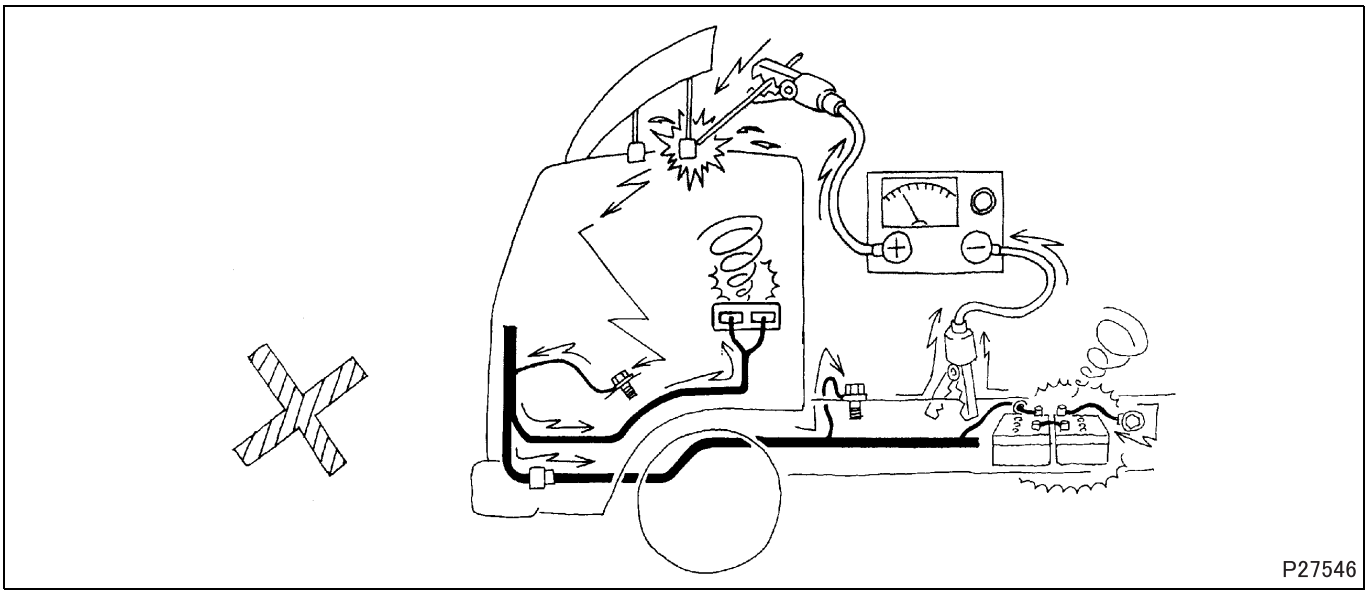
- To identify the connectors, harnesses, and other devices to be checked, consult the troubleshooting procedures for the affected system in this manual.

## 4. Precautions for Electric Welding

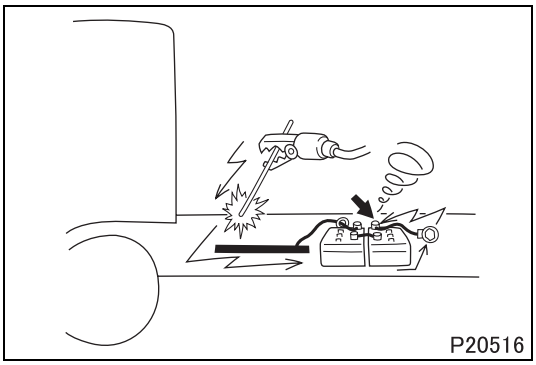
**WARNING ⚠**

- **Before performing any electric welding on a vehicle, disconnect the battery power and ground cable, and any electronic control units or similar devices installed on the vehicle. Electric currents produced during electric welding can damage various electrical components on the vehicle, which could result in malfunction of the components.**

Electric current from the welder flows to ground via the vehicle's metal parts. Unless appropriate steps are taken, this current can damage control units, other electrical devices and wiring harnesses.
Any electrical device near the point of attachment of the welding ground strap is especially liable to damage.




- Current flows backward as shown below.




### 4.1 From battery (–) cable

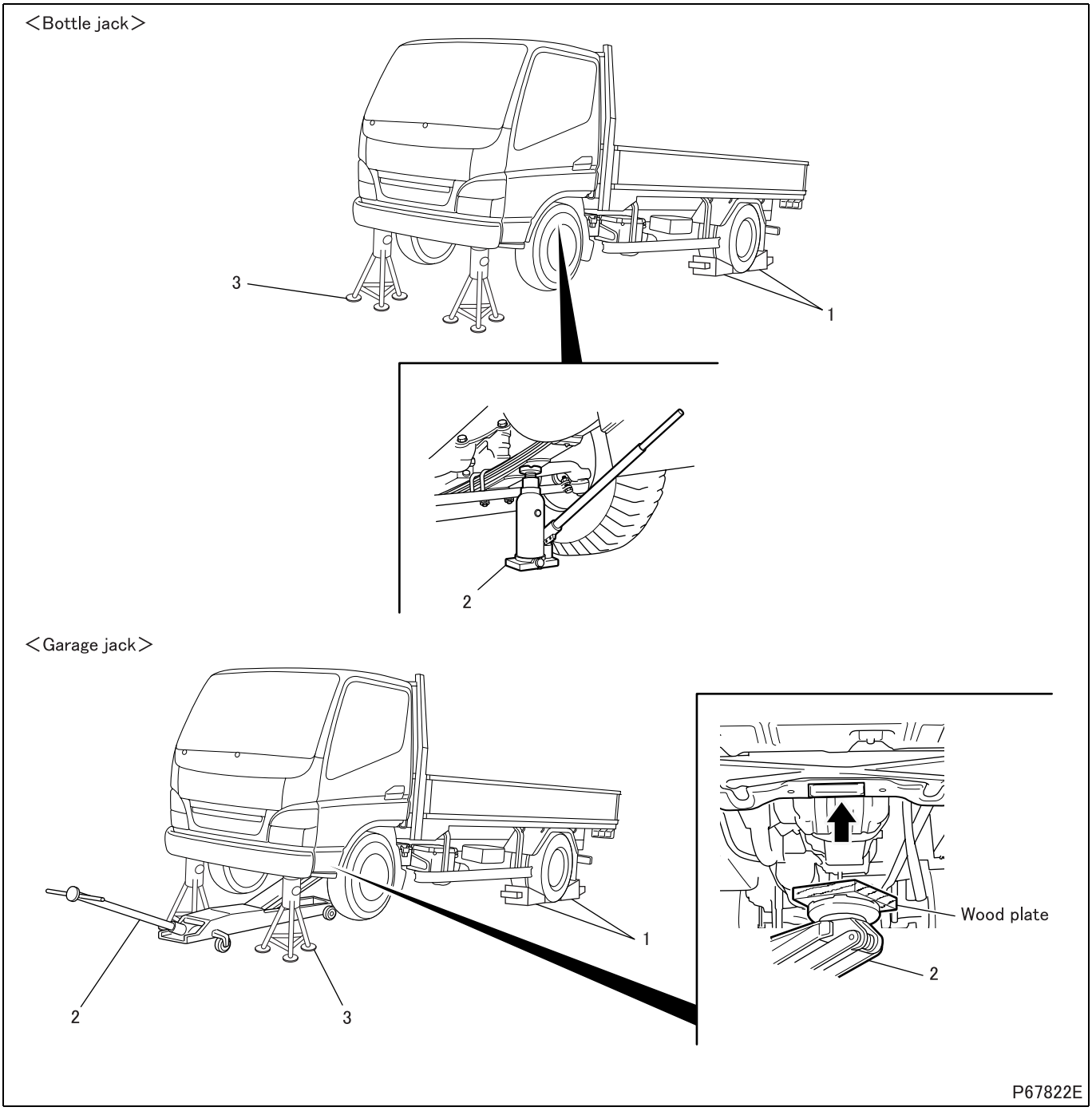
To prevent damage to the battery and to electrical devices that are connected directly to the battery, it is essential to disconnect the batteries.

### 4.2 Procedure

- Park the vehicle on a level surface. Shut down the engine and turn the ignition switch to LOCK.
- Set the parking brake and chock the front and rear tires.
- Disconnect the batteries.
- Attach the welding ground strap as close as possible to the work being done. If the frame is being welded, do not attach the welding ground strap to the cab. Similarly, If the cab is being welded, do not attach the welding ground strap to the frame.
- Cover all parts of the vehicle that may be damaged by welding sparks.
- Disconnect the engine, transmission, and ABS electronic control units.

M E M O

**<Front of vehicle>**




**Jacking procedure**

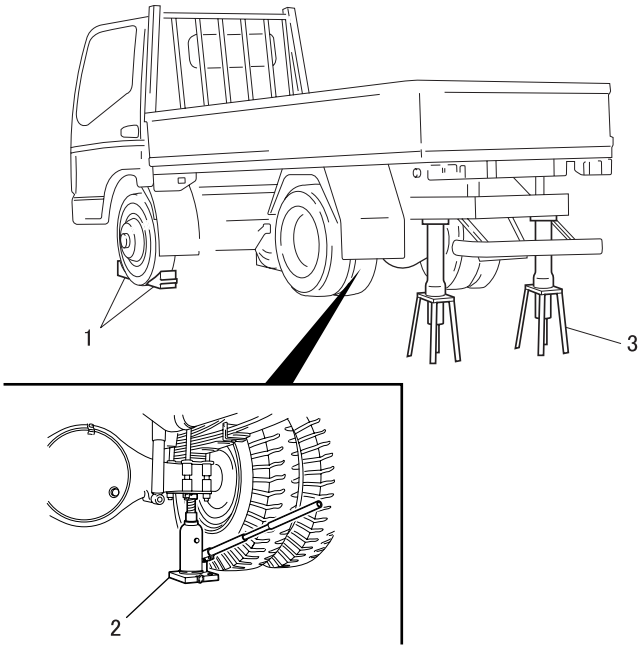
**1** Chock the rear tires.
**2** Using an axle or floor jack, raise the front of the vehicle.
**3** Support the vehicle frame on safety stands.

## WARNING ⚠

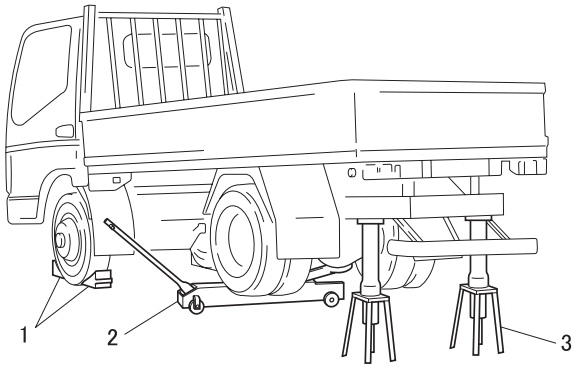
- **To prevent the vehicle from rolling, chock the tires firmly and do not remove the chocks until the operation is completed.**
- **Never work around or under a vehicle that is supported only by a jack. Always support the vehicle with safety stands. Jacks can slip, allowing the vehicle to fall, which could result in serious injury or death.**

**<Rear of Vehicle>**

＜Bottle jack＞




＜Garage jack＞




P58509E

**Jacking up procedure**

**1** Chock the front tires.
**2** Using an axle or floor jack, raise the front of the vehicle.
**3** Support the vehicle frame on safety stands.

## WARNING ⚠

- **To prevent the vehicle from rolling, chock the tires firmly and do not remove the chocks until the operation is completed.**
- **Never work around or under a vehicle that is supported only by a jack. Always support the vehicle with safety stands. Jacks can slip, allowing the vehicle to fall, which could result in serious injury or death.**

## 1. Diagnosis Codes

- Diagnosis codes indicate the faulty sections of the vehicle.
- A fault can be repaired by reading out the diagnosis code(s) stored in the control unit and performing the remedy for that code(s).
- Diagnosis codes can be displayed in the following two methods. Select either of them according to the system to be diagnosed.
  - Using a scanning tool (General Scanning Tool or Multi-Use Tester)
  - Using flashing of a warning lamp on meter cluster
- The table below indicates the systems for which diagnosis codes can be displayed and the methods usable for individual systems.

### 1.1 Systems and diagnosis code displaying methods

| Warning lamp | System | Diagnosis codes displaying methods | | Reference Gr |
|---|---|---|---|---|
| | | Multi-Use Tester | Flashing of warning lamp | |
| CHECK ENGINE or | Common rail | O | O | 13EA |
| | Exhaust gas recirculation | | | 17 |
| | Starter continuous energizing preventing function, Preheating system | | | 54 |
| MVCU | Vehicle speed limiting (SLD) | O | O | 13EB |
| | Auto cruise | | | |
| | Automatic transmission | O | O | 23 |
| ABS or ABS | Anti-lock brake system | O | O | 35E |

### 1.2 Types of diagnosis codes <Except Gr13EA and Gr23>

**(1) System for which present and past codes are discriminately displayed**

**(1.1) Present diagnosis code**

- Fault developed in the vehicle after the starter switch is set to ON is indicated by corresponding diagnosis code.
- The fault warning lamp is lit at the same time.

**(1.2) Past diagnosis code**

- Past fault developed in the vehicle is indicated by corresponding diagnosis code stored in the memory of the electronic control unit.
- With the vehicle restored to its normal condition or the starter switch turned from OFF to ON after inspection or repair against present diagnosis codes, the present diagnosis code is stored as past diagnosis codes in the memory of the electronic control unit.
- The warning lamp is not lit because the indicated fault is not present one.

### 1.3 Types of diagnosis codes <Gr13EA and Gr23>

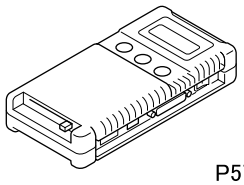
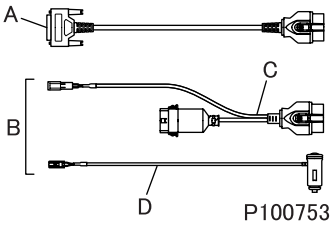
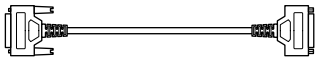
- The diagnosis codes has no distinction of present and past.
- If a fault occurs and an electronic control unit detects the fault, the electronic control unit will store a diagnosis code in memory after a diagnosing time predetermined for each fault content and turn on the warning lamp.
- When the fault has solved, the warning lamp goes off, but the diagnosis code still remains in the memory.
- The diagnosis codes can be erased by using the scanning tool (General Scanning Tool or Multi-Use Tester) or they will be erased automatically after a specified period.

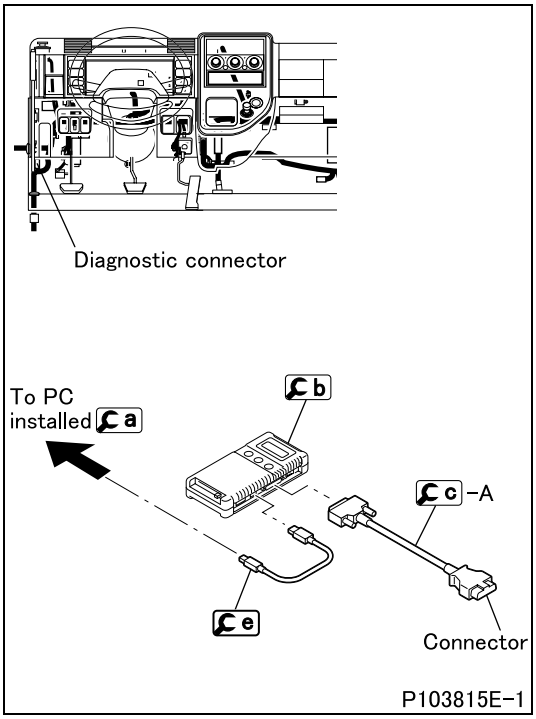
# 2. Reading and Erasing the Diagnosis Code

## 2.1 Using a Multi-Use Tester

### (1) Connecting a Multi-Use Tester

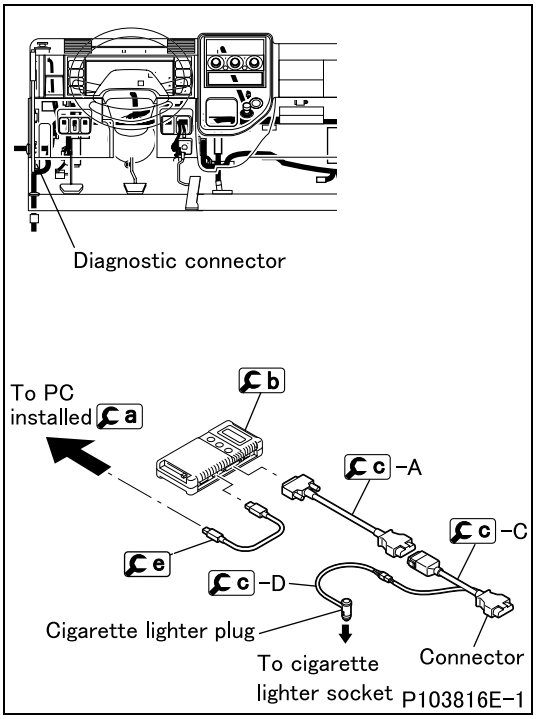
### Special tools

| Mark | Tool name and shape | Part No. | Application |
|---|---|---|---|
| a | PC   P100236 | SMS-E08-1* (Multi-Use Tester-III version) | Installation of the Muti-Use-Tester-III or version-up of the current version into Multi-Use Tester-III SOFTWARE DISC (Pub. No. SN0801C) |
| b | V.C.I.  P57296 | MH062927 | Data transmission between electronic control unit and PC |
| c | Multi-Use Tester test Harness E<br>A: Harness for inspection and drive recorder<br>B: Harness for drive recorder<br>C: Drive recorder harness<br>D: Cigarette lighter plug harness   P100753 | MH063659<br>A: MH063661<br>B: MH063663<br>C: MH063665<br>D: MH063666 | Power supply to V.C.I. and communication with electronic control unit |
| d | Multi-Use Tester test harness D (used for extension)  P57299 | MH062951 | Multi-Use Tester test harness B extension |
| e | USB cable  P57300 | MH063668 | Communication between V.C.I. and PC |



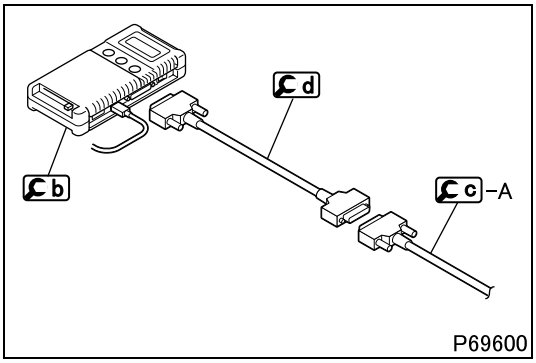

**(1.1) To perform system inspection**

- Move the starter switch to the LOCK position.
- Connect PC installed a, b, c-A and e as shown.
- Connect c-A connector to the diagnostic connector on the vehicle.




**(1.2) To use drive recorder function**

- Move the starter switch to the LOCK position.
- Connect PC installed a, b, c-A, c-C, c-D and e as shown.
- Connect c-C connector to the diagnostic connector on the vehicle.
- Connect the cigarette lighter plug of c-D to the cigarette lighter socket on the vehicle.




**(1.3) To extend the Multi-Use Tester test harness**

- Connect d to c-A to extend the test harness to use the Multi-Use Tester outside the vehicle.

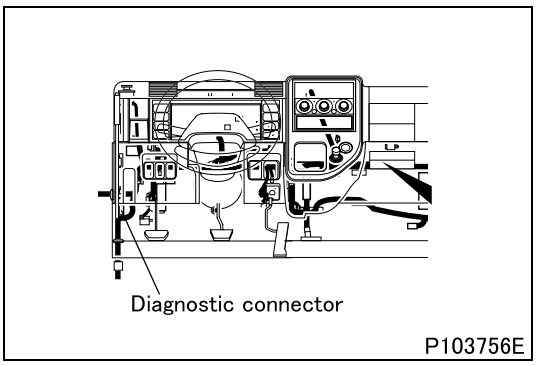
**(2) Access of diagnosis code**

- Set the starter switch to ON.
- Operate the Multi-Use Tester for a display of necessary diagnosis code stored in the memory of the electronic control unit and identify the location of the fault.

**(3) Clearing of diagnosis code**

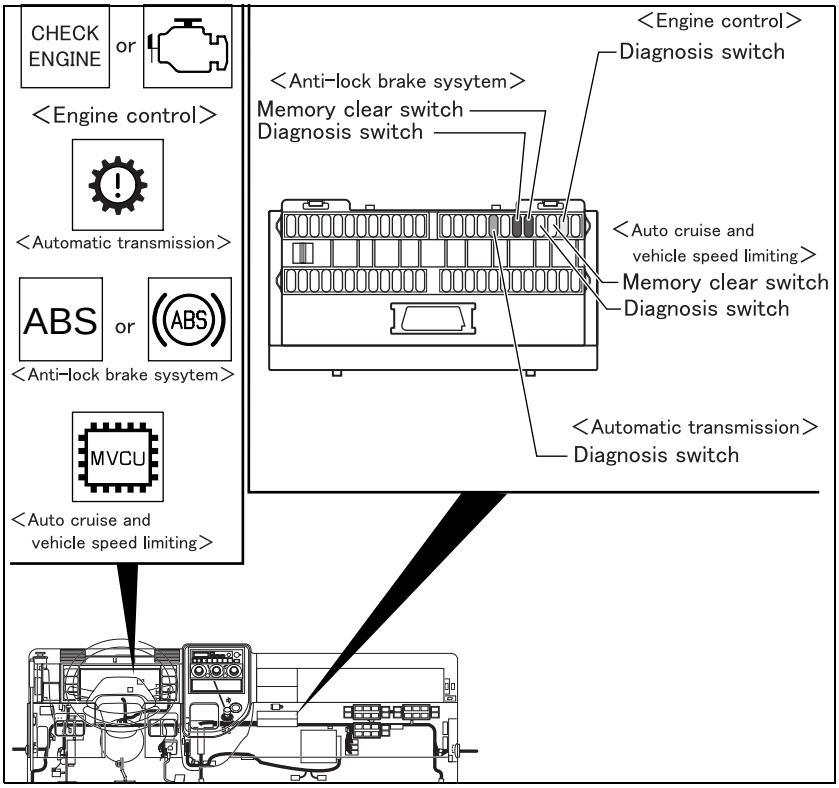
- Set the starter switch to ON (the engine not to be started).
- Operate the Multi-Use Tester to delete all the diagnosis codes stored in the memory of the electronic control unit.

### 2.2 Using a General Scanning Tool




- For the usage of a General Scanning Tool, refer to the instruction manual for that tool.

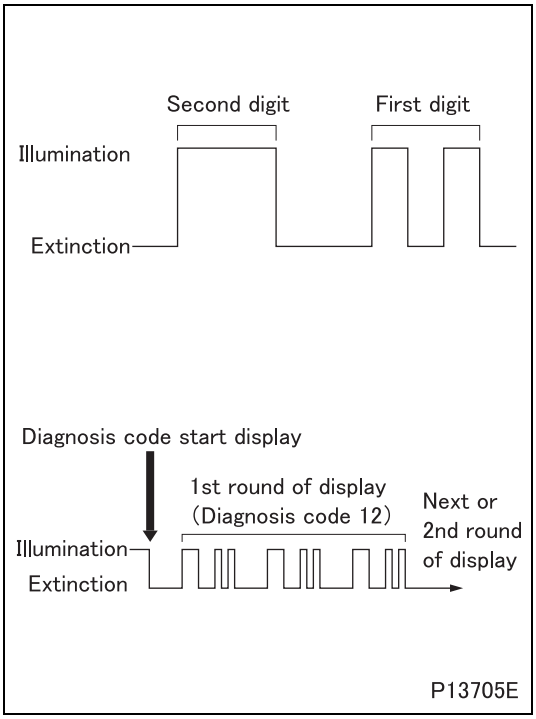
## 3. Retrieving Diagnosis Codes Using the Flashing Diagnostic Light




- Use the diagnosis and memory clear switches to display diagnosis codes.

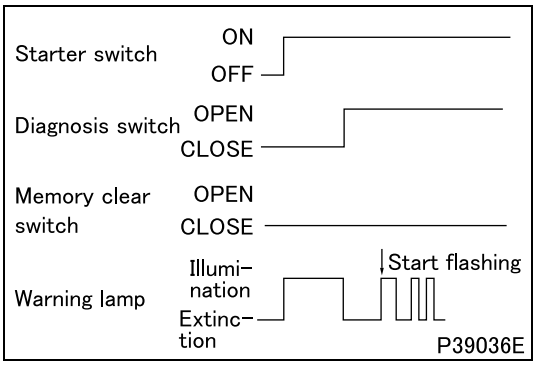
**CAUTION ⚠**

- **Disconnecting and connecting the memory clear switch can erase past diagnosis codes from memory. Before handling diagnosis codes, carefully follow the procedure described below to avoid erasing codes inadvertently. <Except Gr13EA and Gr23>**



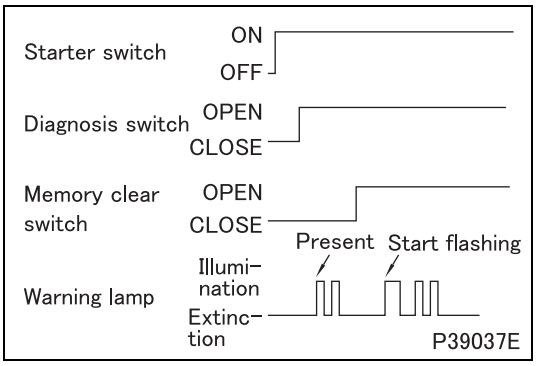

### 3.1 Reading diagnosis codes

- To read a diagnosis code, observe how may times the warning lamp flashes and how long each illumination lasts.
- The duration of illumination differs between the first and second digits.
  - Second digit: 1.2 sec.
  - First digit: 0.4 sec.
- A diagnosis code consists of the flashing of second digit and the flashing of first digit in that order. If a diagnosis code has “0” in the second digit, only the first digit will be displayed.
- The diagnosis code 01 will be displayed if the system is normal.
- The same diagnosis code will be displayed 3 times in a row before moving to the display of the next code.
- After the last diagnosis code is displayed, the first code will be displayed again 3 times in a row and then the subsequent codes. This will be repeated.



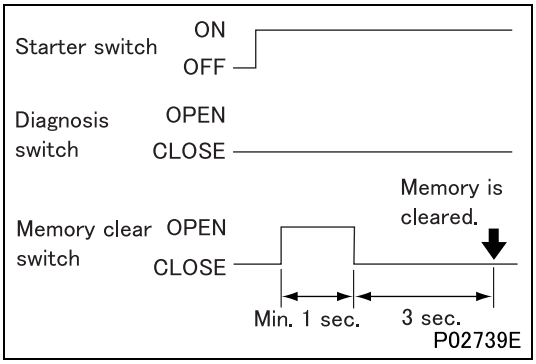

**(4) Diagnosis codes <Gr13EA and Gr23>**
**Present diagnosis codes <Except Gr13EA and Gr23>**

- Turn the starter switch ON.
- Remove the diagnosis switch.
- Present diagnosis codes will be displayed by flashing of the warning lamp.
- When the diagnosis switch is connected, electronic control unit will stop (terminate) displaying diagnosis codes.




**(5) Present and past diagnosis codes <Except Gr13EA and Gr23>**

- Turn the starter switch to the ON position.
- Open the diagnosis switch.
- Present diagnosis codes will be displayed by flashing of the warning lamp.
- Open the memory clear switch.
- Present and past diagnosis codes will be displayed by flashing of the warning lamp.
- Turn the starter switch to the OFF position and connect the memory clear switch and diagnosis switch to terminate the diagnosis code displaying mode.



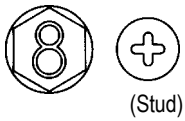

**(6) Erasing diagnosis codes <Except Gr13EA and Gr23>**

- Turn the starter switch to the ON position (do not start the engine).
- Open the memory clear switch and reconnect it; all diagnosis codes stored in electronic control unit memory will be erased.
  To cancel diagnosis code erasure after opening the memory clear switch, turn the starter switch to the OFF position and then reconnect the memory clear switch.

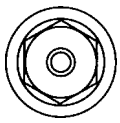
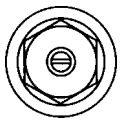
# TABLE OF STANDARD TORQUE VALUES

- Use specified bolts and nuts. Tighten them to the torque values specified in this section unless otherwise stated.
- Threaded portions and bearing surfaces should be dry.
- When the nut is in a different strength class than the bolt (or stud), use the torque value for the bolt (or stud).

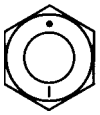
## Hexagon Headed Bolt, Stud (Torque: N·m {lbf·ft, kgf·m})

| Strength | 4T | | 7T | | 8T | |
|---|---|---|---|---|---|---|
| Identification symbol<br>Nominal diameter |  (Stud) |  |  (Stud) |  |  (Stud) |  |
| **M5** | 2 to 3<br>{1.5 to 2.2, 0.2 to 0.3} | – | 4 to 6<br>{3.0 to 4.4, 0.4 to 0.6} | – | 5 to 7<br>{3.7 to 5.2, 0.5 to 0.7} | – |
| **M6** | 4 to 6<br>{3.0 to 4.4, 0.4 to 0.6} | – | 7 to 10<br>{5.2 to 7.4, 0.7 to 1.0} | – | 8 to 12<br>{5.9 to 8.9, 0.8 to 1.2} | – |
| **M8** | 9 to 13<br>{6.6 to 9.6, 0.9 to 1.3} | – | 16 to 24<br>{12 to 18, 1.7 to 2.5} | – | 19 to 28<br>{14 to 21, 2.0 to 2.9} | – |
| **M10** | 18 to 27<br>{13 to 20, 1.8 to 2.7} | 17 to 25<br>{13 to 18, 1.8 to 2.6} | 34 to 50<br>{25 to 37, 3.5 to 5.1} | 32 to 48<br>{24 to 35, 3.3 to 4.9} | 45 to 60<br>{33 to 44, 4.5 to 6.0} | 37 to 55<br>{27 to 41, 3.8 to 5.7} |
| **M12** | 34 to 50<br>{25 to 37, 3.4 to 5.1} | 31 to 45<br>{23 to 33, 3.1 to 4.6} | 70 to 90<br>{52 to 66, 7.0 to 9.5} | 65 to 85<br>{48 to 63, 6.5 to 8.5} | 80 to 105<br>{59 to 77, 8.5 to 11} | 75 to 95<br>{55 to 70, 7.5 to 10} |
| **M14** | 60 to 80<br>{44 to 59, 6.0 to 8.0} | 55 to 75<br>{41 to 55, 5.5 to 7.5} | 110 to 150<br>{81 to 110, 11 to 15} | 100 to 140<br>{74 to 105, 11 to 14} | 130 to 170<br>{96 to 125, 13 to 17} | 120 to 160<br>{89 to 120, 12 to 16} |
| **M16** | 90 to 120<br>{66 to 89, 9 to 12} | 90 to 110<br>{66 to 81, 9 to 11} | 170 to 220<br>{125 to 160, 17 to 23} | 160 to 210<br>{120 to 155, 16 to 21} | 200 to 260<br>{145 to 190, 20 to 27} | 190 to 240<br>{140 to 175, 19 to 25} |
| **M18** | 130 to 170<br>{96 to 125, 14 to 18} | 120 to 150<br>{89 to 110, 12 to 16} | 250 to 330<br>{185 to 245, 25 to 33} | 220 to 290<br>{160 to 215, 23 to 30} | 290 to 380<br>{215 to 280, 30 to 39} | 250 to 340<br>{185 to 250, 26 to 35} |
| **M20** | 180 to 240<br>{130 to 175, 19 to 25} | 170 to 220<br>{125 to 160, 17 to 22} | 340 to 460<br>{250 to 340, 35 to 47} | 310 to 410<br>{230 to 300, 32 to 42} | 400 to 530<br>{295 to 390, 41 to 55} | 360 to 480<br>{265 to 355, 37 to 49} |
| **M22** | 250 to 330<br>{185 to 245, 25 to 33} | 230 to 300<br>{170 to 220, 23 to 30} | 460 to 620<br>{340 to 455, 47 to 63} | 420 to 560<br>{310 to 415, 43 to 57} | 540 to 720<br>{400 to 530, 55 to 73} | 490 to 650<br>{360 to 480, 50 to 67} |
| **M24** | 320 to 430<br>{235 to 315, 33 to 44} | 290 to 380<br>{215 to 280, 29 to 39} | 600 to 810<br>{440 to 595, 62 to 83} | 540 to 720<br>{400 to 530, 55 to 73} | 700 to 940<br>{515 to 695, 72 to 96} | 620 to 830<br>{455 to 610, 63 to 85} |

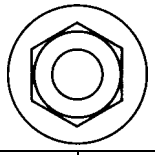
## Hexagon Headed Flange Bolt (Torque: N·m {lbf·ft, kgf·m})

| Strength | 4T | | 7T | | 8T | |
|---|---|---|---|---|---|---|
| Identification symbol<br>Nominal diameter |  |  |  |  |  |  |
| **M6** | 4 to 6<br>{3.0 to 4.4, 0.4 to 0.6} | – | 8 to 12<br>{5.9 to 8.9, 0.8 to 1.2} | – | 10 to 14<br>{7.4 to 10, 1.0 to 1.4} | – |
| **M8** | 10 to 15<br>{7.4 to 11, 1.0 to 1.5} | – | 19 to 28<br>{14 to 21, 2.0 to 2.9} | – | 22 to 33<br>{16 to 24, 2.3 to 3.3} | – |
| **M10** | 21 to 31<br>{15 to 23, 2.1 to 3.1} | 20 to 29<br>{15 to 21, 2.0 to 3.0} | 45 to 55<br>{33 to 41, 4.5 to 5.5} | 37 to 54<br>{27 to 40, 3.8 to 5.6} | 50 to 65<br>{37 to 48, 5.0 to 6.5} | 50 to 60<br>{37 to 44, 5.0 to 6.5} |
| **M12** | 38 to 56<br>{28 to 41, 3.8 to 5.5} | 35 to 51<br>{26 to 38, 3.5 to 5.2} | 80 to 105<br>{59 to 77, 8.0 to 10.5} | 70 to 95<br>{52 to 95, 7.5 to 9.5} | 90 to 120<br>{66 to 89, 9 to 12} | 85 to 110<br>{63 to 81, 8.5 to 11} |

## Hexagon Nuts (Torque: N·m {lbf·ft, kgf·m})

| Strength | 4T | | 6T | |
|---|---|---|---|---|
| Identification symbol |  | |      | |
| Nominal diameter | Standard screw thread | Coarse screw thread | Standard screw thread | Coarse screw thread |
| **M5** | 2 to 3 {1.5 to 2.2, 0.2 to 0.3} | – | 4 to 6 {3.0 to 4.4, 0.4 to 0.6} | – |
| **M6** | 4 to 6 {3.0 to 4.4, 0.4 to 0.6} | – | 7 to 10 {5.2 to 7.4, 0.7 to 1.0} | – |
| **M8** | 9 to 13 {6.6 to 9.6, 0.9 to 1.3} | – | 16 to 24 {12 to 18, 1.7 to 2.5} | – |
| **M10** | 18 to 27 {13 to 20, 1.8 to 2.7} | 17 to 25 {13 to 18, 1.8 to 2.6} | 34 to 50 {25 to 37, 3.5 to 5.1} | 32 to 48 {24 to 35, 3.3 to 4.9} |
| **M12** | 34 to 50 {25 to 37, 3.4 to 5.1} | 31 to 45 {23 to 33, 3.1 to 4.6} | 70 to 90 {52 to 66, 7.0 to 9.5} | 65 to 85 {48 to 63, 6.5 to 8.5} |
| **M14** | 60 to 80 {44 to 59, 6.0 to 8.0} | 55 to 75 {41 to 55, 5.5 to 7.5} | 110 to 150 {81 to 110, 11 to 15} | 100 to 140 {74 to 105, 11 to 14} |
| **M16** | 90 to 120 {66 to 89, 9 to 12} | 90 to 110 {66 to 81, 9 to 11} | 170 to 220 {125 to 160, 17 to 23} | 160 to 210 {120 to 155, 16 to 21} |
| **M18** | 130 to 170 {96 to 125, 14 to 18} | 120 to 150 {89 to 110, 12 to 16} | 250 to 330 {185 to 245, 25 to 33} | 220 to 290 {160 to 215, 23 to 30} |
| **M20** | 180 to 240 {130 to 175, 19 to 25} | 170 to 220 {125 to 160, 17 to 22} | 340 to 460 {250 to 340, 35 to 47} | 310 to 410 {230 to 300, 32 to 42} |
| **M22** | 250 to 330 {185 to 245, 25 to 33} | 230 to 300 {170 to 220, 23 to 30} | 460 to 620 {340 to 455, 47 to 63} | 420 to 560 {310 to 415, 43 to 57} |
| **M24** | 320 to 430 {235 to 315, 33 to 44} | 290 to 380 {215 to 280, 29 to 39} | 600 to 810 {440 to 595, 62 to 83} | 540 to 720 {400 to 530, 55 to 73} |

## Hexagon Flange Nuts (Torque: N·m {lbf·ft, kgf·m})

| Strength | 4T | |
|---|---|---|
| Identification symbol |  | |
| Nominal diameter | Standard screw thread | Coarse screw thread |
| **M6** | 4 to 6 {3.0 to 4.4, 0.4 to 0.6} | – |
| **M8** | 10 to 15 {7.4 to 11, 1.0 to 1.5} | – |
| **M10** | 21 to 31 {15 to 23, 2.1 to 3.1} | 20 to 29 {15 to 21, 2.0 to 3.0} |
| **M12** | 38 to 56 {28 to 41, 3.8 to 5.6} | 35 to 51 {26 to 38, 3.5 to 5.2} |

### Torque Values for General-Purpose Flare Nut: N·m {lbf·ft, kgf·m}

| Pipe diameter | ϕ4.76 mm {0.19 in.} | ϕ6.35 mm {0.25 in.} | ϕ8 mm {0.31 in.} | ϕ10 mm {0.39 in.} | ϕ12 mm {0.47 in.} | ϕ15 mm {0.59 in.} |
|---|---|---|---|---|---|---|
| Torque value | 17 {13, 1.7} | 25 {18, 2.6} | 39 {29, 4.0} | 59 {44, 6.0} | 88 {65, 9.0} | 98 {72, 10} |

### Torque Values for General-Purpose Air Piping Nylon Tube (DIN Type): N·m {lbf·ft, kgf·m}

| Nominal diameter × wall thickness | 6 × 1 mm {0.24 × 0.039 in.} | 10 × 1.25 mm {0.39 × 0.049 in.} | 12 × 1.5 mm {0.47 × 0.059 in.} | 15 × 1.5 mm {0.59 × 0.059 in.} |
|---|---|---|---|---|
| Torque value | $20^{+6}_{0}$ {$15^{+4.4}_{0}$ $2.0^{+0.6}_{0}$} | $34^{+10}_{0}$ {$25^{+7.4}_{0}$ $3.5^{+1.0}_{0}$} | $49^{+10}_{0}$ {$36^{+7.4}_{0}$ $5.0^{+1.0}_{0}$} | $54^{+5}_{0}$ {$40^{+3.7}_{0}$ $5.5^{+0.5}_{0}$} |

### Torque Values for General-Purpose Air Piping Nylon Tube (SAE Type): N·m {lbf·ft, kgf·m}

| Nominal diameter | 1/4 in. | 3/8 in. | 1/2 in. | 5/8 in. |
|---|---|---|---|---|
| Torque value | $13^{+4}_{0}$ {$9.6^{+3.0}_{0}$ $1.3^{+0.4}_{0}$} | $29^{+5}_{0}$ {$21^{+3.7}_{0}$ $3.0^{+0.5}_{0}$} | $49^{+5}_{0}$ {$36^{+3.7}_{0}$ $5.0^{+0.5}_{0}$} | $64^{+5}_{0}$ {$47^{+3.7}_{0}$ $6.5^{+0.5}_{0}$} |