# GROUP 54-00A GENERAL

# VEHICLE MODEL CODING SYSTEM

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫

F E A 5 1 C L 4 S N H B

| | | | |
|---|---|---|---|
| 1 | Basic vehicle type | F | Cab over truck |
| 2 | Driving wheels | E | 4 × 2 |
| 3 | Cab/frame type, development sequence | A | Standard width cab, frame width: 700mm |
| | | B | Wide cab, frame width: 750mm |
| | | C | Wide cab, frame width: 850mm |
| 4 | Chassis, suspension (front/rear), classification of GVW | 5 | Rigid/rigid, GVW: 5 – 6 tons |
| | | 7 | Rigid/rigid, GVW: 6.05 – 7.5 tons |
| | | 9 | Rigid/rigid, GVW: 7.5 tons over |
| | | X | Rigid/rigid, GVW: 8.55 tons |
| 5 | Engine | 1 | 4P10 |
| 6 | Wheelbase | C | 2800 mm |
| | | E | 3400 mm |
| | | G | 3850 mm |
| | | H | 4300 mm |
| 7 | Steering | L | LHD |
| 8 | Floor height, transmission type | 4 | High floor, Manual transmission |
| 9 | Cab configuration | S | Single cab |
| 10<br>11 | Country code | NH | Chile |
| 12 | Engine class | B | 4P10(T2) 96 kW |
| | | C | 4P10(T4) 110 kW |

| Component | Name plate marking | Code description |
|---|---|---|
| Engine | | |
| 4P10T2 | 4 P 1 0 T 2 | Power version number<br>Turbocharged<br>Order of development within same series<br>Order of development among different series<br>Diesel engine<br>No. of cylinders (4) |
| Clutch | | |
| C3W28 | C 3 W 28 | Disc OD<br>Facing material (W: Woven)<br>Load capacity (in tonnes) of main model<br>Initial letter of the clutch |
| Transmission | | |
| M038S5W | M 038 S 5 W | Variation (W: With directly-mounted transfer)<br>Forward speeds<br>Type of mesh (S: Synchromesh)<br>Load capacity (in tonnes) of main model<br>Initial letter of the transmission |
| Propeller shaft | | |
| P3 | P 3 | Load capacity (in tonnes) of main model<br>Initial letter of the propeller shaft |
| Front axle | | |
| F200T | F 200 T I | Axle type<br>Vehicle type (T: Truck)<br>Load capacity of main model<br>Initial letter of the front axle |
| Rear axle | | |
| R035T | R 03 5 T | Vehicle type (T: Truck)<br>Order of development within same series<br>Load capacity (in tonnes) of main model<br>Initial letter of the rear axle |
| Reduction and differential | | |
| D035H | D 03 5 H | Tooth profile (H: Hypoid gear)<br>Order of development within same series<br>Load capacity (in tonnes) of main model<br>Initial letter of the reduction & differential |

# POWER TRAIN TABLE

| Vehicle model | Engine | Clutch | Transmission | Propeller shaft | Front axle | Rear axle | Reduction & differential |
|---|---|---|---|---|---|---|---|
| FEA01BL4SNHB | 4P10-T2 | C3W28 | M038S5 | P3 | F100T | R015T | D1H |
| FEA51CL4SNHB | 4P10-T2 | C3W28 | M038S5 | P3 | F200T | R030T | D3H |
| FEA51EL4SNHB | 4P10-T2 | C3W28 | M038S5 | P3 | F200T | R030T | D3H |
| FEB71GL4SNHC | 4P10-T4 | C4W30 | M038S5 | P3 | F350T | R035T | D035H |
| FEB71GL4WNHC | 4P10-T4 | C4W30 | M038S5 | P3 | F350T | R035T | D035H |
| FEC91HL4SNHC | 4P10-T4 | C4W30 | M038S5 | P3 | F350T | R035T | D035H |
| FECX1HL4SNHC | 4P10-T4 | C4W30 | M038S5 | P3 | F350T | R035T | D035H |
| FGB71EL6SNHC | 4P10-T4 | C4W30 | M038S5W<br>T/F: TF3 | Front: P2<br>Rear: P3 | F200TW | R035T | Front: D1H<br>Rear: D035H |

M E M O

# HOW TO READ THIS MANUAL

This manual consists of the following parts:
- Specifications
- Structure and Operation
- Troubleshooting
- Circuits
- Electrical Equipment Installation Positions
- Inspection of Electrical Equipment
- On-vehicle Inspection and Adjustment
- Service procedures
- Connector configuration chart

**On-vehicle Inspection and Adjustment**
- Procedures for inspection and adjustment of individual parts and assemblies as mounted on the vehicle are described including specific items to check and adjust. Specified or otherwise, inspection should be performed for looseness, play, backlash, crack, damage, etc.

**Service procedures**
- Procedures for servicing components and parts off the vehicle are described centering on key points in their removal, installation, disassembly, reassembly, inspection, etc.

**Inspection**
- Check items subject to “acceptable/unacceptable” judgement on the basis of service standards are all given.
- Some routine visual checks and cleaning of some reused parts are not described but must always be included in actual service work.

**Caution**
- This service manual contains important cautionary instructions and supplementary information under the following four headings which identify the nature of the instructions and information:

| | |
|---|---|
| **DANGER** ⚠ | Precautions that should be taken in handling potentially dangerous substances such as battery fluid and coolant additives. |
| **WARNING** ⚠ | Precautionary instructions, which, if not observed, could result in serious injury or death. |
| **CAUTION** ⚠ | Precautionary instructions, which, if not observed, could result in damage to or destruction of equipment or parts. |
| **NOTE** | Suggestions or supplementary information for more efficient use of equipment or better understanding. |

**Terms and Units**
- Front and rear
  The forward running direction of the vehicle is referred to as the front and the reverse running direction is referred to as the rear.

- Left and right
  Left hand side and right hand side, when facing the forward running direction of the vehicle, are respectively left and right.

**Standard value**
- Standard value dimensions in designs indicating: the design dimensions of individual parts, the standard clearance between two parts when assembled, and the standard value for an assembly part, as the case may be.

**Limit**
- When the value of a part exceeds this, it is no longer serviceable in respect of performance and strength and must be replaced or repaired.

**Tightening torque**

- Values are directly specified for out-of-standard tightening torques for bolts and nuts.
- Where there is no specified figure for tightening torque, follow the table covering standard tightening torques. (Values for standard tightening torques are based on thread size and material.)
- When the item is to be tightened in a wet state, “wet” is indicated. Where there is no indication, read it as dry.

**Units**

- Tightening torques and other parameters are given in SI* units with metric units added in brackets { }.

***SI: Le Système International d’Unités**

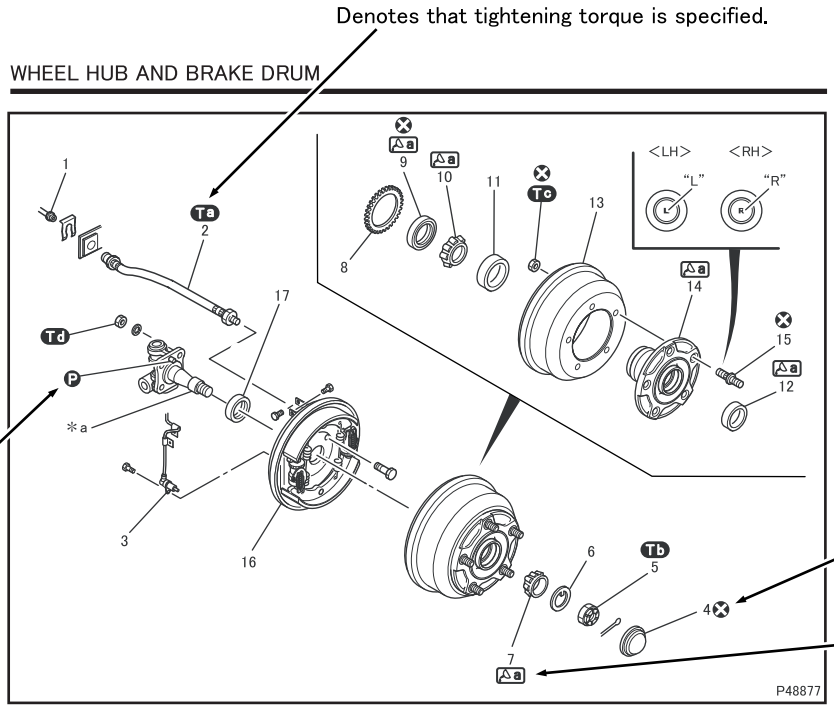
Example: 390 N·m {40 kgf·m}

Metric unit
SI unit

| Unit | | SI unit {metric unit} | Conversion factor |
|---|---|---|---|
| Force | | N {kgf} | 9.80665 N {1 kgf} |
| Moment of force | | N·m {kgf·m} | 9.80665 N·m {1 kgf·m} |
| Pressure | Positive pressure | kPa {kgf/cm$^2$} | 98.0665 kPa {1 kgf/cm$^2$} |
| | Vacuum pressure | kPa {mmHg} | 0.133322 kPa {1 mmHg} |
| | | Pa {mm$H_2O$} | 9.80665 Pa {1 mm$H_2O$} |
| Volume | | dm$^3$ {L} | 1 dm$^3$ {1 L} |
| Heat quantity | | J {kcal} | 4186.05 J {1 kcal} |
| Heat flow | | W {kcal/h} | 1.16279 W {1 kcal/h} |
| Power | | kW {PS} | 0.7355 kW {1 PS} |

## Illustrated Parts Breakdown and Service Procedures

| Symbol | Denotation | Application | Remarks |
|---|---|---|---|
| Ta | Tightening torque | Parts not tightened to standard torques (standard torques specified where necessary for servicing) | Specified values shown in table<br>See Table of Standard Tightening Torques for parts for which no tightening torques are specified. |
| P | Locating pin | Parts to be positioned for installation | |
| ⊗ | Non-reusable parts | Parts not to be reused | |
| a | Lubricant and/or sealant | Parts to be coated with lubricant or sealant for assembly or installation | Necessary lubricant and/or sealant, quantity required, etc. are specified in table. |
| a | 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 | |




● 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 Gr35A.)
17 Spacer

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

● Assembly sequence

Follow the disassembly sequence in reverse.

Service standards (unit: mm)

| 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 {0.10 to 0.35 kgf·m} (tangential force:8.8 to 28.4 N {0.9 to 2.9 kgf}) | – | Adjust or replace |
| 14 | Brake drum | Inside diameter | 320 | 322 | Repair or replace |
| | | Cylindricality | 0.05 | 0.20 | |

These location numbers correspond with disassembly sequence numbers.

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

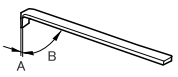
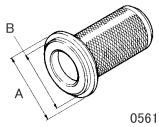
Tightening torque (unit: N·m{kgf·m})

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

Lubricant and/or sealant

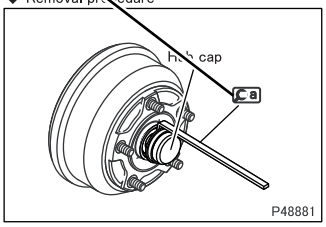
| Mark | Point of application | Specified lubricant and/or sealant | Quantity |
|---|---|---|---|
| La | Between rolls of outer bearing inner race and inner bearing inner race | Mitsubishi wheel bearing grease | As required |
| | Inside wheel hub | | 395 ± 40 g |

Special tools (unit: mm)

| 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, B: ϕ70<br>  <br>05619 | MB999097 | Installation of oil seal |

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

◆ Removal procedure



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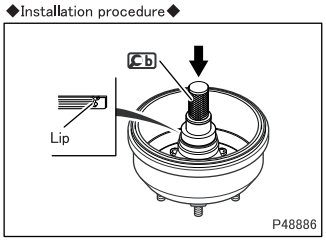
■Removal: Hub cap

◆Installation procedure◆



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

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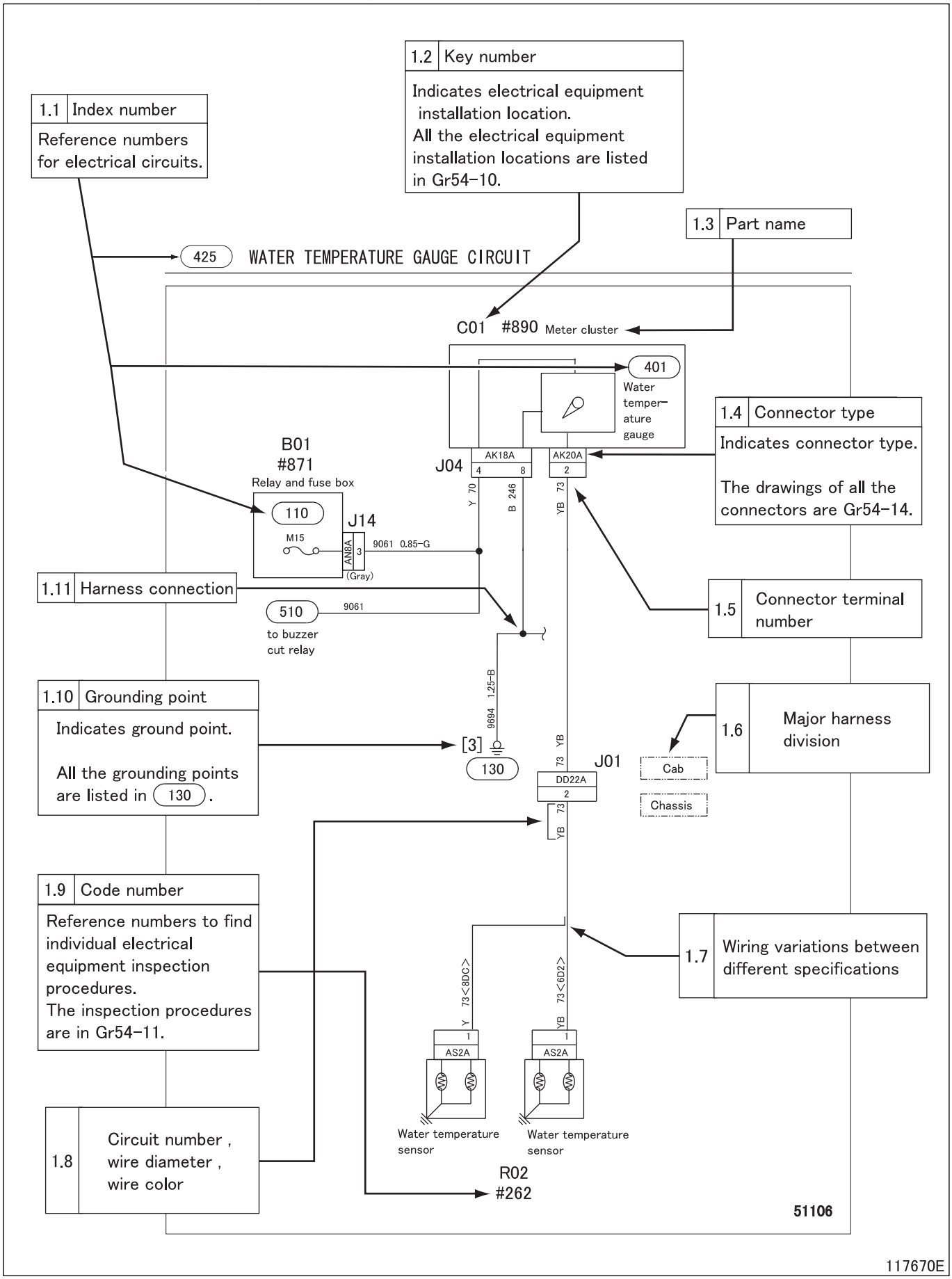
## How to Read Circuits (Electrical)



### 1.1 Index number: (100) to (999)

- Index numbers are used as reference numbers for electrical circuits. Each electrical circuit has been assigned its own index number.

### 1.2 Key number: A01 to Z99

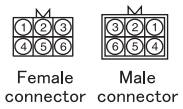
- Key numbers indicate electrical equipment installation locations. The installation location of an electrical equipment can be easily found using its key number shown in a circuit diagram.
  All of the electrical equipment installation locations are listed in Gr54-10.

### 1.3 Part name

### 1.4 Connector type (type indication)

- A list of the connectors used is included in Gr54-14.

### 1.5 Connector terminal number




Connector terminal numbering starts with the upper left corner for female connectors and with the upper right corner for male connectors.

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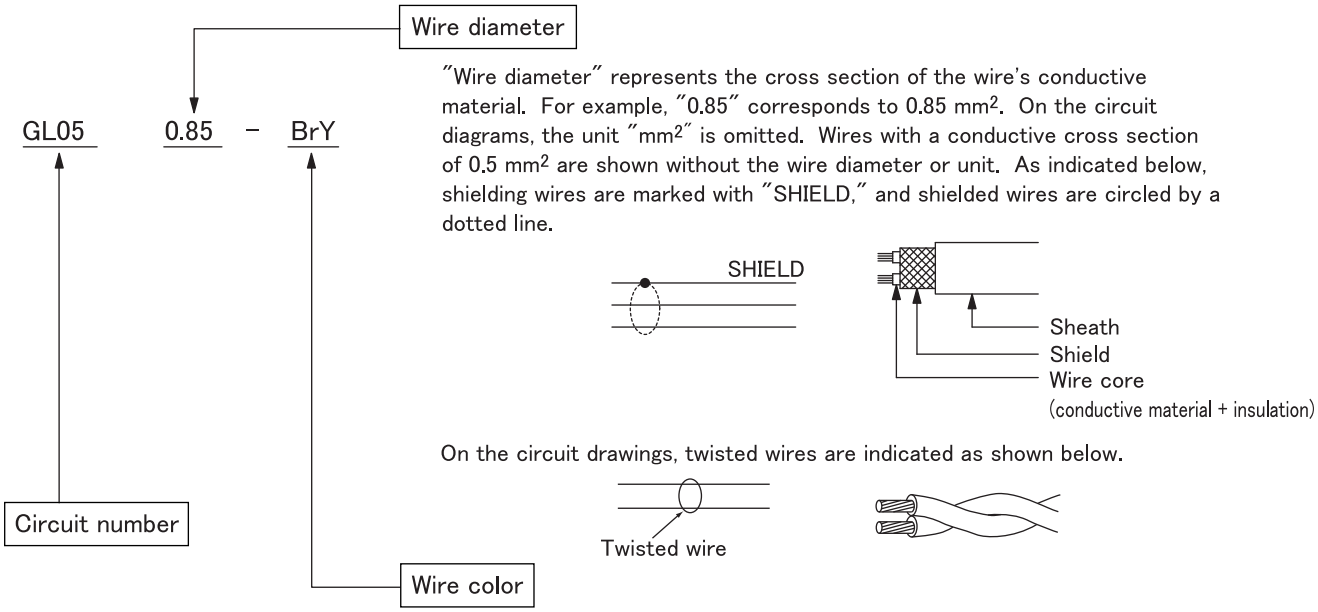
### 1.6 Major harness division

- Major harness divisions are shown.

### 1.7 Wiring variations between different specifications

- Variations in wiring/circuit between different vehicle specifications are clearly indicated as shown.

### 1.8 Circuit number, wire diameter, wire color




"Wire diameter" represents the cross section of the wire's conductive material. For example, "0.85" corresponds to 0.85 mm$^2$. On the circuit diagrams, the unit "mm$^2$" is omitted. Wires with a conductive cross section of 0.5 mm$^2$ are shown without the wire diameter or unit. As indicated below, shielding wires are marked with "SHIELD," and shielded wires are circled by a dotted line.




On the circuit drawings, twisted wires are indicated as shown below.

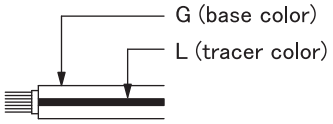



Wire colors are represented by the first letter of the color.
Colors that all start with the letter "B" are indicated as follows.

- BLACK → B
- BLUE → L
- BROWN → Br

Wires that have both base and tracer colors are indicated by two letters.

RY (Yellow tracer on Red base)
GL (Blue tracer on Green base)

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### 1.9 Code number: #001 to #999

- Code numbers are reference numbers to find individual electrical equipment inspection procedures. The inspection procedure for an electrical equipment can be found using its code number shown in a circuit diagram.

### 1.10 Grounding point: [1] to [99]

- Locations where wires are grounded to the vehicle. All of the grounding points are listed in (130).

### 1.11 Harness connection

- The arrow in the wiring diagram indicates where harnesses are connected, and NOT the flow of electricity.

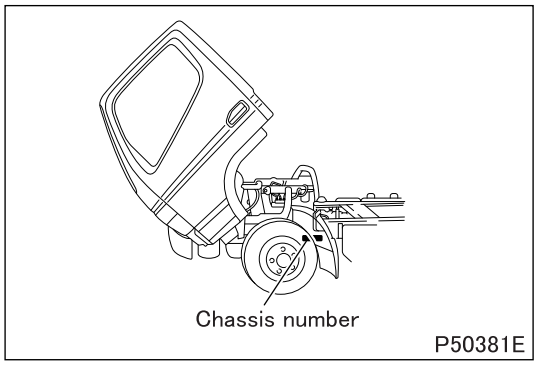
## Wire color

| Wire color | | Base color + tracer | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B | Black | BW | Black/white | BY | Black/yellow | BR | Black/red | BG | Black/green | BL | Black/blue | BO | Black/orange |
| | | BP | Black/pink | BV | Black/violet | B Br | Black/brown | | | | | | |
| Br | Brown | BrW | Brown/white | BrB | Brown/black | BrY | Brown/yellow | BrR | Brown/red | BrG | Brown/green | BrL | Brown/blue |
| | | BrGr | Brown/gray | BrV | Brown/Violet | | | | | | | | |
| G | Green | GW | Green/white | GR | Green/red | GY | Green/yellow | GB | Green/black | GL | Green/blue | GO | Green/orange |
| | | GGr | Green/gray | GBr | Green/brown | GV | Green/violet | | | | | | |
| Gr, Gy | Gray | GrL, GyL | Gray/blue | GrR, GyR | Gray/red | GrB, GyB | Gray/black | GrG, GyG | Gray/green | GrW, GyW | Gray/white | GrY | Gray/yellow |
| | | GrG | Gray/green | GrBr | Gray/brown | | | | | | | | |
| L | Blue | LW | Blue/white | LR | Blue/red | LY | Blue/yellow | LB | Blue/black | LO | Blue/orange | LG | Blue/green |
| | | LGr | Blue/gray | LBr | Blue/brown | | | | | | | | |
| Lg | Light green | LgR | Light green/red | LgY | Light green/yellow | LgB | Light green/black | LgW | Light green/white | | | | |
| O | Orange | OL | Orange/blue | OB | Orange/black | OG | Orange/green | | | | | | |
| P | Pink | PB | Pink/black | PG | Pink/green | PL | Pink/blue | PW | Pink/white | PGr | Pink/gray | PV | Pink/violet |
| Pu | Purple | | | | | | | | | | | | |
| R | Red | RW | Red/white | RB | Red/black | RY | Red/yellow | RG | Red/green | RL | Red/blue | RO | Red/orange |
| | | RBr | Red/brown | Rgr | Red/Gray | | | | | | | | |
| Sb | Sky blue | | | | | | | | | | | | |
| V | Violet | VY | Violet/yellow | VW | Violet/white | VR | Violet/red | VG | Violet/green | VGr | Violet/gray | VB | Violet/black |
| W | White | WR | White/red | WB | White/black | WL | White/blue | WG | White/green | WO | White/orange | WV | White/violet |
| | | WBr | White/brown | WY | White/yellow | | | | | | | | |
| Y | Yellow | YR | Yellow/red | YB | Yellow/black | YG | Yellow/green | YL | Yellow/blue | YW | Yellow/white | YO | Yellow/orange |
| | | YP | Yellow/pink | YV | Yellow/violet | YGr | Yellow/gray | YBr | Yellow/brown | | | | |

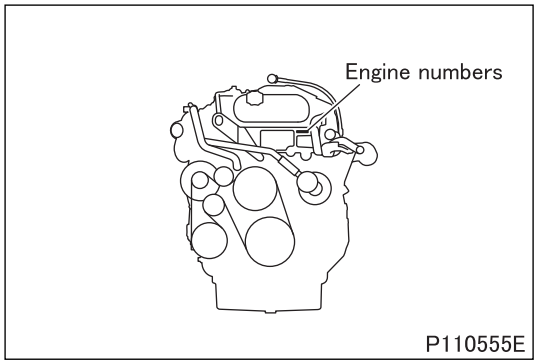
M E M O

# CHASSIS NUMBER, ENGINE NUMBER AND VEHICLE IDENTIFICATION NUMBER

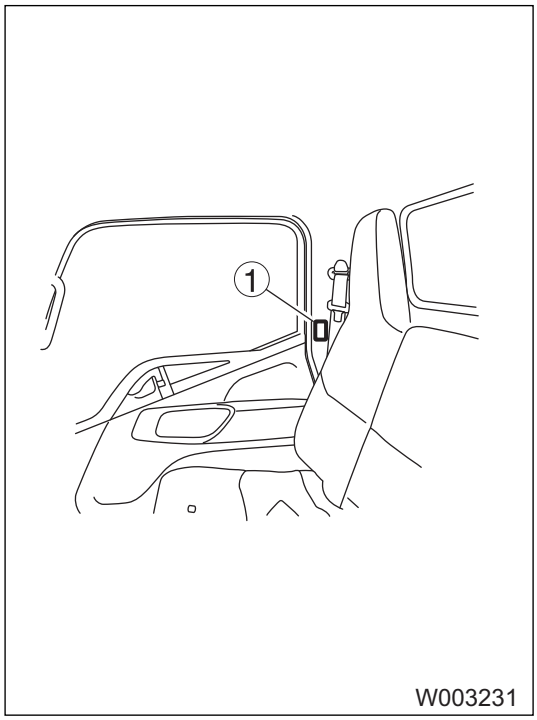
- Serial chassis and engine numbers are assigned to the vehicles and engines in manufacturing sequence. Every vehicle and engine has its own number. These numbers are required for registration and related inspection of the vehicle.



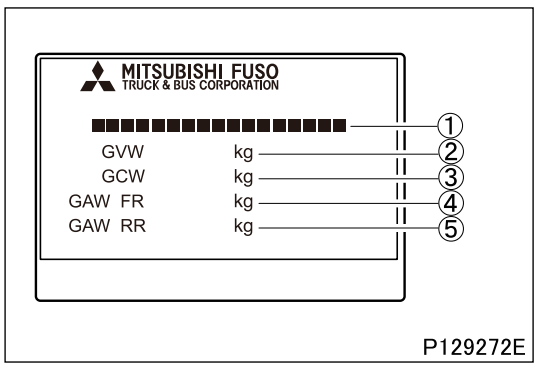

**Chassis number**




**Engine number**



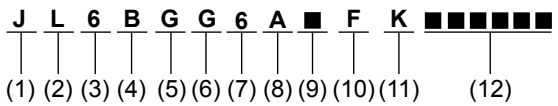

**Vehicle identification number (V.I.N)**




The nameplate shows the following.

① Vehicle identification number (VIN)
② Maximum permitted laden mass of the vehicle
③ Maximum permitted laden mass of the combination
④ Maximum permitted load mass for 1st axle
⑤ Maximum permitted load mass for 2nd axle

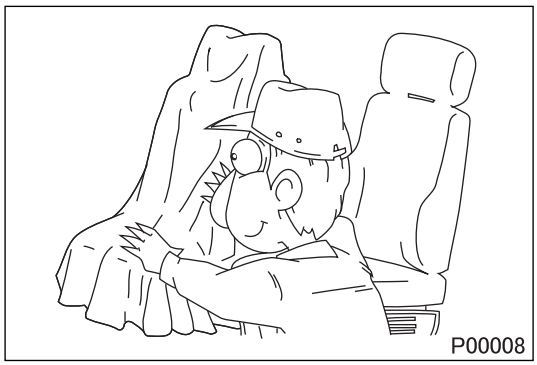
The meanings of VIN are listed below.

Example: 

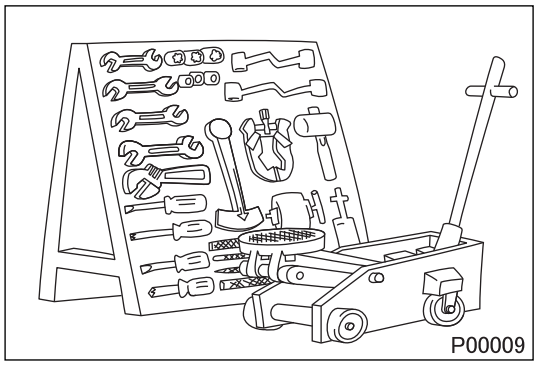

(1) Country
J: Japan
(2) Make
L: Mitsubishi Fuso
(3) Vehicle type
6: Incomplete vehicle
(4) GVW / Brake system
K: 7,001 - 8,000 lbs / Hydraulic
A: 10,001 - 14,000 lbs / Hydraulic
B: 14,001 - 16,000 lbs / Hydraulic
C: 16,001 - 19,500 lbs / Hydraulic
(5) Line
E: FEA01S
F: FEA51S
G: FEB71S
H: FEB71W
J: FEC91S
K: FGB71S
L: FECX1S
(6) Series (wheel base)
B: 2.3 - 2.59 m
C: 2.6 - 2.89 m
E: 3.2 - 3.49 m
G: 3.8 - 4.09 m
H: 4.1 - 4.39 m
(7) Cab / Chassis type
6: Cab over
(8) Engine
A: 2.998 L Diesel turbo charged and charge air cooled
(9) Check digit
(10) Model year
F: 2015
G: 2016
•
•
•
(11) Plant
K: Kawasaki
(12) Plant sequential number

## 1. General Precautions

- Before performing service operations, inquire into the customer's complaints and ascertain the condition by checking the total distance traveled, the conditions under which the vehicle is operated, and other relevant factors on the vehicle. And note the necessary information. This information will 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 disassembled. Then, follow the service procedure given 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 paintwork of the body.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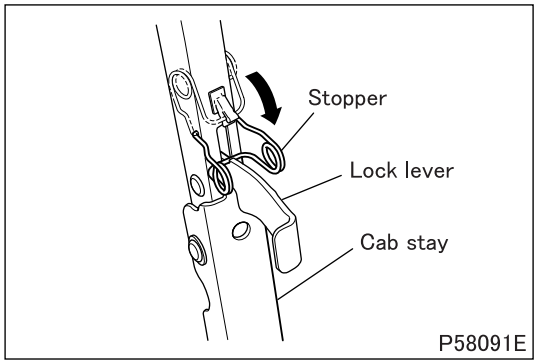
- Prepare all the general and special tools necessary for the job.

**WARNING ⚠**

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



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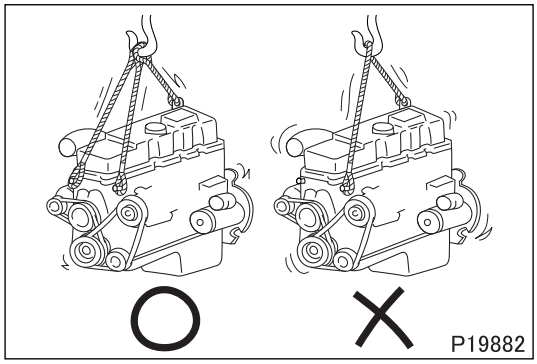
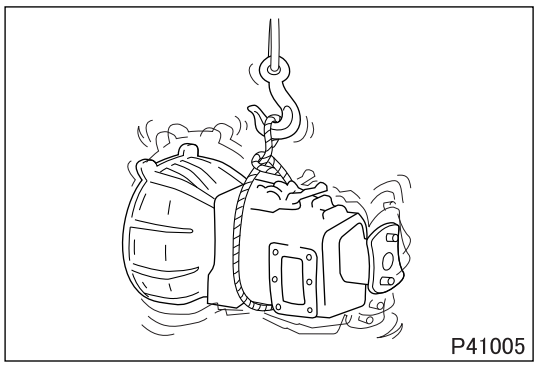
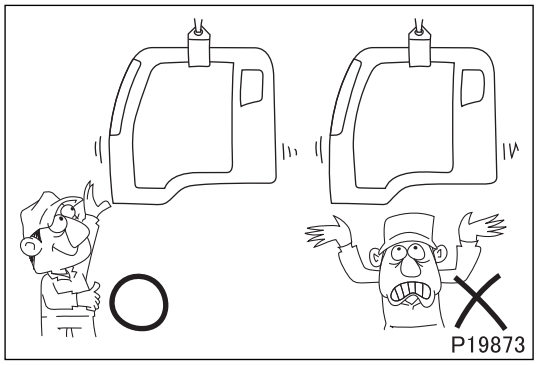
- After manually tilting the cab, be sure to engage the stopper with the lock lever to secure the cab stay in a rigid state.


P19882

- Take extreme care when removing/installing heavy items such as engine, transmission and axle. When lifting heavy items using a cable etc., observe the following precautions.
  - Identify the weight of the item being lifted. Use the cable that is strong enough to support the weight.

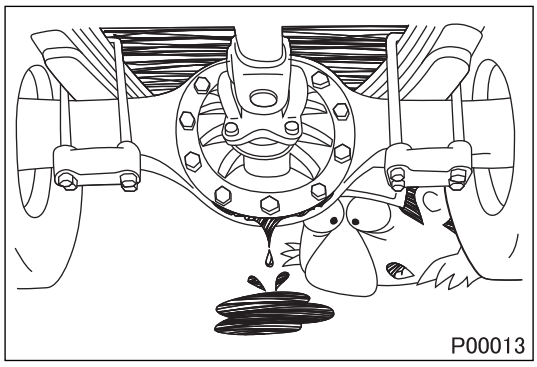



- If lifting eyes are not provided on the item being lifted, tie a cable around the item taking into account the item's center of gravity.

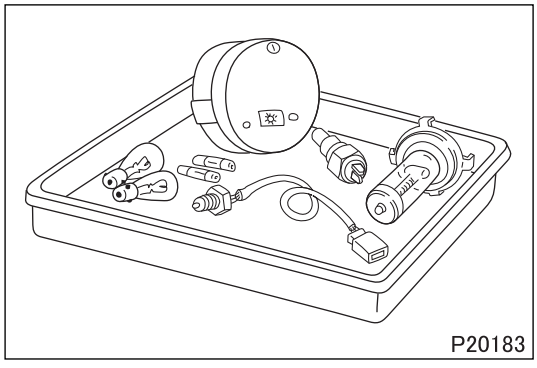



- Do not allow anyone to pass or stay under a lifted item which may possibly fall.

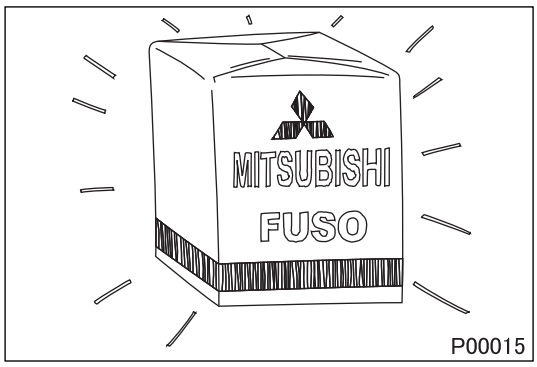

- Never work in shoes that have oily soles.
  When working with a partner or in a group, use pre-arranged signals and pay constant attention to safety. Be careful not to touch switches and levers unintentionally.



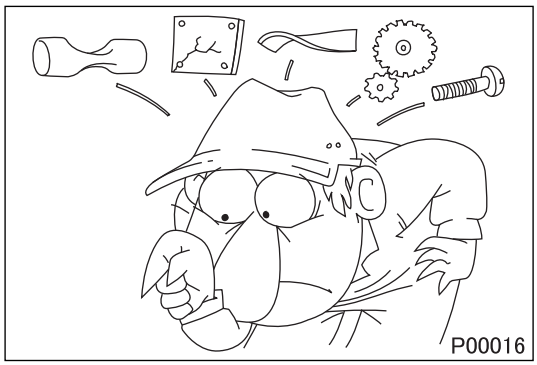

- Inspect for oil leakage etc. before washing the vehicle. If the order is reversed, any oil leakage or fault that may exist could go unnoticed during inspection.



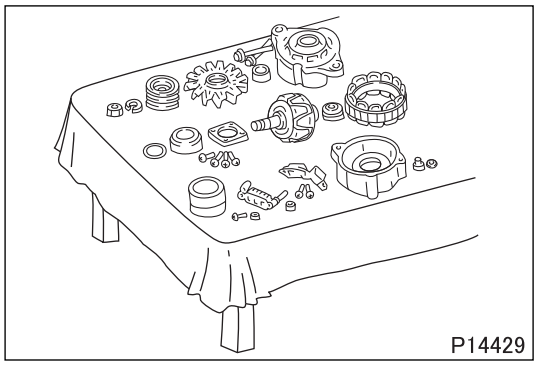

- Prepare replacement parts ready for installation.




- Oil seals, packings, O-rings and other rubber parts, gaskets, and split pins must be replaced with new ones after removal. Use only genuine MITSUBISHI replacement parts.



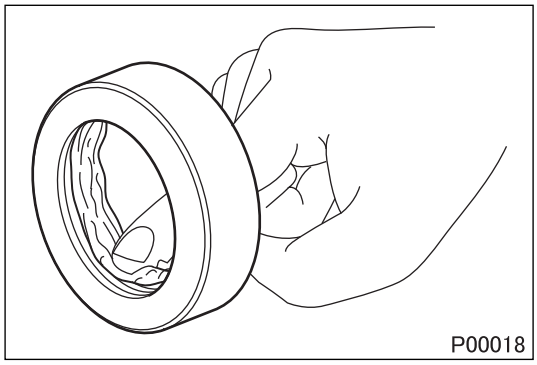

- When disassembling parts, visually check them for wear, cracks, damage, deformation, deterioration, rust, corrosion, defective rotation, fatigue, clogging and any other possible defect.



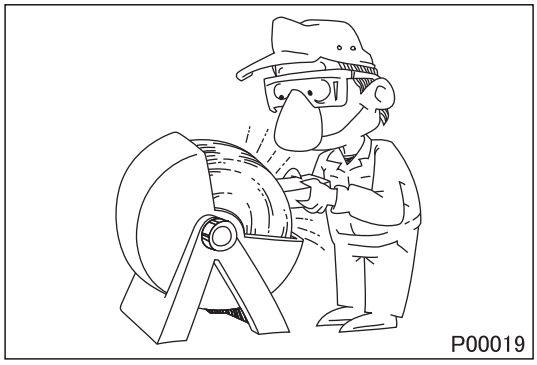

- To facilitate correct reassembly of parts, make alignment marks on them before disassembly and arrange disassembled parts neatly. Make punch marks and other alignment marks where they will not detract from parts' functionality and appearance.
- After removing parts from the vehicle, cover the area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

**CAUTION ⚠**

- **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 separately.**

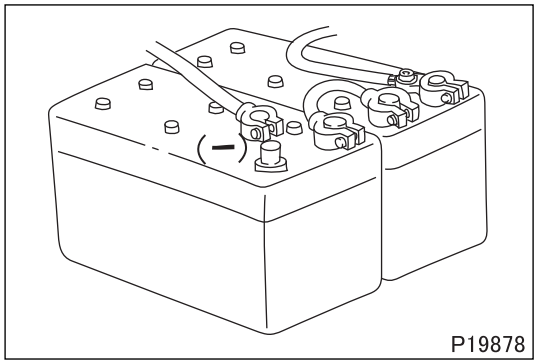



- Apply the specified oil or grease to U-seals, oil seals, dust seals and bearings before reassembly.
- Always use the specified oils and greases when performing inspection or replacement. Immediately wipe away any excess oil or grease with a rag.
- To prevent trouble, do not spill engine oil on the belts and starter.




- Wear safety goggles when using a grinder or welder. Wear gloves when necessary, and watch out for sharp edges and other items that might wound your hands.

## 2. Handling of Battery

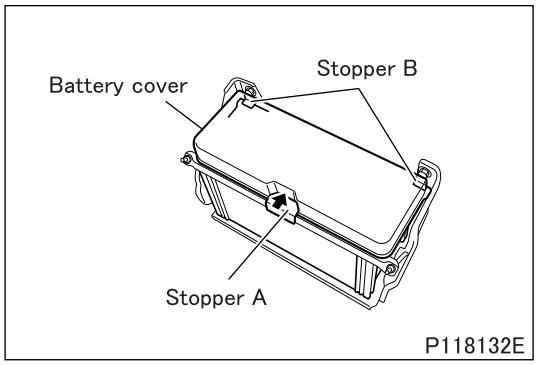



### 2.1 Handling of battery cable

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

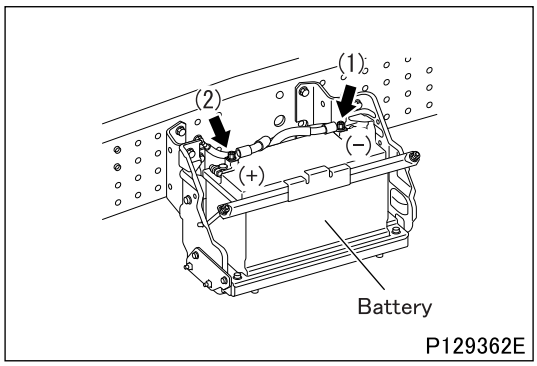
**CAUTION ⚠**

- **Make sure that the starter switch and lighting switches are OFF before disconnecting or connecting battery cable. (Semiconductor components may otherwise be damaged.)**
- **Connect the (+) and (–) battery cables correctly. If the polarity of the battery connections was reverse, the power switch would be damaged, leading to a vehicle fire.**
- **Disconnect the (–) battery cable, then insulate the (–) terminal of the battery and (–) battery cable with insulating tape or the like.**

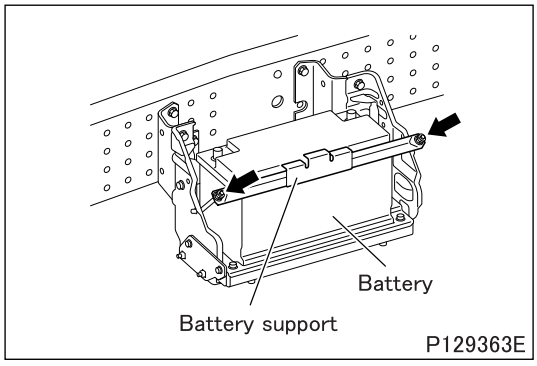



### 2.2 Removal and installation of battery

- Removal and installation of the battery cover
  - Press the stopper A at the arrow to release the battery cover from the stopper A.
  - Draw the battery cover toward you to detach it from the stoppers B.
  - To install the battery cover, follow the removal sequence in reverse. After installing, make sure that the battery cover is securely attached.

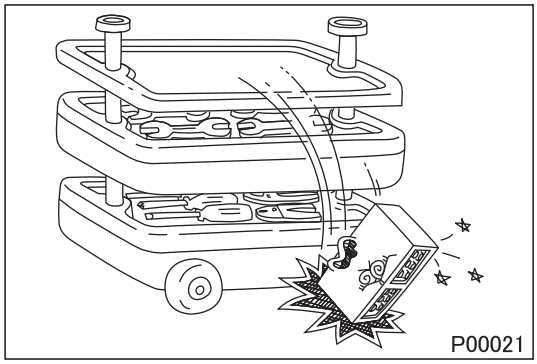



- Removal and installation of battery
  - Disconnect the battery cables at the battery terminals in the following sequence.
  - Disconnect the battery cable at the (–) terminal (1).
  - Disconnect the battery cable at the (+) terminal (2).
  - To connect battery cable, follow the disconnection sequence in reverse. Press in the terminal of the battery cable all the way to the bottom of the battery terminal post and tighten the nut to secure the cable.
    Tightening torque: 5 to 7 N·m {0.5 to 0.7 kgf·m}

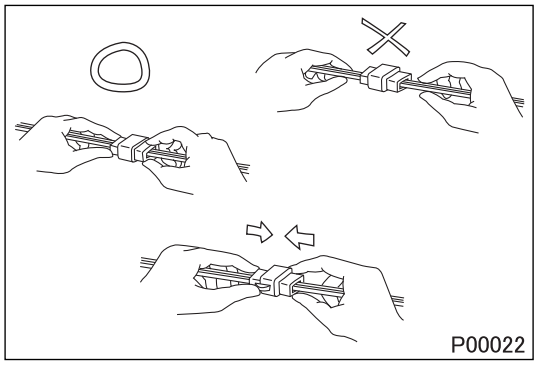



- Remove the nuts holding the battery, then remove the battery support.
- Remove the battery.
- To install the battery, follow the removal sequence in reverse. After installing, make sure that the battery is securely held in place.

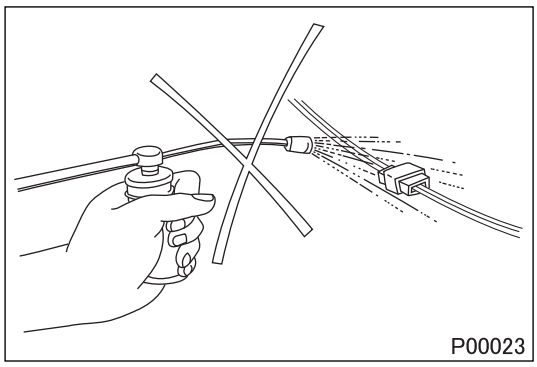
## 3. Handling of Sensors, Relays and Electronic Control Units



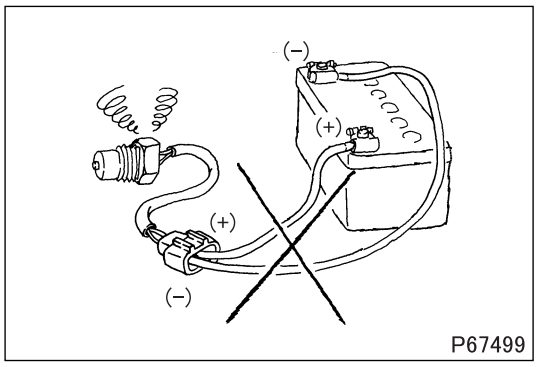

- Carefully handle sensors relays, and other items that are sensitive to shock and heat. Do not remove or paint the cover of any control unit.




- 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.

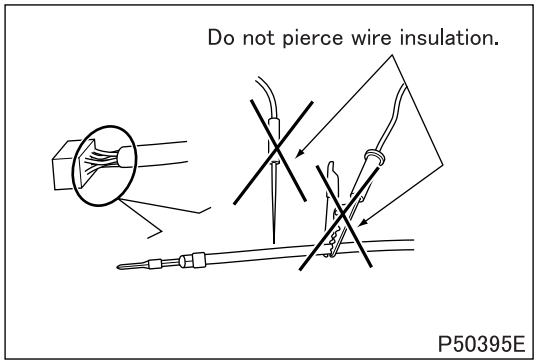



- Before washing the vehicle, cover electrical parts to keep them dry. (Use plastic sheets or equivalent.) Keep water away from harness connectors and sensors and immediately wipe off any water that gets on them.




- 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 the battery voltage.

## 4. Handling Precautions for Electric Circuits




**CAUTION ⚠**

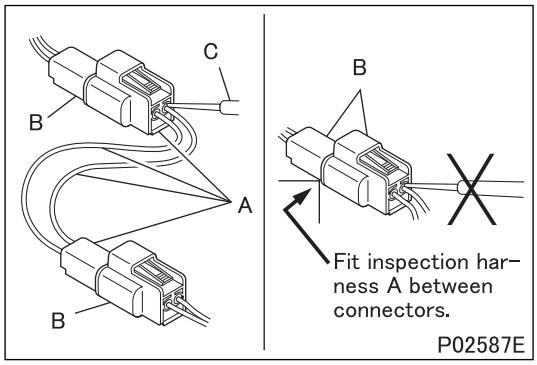
- **Do not pierce wire insulation with test probes or alligator clips when performing electrical inspections. Doing so can, particularly with the chassis harness, hasten corrosion.**

### 4.1 Inspection of harnesses

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

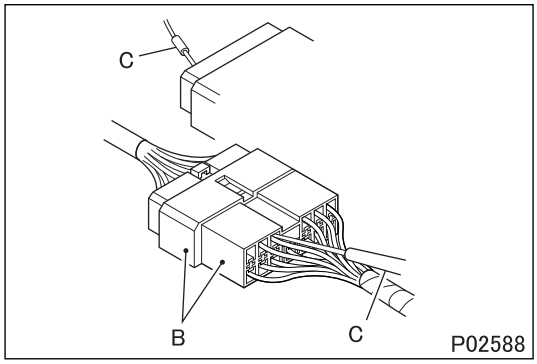
**(1.1) Waterproof connectors**

- 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**

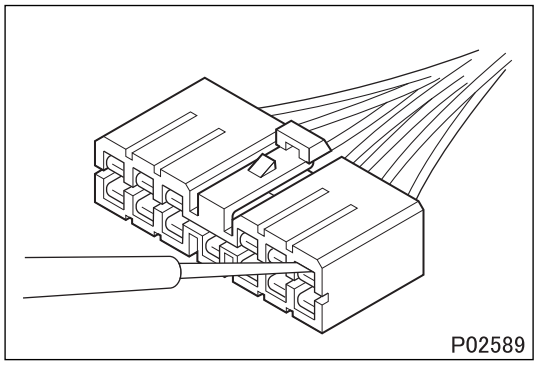
- Perform the inspection by inserting a test probe C into the wire-entry sides of the connectors. An extra-narrow probe is required for control unit connectors, which are smaller than other types of connector. Do not force a regular-size probe into control unit connectors since this would cause damage.




**(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.

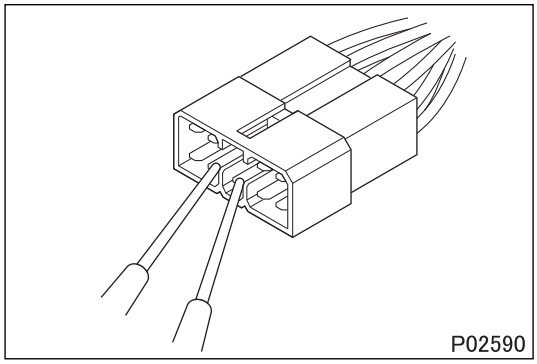


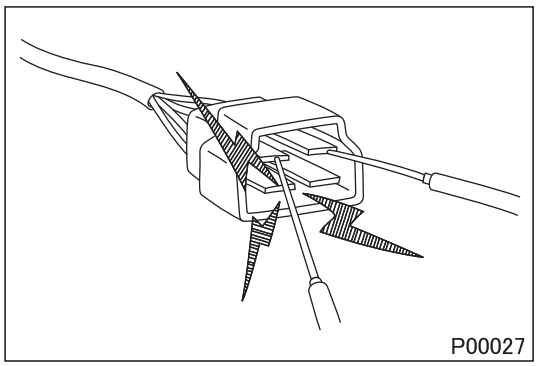

**(2.2) Inspections on male terminals**

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

**CAUTION ⚠**

- **Be careful not to short-circuit pins together with the test probes. With control unit connectors, short-circuiting of pins can cause damage to the control unit's internal circuitry.**

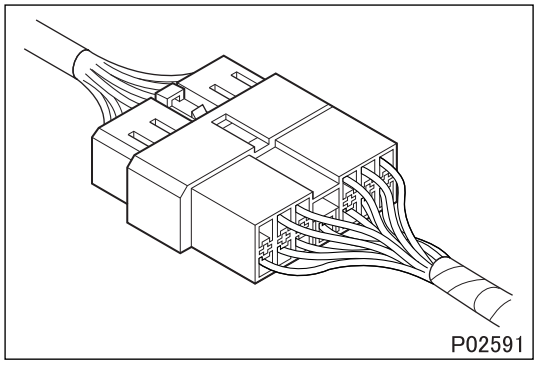




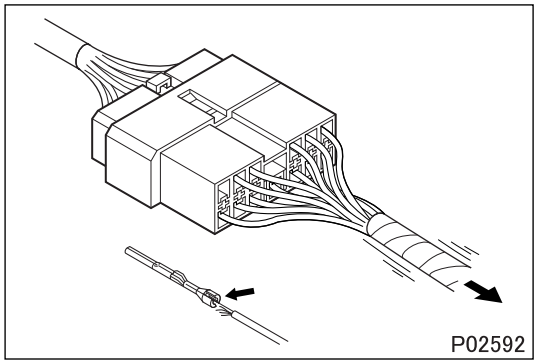

- When using a multimeter to check continuity, do not allow the test probes to touch the wrong terminals.

### 4.2 Inspection of connectors

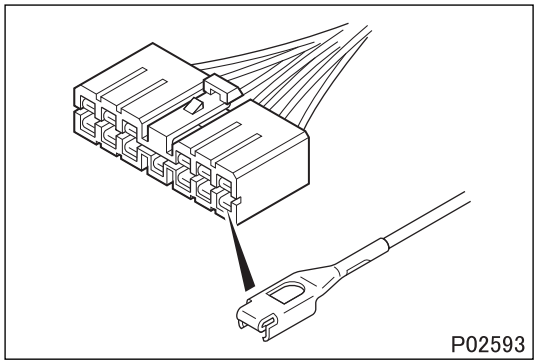
**(1) Visual inspection**



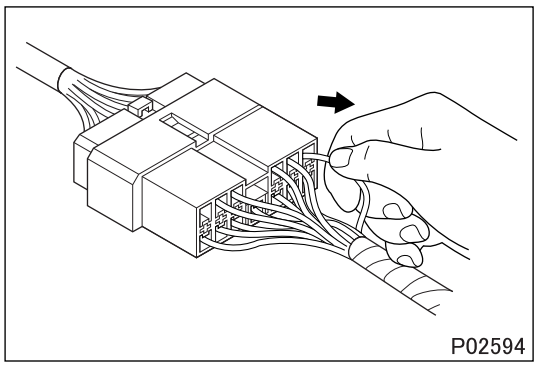

- Check that the connectors are fitted together securely.




- Check whether wires have been separated from their terminals due to pulling of the harness.

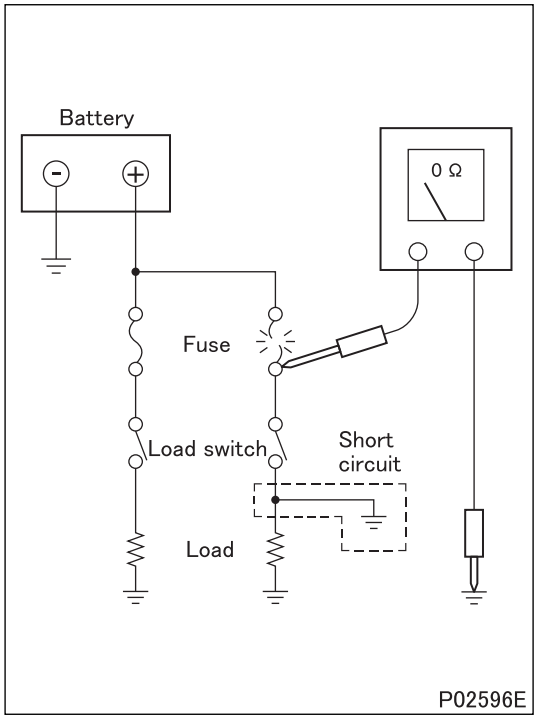



- Check that male and female terminals fit together tightly.
- Check for defective connections caused by loose terminals, by rust on terminals, or by contamination of terminals by foreign substances.


P02594

**(2) Checking for loose terminals**

- If connector 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 pull each wire and see whether any terminals slip out of their connector housings.



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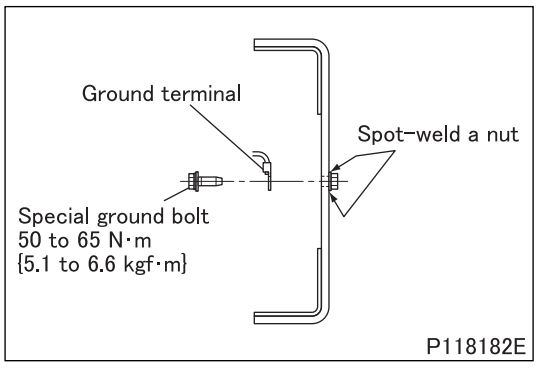
## 4.3 Inspections when a fuse blows

- 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)



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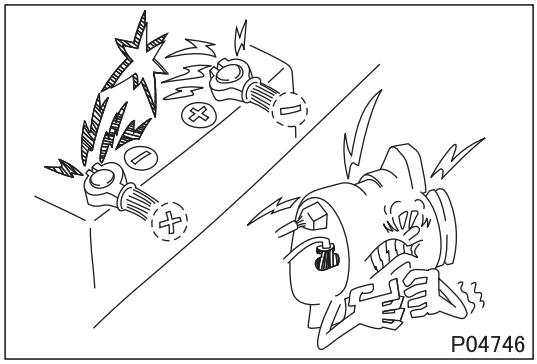
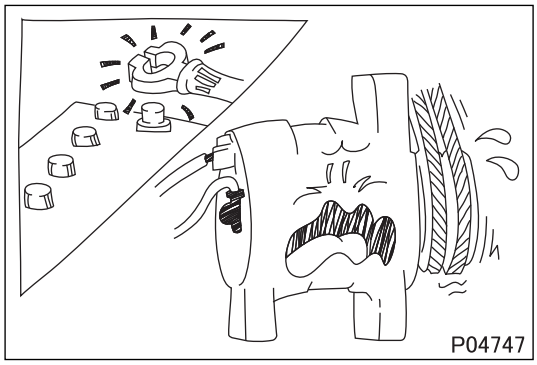
## 4.4 Inspection of chassis ground

- 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.

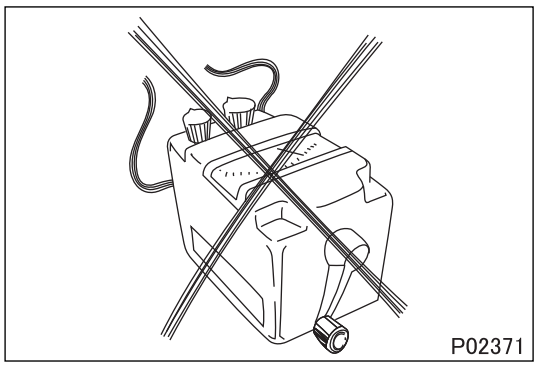
## 5. Service Precautions for Alternators



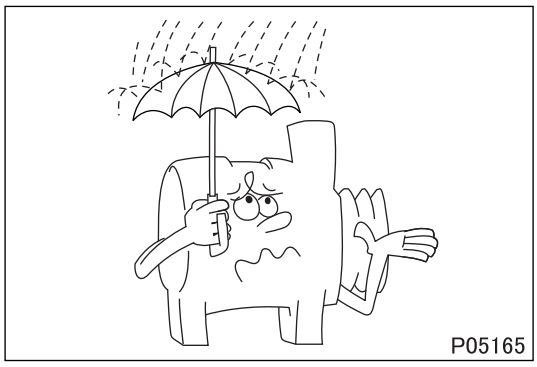

- When servicing alternators, observe the following precautions:
  - Never reverse the polarity of battery connections.
    If the polarity of the battery connections were to be reversed, a large current would flow from the battery to the alternator, damaging the diodes and regulator.



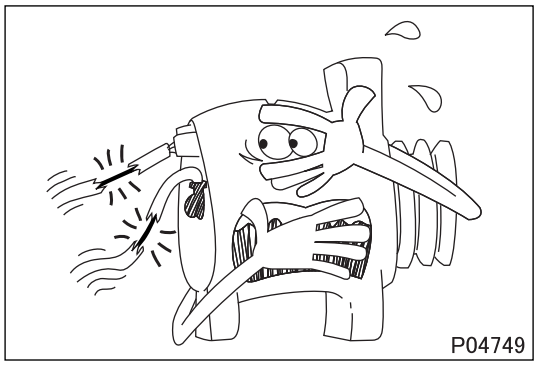

- Never disconnect the battery cables with the engine running.
  Disconnection of the battery cables during engine operation would cause a surge voltage, leading to deterioration of the diodes and regulator.



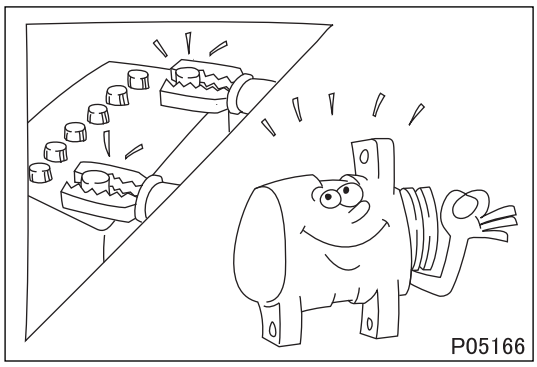

- Never perform inspections using a high-voltage multimeter.
  The use of a high-voltage multimeter could damage the diodes and regulator.




- Keep alternators dry.
  Water on alternators can cause internal short circuits and damage.

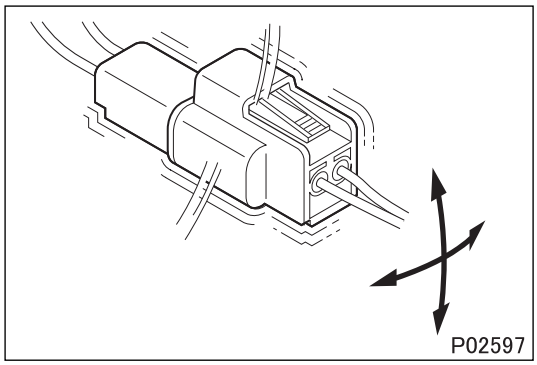


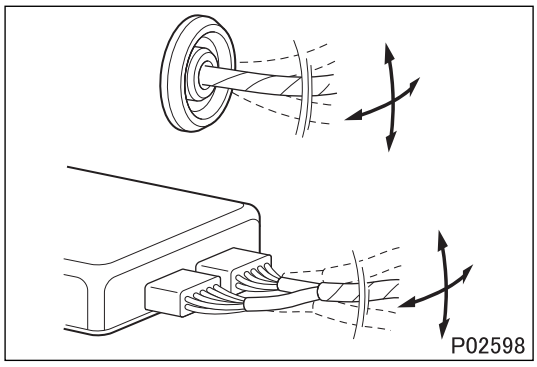

- Never operate an alternator with the B and L terminals short-circuited. Operation with the B and L terminals connected together would damage the diode trio.

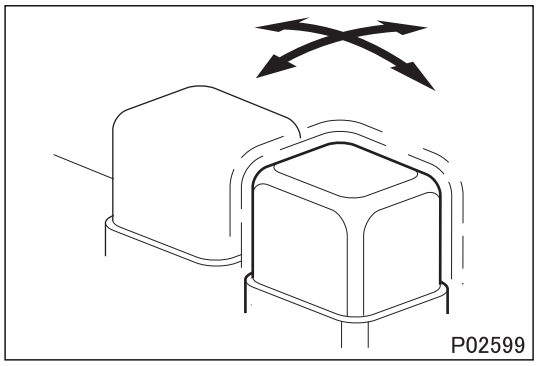



- Disconnect the battery cables before quick-charging the battery with a quick charger.
  Unless the battery cables are disconnected, quick-charging can damage the diodes and regulator.

## 6. Intermittent Faults



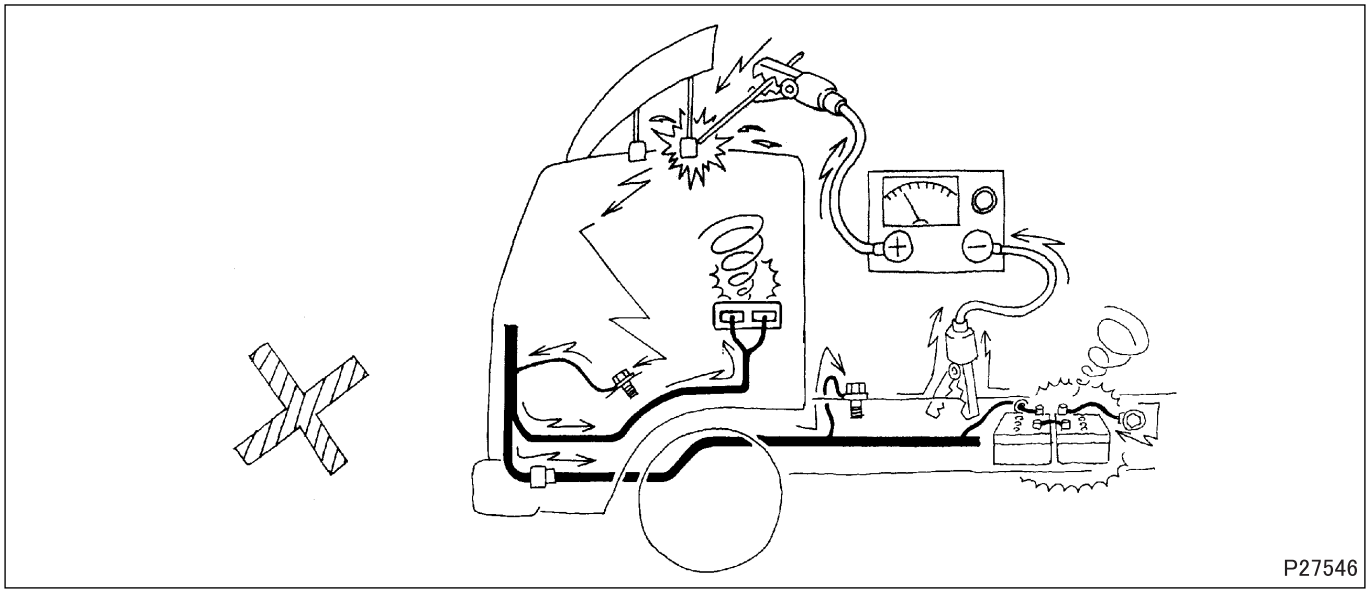




- An intermittent fault typically occurs only under certain operating conditions. Once these conditions have been identified, the cause of the intermittent fault can be ascertained easily. First, ask the customer about the vehicle operating conditions and weather conditions under which the fault occurs. Also ask about the frequency with which the fault occurs and about the fault symptoms. Then, reproduce the fault based on this information.
  In accordance with the conditions under which the fault occurs, determine whether the fault is caused by vibration, heat or other factors. if vibration is a possible factor, see if the fault can be reproduced by performing the following checks on individual connectors and other parts:
  - 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.

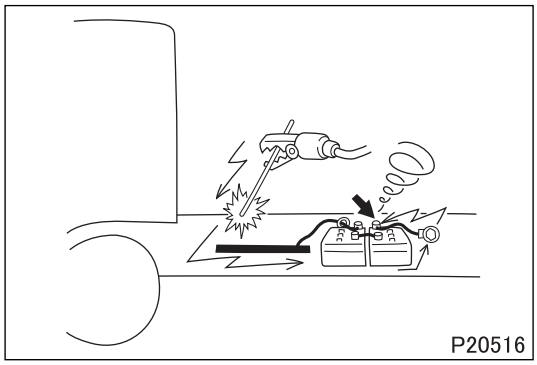
- Connectors and other parts to be checked are those included or given as likely fault locations in inspection procedures corresponding to diagnosis codes and/or fault symptoms.

## 7. Precautions for Arc Welding

- When arc welding is performed, 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. And any electrical device near the point on the vehicle to which the (–) cable of the welder is connected, might be largely damaged.




- Current flows backward as shown below.




### 7.1 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 battery's (–) cable.

### 7.2 Procedure

- Turn the starter switch to the LOCK position.
- Disconnect the battery's (–) cable.
- Cover all parts of the vehicle that may be damaged by welding sparks.
- Connect the welder's (–) cable to the vehicle as close as possible to the area being welded. Do not connect the welder's (–) cable to the cab if the frame is being welded, and vice versa.
- Set the welding current in accordance with the part being welded.

## 8. Precautions When Repainting

- When repainting, cover the following electronic control components with a masking material. If paint get on these components, functional reliability could be deteriorated as a result of the poor connection of connectors, internal circuit failure caused by heat build-up due to poor heat dissipation, erroneous sensor values due to clogged ventilation holes.
  - Engine electronic control unit and other electronic control units
  - Sensors

## 9. Precautions on Cleaning When Servicing the Engine

When servicing the engine care needs to taken with the following to prevent failures caused by dust and foreign objects.

Works that require care to prevent the entry of dust and foreign objects are marked with  and indicated as “Work that requires dust protection”.

### 9.1 Work area

- The working place needs to be well organized and kept clean.
- Do not work outdoors. Take dust prevention measures when working indoors. Do not place parts directly on the floor. Put covers on parts to protect them from dust. Keep the over head doors closed unless necessary such as when a vehicle comes in or goes out.

### 9.2 Clothing and protective wear

- Wear clean working clothes. Do not wear shoes smudged with oil or dirt when working.
- If oil gets on your clothes, immediately wipe it off.
- When a working glove or protective wear becomes dirty or ragged, immediately change it.

### 9.3 Tools

- Common tools, special tools and workbenches used for servicing should be cleaned with a cleaner and rags in advance.
- Whenever a tool or workbench gets damaged or dirty during servicing, immediately clean or replace it.

### 9.4 Washing and drying

- Thoroughly wash the outside of the engine before removing sub-assemblies from the engine.
- After that, remove and disassemble sub-assemblies, then wash each part. The detailed instructions on washing and drying are given in the sections describing washing and inspection procedures and precautions in the engine service manual. Carefully read these instructions to ensure the correct procedures are followed.
- Use the specified cleaner when washing.
- After washing, dry with compressed air to make sure that foreign objects (such as broken bristles of a cleaning brush) do not remain on parts.

### 9.5 Rust prevention and removal of rust-preventive agent (for engine)

- If parts are not used immediately after washing, apply the specified rust-preventive agent (such as engine oil).
- Remove rust-preventive agent when installing a part on the engine.
- When installing a new part to which rust-preventive agent has been applied (such as a crankcase), thoroughly wash it to remove rust and rust-preventive agent. Pay special attention to the fuel and oil lines in particular. Follow the procedure given in the engine service manual for the removal of rust-preventive agent.

### 9.6 New parts (MITSUBISHI FUSO genuine parts)

- Have new parts ready in advance.
- To prevent dust from attaching a new part, unpack immediately before the replacement work.
- Oil seals, packings, O-rings and other rubber parts, gaskets and split pins need to be replaced with new parts after each disassembly. Use MITSUBISHI FUSO genuine parts for replacement.
- Since cleanliness assurance requirements are specified to each part and quality is assured for the delivered parts, handle new parts with care so as not to allow the entry of foreign objects.

### 9.7 Reused parts

#### 9.7.1 Precautions on removal

- Parts removed from engines as well as places where the parts have been removed (intake, exhaust, fuel, lubrication, coolant and other systems) need to be covered with clean paper, rag, plastic sheet, etc. secured with a clean plastic tape if necessary, to prevent the entry of dust.
- Since it is not possible to visually check for dust that has entered pipes in particular, cover both ends of a pipe immediately after washing it.

### 9.7.2 Handling reused parts

- Put removed parts in order for each engine to allow efficient inspection and installation.
- Parts with machined surfaces should not be put directly on the floor. Put these parts on an appropriate wood surface so that the machined surfaces are not damaged.
- Also, other sub-assemblies removed should not be put directly on the floor. Put the sub-assemblies on a clean surface.

### 9.8 Installation

- Install parts by following the instructions given in the engine and chassis service manuals.
- To prevent the entry of dust and foreign objects during installation, thoroughly check that the parts to be installed are clean and free of foreign objects before installation.
- Blow air into reused parts (piping in the intake and injection systems, etc.) again before installation.

### 9.9 Fuel

- Use the specified fuel. Use only clean fuel. Do not use contaminated fuel.
- Be sure to observe the following if fuel is stored on the service site.
  - Cover the filler cap of the storage tank to prevent water contamination.
  - Keep the tank clean. In particular, the filler cap and area around the filler port should be kept clean.
  - Position the tank so that it is slightly inclined toward the bottom drain. This facilitates discharging of accumulated water and deposits. Drain off water at least once a month.
  - Keep the tank as full as possible to minimize condensation.
  - After filling the fuel storage tank, wait for a few hours before filling the equipment's tank. This allows contamination to deposit.

### 9.10 Oils

- Use MITSUBISHI FUSO genuine products for the engine oil, transmission gear oil and automatic transmission fluid. Use only clean oils. Do not use contaminated oils.
- It is not recommended to reuse drained oil or automatic transmission fluid. If it is judged that drained oil or automatic transmission fluid can be reused because it is within the replacement interval and is not excessively contaminated, be sure to observe the following.
  - Store the drained oil or automatic transmission fluid in a clean, dedicated container. Do not use containers that were used to store fuel or water.
  - Make sure that the container is appropriately stored so as to prevent the entry of dust and foreign objects.

### 9.11 Coolant

- Use MITSUBISHI FUSO genuine products for the coolant. Use only clean coolant. Do not use contaminated coolant.
- It is not recommended to reuse drained coolant. If it is judged that coolant can be reused because it is within the replacement interval and is not excessively contaminated, be sure to observe the following.
  - Store the drained coolant in a clean, dedicated container. Do not use containers that were used to store fuel or oil.
  - Make sure that the container is appropriately stored so as to prevent the entry of dust and foreign objects.

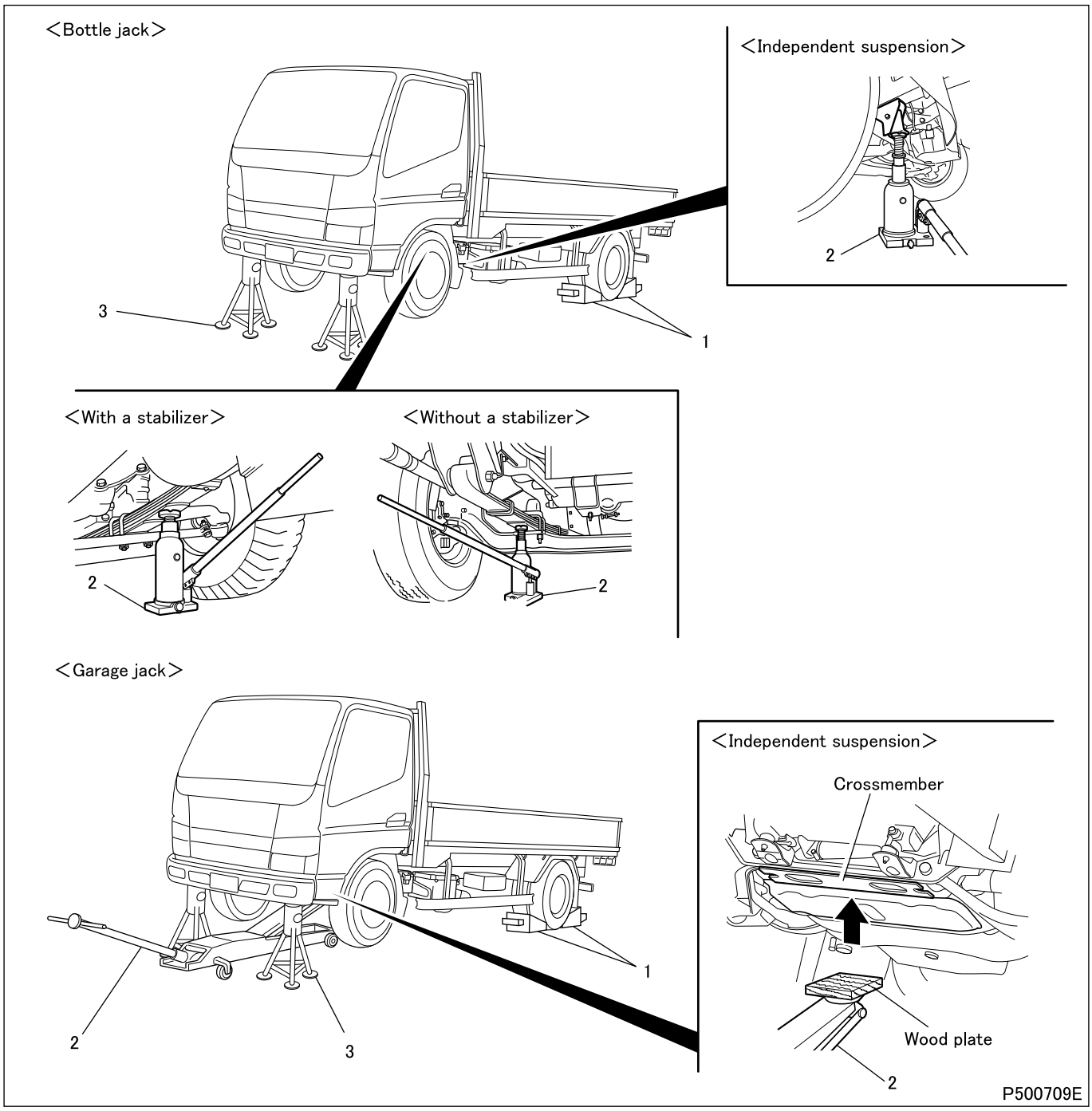
### 9.12 Miscellaneous

- Thoroughly wash the vehicle before servicing. Do not service a dust covered vehicle.
- The garage air must be clean.
  - Blow air onto white paper to check for the presence of water and/or oil in the air flow.
  - If a problem is found, immediately check the compressor.

M E M O

# JACKING UP THE VEHICLE

**<Front of Vehicle>**



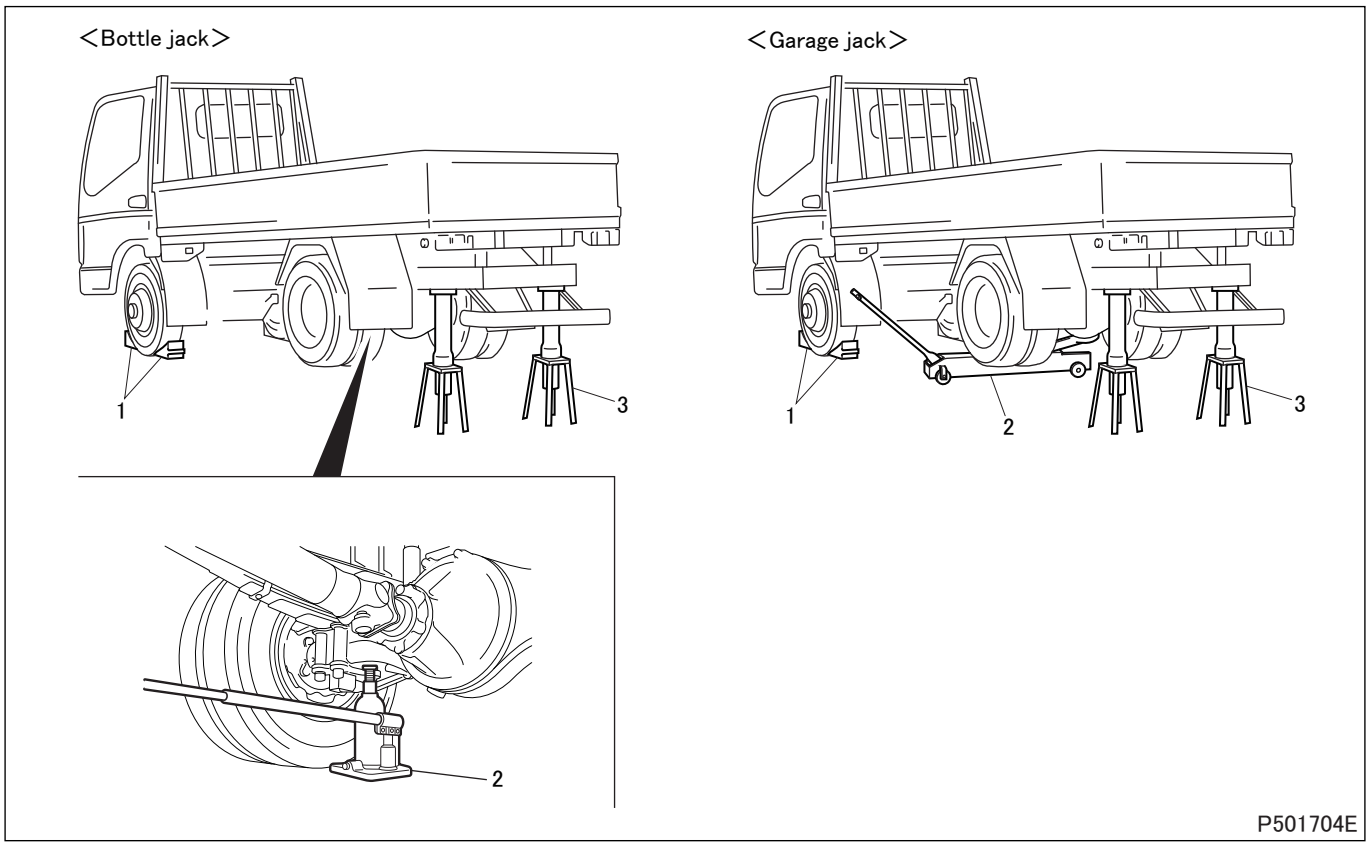

**Jacking up procedure**

1. Place chocks against the rear wheels.
2. Jack up the front of the vehicle with a bottle jack or garage jack.
3. If you use a bottle jack, set it at the jack-up point shown in the figure. If you use a garage jack, set it at the center of the front axle or suspension crossmember <Independent suspension>.
4. Support the front of the vehicle frame on jack stands.

## WARNING ⚠

- **Chock the wheels firmly to prevent the vehicle from rolling away.**
- **Do not attempt to remove the chocks until the operation is completed.**
- **It is extremely dangerous to support the vehicle with only bottle jack or garage jack. Be sure to additionally support the front of the vehicle frame on jack stands.**
- **Never attempt to remove the bottle jack, garage jack, or jack stands until the operation is completed.**

**<Rear of Vehicle>**




**Jacking up procedure**

**1** Place chocks against the rear wheels.
**2** Jack up the rear of the vehicle using a bottle jack or garage jack as illustrated above.
**3** Support the vehicle frame on jack stands on both sides.

## WARNING ⚠

- **Chock the wheels firmly to prevent the vehicle from rolling away.**
- **Do not attempt to remove the chocks until the operation is completed.**
- **It is extremely dangerous to support the vehicle with only bottle jack or garage jack. Be sure to additionally support the vehicle frame on jack stands on both sides.**
- **Never attempt to remove the bottle jack, garage jack, or jack stands until the operation is completed.**

## 1. Diagnosis Codes

- The diagnosis system consists of electronic control unit functions to detect failures of electrical components, communicate with diagnosis tools, and update various data.
- When an electronic control unit detects a failure, it stores the failure information as a diagnosis code (that describes a failure of the vehicle) and alerts the user by displaying a warning.
- By reading diagnosis codes and checking for problems accordingly (troubleshooting), failures in electronically controlled systems can be efficiently identified and remedied.
- Diagnosis codes (fault codes) can be displayed in the following two methods:
  - Using the FUSO Diagnostics. (See later section.)
  - Using the multi-information display in the meter cluster. (See later section.)

### 1.1 Reference Gr list for diagnosis codes

| Warning | System | Reference Gr |
|---|---|---|
| ENG SYS | ENGINE CONTROL | 13E |
| | DPF (Diesel Particulate Filter) SYSTEM | |
| ABS | ANTI-LOCK BRAKE SYSTEM (ABS) | 35E |
| | SUPPLEMENTAL RESTRAINT SYSTEM (SRS) AIRBAG | 52E |
| ISS | IDLING STOP AND START SYSTEM | 54EA |
| METER | METER CLUSTER | 54EM |
| SAM | SIGNAL DETECTED AND ACTUATION MODULES | 54ES |

### 1.2 Types of diagnosis codes

- There are two types of diagnosis codes: current codes and past codes

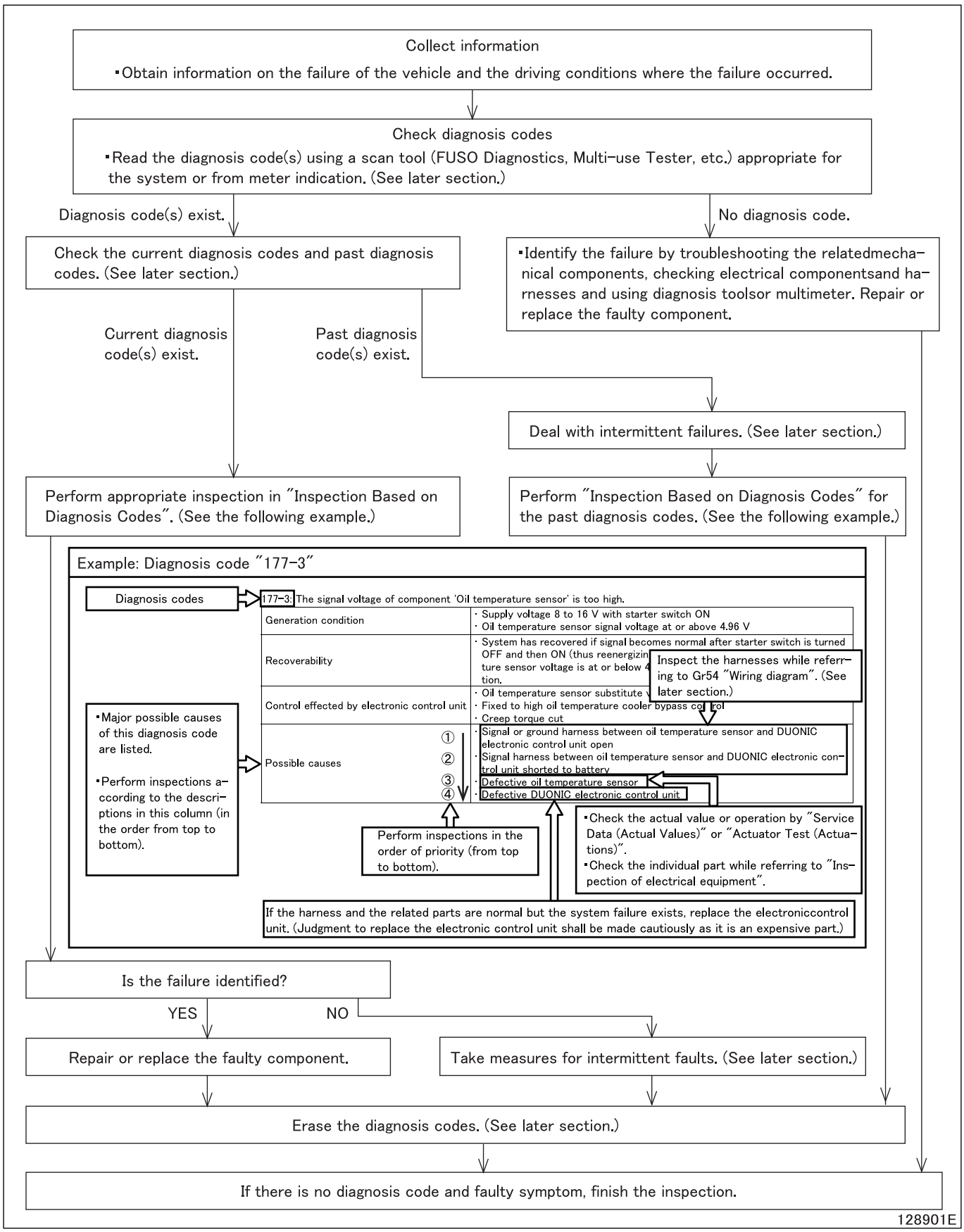
#### 1.2.1 Current diagnosis code

- The current failures in the vehicle can be checked by reading the current diagnosis codes.
- When a current diagnosis code is generated, the warning (or indicator) from the failed system is displayed and its electronic control unit initiates failure mode control such as stopping control or exercising backup control.

#### 1.2.2 Past diagnosis code

- The past failures in the vehicle can be checked by reading the past diagnosis codes.
- When the indication changes from the current diagnosis codes to the past diagnosis codes, the warning (or indicator) showing a failure goes off and the electronic control unit recovers from failure mode control to normal control. (The recovery timing varies depending on the diagnosis code.)
- If the failure has not been resolved, the electronic control unit will detect it again and generate a current diagnosis code.

## 1.3 Follow the flowchart below to inspect the system.

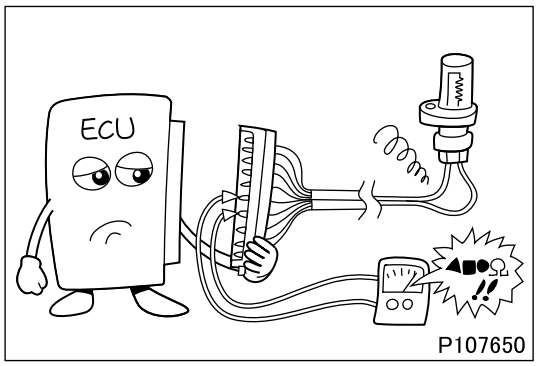


### 1.4 Precautions on troubleshooting

- Check the charging state and specific gravity of the battery before measuring voltage. If inspection is performed with insufficient charging or specific gravity, accurate measurements may not be displayed.
- Be sure to place the starter switch to the LOCK or OFF position and wait for about 5 minutes before removing battery cables, harnesses or connectors. (This is because the BlueTec® system is still in operation.)
- When installing battery cables, harnesses or connectors, place the starter switch and lighting switch to the LOCK or OFF position. Otherwise, electrical components could be damaged.
- When measuring with a multimeter, carefully handle the test bars so that the bars do not short-circuit between connector pins or with the body. Otherwise, electronic control units' internal circuits and electrical components could be damaged.
- Since resistance values are affected by temperature, refer to the descriptions on temperature in this manual as a guideline for pass/fail judgment. If temperature is not specified, normal temperature (10 to 35°C) is assumed.

### 1.5 Inspecting the input and output signals at the electronic control unit connector

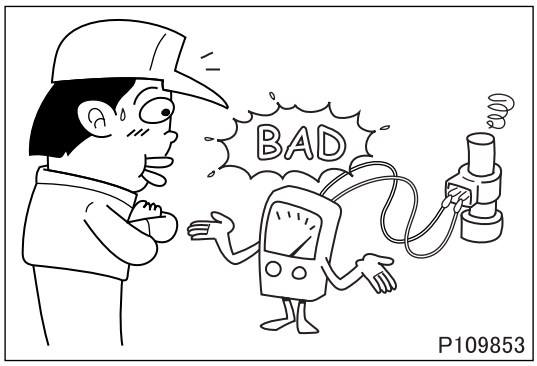
- This inspection is to confirm that signals from electronic control units and electrical components are correctly transmitted to the harnesses and connectors on the vehicle side.




- This inspection includes the following checks:
  - Measure the input voltage of switches and sensors and the output voltage of relays to check for open circuit and short circuit to battery or ground by inserting the test bars from the back side of the connector with the harness (on the electronic control unit connector) on the vehicle side connected.
  - Measure the resistance of temperature sensors, rotation sensors and solenoids to check for open circuit by disconnecting the electronic control unit connector and inserting the test bars into the harness on the vehicle side.
  - Check the operation of magnetic valves for open circuit and valve failure by disconnecting the electronic control unit connector and applying a voltage from the harness on the vehicle side.
- Some electronic unit connectors are equipped with water- or dust-proofing treatment and do not allow test probes to be inserted from the back side of the connectors.

### 1.6 Inspecting the electrical components

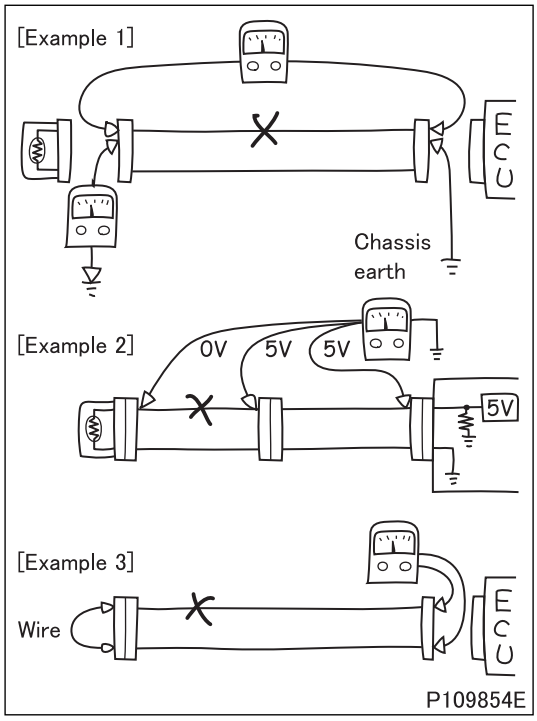
- This inspection is to check that electrical components are operating normally.




- This inspection includes the following checks:
  - Check if electrical components actually operate.
  - Check the internal circuits of electrical components for open and short circuit.
  - Check the characteristics of the output signals from electrical components.
- Operation or signal characteristics checking is not easy on some electrical components, for which only electrical checking for open and short circuit is performed. As a result, there may be cases where a mechanical failure exists in these components even if they are electrically normal. Therefore, it is necessary to make a pass/fail judgment on these electrical components by checking the overall system operation and the related components such as harnesses and connectors.

## 1.7 Inspecting the harnesses

- This inspection is to check for faulty sections of harnesses and connectors.




### 1.7.1 Open circuit

- An open circuit means a harness is broken.

[Inspection example 1]

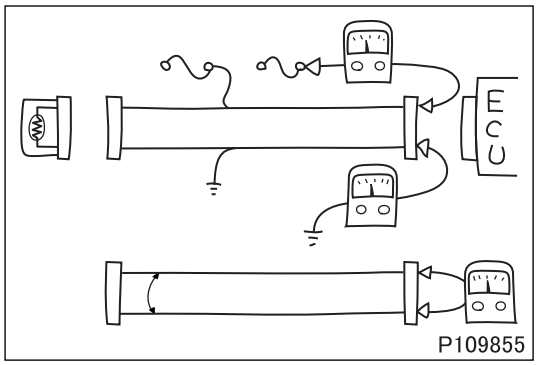
- Measure the resistance between components to confirm that that there is continuity. Gently shake the harness up and down while measuring.
- If the connectors to be measured are far apart from each other, chassis ground may be used.
  Standard value: Less than 5 Ω
- If the measurement is out of the standard value, there is an open circuit in the harness or a poor connection of pins in the connector.

[Inspection example 2]

- Measure voltage from the back side of each connector. Gently shake the harness up and down while measuring.
- If there is a voltage drop, there is an open circuit in the harness in that section or a poor connection of pins in the connector.

[Inspection example 3]

- Connect a wire or equivalent to the component side and measure the resistance between adjacent harnesses. Gently shake the harnesses up and down while measuring.
- If the measurement is out of the standard value shown above, there is an open circuit in the harnesses or a poor connection of pins in the connector.



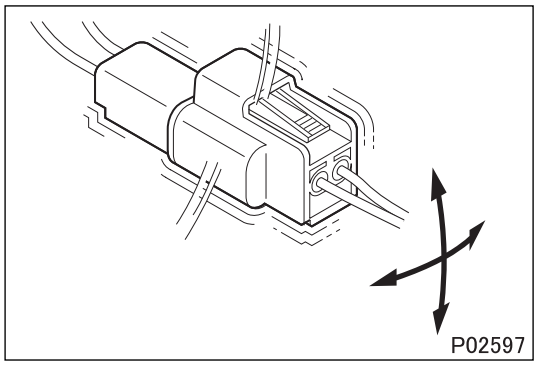

### 1.7.2 Short circuit

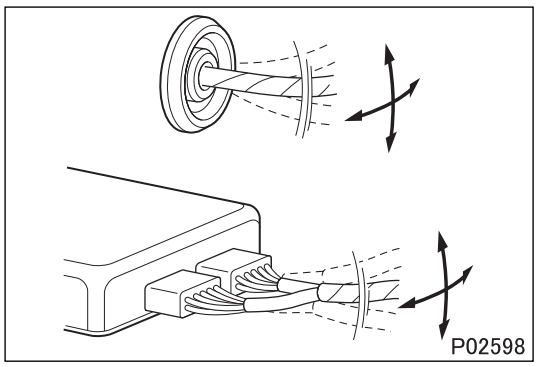
- A short circuit means a harness is in contact with another harness. A large current may occur if the power supply harness directly touches a grounding harness without going through a load.
- A short circuit to power refers to a short circuit to the power supply line carrying the same voltage as the battery voltage. A short circuit to ground refers to a short circuit to a grounding line.

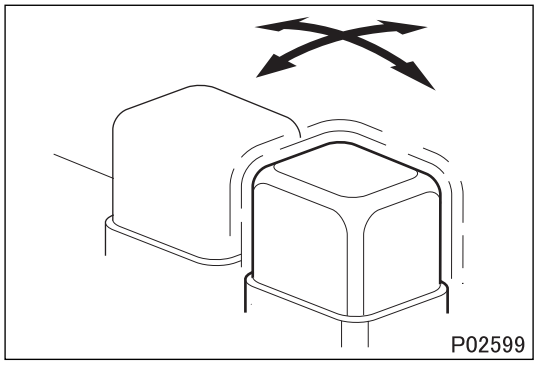
[Inspection example]

- Check the following to confirm that there is no continuity. Gently shake the harness up and down while measuring.
  - Measure the resistance between the pins to be inspected.
  - Measure the resistance between the pin to be inspected and a power line. (short circuit to power)
  - Measure the resistance between the pin to be inspected and a grounding line or chassis ground. (short circuit to ground)
    Standard value: More than 1 MΩ
- If the measurement is out of the standard value, there is a short circuit in the harness or in the connector.

### 1.8 Intermittent faults




- An intermittent fault typically occurs only under certain operating conditions. Once these conditions have been identified, the cause of the intermittent fault can be ascertained easily. 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.
  In accordance with the conditions under which the fault occurs, determine whether the fault is caused by vibration, heat or other factors. if vibration is a possible factor, see if the fault can be reproduced by performing the following checks on individual connectors and other parts:
  - 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.

- Connectors and other parts to be checked are those included or given as likely fault locations in inspection procedures corresponding to diagnosis codes and/or fault symptoms.

## 1.9 Diagnosis tool functions and available tests

### 1.9.1 Basic functions

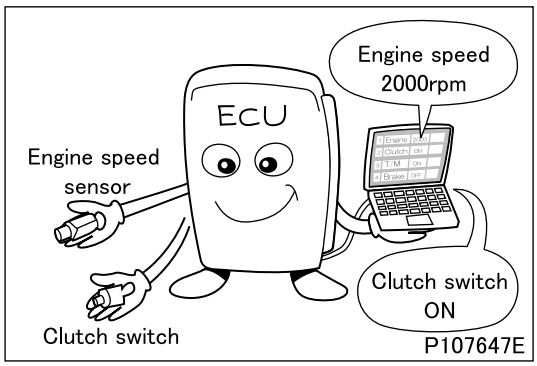
- The basic functions of the diagnosis tools include the readout of diagnosis codes and control information from electronic control units. Efficient troubleshooting can be made by using these functions. A writing function is also provided to allow registering or changing information on electronic control units.
- If you perform a short test with the FUSO Diagnostics, the systems on the vehicle that support the FUSO Diagnostics are automatically determined and a list of the current diagnosis codes (fault codes) is displayed.
- Failures can be efficiently identified and removed by reading diagnosis codes and taking actions (troubleshooting) accordingly.

**(1) Reading diagnosis codes**

- By reading diagnosis codes, failures in the vehicle can be efficiently identified and remedied.

**(2) Reading service data (measured values)**

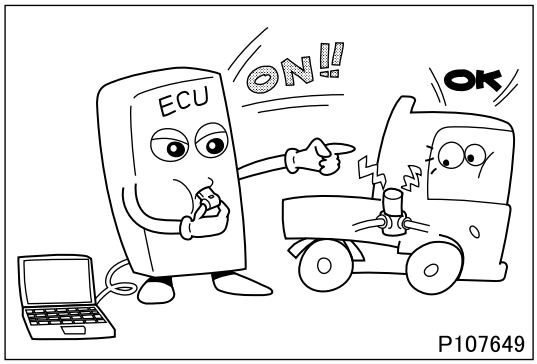
- Service data shows the values and information used for control by an electronic control unit, allowing you to check if the switches, sensors, harnesses or connectors that provide the information are operating normally.




- The following types of service data are available (which varies depending on the electronic control unit):
  - Input or calculated values from switches, sensors and other electronic control units
  - Output values to relays and actuators
  - Vehicle specifications stored in the electronic control unit
- If backup values are displayed as service data, the electrical component or harness associated with the service data is faulty.
- Since some systems store related service data when a diagnosis code is generated as freeze frame data, there may be cases where the cause of a failure can be presumed without reproducing the failure.

**(3) Performing the actuator test (control)**

- By performing an actuator test, functions of an electrical component or electronic control unit can be easily activated to check if the component or unit is faulty or not. Since operation checks can be performed without driving the vehicle, greater efficiency and safety of troubleshooting are assured.




- The following types of actuator tests are available (which varies depending on the electronic control unit):
  - Make an electrical component operate to determine and check failures.
  - Input pseudo signals to an electronic control unit (e.g. a signal that tells the unit that a switch is set to ON regardless of the actual position of the switch).
- In actuator tests, service data may be displayed as “Operating” even if the electrical component is not operating normally. Therefore, also check for operation sound, etc. to make sure.
- When an electronic control unit is exercising failure mode control, the unit may not activate the actuator even if an actuator test is performed (depending on the electronic control unit and failure conditions).

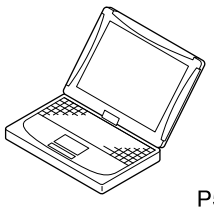
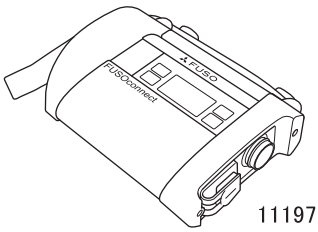
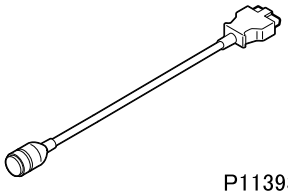
**(4) Registering, changing and resetting the specifications and parameters of electronic control units and coding such as calibration**

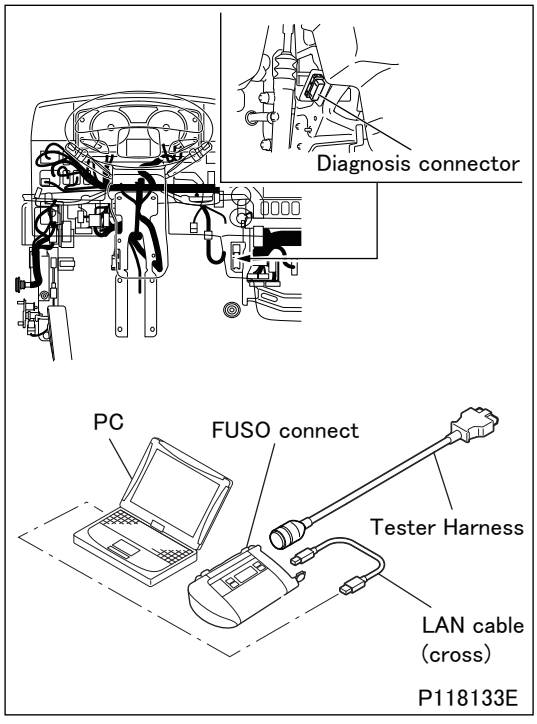
- It is possible to check the specifications and parameters stored in electronic control units, register, change, or reset the parameters or data upon replacement of related components, and update learned values.

## 2. Reading and Erasing the Diagnosis Code

### 2.1 Using the FUSO Diagnostics

### Special tools

| Mark | Tool name and shape | Part No. | Application |
|---|---|---|---|
| ⓒa | PC  P57295 | FD09/2016 or higher (FUSO Diagnostics version) | Data transmission between FUSO connect and PC |
| ⓒb | FUSO Connect  111971 | MH064036 | Data transmission between electronic control unit and PC |
| ⓒc | FUSO Diagnostics test harness  P113938 | MH062998 | Power supply to FUSO connect and communication with electronic control unit |



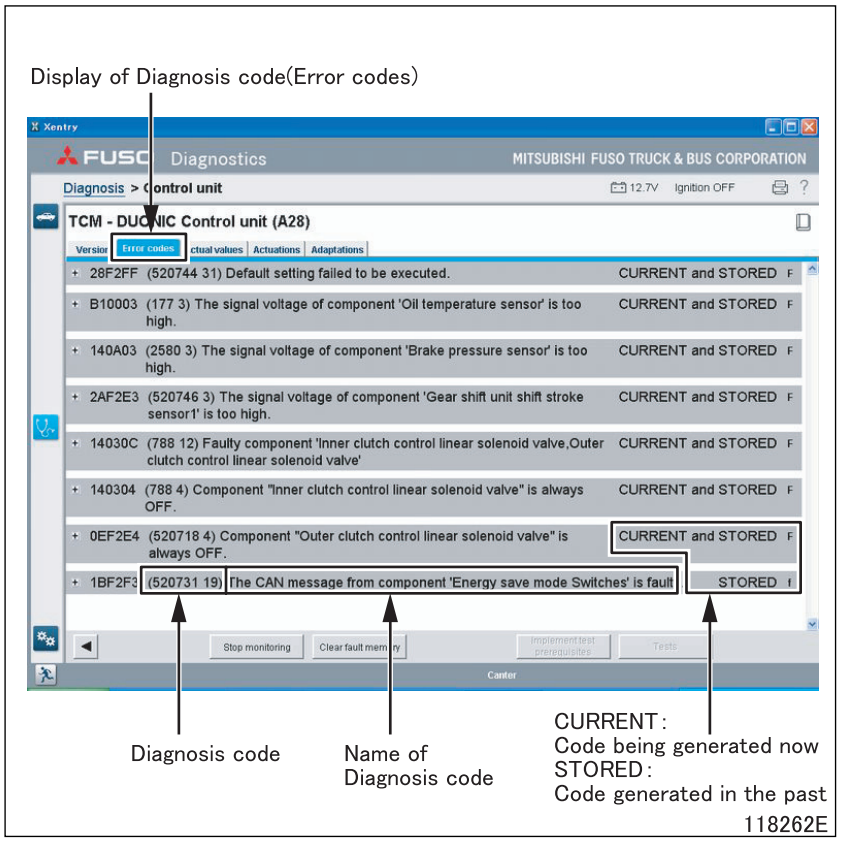

**(1) Connecting the FUSO Diagnostics**

- Turn the starter switch to the LOCK position.
- Connect ⓒa, ⓒb, ⓒc and LAN cable (cross cable; category 5 or higher).
- Connect the diagnostic connector to the ⓒc connector.

**(2) Operating instructions for FUSO diagnostics**

- See the instruction manual for FUSO diagnostics.

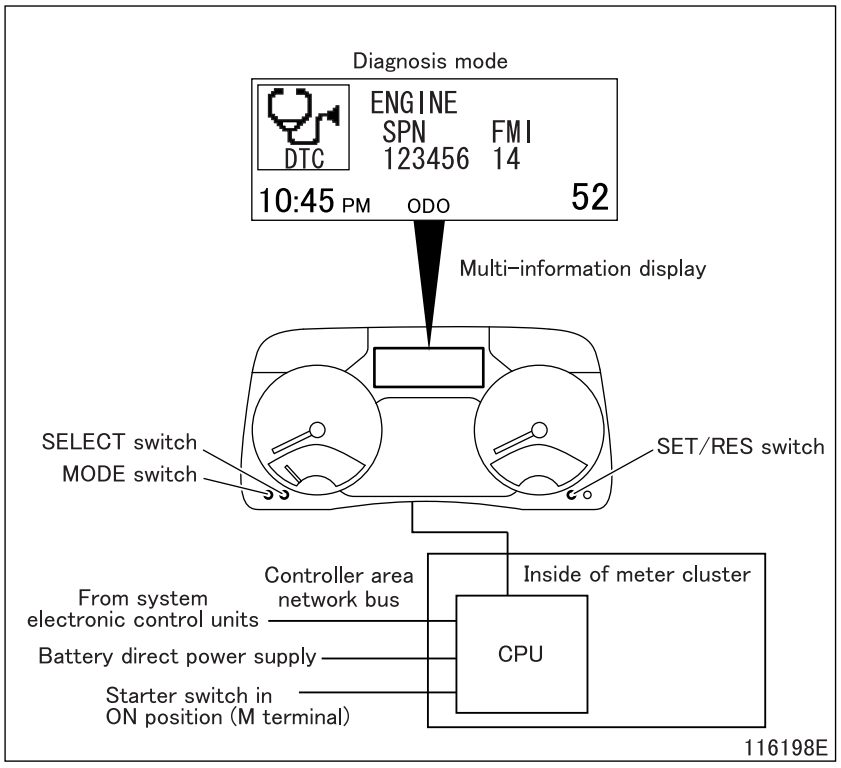
### (3) Description of diagnosis code (fault code) screen.




- [CURRENT and STORED F] shown at the right end denote diagnosis codes issued presently and in the past respectively. [STORED f] denotes diagnosis code issued in the past.

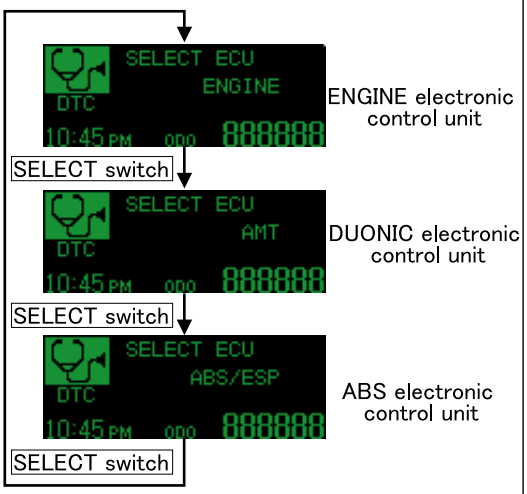
## 2.2 When FUSO diagnostics is not used

- Even if the FUSO Diagnostics is not available, you can display or erase diagnosis codes by using the multi-information display on the meter cluster as follows.




### (1) Preparations for system inspection

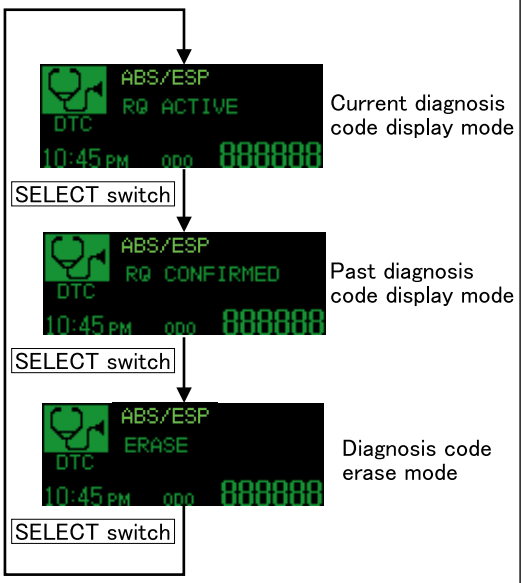
- Stop the vehicle.
- Turn the starter switch ON.
- Press the SELECT, MODE and SET/RES switches simultaneously.
- The multi-information display in the meter cluster enters the diagnosis mode.




The systems (electronic control units) installed vary according to vehicle specification.
The electronic control unit described here is a typical example.

116411E

Case of Anti-lock brake system (hydraulic unit)



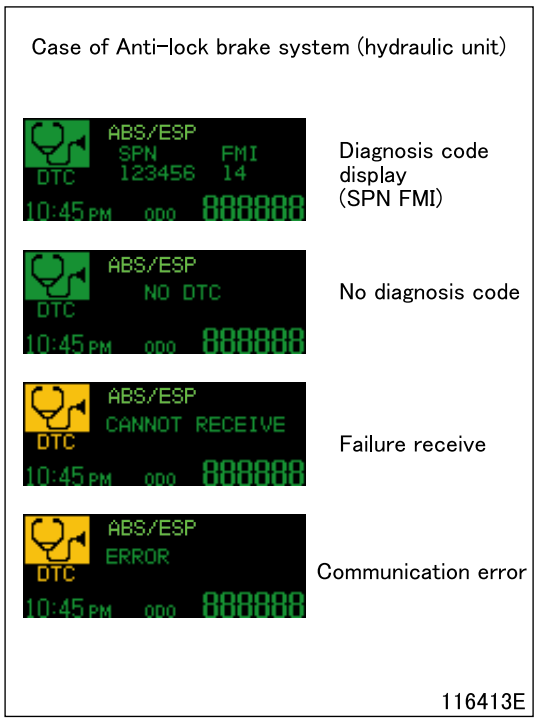

116412E

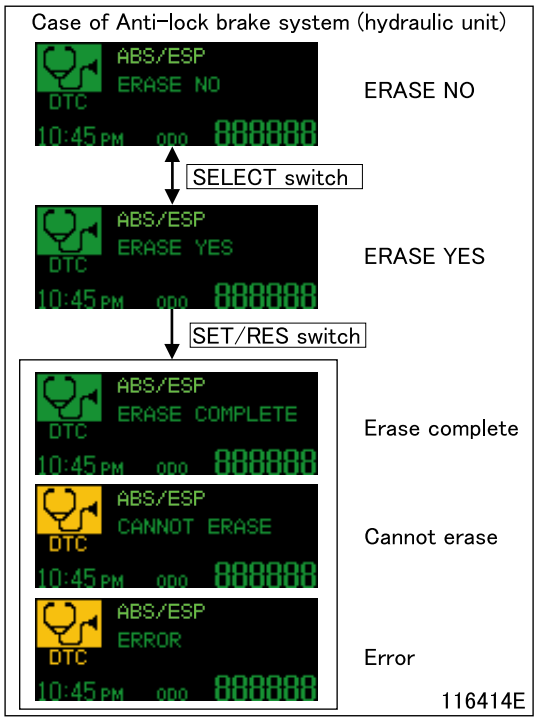
**(2) System (electronic control unit) selection mode**

- Press the SELECT switch to select the system (electronic control unit) to be checked.
- Press the SET/RES switch to enter the function selection mode.

**(3) Function selection mode**

- Press the SELECT switch to select the desired mode.
- Press the SET/RES switch to enter one of the following modes:
  - Current diagnosis code display mode
  - Past diagnosis code display mode
  - Diagnosis code erase mode
- When the MODE switch is pressed, the system (electronic control unit) selection mode will be entered.




### (4) Current and past diagnosis code display modes

- Generated diagnosis codes are displayed. When two or more diagnosis codes have been generated, they are displayed in turns at 3-second intervals. If there is no diagnosis code, “NO DTC” is displayed.
- If “ERROR” or “CANNOT RECEIVE” is displayed during communication, perform the operation again.
- When the MODE switch is pressed, the function selection mode will be entered.

## NOTE

- **For the engine electronic control unit, check the diagnosis code shown in the “RQ CONFIRMED” screen.**
- **For the engine electronic control unit, “RQ ACTIVE” is not a diagnosis code indicating a failure.**

### (5) Diagnosis code erase mode

- If the SET/RES switch is pressed in the “ERASE YES” screen, all diagnosis codes stored in the selected electronic control unit will be erased and “ERASE COMPLETE” will be displayed.
- If “CANNOT ERASE” or “ERROR” screen is displayed, connect the FUSO Diagnostics to check each system and take necessary actions.
- When the MODE switch is pressed, the function selection mode will be entered.
- When the SET/RES switch is pressed in the “ERASE NO” screen, the function selection mode will be entered.

# TABLE OF STANDARD TIGHTENING TORQUES

## 1. Tightening Torques

- Tightening torques are roughly classified into the following two categories:

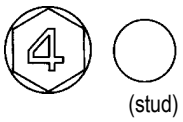
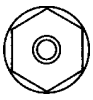
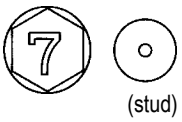
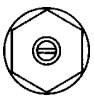
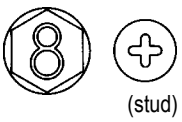
| Tightening torque | Definition | Availability of torque specifications in text | How to determine tightening torque |
|---|---|---|---|
| Standard tightening torque | Tightening torque determined according to thread size and material of bolts and nuts | None | Locate a bolt or nut corresponding to actual part in the following standard tightening torque table. |
| Specified tightening torque | Tightening torque of bolts and nuts other than those defined in “Standard tightening torque”, or that of bolts and nuts not identified in the following tables | Provided | Tightening torque is shown in the text. |

- Fasteners used in a location denoted by “wet” should always be tightened in a wet condition (lubricated with engine oil or grease). Any other fasteners than those so specified should be tightened in a dry condition.

## 2. Table of Standard Tightening Torque <JIS >

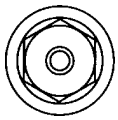
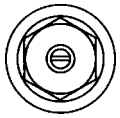
- Threads and bearing surfaces shall be dry (tightened in a dry condition).
- If the mating nut and bolt (or stud bolt) are different in level of strength, tighten them to the torque specified for the bolt.
- Automotive screws refer to coarse screw thread with nominal diameter of 3 to 8 mm or fine screw thread with nominal diameter of 10 mm or larger.

**(1) Hexagon head bolts and stud bolts (Unit: N·m {kgf·m})**

| | | Strength | | | | | |
|---|---|---|---|---|---|---|---|
| | | 4T | | 7T | | 8T | |
| | |  (stud) |  |  (stud) |  |  (stud) |  |
| | | Automotive screw thread | Coarse screw thread | Automotive screw thread | Coarse screw thread | Automotive screw thread | Coarse screw thread |
| Nominal diameter mm | **M5** | 2 to 3 {0.2 to 0.3} | – | 4 to 6 {0.4 to 0.6} | – | 5 to 7 {0.5 to 0.7} | – |
| | **M6** | 4 to 6 {0.4 to 0.6} | – | 7 to 10 {0.7 to 1.0} | – | 8 to 12 {0.8 to 1.2} | – |
| | **M8** | 9 to 13 {0.9 to 1.3} | – | 16 to 24 {1.6 to 2.4} | – | 19 to 28 {1.9 to 2.9} | – |
| | **M10** | 18 to 27 {1.8 to 2.8} | 17 to 25 {1.7 to 2.5} | 34 to 50 {3.5 to 5.1} | 32 to 48 {3.3 to 4.9} | 45 to 60 {4.6 to 6.1} | 37 to 55 {3.8 to 5.6} |
| | **M12** | 34 to 50 {3.5 to 5.1} | 31 to 45 {3.2 to 4.6} | 70 to 90 {7.1 to 9.2} | 65 to 85 {6.6 to 8.7} | 80 to 105 {8.2 to 11} | 75 to 95 {7.6 to 9.7} |
| | **M14** | 60 to 80 {6.1 to 8.2} | 55 to 75 {5.6 to 7.6} | 110 to 150 {11 to 15} | 100 to 140 {10 to 14} | 130 to 170 {13 to 17} | 120 to 160 {12 to 16} |
| | **M16** | 90 to 120 {9.2 to 12} | 90 to 110 {9 to 11} | 170 to 220 {17 to 22} | 160 to 210 {16 to 21} | 200 to 260 {20 to 27} | 190 to 240 {19 to 24} |
| | **M18** | 130 to 170 {13 to 17} | 120 to 150 {12 to 15} | 250 to 330 {25 to 34} | 220 to 290 {22 to 30} | 290 to 380 {30 to 39} | 250 to 340 {25 to 35} |
| | **M20** | 180 to 240 {18 to 24} | 170 to 220 {17 to 22} | 340 to 460 {35 to 47} | 310 to 410 {32 to 42} | 400 to 530 {41 to 54} | 360 to 480 {37 to 49} |
| | **M22** | 250 to 330 {25 to 34} | 230 to 300 {23 to 31} | 460 to 620 {47 to 63} | 420 to 560 {43 to 57} | 540 to 720 {55 to 73} | 490 to 650 {50 to 66} |
| | **M24** | 320 to 430 {33 to 44} | 290 to 380 {30 to 39} | 600 to 810 {61 to 83} | 540 to 720 {55 to 73} | 700 to 940 {71 to 96} | 620 to 830 {63 to 85} |

| | | Strength | |
|---|---|---|---|
| | | 8.8 (Nut 4T) | 8.8 (Nut 6T) |
| | |  | |
| | | Automotive screw thread | |
| Nominal diameter mm | **M10** | 18 to 27 {1.8 to 2.8} | 45 to 60 {4.6 to 6.1} |
| | **M12** | 34 to 50 {3.5. to 5.1} | 80 to 105 {8.2 to 11} |
| | **M14** | 60 to 80 {6.1 to 8.2} | 130 to 170 {13 to 17} |

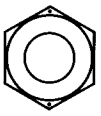
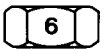
**(2) Hexagon flange bolts (Unit: N·m {kgf·m})**

| | | Strength | | | | | |
|---|---|---|---|---|---|---|---|
| | | 4T | | 7T | | 8T | |
| | |  |  |  |  |  |  |
| | | Automotive screw thread | Coarse screw thread | Automotive screw thread | Coarse screw thread | Automotive screw thread | Coarse screw thread |
| Nominal diameter mm | **M6** | 4 to 6 {0.4 to 0.6} | – | 8 to 12 {0.8 to 1.2} | – | 10 to 14 {1.0 to 1.4} | – |
| | **M8** | 10 to 15 {1.0 to 1.5} | – | 19 to 28 {1.9 to 2.9} | – | 22 to 33 {2.2 to 3.4} | – |
| | **M10** | 21 to 31 {2.1 to 3.2} | 20 to 29 {2.0 to 3.0} | 45 to 55 {4.6 to 5.6} | 37 to 54 {3.8 to 5.5} | 50 to 65 {5.1 to 6.6} | 50 to 60 {5.1 to 6.1} |
| | **M12** | 38 to 56 {3.9 to 5.7} | 35 to 51 {3.6 to 5.2} | 80 to 105 {8.2 to 11} | 70 to 95 {7.1 to 9.7} | 90 to 120 {9.2 to 12} | 85 to 110 {8.7 to 11} |

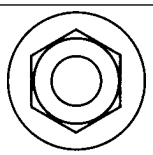
| | | Strength | |
|---|---|---|---|
| | | 8.8 (Nut 4T) | 8.8 |
| | |  | |
| | | Automotive screw thread | |
| Nominal diameter mm | **M10** | 21 to 31 {2.1 to 3.2} | 50 to 65 {5.1 to 6.6} |
| | **M12** | 38 to 56 {3.9 to 5.7} | 90 to 120 {9.2 to 12} |

# TABLE OF STANDARD TIGHTENING TORQUES

**(3) Hexagon nuts (Unit: N·m {kgf·m})**

| | | Strength | | | | | |
|---|---|---|---|---|---|---|---|
| | | 4T | | 6T (Bolt 7T) | | 6T (Bolt 8T) | |
| | |  | |  |  |  |  |
| | | Automotive screw thread | Coarse screw thread | Automotive screw thread | Coarse screw thread | Automotive screw thread | Coarse screw thread |
| Nominal diameter mm | **M5** | 2 to 3 {0.2 to 0.3} | – | 4 to 6 {0.4 to 0.6} | – | 5 to 7 {0.5 to 0.7} | – |
| | **M6** | 4 to 6 {0.4 to 0.6} | – | 7 to 10 {0.7 to 1.0} | – | 8 to 12 {0.8 to 1.2} | – |
| | **M8** | 9 to 13 {0.9 to 1.3} | – | 16 to 24 {1.6 to 2.4} | – | 19 to 28 {1.9 to 2.9} | – |
| | **M10** | 18 to 27 {1.8 to 2.8} | 17 to 25 {1.7 to 2.5} | 34 to 50 {3.5 to 5.1} | 32 to 48 {3.3 to 4.9} | 45 to 60 {4.6 to 6.1} | 37 to 55 {3.8 to 5.6} |
| | **M12** | 34 to 50 {3.5 to 5.1} | 31 to 45 {3.2 to 4.6} | 70 to 90 {7.1 to 9.2} | 65 to 85 {6.6 to 8.7} | 80 to 105 {8.2 to 11} | 75 to 95 {7.6 to 9.7} |
| | **M14** | 60 to 80 {6.1 to 8.2} | 55 to 75 {5.6 to 7.6} | 110 to 150 {11 to 15} | 100 to 140 {10 to 14} | 130 to 170 {13 to 17} | 120 to 160 {12 to 16} |
| | **M16** | 90 to 120 {9.2 to 12} | 90 to 110 {9 to 11} | 170 to 220 {17 to 22} | 160 to 210 {16 to 21} | 200 to 260 {20 to 27} | 190 to 240 {19 to 24} |
| | **M18** | 130 to 170 {13 to 17} | 120 to 150 {12 to 15} | 250 to 330 {25 to 34} | 220 to 290 {22 to 30} | 290 to 380 {30 to 39} | 250 to 340 {25 to 35} |
| | **M20** | 180 to 240 {18 to 24} | 170 to 220 {17 to 22} | 340 to 460 {35 to 47} | 310 to 410 {32 to 42} | 400 to 530 {41 to 54} | 360 to 480 {37 to 49} |
| | **M22** | 250 to 330 {25 to 34} | 230 to 300 {23 to 31} | 460 to 620 {47 to 63} | 420 to 560 {43 to 57} | 540 to 720 {55 to 73} | 490 to 650 {50 to 66} |
| | **M24** | 320 to 430 {33 to 44} | 290 to 380 {30 to 39} | 600 to 810 {61 to 83} | 540 to 720 {55 to 73} | 700 to 940 {71 to 96} | 620 to 830 {63 to 85} |

**(4) Hexagon flange nuts (Unit: N·m {kgf·m})**

| | | Strength | |
|---|---|---|---|
| | | 4T | |
| | |  | |
| | | Automotive screw thread | Coarse screw thread |
| Nominal diameter mm | **M6** | 4 to 6 {0.4 to 0.6} | – |
| | **M8** | 10 to 15 {1.0 to 1.5} | – |
| | **M10** | 21 to 31 {2.1 to 3.2} | 20 to 29 {2.0 to 3.0} |
| | **M12** | 38 to 56 {3.9 to 5.7} | 35 to 51 {3.6 to 5.2} |

**(5) Tightening torques of general flare nuts (Unit: N·m {kgf·m})**

| Pipe diameter mm | ϕ4.76 | ϕ6.35 | ϕ8 | ϕ10 | ϕ12 | ϕ15 |
|---|---|---|---|---|---|---|
| Tightening torque | 17 {1.7} | 25 {2.6} | 39 {4.0} | 59 {6.0} | 88 {9.0} | 98 {10} |

**(6) Tightening torques of nylon tubes for general air piping (DIN) (Unit: N·m {kgf·m})**

| Nominal diameter × wall thickness mm | 6 × 1 | 10 × 1.25 | 12 × 1.5 | 15 × 1.5 |
|---|---|---|---|---|
| Tightening torque | $20^{+6}_{0}$ {$2.0^{+0.6}_{0}$} | $34^{+10}_{0}$ {$3.5^{+1.0}_{0}$} | $49^{+10}_{0}$ {$5.0^{+1.0}_{0}$} | $54^{+5}_{0}$ {$5.5^{+0.5}_{0}$} |

**(7) Tightening torques of nylon tubes for general air piping (SAE) (Unit: N·m {kgf·m})**

| Nominal diameter in. | 1/4 | 3/8 | 1/2 | 5/8 |
|---|---|---|---|---|
| Tightening torque | $13^{+4}_{0}$ {$1.3^{+0.4}_{0}$} | $29^{+5}_{0}$ {$3.0^{+0.5}_{0}$} | $49^{+5}_{0}$ {$5.0^{+0.5}_{0}$} | $64^{+5}_{0}$ {$6.5^{+0.5}_{0}$} |