



## **STERLING 360™ WORKSHOP MANUAL**

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**Models: COE 30  
COE 45  
COE 50**

# STERLING 360™

## WORKSHOP MANUAL

### 2008 Model Year FOREWORD

This Workshop Manual contains maintenance and repair methods for the Sterling 360™. The purpose of this manual is to assist the service technician when the vehicle is serviced.

**IMPORTANT:** Descriptions and specifications in this manual were in effect at the time of printing. Freightliner LLC reserves the right to discontinue models, and to change specifications or design at any time without notice and without incurring obligation. Descriptions and specifications contained in this publication provide no warranty, express or implied, and are subject to revision and editions without notice. For additional information, please contact Freightliner LLC, Service Systems and Documentation, P.O. Box 3849, Portland, OR 97208-3849, U.S.A. or refer to <http://www.Freightliner.com> and <http://www.SterlingTrucks.com>.

Whenever you see instructions in this manual to discard materials, you should attempt to reclaim and recycle them. To preserve our environment, follow appropriate environmental rules and regulations when disposing of materials.

**NOTICE:** Do not replace suspension, axle, or steering parts (such as springs, wheels, hubs, and steering gears) with used parts. Used parts may have been subjected to collisions or improper use and have undetected structural damage.

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# EQUIPMENT TYPE CODES LIST

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

# POWER TRAIN TABLE

00

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

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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 re-used 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.

# HOW TO READ THIS MANUAL

## ● Torque values

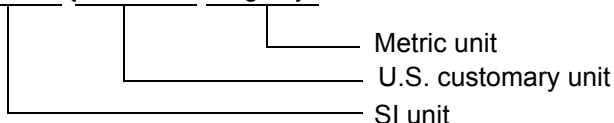
- In each section, specific values are given for non-standard fasteners.
- When no torque value is specified, use the “Table of standard torques” in this section.  
(Values for standard torques are based on thread size and material.)
- When a fastener is to be tightened “wet,” this will be indicated.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

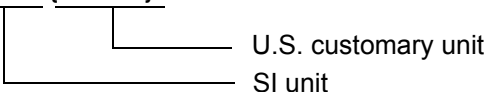
\*SI: Le Système International d’Unités

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 <sup>2</sup> }	98.0665 kPa {14.22 psi, 1 kgf/cm <sup>2</sup> }
	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}

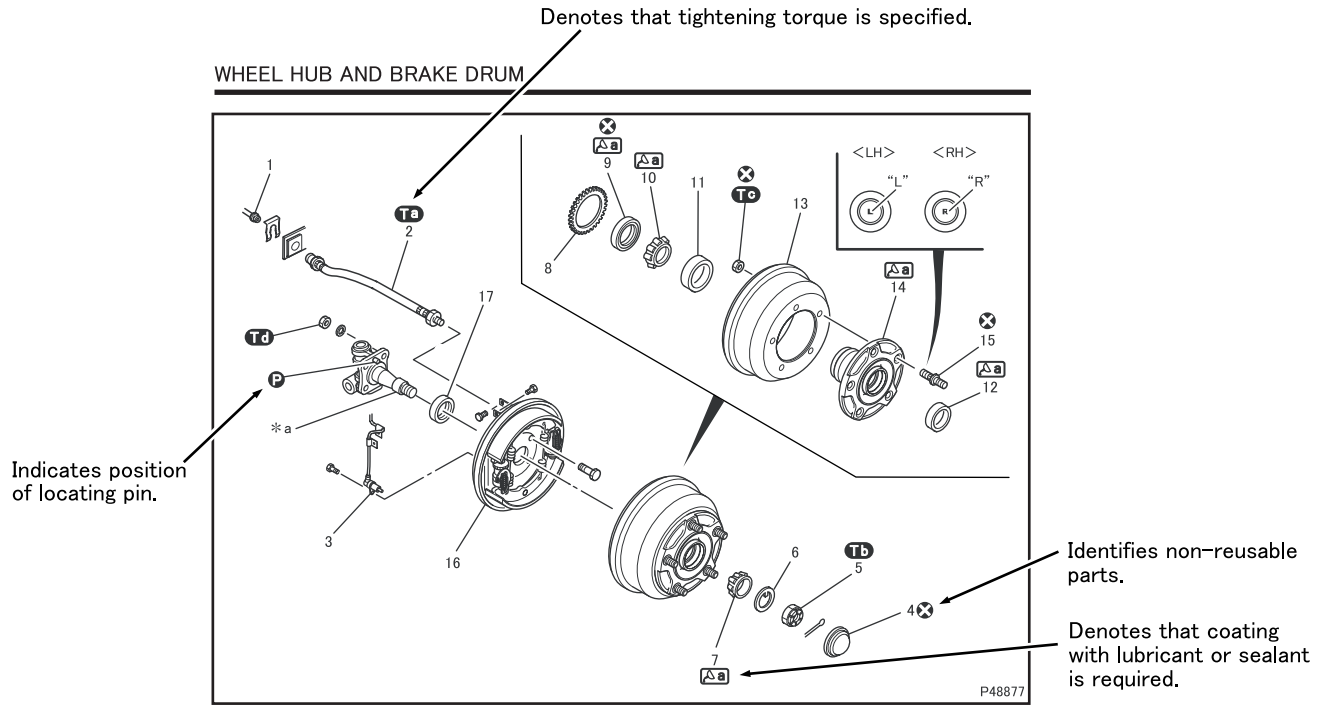
Example: 30 mm {1.18 in.}



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 <sup>3</sup> {cu.in.}	1 cm <sup>3</sup> {0.061023 cu.in.}
Area		m <sup>2</sup> {in <sup>2</sup> }, m <sup>2</sup> {ft <sup>2</sup> }	1 m <sup>2</sup> {1.550 × 10 <sup>3</sup> in <sup>2</sup> }, 1 m <sup>2</sup> {1.076 × 10 ft <sup>2</sup> }



Symbol	Denotation	Application	Remarks
<b>Ta</b>	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.
<b>P</b>	Locating pin	Parts to be positioned for installation	
<b>X</b>	Expendable part	Parts not to be reused	Replace the part whenever removed.
<b>Δa</b>	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.
<b>C a</b>	Special tool	Parts for which special tools are required for service operation	Tool name/shape and part number are shown in table.
<b>*a</b>	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 Gr.35A)
  - 17 Spacer
- \* a: Knuckle  
**P**: Locating pin  
**X**: 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
		Cylindricity	0.05 [0.0020]	0.05 [0.0079]	

These location numbers correspond with disassembly sequence numbers.

# HOW TO READ THIS MANUAL

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

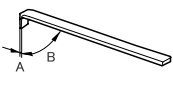
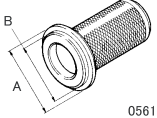
## Tightening torque (unit: N·m [ft.lbs, kgf·m])

Mark	Part to be tightened	Tightening torque	Remarks
<b>Tb</b>	Brake force tightening	13 to 17 [9.6 to 13, 1.3 to 1.7]	-
<b>Tb</b>	Lock nut	113 ± 15 [83 ± 11, 11.5 ± 1.5]	Wet
<b>Tb</b>	Nut (brake drum and wheel hub mounting)	343 ± 39 [250 ± 29, 35 ± 4]	-
<b>Tb</b>	Nut (front drum brake mounting)	118 ± 20 [87 ± 15, 12 ± 2]	-

## Lubricant and/or sealant

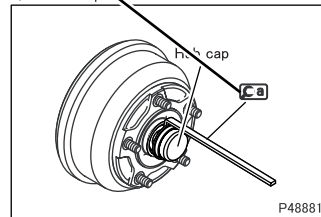
Mark	Point of application	Specified lubricant and/or sealant	Quantity
<b>Aa</b>	Between rolls of outer bearing inner race and inner bearing inner race	Mitsubishi wheel bearing grease	As required
	Inside wheel hub		395 ± 40 g (13.9 ± 1.41 oz)

## Special tools (unit: mm [in.])

Mark	Tool name and shape	Part No.	Application				
<b>Ca</b>	Hub Cap Wrench <table border="1"> <tr> <td>A</td> <td>B</td> </tr> <tr> <td>0.5°</td> <td>78°</td> </tr> </table>  P49261	A	B	0.5°	78°	MB999108	Removal of hub cap
A	B						
0.5°	78°						
<b>Cb</b>	Oil Seal Installer <table border="1"> <tr> <td>A</td> <td>B</td> </tr> <tr> <td>φ 84 [3.31]</td> <td>φ 70 [2.76]</td> </tr> </table>  05619	A	B	φ 84 [3.31]	φ 70 [2.76]	MB999097	Installation of oil seal
A	B						
φ 84 [3.31]	φ 70 [2.76]						

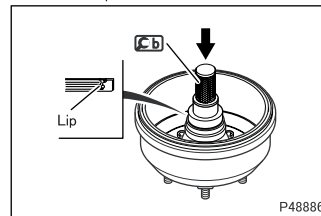
Identification marks for special tools are the same as used in the text.

### ◆ Removal procedure



■ Removal: Hub cap

### ◆ Installation procedure ◆



■ 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.

P58290N

This section suggests areas to inspect for each diagnosis code.

**TROUBLESHOOTING**

1. Diagnosis Procedure
2. Diagnostic Precautions
3. Inspections Based On Diagnosis Codes
4. Multi-Use Tester Service Data
5. Actuator Tests Performed Using Multi-Use Tester
6. Inspections Performed At Electronic Control Unit Connectors

**INSPECTION OF ELECTRICAL EQUIPMENT**

**INSTALLED LOCATIONS OF PARTS**

**ELECTRIC CIRCUIT DIAGRAM**

These are the diagnosis codes and message displayed on the Multi-Use Tester. Numerical values in parenthesis are added only when a diagnostic code indicated in the Multi-Use Tester display differs from the code indicated by flashing the diagnostic light.

**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	17: Exhaust brake 3-Way magnetic valve
	Electrical part	#565: Exhaust brake 3-Way magnetic valve
	Wiring diagram	Exhaust brake 3-Way magnetic valve circuit

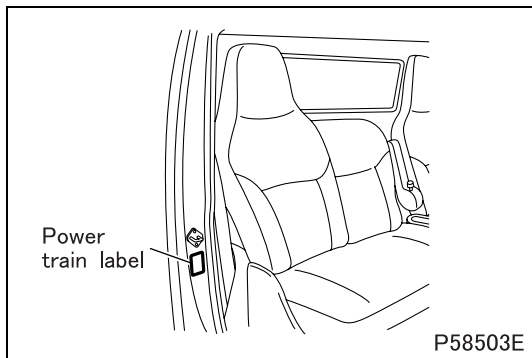
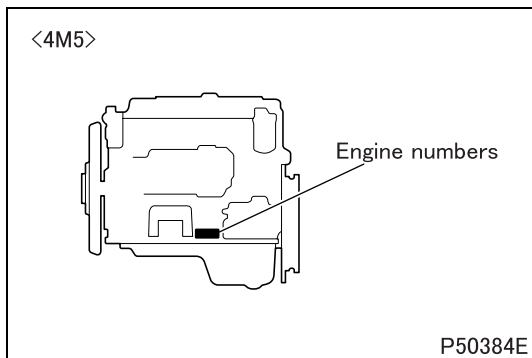
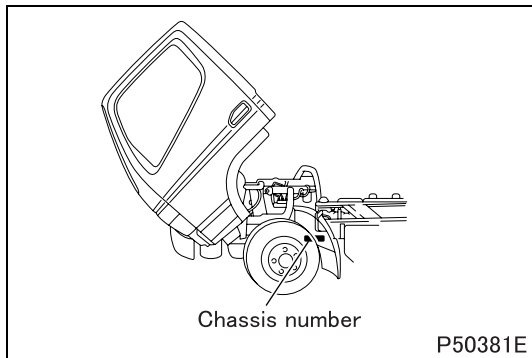
Refer to "Inspection of Electrical Equipment."

Refer to "Electric Circuit Diagram."

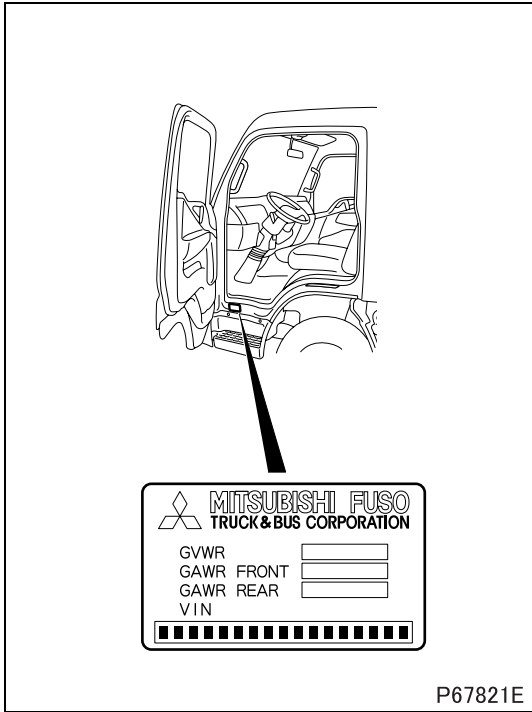
# CHASSIS NUMBER, ENGINE NUMBER, POWER TRAIN LABEL

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- 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 ■ 7 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                         | 8: 2008                                   |
| (11) Plant                              | K: Kawasaki                               |
| (12) Plant sequential number            |   |

# PRECAUTIONS FOR MAINTENANCE OPERATION

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## DANGER

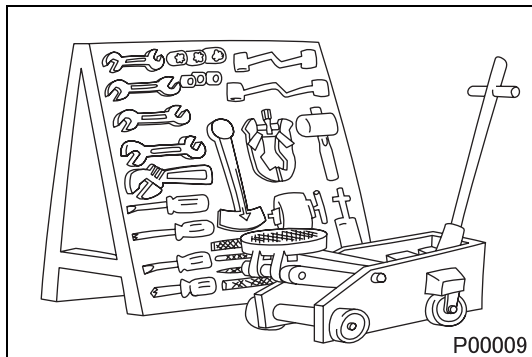
This product contains or emits chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

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- 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.



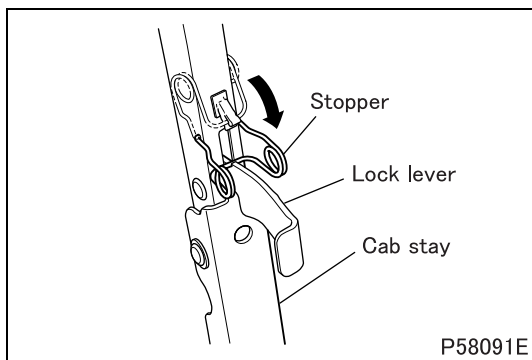
- Perform service operations on a level surface. Before starting, take the following preparatory steps:
  - To prevent soiling and damage, place covers over the seats, trim and floor in the cab and over the paint work of the body.



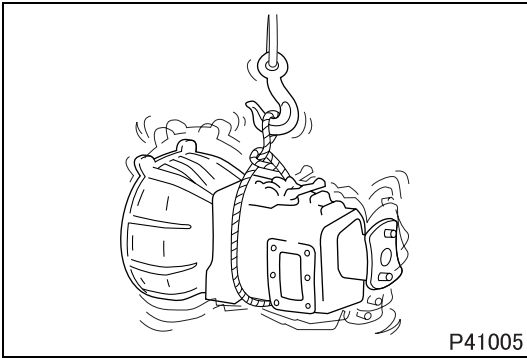
- Have ready all the tools necessary for the job, including special tools as required.

## CAUTION

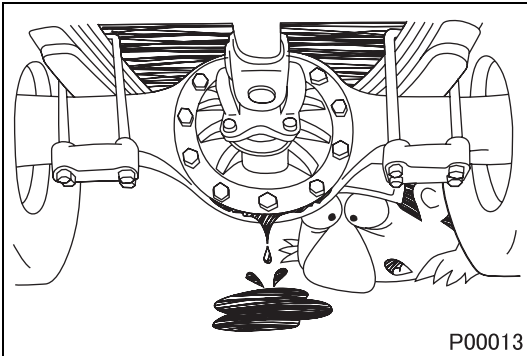
- **Special tools must be used whenever this manual requires them. Do not attempt to use other tools since they could cause injuries and/or vehicle damage.**
- 



- 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.

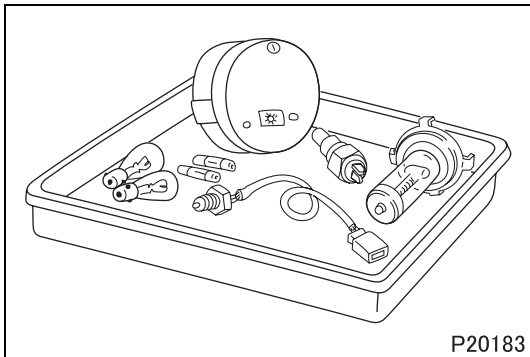


- If lifting eyes are not provided, tie a cable around the unit taking into account the unit's center of gravity.
- Do not allow anyone to walk or stand underneath a unit suspended on a lifting device.
- Never work in shoes with oily soles.  
When working with a partner or in a group, use pre-arranged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

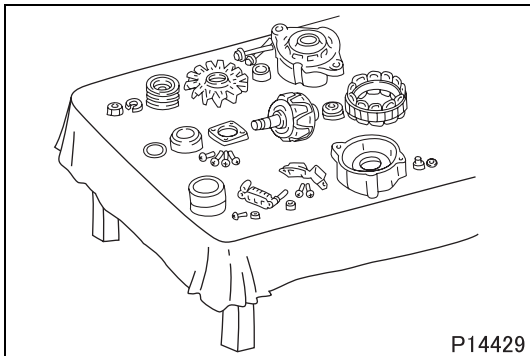


- Inspect for fluid leaks before washing the vehicle. Signs of fluid leaks may go unnoticed on a freshly-washed vehicle.

# PRECAUTIONS FOR MAINTENANCE OPERATION



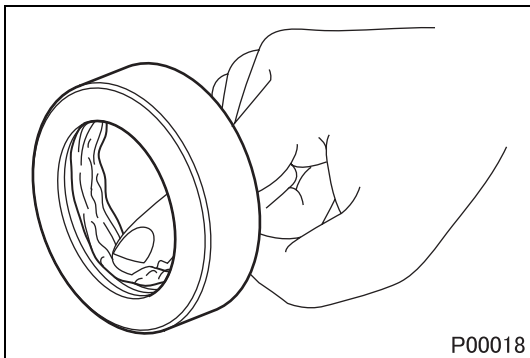
- Have replacement parts ready for installation.
- Oil seals, packings, O-rings and other rubber parts, gaskets, and split pins must be replaced with new ones after removal.
- When disassembling parts, visually check them for wear, cracks, damage, deformation, deterioration, rust, corrosion, defective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



- 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.

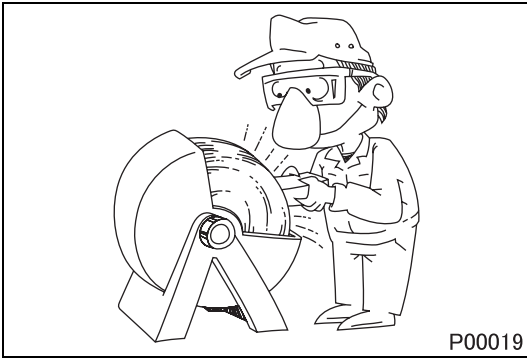
## NOTE

- **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.**

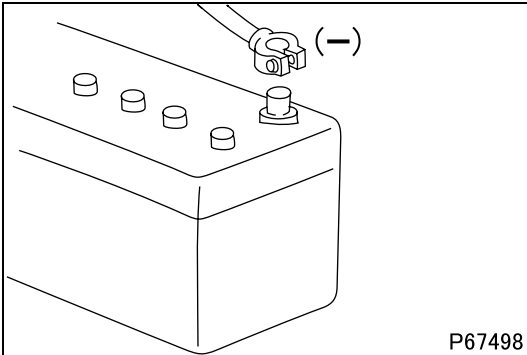


- Apply oil or grease as specified to O-rings, oil seals, dust seals and bearings before reassembly.
- Always use the required oils and greases when performing inspection or replacement. Immediately wipe away any excess oil or grease with a shop towel.





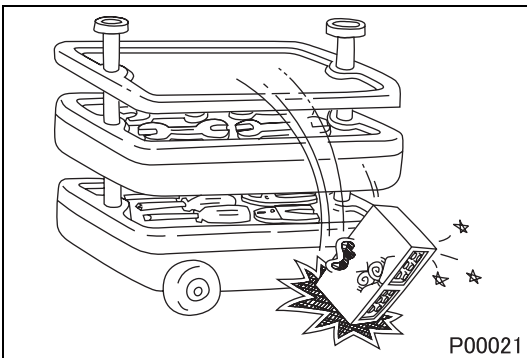
- Wear safety goggles when using power tools or equipment. Wear gloves when necessary, and watch out for sharp edges and other items that might injure your hands.



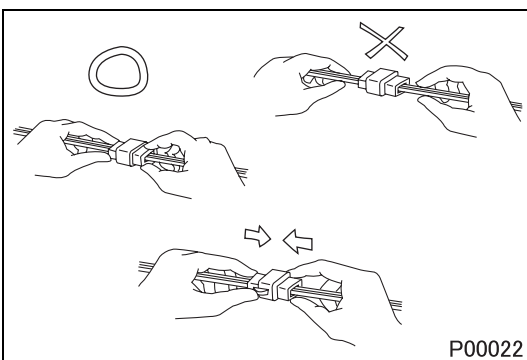
- Before working on the electrical system, disconnect the battery's (-) cable to prevent short circuits.

**CAUTION** ⚠

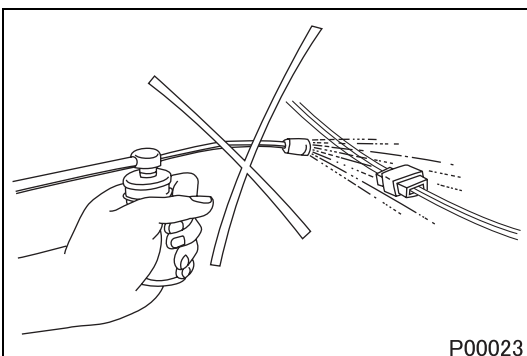
- **Make sure the ignition switch and all light switches are OFF before disconnecting or connecting battery cable. This will prevent damage to semiconductor components.**



- 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.

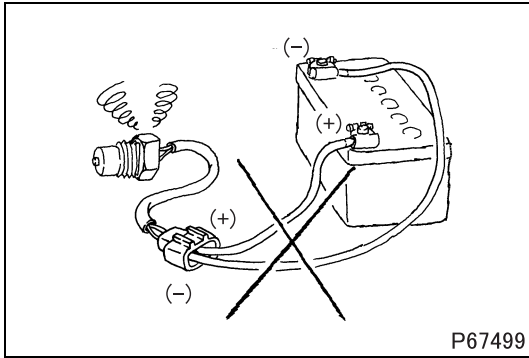


- When separating connectors, grasp the connectors themselves rather than the harnesses.
- To separate locking connectors, first push them in the direction of the arrows. To reconnect locking connectors, push them together until they click.



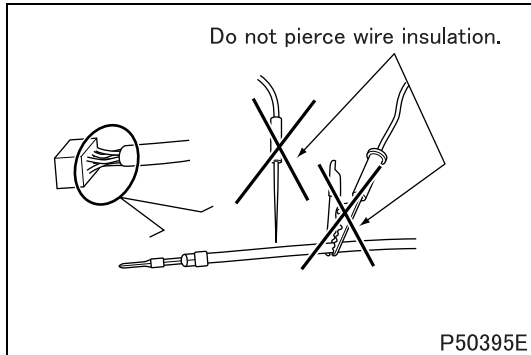
- Before washing the vehicle, cover all electrical parts to keep them dry. (Use plastic sheets or the like.) Keep water away from harness connectors and sensors and immediately wipe off any water that gets on them.

# PRECAUTIONS FOR MAINTENANCE OPERATION



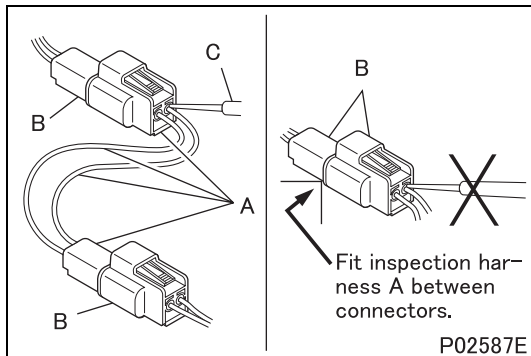
- When applying a voltage to a part for inspection purposes, check that the (+) and (-) cables are connected properly then gradually increase the voltage from zero. Do not exceed the specified voltage.  
Remember that control units and sensors do not necessarily operate on battery voltage.

## 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.

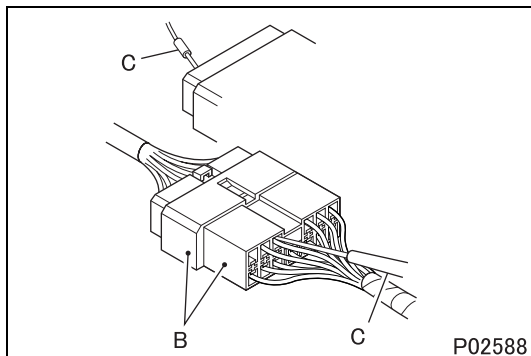


### 1.1 Inspection of harnesses

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

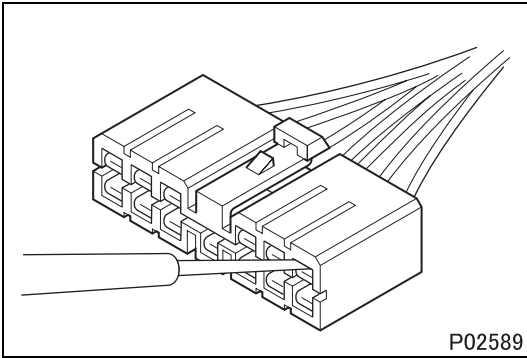
##### (1.1) Waterproof connectors

- 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

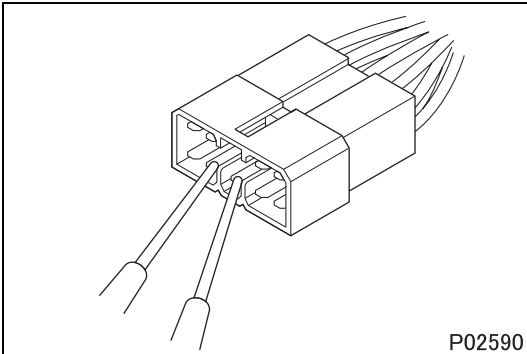
- Perform the inspection by inserting a test probe **C** into the wire-entry sides of the connectors. An extra-narrow probe is required for control unit connectors, which are smaller than other types of connector. Do not force a regular-size probe into control unit connectors since this would cause damage.



## (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.

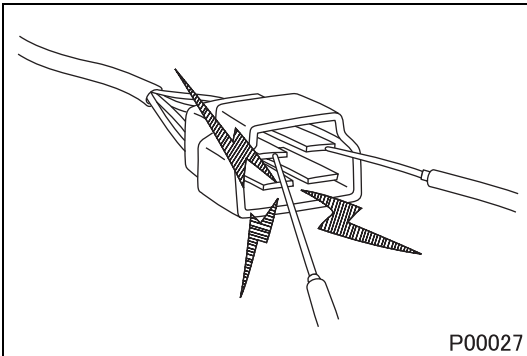


### (2.2) Inspections on male terminals

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

### CAUTION

- **Be careful not to short-circuit pins 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.**

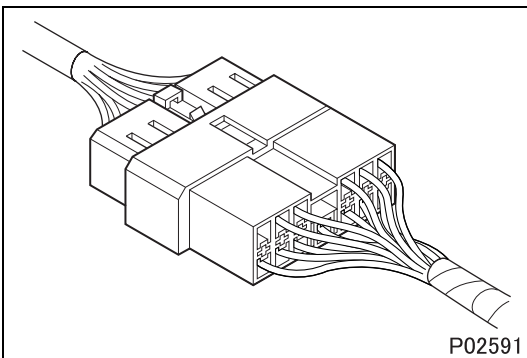


- When using a multimeter to check continuity, do not allow the test probes to touch the wrong terminals.

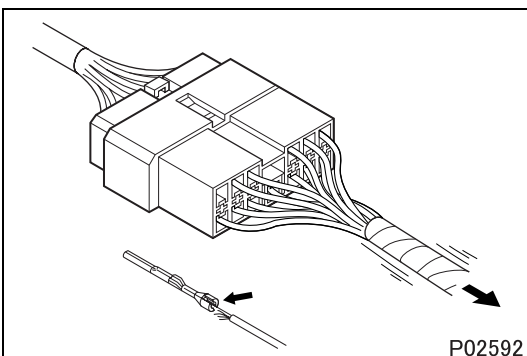
## 1.2 Inspection of connectors

### (1) Visual inspection

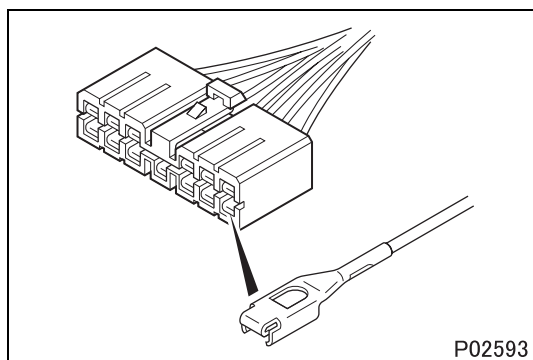
- Check that the connectors are fitted together securely.



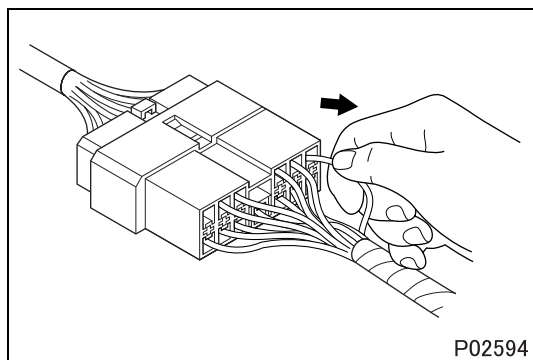
- Check for wires that have separated from their terminals due to pulling of the harness.



# PRECAUTIONS FOR MAINTENANCE OPERATION



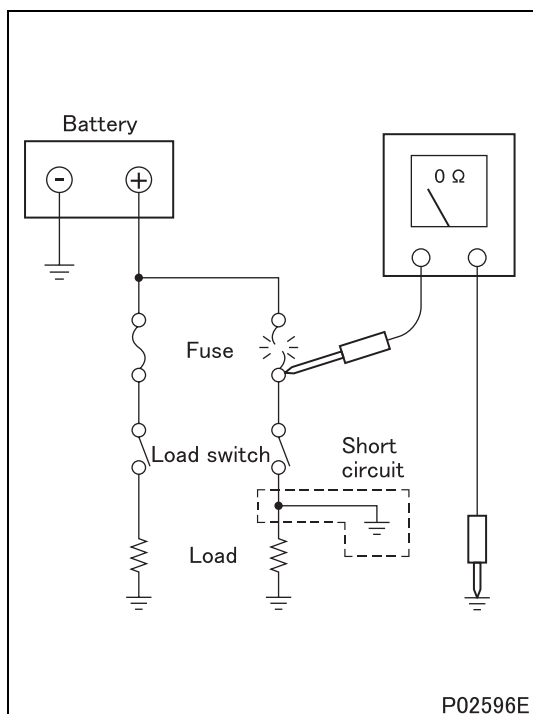
- Check that male and female terminals fit together tightly.



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

## (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.



## 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)