DIAGNOSIS CODES

1. Diagnosis Codes

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

1.1 Systems and diagnosis code displaying methods

Warning lamp	System	Diagnosis codes displaying methods		Reference Gr
		Multi-Use Tester	Flashing of warning lamp	
	Common rail	O	O	13
	Turbocharger			15
	Exhaust gas recirculation			17
	Starter continuous energizing preventing function			54
	Vehicle speed limiting (SLD)	O	O	54
	Auto cruise			
–	Full auto air conditioner	O	O	55

1.2 Types of diagnosis codes

- There are two types of diagnosis code output method depending on the system: one has a distinction of present and past codes, and the other does not have such a distinction.

System	Diagnosis code	
	With distinction of present and past	Without distinction
Except below	O	–
Full auto air conditioner	–	O

(1) The system that has a distinction of present and past diagnosis codes

(1.1) Present diagnosis code

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

(1.2) Past diagnosis code

- Past fault developed in the vehicle is indicated by corresponding diagnosis code stored in the memory of the electronic control unit.
- With the vehicle restored to its normal condition or the starter switch turned from OFF to ON after inspection or repair against present diagnosis codes, the present diagnosis code is stored as past diagnosis codes in the memory of the electronic control unit.
- When reading out the past diagnosis codes, the warning lamp does not illuminate as such codes do not indicate the current fault.

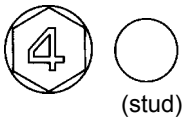
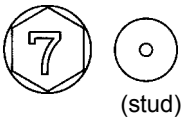
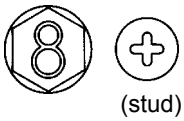
(2) The system that does not have a distinction of present and past diagnosis codes

- The present and past diagnosis codes are displayed together without distinction.

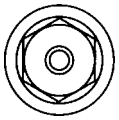
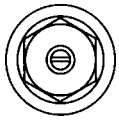
TABLE OF STANDARD TIGHTENING TORQUES

- Use specified bolts and nuts. Tighten them to the torques shown below as appropriate, unless otherwise specified.
- Threads and bearing surfaces shall be dry.
- If the mating nut and bolt (or stud bolt) are different in level of strength, tighten them to the torque specified for the bolt.

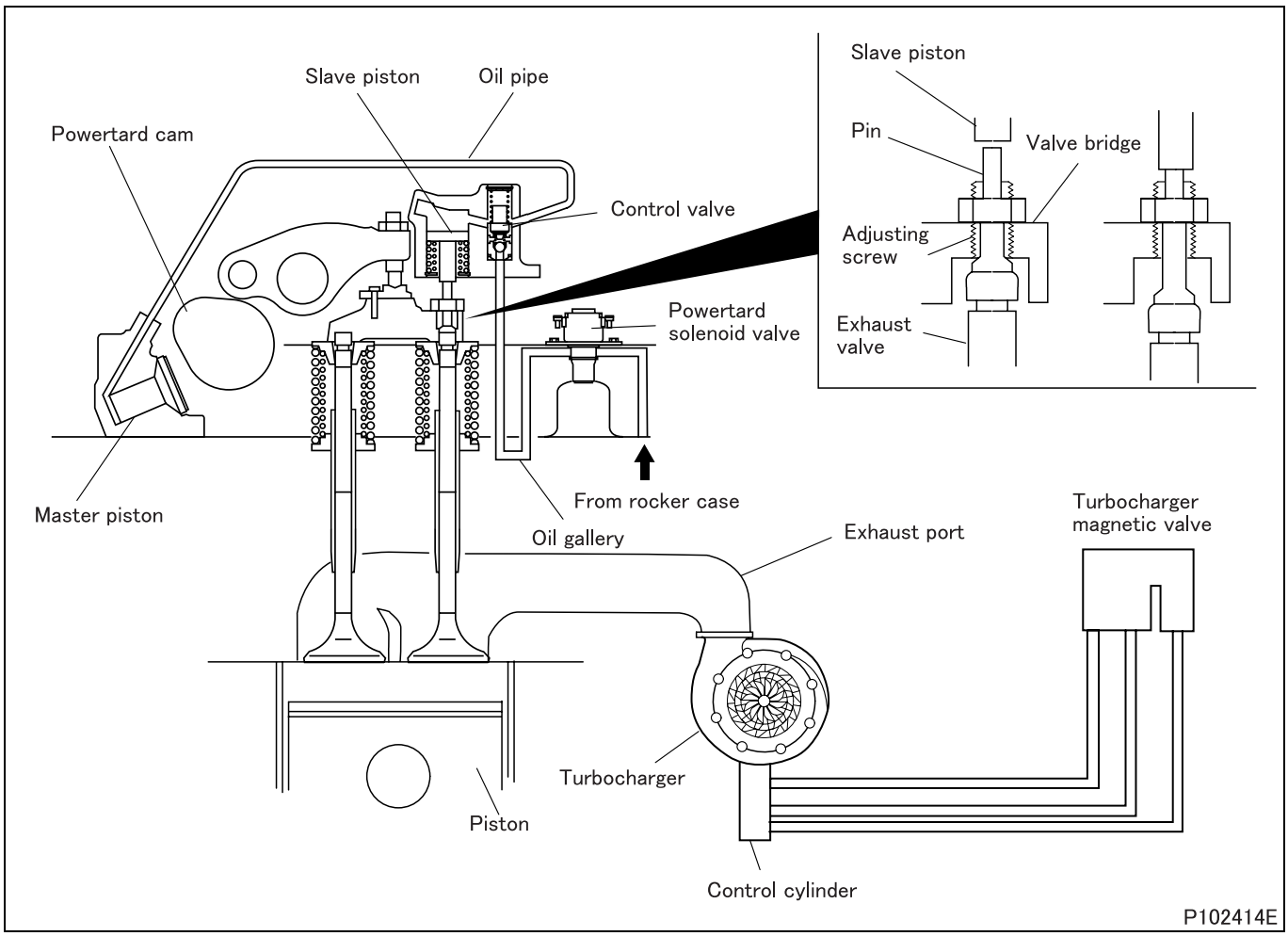
Hexagon Head Bolts and Stud Bolts (Unit: N·m {kgf·m})

Strength	4T		7T		8T	
Identification symbol / Nominal diameter	 (stud)		 (stud)		 (stud)	
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 {1.7 to 2.5}	–	19 to 28 {2.0 to 2.9}	–
M10	18 to 27 {1.8 to 2.7}	17 to 25 {1.8 to 2.6}	34 to 50 {3.5 to 5.1}	32 to 48 {3.3 to 4.9}	45 to 60 {4.5 to 6.0}	37 to 55 {3.8 to 5.7}
M12	34 to 50 {3.4 to 5.1}	31 to 45 {3.1 to 4.6}	70 to 90 {7.0 to 9.5}	65 to 85 {6.5 to 8.5}	80 to 105 {8.5 to 11}	75 to 95 {7.5 to 10}
M14	60 to 80 {6.0 to 8.0}	55 to 75 {5.5 to 7.5}	110 to 150 {11 to 15}	100 to 140 {11 to 14}	130 to 170 {13 to 17}	120 to 160 {12 to 16}
M16	90 to 120 {9 to 12}	90 to 110 {9 to 11}	170 to 220 {17 to 23}	160 to 210 {16 to 21}	200 to 260 {20 to 27}	190 to 240 {19 to 25}
M18	130 to 170 {14 to 18}	120 to 150 {12 to 16}	250 to 330 {25 to 33}	220 to 290 {23 to 30}	290 to 380 {30 to 39}	250 to 340 {26 to 35}
M20	180 to 240 {19 to 25}	170 to 220 {17 to 22}	340 to 460 {35 to 47}	310 to 410 {32 to 42}	400 to 530 {41 to 55}	360 to 480 {37 to 49}
M22	250 to 330 {25 to 33}	230 to 300 {23 to 30}	460 to 620 {47 to 63}	420 to 560 {43 to 57}	540 to 720 {55 to 73}	490 to 650 {50 to 67}
M24	320 to 430 {33 to 44}	290 to 380 {29 to 39}	600 to 810 {62 to 83}	540 to 720 {55 to 73}	700 to 940 {72 to 96}	620 to 830 {63 to 85}

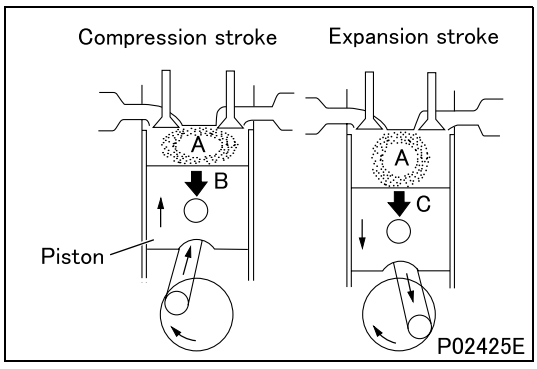
Hexagon Head Flange Bolts (Unit: N·m {kgf·m})

Strength	4T		7T		8T	
Identification symbol / Nominal diameter						
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 {2.0 to 2.9}	–	22 to 33 {2.3 to 3.3}	–
M10	21 to 31 {2.1 to 3.1}	20 to 29 {2.0 to 3.0}	45 to 55 {4.5 to 5.5}	37 to 54 {3.8 to 5.6}	50 to 65 {5.0 to 6.5}	50 to 60 {5.0 to 6.5}
M12	38 to 56 {3.8 to 5.5}	35 to 51 {3.5 to 5.2}	80 to 105 {8.0 to 10.5}	70 to 95 {7.5 to 9.5}	90 to 120 {9 to 12}	85 to 110 {8.5 to 11}

9.1 Operation of Powertard brake system



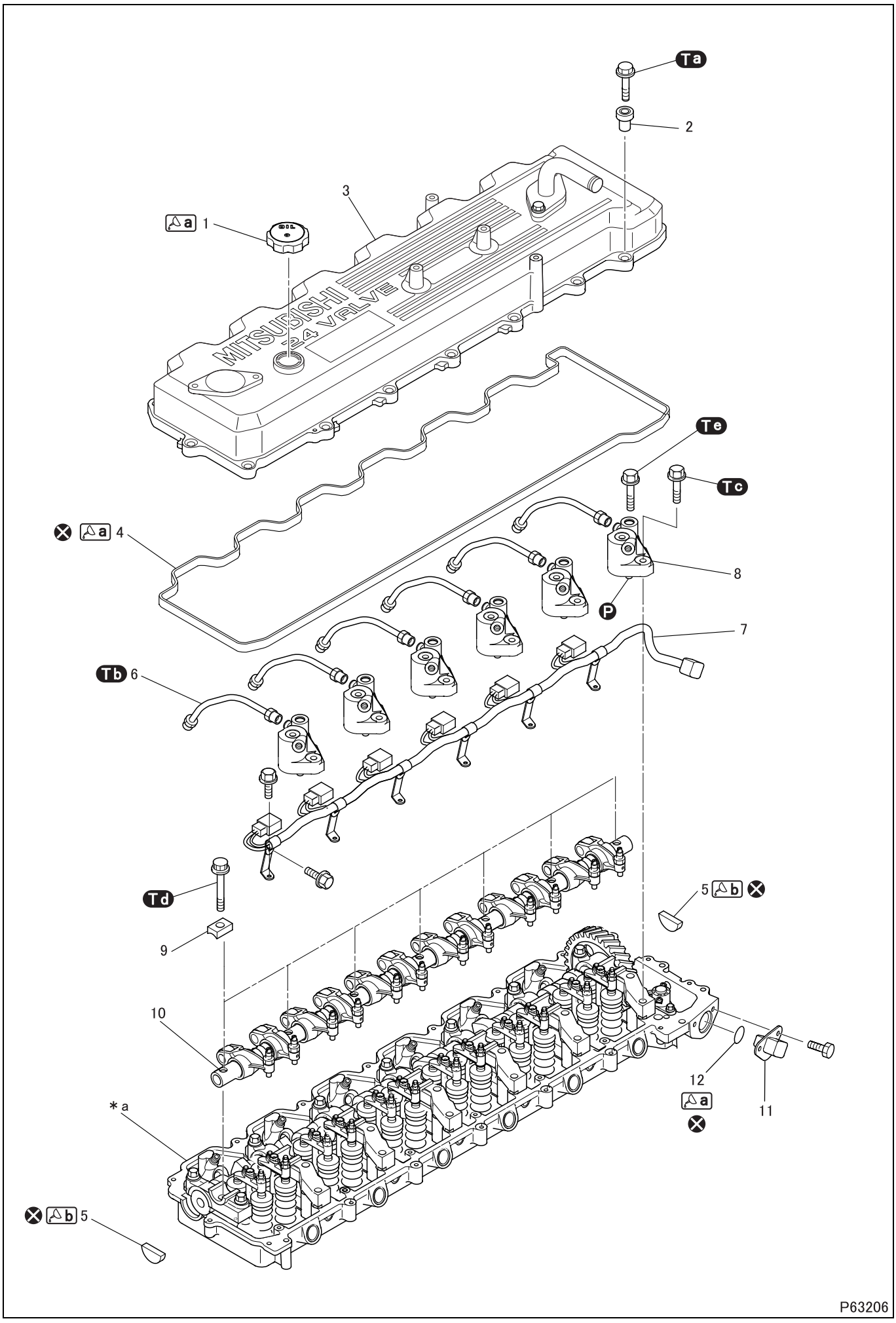
- The Powertard brake system is a device to enhance the engine brake performance. It opens and closes the exhaust valve (one side only) to control the volume of compressed air in the combustion chamber in accordance with the movement of the piston, thereby providing a boosted braking force. Powertard components are located in the cylinder head.
- The valve bridge is provided with an adjusting screw and a pin that allow the exhaust valve to be opened and closed under the control of the Powertard, in addition to ordinary valve control.
- The pin is free to move in the adjusting screw. Its movement is controlled by the control valve.
- The adjusting screw is used to adjust the timing (Powertard clearance) for the control valve to press the pin.



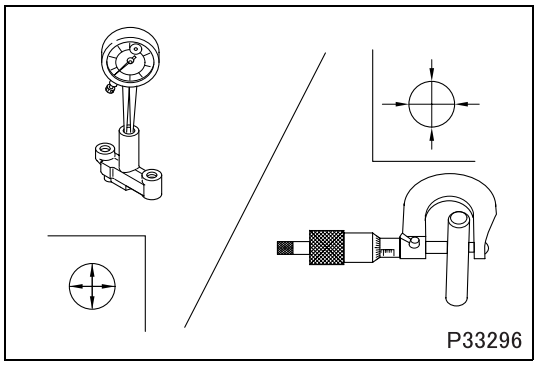
(1) Operating principle

- In the ordinary engine brake, the piston is forced up during its compression stroke when compressed air A develops a counter force B to press the piston. This force works as a braking force. However, the piston is forced down during its expansion stroke to let compressed air expand. This causes an accelerating force C to work on the piston downward, resulting in the braking force obtained during the compression period being lost largely.

MITSUBISHI 6M70 ROCKER COVER, ROCKER AND SHAFT



◆Inspection procedure◆



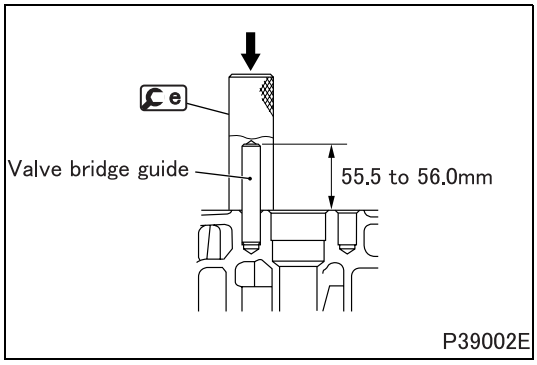
■ Inspection: Valve bridge and valve bridge guide

(1) Valve bridge-to-guide clearance

- If the measurement exceeds the limit, replace the defective part(s).

(2) Outer diameter of valve bridge guide

- If the measurement is less than the limit or if the parts are unevenly worn, replace the valve bridge guide.



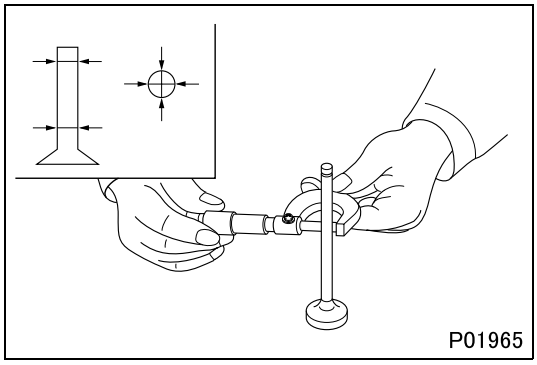
Replacement of valve bridge guide

[Installation]

- Before installation, ensure that no water, oil or other foreign matter is in the installation hole.
- Using [e], install the valve bridge guide until it securely contacts the cylinder head.

CAUTION ⚠

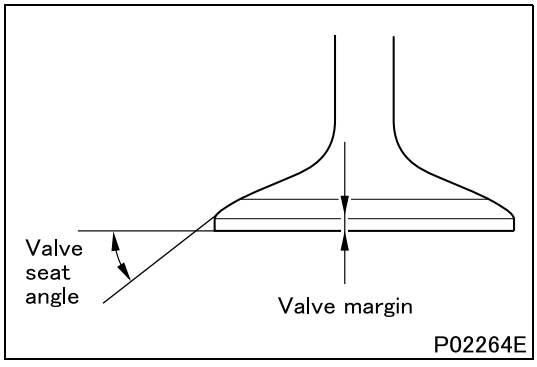
- **The valve bridge guide must be installed to the specified depth of the cylinder head. Correct installation can only be possible by using [e].**



■ Inspection: Mitsubishi 6M70 Intake and exhaust valve (1)

Valve stem outer diameter

- If the measurement is less than the limit or the valve is worn extremely unevenly, replace the valve.
- When the valve has been replaced with a new one, make sure to lap the valve and valve seat.

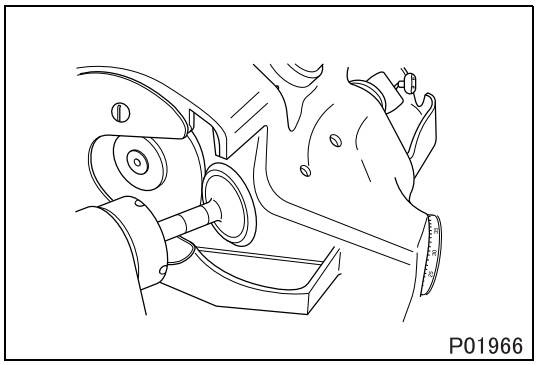


(2) Valve seat angle

- If the measurement deviates from the standard value, rectify the valve.

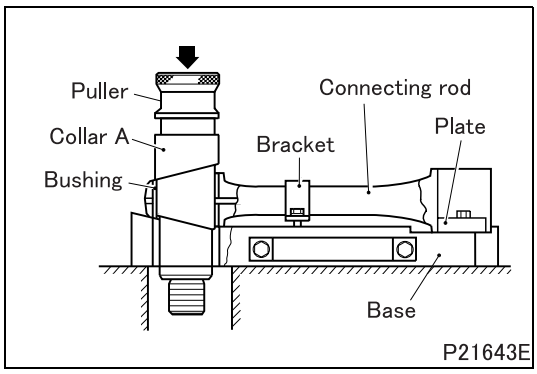
(3) Valve margin

- If the measurement is less than the limit, replace the valve.



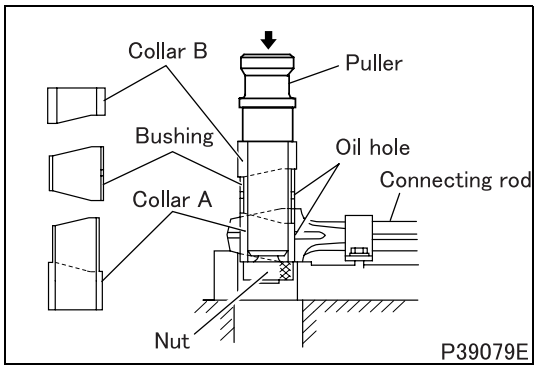
Refacing valve

- Limit grinding to a necessary minimum.
- If the valve margin is below the limit after grinding, replace the valve.
- After grinding, make sure to lap the valve and valve seat.



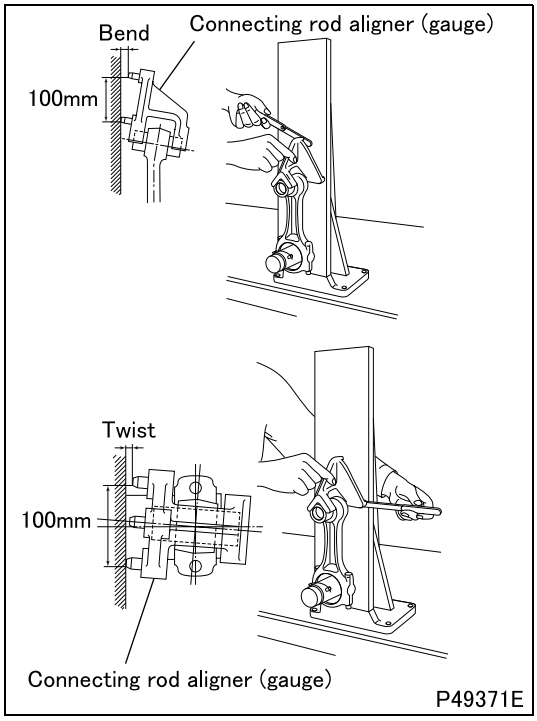
[Removal]

- If the upper connecting rod bearing is installed on the big end of the connecting rod, remove the bearing.
- Secure the connecting rod to the base with a bracket and plate.
- Set collar A on the puller in the direction shown in the illustration and gradually remove the bushing with a press load of approximately 49 kN {5000 kgf}.



[Installation]

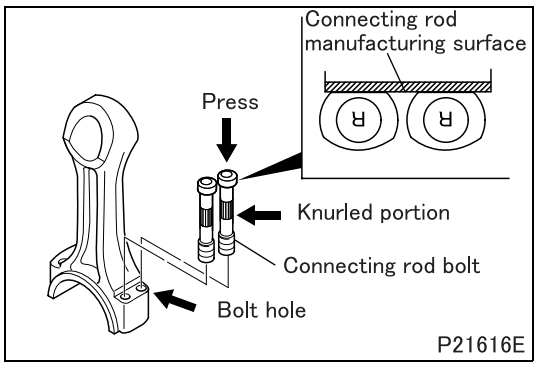
- Apply engine oil to the outer periphery of the connecting rod bushing and the bushing fitting surface of the connecting rod.
- Fit collar B, the bushing, and collar A over the puller in the direction shown in the illustration and lock this arrangement together with the nut.
- Align the oil holes in the bushing and the connecting rod. Then, use a press to slowly apply a pressure of approximately 49 kN {5,000 kgf} to the puller until the bushing is forced into place.
- After assembly, measure the clearance again.
- If the measurement is less than the standard value, ream the bushing.



■ Inspection: Connecting rod bend and twist

- Mount the connecting rod on the connecting rod aligner. Also mount the connecting rod bearings, piston pin, and connecting rod cap to create the same conditions as are expected when the connecting rod is mounted on a crankshaft. Tighten the nuts of the connecting rod cap to a torque of 115 N·m {12 kgf·m}.
- Measure the extent of bend and twist in the connecting rod.
- If either measurement exceeds the limit, replace the connecting rod.

◆Installation procedure◆



■ Installation: Mitsubishi 6M70 Connecting rod bolt

- Make sure that bolt holes of the connecting rod are free of flaws and burrs.
- Apply engine oil to the knurled portion of the connecting rod bolt and press fit it in the illustrated direction with the maximum press load of 5880 N {600 kgf}.

● **Disassembly sequence**

1 Crankshaft pulley
2 Front oil seal
3 Front cover
4 Front cover gasket
5 Thrust plate
6 Lower main bearing
7 Main bearing cap
8 Front oil seal slinger
9 Ring
10 Rear oil seal slinger
11 Crankshaft gear
12 Crankshaft
13 Rear plate
14 Gasket
15 Upper main bearing
16 Check valve
17 Oil jet
18 Oil spray plug
19 Crankcase

Ⓟ: Locating pin
⊗: Non-reusable parts

CAUTION ⚠

- **The check valve has been tightened using thread-locking compound and so, may deform during removal. Once removed, the check valve must not be reused. Therefore, do not remove the check valve unless any fault is found.**

● **Assembly sequence**

Follow the disassembly sequence in reverse.

CAUTION ⚠

- **If overtightened, the check valve will not operate properly, leading to engine seizure. Be sure to tighten the check valve to the specified torque.**
- **The main cap bolt is tightened within the plastic region. The number of punch marks indicates the number of times the bolt has been tightened. If there are 3 punch marks (tightened 3 times in the past), replace the bolt.**

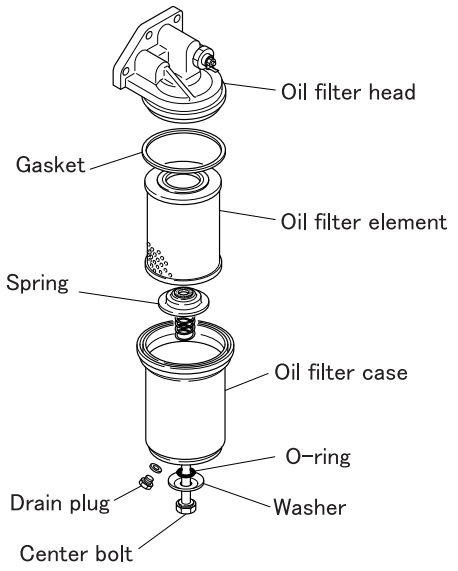
Mitsubishi 6M70 Service standards (Unit: mm)

Location	Maintenance item			Standard value	Limit	Remedy
6, 15	Main bearing	Oil clearance		0.06 to 0.122	0.25	Replace
		Span when free		–	106.5	Replace
12	Crankshaft	End play		0.09 to 0.23	0.4	Replace thrust plate
		Bend		0.04 or less	0.1	Replace
		Pins and journals	Roundness	0.01 or less	0.03	Rectify or replace
			Cylindricity	0.006 or less	–	Rectify or replace
		Center-to-center distance between the journal and pin		75 ± 0.07	–	Replace
		Journal width		42 ± 0.3	–	Replace
		Pin width		$54\ ^{+0.2}_{0}$	–	Replace
		Fillet		R5	–	Replace
19	Crankcase	Distortion of top surface		0.07 or less	0.2	Rectify or replace
		Cylinder block	Roundness	0.005 or less	–	Replace
			Cylindricity	0.015 or less	–	

Mitsubishi 6M70 Tightening torque (Unit: N·m {kgf·m})

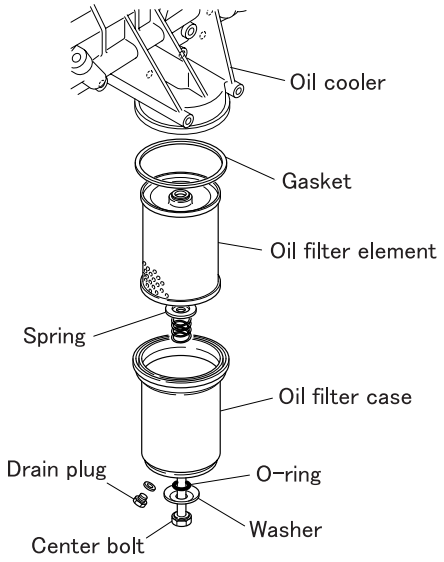
Mark	Parts to be tightened	Tightening torque	Remarks
Ⓣa	Bolt (crankshaft pulley installation)	240 {24}	–
Ⓣb	Bolt (front cover installation)	45 {4.6}	–
Ⓣc	Bolt (main bearing cap installation)	100 {10} + 130 ± 2°	• Wet • Can be reused up to 3 times
Ⓣd	Check valve	34 {3.5}	–

<Full-flow oil filter>

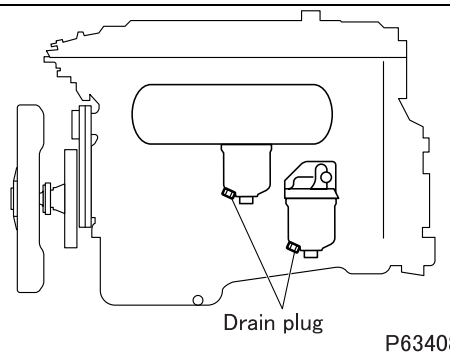


P63410E

<Bypass oil filter>



P63409E



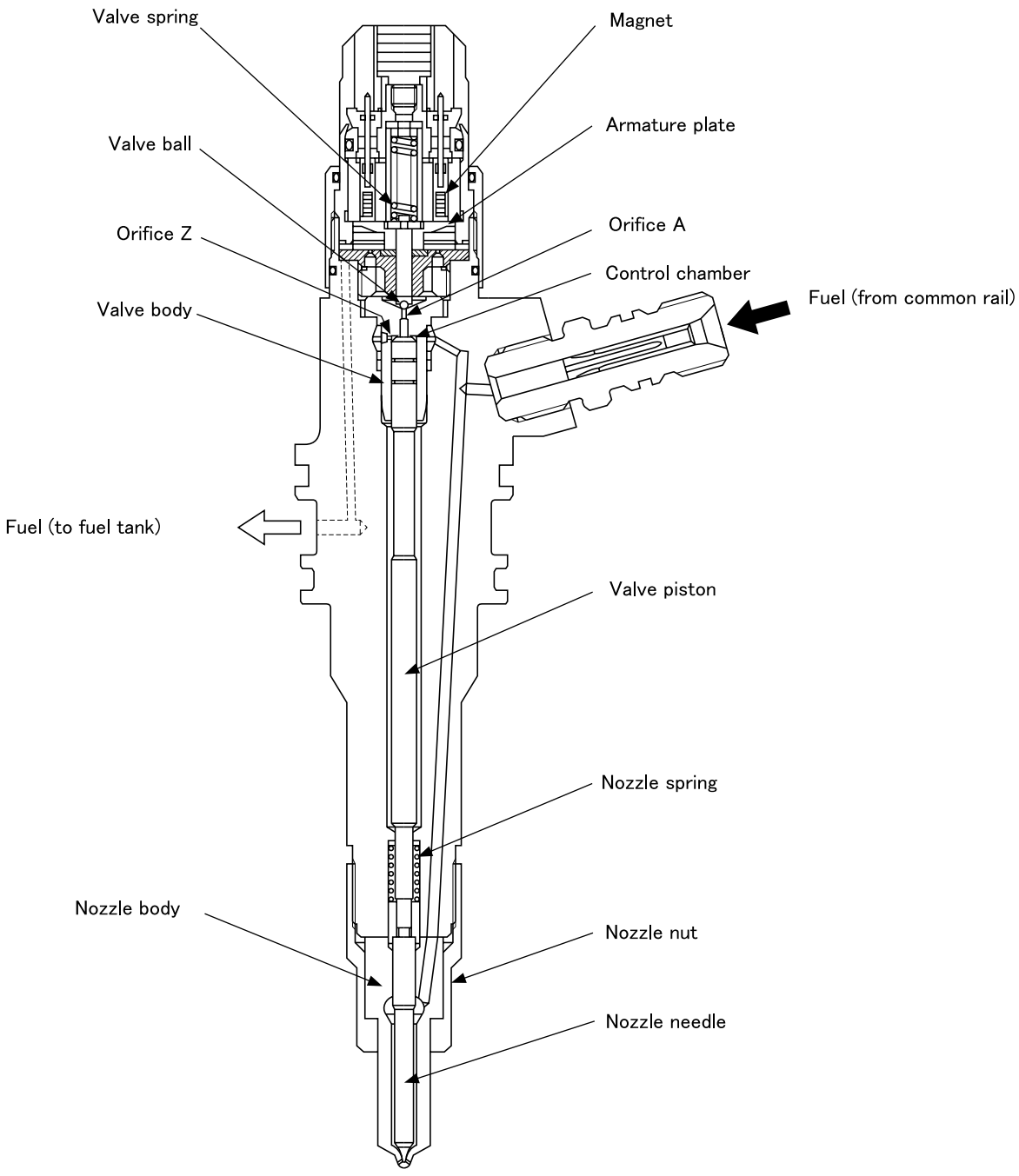
P63408E

- Clean other parts than the element, O-ring and gasket to be replaced with washing oil.

[Installation]

- Replace the element, O-ring and gasket with new ones, respectively.
- Install the oil filter case so that the drain plug is positioned as shown in the illustration.
- With the oil filter installed, start the engine and ensure that there is no oil leakage through the gasket.
- If oil is leaking, remove and reinstall the oil filter.
- Stop the engine and check the engine oil level.
- Add engine oil if the engine oil level is low.

1.3 Mitsubishi 6M70 Injector



- In accordance with electrical signals from the engine electronic control unit, each injector supplies high-pressure fuel from the common rail to the relevant combustion chamber of the engine at the optimal timing and in the optimal quantity.
- The Mitsubishi 6M70 injector is divided into the control section and the injector section.
  - The control section consists of the control chamber, magnet, valve spring, armature plate, valve ball, valve body, valve piston, orifice A, and orifice Z. The valve piston is located between the control section and the injection section.
  - The injection section consists of the nozzle body, nozzle needle, nozzle spring, and nozzle nut.

P0340: Camshaft Position SNSR (warning lamp flashes: 12)

Generation condition		Diagnosis code is generated under either of the following conditions. (1) Phase difference between cylinder recognition sensor and engine speed sensor deviates from the standard value when engine speed is 20 rpm or more. (2) No signal from the cylinder recognition sensor during the 132-pulse inputs of the engine speed sensor signal after recognition of the gap of the engine speed sensor. (3) Abnormal signal (timing) of cylinder recognition sensor signal during the 240-pulse inputs of the engine speed sensor signal.
Recoverability		• In the case of above problem (1) • System recovers when phase difference between cylinder recognition sensor and engine speed sensor is within the standard value when engine speed is 20 rpm or more. • In the case of above problem (2) • System recovers when signals from cylinder recognition sensor are input. • In the case of above problem (3) • System recovers when the signal (timing) of cylinder recognition sensor signal during the 240-pulse inputs of the engine speed sensor signal becomes normal.
Control effected by electronic control unit		• In the case of above problem (1) • Control is effected using engine speed sensor. • In the case of above problems (2) and (3) • Control is effected using engine speed sensor. • Auto cruise control is stopped.
Inspection	Service data	01: Engine Revolution
	Electronic control unit connector	08 : Cylinder recognition sensor
	Electrical equipment	#320: Cylinder recognition sensor
	Electric circuit diagram	Cylinder recognition sensor system

P0500: Vehicle Speed Sensor (warning lamp flashes: 25)

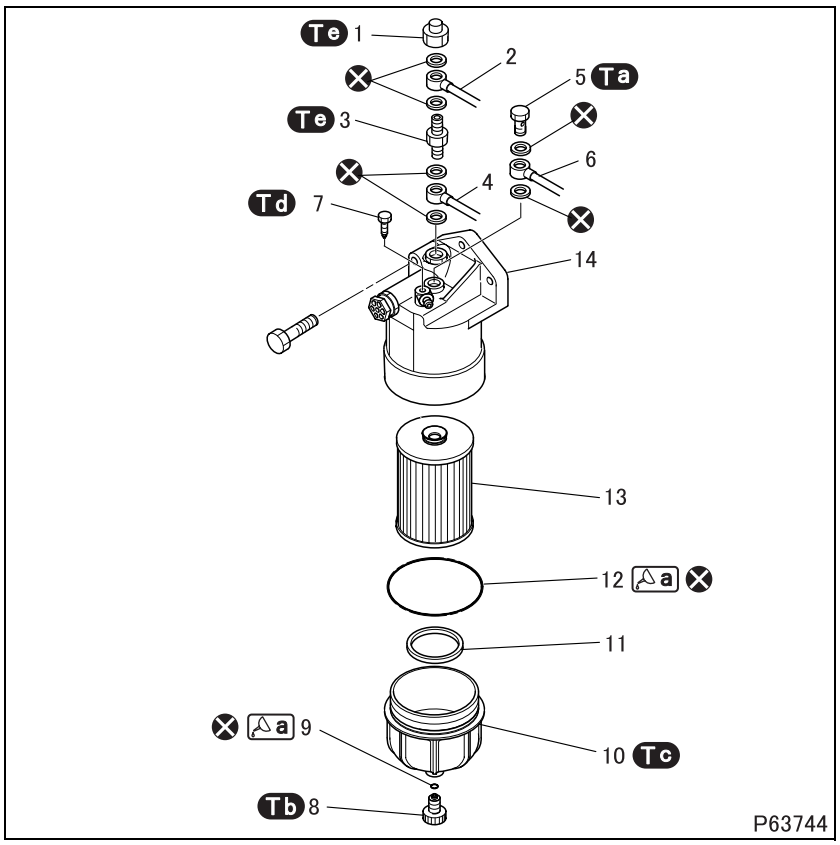
Generation condition		Vehicle speed remains 2 km/h or less for 20 seconds when engine speed is 1000 rpm or more, clutch pedal is released and transmission neutral signal indicates that transmission is in gear.
Recoverability		System recovers when vehicle speed remains 2 km/h or more for 3 seconds when engine speed is 1000 rpm or more, clutch pedal is released and transmission neutral signal indicates that transmission is in gear.
Control effected by electronic control unit		• Auto cruise control is stopped. • Vehicle speed limiting control is stopped. (Engine speed is also limited.)
Inspection	Service data	29: Vehicle Speed
	Electronic control unit connector	09 : Vehicle speed sensor
	Electrical equipment	#265: Vehicle speed sensor
	Electric circuit diagram	Vehicle speed sensor system

P0506: Idle Volume (warning lamp flashes: 31)

Generation condition		Idling speed adjustment potentiometer voltage remains less than 0.7 V for 3 seconds.
Recoverability		System recovers when idling speed adjustment potentiometer voltage remains 0.7 V or more for 1 second.
Control effected by electronic control unit		• Control is effected with auto idle permanently selected. • Actuator test “BA: VGT Test” is stopped.
Inspection	Service data	28: Idle Volume Voltage
	Electronic control unit connector	10 : Idling speed adjustment potentiometer
	Electrical equipment	#157: Idling speed adjustment potentiometer
	Electric circuit diagram	Idling speed adjustment potentiometer system

Check item	Measurement method
02 Resistance of water temperature sensor	[Conditions] • Starter switch OFF • Disconnect connector. Perform inspection on vehicle-side connector. [Requirements] Terminals: A40-A41 • 20°C: 2.45 ± 0.14 kΩ • 80°C: 0.32 kΩ (reference value) • 110°C: 147.1 ± 2 kΩ
03 Output voltage of accelerator pedal position sensor	[Conditions] • Starter switch ON • Vehicle-side harness connected (Perform inspection on back of connector.) [Requirements] Terminals (+)-(–): B34-B33 (accelerator pedal position sensor 1) B46-B45 (accelerator pedal position sensor 2) • With accelerator pedal not pressed: 0.85 ± 0.1 V • With accelerator pedal pressed: 4.15 ± 0.1 V
04 Resistance of fuel temperature sensor	[Conditions] • Starter switch OFF • Disconnect connector. Perform inspection on vehicle-side connector. [Requirements] Terminals: A89-A65 • 20°C: 2.5 ± 0.25 kΩ • 80°C: 0.32 ± 0.02 kΩ • 110°C: 0.144 ± 0.01 kΩ
05 Resistance of injector magnetic valve	[Conditions] • Starter switch OFF • Disconnect connector. Perform inspection on vehicle-side connector. [Requirements] Terminals: A72-A23 (injector magnetic valve: No. 1 cylinder) A70-A22 (injector magnetic valve: No. 2 cylinder) A71-A46 (injector magnetic valve: No. 3 cylinder) A94-A47 (injector magnetic valve: No. 4 cylinder) A96-A24 (injector magnetic valve: No. 5 cylinder) A95-A48 (injector magnetic valve: No. 6 cylinder) • 0.21 to 0.295 Ω
06 Output voltage of Power take-off load sensor	[Conditions] • Starter switch ON • Vehicle-side harness connected (Perform inspection on back of connector.) [Requirements] Terminals (+)-(–): A15-A16 • Idling: 0.85 ± 0.1 V • Full-load: 3.0 ± 0.1 V
07 Resistance of engine speed sensor	[Conditions] • Starter switch OFF • Disconnect connector. Perform inspection on vehicle-side connector. [Requirements] Terminals: A10-A9 • 2.2 ± 0.2 Ω (25°C)
08 Resistance of cylinder recognition sensor	[Conditions] • Starter switch OFF • Disconnect connector. Perform inspection on vehicle-side connector. [Requirements] Terminals: A59-A83 • 860 ± 86 Ω
09 Output voltage of vehicle speed sensor	[Conditions] • Starter switch ON • Vehicle-side harness connected (Perform inspection on back of connector.) • Turn wheels slowly using chassis dynamometer. [Requirements] Terminals (+)-(–): A67-chassis ground • High pulse voltage: 8 ± 1 V • Low pulse voltage: 0.5 V or lower

FUEL FILTER



● **Disassembly sequence**

1 Cap
2 Fuel return pipe
3 Overflow valve
4 Fuel feed pipe
5 Eyebolt
6 Fuel feed pipe
7 Plug
8 Drain plug
9 O-ring
10 Case
11 Float
12 O-ring
13 Element
14 Fuel filter head

⊗: Non-reusable parts

● **Assembly sequence**

Follow the disassembly sequence in reverse.

WARNING ⚠

- **Fuel is highly flammable. Keep it away from flames and sources of heat.**
- **Thoroughly wipe up any spilled fuel. Otherwise, it may catch fire.**

CAUTION ⚠

- **Be careful not to damage the case.**

Service standards

Location	Maintenance item	Standard value	Limit	Remedy
3	Overflow valve	1.14 ± 0.03 MPa {12 ± 0.3 kgf/cm^2}	–	Replace

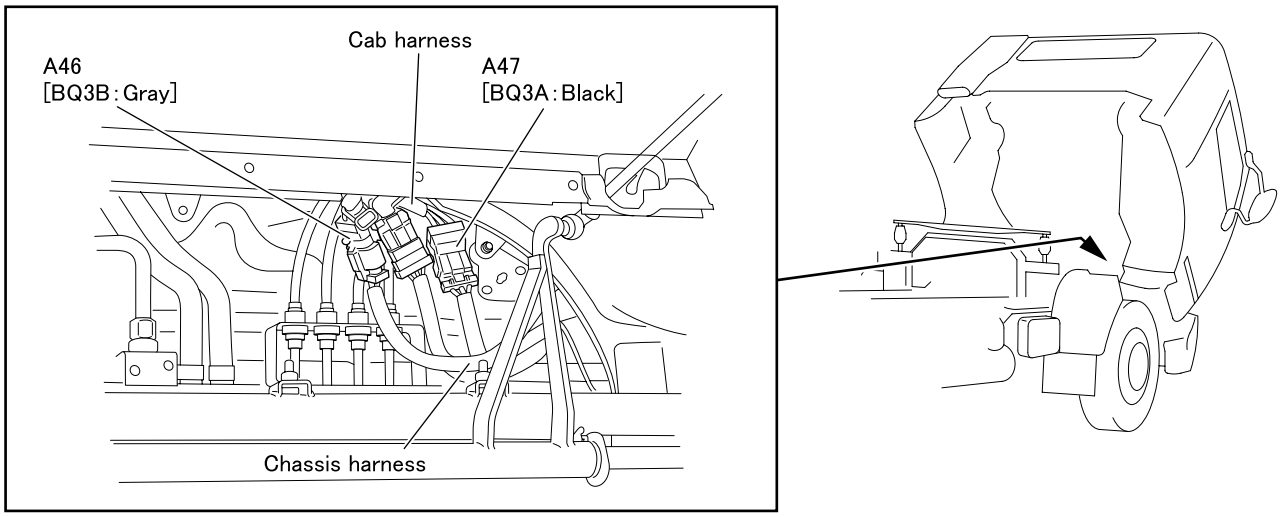
Tightening torque (Unit: N·m {kgf·m})

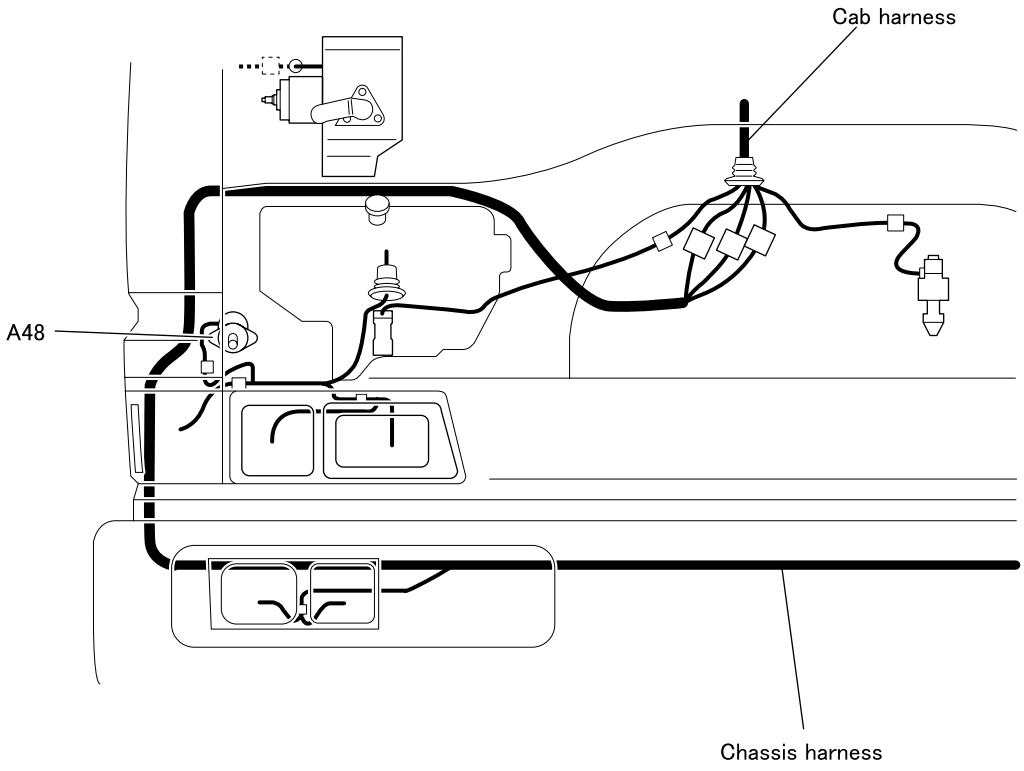
Mark	Parts to be tightened	Tightening torque	Remarks
Ta	Eyebolt	30 {3.0}	–
Tb	Drain plug	2 ± 0.5 {0.2 ± 0.05}	–
Tc	Case	18 to 20 {1.8 to 2.0}	–
Td	Plug	9.8 ± 2.0 {1.0 ± 0.2}	–
Te	Overflow valve	20 to 29 {2.0 to 3.0}	–
	Cap		

Lubricant and/or sealant

Mark	Points of application	Specified lubricant and/or sealant	Quantity
a	O-ring	Engine oil	As required

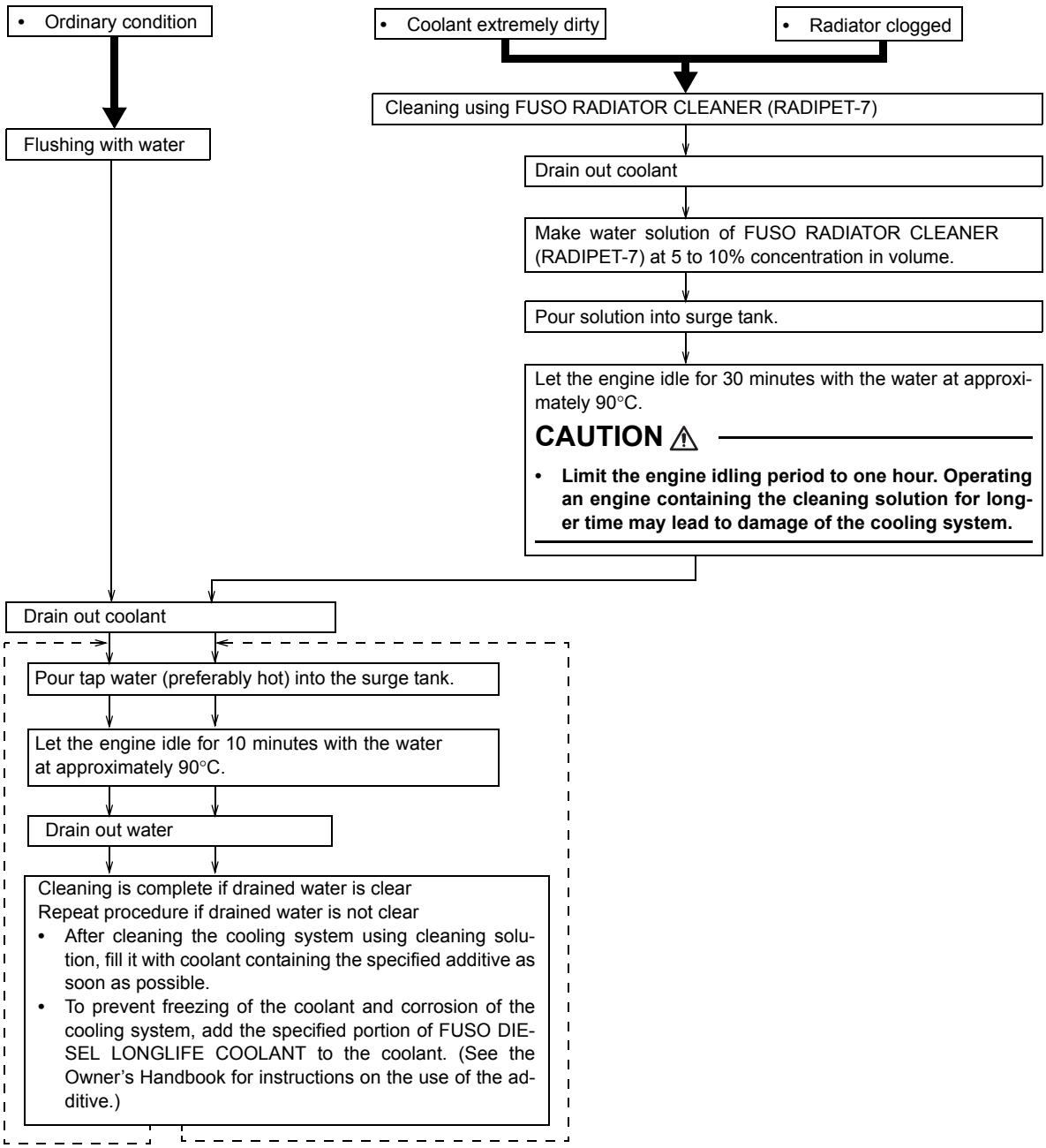
A46 – 48





A46 Connection of cab harness and chassis harness
A47 Connection of cab harness and chassis harness
A48 Accelerator pedal position sensor

Indicate by connector type and connector color [ ].



WARNING ⚠

- **FUSO DIESEL LONGLIFE COOLANT is flammable. Keep it away from heat and flames.**

CAUTION ⚠

- **If you accidentally splash FUSO DIESEL LONGLIFE COOLANT in your eyes, wash it out immediately with water and seek medical attention.**

(2) Diagnosis function

- While the starter switch is on, the diagnosis function is constantly activated to find faults in various sensors. Upon any sensor being found faulty, the driver is informed of the fault through the display in the meter cluster. At the same time, the fault is memorized in the form of a diagnosis code and the system starts to effect necessary at-fault control(s).
- During at-fault control(s), the system is limited in the workings to ensure the safety of the vehicle and driver. The memorized diagnosis code can be accessed on the Multi-Use Tester screen or through blinking of warning lamp.
- Diagnosis codes are different in the way of indication between the Multi-Use Tester and blinking of the warning lamp.
- The Multi-Use Tester provides more specific diagnosis codes.

3.3 Electronic control unit connection diagram

