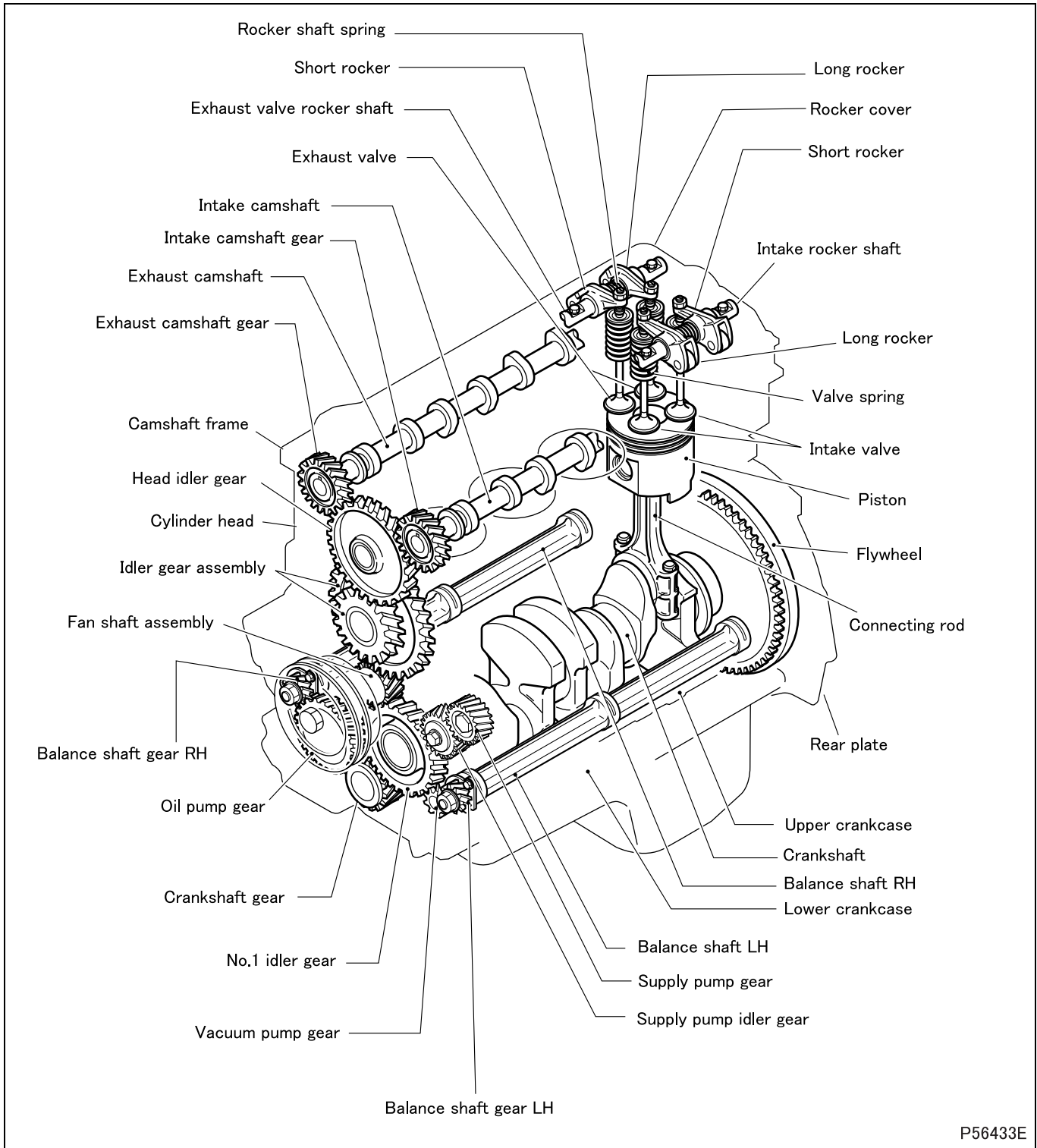
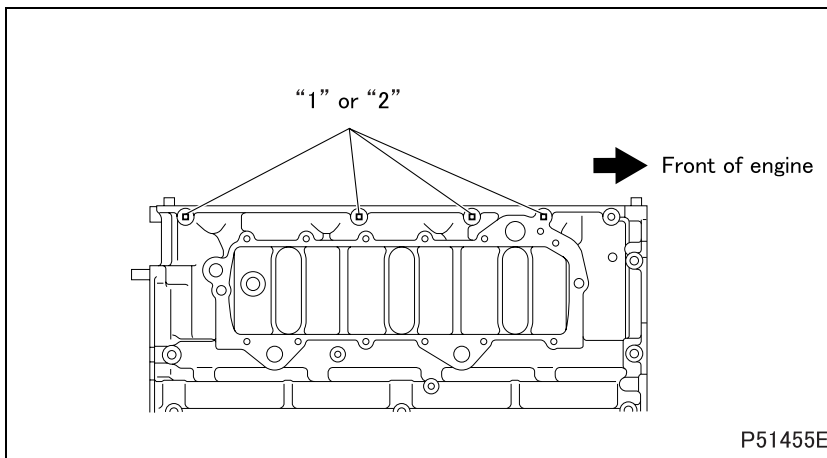


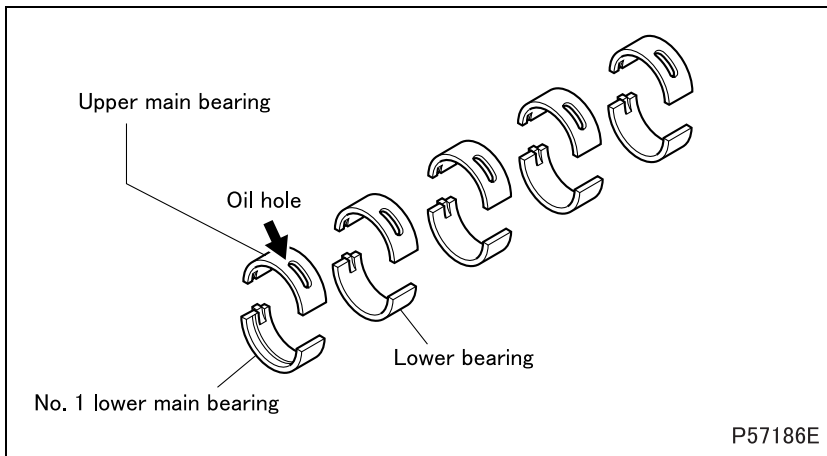
1. Exploded View



STRUCTURE AND OPERATION

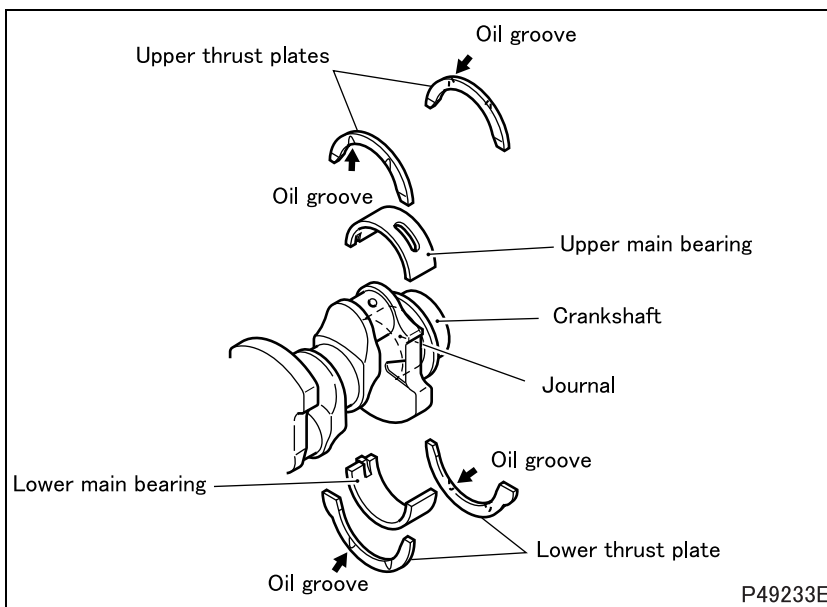


- The upper crankcase is marked with a size mark ("1" or "2") to be used as a reference in selecting cylinder liners.
- The first to fourth size marks from the front of the engine correspond to the No. 1 to No. 4 cylinders.



9.2 Main bearing

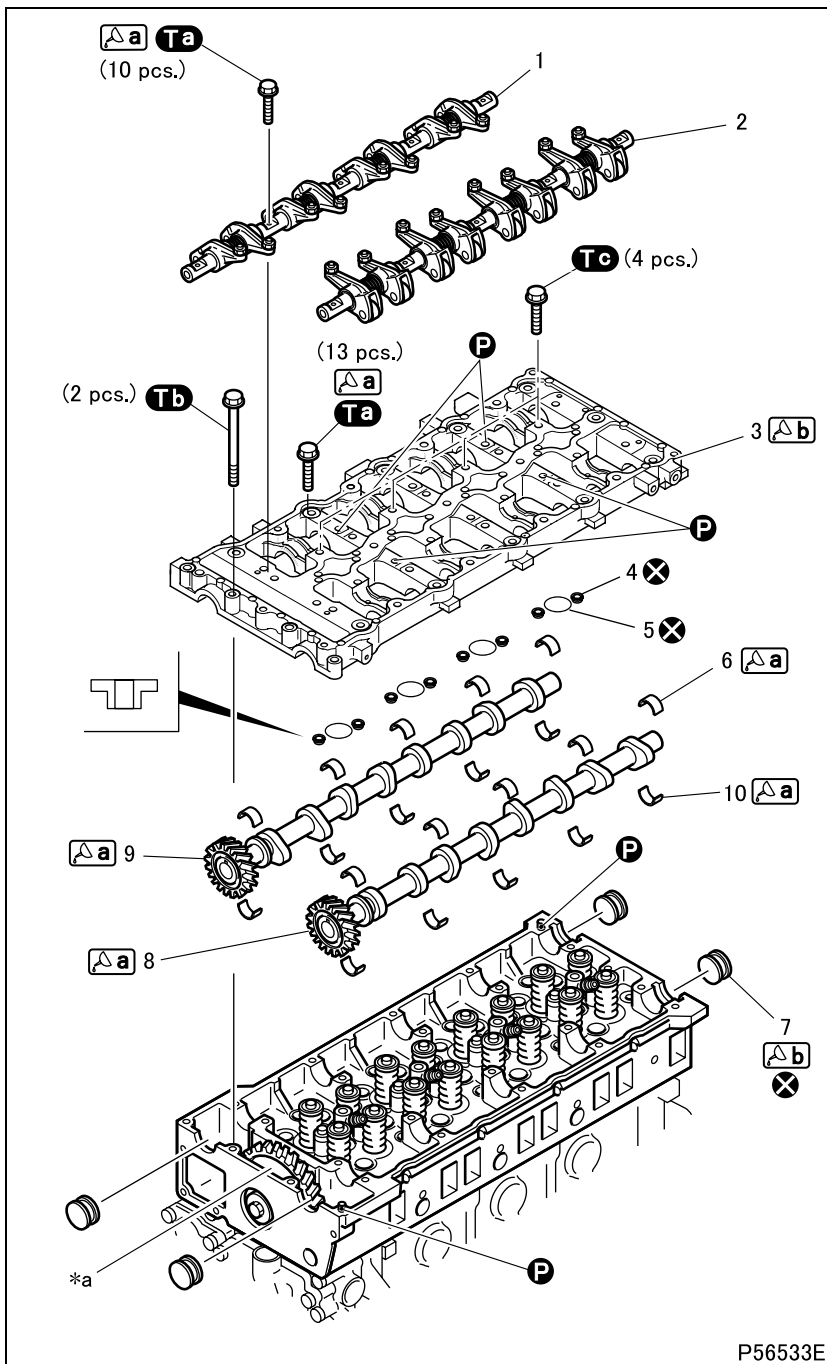
- The upper main bearings have oil holes through which engine oil is supplied to the crankshaft journals.
- An oil groove is provided in the No. 1 lower bearing.



9.3 Thrust plates

- Two upper and lower thrust plate pairs are installed on both sides of the upper and lower main bearings at the rearmost journal of the crankshaft.
- Select the thrust plates of a thickness that can accommodate the crankshaft end play. The thrust plates each have two oil grooves, which assures their minimum friction against the crankshaft journal.

MITSUBISHI 4M50 ROCKERS AND CAMSHAFTS



● Disassembly sequence

- 1 Exhaust rocker shaft
(See later sections.)
- 2 Intake rocker shaft
(See later sections.)
- 3 Camshaft frame
- 4 Gasket
- 5 O-ring
- 6 Upper camshaft bearing
- 7 Packing
- 8 Intake camshaft
(See later sections.)
- 9 Exhaust camshaft
(See later sections.)
- 10 Lower camshaft bearing

*a: Head idler gear

P: Locating pin

X: Non-reusable parts

CAUTION

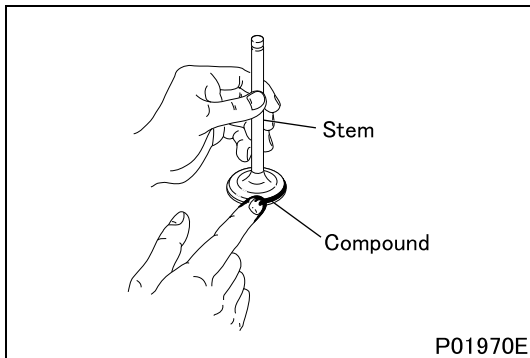
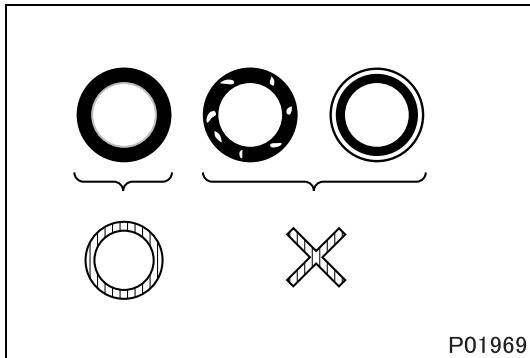
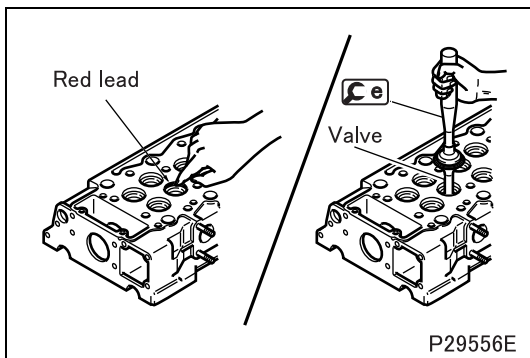
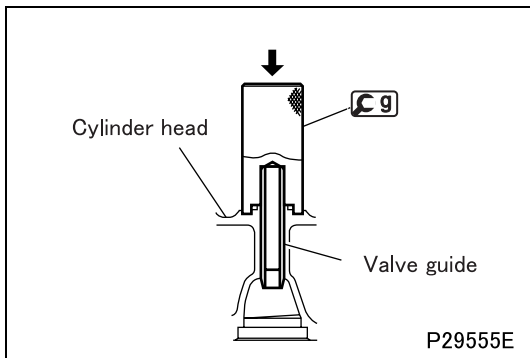
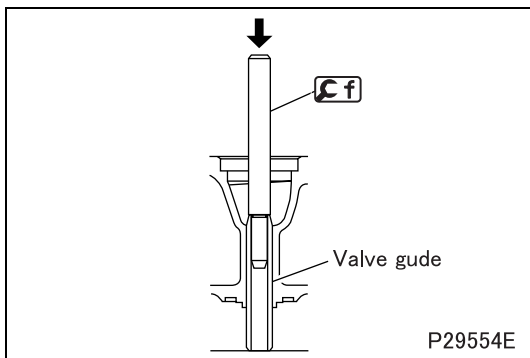
- The camshaft frame and cylinder head are manufactured as a matched set. Never replace the camshaft frame or the cylinder head individually.
- Do not change the upper and lower camshaft bearing combinations. Do not interchange the position of an upper and lower camshaft bearing set with that of another.

● Assembly sequence

Follow the disassembly sequence in reverse.

Service standards (Unit: mm {in.})

Location	Maintenance item		Standard value	Limit	Remedy
-	Backlash	Head idler gear-to-camshaft gear	0.080 to 0.126 {0.0031 to 0.0050}	0.3 {0.012}	Replace
		Head idler gear-to-idler gear	0.103 to 0.158 {0.0041 to 0.0062}	0.3 {0.012}	
-	End play	Camshaft	0.10 to 0.20 {0.0039 to 0.0079}	0.3 {0.012}	Inspect
		Head idler gear	0.10 to 0.20 {0.0039 to 0.0079}	0.3 {0.012}	
6, 8, 10	Camshaft bearing-to-intake camshaft clearance		0.07 to 0.12 {0.0028 to 0.0047}	0.16 {0.024}	Replace
6, 8, 10	Camshaft bearing-to-exhaust camshaft clearance		0.07 to 0.12 {0.0028 to 0.0047}	0.16 {0.024}	Replace
6, 10	Camshaft bearing span (when free)		-	35.5 {1.40} or less	Replace



Replacement of Mitsubishi 4M50 valve guides [Removal]

[Installation]

- Install the valve guide until **C g** sits snugly on the cylinder head.

CAUTION ⚠

- **The valve guides must be pressed to the specified depth. Be sure to use **C g** for this operation.**
- **Exhaust valve guides are longer than intake valve guides. Make sure to install the correct type of guide in each location.**

■ Inspection: Contact between valve and valve seat

- Before starting inspection, check that the valve and valve guide are intact.
- Apply an even coat of red lead to the valve contact surface of the valve seat.
- Strike the valve once against the valve seat. Do not rotate the valve during this operation.

- If the red lead deposited on the valve indicates a poor contact pattern, take either of the following corrective actions.

	Corrective action
Minor defect	Lapping
Serious defect	Reface or replace valve and valve seat

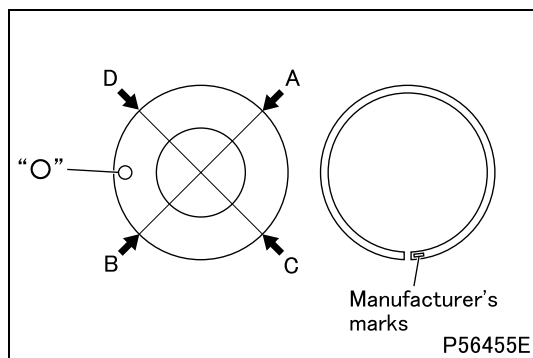
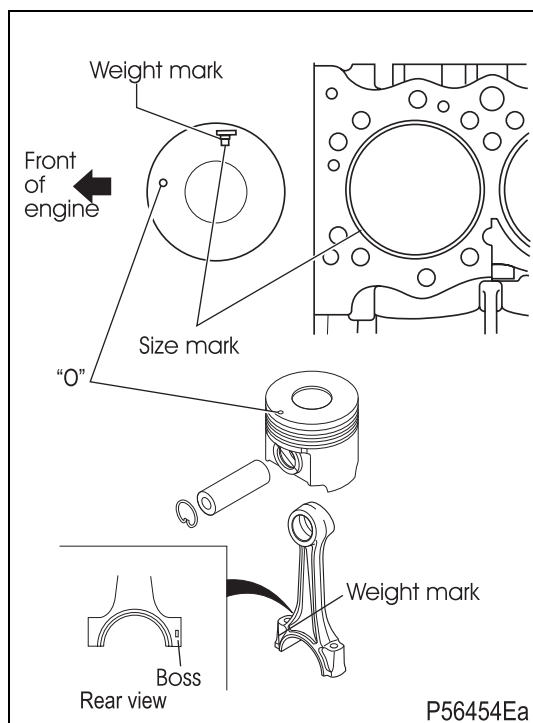
Lapping

- Perform the valve lapping in the following procedure.
- Apply a thin coat of lapping compound to the seat contact surface of the valve.

CAUTION ⚠

- **Do not put any compound on the stem.**
- **Start with an intermediate-grit compound (120 to 150 grit) and finish with a fine-grit compound (200 grit or more). Do not put any compound on the stem.**
- **Adding a small amount of engine oil to the lapping compound can facilitate even application.**

◆ Installation procedure ◆



■ Installation: Mitsubishi 4M50 Piston and connecting rod

- When replacing a piston and connecting rod assembly, select and install a new piston and connecting rod by the following procedure.
- Choosing pistons
 - Choose pistons of the same weight for all cylinders.
 - Check that the size marks ("A" or "B") on the piston and cylinder liner are identical.

CAUTION ⚠

- **Make sure to use pistons and cylinder liners of the same size. Failure to do so may result in seizures in the engine.**

- Choose connecting rod of the same weight for every cylinder.
- NOTE: Weight mark: "C" to "G" (with "G" as the maximum)
- Apply engine oil to the piston pin, and assemble the piston and connecting rod with their marks facing in the illustrated directions.

"O": Front mark

- If the piston pin is difficult to insert, heat the piston in hot water or with a piston heater.

■ Installation: Mitsubishi 4M50 Piston rings

- With the manufacturer's marks (found near the piston ring end gaps) facing up, install the piston rings so that the end gap of each ring is positioned as illustrated.

A: 1st compression ring end gap

B: 2nd compression ring end gap

C: Oil ring end gap

D: Oil ring's expander spring end gap

"O": Front mark on piston

The manufacturer's marks are present only on the 1st and 2nd compression rings.

● Assembly sequence

Follow the disassembly sequence in reverse.

CAUTION

- The main bearing cap bolts are tightened using the torque-turn tightening method. Any bolt that has three punch marks must be replaced.
- Do not overtighten the check valve. If it is tightened to a torque exceeding the specification, the check valve may malfunction, resulting in seizures in the engine.
- The No. 1 lower bearing has a oil groove. Be sure to install it in the correct position, otherwise a crankshaft seizure may result.



Service standards (Unit: mm {in.})

Location	Maintenance item		Standard value	Limit	Remedy	
–	Mitsubishi 4M50 Crankshaft end play		0.10 to 0.28 {0.0039 to 0.011}	0.4 {0.016}	Replace thrust plate	
4, 5, 12	Main bearing	Oil clearance	All except No. 3 0.038 to 0.1 {0.0015 to 0.0039}	0.15 {0.0059}	Replace	
			No. 3 0.058 to 0.12 {0.0023 to 0.0047}			
	Span when free		–	Less than 91.5 {3.60}		
11	Mitsubishi 4M50 Crankshaft	Bend		0.02 {0.00079} or less	0.05 {0.0020}	Replace
		Pins and journals	Out-of-roundness	0.01 {0.00039} or less	0.03 {0.0012}	Rectify or replace
			Taper	0.006 {0.00024} or less	–	
15	Distortion of upper crankcase top surface		0.07 {0.0028} or less	0.2 {0.0079}	Rectify or replace	

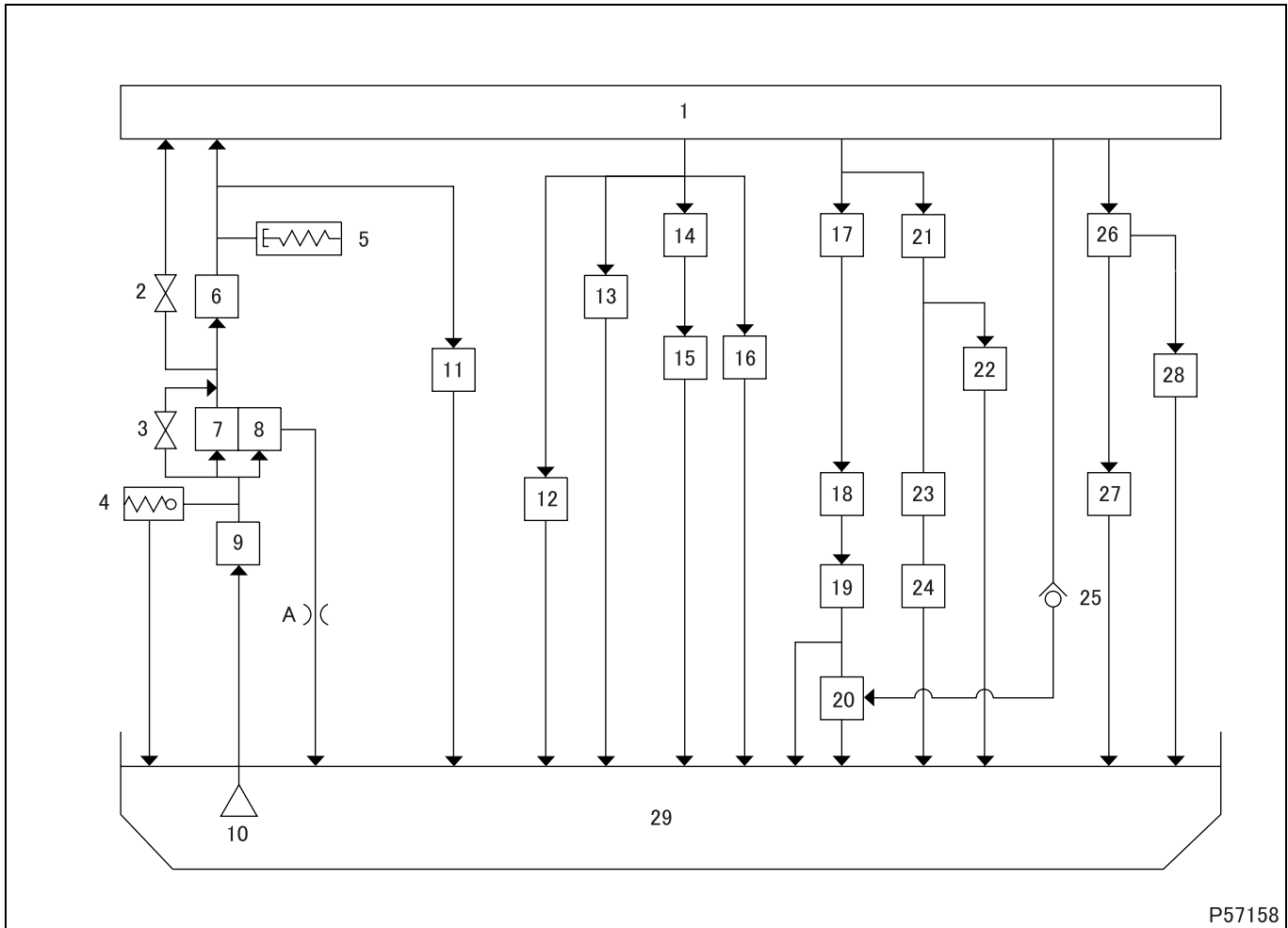
Tightening torque (Unit: N·m {lbf·ft, kgf·m})

Mark	Parts to be tightened	Tightening torque	Remarks
Ta	Bolt (rear plate installation)	63.7 {47, 6.5}	–
Tb	Bolt (lower crankcase installation)	23.5 {17, 2.4}	Wet
Tc	Main cap bolt (lower crankcase installation)	49 {36, 5.0} +90°	Wet Reusable up to 3 times
Td	Check valve	29.4 {22, 3.0}	Wet

Lubricant and/or sealant

Mark	Points of application	Specified lubricant and/or sealant	Quantity
	Rear oil seal lip	Engine oil	As required
	Bolt and main bearing cap bolt threads and seating surface of head		
	Main bearing inside surface		
	Check valve threads		
	Upper and lower crankcase mating surface of rear oil seal	ThreeBond 1207C or D	As required
	Lower crankcase mounting surface of upper crankcase		

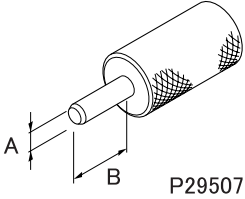
1. Mitsubishi 4M50 Lubrication System



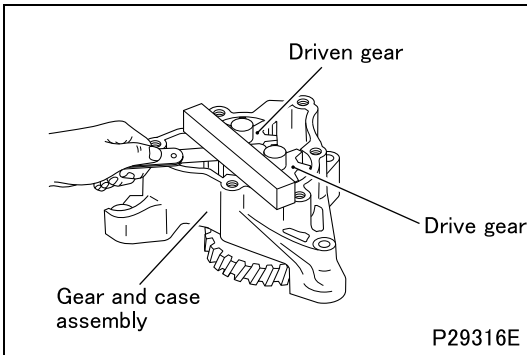
P57158

- | | |
|------------------------------|-----------------------------------|
| 1 Main oil gallery | 17 Crankshaft main bearing |
| 2 Bypass valve | 18 Connecting rod bearing |
| 3 Bypass valve | 19 Connecting rod bushing |
| 4 Regulator valve | 20 Piston |
| 5 Engine oil pressure switch | 21 Balance shaft bushing RH |
| 6 Oil cooler | 22 Supply pump gear bushing |
| 7 Full-flow filter element | 23 Supply pump idler gear bushing |
| 8 Bypass filter element | 24 Supply pump idler gear shaft |
| 9 Oil pump | 25 Check valve for oil jet |
| 10 Oil strainer | 26 Rocker bushing |
| 11 Turbo charger | 27 Camshaft bushing |
| 12 Oil jet for gear | 28 Rocker roller |
| 13 Vacuum pump | 29 Oil pan |
| 14 Idler bushing | |
| 15 Timing gear | |
| 16 Balance shaft bushing LH | |
- A: Orifice

Special tools (Unit: mm {in.})

Mark	Tool name and shape	Part No.	Application						
Ca	Pump cover pin <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td>A</td> <td>B</td> </tr> <tr> <td>$\phi 7 \begin{smallmatrix} 0 \\ -0.14 \end{smallmatrix}$</td> <td>20 {0.79}</td> </tr> <tr> <td>$\{\phi 0.28 \begin{smallmatrix} 0 \\ -0.0055 \end{smallmatrix}\}$</td> <td></td> </tr> </table>	A	B	$\phi 7 \begin{smallmatrix} 0 \\ -0.14 \end{smallmatrix}$	20 {0.79}	$\{\phi 0.28 \begin{smallmatrix} 0 \\ -0.0055 \end{smallmatrix}\}$		 P29507	MH063431 Installation of oil pump cover
		A	B						
$\phi 7 \begin{smallmatrix} 0 \\ -0.14 \end{smallmatrix}$	20 {0.79}								
$\{\phi 0.28 \begin{smallmatrix} 0 \\ -0.0055 \end{smallmatrix}\}$									

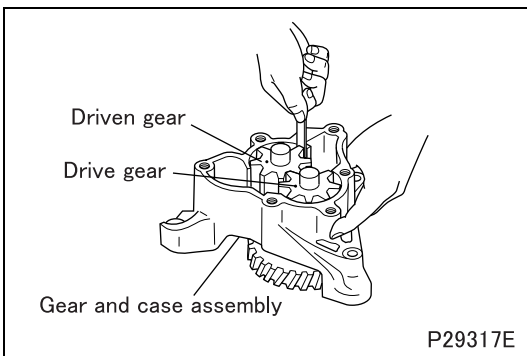
◆ Inspection procedure ◆



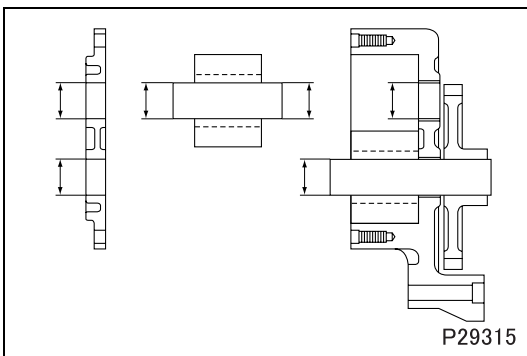
■ Inspection: Driven gear, drive gear and gear and case assembly

- Carry out the following inspection. Replace the oil pump if any defects are found.

(1) Sinkage of each gear from gear and case assembly end surface



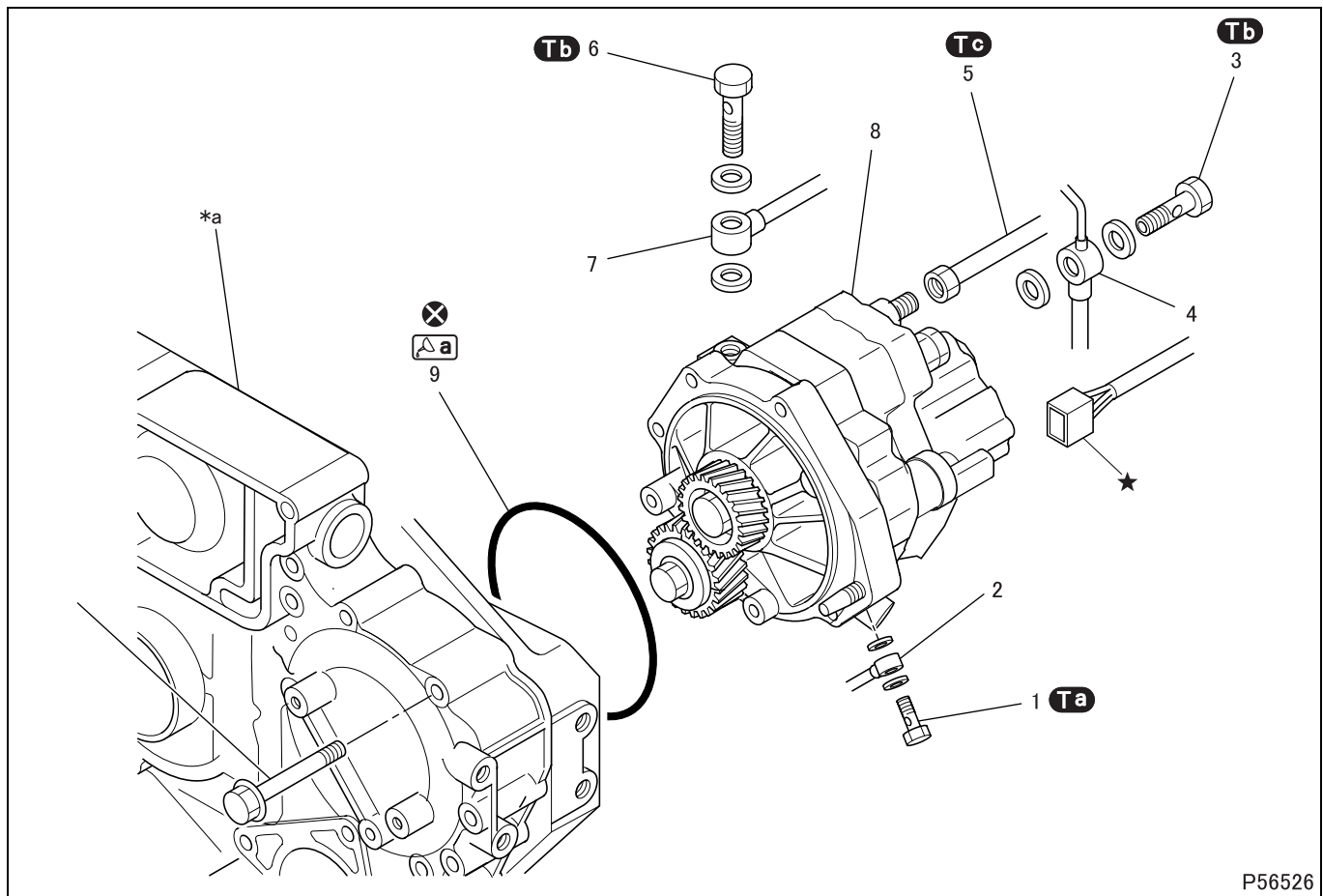
(2) Gear and case assembly-to-tooth tip clearance for each gear



■ Inspection: Oil pump cover, driven gear, and gear and case assembly

- Measure the clearance between each gear's shaft and the oil pump cover, as well as between each gear's shaft and the gear and case assembly.
- If the measurements are not within the standard value range, replace the oil pump.

MITSUBISHI 4M50 HIGH PRESSURE FUEL SUPPLY PUMP



P56526

● Removal sequence

- | | | |
|--------------------|-------------------------------|-----------------------|
| 1 Eyebolt | 5 Fuel pipe | 9 O-ring |
| 2 Oil pipe | 6 Eyebolt (with gauze filter) | |
| 3 Eyebolt | 7 Fuel suction pipe | *a: Front case |
| 4 Fuel return pipe | 8 Supply pump | ⊗: Non-reusable parts |

CAUTION ⚠

- Contact each seating surface fully and evenly, tighten the bolt or nut temporarily, and finally tighten it to the specified torque.
- Have the injection pump assembly serviced by a BOSCH service station.
- Dirt and dust in the injection pump assembly can seriously detract from engine performance. To prevent this from happening, fully cover all open joints after removing any pipes or hoses.

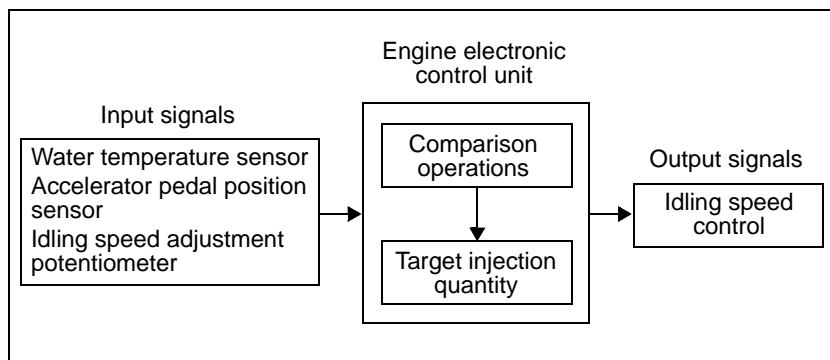
● Installation sequence

Follow the removal sequence in reverse.

CAUTION ⚠

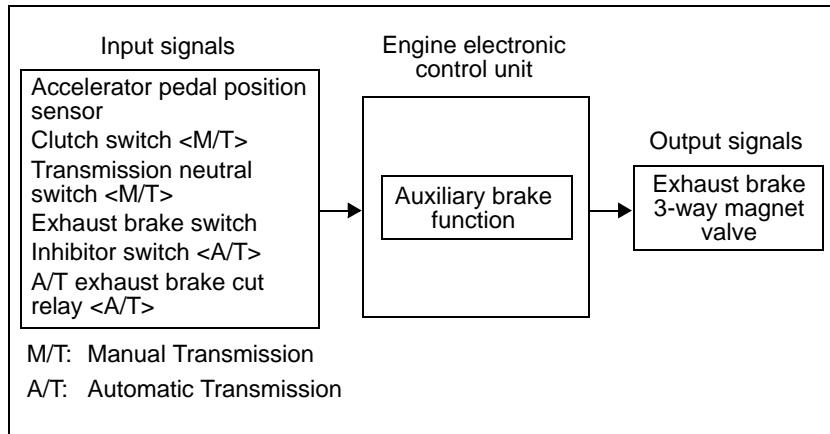
- Make sure that the harness (marked with “ ★ ”) of MPROP (rail pressure control valve) is connected to the supply pump before starting the engine. Starting the engine without connection causes a malfunction.

STRUCTURE AND OPERATION



2.6 Warm-up acceleration function

- The warm-up acceleration function increases engine warm-up by varying the engine's idling speed in accordance with the engine's coolant temperature. It can operate either automatically or manually. Selection is made using the idling speed adjustment potentiometer.



2.7 Auxiliary brake function

- The auxiliary brake function activates or deactivates the exhaust brake 3-way magnet valve according to the vehicle condition to control the exhaust brake.

2.8 Fault diagnosis function

- While the starter switch is in the ON position, the sensors and other components are continuously monitored for faults. In the event that a component is found faulty, an indication is made in the meter cluster to alert the driver, the fault location is memorized in the form of a diagnosis code, and the control during fault is initiated.
- While the control during fault is taking place, the system's functionality is limited to ensure vehicle and driver safety. It is possible to read the memorized diagnosis code using a Multi-Use Tester or from flashing of the warning lamp.

NOTE

- **Diagnosis codes shown by the Multi-Use Tester and those indicated by flashing of the warning lamp are different.**
- **The Multi-Use Tester is capable of showing more detailed diagnosis codes.**

P1462: Exhaust Brake M/V 1 (warning lamp flashes: 93)

Generation condition		Exhaust brake 3-way magnetic valve voltage is below standard value.
Recoverability		System recovers if signal becomes normal with starter switch in ON position.
Control effected by electronic control unit		Operation of exhaust brake is stopped.
Inspection	Service data	87: Exhaust Brake M/V 1
	Actuator test	AC: Auxiliary Brake M/V 1
	Electronic control unit connector	13 : Exhaust brake 3-way magnetic valve
	Electrical equipment	#565: Exhaust brake 3-way magnetic valve
	Electric circuit diagram	Exhaust brake 3-way magnetic valve system

P1463: Exhaust Brake M/V 1 (warning lamp flashes: 93)

Generation condition		Exhaust brake 3-way magnetic valve voltage is above standard value.
Recoverability		System recovers if signal becomes normal with starter switch in ON position.
Control effected by electronic control unit		Operation of exhaust brake is stopped.
Inspection	Service data	87: Exhaust Brake M/V 1
	Actuator test	AC: Auxiliary Brake M/V 1
	Electronic control unit connector	13 : Exhaust brake 3-way magnetic valve
	Electrical equipment	#565: Exhaust brake 3-way magnetic valve
	Electric circuit diagram	Exhaust brake 3-way magnetic valve system

P1562: Sensor Supply Voltage 1 (warning lamp flashes: 81)

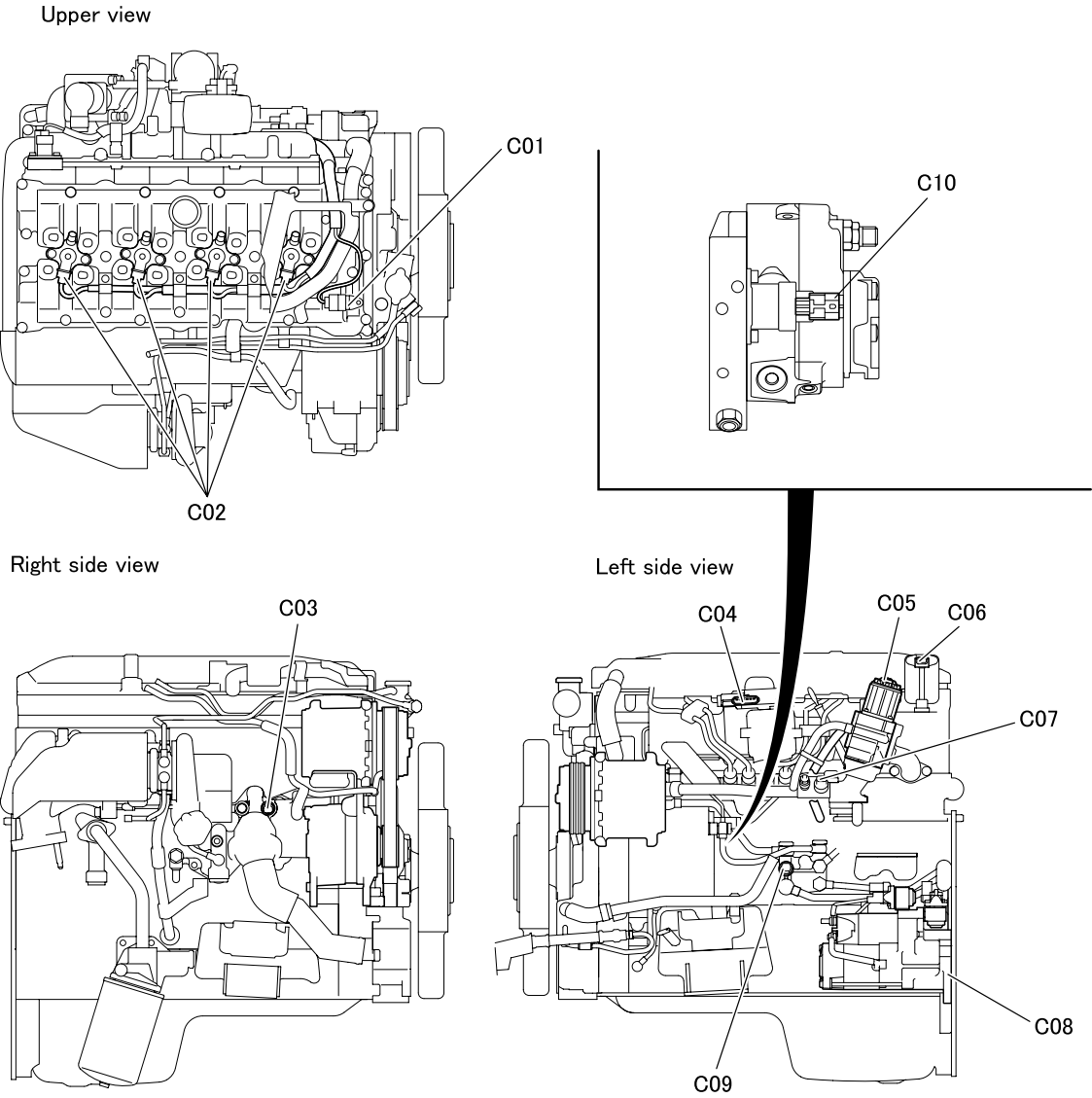
Generation condition		Circuit voltage (sensor supply voltage 1) in electronic control unit is below standard value.
Recoverability		System recovers if signal becomes normal with starter switch in ON position.
Control effected by electronic control unit		No specific control is effected. Failure occurs only to circuit abnormality.
Inspection	Service data	24: Accel Pedal Sensor Voltage 1, 3B: Idle Volume Voltage
	Electronic control unit connector	03 : Accelerator pedal position sensor 1, 09 : Idling speed adjustment potentiometer
	Electrical equipment	#157: Idling speed adjustment potentiometer, #324: Accelerator pedal position sensor 1
	Electric circuit diagram	Boost air temperature sensor, accelerator pedal position sensor 1, and idling speed adjustment potentiometer systems

P1563: Sensor Supply Voltage 1 (warning lamp flashes: 81)

Generation condition		Circuit voltage (sensor supply voltage 1) in electronic control unit is above standard value.
Recoverability		System recovers if signal becomes normal with starter switch in ON position.
Control effected by electronic control unit		No specific control is effected. Failure occurs only to circuit abnormality.
Inspection	Service data	24: Accel Pedal Sensor Voltage 1, 3B: Idle Volume Voltage
	Electronic control unit connector	03 : Accelerator pedal position sensor 1, 09 : Idling speed adjustment potentiometer
	Electrical equipment	#157: Idling speed adjustment potentiometer, #324: Accelerator pedal position sensor 1
	Electric circuit diagram	Boost air temperature sensor, accelerator pedal position sensor 1, and idling speed adjustment potentiometer systems

C01 to 10

Mitsubishi 4M50 Location of Electrical Parts, Sensors, Valves,



- C01 Cylinder recognition sensor
 - C02 Injector magnetic valve
 - C03 Water temperature sensor
(Connects to engine ECU)
 - C04 Intake throttle
(Building into motor, position sensor)
 - C05 EGR valve
(Building into motor, position sensor)
 - C06 Boost pressure sensor
 - C07 Common rail pressure sensor
 - C08 Starter
 - C09 Fuel temperature sensor
 - C10 MPROP (rail pressure control valve)
- ECU : Electronic control unit

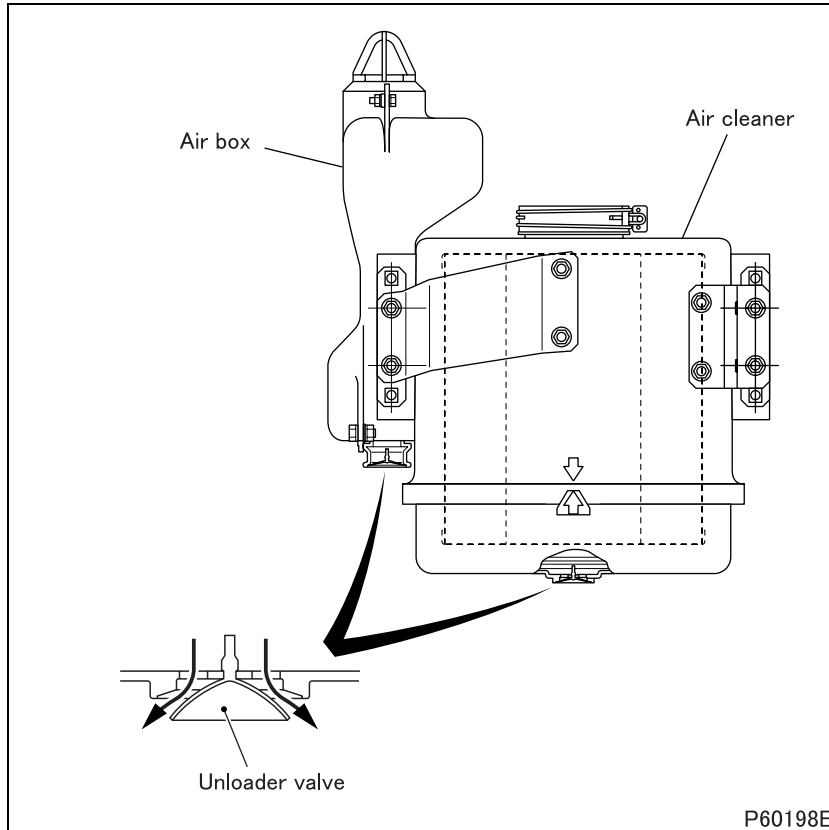
SPECIFICATIONS/STRUCTURE AND OPERATION

SPECIFICATIONS

Item		Specifications
Air cleaner element		Filter paper type
Turbocharger	Model	TD04
	Manufacturer	Mitsubishi Heavy Industries, Ltd.
Intercooler		Tube and corrugated fin type air-to-air heat exchanger

STRUCTURE AND OPERATION

1. Air Cleaner



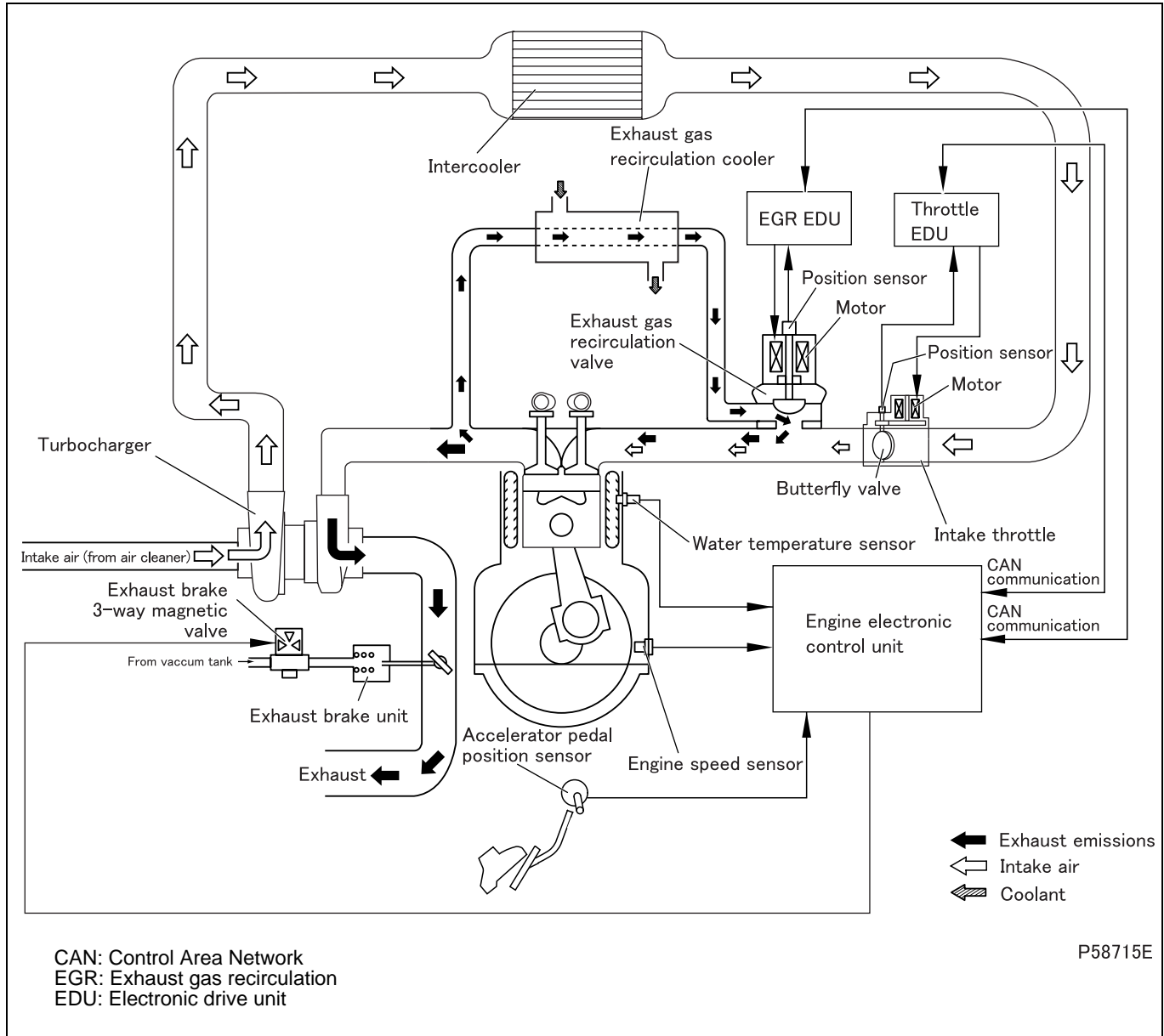
- The air cleaner is a single element type.
- When the engine slows down below the predetermined speed, the level of vacuum changes and causes the unloader valve to vibrate. Vibration of the unloader valve allows the air cleaner to automatically discharge any water and dust that has accumulated in its inside.

STRUCTURE AND OPERATION

1. Mitsubishi 4M50 Exhaust Gas Recirculation System

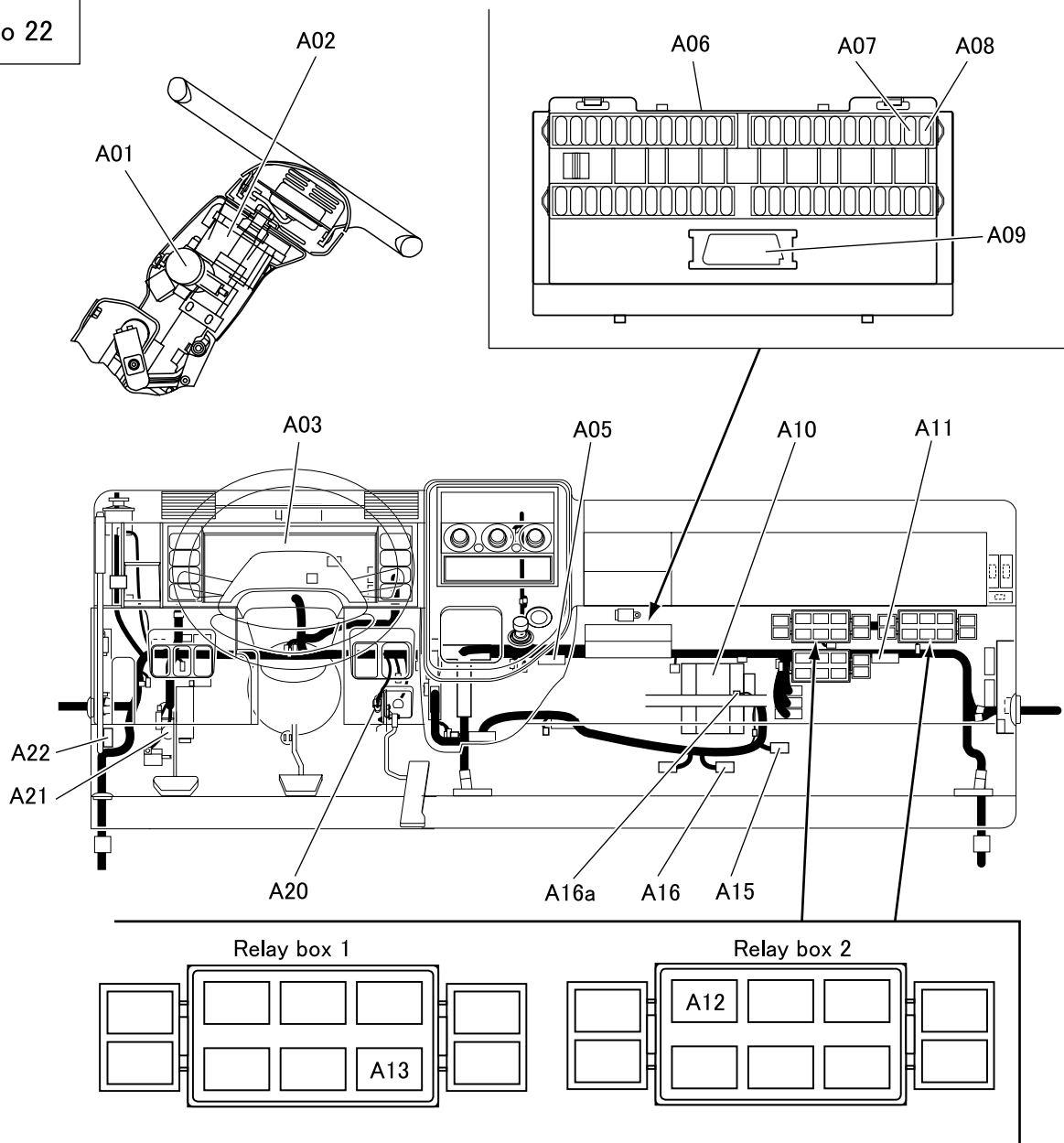
1.1 Overview

- In the exhaust gas recirculation system, the engine electronic control unit and multiple electronic drive units control the exhaust gas recirculation valve and intake throttle in accordance with information from sensors on various aspects of the engine (engine speed, coolant temperature, throttle opening, etc.).
- Exhaust gas recirculation involves the introduction of inert gases in the post-combustion exhaust emissions into the intake manifold. By reducing the combustion temperature, it reduces the amount of nitrogen oxides (NOx), which are harmful, in the exhaust emissions. Further, an exhaust gas recirculation cooler cools the recirculated exhaust emissions, thereby reducing the peak combustion temperature.
- The intake air quantity is adjusted by means of intake throttle control such that the effectiveness of exhaust gas recirculation is maximized.



8. Installed Locations of Parts

A01 to 22



No relevant parts in a missing number

- | | | | |
|-----|---|------|---|
| A01 | Starter switch | A16 | Resistor unit |
| A02 | Combination switch | A16a | Ground |
| A03 | Meter cluster | A20 | Accelerator pedal position sensor |
| A05 | Joint connector (J/C-1) | A21 | Clutch switch |
| A06 | Fuse box | A22 | Multi-Use Tester-III connector (for inspection) |
| A07 | Diagnosis switch | | |
| A08 | Memory clear switch | ABS | : Anti-lock brake system |
| A09 | Multi-Use Tester-III connector (for recorder) | A/T | : Automatic transmission |
| A10 | Engine ECU | ECU | : Electronic control unit |
| A11 | Joint connector (J/C-2, 3) | | |
| A12 | ABS exhaust brake cut relay | | |
| A13 | Exhaust brake cut relay <A/T> | | |
| A15 | Joint connector (J/C-4) | | |