

How to use this manual

This service manual consists of several Groups, which are arranged so as to allow you to make reference quickly to specifications, maintenance standards, adjustment procedures and service procedures including methods for disassembly, inspection, repair and reassembly of the Mitsubishi Diesel Engine (standard model for land use).

A short summary describing the content of each Group is given in the General Contents page, and there is also a detailed table of contents at the beginning of each Group.

Regarding the procedures for operation and periodical maintenance of the engine, refer to the Operation and Maintenance Manual. For information on the engine components and ordering of service parts, refer to the Parts Catalogue. Structure and function of the engine are described in the relevant training manuals.

Methods of presentation

- (1) Index numbers allotted to parts in exploded views are not only a call-out of part names listed in the text but also an indication of the sequence of disassembly.
- (2) Inspections to be conducted during disassembly process are indicated in boxes in the relevant exploded views.
- (3) Maintenance standards required for inspection and repair works are indicated in the appropriate positions in the text. They are also collectively indicated in Group 2, the General Contents group.
- (4) Fasteners to be tightened in "wet" condition, or with engine oil applied, are identified by [Wet] placed after tightening torque values. If no such indication is suffixed, the fastener should be tightened in "dry" condition, or without lubricating with engine oil.
- (5) In this manual, important safety or other cautionary instructions are emphasized with the following marks headed.



Indicates an immediately hazardous situation which, if not avoided, will result in death or serious injury.



Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



Indicates an immediately hazardous situation which, if not avoided, may result in minor or moderate injury.



Indicates a potentially hazardous situation which, if not avoided, can result in property damage.

Note:

Indicates important information or information useful for operation or maintenance of the engine.

Safety Cautions

⚠ WARNING

Fire and explosion

Keep flames away

Store fuel and engine oil in a well-ventilated designated area.

Make sure that the caps of fuel and engine oil containers are tightly closed.

Do not use flames, do not smoke, or do not work near heater or other fire hazards where fuel or oil is handled or when cleaning solvent is being used for washing parts.

Wipe off spilled fuel, oil and LLC immediately and thoroughly. Spilled fuel, oil and LLC may ignite and cause a fire.



Keep surrounding area neat and clean

Do not leave combustible or explosive materials, such as fuel, engine oil and LLC, near the engine. Such substances can cause fire or explosion.

Remove dust, dirt and other foreign materials accumulated on the engine and surrounding parts thoroughly. Such materials can cause fire or the engine to overheat. In particular, clean the top surface of the battery thoroughly. Dust can cause a short-circuit.

Always operate the engine at a position at least 1 m [3.28 ft.] away from buildings and other equipment to prevent possible fire caused by engine heat.

Care about fuel, oil and exhaust gas leakage

If any fuel, oil or exhaust gas leakage is found, immediately take corrective measures to stop it.

Such leakages, if left uncorrected, can cause fuel or engine oil to reach hot engine surfaces or hot exhaust gas to contact flammable materials, possibly leading to personal injury and/or damage to equipment.

Use explosion-proof lighting apparatus

When inspecting fuel, engine oil, coolant, battery electrolyte, etc., use a flameproof light. An ordinary light, if it accidentally broken, may ignite and cause an explosion.

Prevent electrical wires from short-circuiting

Avoid inspecting or servicing the electrical system with the ground cable connected to the battery. Otherwise, a fire could result from short-circuiting. Be sure to disconnect the battery cable from the negative (-) terminal before beginning with the work procedure.

Short-circuits, possibly resulting in fire, may be caused by a loose terminal or damaged cable/wire. Inspect the terminals, cables and wires, and repair or replace the faulty parts before beginning with the service procedure.

Keep fire extinguishers and first-aid kit handy

Keep a fire extinguisher handy and be familiarized with their usage.

Keep a first-aid kit at a designated place, and make sure it is easily accessible whenever needed.

Establish emergency procedures to follow in the event of fire or accident, and keep the personnel informed of emergency contact locations and contact methods.



CAUTION

About warning labels

Maintenance of warning labels

Make sure all warning/caution labels are legible.

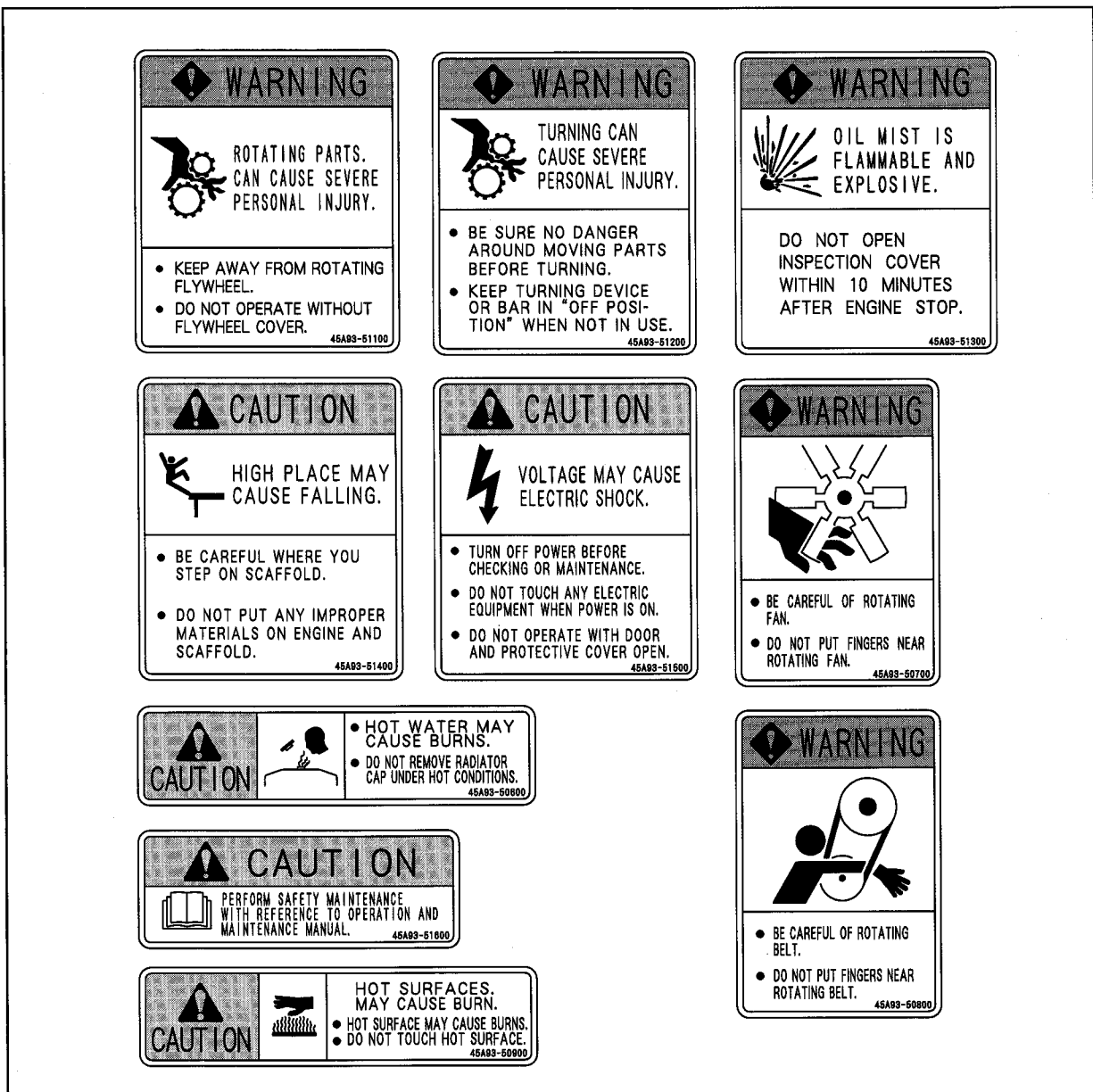
Clean or replace the warning/caution labels the description and/or illustration of which cannot be seen clearly.

For cleaning the warning/caution labels, use a cloth, water and soap. Do not use cleaning solvents, gasoline or other chemicals to prevent the letters from getting blurred or the adhesion from being weakened.

Replace damaged or fractured labels with new ones.

If any engine part on which a warning label is attached is replaced with a new one, attach a new identical warning label to the new part.

To obtain replacement warning labels, contact a Mitsubishi dealer.



Warning labels

Table 1-1 Main specifications (3 / 3)

Engine model		D04FD-TAA		
Electrical system	Starter	Manufacturer	Mitsubishi Electronic Corporation	
		Type	M008T60471	
		Pinion meshing type	Pinion shift	
		Output	24V - 5 kW	
		Qty	1	
		Ring gear and pinion ratio	10/127	
		No-load characteristics	Voltage	23V
			Current	85A or below
			Speed	3300 min ⁻¹ or above
		Load characteristics	Voltage	9V
			Current	1400A or below
			Torque	88 N·m {9.0 kgf·m} [65 lbf·ft] or above
		Switching voltage	ON	16V or below
	OFF		When circuit is opened, plunger returns	
	Alternator	Type	3-phase alternating current, with rectifier	
		Manufacturer	Mitsubishi Electronic Corporation	
		Model number	A004TU3599	
		Output	24V-50A	
		Rated voltage generating speed	1000 min ⁻¹	
		Rated output generating speed	5000 min ⁻¹	
Permissible speed		8000 min ⁻¹		
Regulated voltage		28.5 V ± 0.5V		
Speed ratio (to crank pulley speed)		Varies depending on specifications.		
Air heater		Type	Electric heater	
	Capacity	2.1 kW		

2.1.3 Lubrication system

Table 2-9 Major bolts and nuts tightening torque - Lubrication system

Item	Threads Dia x Pitch (mm)	Tightening torque			Remark
		N·m	kgf·m	lbf·ft	
Relief valve	22 x 1.5	49 ± 4.9	5 ± 0.5	36.2 ± 3.6	
Relief valve plug	18 x 1.5	44 ± 4.9	4.5 ± 0.5	32.5 ± 3.6	
Safety valve	18 x 1.5	69 ± 4.9	7 ± 0.5	50.6 ± 3.6	
Oil pump cover bolt	10 x 1.5	33 ± 3.3	3.4 ± 0.34	24.6 ± 2.5	
Turbocharger oil feed eye bolt	10 x 1.25	17 ± 2	1.7 ± 0.2	12.3 ± 1.4	

2.1.4 Inlet and exhaust system

Table 2-10 Major bolts and nuts tightening torque - Inlet and exhaust system

Item	Threads Dia x Pitch (mm)	Tightening torque			Remark	
		N·m	kgf·m	lbf·ft		
Air heater terminal nut	Terminal side	6 x 1	12.75 ± 1	1.3 ± 0.1	9.4 ± 0.7	
	Short bar side	6 x 1	7.35 ± 1.5	0.75 ± 0.15	5.4 ± 1.1	
Air heater terminal flange nut	6 x 1	8.8 ± 1	0.9 ± 0.1	6.5 ± 0.7		
Inlet manifold bolt	8 x 1.25	18 ± 2	1.8 ± 0.2	13 ± 1.4		
Exhaust manifold nut	8 x 1.25	18 ± 2	1.8 ± 0.2	13 ± 1.4		

2.1.5 Electrical system

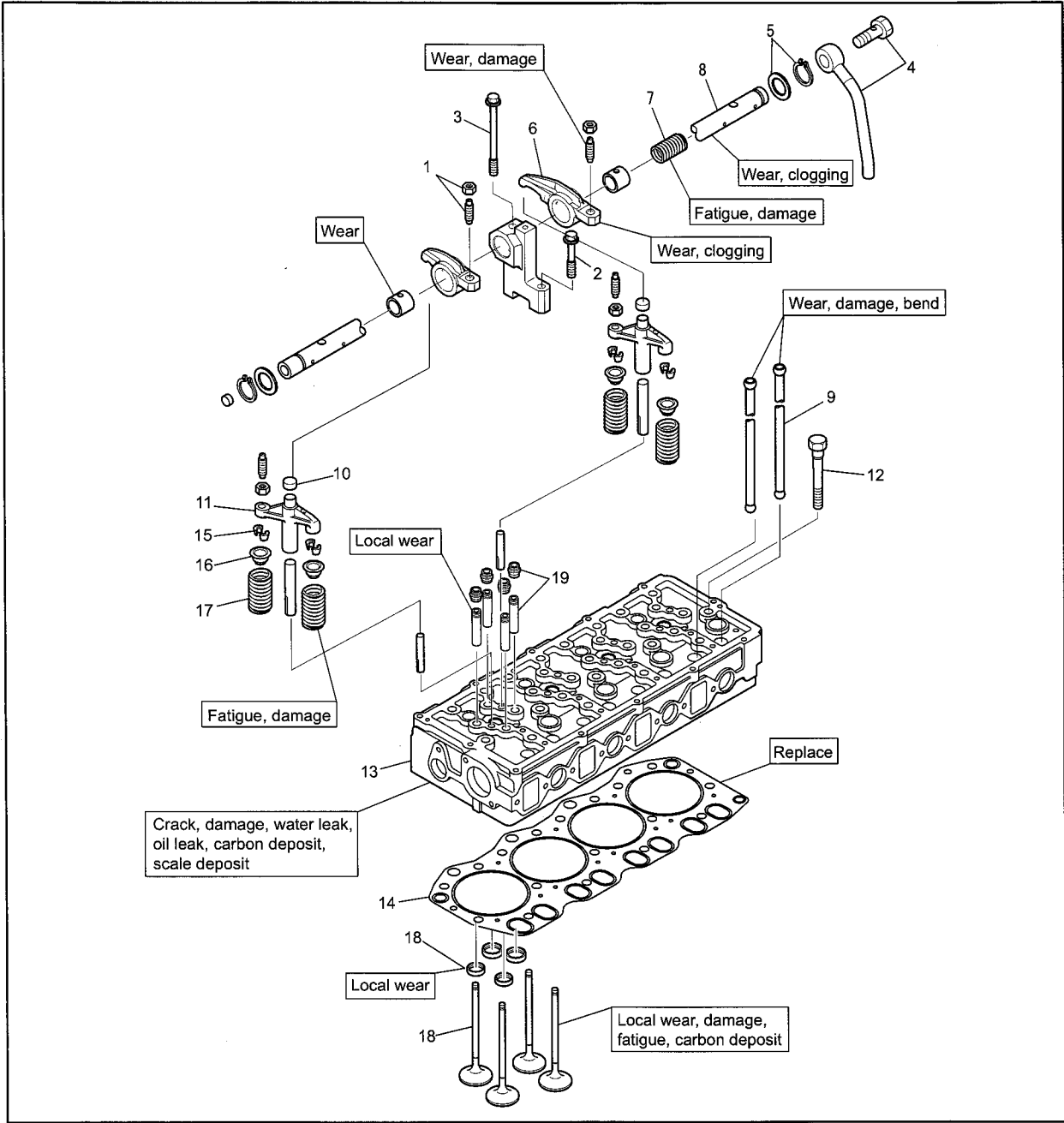
Table 2-11 Major bolts and nuts tightening torque - Electrical system

Item	Threads Dia x Pitch (mm)	Tightening torque			Remark
		N·m	kgf·m	lbf·ft	
Starter B terminal	8 x 1.25	9.9 ± 1	1 ± 0.1	7.2 ± 0.7	
Alternator E terminal	6 x 1	5 ± 1	0.5 ± 0.1	3.6 ± 0.7	
Alternator B terminal	5 x 0.8	2.75 ± 0.35	0.27 ± 0.03	2.0 ± 0.2	
Alternator pulley nut	20 x 1.5	147 ± 15	15 ± 1.5	108 ± 11	
Alternator through bolt	6 x 1	5.4 ± 1.5	0.54 ± 0.15	3.9 ± 1.1	

2.1.6 Sensors and ECM

Table 2-12 Major bolts and nuts tightening torque - Sensors and ECM

Item	Threads Dia x Pitch (mm)	Tightening torque			Remark
		N·m	kgf·m	lbf·ft	
Water temperature sensor Charge air temperature sensor	M12 ± 1.5	15 ± 3	1.5 ± 0.3	10.8 ± 2.2	
Boost pressure sensor	M14 ± 1.5	10 ± 2	1 ± 0.2	7.2 ± 1.4	
Engine oil pressure sensor	M12 ± 1.5	10 ± 2	1 ± 0.2	7.2 ± 1.4	
Common rail pressure sensor	M12 ± 1.5	34 ± 6	3.4 ± 0.6	24.6 ± 4.3	
Speed/timing sensor (crankshaft side)	M8 ± 1.25	17 ± 1.7	1.65 ± 0.15	11.9 ± 1.1	
ECM connector mounting hexagon bolt	-	5 ± 1	0.50 ± 0.10	3.7 ± 0.7	
Relay connector mounting hexagon bolt	-	2.8 ± 0.3	0.29 ± 0.03	2.07 ± 0.22	

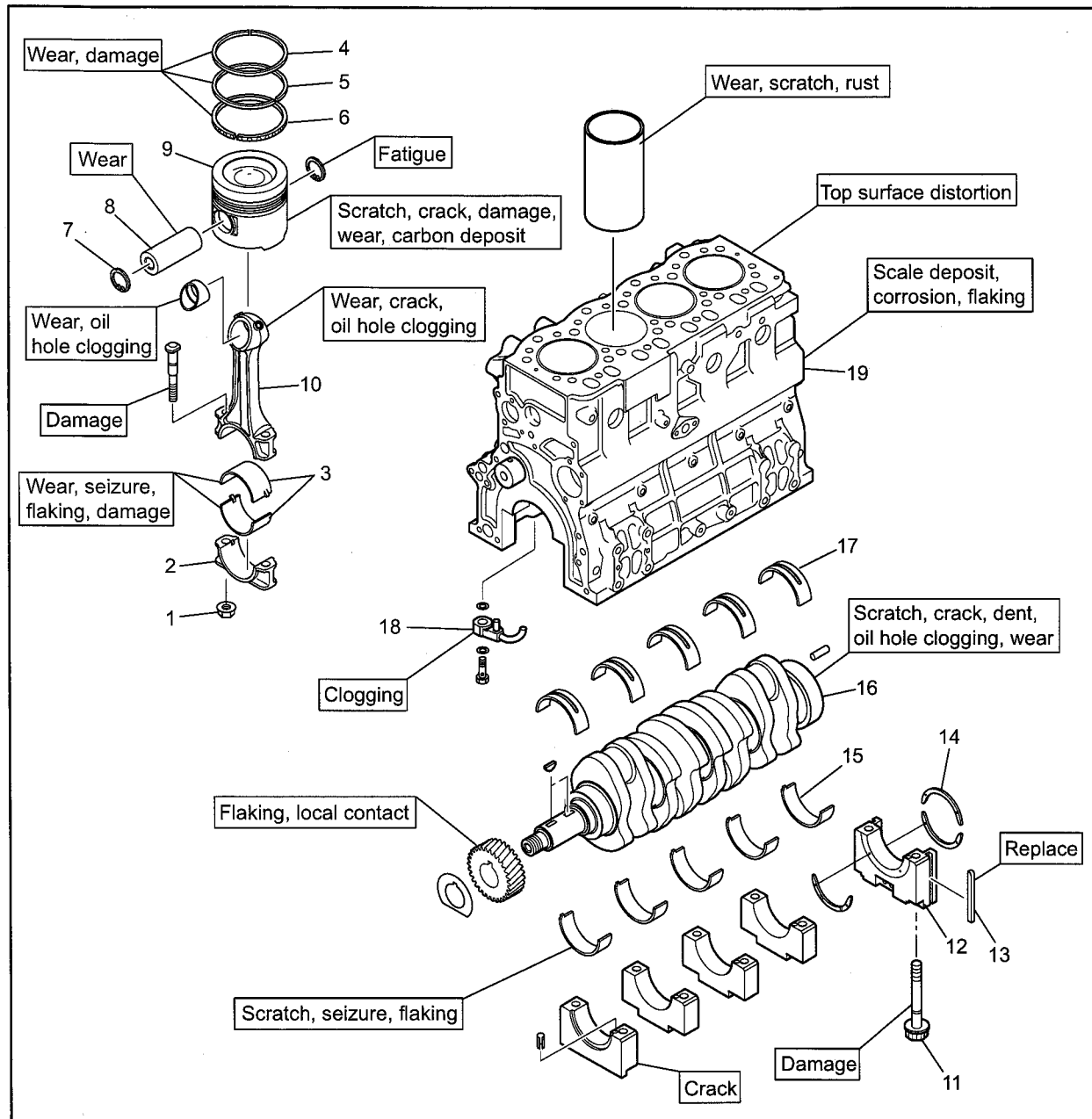


Disassembling and inspecting cylinder head and valve mechanism

Disassembling sequence

- | | | |
|-----------------------|-----------------------|----------------------------|
| 1 Adjusting screw | 8 Rocker shaft | 15 Valve cotter |
| 2 Bolt (short) | 9 Pushrod | 16 Valve retainer |
| 3 Bolt (long) | 10 Bridge cap | 17 Valve spring |
| 4 Eye bolt , oil pipe | 11 Valve bridge | 18 Valve , valve seat |
| 5 Snap ring , spacer | 12 Cylinder head bolt | 19 Stem seal , valve guide |
| 6 Rocker arm | 13 Cylinder head | |
| 7 Rocker shaft spring | 14 Gasket | |

4. Disassembling and inspection crankcase, crankshaft and piston



Disassembling and inspection crankcase, crankshaft and piston

Disassembling sequence

- | | | |
|---------------------------|--------------------------|--------------------------|
| 1 Nut | 8 Piston pin | 15 Main bearing (lower) |
| 2 Connecting rod cap | 9 Piston | 16 Crankshaft |
| 3 Connecting rod bearing | 10 Connecting rod | 17 Main bearing (upper) |
| 4 Compression ring, No. 1 | 11 Main bearing cap bolt | 18 Piston cooling nozzle |
| 5 Compression ring, No. 2 | 12 Main bearing cap | 19 Crankcase |
| 6 Oil ring | 13 Side seal | |
| 7 Snap ring | 14 Thrust plate | |

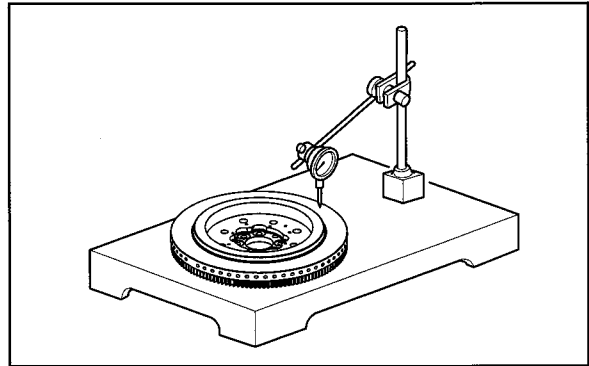
2. Inspecting and repairing flywheel

2.1 Measuring flatness of flywheel

Place the flywheel on a surface plate and move a dial gauge on the friction surface of the flywheel to measure the flatness.

Grind the friction surface of the flywheel if the limit is exceeded.

Item	Standard	Limit
Flywheel flatness	0.15 mm [0.0059 in.] or less	0.50 mm [0.0197 in.]

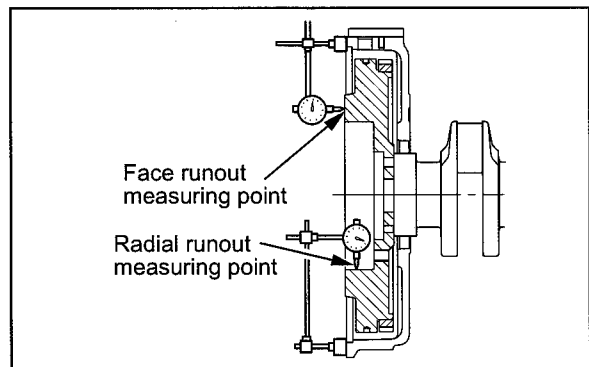


Measuring flatness of flywheel

2.2 Measuring flywheel face runout and radial runout

Measure the runouts of the flywheel in the installed condition. If any of the measurements exceeds the standard, check the flywheel for loosened bolts and foreign matter accumulation on the mounting face.

Item	Standard	Limit
Flywheel face runout and radial runout	Within 0.15 mm [0.0059 in.]	0.50 mm [0.0197 in.]



Measuring flywheel face runout and radial runout

2.3 Inspecting ring gear

Replace the ring gear if missing or abnormally worn teeth are found by inspection.

2.4 Replacing ring gear

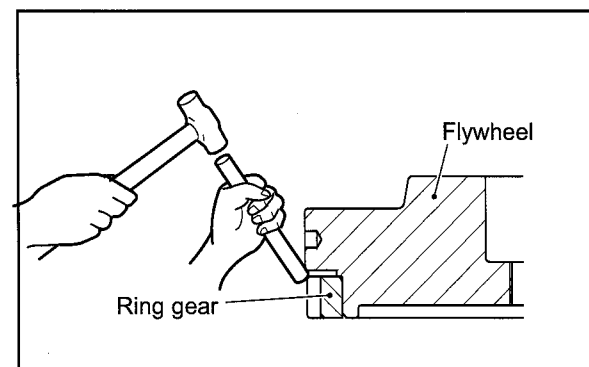
2.4.1 Removing ring gear

- (1) Heat the ring gear evenly using an acetylene torch or other appropriate heat source.
- (2) With a rod placed on the periphery of ring gear, tap the rod with a hammer evenly around the ring gear, and remove the ring gear.

2.4.2 Installing ring gear

- (1) Heat the ring gear evenly up to approx. 150°C [176°F] with an appropriate heater.
- (2) Install the ring gear onto the flywheel with the no-gear-chamfering side faced to the flywheel.

Note: Do not heat the ring gear excessively.



Removing ring gear

1.4 Installing main bearing caps

CAUTION

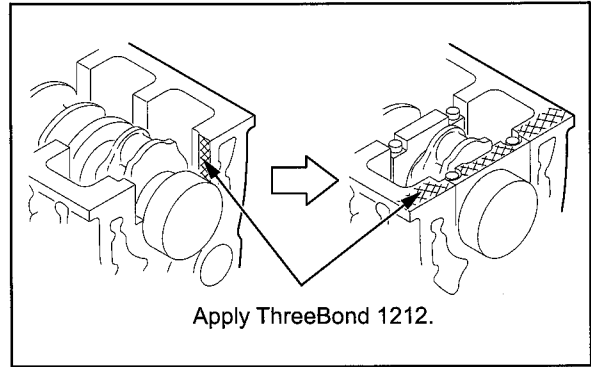
Install the foremost and rearmost caps so that they are flush with the crankcase surface.

Install the main bearing caps from the front side in the order of the numbers marked on them.

- (1) Apply engine oil to lower main bearings and install them to the main bearing caps.
- (2) Apply ThreeBond 1212 to the mating surface of the foremost and rearmost caps and the crankcase mating faces before installing the main bearing caps.

Note: Do not apply ThreeBond 1212 any other area other than the mating surfaces of the foremost and rearmost caps and the crankcase mating faces.

- (3) Install the main bearing caps and temporarily tighten bolts.



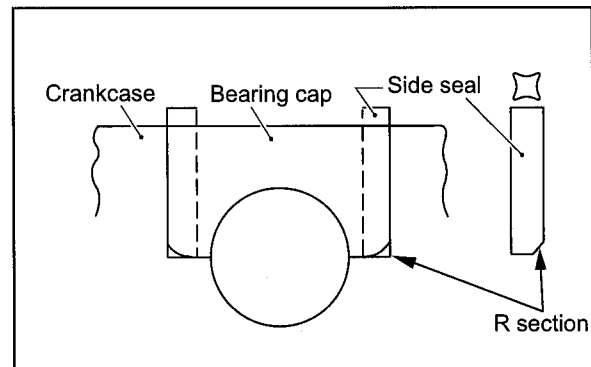
Installing main bearing cap

1.5 Inserting side seal

- (1) Apply a sealant to the circumference of new side seals.

Sealant	THREEBOND 1212 or 1211
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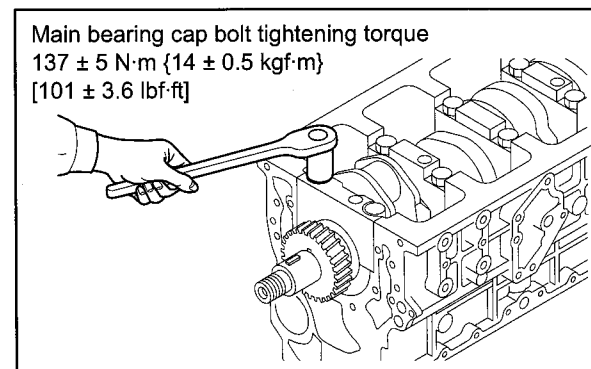
- (2) With roundings of the side seals facing outward, push them in the front and rear caps to some extent by hands.
- (3) When the side seals are pushed-in to some extent, use a tool with flat surface such as flat-head screwdriver to completely push them in, taking care not to bend them.



Inserting side seal

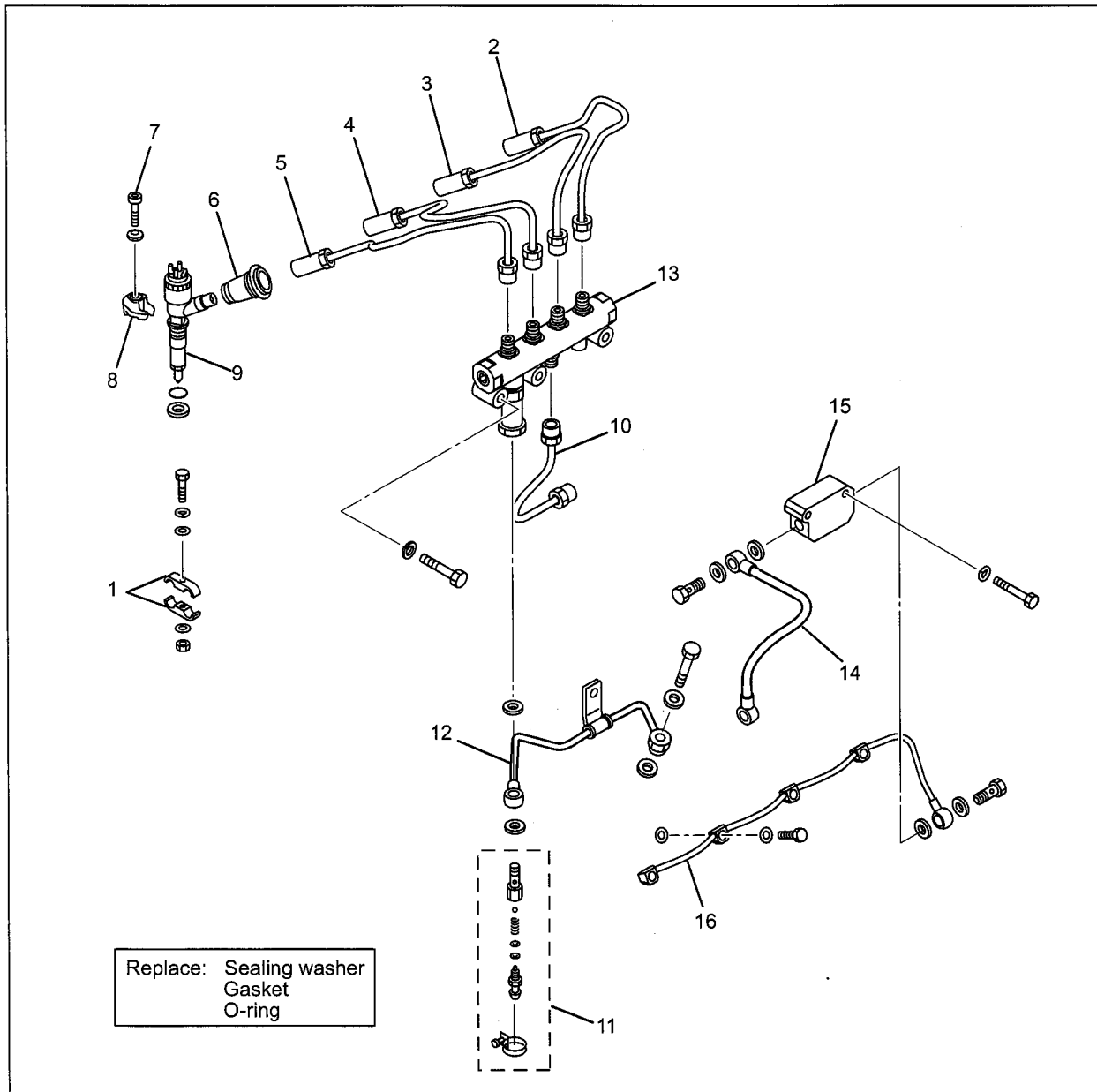
1.6 Installing main bearing cap bolt

- (1) Tighten the main bearing cap bolts alternately and progressively to the specified torque.
- (2) Make sure that the crankshaft rotates smoothly.



Installing main bearing cap bolt

1.2 Removing fuel system (Part 2)



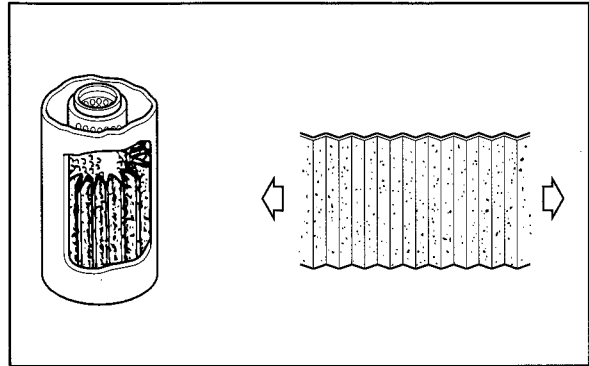
Removing fuel system (Part 2)

Removing sequence

- | | | |
|-----------------------|---------------------|----------------------|
| 1 Pipe clamp | 7 Hexagon head bolt | 13 Common rail |
| 2 No.1 injection pipe | 8 Nozzle gland | 14 Fuel outlet pipe |
| 3 No.2 injection pipe | 9 Injector | 15 Fuel relief block |
| 4 No.3 injection pipe | 10 Pump pipe | 16 Fuel pipe |
| 5 No.4 injection pipe | 11 Check valve | |
| 6 Injection seal | 12 Relief pipe | |

2.4 Inspecting oil filter

When replacing the oil filter, sample the oil (500 mL [30.5 cu.in.]) and check for metal and other particles. If metal or other particles are found, cut and unfold the element, and inspect the color and shape of metal particles trapped in the element to identify the cause.

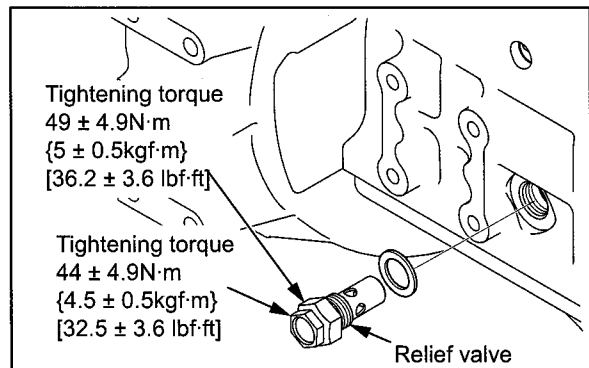


Inspecting oil filter

2.5 Inspecting relief valve

- (1) Check the relief valve and its seat for contact. Check the spring for fatigue and damage. If faulty, replace the relief valve with new one.
- (2) Measure the relief valve opening pressure. If the pressure does not fall within the standard range, replace the relief valve with new one.

Item	Standard
Relief valve opening pressure	0.35 ± 0.05 MPa { 3.5 ± 0.5 kgf/cm ² } [49.8 ± 7.1 psi]

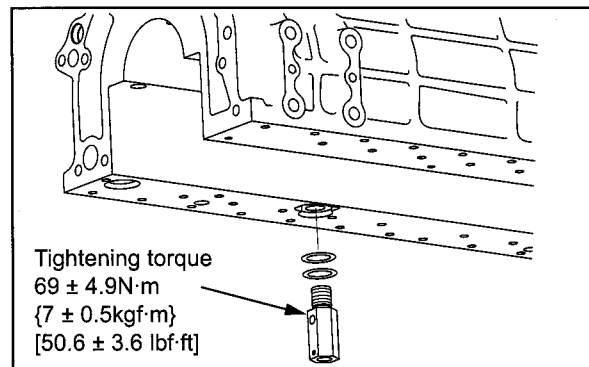


Inspecting relief valve

2.6 Inspecting safety valve

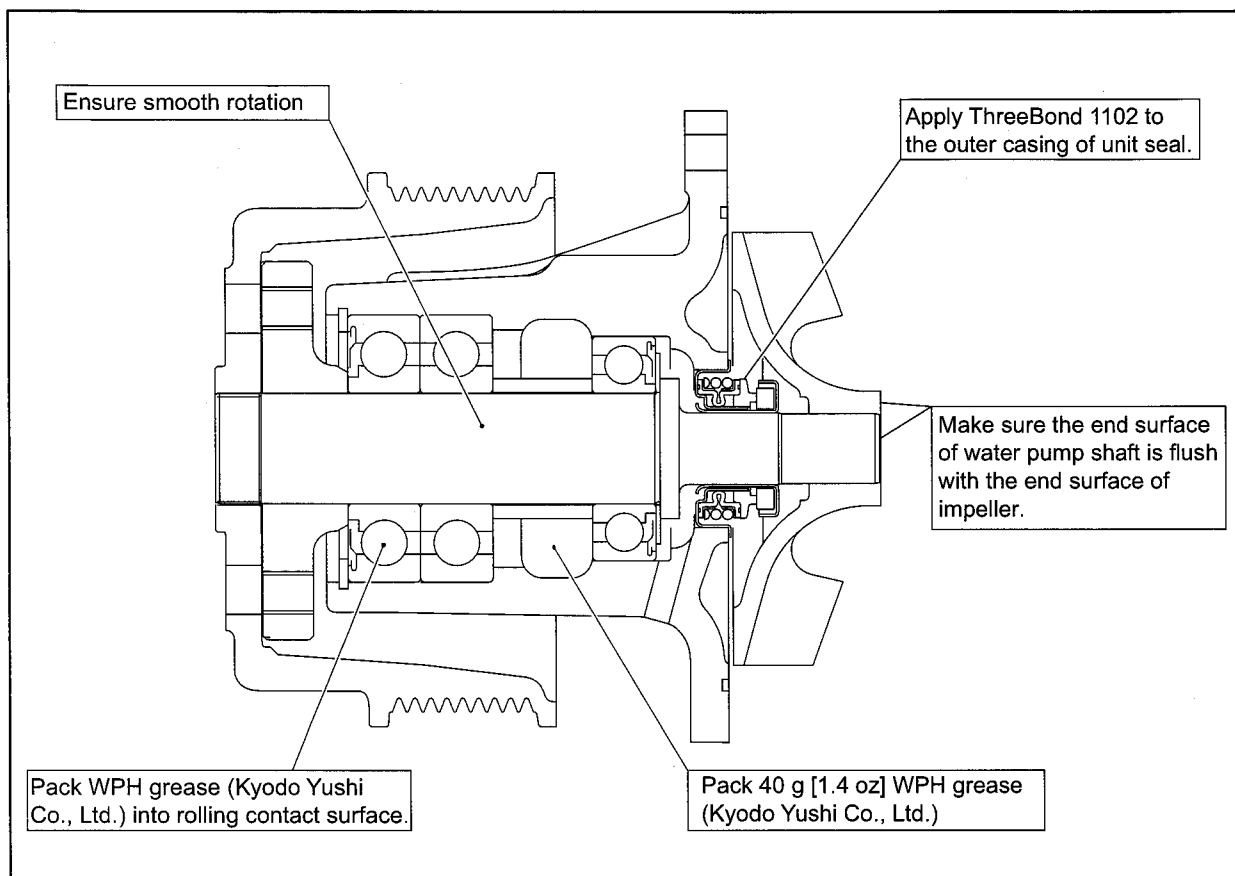
- (1) Make sure that the steel ball inside safety valve slides smoothly. If faulty, replace the safety valve with new one.
- (2) Measure the safety valve opening pressure. If the pressure does not fall within the standard range, replace the safety valve with new one.

Item	Standard
Safety valve opening pressure	1.1 MPa { 11 kgf/cm ² } [157 psi]



Inspecting oil pump safety valve

2.7 Reassembling water pump



Reassembling water pump

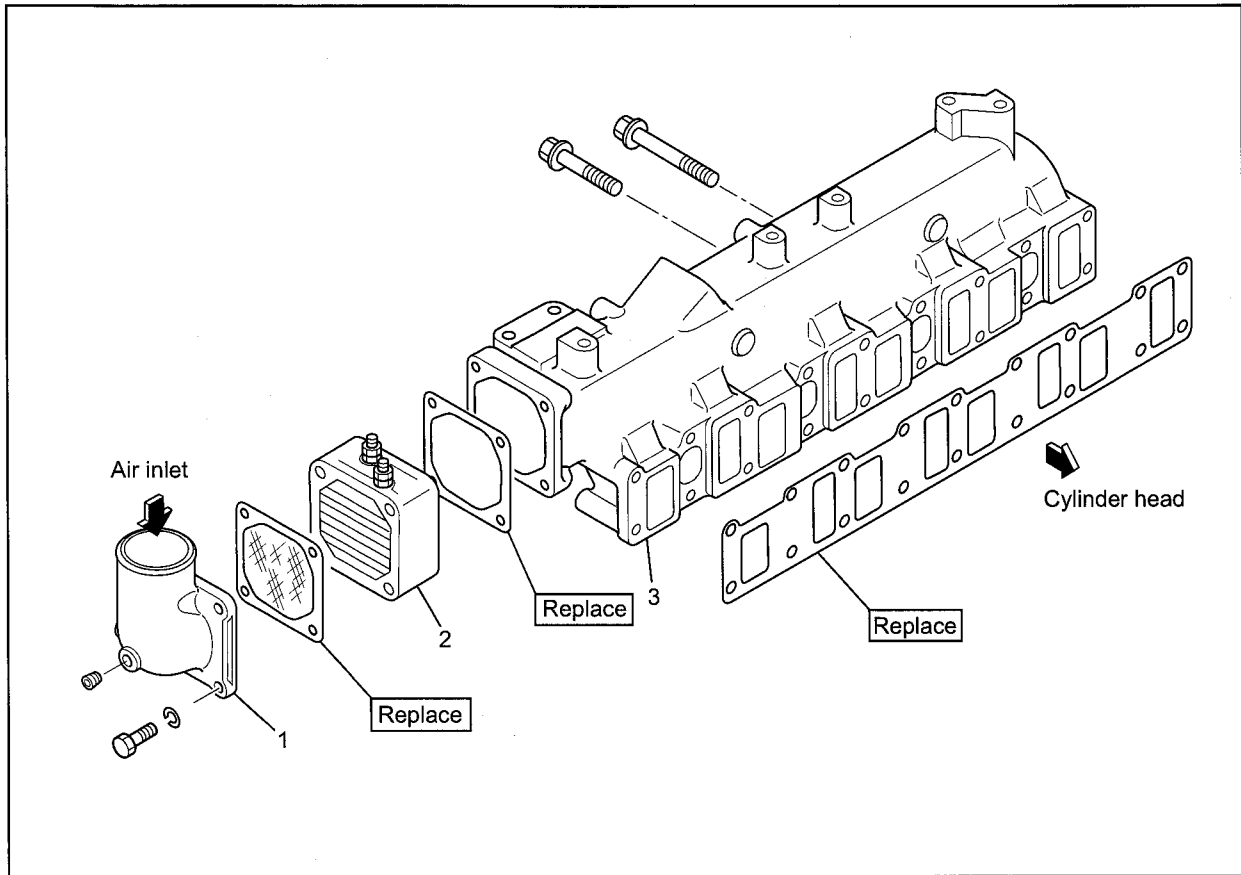
CAUTION

- (a) After reassembling, install the water pump to the timing gear case, and make sure that the impeller does not contact with the timing gear case.
- (b) Reassembling of the water pump shaft, the flange and the impeller is restricted to only twice.

- (1) For reassembly, reverse the order of the disassembly procedure.
- (2) Use a hydraulic press to press fit bearings.
- (3) After reassembling, make sure that the pulley rotates smoothly without any looseness, eccentricity, or abnormal noise.

1. Removing inlet and exhaust system

1.1 Removing inlet system



Removing inlet system

Removing sequence

1 Air inlet elbow

2 Air heater

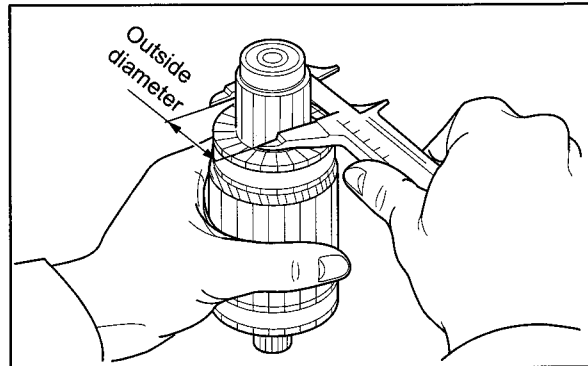
3 Inlet manifold

2.3.5 Measuring commutator outside diameter

Measure the commutator outside diameter.

If the measured value is less than the limit, replace the armature with a new one.

Item	Standard	Limit
Commutator outside diameter	32.0 mm [1.259 in.]	31.4 mm [1.236 in.]



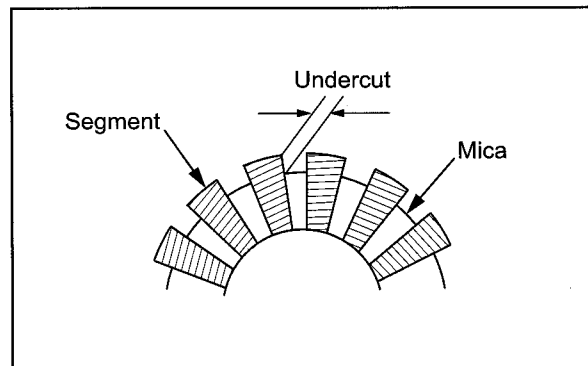
Measuring commutator outside diameter

2.3.6 Measuring undercut depth

Measure the depth of undercutting between the commutator segments.

If the measured value is less than the limit, repair or replace with a new part.

Item	Limit
Undercut depth	0.2 mm [0.008 in.]

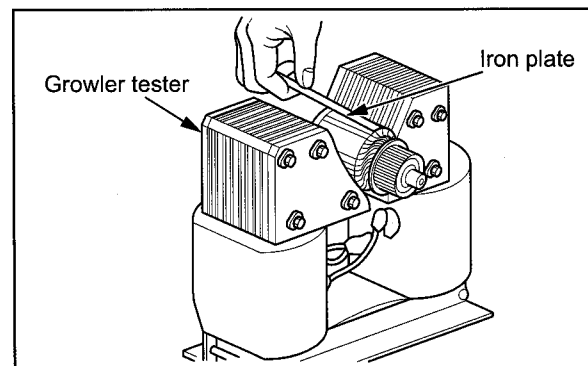


Measuring undercut depth

2.3.7 Checking armature coil

- (1) Inspect the armature coil using a growler.

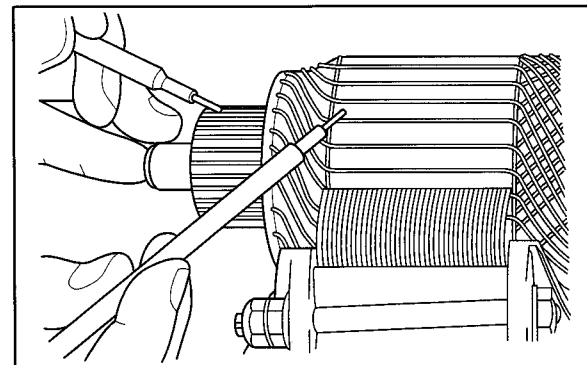
Hold a piece of iron plate against the armature core. If the iron plate vibrates, replace the armature with a new one.



Inspecting armature coil short circuit

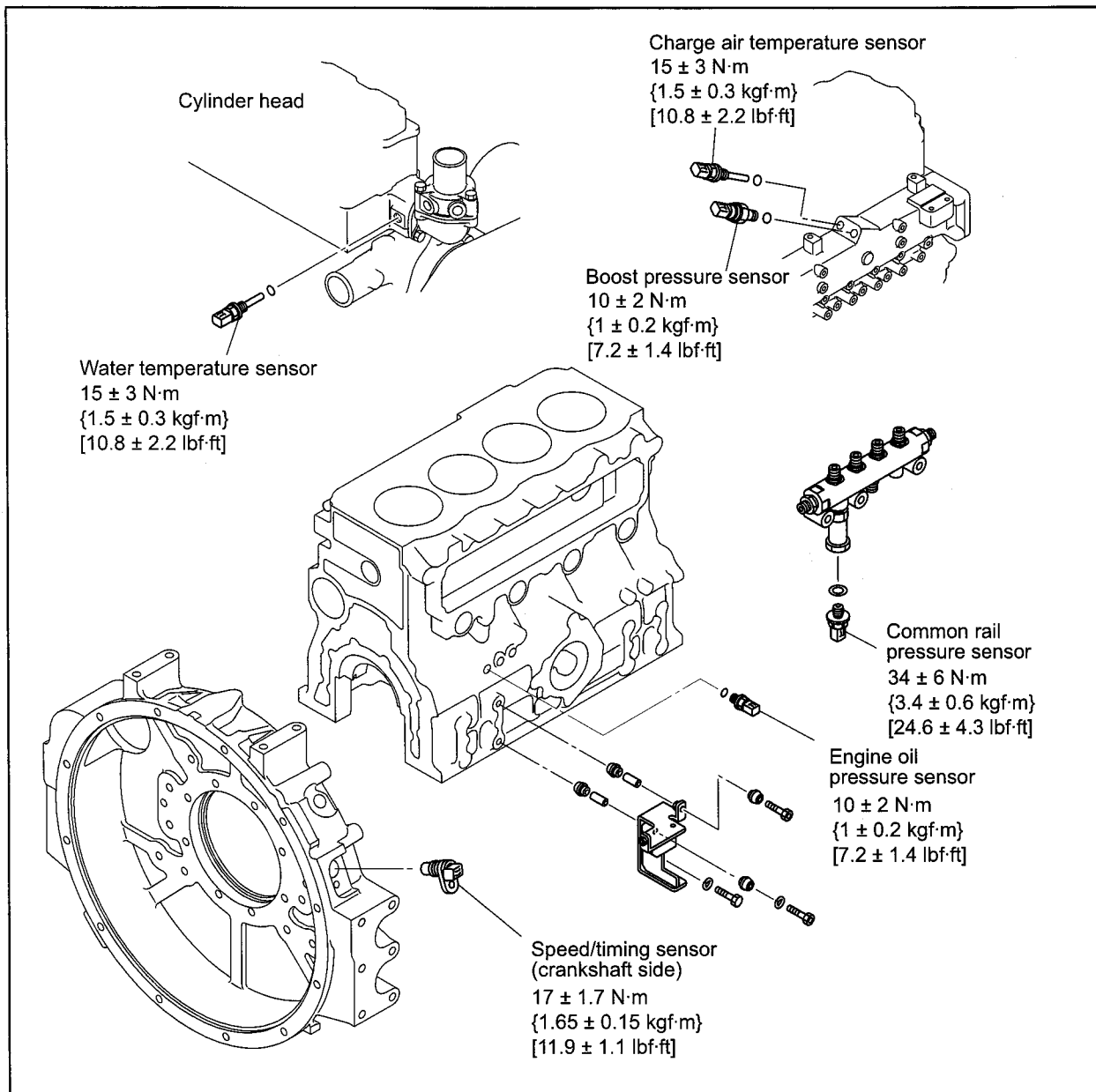
- (2) Check that there is no continuity between the commutator and the shaft (core).

If any continuity is observed, replace the armature with a new one.



Inspecting insulation between commutator and shaft

3.3 Installing various sensors



Installing various sensors