

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:

Emphasizes important matter, or indicates 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, and do not work near a heater or other fire hazard 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 tidy 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.

Avoid accessing crankcase until engine cools

Do not attempt to open the side cover of the crankcase before the engine cools down. Wait at least 10 minutes after stopping the engine.

Opening the cover when the engine is hot allows fresh air to flow into the crankcase, which can cause oil mist to ignite and explode.

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 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 fire extinguishers handy, and become familiar with their usage.

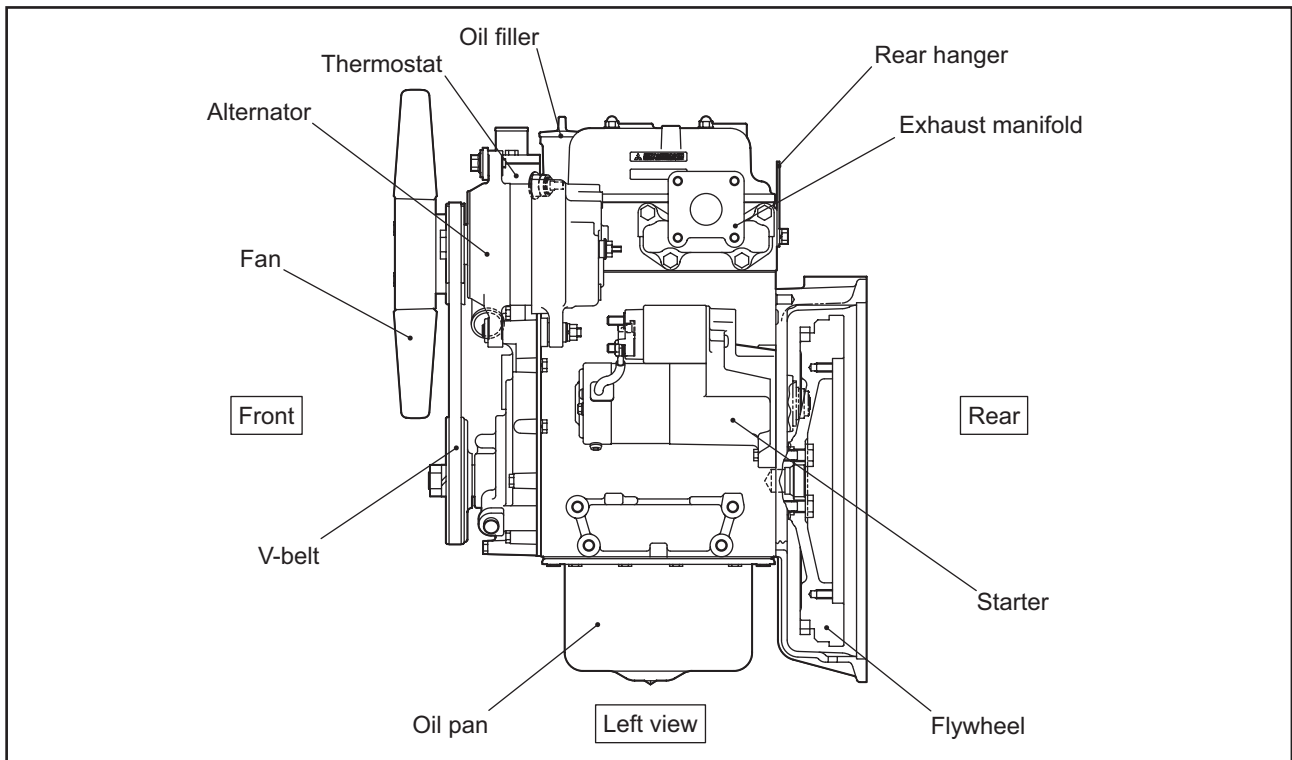
Keep a first-aid kit at the designated place where it is easily accessible by anyone at any time.

Establish response procedures to follow in the event of fire or accident. Provide an emergency evacuation route, contact points, and means of communication in case of emergency.

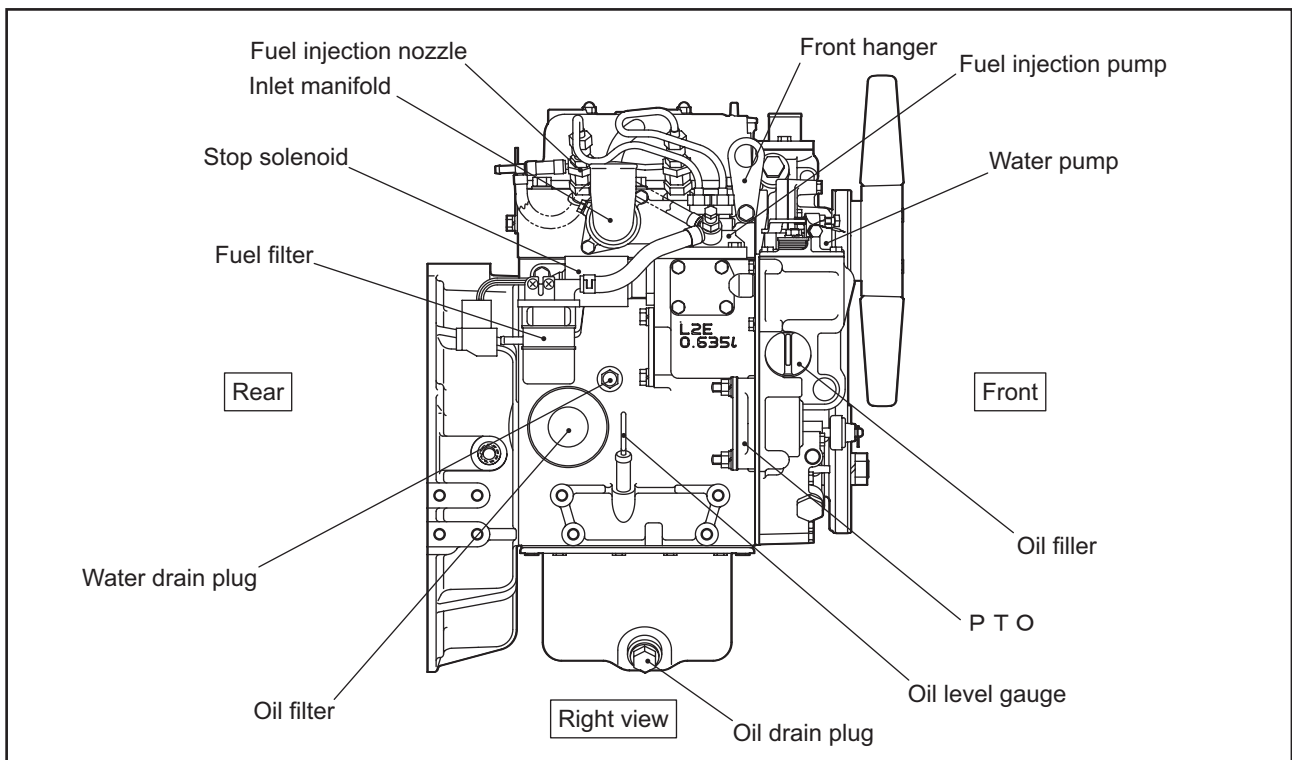


1. External view

1.1 External view of L2A, L2C and L2E



Engine left view



Engine right view

Table 1-1 Specifications of L2A, L2C and L2E (3 / 4)

Engine model		L2A	L2C	L2E
Electrical system	Voltage - polarity	12V - negative (-) ground, 24V - negative (-) ground		
	Starter (1)	Type	M000T60481	
		Manufacturer	Mitsubishi Electric Corporation	
		Pinion engagement type	Pinion shift (reduction type)	
		Output	12V - 1.2 kW	
		Number	1	
		Pinion/ring gear ratio	14/106	
	Starter (2)	Type	M001T68381	
		Manufacturer	Mitsubishi Electric Corporation	
		Pinion engagement type	Pinion shift (reduction type)	
		Output	12V - 1.7 kW	
		Number	1	
		Pinion/ring gear ratio	14/106	
	Starter (3)	Type	M002T66071	
		Manufacturer	Mitsubishi Electric Corporation	
		Pinion engagement type	Pinion shift (reduction type)	
		Output	24V - 3.2 kW	
		Number	1	
		Pinion/ring gear ratio	15/106	
	Alternator (1)	Type	A007TA0171B	
		Type	Three-phase current generator, integral with IC regulator	
		Manufacturer	Mitsubishi Electric Corporation	
		Output V - A	12V - 40A	
		Rated voltage generating speed	5000 min ⁻¹ (at 13.5V, 37A, when hot)	
		Regulator adjusting voltage	14.7 ± 0.3V	
	Alternator (2)	Type	A007TA8271A	
		Type	Three-phase current generator, integral with IC regulator	
Manufacturer		Mitsubishi Electric Corporation		
Output		24V - 25A		
Rated voltage generating speed		5000 min ⁻¹ (at 27.0V, 22A, when hot)		
Regulator adjusting voltage		28.5 ± 0.5V		
Glow plug (1)	Type	Sheathed		
	Rated voltage-current	10.5V - 9.7A ± 1.0A (30-second duration)		
Glow plug (2)	Type	Sheathed		
	Rated voltage-current	22.5V - 4.8A ± 0.5A (30-second duration)		

1.7 Electrical system

Table 2-7 Maintenance service data table - Electrical system(1 / 3)

Unit: mm [in.]

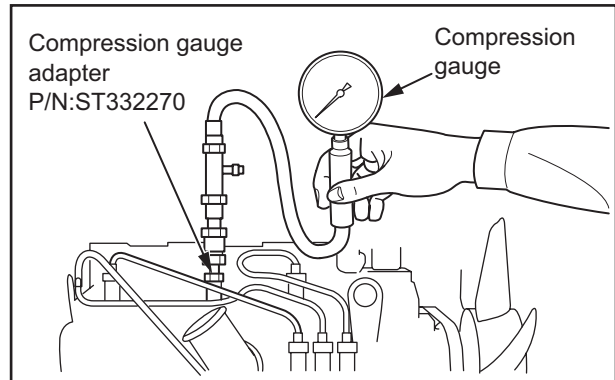
Inspection point		Nominal	Standard	Limit	Remark
Starter M000T60481 (12V-1.2kW)	Pinion clearance		0.5 to 2.0 [0.0197 to 0.0787]		
	Brush length		16.5 [0.650]	10.0 [0.394]	
	Brush spring load	20.58 N {2.10 kgf} [4.6 lbf]	17.5 to 23.7 N {1.78 to 2.42 kgf} [3.92 to 5.34 lbf]	6.86 N {0.70 kgf} [1.54 lbf]	
	Commutator radial runout		0.03 [0.0012]	0.10 [0.0039]	
	Commutator outside diameter		∅ 29.4 [1.158]	∅ 28.8 [1.134]	
	Depth of undercuts between segments	0.75 [0.030]	0.5 to 1.0 [0.0197 to 0.0394]	0.2 [0.0079] or less	
	No-load characteristics	Terminal voltage		11 V	
Current			90 A or less		
Rotation speed			2500 min ⁻¹ or more		
Starter M001T68381 (12V-1.7kW)	Pinion clearance		0.5 to 2.0 [0.0197 to 0.0787]		
	Brush length		16.5 [0.650]	10 [0.394]	
	Brush spring load	20.58 N {2.10 kgf} [4.6 lbf]	17.5 to 23.7 N {1.78 to 2.42 kgf} [3.92 to 5.34 lbf]	6.86 N {0.70 kgf} [1.54 lbf]	
	Commutator radial runout		0.03 [0.0012]	0.10 [0.0039]	
	Commutator outside diameter		∅ 29.4 [1.158]	∅ 28.8 [1.134]	
	Depth of undercuts between segments	0.75 [0.030]	0.5 to 1.0 [0.0197 to 0.0394]	0.2 [0.0079] or less	
	No-load characteristics	Terminal voltage		11 V	
Current			110 A or less		
Rotation speed			2400 min ⁻¹ or more		

2. Testing compression pressure

CAUTION

- (a) Be sure to measure the compression pressure for all the cylinders. It is not a good practice to measure the compression pressure for only one cylinder, and presume the compression for the remaining cylinder.
- (b) Also be sure to check engine speed when measuring the compression pressure, as compression pressure varies with engine speed.
- (c) Measuring the compression pressure at regular intervals is important to obtain correct data.
- (d) When measuring the compression pressure for cylinders one by one, do not remove other fuel injection nozzles from their positions, except for the one being measured.

- (1) Remove the injection nozzle from the cylinder head where the compression pressure is to be measured.
- (2) Remove the glow plugs from all cylinders.
- (3) Attach the compression gauge adapter to the injection nozzle mount, and connect compression gauge.
- (4) Stop the fuel supply.
- (5) Crank the engine with the starter, then read the compression gauge indication while the engine is running at the specified speed.
- (6) If the compression pressure is lower than the limit, overhaul the engine.



Testing compression pressure

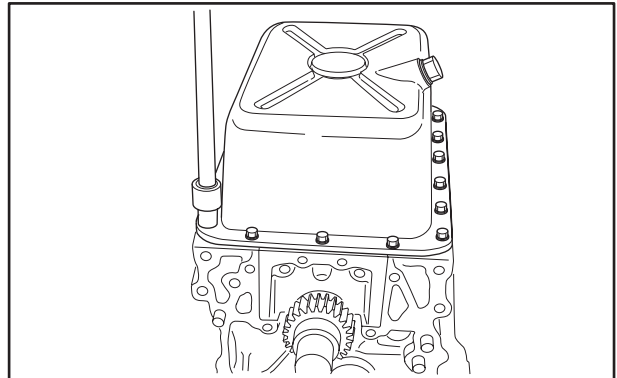
Item	Standard	Limit
Engine speed	280 min ⁻¹	-
Compression pressure	2.7 MPa {28 kgf/cm ² } [398 psi]	Not acceptable at or below 2.2 MPa {22 kgf/cm ² } [313 psi]
Difference between each cylinder	Within 0.25 MPa {2.5 kgf/cm ² } [36 psi]	-

4.1 Removing oil pan

CAUTION

Do not insert a chisel or screwdriver between the oil pan and crankcase to remove the oil pan, as it could deform the oil pan flange.

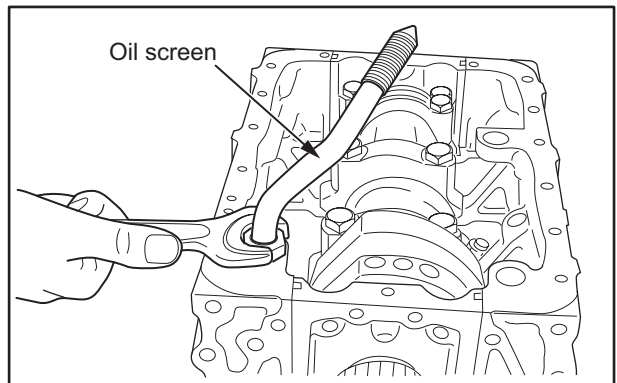
- (1) Turn the engine around.
- (2) Remove bolts from the oil pan.
- (3) To remove oil pan, tap bottom corners of the oil pan with a plastic hammer.



Removing oil pan

4.2 Removing oil screen

Loosen the nut, and remove the oil screen and gasket.

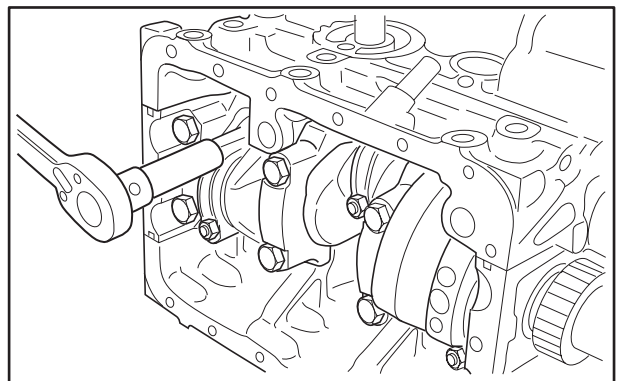


Removing oil screen

4.3 Removing connecting rod cap

- (1) Lay the engine by its side.
- (2) Mark the cylinder number on the connecting rod and connecting rod cap so that their combination is not changed when reassembling.
- (3) Remove the connecting rod caps.

Note: Mark the cylinder No. and upper/lower on connecting rod bearings to ensure correct reassembling.



Removing connecting rod cap

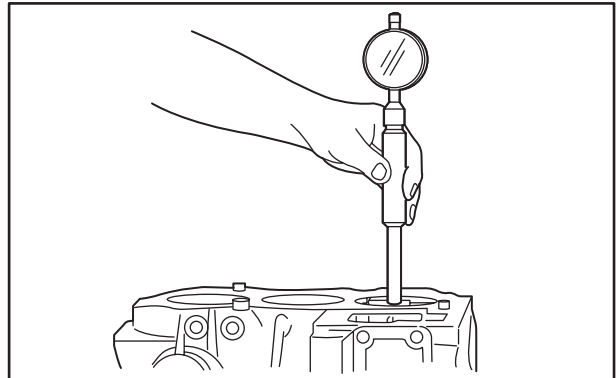
4. Inspecting and repairing cylinder block, crankshaft, piston and oil pan

4.1 Measuring cylinder inside diameter

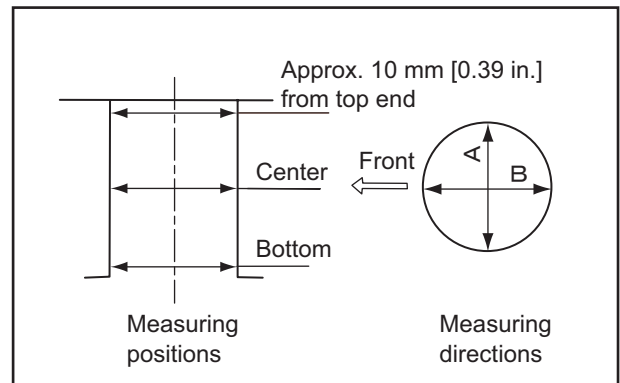
Use a cylinder gauge to measure the inside diameter and cylindricity of the cylinder at three locations in the A and B directions as shown in the illustration.

If any one of the cylinders exceeds the repair limit, bore all the cylinders and replace the pistons and piston rings with oversize ones.

Replace the cylinder block if the limit is exceeded.



Measuring cylinder inside diameter

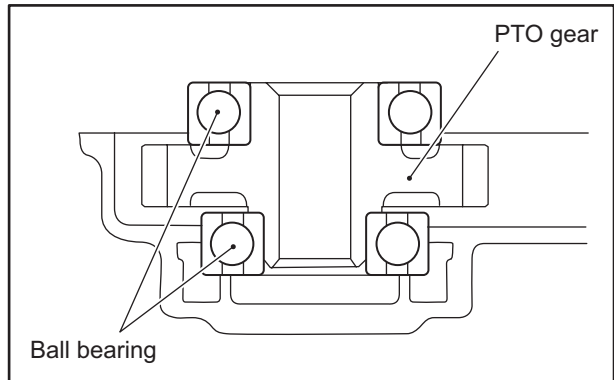


Measuring position of cylinder inside diameter

Item	Nominal	Standard	Limit	Remark
Cylinder inside diameter	L2A, L3A ø 65 mm [2.56 in.]	65.00 to 65.03 [2.5591 to 2.5602 in.]	+0.7 mm [+0.0276 in.]	Repair limit is +0.2 mm [+0.0079 in.]
	L2C, L3C ø 70 mm [2.76 in.]	70.00 to 70.03 [2.7559 to 2.7571 in.]		
	L2E, L3E ø 76 mm [2.99 in.]	76.00 to 76.03 [2.9921 to 2.9933 in.]		
Cylindricity of cylinder	-	0.01 mm [0.0004 in.] or less	-	-

2.11 Installing PTO gear

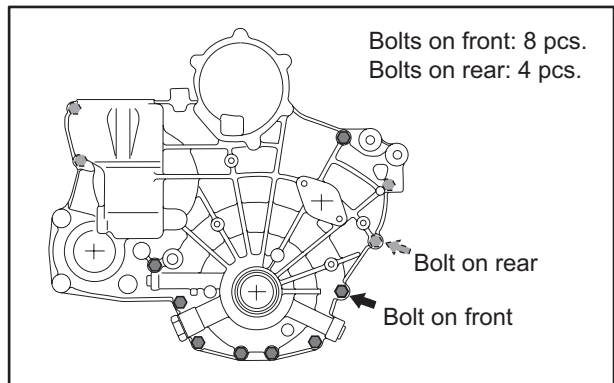
Install ball bearings on both sides of PTO gear, and install the PTO gear into the gear case.



Installing PTO gear

2.12 Installing timing gear case

- (1) Apply sealant to the gasket to prevent it from displacing and install the gasket on the front plate.
- (2) Apply engine oil to the oil seal lip.
- (3) Install the timing gear case and tighten the bolts.

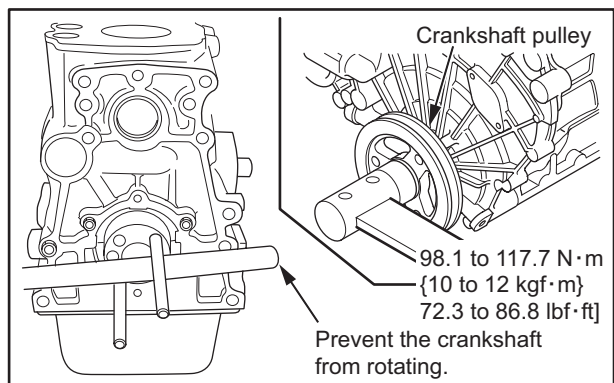


Installing gear case

2.13 Installing crankshaft pulley

CAUTION
The bar could come off. Be very careful.

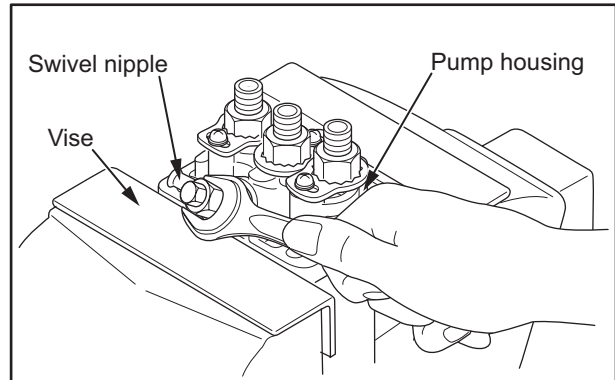
- (1) Screw two guide bolts into the threaded holes at the rear end of the crankshaft. Place a bar across the two guide bolts so that the crankshaft does not turn.
- (2) Install the woodruff key on the crankshaft.
- (3) Install the crankshaft pulley and tighten the nuts to the specified torque.



Installing crankshaft pulley

2.4.1 Removing swivel nipple

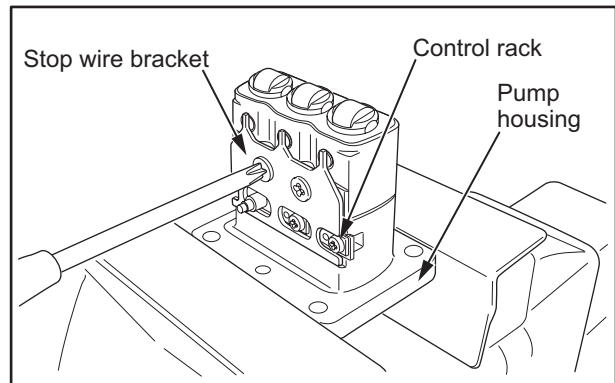
- (1) Grab the plunger of the pump housing with a vise.
- (2) Remove the swivel nipple from the pump housing.



Removing swivel nipple

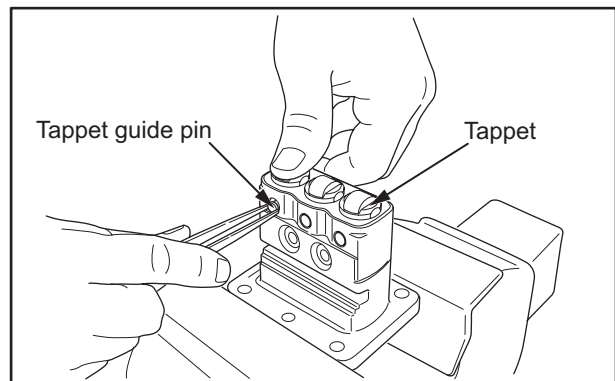
2.4.2 Removing tappets

- (1) Turn the pump housing upside down and grab the housing with a vise.
- (2) Remove the stop wire bracket and remove the control rack.



Removing stop wire bracket

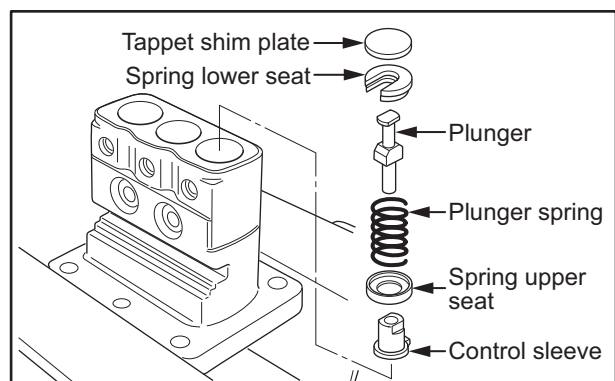
- (3) Push in the tappet and, pull out the tappet guide pin with tweezers.
- (4) Remove the tappet.



Removing tappet guide pin

2.4.3 Removing plunger

Using tweezers, remove the tappet shim plate, spring lower seat, plunger, plunger spring, spring upper seat and control sleeve from the pump housing.



Removing plunger

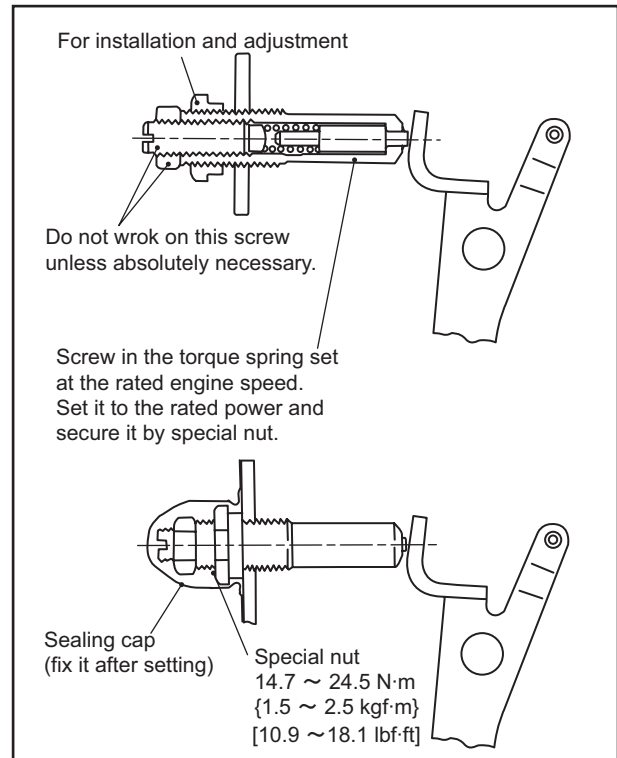
**3.2.3 Installing torque spring set
(Single spring, double spring)**

CAUTION

The torque spring set is properly adjusted at the factory before shipment. Do not work on the torque spring set unless absolutely necessary.

Adjust and reassemble the torque spring set as described in the following.

- (1) Adjust the speed control lever with the high speed set bolt. After setting it at the high idle engine speed, secure it by nut.
- (2) Screw in the torque spring set at the rated engine speed. Set it to the rated engine power and secure it by special nut.
- (3) Put a torque spring set sealing cap on the torque spring and firmly tighten the sealing cap.

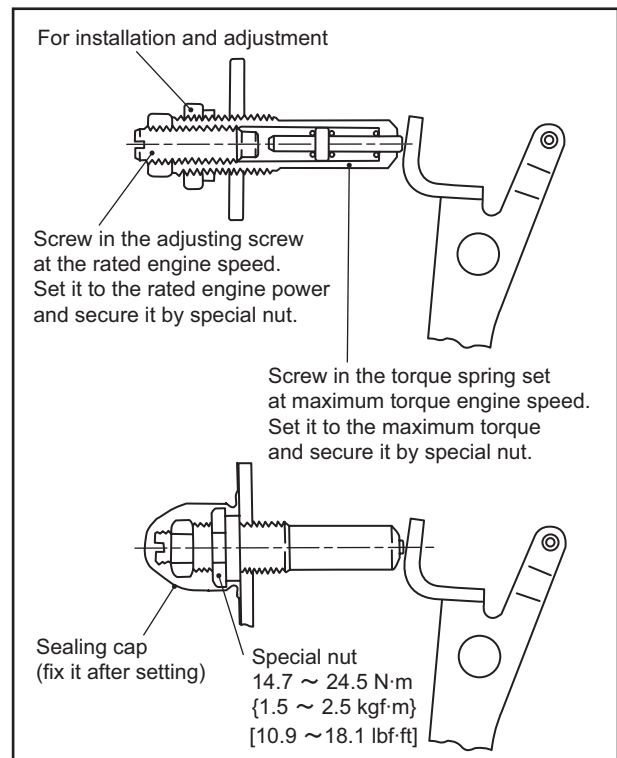


Installing torque spring set (single spring)

**3.2.4 Installing torque set spring
(Double spring, two point control)**

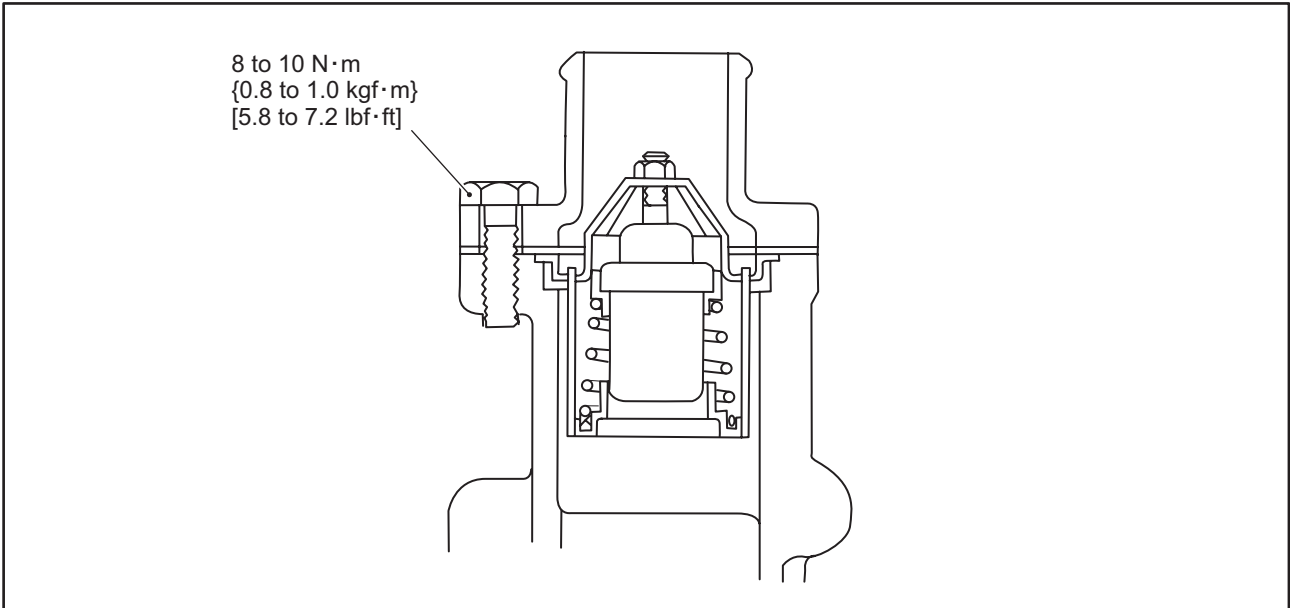
Adjust and reassemble the torque spring set as described in the following.

- (1) Adjust the speed control lever with the high speed set bolt. After setting it to the high idle engine speed, secure it by nut.
- (2) Screw in the torque spring set at maximum torque engine speed. Set it to the maximum torque and secure it by special nut.
- (3) Screw in the adjusting screw at the rated engine speed. Set it to the rated engine power and secure it by special nut.
- (4) Put a torque spring set sealing cap on the torque spring and firmly tighten the sealing cap.



Installing torque spring set (double spring)

2.3 Reassembling thermostat



Reassembling thermostat

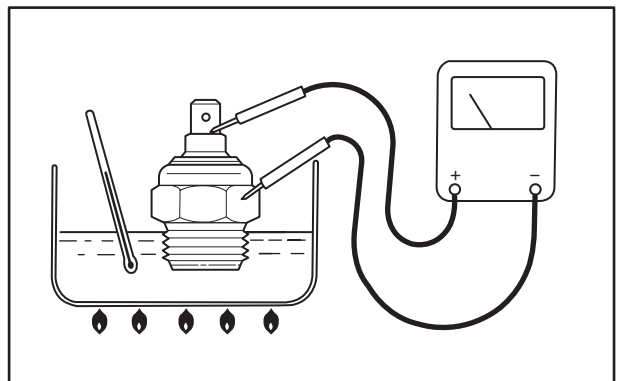
2.4 Inspecting thermostat

CAUTION

Both water and the thermostat become hot. Pay attention to prevent burn and fire.

Immerse the temperature-senser in oil and measure the resistance while raising the oil temperature. If the resistance extremely deviates from the standard, replace the thermostat.

Temperature	Standard
120°C [248°F]	30 mΩ

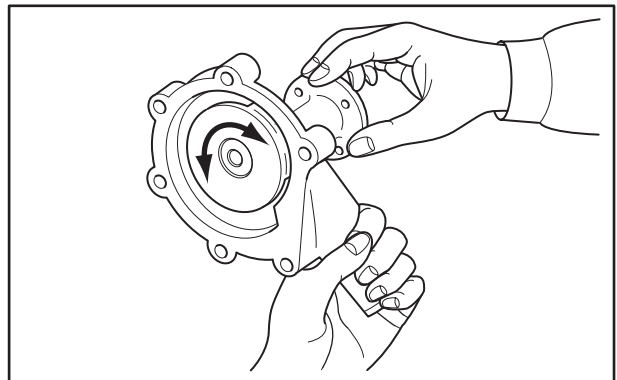


Inspecting thermostat

2.5 Inspecting water pump

2.5.1 Checking water pump for smooth rotation

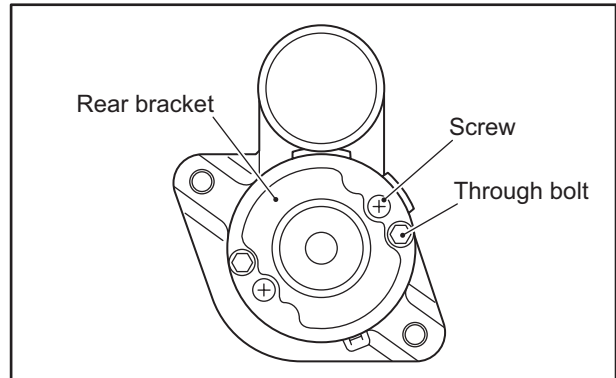
Check to make sure that the impeller and shaft of water pump rotate smoothly without noise and irregularities. If faulty, replace the water pump assembly.



Checking impeller and shaft for smooth rotation

2.3.3 Removing rear bracket

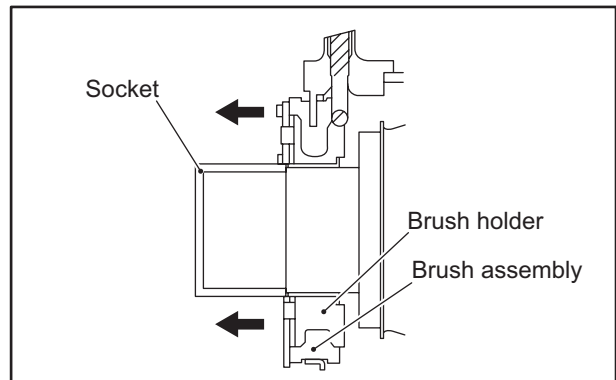
Remove the through bolts and screws of the brush holder, and then remove the rear bracket.



Removing rear bracket

2.3.4 Removing brush holder and brush assembly

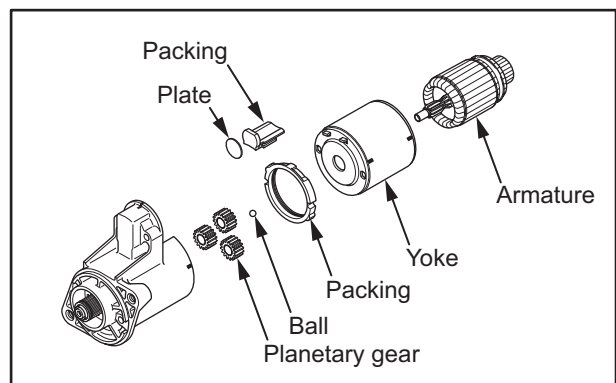
Apply a socket (of the same diameter as the commutator) to the commutator of the armature. Remove the brush holder and brush assembly by sliding on the socket.



Removing brush holder and brush assembly

2.3.5 Removing armature and yoke

- (1) Remove the armature and the yoke.
- (2) Remove the packing from the internal gear.
- (3) Remove the packing and plate on the lever support.
- (4) Remove the ball from the internal gear.
- (5) Remove the planetary gears.



Removing armature and yoke

2.6.2 Inspecting magnetic switch

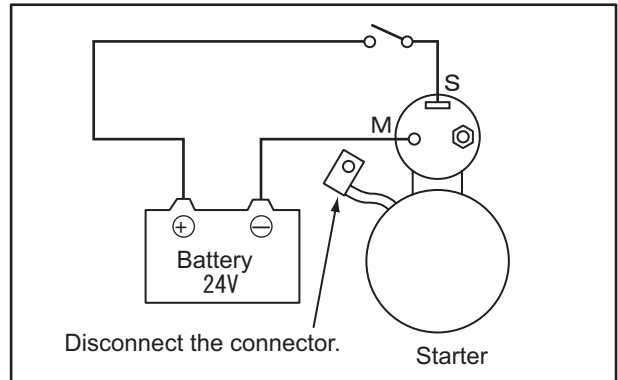
Perform the inspection as described below. If faulty, replace the magnetic switch with a new one.

CAUTION

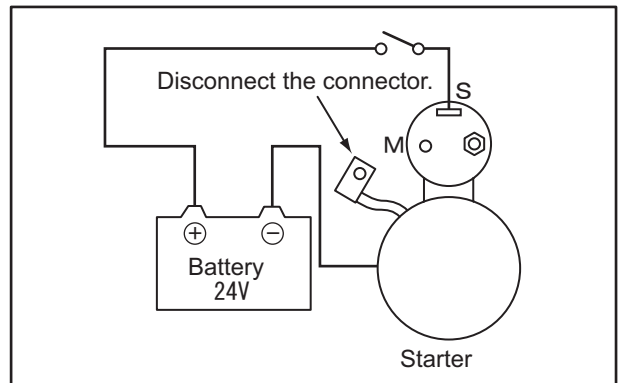
Do not apply current continuously for longer than 10 seconds.

- (1) Disconnect the connector of M terminal.
- (2) Pull-in test
Connect the starter to the circuit as shown in the illustration. The magnetic switch is normal if the pinion springs out when the switch is turned ON.
- (3) Holding test
Connect the starter to the circuit as shown in the illustration. Pull out the pinion fully by hand. The magnetic switch is normal if the pinion does not return when it is released.

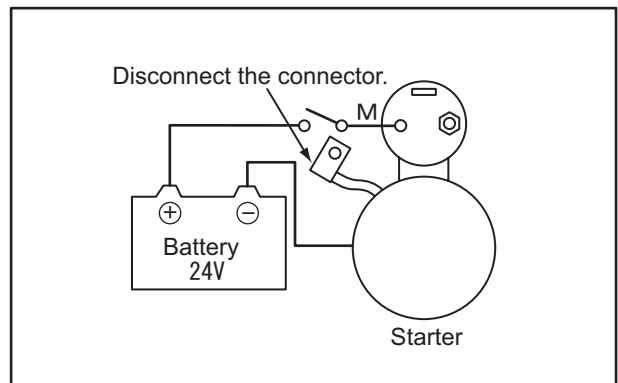
- (4) Return test
Connect the starter to the circuit as shown in the illustration. Pull out the pinion fully by hand. The magnetic switch is normal if the pinion returns immediately when it is released.



Pull-in test

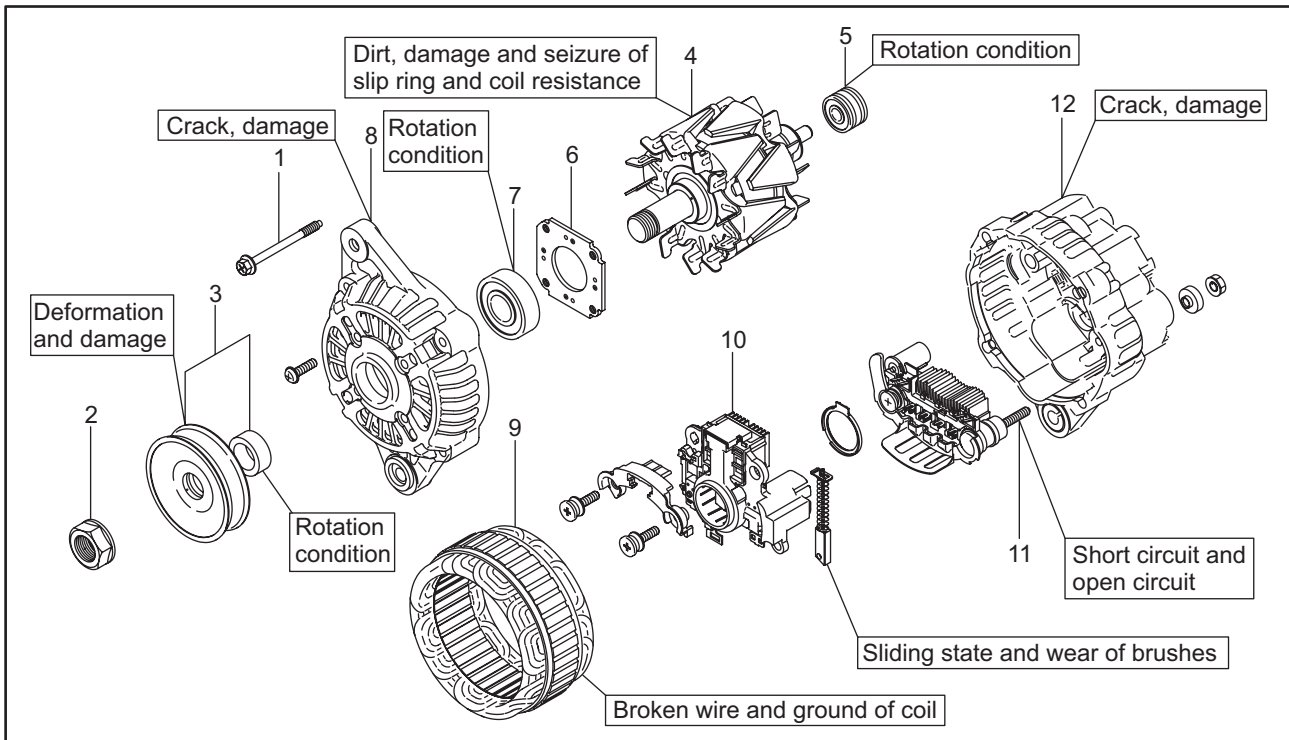


Holding test



Return test

2.10 Disassembling and inspecting alternator



Disassembling and inspecting alternator

Disassembling sequence

- | | | |
|------------------|--------------------|-----------------------|
| 1 Through bolt | 5 Rear bearing | 9 Stator |
| 2 Nut | 6 Bearing retainer | 10 Regulator assembly |
| 3 Pulley, spacer | 7 Front bearing | 11 Rectifier assembly |
| 4 Rotor | 8 Front bracket | 12 Rear bracket |