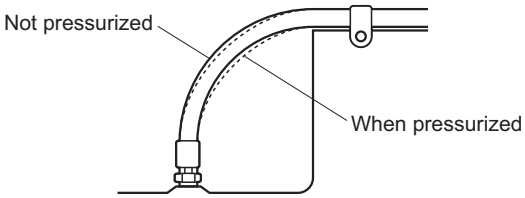
YANMAR

# SERVICE MANUAL

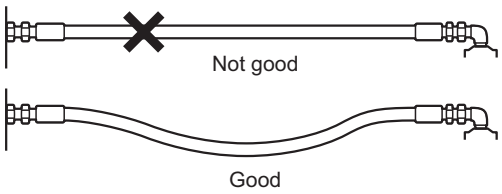
# WHEEL LOADER

## V7

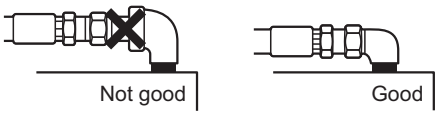
(3) When the hose is pressurized, the hose length varies slightly at the bend. Allow this change to occur and do not try to fasten the bend.



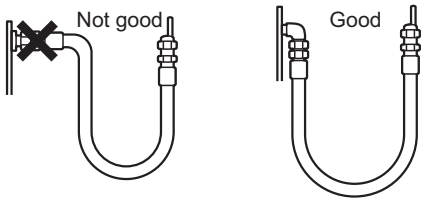

(4) It is necessary for the hose to have ample slackness for elongation and contraction, because its length will change by +2 % to -4 % when used at high pressure.



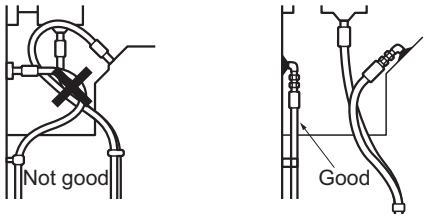

(5) Use the proper adapters, not pipes, in order to reduce the number and length of joints and improve the external appearance.




(6) Use an elbow to prevent excessive twisting or bending of the hose.




(7) Use adapters to make the hose as straight as possible. The outside appearance can be improved by avoiding the use of hoses that are too long.



# 2. TECHNICAL DATA

| Item | | | Unit | V7 |
|---|---|---|---|---|
| Main specifications of machine | | | | |
| | Transmission | | | |
| | | Type | - | HYDROMATIK<br>Closed circuit hydraulic transmissione) |
| | | Pump | - | With variable displacement |
| | | Hydrostatic motor | - | With double displacement |
| | Axle | | | |
| | | Front | - | Rigid |
| | | Rear | - | Oscillating |
| | | Oscillating | Deg | 20 |
| | | Total reduction | - | 16,91 : 1 |
| | | Differential reducers | - | Conventional<br>(automatic proportional limited-slip differential) |
| | | Final gears | - | Epicyclic reducers |
| | Brake | | | |
| | | Service | - | Drum - type on the front axle working on all the wheels |
| | | Parking | - | Manual lever on the drum type of the front axle |
| Engine | | | | |
| | Main specifications | | | |
| | | Engine model | - | 4TNV88-BDSA2 |
| | | Type | - | Vertical type series water-cooled 4cycle diesel engine |
| | | Combustion system | - | Direct injection |
| | | Number of cylinders - Bore × Stroke | pcs - mm x mm | 4 - ø88 x 90 |
| | | Total displacement | $cm^3$ | 2190 |
| | | Rated output / engine speed (GROSS) | kW/rpm | 35 / 3000 |
| | | Compression pressure at 250 rpm | Mpa | 3.33 - 3.53 |
| | | Specific fuel consumption | L/h | - |
| | | Maximum idling speed | rpm | 3235 |
| | | Minimum idling speed | rpm | 3185 |
| | | Engine dry mass (excluding air cleaner and silencer) | kg | 170 |
| | | Lubricating method | - | Forced lubrication with trochoid pump |
| | | Specific lubricating oil consumption | g/kW•h | - |

## 2-7 Electrical Diagram

To consult the electrical diagrams, refer to the specific chapter "5-2 Elecrical diagram" on page 5-2-1.

**⚠ WARNING**

**EXHAUST HAZARD!**

- NEVER operate the engine in an enclosed area such as a garage, tunnel, underground room, manhole or ship's hold without proper ventilation.
- NEVER block windows, vents, or other means of ventilation if the engine is operating in an enclosed area. All internal combustion engines create carbon monoxide gas during operation. Accumulation of this gas within an enclosure could cause illness or even death.
- Make sure that all connections are tightened to specifications after repair is made to the exhaust system.
- Failure to comply could result in death or serious injury.

**⚠ WARNING**

**ALCOHOL AND DRUG HAZARD!**

- NEVER operate the engine while you are under the influence of alcohol or drugs.
- NEVER operate the engine when you are feeling ill.
- Failure to comply could result in death or serious injury.

**⚠ WARNING**

**EXPOSURE HAZARD!**

- Wear personal protective equipment such as gloves, work shoes, eye and hearing protection as required by the task at hand.
- NEVER wear jewelry, unbuttoned cuffs, ties or loose-fitting clothing when you are working near moving / rotating parts such as the cooling fan, flywheel or PTO shaft.
- ALWAYS tie back long hair when you are working near moving / rotating parts such as a cooling fan, flywheel, or PTO shaft.
- NEVER operate the engine while wearing a headset to listen to music or radio because it will be difficult to hear the alert signals.
- Failure to comply could result in death or serious injury.

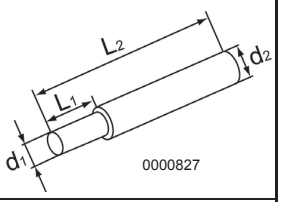
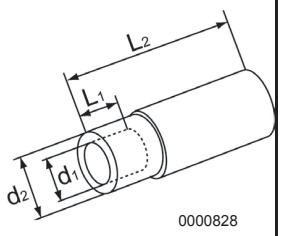
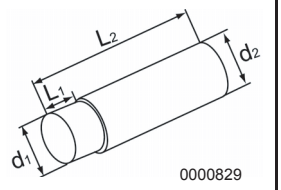
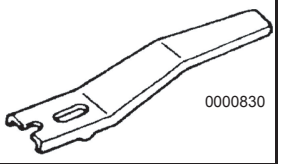
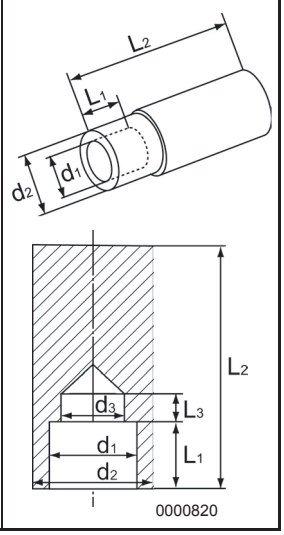
**⚠ WARNING**

**BURN HAZARD!**

- If you must drain the engine oil while it is still hot, stay clear of the hot engine oil to avoid being burned.
- ALWAYS wear eye protection.
- Wait until the engine cools before you drain the engine coolant. Hot engine coolant may splash and burn you.
- Keep your hands and other body parts away from hot engine surfaces such as the muffler, exhaust pipe, turbocharger (if equipped) and engine block during operation and shortly after you shut the engine down. These surfaces are extremely hot while the engine is operating and could seriously burn you.
- Failure to comply could result in death or serious injury.

### 4-2-2 Special Service Tools

Note: Tools not having Yanmar part numbers must be acquired locally.

<table>
<tr><th>No</th><th>Tool Name</th><th>Applicable Model and Tool Size</th><th>Illustration</th></tr>
<tr><td>1</td><td>Valve Guide Tool (For Removing Valve Guides)</td><td>
<table>
<tr><td>L1</td><td>L2</td><td>d1</td><td>d2</td></tr>
<tr><td>20 mm</td><td>75 mm</td><td>7.5 mm</td><td>11 mm</td></tr>
</table>
Locally Manufactured
</td><td> 
</td></tr>
<tr><td>2</td><td>Valve Guide Tool (For Installing Valve Guides)</td><td>
<table>
<tr><td>L1</td><td>L2</td><td>d1</td><td>d2</td></tr>
<tr><td>15 mm</td><td>65 mm</td><td>14 mm</td><td>20 mm</td></tr>
<tr><td colspan="2">Locally Manufactured</td><td colspan="2">Allowance L1:<br>0 to -0.3 mm</td></tr>
</table>
</td><td> 
</td></tr>
<tr><td>3</td><td>Wrist Pin Bushing Tool (For Removing / Installing of Wrist Pin Bushings)</td><td>
<table>
<tr><td>L1</td><td>L2</td><td>d1</td><td>d2</td></tr>
<tr><td>20 mm</td><td>100 mm</td><td>26 mm</td><td>29 mm</td></tr>
<tr><td colspan="2">Locally Manufactured</td><td>Allowance d1:<br>-0.3 to -0.6 mm</td><td>Allowance d2:<br>-0.3 to -0.6 mm</td></tr>
</table>
</td><td> 
</td></tr>
<tr><td>4</td><td>Valve Spring Compressor (For Removing / Installing Valve Springs)</td><td>Yanmar Part No.<br>129100-92630</td><td> 
</td></tr>
<tr><td>5</td><td>Stem Seal Tool (for Installing Stem Seals)</td><td>
<table>
<tr><td>d1</td><td>d2</td><td>d3</td><td>L1</td><td>L2</td><td>L3</td></tr>
<tr><td>16.2 mm</td><td>22 mm</td><td>13.5 mm</td><td>18.8 mm</td><td>65 mm</td><td>4 mm<br>or more</td></tr>
</table>
Allowance:<br>d1: ±0.2 mm<br>L1: ±0.1 mm<br>Locally Manufactured
</td><td> 
</td></tr>
</table>

## Inspection of Rocker Arm Assembly

### *Rocker Arm Shaft Hole Diameter*

Use a telescoping gauge and micrometer to measure the inside diameter of all the rocker arm support brackets and the rocker arms **(Figure 4-2-12)**. Record the measurements. *See "3-2 Engine Service Standard" section for the service limit.*

Inspect contact areas **(Figure 4-2-12, (1))** for excessive wear or damage.

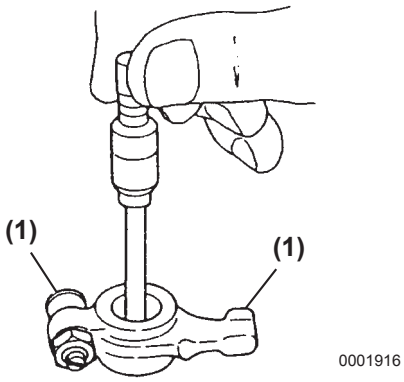



***Figure 4-2-12***

### *Rocker Arm Shaft Outside Diameter*

Use a micrometer to measure rocker arm shaft diameter. Measure at each rocker arm location in two directions 90° apart **(Figure 4-2-13)**. Record the measurements. *See "3-2 Engine Service Standard" section for the service limit.*

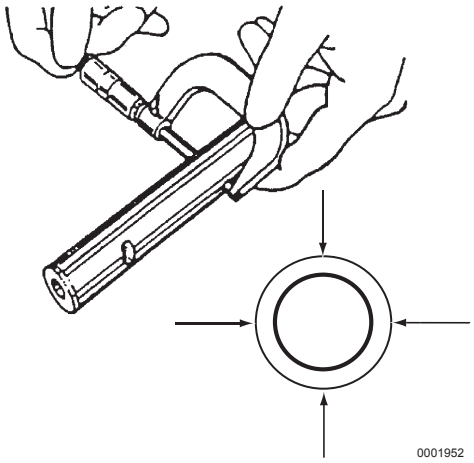



***Figure 4-2-13***

## Inspection of Valve Guides

Visually inspect the valve guides for distortions, scoring or other damage.

Note: Measure valve guides while they are installed in cylinder head.

Use a telescoping gauge and micrometer to measure the inside diameter of the valve guide. Measure in three places and 90° apart **(Figure 4-2-14)**. Record the measurements. *See "3-2 Engine Service Standard" section for the service limit.* Replace valve guides if not within specification.

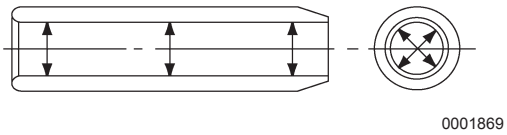



***Figure 4-2-14***

## Inspection of Cylinder Head

### *Cylinder Head Distortion*

Put the cylinder head flat and inverted (combustion side up) on the bench. Use a straightedge and feeler gauge to measure cylinder head distortion **(Figure 4-2-15)**. Measure diagonally and along each side. Record the measurements. *See "3-2 Engine Service Standard" section for the service limit.*

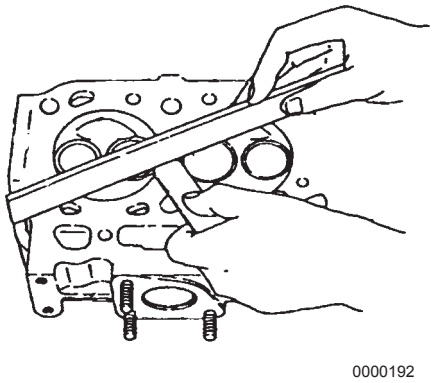



***Figure 4-2-15***

If distortion exceeds the service limit, resurface or replace the cylinder head. Remove only enough material to make the cylinder head flat, but do not remove more than 0.008 in. (0.20 mm).

7. Tighten the lock nut **(Figure 4-2-38, (1))**, while holding the valve bridge **(Figure 4-2-38, (3))** with a wrench **(Figure 4-2-38, (2))**. Verify that the valve clearance **(Figure 4-2-38, (4)** is zero “0”.

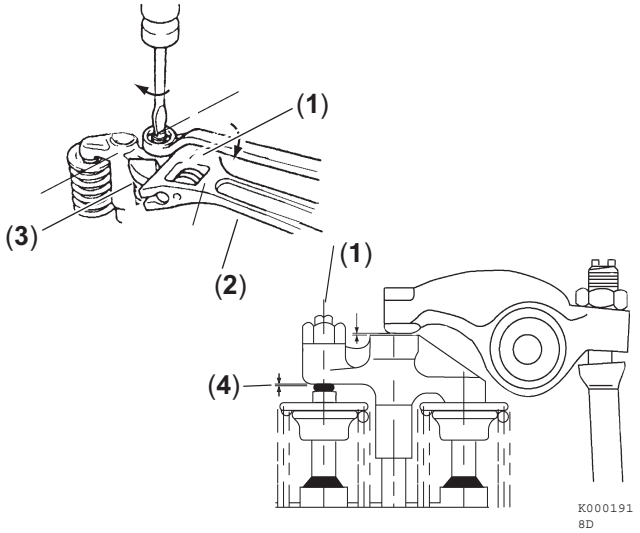



***Figure 4-2-38***

*Note: There is a tendency for the clearance to decrease slightly when the lock nut is tightened. It is suggested that you make the initial clearance adjustment is made slightly on the “loose” side before tightening the lock nut.*

8. To adjust the actual valve clearance between the rocker arm and the valve bridge, insert a feeler gauge **(Figure 4-2-39, (1))** of the correct thickness *(See Adjustment Specifications on page 6-4)* between the rocker arm **(Figure 4-2-38, (2))** and valve bridge **(Figure 4-2-38, (3))**. Record the results and use this value as an indication of wear.

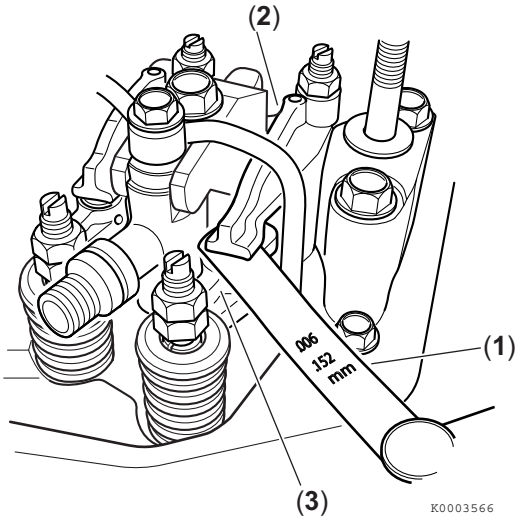



***Figure 4-2-39***

9. If adjustment is required, proceed to the next step.
10. Loosen the valve adjusting screw lock nut **(Figure 4-2-40, (5))** and valve adjusting screw **(Figure 4-2-40, (4))** on the rocker arm **(Figure 4-2-40, (3))** and check the clearance gap **(Figure 4-2-40, (2))** for evidence of dirt or wear.

    *Note: There is a tendency for the clearance to decrease slightly when the lock nut is tightened. It is suggested that you make the clearance adjustment is made slightly on the “loose” side before tightening the lock nut.*

11. Adjust the valve clearance **(Figure 4-2-40, (2))** by turning the adjusting screw **(Figure 4-2-40, (4))** until there is a slight “drag” on the feeler gauge when sliding it between the rocker arm and the valve bridge.

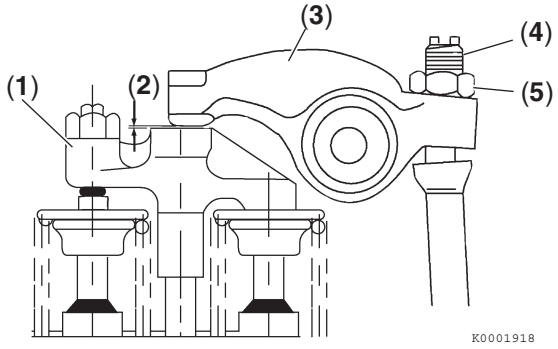



***Figure 4-2-40***

12. Hold the adjusting screw **(Figure 4-2-40, (4))** while tightening the valve adjusting screw lock nut **(Figure 4-2-40, (5))**. Recheck the clearance.
13. Apply oil to the contact surface between the adjusting screw and push rod.
14. Rotate the crankshaft to measure and adjust the set of valves. Continue until all valves are measured and adjusted.

- **Method B:** Use a feeler gauge to measure the clearance **(Figure 4-2-59, (3))** between the thrust bearing **(Figure 4-2-59, (1))** and crankshaft **(Figure 4-2-59, (2))**. Record the measurement. *See "3-2 Engine Tightening Torque" section for tightening torque.*

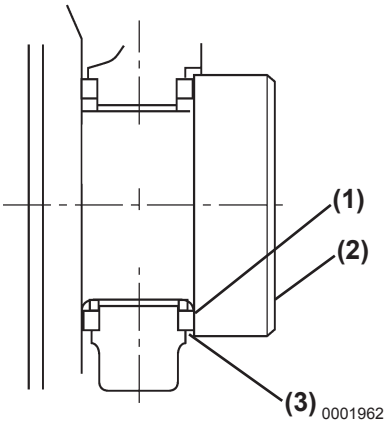



***Figure 4-2-59***

4. Remove the main bearing caps **(Figure 4-60,(1))**. Remove the bearing inserts **(Figure 4-2-60, (2))** and thrust bearings **(Figure 4- 2-60, (3))**.

Note: Do not remove the crankshaft gear unless the gear or crankshaft are damaged and require replacement.

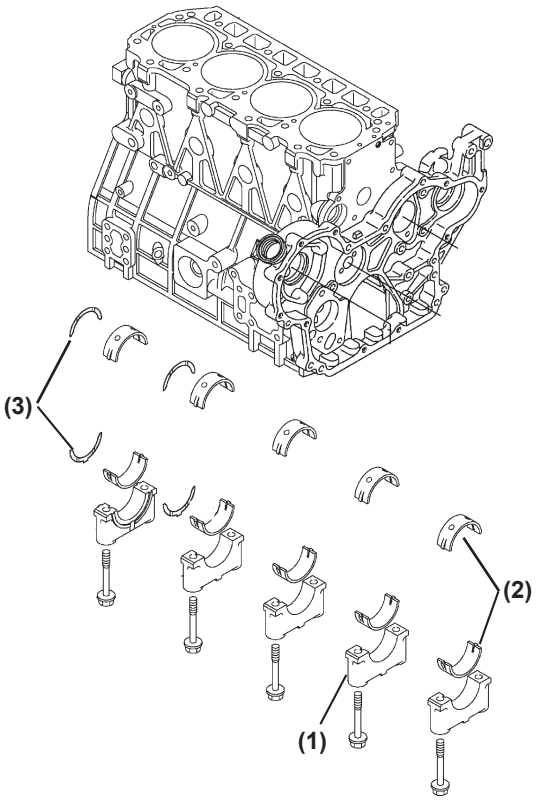



***Figure 4-2-60***

5. Wipe oil from the bearing insert and crankshaft journal surfaces.
6. Place a piece of PLASTIGAGE® **(Figure 4-2-61, (1))** along the full width of the bearing insert.

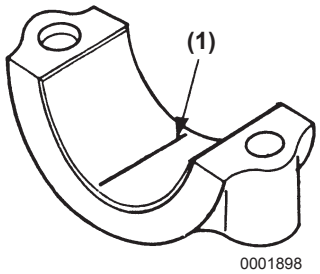



***Figure 4-2-61***

**NOTICE**

Do not rotate the crankshaft when using PLASTIGAGE. A false reading may result.

7. Reinstall the bearing cap and tighten to specification. *See "3-7-2 Engine Tightening Torque" section for tightening torque.*
8. Remove the bearing cap.

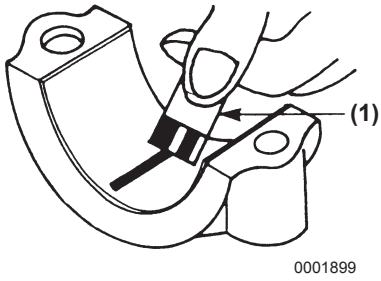



***Figure 4-2-62***

9. Compare the width of the flattened PLASTIGAGE **(Figure 4-2-62, ( 1 ) )** to the graduation marks on the package. The mark that most closely matches the width of the flattened PLASTIGAGE will indicate the bearing oil clearance. Record the measurement. *See "3-2 Engine Service Standard" section for the service limit.*
10. Repeat with the remaining main bearings.

Note: Be sure to note the markings on the main bearing caps, or make marks so they can be reinstalled in the same order as they were removed. The “arrows” on the main bearing caps point to the flywheel end of the engine.

5. Lubricate and install the wrist pin **(Figure 4-2-86, (6))** through the piston and connecting rod.
6. Reinstall the second circlip **(Figure 4-2-86, (5))** and ensure it is securely seated in the groove.

Note: If installing new piston rings the end gap must be checked and adjusted as necessary. *See Inspection of Pistons, Piston Rings and Wrist Pin on page 4-2-34.* Use a piston ring end gap filing tool to adjust the piston ring end gap on new piston rings.

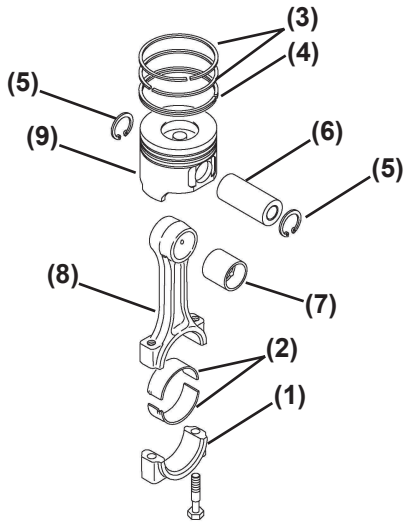



***Figure 4-2-86***

Note: Reinstall the top and second piston rings with the stamped “makers mark” **(Figure 4-2-87, (1))** facing the top of the piston. The “makers mark” may vary in appearance but will always be located on the top surface of the piston ring adjacent to the piston ring gap. The oil ring and oil ring expander can be installed either side up.

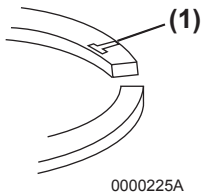



***Figure 4-2-87***

**NOTICE**

Always use a piston ring installation tool (expander) when installing piston rings. Never attempt to install piston rings by hand.

7. Reinstall the oil ring expander **(Figure 4-2-88, (4))**. Install the oil ring **(Figure 4-2-88, (3))** with the end gap at 180° from the expander end gap.
8. Reinstall the second compression ring **(Figure 4-2-88, (2))**. This ring is identified by its dark color and tapered face profile.
9. Reinstall the top compression ring **(Figure 4-2-88, (1))**. This ring is identified by its silver color and barrel-shaped face profile.

**NOTICE**

The oil ring expander **(Figure 4-2-88, (4))** end gap must be located 180° from the oil ring **(Figure 4-2-88, (3))** end gap.

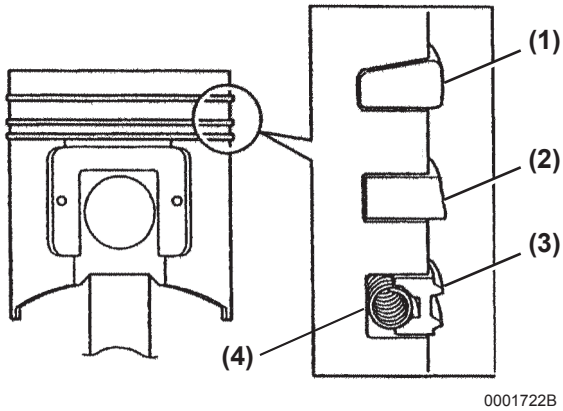



***Figure 4-2-88***

10. Stagger the piston ring end gaps at 120° intervals **(Figure 4-2-89, (1, 2, and 3))**. Do not position the top piston ring end gap in line with the wrist pin.

# FUEL SYSTEM SPECIFICATIONS

## Special Torque Chart

| Component | Tightening torque | Lubricating oil application (Thread portion and seat surface) |
|---|---|---|
| Fuel injector retainer bolt | 39.2 N·m | Not applied |
| Fuel pump drive gear nut | 78 - 88 N·m | Not applied |
| High-pressure fuel injection line nuts | 29 - 34 N·m | Not applied |
| Fuel return line bolts | 7.8 - 9.8 N·m | Not applied |
| Fuel injection pump mounting nuts | 23 - 28 N·m | Not applied |
| Fuel injector nozzle case nut | 39.2 - 44.1 N·m | Not applied |
| Fuel injection pump plunger plug | 30 - 35 N·m | Not applied |

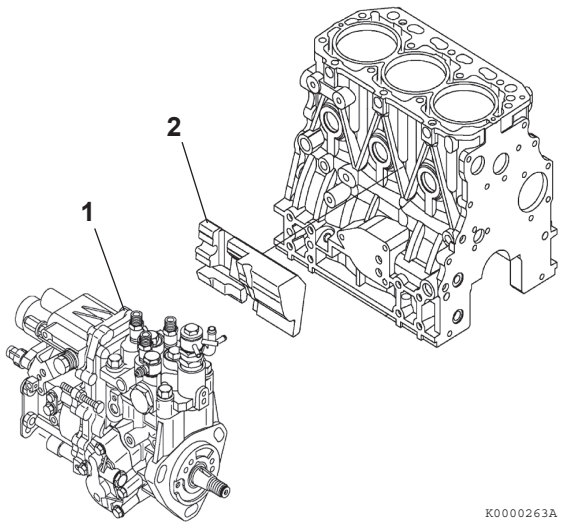



*Figure 4-3-18*

22. If required, remove the intake manifold and fuel pump insulator to access the fuel injection pump mounting nuts.

    *Note: The MP2 fuel injection pumps (TNV88 model engines) are fastened to the gear case with three (3) studs and nuts.*

23. Remove the fuel injection pump **(Figure 4-3-18, (1))**. For purposes of future injection timing purposes, record the fuel injection pump timing index number located on the boss on the engine side (back) of the of the fuel injection pump **(Figure 4-3-19, (1))**.

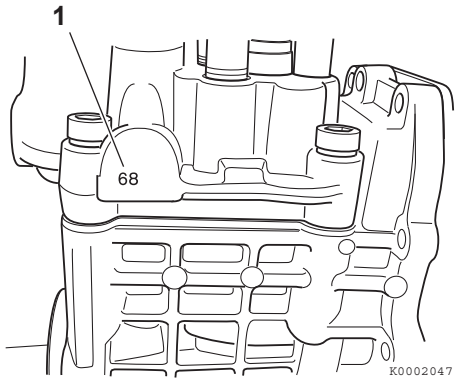



*Figure 4-3-19*

**NOTICE**

Do not rotate the crankshaft with the injection pump removed.

24. If the fuel injection pump requires servicing, it must be sent to an authorized YANMAR FIE repair facility for repair and calibration, or replaced with a new fuel injection pump.

**NOTICE**

- Never remove or attempt to remove the tamper-proof devices from the full-load fuel adjusting screw or the high-speed throttle limit screw on the fuel injection pump and governor assembly. These adjustments have been made at the factory to meet all applicable emissions regulations and then sealed.
- Never attempt to make any adjustments to these sealed adjustment screws. If adjustments are required, they can be made only by a qualified fuel injection shop that will ensure the injection pump continues to meet all applicable emissions regulations and then replace the tamper-proof seals.
- Tampering with or removing these devices may void the “YANMAR Limited Warranty.”

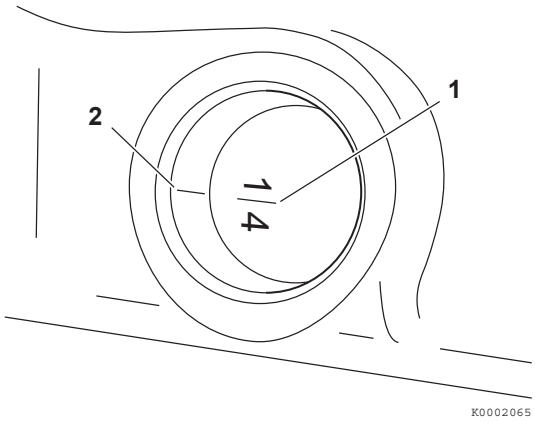
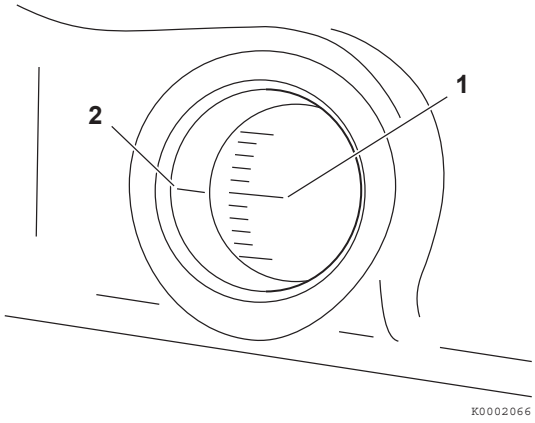



*Figure 4-3-43*



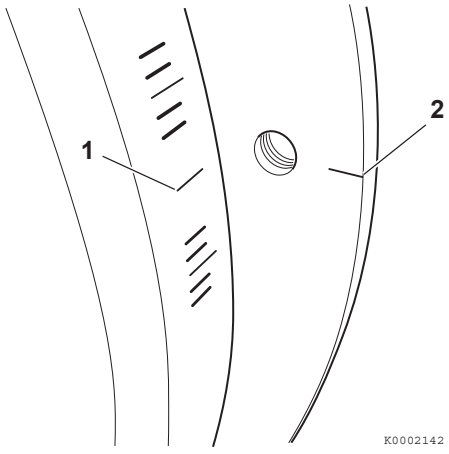




*Figure 4-3-44*

10. Rotate the crankshaft counter-clockwise until the dial indicator shows that the injection pump plunger is at the bottom of its stroke. Rock the crankshaft back and forth slightly to confirm a point where the dial indicator shows no movement. Zero the dial indicator.
11. Slowly rotate the crankshaft clockwise until the dial indicator shows a pump plunger lift of 2.5 mm (0.098 in.).
12. Check the position of the flywheel target timing mark (previously determined) **(Figure 4-3-44, (1))** in relation to the timing reference mark **(Figure 4-3-44, (2))** on the flywheel housing or engine back plate. If the two marks are aligned, the fuel injection timing is correct. If the marks do not align, the fuel injection timing must be adjusted. *See Adjusting Fuel Injection Timing on page* 4-3-22.
13. If the injection timing is correct, remove the dial indicator and adapter. Replace the pump plunger plug and its copper gasket and tighten to specifications. Replace the flywheel inspection port cover. Open the fuel supply valve and remove the clamp from the fuel supply hose and the fuel return hose.
14. Prime the fuel system. Operate the engine and check for leaks.

## Adjusting Fuel Injection Timing

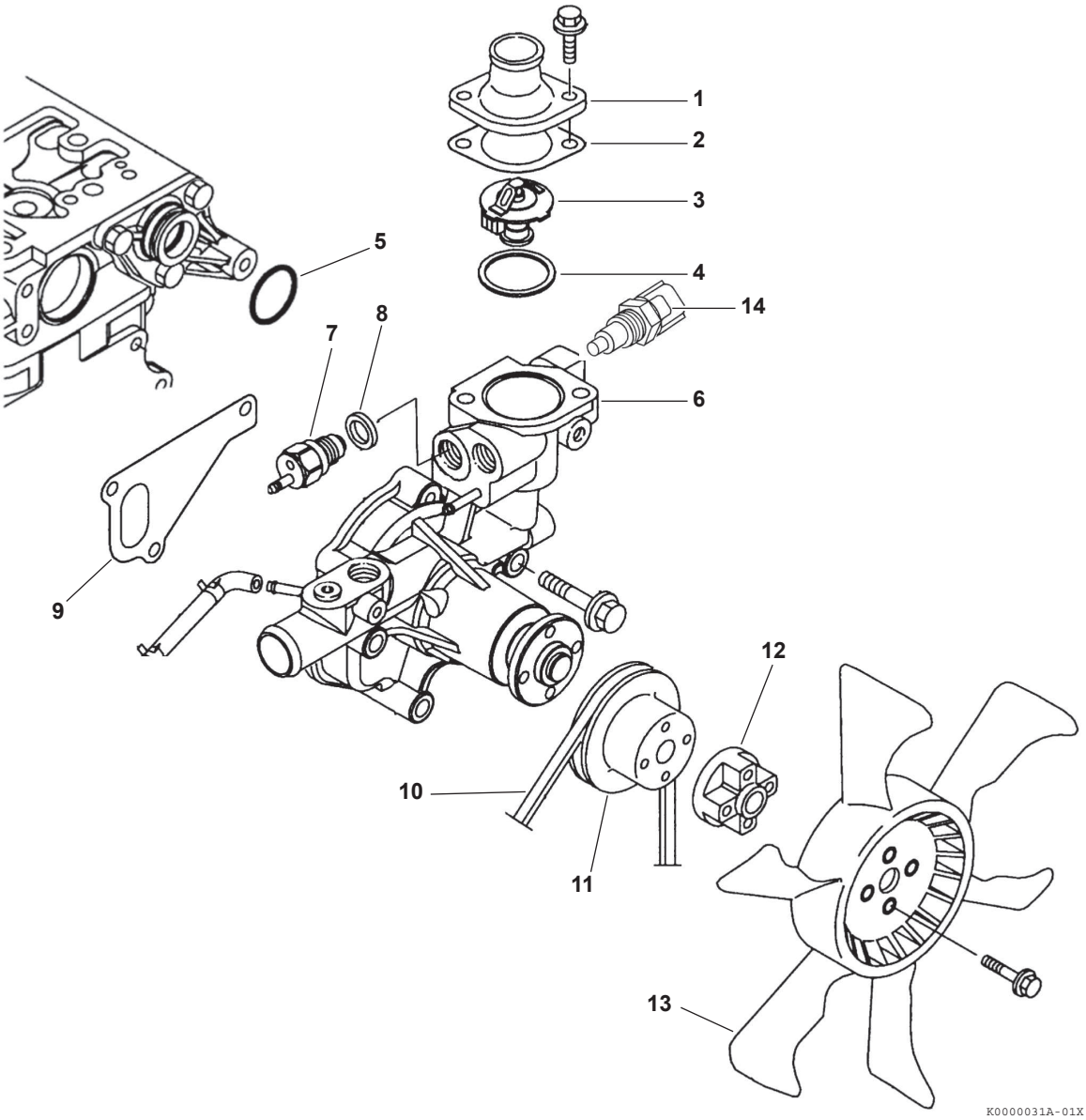
If the timing marks did not align when performing the *Checking Fuel Injection Timing on page* 4-3-22, the following steps must be performed to properly time the engine.

1. Leave the dial indicator installed in the fuel injection pump. Do not disturb the reading on the dial indicator.
2. Rotate the flywheel until the target timing mark **(Figure 4-3-45, (1))** and the timing reference mark **(Figure 4-3-45, (2))** on the flywheel housing or back plate are aligned.

**NOTICE**

Do not rotate the crankshaft during the remainder of this procedure.

### 4-4-4 Engine Coolant Pump Components




1 – Thermostat cover
2 – Thermostat cover gasket
3 – Thermostat
4 – Thermostat O-ring
5 – Special O-ring
6 – Engine coolant pump
7 – Temperature switch
8 – Gasket
9 – Engine coolant pump gasket
10 – V-belt
11 – Engine coolant pump V-pulley
12 – Spacer
13 – Engine coolant fan
14 – Water temperature sensor (Electronically controlled engine)

***Figure 4-4-2***

### 4-5-4 Checking Engine Oil Pressure

Perform an engine oil pressure check if there is any indication of low oil pressure such as the oil pressure indicator is on or the oil pressure gauge indicates low oil pressure.

1. Disconnect the wire lead from the oil pressure switch or sending unit **(Figure 4-5-2, (1))**.

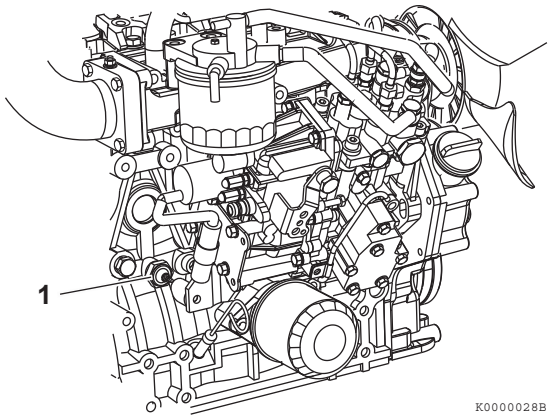


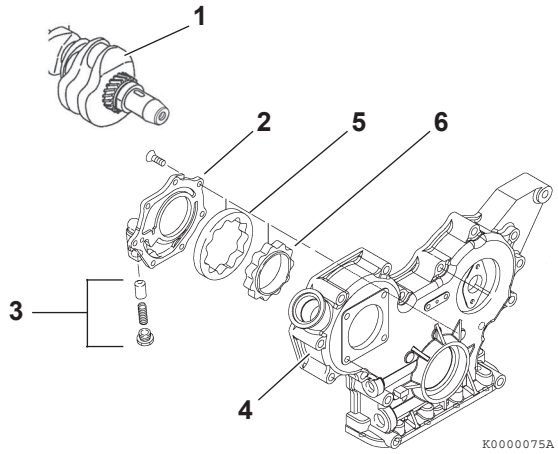

***Figure 4-5-2***

2. Remove the oil pressure switch.
3. Install a mechanical oil pressure gauge in the oil pressure switch port.
4. Start the engine:
   - If the mechanical oil pressure test gauge indicates good oil pressure, replace the faulty oil pressure switch or sending unit or faulty machine oil pressure gauge in instrument panel.
   - If the mechanical oil pressure test gauge indicates low oil pressure, troubleshoot the lubrication system to locate the cause of the low oil pressure. *See Troubleshooting Charts.* Repair as necessary.

### 4-5-5 Trochoid Oil Pump

## Oil Pump Components

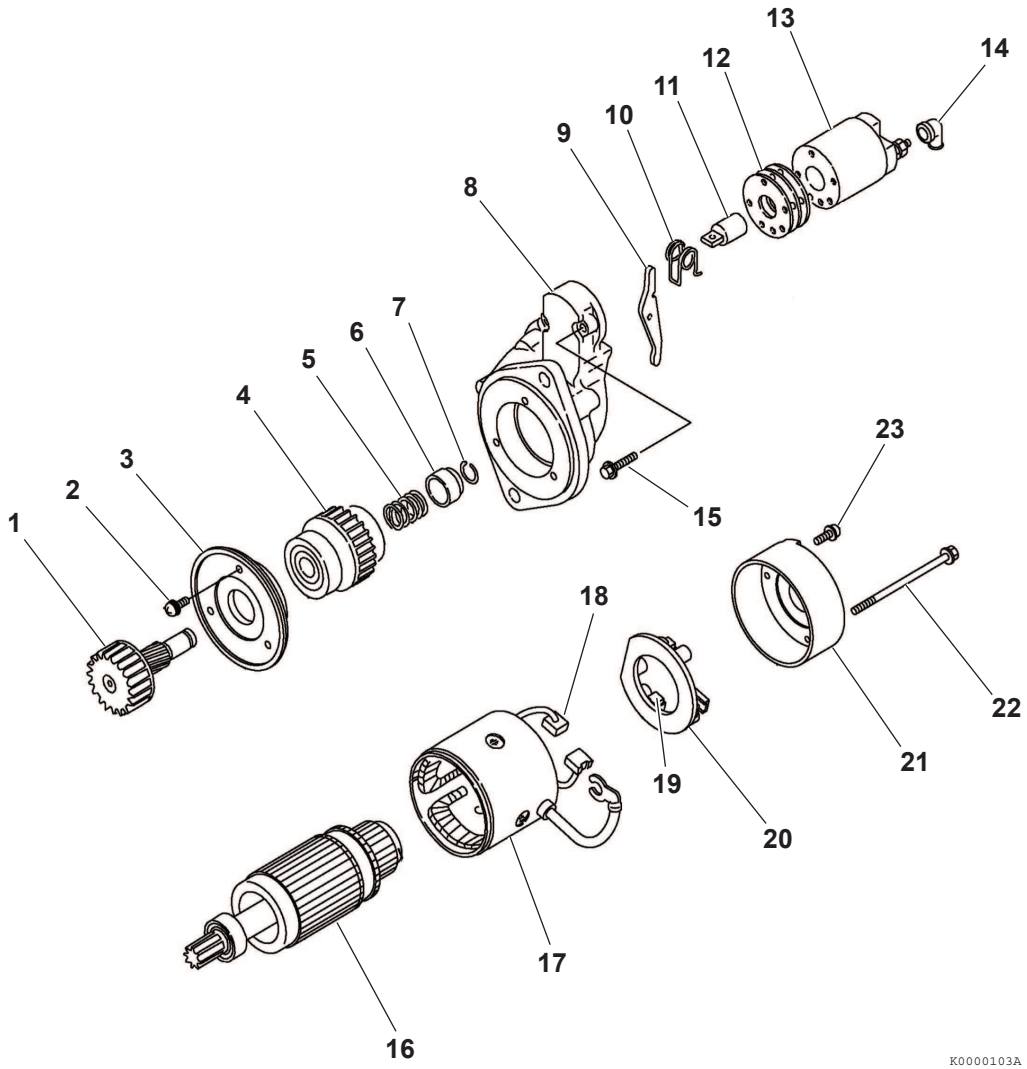
On these model engines, the oil pump is located inside the front gear case cover and is driven by a boss on the front crankshaft gear. You must remove the front gear case cover to gain access to the oil pump.




**1 – Crankshaft**
**2 – Oil Pump Cover**
**3 – Oil Pressure Regulator**
**4 – Gear Case Cover**
**5 – Outer Rotor**
**6 – Inner Rotor**

***Figure 4-5-3***

### 4-6-5 Starter Motor Components




1 – Pinion shaft
2 – M4 bolts (3 used)
3 – Bearing retainer
4 – Pinion clutch assembly
5 – Return spring
6 – Pinion stop
7 – Retaining ring
8 – Gear housing
9 – Shift lever
10 – Torsion spring
11 – Plunger
12 – Dust covers (shims)
13 – Magnetic switch assembly (solenoid)
14 – Cover
15 – M6 bolts (2 used)
16 – Armature assembly
17 – Field coil assembly
18 – Positive (+) brushes
19 – Negative (-) brushes
20 – Brush holder assembly
21 – Rear cover
22 – M5 through bolts (2 used)
23 – M4 bolts (2 used)

***Figure 4-6-1***

## No-Load Test

Test the characteristics of the starter motor by performing a no-load test.

**NOTICE**

The starter motor can be damaged if operated continuously longer than 10 seconds while performing the no-load test.

1. Secure the starting motor in a vise or other suitable fixture.
2. Connect an ammeter **(Figure 4-6-35, (1))** in series between the battery positive (+) terminal **(Figure 4-6-35, (2))** and the main positive (+) terminal **(Figure 4-6-35, (3))** on the starter motor.

   *Note: The ammeter and all wire leads used in this test must have a capacity equal to or greater than the amperage draw specification for the starter motor being tested.*

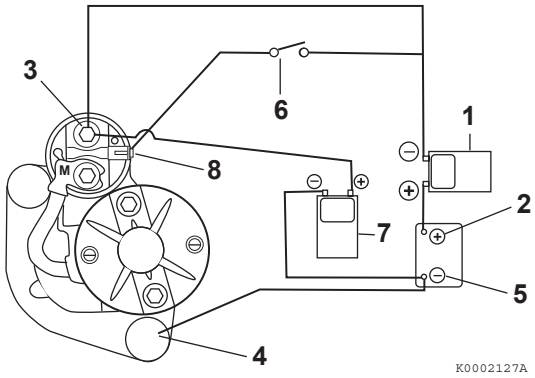



***Figure 4-6-35***

3. Connect a wire lead between the mounting base of the starter motor **(Figure 4-6-35, (4))** and the battery negative terminal **(Figure 4-6-35, (5))**.
4. Connect a voltmeter **(Figure 4-6-35, (7))** to the battery negative (-) terminal **(Figure 4-6-35, (5))** and the main positive (+) battery terminal **(Figure 4-6-35, (3))** on the starter motor.
5. Install a switch **(Figure 4-6-35, (6))** in a circuit between the battery positive (+) terminal **(Figure 4-6-35, (2))** and the starter magnetic switch (solenoid) terminal **(Figure 4-6-35, (8))** on the starter motor.
6. Use a suitable tachometer to monitor the rpm of the starter.
7. Turn the switch to the ON position. Monitor the rpm, amperage draw and voltage. For test specifications, *see 3TNV82A to 4TNV88 - Standard and Optional and 4TNV94L to 4TNV106T - Standard and Optional on page 11-4 for the appropriate starter motor.*

## Installation of Starter Motor

1. Reinstall the starter motor to the flywheel housing.
2. Reinstall the starter mounting bolts **(Figure 4-6-36, (1))**. Tighten the bolts to specification. *See Tightening Torques for Standard Bolts and Nuts*.

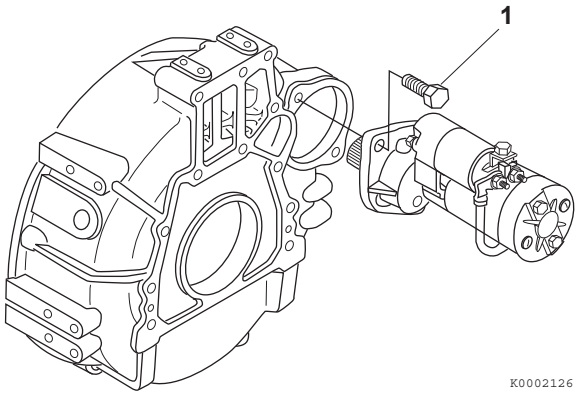



***Figure 4-6-36***

3. Reconnect the electrical wires to the magnetic switch assembly (solenoid). Be sure to place the cover over the battery positive (+) cable connection.
4. Reconnect the battery cables at the battery.

4. Lubricate the shaft of the rotor assembly **(Figure 4-7-14, (1))**. Press the rotor assembly into the front frame housing **(Figure 4-7-14, (2))** and rear frame housing **(Figure 4-7-14, (3))**.

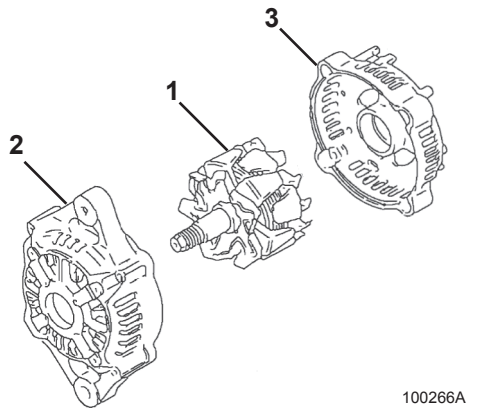



***Figure 4-7-14***

5. Align the front frame housing with the rear frame housing. Reinstall the two bolts **(Figure 4-7-15, (1))** and two nuts **(Figure 4-7-15, (2))**.

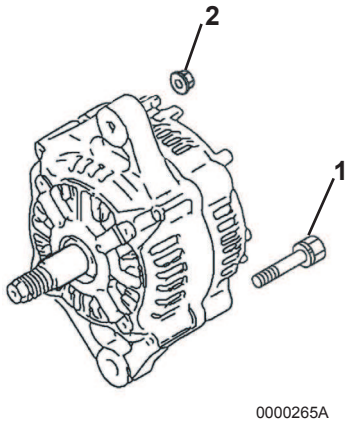



***Figure 4-7-15***

6. Reinstall the insulation bushing **(Figure 4-7-16, (4))** and nut **(Figure 4-7-16, (3))**.

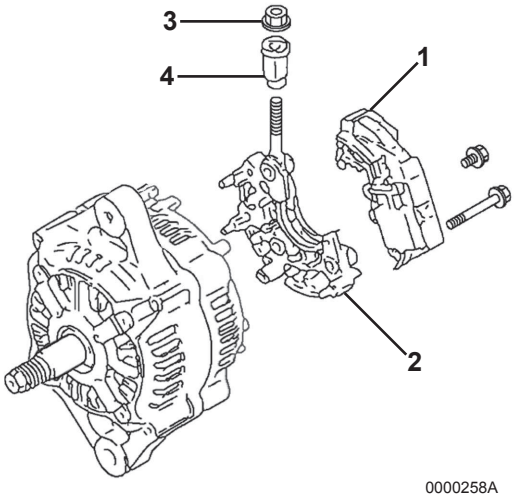



***Figure 4-7-16***

7. Reassemble the regulator assembly **(Figure 4-7-16, (1))** to the holder **(Figure 4-7-16, (2))**.
8. Reinstall the brush holder **(Figure 4-7-17, (3))**, springs **(Figure 4-7-17, (4))** and brushes **(Figure 4-7-17, (5))**.
9. Reattach the regulator assembly and holder to the rear frame housing.

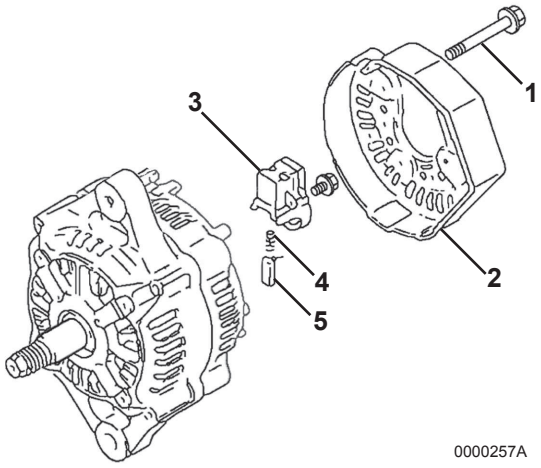



***Figure 4-7-17***

| Symptoms and conditions of failures | Defective start | | | Engine stall after start | | Defective rotation control | | | Insufficient engine output | | Noise/vibration | | | Lubricant | | | Cooling water | | Intake | Exhaust | | Exhaust | | Fuel | | Electrics/electronics | | | | Action | Referenced page number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cause | Starter not rotate | Starter rotates | | Exhaust fume | | Without load | | At work | Exhaust color | | | | | | | | | | | At work | | | | | | | | | | |
| | ECU indicator lamp not on just after key-on | ECU indicator lamp on just after key-on (2 seconds) | Engine not start (not even initial combustion) | Engine not start (stall after serial combustion) | Engine starts later than ever | None | Little | Much | Speed change by accelerator not available (constant speed) | Specified speed setting not available | Poor acceleration | Return to low speed not smooth | Hunting | Hunting | Normal | White | | Knocking noise at combustion too high | Combustion noise uneven | Noise other than combustion from engine | Engine vibration too big | Lubricant consumption too much | Lubricant diluted with fuel | Lubricant mixed with water | Oil pressure too low (oil pressure lamp on) | Overheated (water temperature lamp on) | Water temperature too low | Pressure down (air cleaner lamp on) | Pressure up | | | Blow-by too much | Exhaust temperature up | Fuel consumption too much | Fuel mixed with water (oil-water separator lamp on) | Fuel filter contaminated too early | Battery charge defect (charge lamp on) | ECU indicator lamp flashing | ECU indicator lamp not on just after key-on (2 seconds) | Prescribed ECU control function not operate | Fuse meltdown, disconnection (repeated) | | |
| ECU control function operating | | ○ | | | | | | | ○ | ○ | | | | | ○ | | | | | | | | | | | | | | | | Not failure<br>Implement regular usage | Check the causes of engine stop or starter restraint by a diagnosis tool. |
| Disconnection/short-circuit of water temperature sensor | | | | | | | | | | ○ | | | | | ○ | | | | | | | | | | | | | | | | Repair or replacement of harness<br>Replacement of water temperature sensor | |
| Disconnection/short-circuit of accelerator sensor | | | | | | | | | ○ | | | | | | | | | | | | | | | | | | | | | | Repair or replacement of harness<br>Replacement of accelerator sensor | |
| Speed sensor signal error | | | | | ○ | | | | | | | | | | | | | | | | | | | | | | | | | | Repair or replacement of harness<br>Repair or replacement of fuel injection pump | |
| Rack position sensor signal error | | | | | | | | | | ○ | | | ○ | ○ | ○ | | | | | | | | | | | | | | | | Repair or replacement of harness<br>Repair or replacement of fuel injection pump | |
| Operation defect of rack actuator | | ○ | | | ○ | | | | | | | | | | | | | | | | | | | | | | | | | | Repair or replacement of harness<br>Repair or replacement of fuel injection pump | |
| Engine over speed | | | | | ○ | | | | | | | | | | | | | | | | | | | | | | | | | | Check operating machine's driving.<br>Check speed sensor signal. | |
| CAN communication error | | | | | | | ○ | | | | | | | | | | | | | | | | | | | | | | | | Repair or replacement of harness<br>ECU Replacement | |
| Disconnection/short-circuit of EGR valve motor | | | | | | | | | | ○ | | | | | ○ | | | | | | | | | | | | | | | | Repair or replacement of harness<br>Replacement of EGR valve | |
| Disconnection/short-circuit of CSD solenoid valve | | | ○ | ○ | | | | | | | | | | | | | | | | | | | | | | | | | | | Repair or replacement of harness<br>Replacement of CSD valve solenoid | |
| Disconnection/short-circuit of start assist relay | | ○ | | | ○ | | | | | | | | | | | | | | | ○ | | | | | | | | | | | Repair or replacement of harness<br>Relay replacement | |
| Main relay "OFF" not available | | | | | | | | | | | | | | | | | | | | | | | | | | | ○ | | | | Relay replacement | |
| Disconnection/short-circuit of rack actuator relay | | ○ | | | | | | | | | | | | | | | | | | | | | | | | | ○ | | | | Repair or replacement of harness<br>Relay replacement | |
| Malfunction by ECU self-diagnosis | | ○ | | | | | | | | | | | | | | | | | | | | | | | | | ○ | | | | ECU Replacement | |
| Engine stop or operation limits by ECU failure diagnosis function | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| ITEM | DESCRIPTION | ITEM | DESCRIPTION |
|---|---|---|---|
| A555 | GLOW TIMER | X100 | CONNECTOR |
| A556 | PULL ELECTROSTOP TIMER | X101.S | CONNECTOR |
| B0 | BATTERY | K201 | SAFETY STARTING RELAY |
| B8 | PARKING BRAKE SWITCH | K202 | JOYSTICK SUPPLY RELAY |
| B16 | OIL FILTER CLOGGING INDICATOR | K203 | KICK DOWN RELAY |
| B21 | HYDRAULIC TEMPERATURE INDICATOR | S110.1 | JOYSTICK |
| B22 | OIL FILTER CLOGGING INDICATOR | S200 | SHIFT SWITCH |
| B23 | STEERING PRESSURE SWITCH | X101.P | CONNECTOR |
| B24 | FUEL LEVEL SENSOR | B2 | HORN |
| B25 | AIR FILTER CLOGGING INDICATOR | E1 | RIGHT FRONT LIGHT |
| B26 | COOLANT ENGINE TEMPERATURE SENSOR | E3 | LEFT FRONT LIGHT |
| B28 | OIL BRAKE LEVEL SENSOR | S110 | JOYSTICK |
| E1 | RIGHT REAR LIGHT | Y111 | EV. OPTIONAL 1 |
| E10 | PLATE LAMP | Y112 | EV. OPTIONAL 2 |
| E17 | LEFT REAR LIGHT | X101.P | CONNECTOR |
| F1 | +30 CPU AND RELAYS FUSE | A505 | RIGHT SPEAKER |
| F2 | +30 GLOW RELAY FUSE | A507 | LEFT SPEAKER |
| F3 | +30 ELECTROSTOP FUSE | B513 | RADIO |
| F4 | +30 KEY START | E500 | LEFT FRONT WORKING LIGHT |
| F5 | +30 STARTING MOTOR RELAY FUSE | E501 | ROTARY LAMP |
| G0 | ALTERNATOR | E502 | CEILING LIGHT |
| H19 | BACKALLARM BUZZER | E503 | RIGHT FRONT WORKING LIGHT |
| K132.1 | GLOW RELAY | E504 | RIGHT REAR WORKING LIGHT |
| K132.2 | STARTING MOTOR RELAY | E506 | LEFT REAR WORKING LIGHT |
| K551 | ELECTROSTOP RELAY | M508 | HEATING FAN MOTOR |
| M0 | STARTING MOTOR | M509 | WINDSHIELD WASHER PUMP |
| M18 | CLUTCH AIR CONDITIONING | M511 | REAR WINDSHIELD WIPER MOTOR |
| R5 | GLOVE | M516 | FRONT WINDSHIELD WIPER MOTOR |
| S0 | BATTERY KNIFE SWITCH | S510 | HEATING FAN SWITCH |
| S20 | STOP PRESSURE SWITCH | X8 | CONNECTOR |
| Y13 | EV. GEAR | X512 | CONNECTOR |
| Y14 | EV. REVERSE | X515 | PLUG SUPPLY |
| Y15 | EV. FORWARD | | |
| Y30 | ELECTROSTOP PULLER | | |
| Y31 | ENGINE STOP | | |
| X9 | CONNECTOR | | |
| X10 | CONNECTOR | | |
| X11 | CONNECTOR | | |

## 6-3-4 Hydrostatic pump

**A)** Hydraulic servo control

**B)** Two pressure relief valves :
one for forword motion and one for reverse motion

**C)** Booster pump (filling)

**D)** Power absorption control valve

**E)** Booster pump valve

**F)** Two solenoid valves for motion reversal

**G)** Working pressure control valve

**H)** Hydraulic pump and steering unit