(Piston Ring Cont.)

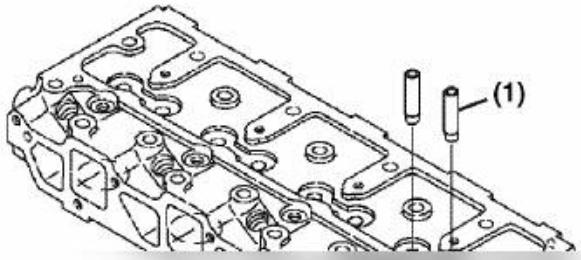
Model	Inspection Item		Standard	Limit	Reference Page
	Top Ring	Ring Groove Width	0.0992 - 0.1000 in. (2.520 - 2.540 mm)	-	
		Ring Width	0.0961 - 0.0969 in. (2.440 - 2.460 mm)	0.0953 in. (2.420 mm)	
		Side Clearance	0.0024 - 0.0039 in. (0.060 - 0.100 mm)	-	
		End Gap	0.0118 - 0.0177 in.	0.0213 in.	

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2. Immediately after removing the valve guides from the freezer, insert the valve guides **(Figure 6-28, (1))** in their proper positions.



Reassembly of Intake and Exhaust Valves

IMPORTANT

Always install new valve stem seals.

*The exhaust valve stem seals are different than the intake valve stem seals and can be identified by either the paint marks on the outside of the seals or by the color of the seal spring **(Figure 6-30, (4))**. Ensure they are installed in the correct locations.*

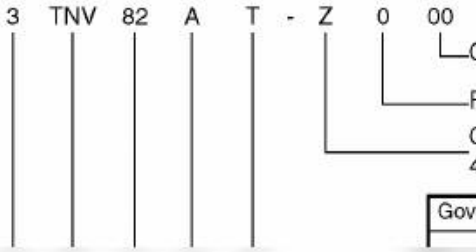
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SPECIFICATIONS

Description of Model Number



Governor Type Symbol	Governor Type	Applicable engine
Z	Electronic Governor (Eco-governor)	

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Section 4

GENERAL SERVICE INFORMATION

Page

Component Identification 4-3
Location of Labels 4-5
  Engine Nameplate (Typical) 4-6
Emission Control Regulations 4-6
  EPA / ARB Regulations - USA Only 4-6
Emission Control Labels 4-6
The 97/68/EC Directive Certified Engines 4-7
Engine Family 4-7
Function of Major Engine Components 4-8
MAIN ELECTRONIC CONTROL COMPONENTS AND FEATURES 4-9
Function of Cooling System Components 4-11
Diesel Fuel 4-12
  Diesel Fuel Specifications 4-12
  Filling The Fuel Tank 4-17
  Priming the Fuel System 4-18
Engine Oil 4-19
  Engine Oil Specifications 4-19
  Engine Oil Viscosity 4-19
  Checking Engine Oil 4-20
  Adding Engine Oil 4-20
  Engine Oil Capacity (Typical) 4-20
Engine Coolant 4-21
  Engine Coolant Specifications 4-22
  Filling Radiator with Engine Coolant 4-22
  Engine Coolant Capacity (Typical) 4-23

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NOTICE

Any part which is found defective as a result of inspection or any part whose measured value does not satisfy the standard or limit must be replaced.

NOTICE

Any part determined to not meet the service standard or limit before the next service, as determined from the state of current rate of wear, should be replaced even though the part currently meets the service standard limit.

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.”

NOTICE

Never use a steel wire brush to clean fuel injectors. Damage to the nozzle and other components is likely to result.

NOTICE

Allow the engine to warm-up for at least five minutes and the idle speed of the engine to return to normal before engaging the transmission or any PTOs. Engaging the transmission or PTO at an elevated engine speed could result in an unexpected movement of the equipment.

NOTICE

Shut down the engine if the fault indicator comes on.

Continuing running the engine with the fault indicator being on may result in a serious malfunction of or damage to the engine, and will void the engine warranty.

NOTICE

Do not energize the starter for a period of longer than 15 seconds.

Take a pause of at least 30 seconds between energization of the starter.

Otherwise the starter could suffer damage.

NOTICE

- High-pressure washing not recommended.
- Avoid using high-pressure washing for electronic or electric devices installed in, on or around the engine, including the E-ECU, relays and harness couplers.

Otherwise such devices may suffer malfunction due to water ingress into them.

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Engine General Specifications

Type	Vertical In-line, Water Cooled, 4-Cycle Diesel Engine	
Combustion System	Direct Injection Models	Direct Injection
	Indirect Injection Models	Swirl Chamber (Ball-Type)
Starting System	Electric Starting	
Cooling System	Radiator	
Lubricating System	Forced Lubrication with Trochoid Pump	
PTO Position	Flywheel End	
Direction of Rotation	Counterclockwise Viewed from Flywheel End	

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ENGINE SERVICE STANDARDS

Inspection Item		Standard	Limit	Reference page
Intake / Exhaust Valve Clearance	All models except 4TNV106 and 4TNV106T	0.006 - 0.010 in. (0.15 - 0.25 mm)	-	*See Measuring and Adjusting Valve Clearance on page 6-64*
	4TNV106 and 4TNV106T	0.010 - 0.014 in. (0.25 - 0.35 mm)	-	
Fuel Injection Timing	*See Checking and Adjusting Fuel Injection Timing on page 7-27.*			

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Clean Fuel Filter / Water Separator

⚠ DANGER

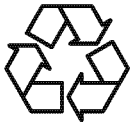
FIRE AND EXPLOSION HAZARD!



- **Diesel fuel is flammable and explosive under certain conditions.**

- **NEVER use diesel fuel as a cleaning agent.**
- **When you remove any fuel system component to perform maintenance (such as changing the fuel filter) place an approved container under the opening to catch the fuel.**
- **NEVER use a shop rag to catch the fuel. Vapors from the rag are flammable and explosive.**
- **Wipe up any spills immediately.**
- **Wear eye protection. The fuel system is under pressure and fuel could spray out when you remove any fuel system component.**
- **Failure to comply will result in death or serious injury.**

NOTICE



- ALWAYS be environmentally responsible.

- Follow the guidelines of the EPA or other governmental agencies for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.
- NEVER dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground, or into ground water or waterways.
- Failure to follow these procedures may seriously harm the environment.

Periodically clean the fuel filter / water separator element and inside cup.

1. Position an approved container under the cup **(Figure 5-15, (1))** of the fuel filter / water separator to collect the contaminants.

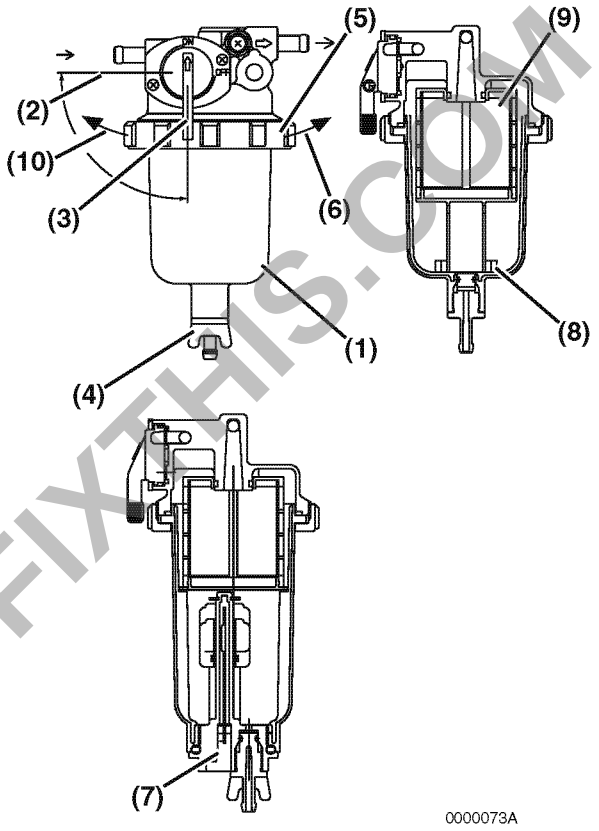


Figure 5-15

2. Close **(Figure 5-15, (2))** the fuel cock **(Figure 5-15, (3))**.
3. Loosen the drain cock **(Figure 5-15, (4))** and drain the contaminants. *See Drain Fuel Filter / Water Separator on page 5-12.*
4. Turn the retaining ring **(Figure 5-15, (5))** to the left **(Figure 5-15, (10))** and remove the cup **(Figure 5-15, (6))**. If equipped, disconnect the sensor wire **(Figure 5-15, (7))** from the cup before removing the cup.
5. Carefully hold the cup to prevent fuel from spilling. If you spill any fuel, clean up the spill completely.

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Connecting Rod

Connecting Rod Small End

Model	Inspection Item	Standard	Limit	Reference Page
3TNV82A	Wrist Pin Bushing Inside Diameter	0.9065 - 0.9070 in. (23.025 - 23.038 mm)	0.9082 in. (23.068 mm)	
	Wrist Pin Outside Diameter	0.9053 - 0.9055 in. (22.995 - 23.000 mm)	0.9042 in. (22.967 mm)	
	Oil Clearance	0.0010 - 0.0017 in.	0.0040 in.	

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4-VALVE CYLINDER HEAD

4-Valve Cylinder Head Components

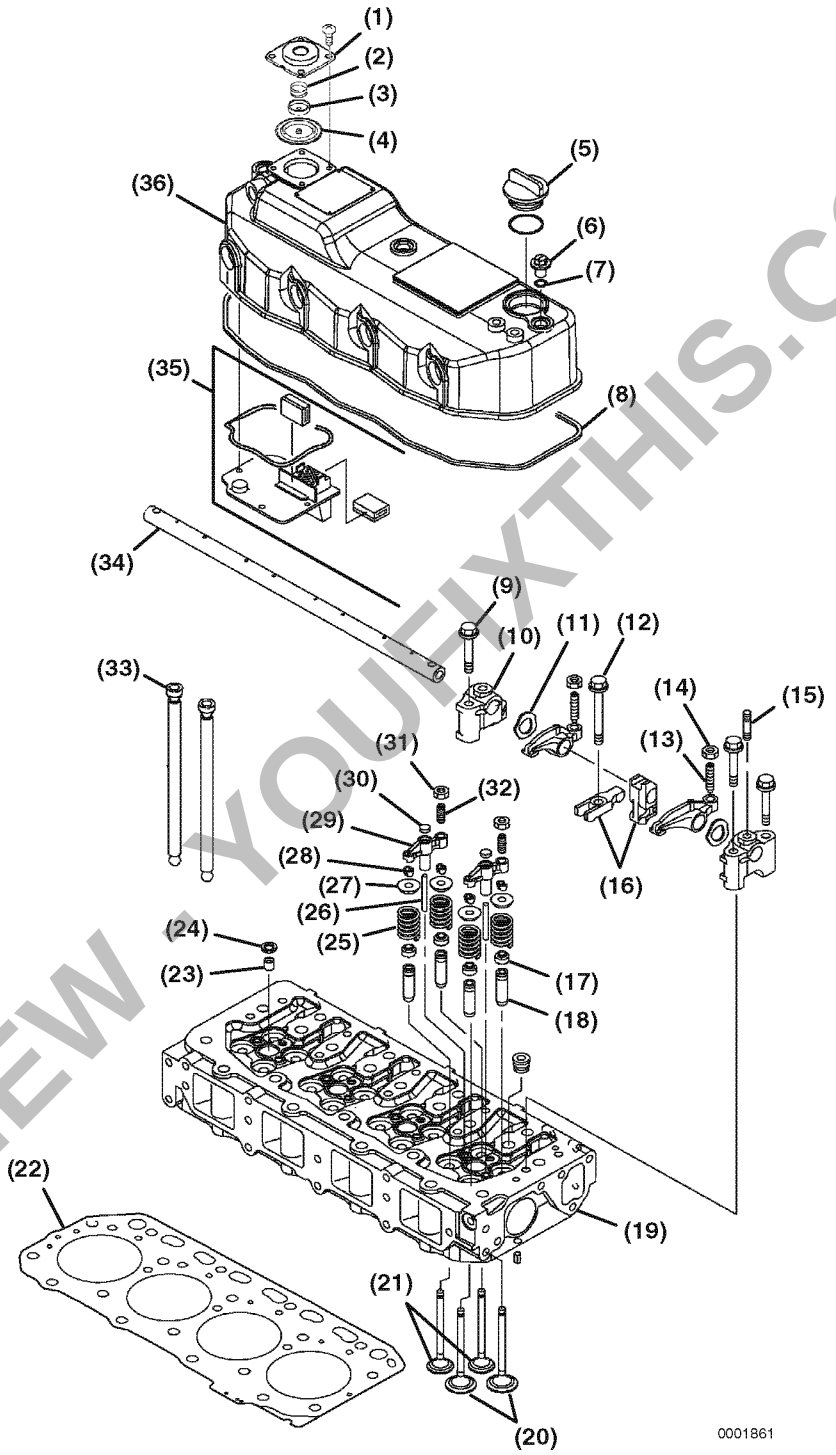


Figure 6-39

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NOTICE

Do not loosen or remove the four bolts retaining the fuel injection pump drive gear to the fuel injection pump hub. Do not disassemble the fuel injection pump drive gear from the hub. Correct fuel injection timing will be very difficult or impossible to achieve.

4. Do not remove the fuel injection pump drive gear unless absolutely necessary to avoid damage to the gear or pump. Do not loosen or remove the four bolts **(Figure 6-92, (3))** retaining the pump drive gear to the hub. Only remove the nut **(Figure 6-92, (1))** and washer **(Figure 6-92, (2)),** leaving the hub attached to the gear**.** Remove the pump drive gear and hub as an assembly using a gear puller.

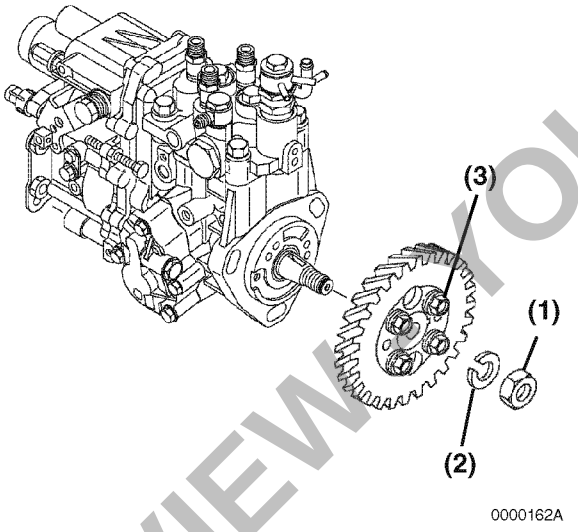


Figure 6-92

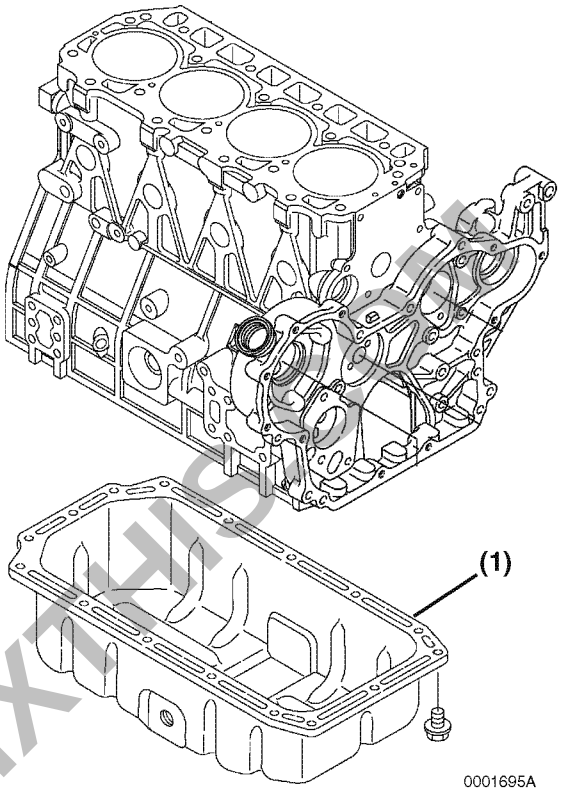


Figure 6-93

Removal of Oil Pan

1. Invert the engine (oil pan up) on the engine stand.
2. Remove the oil pan **(Figure 6-93, (1))**.

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EGR system

⚠ DANGER

SCALD HAZARD!



- NEVER remove the radiator cap if the engine is hot. Steam and hot engine coolant will spurt out and seriously burn you. Allow the engine to cool down before you attempt to remove the radiator cap.
- Tighten the radiator cap securely after you check the radiator. Steam can spurt out during engine operation if the cap is loose.
- ALWAYS check the level of the engine coolant by observing the reserve tank.
- Failure to comply will result in death or serious injury.

⚠ WARNING

BURN HAZARD!



- 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.

⚠ WARNING

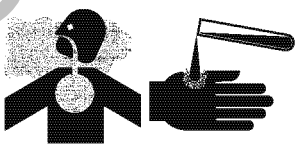
ENTANGLEMENT HAZARD!



- Stop the engine before you begin to service it.
- NEVER leave the key in the key switch when you are servicing the engine. Someone may accidentally start the engine and not realize you are servicing it. This could result in a serious injury.
- If you must service the engine while it is operating, remove all jewelry, tie back long hair, and keep your hands, other body parts and clothing away from moving / rotating parts.
- Failure to comply could result in death or serious injury.

⚠ WARNING

FUME / BURN HAZARD!



- Always read and follow safety related precautions found on containers of hazardous substances like parts cleaners, primers, sealants and sealant removers.
- Failure to comply could result in death or serious injury.

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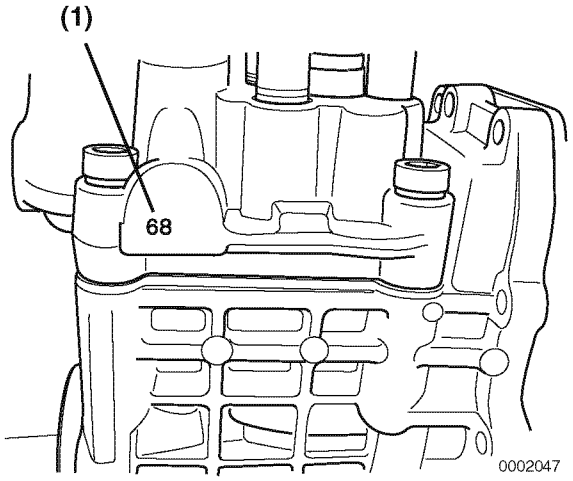


Figure 7-21

NOTICE

Do not rotate the crankshaft with the injection pump removed.

25. 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.”

Installation of Fuel Injection Pump

For electronically controlled engine

⚠ WARNING

- **Replacing the fuel injection pump involves rewriting the fuel injection data in the E-ECU. Be sure to contact your local Yanmar dealer before replacing the fuel injection pump. Failure to rewrite the fuel injection data before replacing the fuel injection pump will void the engine warranty.**
- **Improper use or misuse of the E-ECU may result in death or serious injury due to an abrupt and unexpected increase in engine speed.**

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- On models not equipped with an oil cooler, remove the coolant drain plug **(Figure 8-6, (1))** from the engine block.

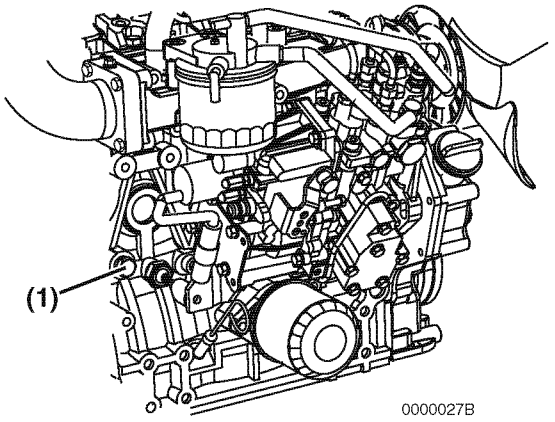


Figure 8-6

5. Loosen the alternator mounting bolts. Loosen and remove the V-belt and rotate the alternator away from the engine and out of the way.

⚠ CAUTION

PINCH HAZARD!

Carefully rotate the alternator toward the cylinder block while loosening the V-belt. Failure to comply may result in minor or moderate injury.

6. Remove the engine coolant fan guard (if equipped), engine coolant fan **(Figure 8-7, (1))**, spacer **(Figure 8-7, (2))** and engine coolant pump V-pulley **(Figure 8-7, (3))**.

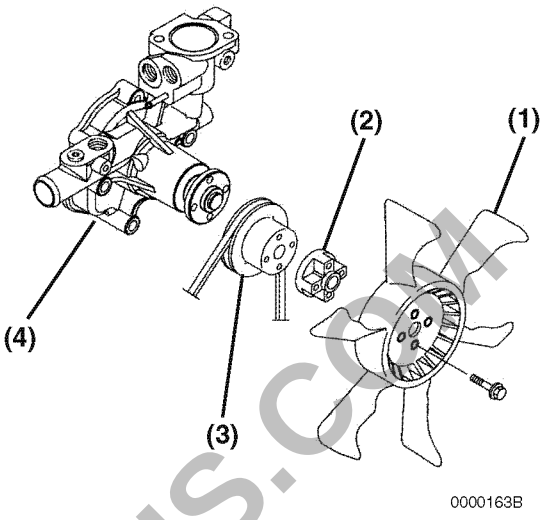


Figure 8-7

7. Disconnect the coolant hoses and the temperature switch lead wire from the engine coolant pump.
8. Remove the engine coolant pump **(Figure 8-7, (4))**. Discard the gasket.

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BEFORE YOU BEGIN SERVICING

Before performing any service procedures within this section, read the following safety information and review the *Safety* section on page *3-1*.

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Reassembly of Starter Motor

1. Apply the appropriate starter bendix grease (obtain locally) to the pinion shaft. Reassemble the pinion shaft **(Figure 11-27, (5))**, pinion clutch assembly **(Figure 11-27, (1))**, return spring **(Figure 11-27, (4))** and pinion stop **(Figure 11-27, (3))**. Reinstall the retaining ring **(Figure 11-27, (2))** in the groove in the pinion shaft. Slide the piston stop over the retaining ring.

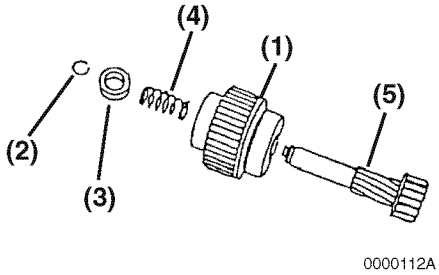


Figure 11-27

2. Reinstall the pinion clutch assembly into the bearing retainer assembly.
3. Reinstall the bearing retainer assembly and pinion assembly to the gear housing. Reinstall and tighten the three M4 bolts.
4. Apply a small amount of high temperature lithium grease (obtain locally) to the sliding portions of the shift lever **(Figure 11-28, (1))**. Reassemble the torsion spring **(Figure 11-28, (2))**, shift lever and dust cover(s) **(Figure 11-28, (3))**, plunger **(Figure 11-28, 4)** and magnetic switch assembly **(Figure 11-28, (5))**.

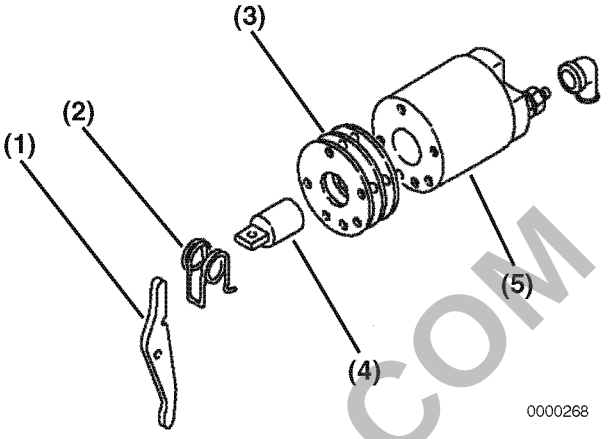


Figure 11-28

5. Reassemble the magnetic switch assembly to the gear housing. Pry the pinion away from the gear housing to allow installation of the magnetic switch assembly **(Figure 11-29)**.

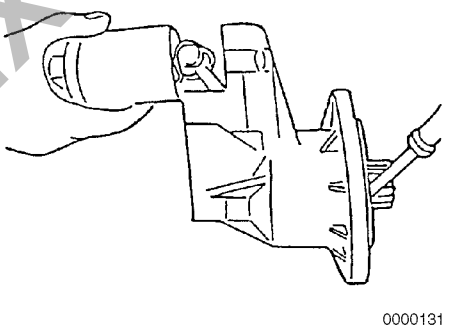


Figure 11-29

6. Secure the magnetic switch assembly to the gear housing using the two M6 bolts.

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