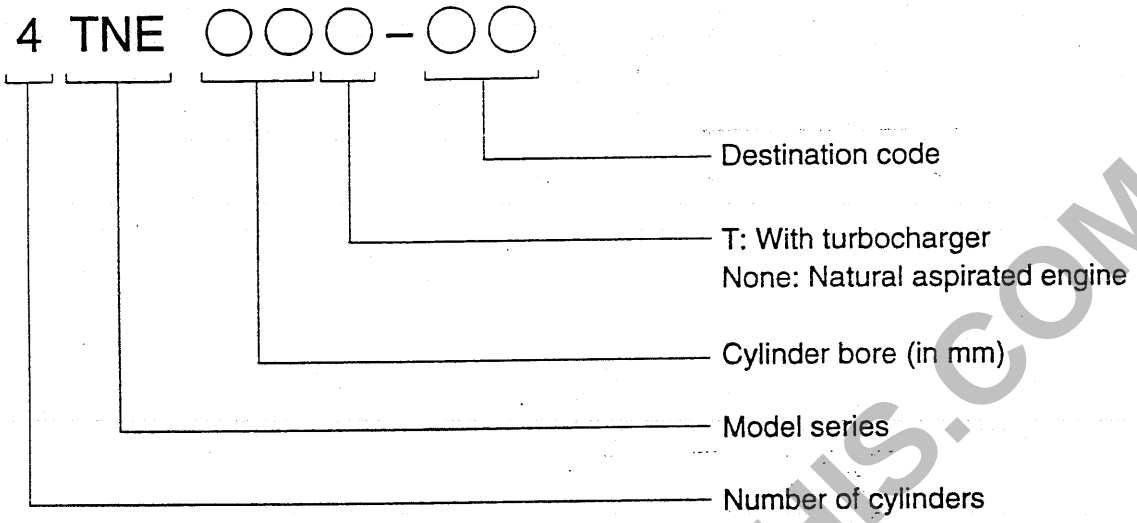
1.1 Engine Nomenclature



• Engine application class

	Application	Revolving speed	Number of revolutions (rpm)
CL	Generator driving	Constant speed	1500/1800
VM	General purpose	Variable speed	2000~2500

※The engine application class (CL or VM) is described in the specifications table.

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(3) Cooling water

Use clean drinkable water (tap water or rainwater) as the cooling water.

[NOTICE]

Always add antirust or antifreeze in the cooling water.
Especially in cold weather, be sure to add antifreeze to prevent freezing. Since scale or rust will be generated in the water piping when only clear water is used, the cooling performance is worsened. In a cold weather, the cooling water may be expanded by freezing to cause damage to the cooling system parts.

1) Rust preventive agent

Be sure to add the rust preventive agent to the cooling water. However, do not use it in cold weather because freezing will occur.

When you use a rust preventive agent sold on the market, be sure to follow the mixing rate designated by the manufacturer.
Replace the rust preventive agent once a year.

2) Antifreeze

in cold weather, be sure to add the antifreeze to prevent freezing.
If you use antifreeze, addition of the rust preventive agent is unnecessary. Antifreeze can be used throughout the year.
The mixing rate should be between 30% and 55%.

Lowest atmospheric temperature °C	–15 or above	–20	–25
Mixing rate %	30	35	40

When you use an antifreeze sold on the market, be sure to follow the mixing rate designated by the manufacturer.
Replace the antifreeze once a year.

[NOTICE]

Excessive addition of antifreeze will worsen engine cooling.
Always observe the mixing rate specified by the manufacturer for each ambient temperature.

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System	Cause \ Trouble symptom	Starting failure: Engine does not start.	Starting failure: Engine starts but stops soon. Exhaust smoke: None	Starting failure: Engine starts but stops soon. Exhaust smoke: Little	Starting failure: Engine starts but stops soon. Exhaust smoke: Much	Insufficient engine output: Exhaust color: Ordinary	Insufficient engine output: Exhaust color: White	Insufficient engine output: Exhaust color: Black	Poor exhaust color: During work: White	Poor exhaust color: During work: Black	High knocking sound during combustion	Abnormal engine sound	Uneven combustion sound	Hunting: During idling	Hunting: During work	Large engine vibration	Difficulty in returning to low speed	Excessive fuel consumption	Lubricating oil: Excessive consumption	Lubricating oil: Dilution by fuel oil	Lubricating oil: Mixture with water	Lubricating oil: Low L.O. pressure	Much blow-by gas	Cooling water: Overheat	Cooling water: Low water temperature	Air intake: Pressure drop	Air intake: Pressure rise	Exhaust temperature rise		Corrective action
Air/Exhaust Gas System	Clogged air filter				○			○		○			○													○				Clean.
	Engine used at high temperatures or at high altitude							○		○								○						○		○				Study output drop and load matching.
	Clogged exhaust pipe							○		○			○															○		Clean.
Electrical System	Starting motor defect	○																												Repair or replace. (See Chapter 9.)
	Alternator defect	○																												Repair or replace. (See Chapter 10.)
	Open-circuit in wiring	○																												Repair.
	Battery voltage drop	○																												Inspect and charge the battery. (See 3.10 in Chapter 3.)

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(B) Working Wear

⚠ CAUTION



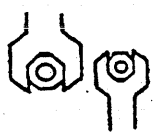
- **Wears for Safe Operation**
  Wear a helmet, working clothes, safety shoes and other safety protectors matching each job. Especially, wear well-fitting working clothes.
  [Otherwise]
  A serious accident such as trapping by a machine may arise.

(C) Tools to Be Used

⚠ WARNING

- **Appropriate holding and lifting**
  Never operate when the engine is supported with blocks or wooden pieces or only with a jack. To lift and hold the engine, always use a crane with a sufficient allowance in limit load or a rigid jack.
  [Otherwise]
  A serious accident may arise.

⚠ WARNING



- **Use of Appropriate Tools**
  Use tools matching the jobs to be done. Use a correctly sized tool for loosening or tightening a machine part.
  [Otherwise]
  A serious injury or engine damage may arise.

(D) Use of Genuine Parts, Oil and Grease

⚠ CAUTION

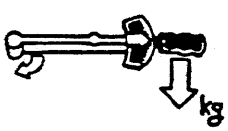


- **Always use genuine parts.**

  [Otherwise]
  Shortening of engine life or an unexpected accident may arise.

(E) Bolt and Nut Tightening Torques

⚠ WARNING



- **Always tighten to the specified torque if designated in the manual.**

  [Otherwise]
  Loosening or falling may cause parts damage or an injury.

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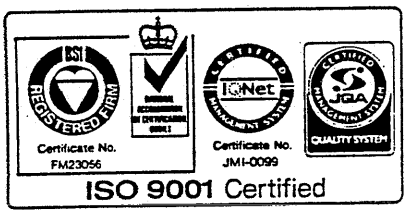
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FOREWORD

This manual describes the service procedures for the 4TNE94·98·106(T) engines (direct injection) for industrial use.

Please use this manual for accurate, quick and safe servicing of the said engine. Since the explanation in this manual assumes the standard type engine, the specifications and components may partially be different from the engine installed on individual work equipment (power generator, pump, compressor, etc.). Please also refer to the service manual for each work equipment for details.

The specifications and components may be subject to change for improvement of the engine quality. If any modification of the contents described herein becomes necessary, it will be notified in the form of a correction information each time.



This propduct has been developed, desigened and manufactured in a plant certified by the JMI, BSI and EQNET to conform to the quality assurance system standard provided as ISO 9001 (International Standard for Quality Assurance).

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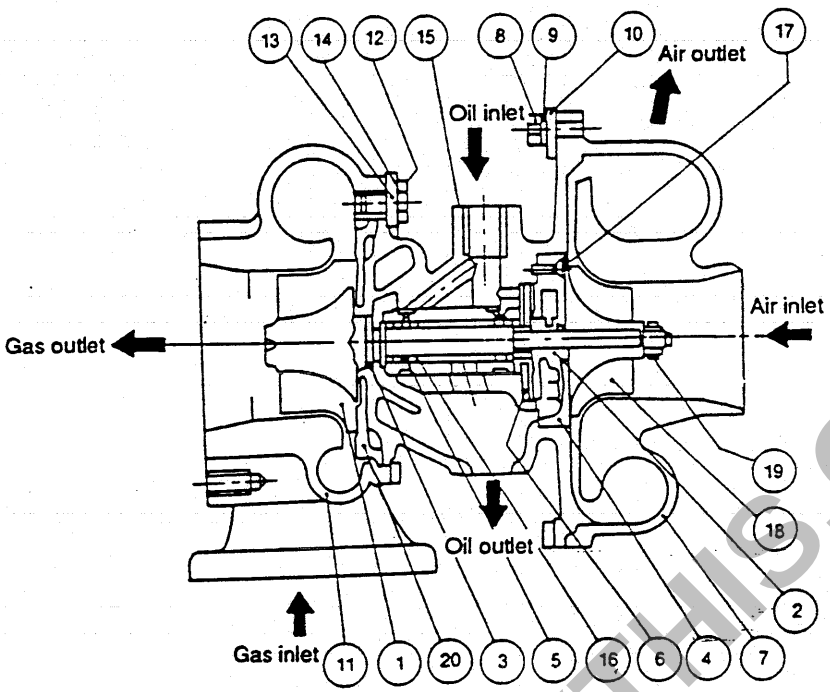
(4) 4TNE106T

Engine name		Unit	4TNE106T					
Engine specification class		–	CL		VM			
Type		–	Vertical, in-line, 4-cycle, water-cooled diesel engine					
Combustion chamber		–	Direct injection					
Number of cylinders		–	4					
Cylinder bore × stroke		mm × mm	106 × 125					
Displacement		ℓ	4.412					
Continuous rating	Revolving speed	rpm	1500	1800	–			
	Output	kW (hp)	54.8 (73.4)	65.5 (87.8)	–			
Rated output	Revolving speed	rpm	1500	1800	2000	2200	2400	2500
	Output	kW (hp)	60.3 (80.8)	72.1 (96.6)	69.9 (93.7)	75.8 (101.6)	81.6 (109.3)	84.2 (112.8)
Fuel injection timing (FID, bTDC)		deg	11~13					
Fuel injection pressure		MPa (kgf/cm²)	21.57~ 22.55 (220~230)					
Ignition order		–	1–3–4–2 (No. 1 cylinder on flywheel side)					
Power take off		–	Flywheel					
Direction of rotation		–	Counterclockwise (viewed from flywheel)					
Cooling system		–	Radiator					
Lubrication system		–	Forced lubrication with trochoid pump					
Starting system		–	Electric					
Applicable fuel		–	Diesel oil-ISO 8217 DMA, BS 2869 A1 or A2 (cetane No. 45 min.)					
Applicable lubricant		–	API grade class CD					
Battery capacity		V-AH	12–88 (5HR) or above					
Lubricant capacity (oil pan)	Total	ℓ	12.5					
	Effective	ℓ	5.5					
Cooling water capacity (engine only)		ℓ	6.0					
Engine dimensions	Overall length	mm	789					
	Overall width	mm	547					
	Overall height	mm	855					
Engine weight (dry)		kg	306					

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(2) Structure



No.	Part name
1	Turbine shaft
2	Oil thrower
3	Turbine side seal ring
4	Seal plate
5	Journal bearing
6	Thrust bearing
7	Compressor housing
8	M5 hexagon bolt
9	M5 spring washer
10	Compressor side clamp
11	Turbine housing
12	M6 hexagon bolt
13	Turbine side clamp
14	Lock washer
15	Bearing housing
16	Retaining ring
17	M3 countersunk flat head screw
18	Compressor wheel
19	Shaft end nut
20	Heat protector

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3.1 Oil Inspection

• Standard
The level shall be between the upper and lower limit lines on the dipstick.

———	4TNE94•98	4TNE106(T)
Total volume	10.2 ℓ	12.5 ℓ
Effective volume	4.5 ℓ	5.5 ℓ

① The oil shall not be contaminated heavily and have appropriate viscosity. No cooling water or diesel gas oil shall be mixed.
② Insert the dipstick fully and check the oil level.

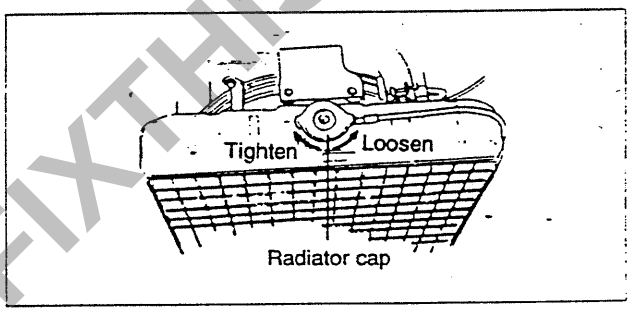
[NOTICE]
The oil should not be overfilled to exceed the upper limit line. Otherwise, oil may jet out from the breather or the engine may become faulty.

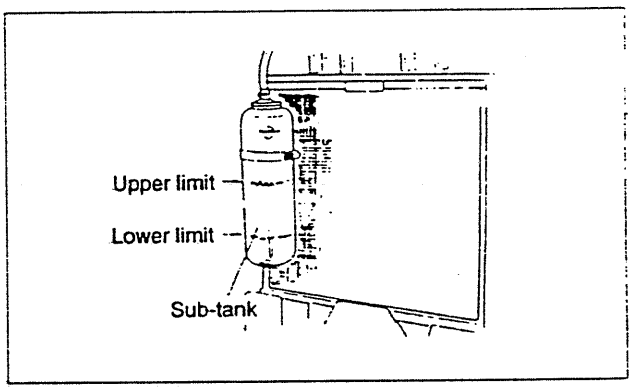
3.2 Cooling Water Inspection

• Standard
Engine: The radiator shall be filled up.
Sub-tank: The water level shall be between the upper and lower limit lines.

———		4TNE94•98	4TNE106(T)
Capa-city	Engine	4.2 ℓ	6.0 ℓ
	Sub-tank	Approx. 0.8 ℓ	

① The cooling water shall be checked when the engine is cold.
② If the water level is normal in the sub-tank but low in the radiator, check loosened clamping of the rubber hose between the radiator and sub-tank or tear in the hose.

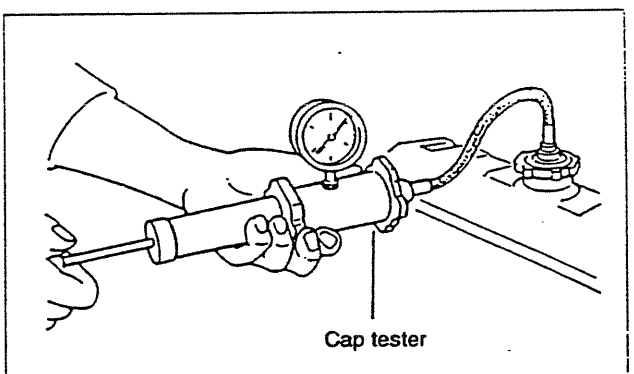




3.3 Inspecting Water Leak from Cooling Water System and Radiator

(1) Water leak check in cooling water system

① Fill cooling water to the normal level in the radiator, and install the cap tester on the radiator.
② Operate the manual pump to set the pressure to 0.9±0.15 kgf/cm². If the cap tester pressure gage reading drops then, water is leaking from the cooling water system. Check the water leaking point.



Water leak check in cooling water system

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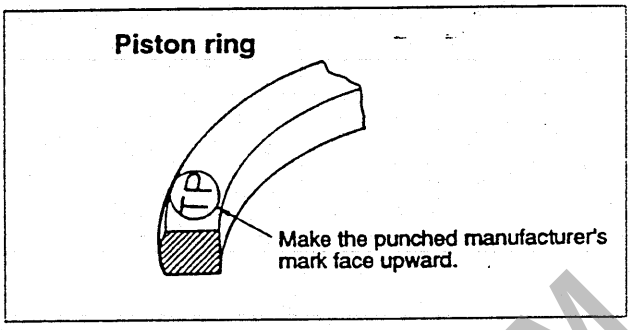
Point 6 Piston pin and rings

Disassemble:

- Use the piston ring replacer (see 11.1-10 in Chapter 11), remove the piston rings.
- Remove the circlip and remove the piston pin by pushing it out.

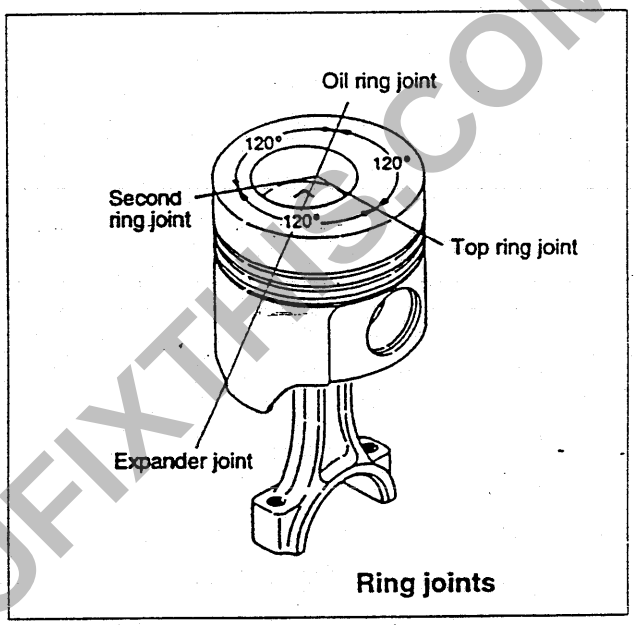
Reassemble:

- Install each piston ring on the piston, with the punched manufacturer's mark facing upward.



Reassemble:

- The piston ring joints shall be staggered at by 120° intervals. Do not position the top ring joint vertical to the piston pin. The coil expander joint shall be opposite to the oil ring joint.



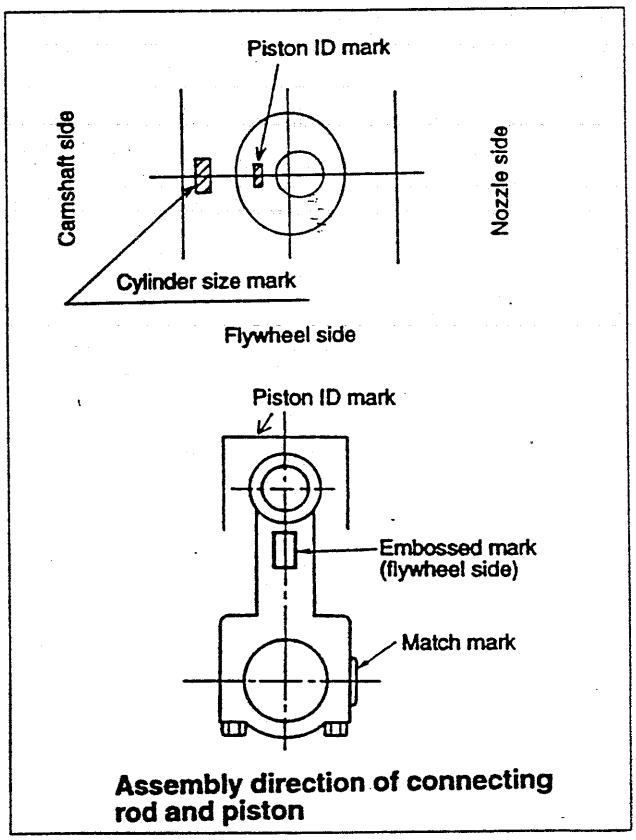
Ring joints

Reassemble:

- When installing the piston pin to the rod and piston, the punched match mark on the big end of the connecting rod shall be opposite to the size mark on the piston top.

Reassemble:

- Install the piston in the cylinder block with the punched mark on the big end of the rod on the nozzle side. (The embossed mark at the connecting rod I-beam section shall be on the flywheel side.)



Assembly direction of connecting rod and piston

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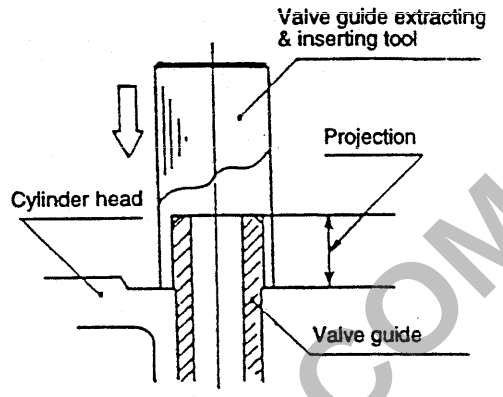
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(7) Valve guide replacement

① Use a valve guide extraction tool (11.1-1 in Chapter 11) and extract the valve guide from the cylinder head.
② Put liquid nitrogen or ether (or alcohol) with dry ice added in a container and put the valve guide for replacement in it for cooling. Then insert it in with a valve guide inserting tool (10.1-2 in Chapter 10).
③ Check the inside diameter and finish to the standard inside diameter as required with a reamer.
④ Check the projection from the cylinder head.

–	Projection (mm)
4TNE94•98	14.7~15.0
4TNE106 (T)	13.2~13.5

Valve guide replacement



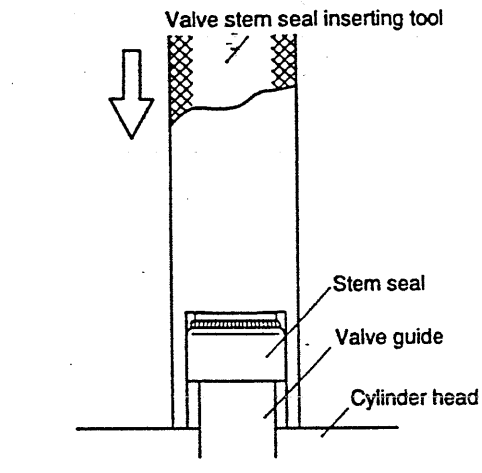
⚠ CAUTION

Do not touch the cooled valve guide with bare hands to avoid skin damage.

(8) Valve stem seal replacement

Always use a new seal after the intake/exhaust valve is disassembled. Since the one for the exhaust valve is marked with yellow paint, do not confuse the intake and exhaust valves.

① Apply engine oil to the lip.
② Push with the inserting tool (11.1-5 in Chapter 11) for installation.



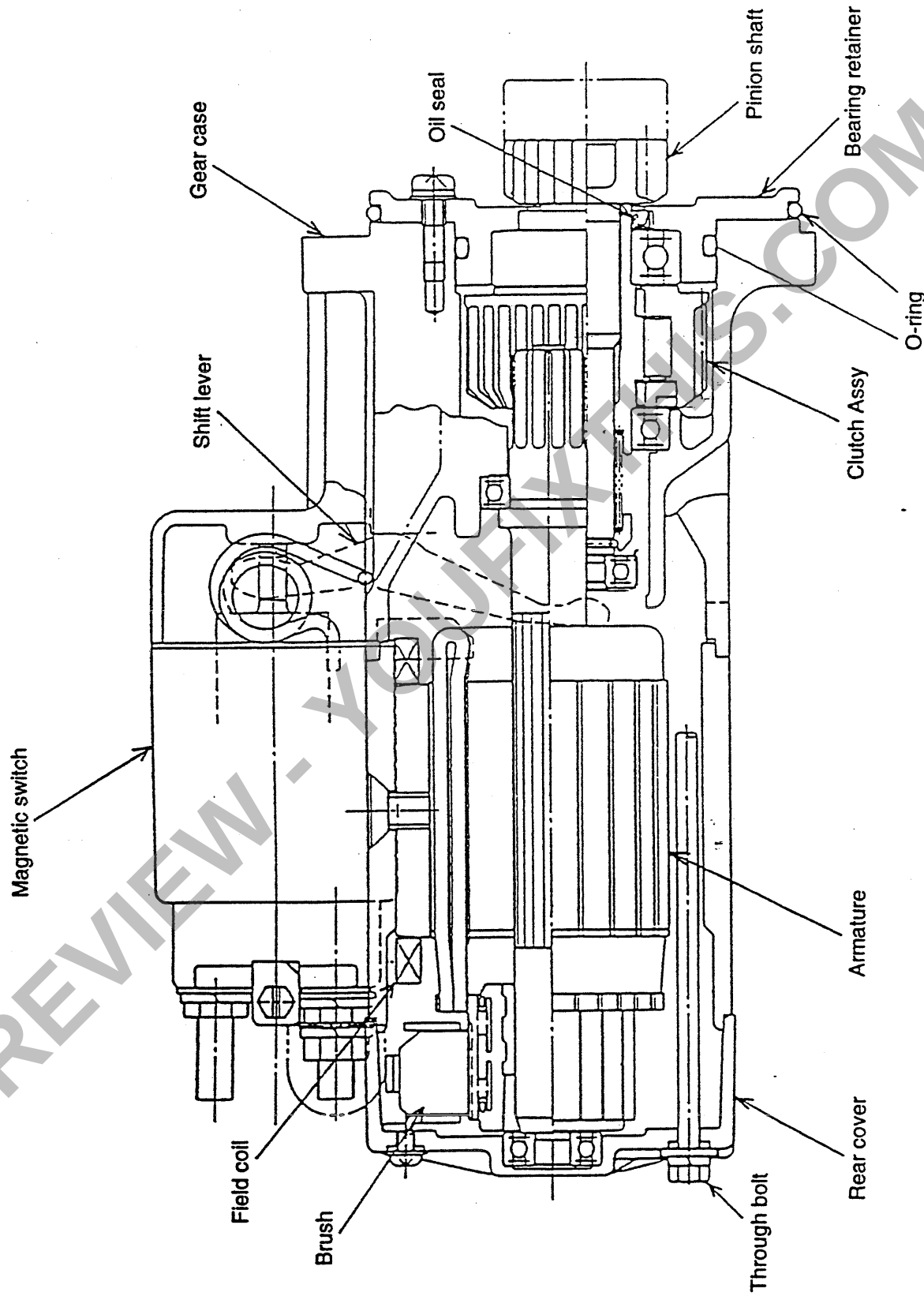
Stem seal insertion

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9.1.2 Components



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