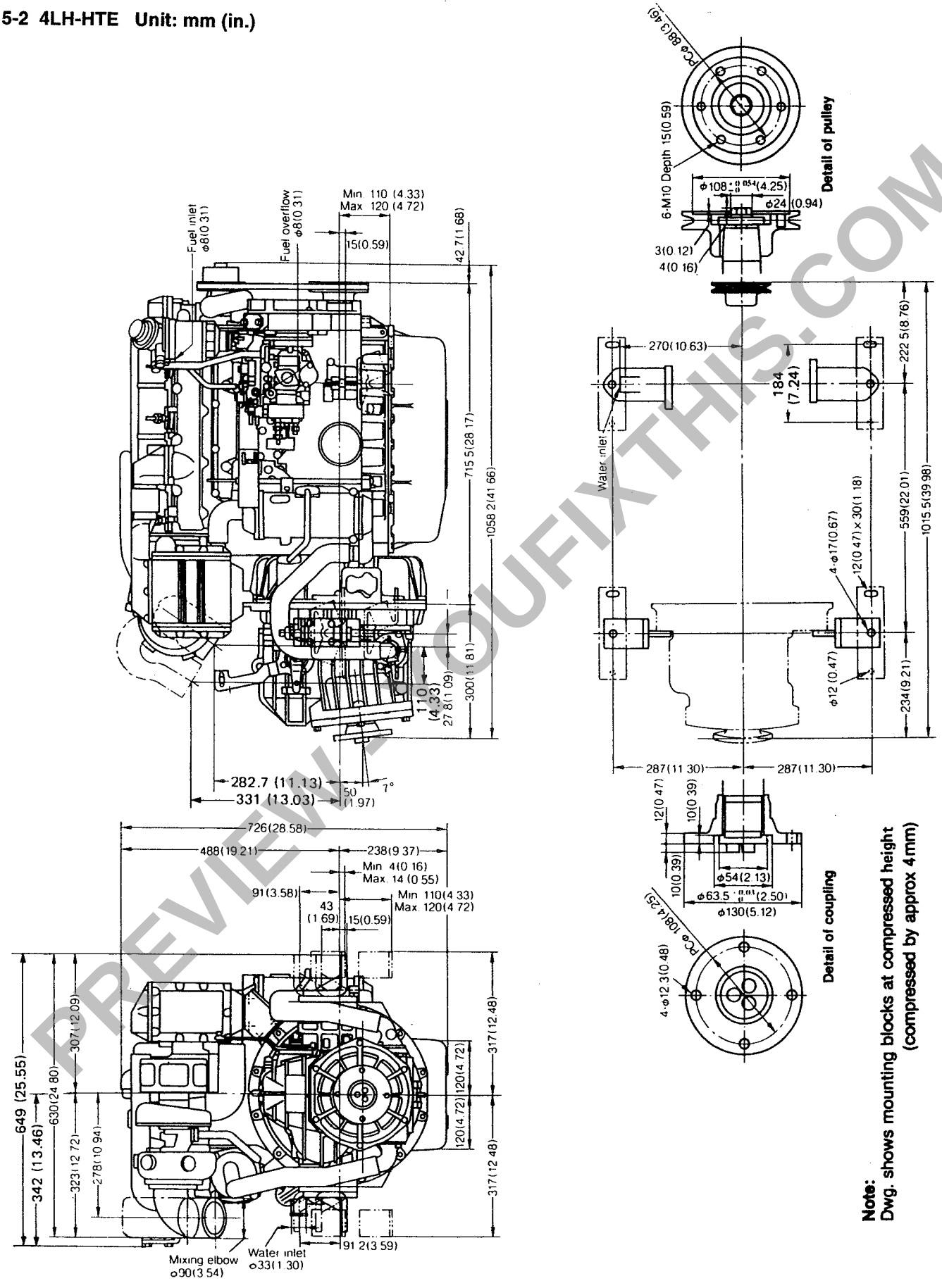
5-2 4LH-HTE Unit: mm (in.)



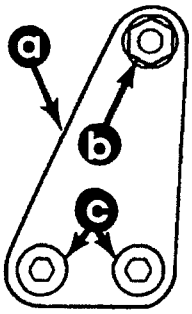
Note:
Dwg. shows mounting blocks at compressed height (compressed by approx 4mm)

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NOTE: Anchor stud for shift cable on early style bracket with only one locating hole should be installed as shown.



a - Bracket, Shift Cable
b - Shift Cable Anchor Stud
c - Bracket-to-Transmission Fasteners

Early Style Shift Cable Bracket Shown

4. Center cable end-play, then adjust cable barrel to align holes in barrel and cable end guide, with attaching points on transmission.

5. Temporarily install shift cable. Do not secure at this time.

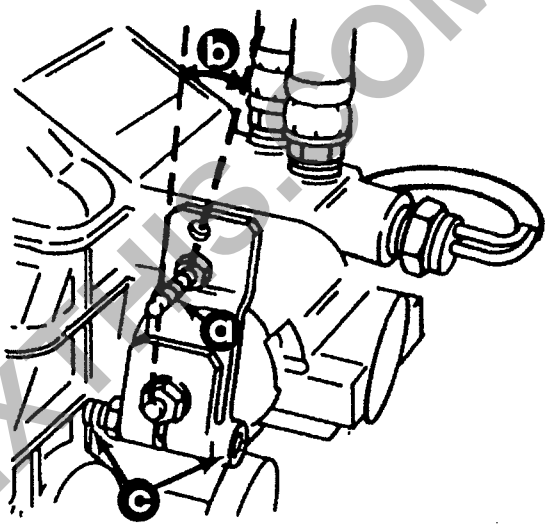
IMPORTANT: Transmission is "fully" in gear when shift lever comes to a stop, in either direction.

6. Place remote control shift lever in the forward gear position. Check to ensure transmission is fully in gear, as follows:

   a. Hold shift lever in position.
   b. Carefully slide shift cable off of anchor points.
   c. Attempt to move transmission shift lever further.

7. Temporarily install shift cable onto anchor points again. Do not secure at this time. Place remote control shift lever in the reverse gear position. Check that transmission is fully in gear, following the same procedure as outlined above.

8. If transmission shift lever will position properly in one gear, but not in the other, recheck shift cable adjustment. If transmission shift lever will not position properly in both gears, move transmission shift lever stud (a), from top hole in shift lever, to bottom hole, and recheck for proper positioning. If proper positioning is still not obtained, remote control does not provide sufficient shift cable travel and must be replaced.



a - Shift Lever Stud
b - Lever in Neutral Detent, Must Be Approximately 10° Aft of Vertical
c - Clamping Bolt

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Models 4LH-TE,4LH-HTE,4LH-DTE,4LH-STE

CHAPTER 1 GENERAL

1. Exterior Views 1-1
2. Specifications 1-2
3. Service Data Sheet 1-3
4. Performance Curves 1-5
5. Dimensions 1-9
6. Piping Diagrams 1-13
7. Electrical Diagrams 1-17

CHAPTER 2 BASIC ENGINE

1. Disassembly and Reassembly Tools 2-1
2. Cylinder Block 2-9
3. Cylinder Liners 2-12
4. Cylinder Head 2-14
5. Piston and Piston Pins 2-21
6. Connecting Rod 2-25
7. Crankshaft and Main Bearing 2-28
8. Camshaft and Tappets 2-32
9. Timing Gear 2-35
10. Flywheel 2-36

CHAPTER 3 FUEL INJECTION EQUIPMENT

3-1. DISTRIBUTOR TYPE

1. Fuel Supply System 3-1-1
2. Bleeding and Checking Injection Timing 3-1-2
3. Fuel Injection Pump Outline 3-1-4
4. Fuel System 3-1-5
5. Injection Pump Construction and Operation 3-1-6
6. Governor Mechanism 3-1-16
7. Timer Construction and Operation 3-1-38
8. Magnet Valve 3-1-43
9. Pump Reassembly, Adjustment and Inspection 3-1-44
10. Test Bench Adjustment of VE Pump 3-1-52
11. Troubleshooting 3-1-55
12. Fuel Injection Nozzle 3-1-59
13. Fuel Filler 3-1-63

3-2. YPES-AL TYPE

1. Fuel Supply System 3-2-1
2. Disassembly, Reassembly and Inspection of Governor 3-2-15
3. Disassembly, Reassembly and Inspection of Fuel Injection Pump 3-2-21
4. Adjustment of Fuel Injection and Governor 3-2-31
5. Automatic Advancing Timer 3-2-38
6. Fuel Feed Pump 3-2-40
7. Fuel Injection Nozzle 3-2-43
8. Troubleshooting 3-2-48
9. Tools 3-2-50
10. Fuel Injection Pump Specifications 3-2-53
11. Service Data 3-2-54

CHAPTER 4 INTAKE AND EXHAUST SYSTEM

1. Intake and Exhaust System 4-1
2. Intake Silencer 4-3
3. Intake Manifold 4-4
4. Turbocharger 4-6
5. Mixing Elbow 4-38
6. Breather 4-39

CHAPTER 5 LUBRICATION SYSTEM

1. Lubrication System 5-1
2. Lube Oil Pump 5-3
3. Lube Oil Filter 5-6
4. Oil Pressure Control Valve 5-8
5. Lube Oil Cooler 5-9
6. Piston Cooling Nozzle 5-10
7. Rotary Waste Oil Pump (Optional) 5-11

CHAPTER 6 COOLING WATER SYSTEM

1. Cooling Water System 6-1
2. Sea Water Pump 6-4
3. Fresh Water Pump 6-7
4. Heat Exchanger 6-10
5. Pressure Cap and Sub Tank 6-12
6. Thermostat 6-14
7. Kingston Cock (Optional) 6-16
8. Sea Water Filter (Optional) 6-17
9. Bilge Pump and Bilge Strainer (Optional) 6-18

CHAPTER 7 REDUCTION AND REVERSING GEAR

7-1 Marine gear model KM5A

1. Construction 7-1-1
2. Shifting Device 7-1-5
3. Inspection and Servicing 7-1-10
4. Special Tools 7-1-20
5. Disassembly 7-1-21
6. Reassembly 7-1-29

7-2 Marine gear model HSW630A1

1. Construction 7-2-1
2. Shifting Device 7-2-2
3. Inspection and Servicing 7-2-6
4. Disassembly 7-2-9
5. Reassembly 7-2-23

CHAPTER 8 REMOTE CONTROL (OPTIONAL)

1. Remote Control System 8-1
2. Remote Control Installation 8-2
3. Remote Control Inspection 8-5
4. Remote Control Adjustment 8-6

CHAPTER 9 ELECTRICAL SYSTEM

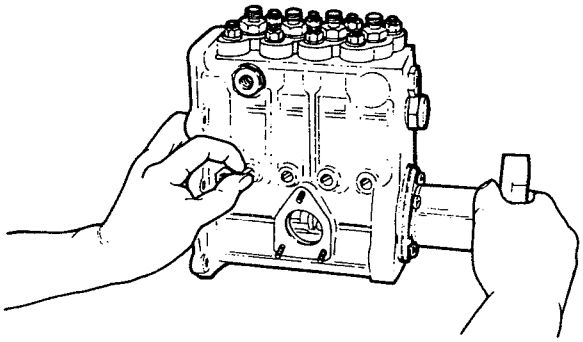
1. System Diagram 9-1
2. Battery 9-2
3. Starter Motor 9-7
4. Alternator 9-17
5. Instrument Panel 9-35
6. Warning Devices 9-37
7. Tachometer 9-40

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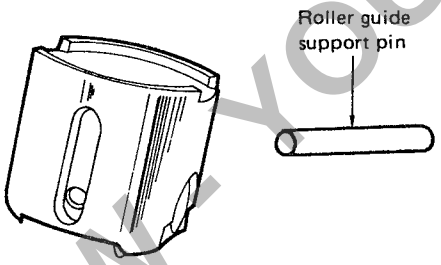
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(4) Turn the camshaft and push the roller guide support pin into the hole on the stopper groove of the roller guide.



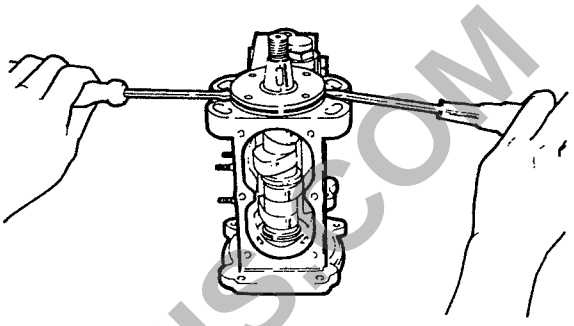
NOTE: If the camshaft does not turn, put double nuts or a coupling on the end of camshaft.



(5) Remove the camshaft woodruff key.

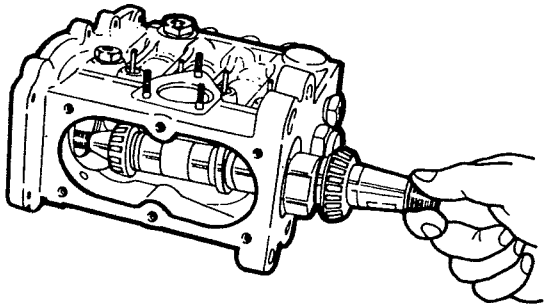
(6) Remove the 4 bolts of the bearing holder.

(7) Place a screwdriver in the two grooves on the camshaft bearing holder mounting surface, and pull out the camshaft bearing holder.



NOTE: 1. Be careful not to damage the oil seal with the threaded part of the camshaft.
2. Be careful not to lose the shims between the pump and bearing holder.

(8) Put a plate against the governor end side of the camshaft and tap it lightly. Pull out the camshaft and drive side bearing.



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2. Specifications

Model		4LH-TE	4LH-HTE	4LH-DTE	4LH-STE
Type		Vertical 4-cycle water cooled diesel engine			
Combusition system		Direct injection			
Aspiration		Turbocharger	Turbocharger with air cooler		
Number of cylinders		4			
Bore × storoke	mm (in.)	100 × 110 (3.84 × 4.33)			
Displacement	e (cu.in.)	3.455 (210.82)			

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1-5 Governor construction

Diesel engines are used in extremely varied conditions, with a wide range of loads and rpms. The governor has the important function of controlling the fuel injection quantity. It quickly responds to changes in rpm by adjusting the position of the control rack.

YPES-AL fuel injection pump is equipped with the all speed type governor. The governor is available in 2 types: one has the torque rise spring (angleich spring) (Fig. 1), and the other has the smoke cut spring (angleich spring) (Fig. 2).

Fig. 1 Governor with torque rise spring



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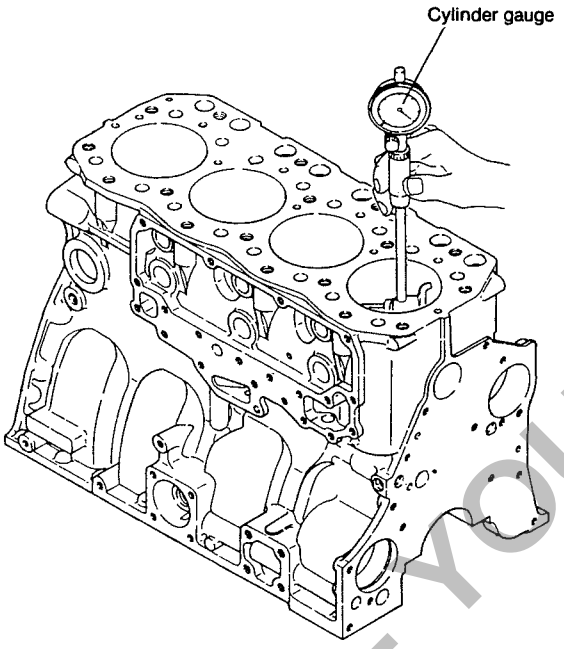
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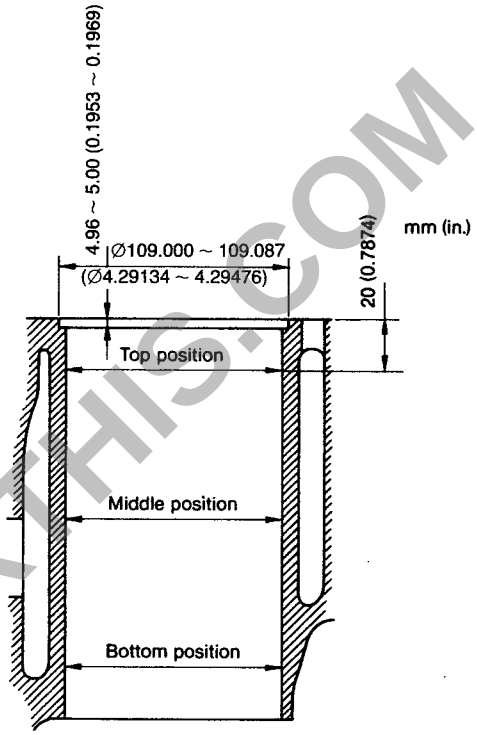
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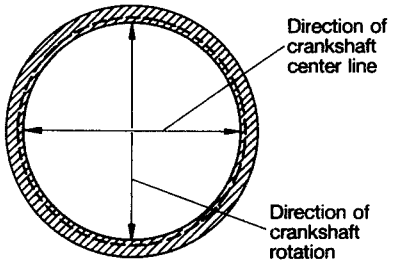
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2-5 Cylinder bore measurement

Measure the bore diameter with a cylinder gauge at the positions shown in the figure.
Replace the cylinder bore when the measured value exceeds the wear limit. Measurement must be done in at least 3 positions as shown in the figure, namely, the top, middle and bottom positions in both directions along the crankshaft rotation and crankshaft center lines.







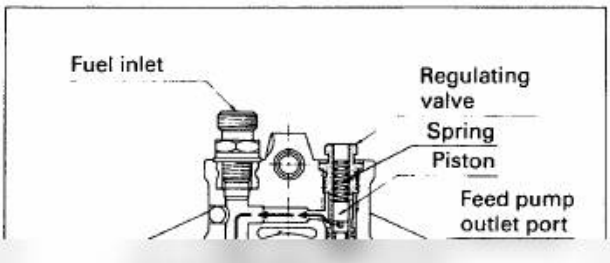
mm (in.)

	Standard	Wear limit
Cylinder bore dia.	Ø103.00 ~ 103.03 (Ø4.0551 ~ 4.0563)	Ø103.06 (Ø4.0575)
Cylinder roundness	0 ~ 0.01 (0 ~ 0.0004)	0.02 (0.0008)

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Regulating Valve



Feed pump fuel oil delivery pressure increases proportionately with an increase in injection pump speed.
However, the total fuel oil injection quantity necessary for the engine is considerably less than that delivered by the feed pump. Therefore, in order to prevent an excessive increase in the pump chamber pressure caused by the excess fuel oil, and to adjust the pump chamber pressure so that it is usually within the spe-

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9. Pump Reassembly, Adjustment and Inspection

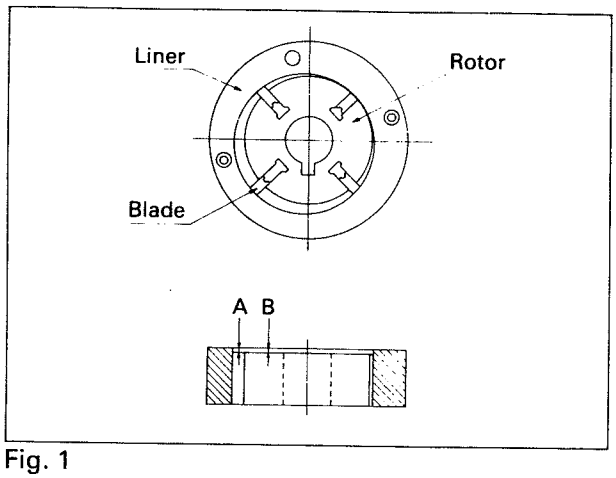
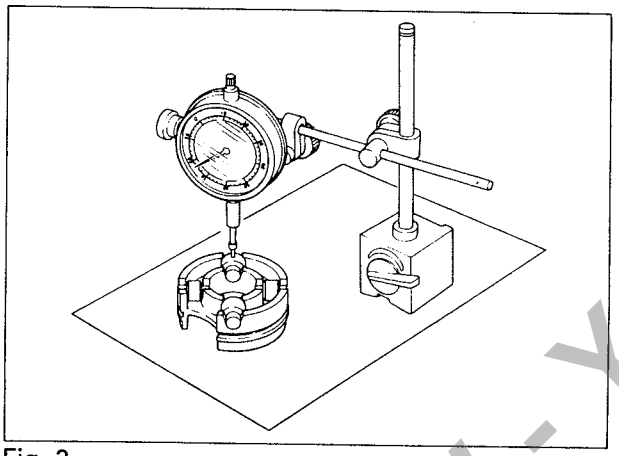


Fig. 1

1. Feed Pump Assembly

Set the rotor and blades inside the liner as a unit, so that their axial clearance will be within the specified tolerance. (The feed pump is delivered as a pre-adjusted assembly.)

Clearance between liner and rotor : A
0.010–0.020 mm.
Clearance between liner and blades: B
0.010–0.020 mm.


Fig. 2

2. Roller Height

When reassembling the roller holder, select the roller so that the difference in height (See Fig. 2) will be within the specified tolerance. (The roller holder is delivered as a pre-adjusted assembly.)

Difference in roller height:
±0.02 mm.

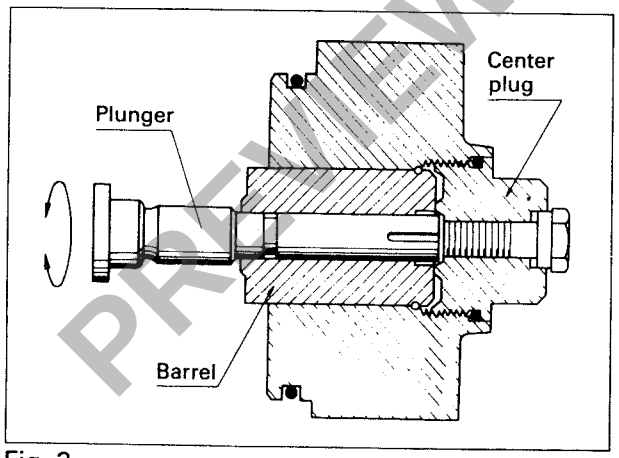


Fig. 3

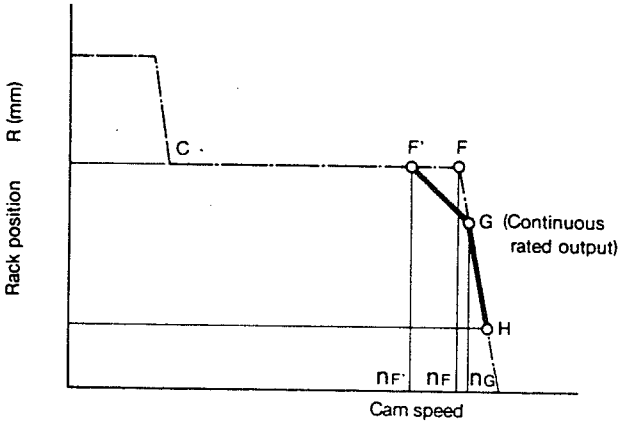
3. Distributor Head Inspection

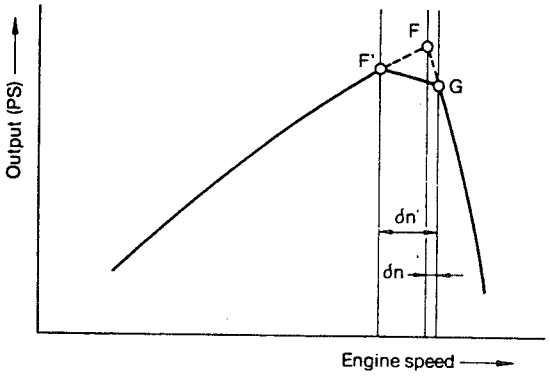
a) Plunger barrel movement.
With the center plug tightened to the head at the specified torque (6-8 kg.m) insert the plunger into the barrel. Confirm that in any position the plunger slides smoothly in the barrel.

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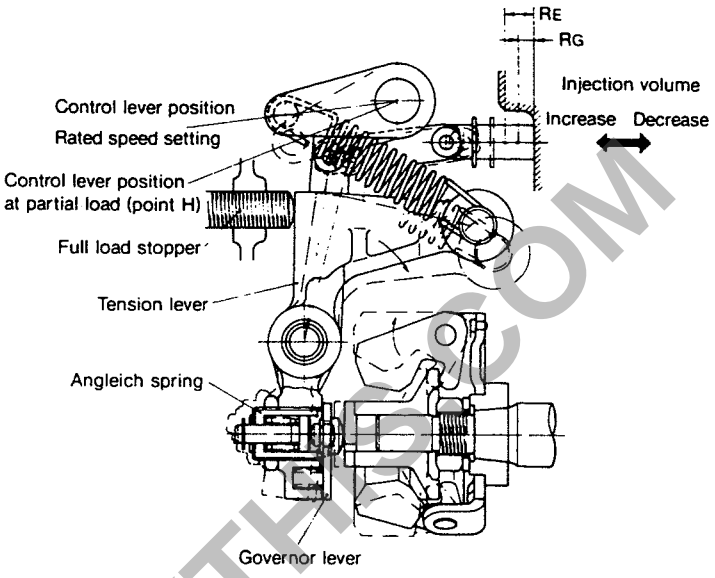


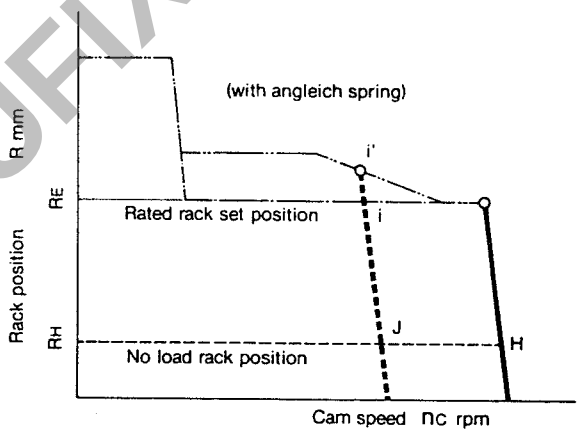
The torque spring thus provides for increasing injection volume as the speed falls. This increases the engine torque and in turn prevents engine stopping due to sudden increases in load. This also contributes to strong engine output characteristics.

(7) No-load maximum speed

When the load decreases from full load max. speed and engine speed increases, the increased thrust load of the governor weight acting on the governor spring through the tension lever exceeds the set load of the spring. The tension lever and governor lever descend clockwise; the control rack is pushed to the no-load injection volume position (R_H) and the engine is operated at no-load max. speed.

When the engine is being used at a partial load, the governor spring functions in the same way at a lower speed (i, i''–j) as for full load max. speed, (because the governor spring set load is also smaller).





(8) Stopping the engine

The engine stops when you turn the governor control lever all the way to stop.

On engines equipped with a stop device, the engine can be stopped by moving the control rack to the stop position, regardless of the control lever position.

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Fault		Cause	Remedy
3. Engine's output is insufficient.	Defective injection timing, and other failures.	(1) Knocking sounds caused by improper (too fast) injection timing.	Inspect and adjust
		(2) Engine overheats or emits large amount of smoke due to improper (too slow) injection timing.	Inspect and adjust
		(3) Insufficient fuel delivery from feed pump.	Repair or replace
	Nozzle movement is defective	(1) Case nut is loose.	Inspect and retighten
		(2) Defective injection nozzle performance.	Repair or replace nozzle
		(3) Nozzle spring is broken.	Replace
		(4) Excessive oil leaks from nozzle.	Replace nozzle assembly

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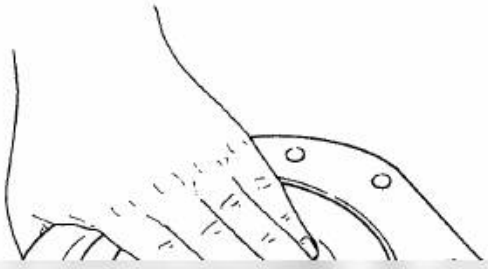
- Insert flinger sleeve (11), complete with piston rings (6) into backplate (17). When necessary press piston rings together using screw driver. **Illustration 3.10**
- Sealing backplate (17) to bearing housing: Coat seating face of backplate (17) with LOCTITE 573. **Illustration 3.11**
- For constructions with O-ring seals, coat the O-ring (16) with acid-

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Measuring clearance between impeller and pump body.



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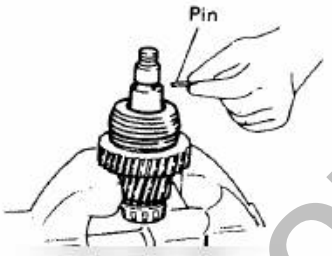
5-2 Disassembling the clutch shaft

5-2-1 Clutch gear (A) side

(1) Loosen the calking of the end nut and remove the nut. Remove the nut by a torque wrench, fixing the clutch shaft in a vice.



(3) Remove the pin.



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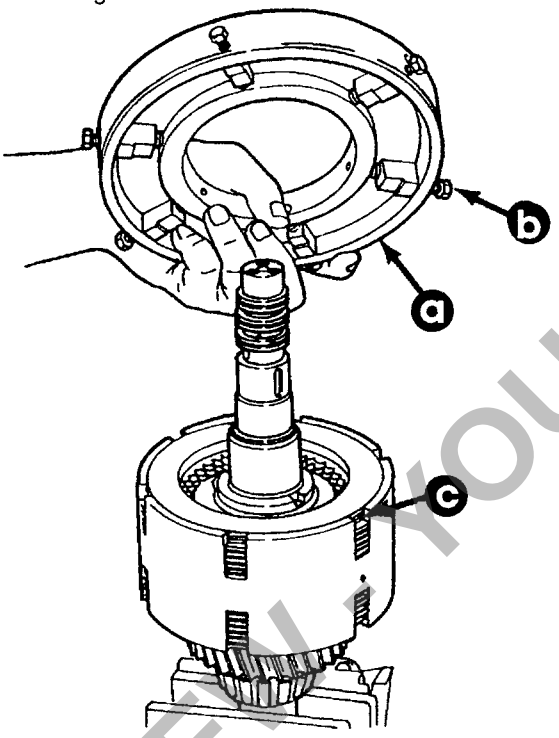
34. Position snap ring compression tool on clutch assembly so that compression screws are centered over slots in clutch housing.

35. Remove end disc and snap ring as follows:

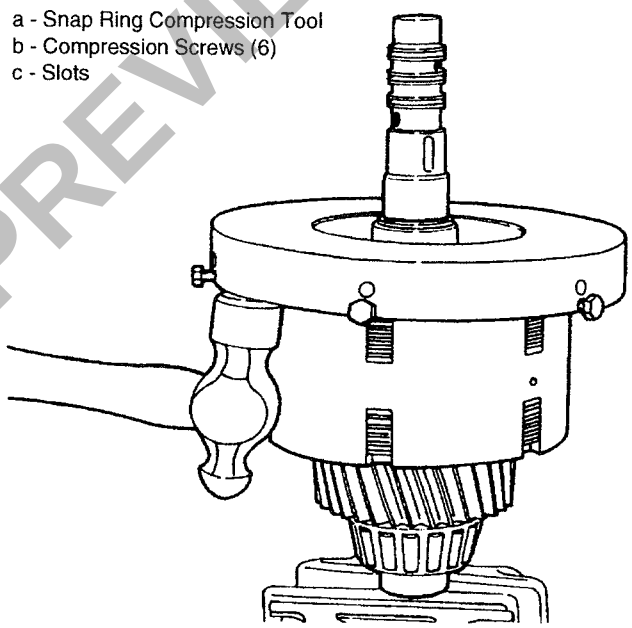
    a. Tighten all compression screws until a slight resistance is felt.

    b. Tighten compression screws evenly (approximately 1/2 turn at a time).

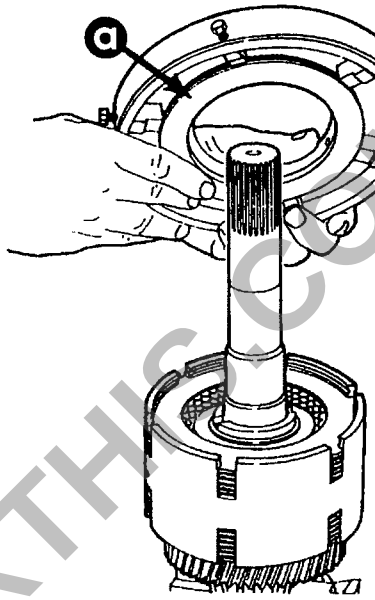
    c. Tap up rightly on bottom edge of compression tool unitil snap ring pops up and out of groove in clutch housing.



a - Snap Ring Compression Tool
b - Compression Screws (6)
c - Slots

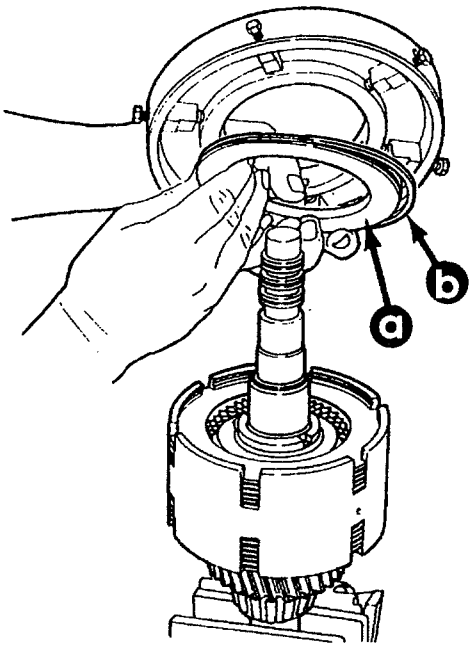


NOTE: For ease of reassembly, end disc and snap ring should not be removed from tool unless their condition is questionable.



a - End Disc (Snap Ring Compressed)

d. If necessary, remove end disc and snap ring from tool.



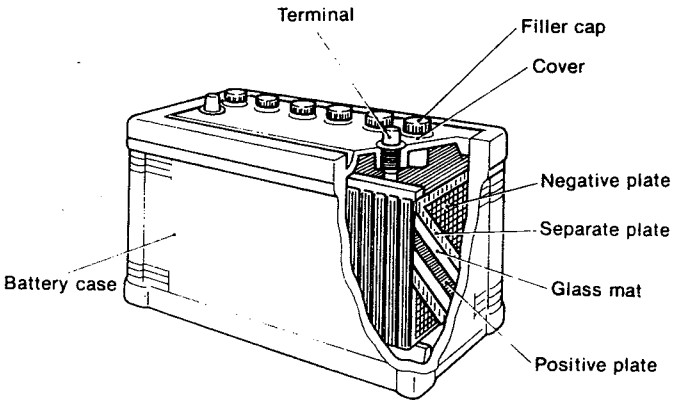
a - End Disc
b - Snap Ring

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2. Battery

2-1 Construction



The battery utilizes chemical action to convert chemical energy to electrical energy. This engine uses a lead acid battery which stores a fixed amount of power that can be used when required. After use, the battery can be recharged and used again.
As shown in the figure, a nonconductive container is filled with dilute sulfuric acid electrolyte. Lead dioxide positive plates and lead dioxide negative plates separated by glass mats are stacked alternately in the electrolyte. The positive and negative plates are connected to their respective terminals.
Power is removed from the battery by connecting the load across these two terminals.
When the battery is discharging, an electric current flows from the positive plates to the negative plates. When the battery is being charged, electric current is passed through the battery in the opposite direction by an external power source.

2-2 Battery capacity and battery cables

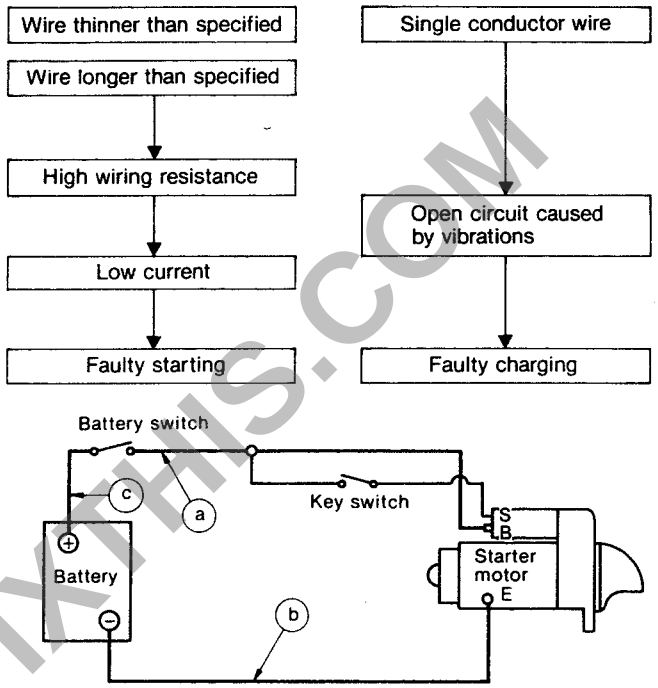
2-2.1 Battery capacity

Since the battery has a minimum capacity of 12V, 70AH, it can be used for 100 ~ 150AH.

Battery capacity	minimum	12V — 100AH
	standard	12V — 120AH
	cold weather	12V — 150AH
Full charged specific gravity		1.26

2-2.2 Battery cable

Wiring must be performed with the specified electric wire. Thick, short wiring should be used to connect the battery to the starter, (soft automotive low-voltage wire [AV wire]). Using wire other than that specified may cause the following troubles:



The overall lengths of the wire between the battery (+) terminal and the starter (B) terminal, and between the battery (–) terminal and the starter (E) terminal, should be determined according to the following table.

Voltage system	Allowable wiring voltage drop	Conductor cross-section area	a + b + c allowable length
12V	0.2V or less/100A	20mm² (0.0311 in.²)	Up to 2.5m (98.43 in.)
		40mm² (0.062 in.²)	Up to 5m (196.87 in.)

Note: Excessive resistance in the key switch circuit (between the battery and start [S] terminals) can cause improper pinion engagement. To prevent this, follow the wiring diagram carefully.

2-3 Inspection

The quality of the battery governs the starting performance of the engine. Therefore the battery must be routinely inspected to ensure that it functions perfectly at all times.

2-3.1 Visual inspection

(1) Inspect the case for cracks, damage and electrolyte leakage.
(2) Inspect the battery holder for tightness, corrosion, and damage.
(3) Inspect the terminals for rusting and corrosion, and check the cables for damage.
(4) Inspect the caps for cracking, electrolyte leakage and clogged vent holes.
Correct any abnormal conditions found. Clean off rusted terminals with a wire brush before reconnecting the battery cable.

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