

TABLE OF CONTENTS

	Page
Table of Contents	iii
Introduction.....	1-1
Safety	2-1
General Service Information.....	3-1
Governor	4-1
Fuel Injection Pump.....	5-1
Adjustment	6-1
Fuel Injection Nozzle	7-1
Troubleshooting.....	8-1

FUEL INJECTION PUMP

The MP fuel injection pump was developed for use on Yanmar Direct Injection (DI) diesel engines to comply with new exhaust gas emission regulations.

The MP fuel injection pump is a mono-plunger fuel pump that utilizes a distribution shaft to deliver equal amounts of fuel to each cylinder.

Fuel Injection Pump Nameplate

The fuel injection pump nameplate is located on the outside of the aluminum pump body. The fuel injection pump eleven digit part number (**Figure 3-1, (1)**), identification number (**Figure 3-1, (2)**) and manufacture date code (**Figure 3-1, (3)**) are located on the name plate. The information on the fuel injection pump nameplate is required for calibration and service parts information.

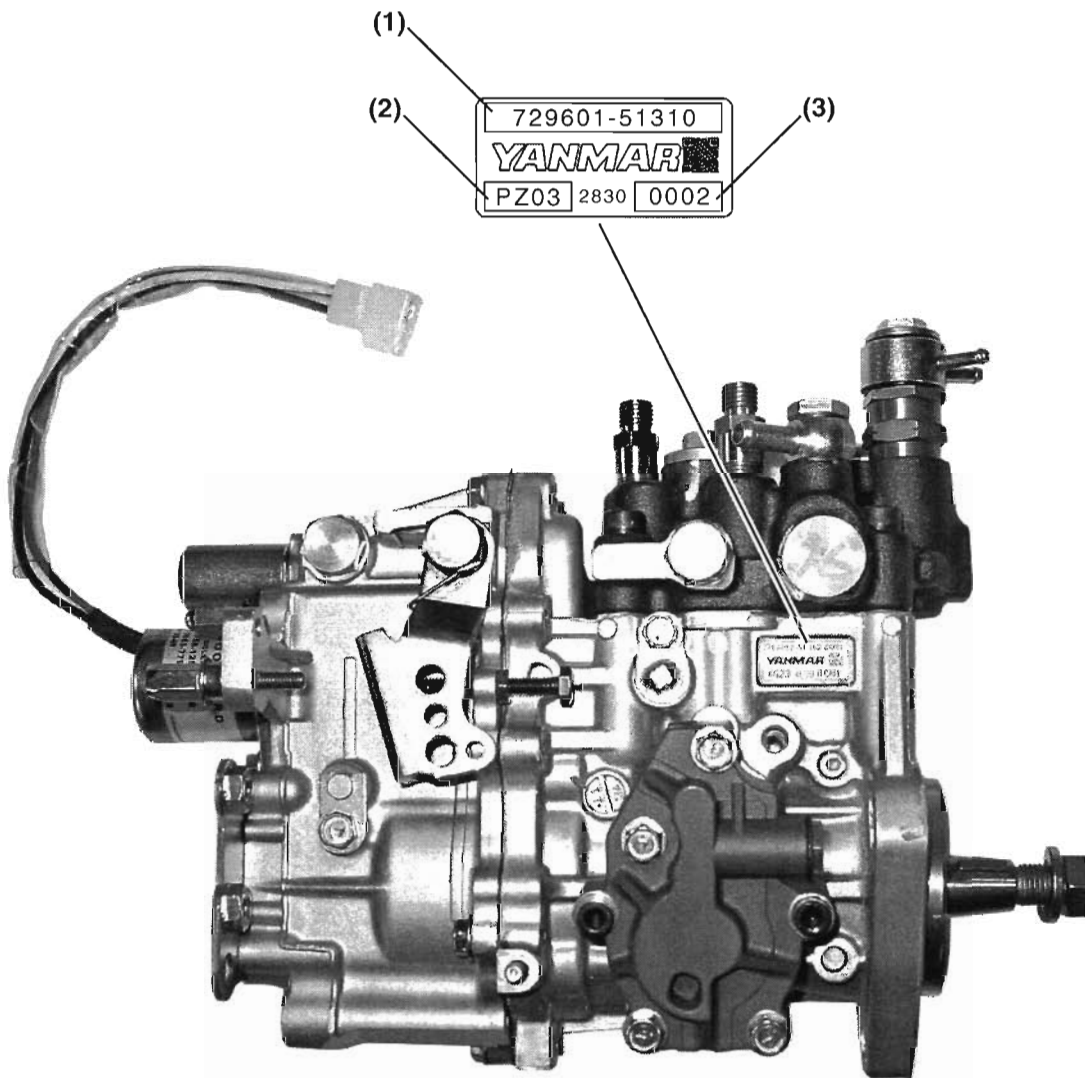
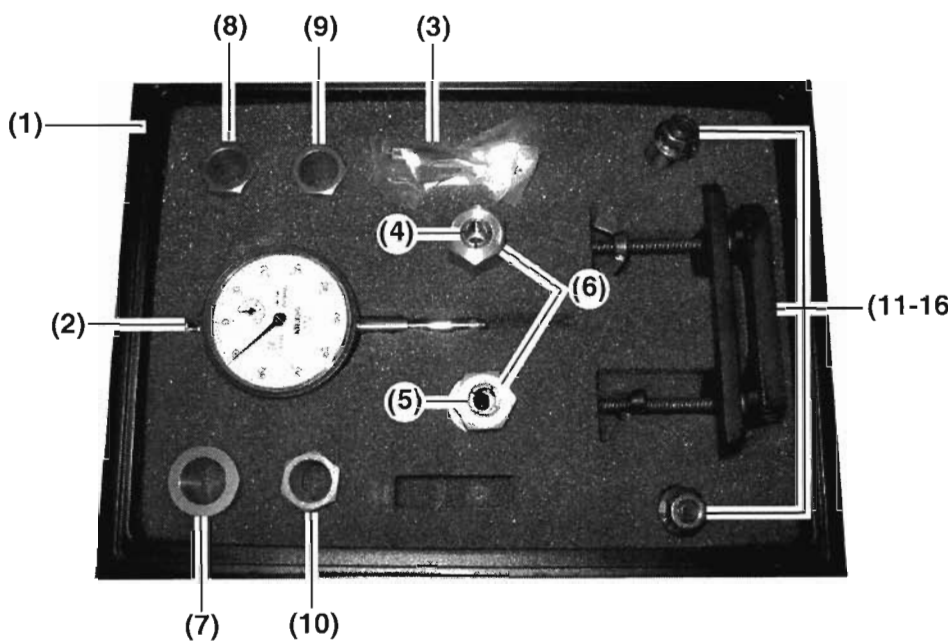


Figure 3-1

Name of tool	Image		
<p>Fuel Injection Pump Special Tool Kit P/N 458091</p> <p>Includes: Dial Indicator Set with Adapters and Plunger Spring Compressor</p>			
	0003542a		
No.	Item	Yanmar Part No.	Qty.
1	Carrying Case	15809000	1
2	Dial Indicator	15809001	1
3	30 mm Extension Rod	15809002	1
4	M14 Adapter	15809003	1
5	M16 Adapter	15809004	1
6	Adapter Nut	15809005	2
7	Lift Gauge, 28.55 mm	15809007	1
8	Lift Gauge, 25.5 mm	15809008	1
9	Lift Gauge, 25.9 mm	15809009	1
10	Lift Gauge, 26.3 mm	15809010	1
11 - 16	Base Spring Compressor	15809011	1
	Top, Spring Compressor	15809012	1
	Rod, Spring Compressor	15809013	2
	U-Nut, M8	26366-080002	2
	Bolt, M8x50	26450-080502	2
	Wing Nut M6	26636-060002	2

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

GOVERNOR TORQUE SPECIFICATIONS (MP2 / MP4 MODELS)

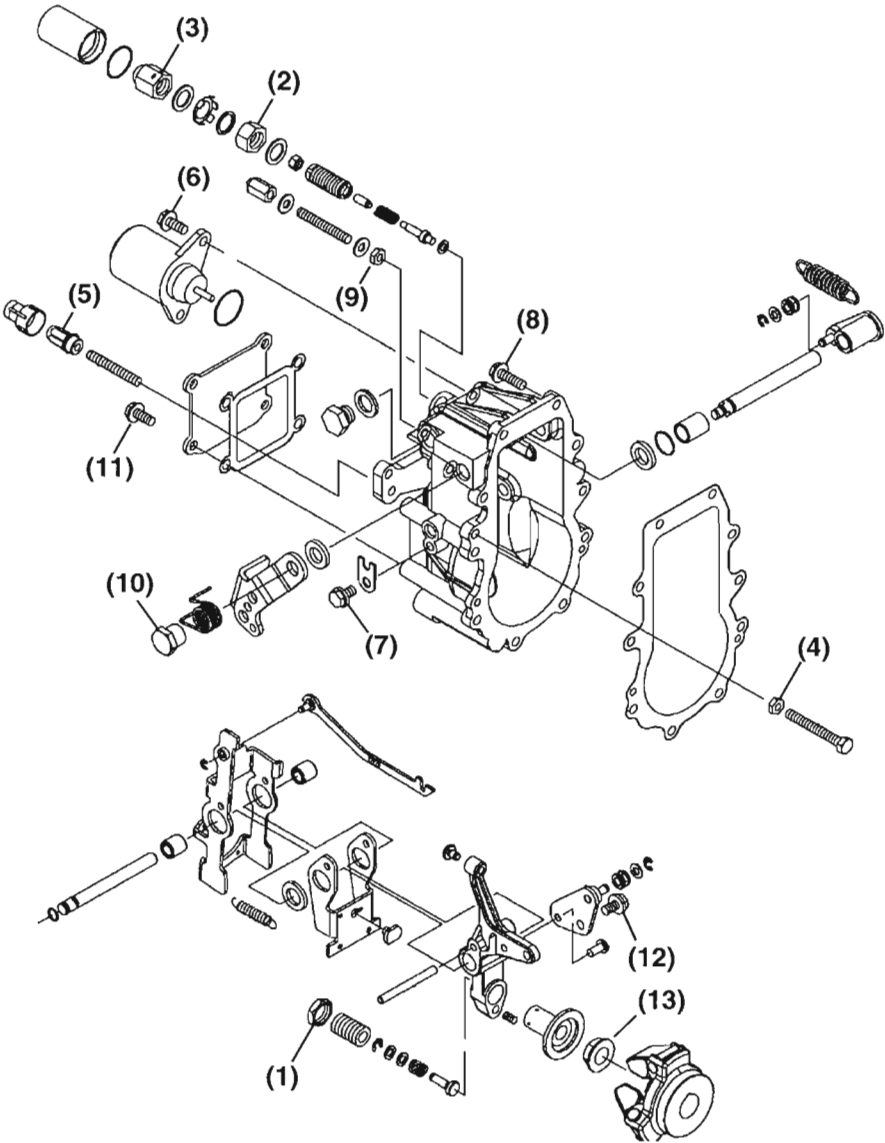


Figure 4-4

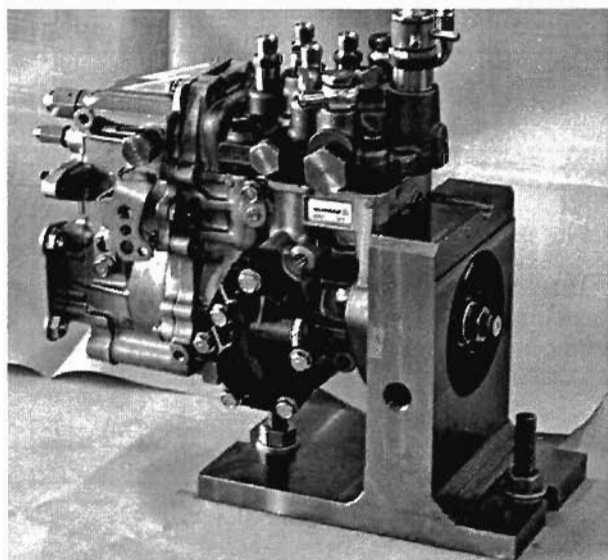
0003465C

GOVERNOR SERVICE

Removal

Note: Keep parts in order during disassembly to ensure proper assembly.

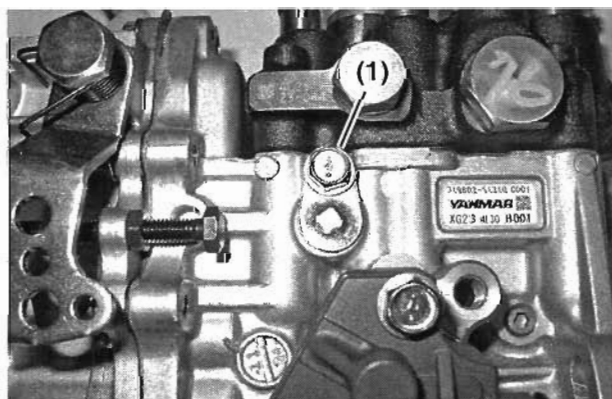
1. Mount the fuel pump and governor assembly to a repair stand (**Figure 4-5**).



0001170a

Figure 4-5

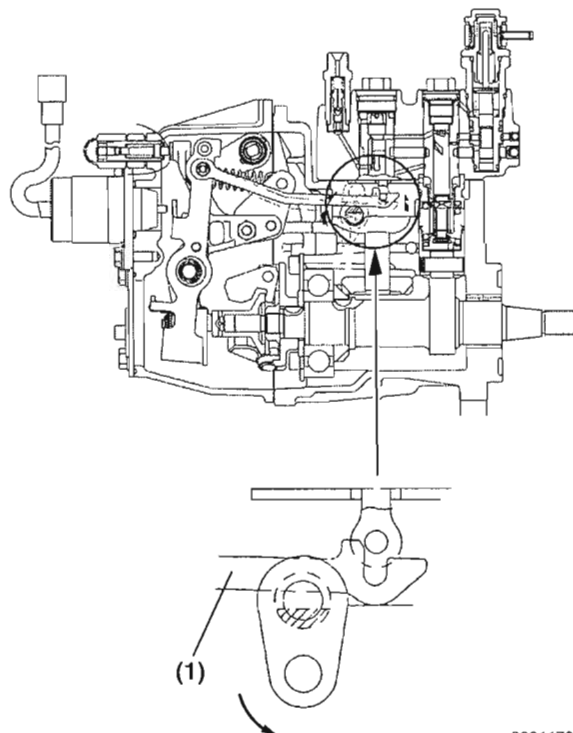
2. Remove the link lifter plate bolt (**Figure 4-6, (1)**).



0001171a

Figure 4-6

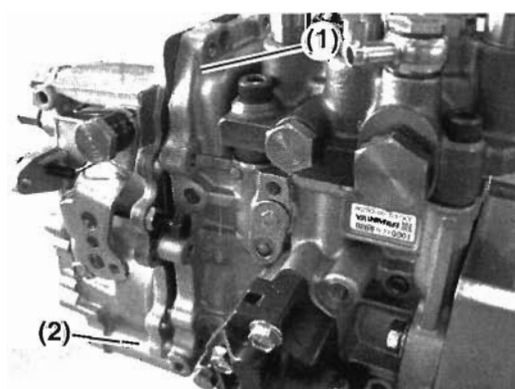
3. Turn the link lifter plate (**Figure 4-7**) counterclockwise 180 degrees to the 6 o'clock position to disengage the governor link (**Figure 4-7, (1)**) from the control rack.



0001173

Figure 4-7

4. Remove the bolts from the governor housing (**Figure 4-8, (2)**) and remove the governor assembly from the fuel pump body (**Figure 4-8, (1)**).



0001174a

Figure 4-8

GOVERNOR

6. Install the control lever shaft (**Figure 4-29, (1)**) through the governor housing, control lever shaft bushing (**Figure 4-29, (3)**) and into the mating part of the control lever shaft.
7. Align the mating part of the control lever shaft with the alignment marks made during disassembly. Install the control lever shaft pin (**Figure 4-29, (2)**) to fasten the two parts.
8. Install the O-ring (**Figure 4-29, (4)**) on the governor lever shaft.

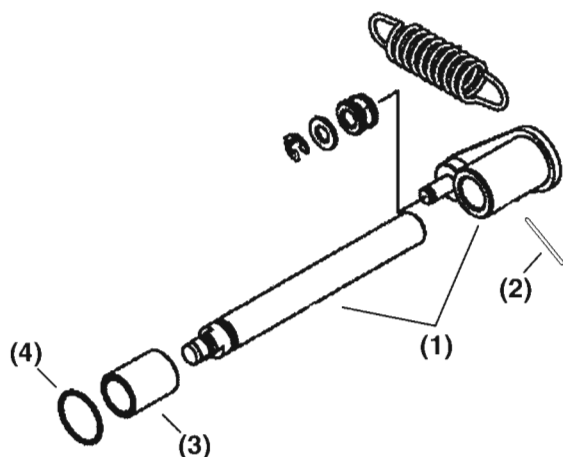
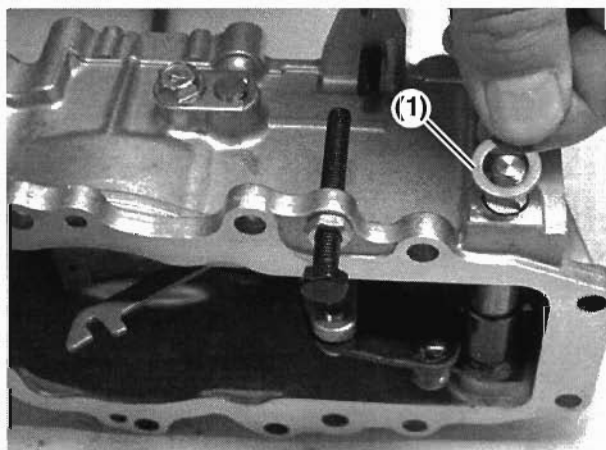


Figure 4-29

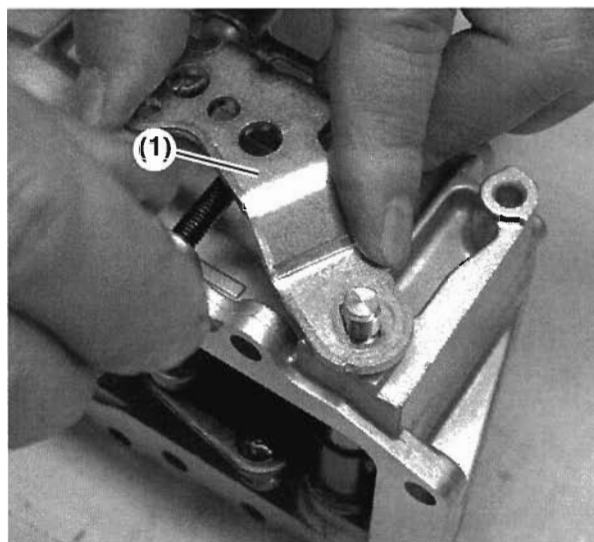
9. Install the control lever shaft shim (**Figure 4-30, (1)**).



0001296a

Figure 4-30

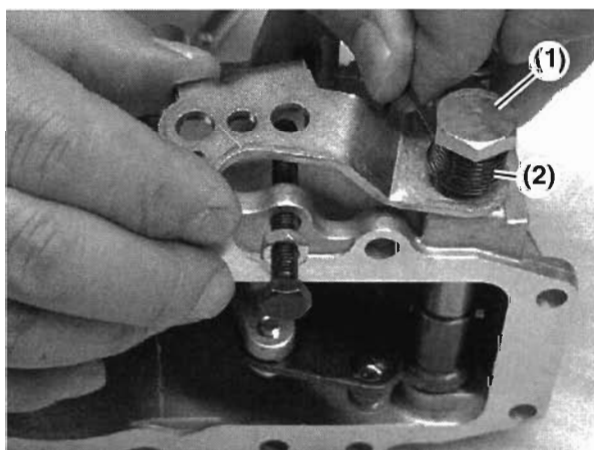
10. Install the control lever (**Figure 4-31, (1)**).



0001297a

Figure 4-31

11. Insert the control lever return spring (**Figure 4-32, (2)**) through the control lever lock nut (**Figure 4-32, (1)**) and attach as shown.



0001298a

Figure 4-32

FUEL INJECTION PUMP

SPECIAL TOOLS

Name of tool	Image
<p>Fuel Injection Pump Special Tool Kit P/N 458091</p> <p>Includes: Dial Indicator Set with Adapters and Plunger Spring Compressor</p>	

No.	Item	Yanmar Part No.	Qty.
1	Carrying Case	15809000	1
2	Dial Indicator	15809001	1
3	30 mm Extension Rod	15809002	1
4	M14 Adapter	15809003	1
5	M16 Adapter	15809004	1
6	Adapter Nut	15809005	2
7	Lift Gauge, 28.55 mm	15809007	1
8	Lift Gauge, 25.5 mm	15809008	1
9	Lift Gauge, 25.9 mm	15809009	1
10	Lift Gauge, 26.3 mm	15809010	1
11 - 16	Base Spring Compressor	15809011	1
	Top, Spring Compressor	15809012	1
	Rod, Spring Compressor	15809013	2
	U-Nut, M8	26366-080002	2
	Bolt, M8x50	26450-080502	2
	Wing Nut M6	26636-060002	2

FUEL INJECTION PUMP

Cold Start Timer

To facilitate easy engine starting under cold temperatures, the timer senses the engine coolant temperature for advancing the fuel injection timing. The cold start timer closes the sub port (Figure 5-10, (6)) in cold temperatures which advances the injection timing to assist cold engine starts.

The timer uses a thermo-element (Figure 5-10, (2)) that reacts to engine coolant water (Figure 5-10, (1)), which circulates around it. Below the set temperature, the return spring holds the timer piston (Figure 5-10, (3)) in the closed position. As engine temperature increases, the thermo-element pushes the timer piston to the open position allowing the sub port (Figure 5-10, (9)) to function.

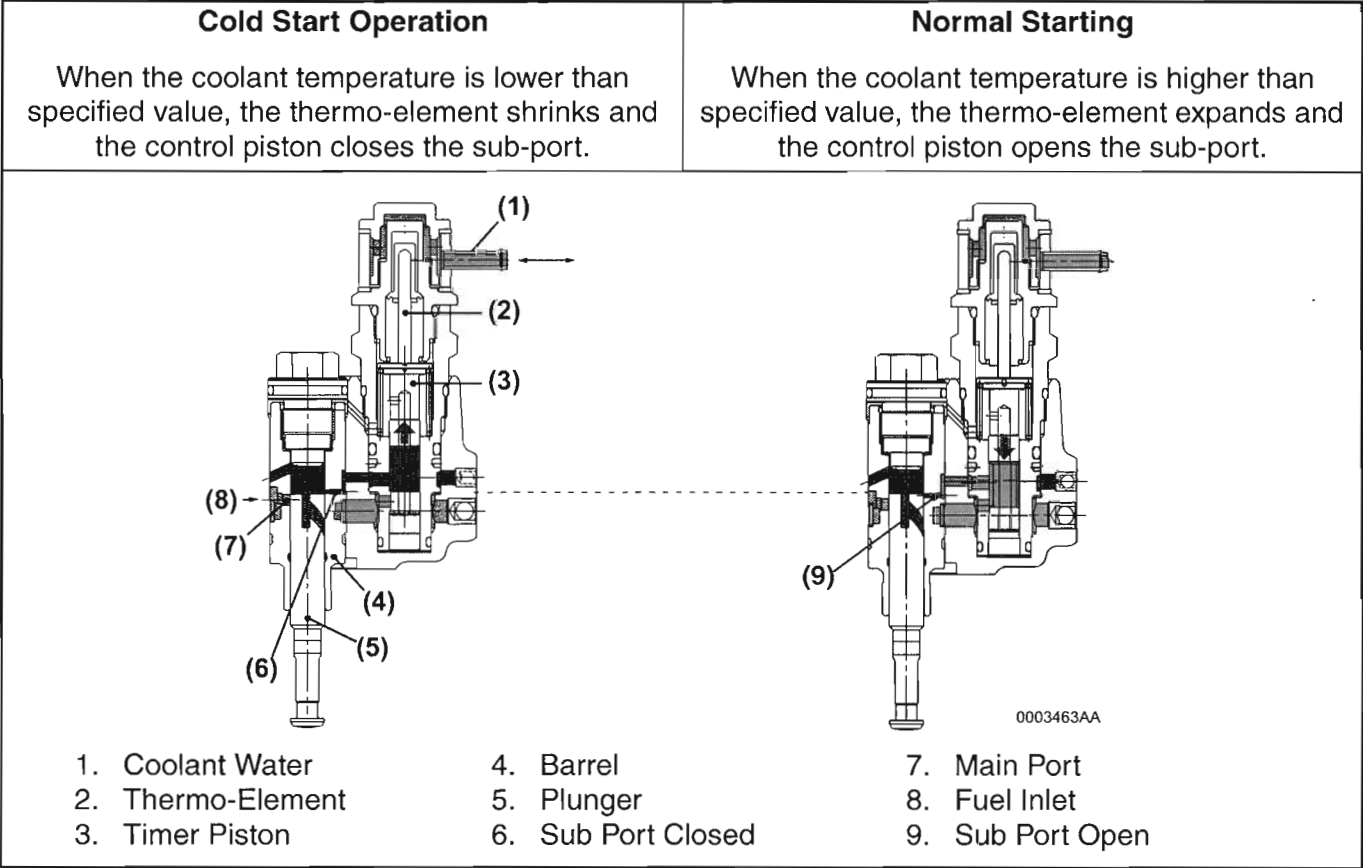


Figure 5-10

FUEL INJECTION PUMP

8. Remove the charge pump fuel outlet strainer plug (**Figure 5-29, (1)**) and gasket (**Figure 5-29, (2)**). Do not remove the strainer. Remove the accumulator plug (**Figure 5-29, (3)**) washer (**Figure 5-29, (4)**), spring and piston (**Figure 5-29, (5,6)**).

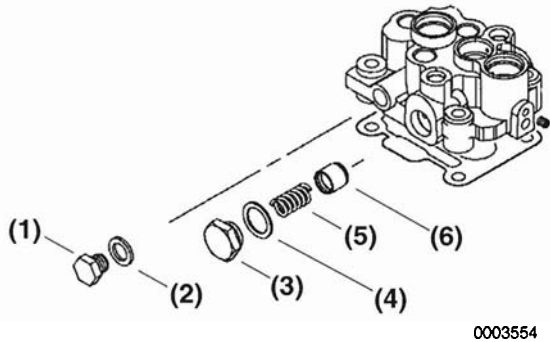


Figure 5-29

9. Remove the four hydraulic head bolts (**Figure 5-30, (1)**).



Figure 5-30

10. Remove the hydraulic head assembly and gasket (**Figure 5-31, (1)**).

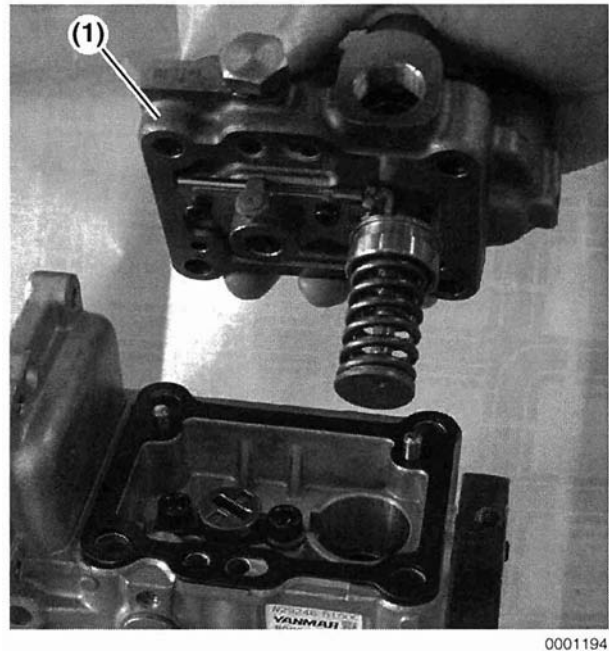


Figure 5-31

11. Use the spring compressor tool (**Figure 5-33, (2)**) (Included in Yanmar Special Tool Kit P/N 458091) to compress the plunger spring (**Figure 5-32, (1)**) and remove the spring retainer (**Figure 5-33, (1)**).

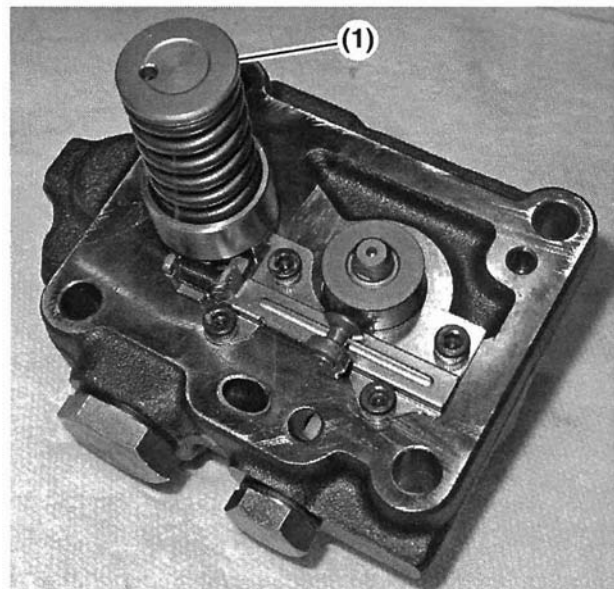
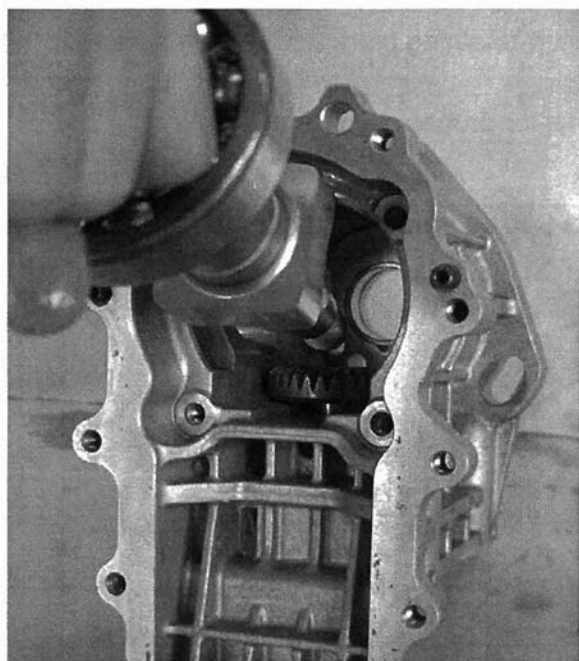


Figure 5-32

3. With the distribution shaft gear touching the pump body, insert the camshaft into the body. During installation prevent the cam lobes from hitting the distribution shaft gear and the camshaft key from hitting the camshaft bushing. **(Figure 5-48).**

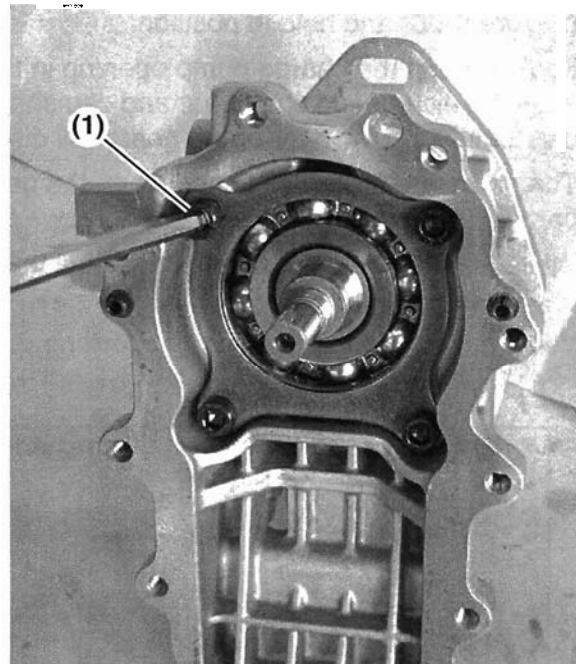
Note: 4-cylinder camshafts require special care during reassembly due to tight tolerances.



0001239

Figure 5-48

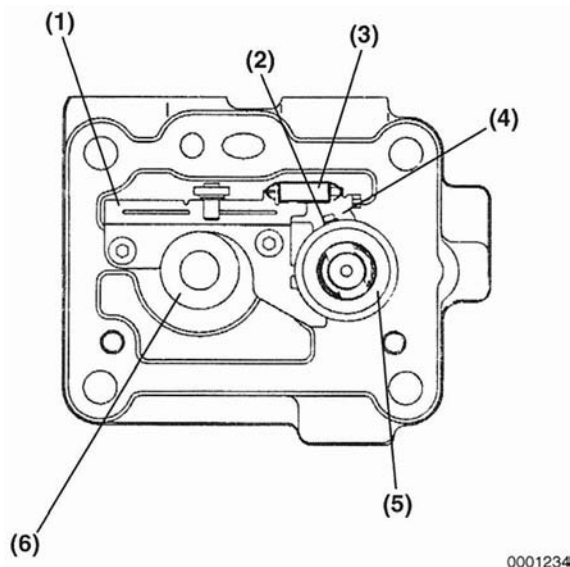
4. Install the camshaft bearing retainer and bolts **(Figure 5-49, (1))** and tighten to 6 - 7 ft-lb. (8 - 10 N·m).



0001241

Figure 5-49

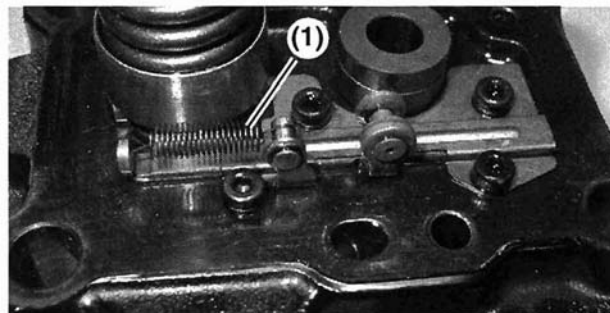
7. Measure the rack (**Figure 5-60, (4)**) movement, the range of rack motion should be approximately 14 mm of total travel.
8. Measure rack backlash, the total backlash should be equal to or less than 0.008 in. (0.2 mm). If the backlash is excessive, replace the rack assembly and control sleeve.



- | | |
|--------------------------|------------------------------|
| 1. Control Rack Guide | 4. Rack |
| 2. Control Sleeve | 5. Upper Spring Retainer |
| 3. Rack Auxiliary Spring | 6. Distribution Shaft Sleeve |

Figure 5-60

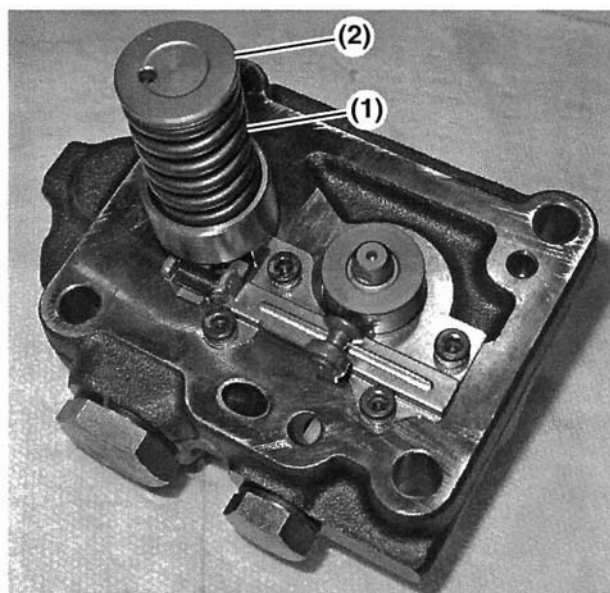
9. Install the rack return spring (**Figure 5-61, (1)**). The spring must be able to return the rack from the maximum decreased fuel position to the maximum increased fuel position.



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Figure 5-61

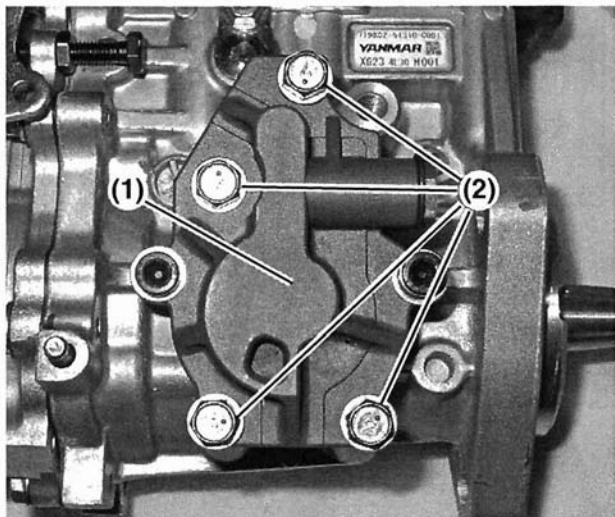
10. Install the plunger spring (**Figure 5-62, (1)**) and spring retainer (**Figure 5-62, (2)**). Use the spring compressor tool (**Figure 5-63, (2)**) (Included in Yanmar Special Tool Kit P/N 458091) to compress the plunger spring and install the spring retainer.



0001212B

Figure 5-62

4. Install the charge pump (**Figure 5-80, (1)**) and tighten the four mount screws (**Figure 5-80, (2)**) to 6 - 7 ft-lb. (8 - 10 N·m).



0001197a

Figure 5-80

Governor Installation

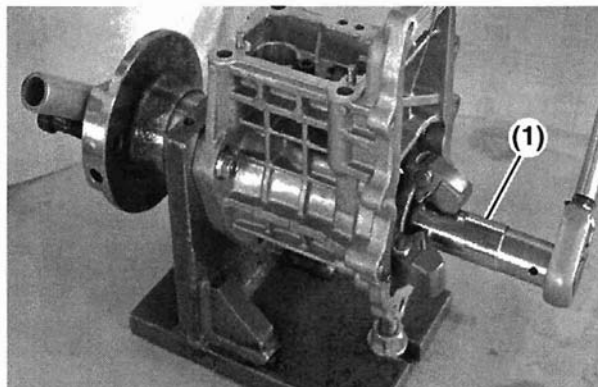
1. Install the governor weight assembly and nut (**Figure 5-81, (1)**) to the fuel injection pump camshaft.



0001250a

Figure 5-81

2. Attach a stop to the camshaft. Tighten the governor weight nut (**Figure 5-82, (1)**) to 58 - 62 ft-lb. (79 - 84 N·m). Install the governor sleeve.

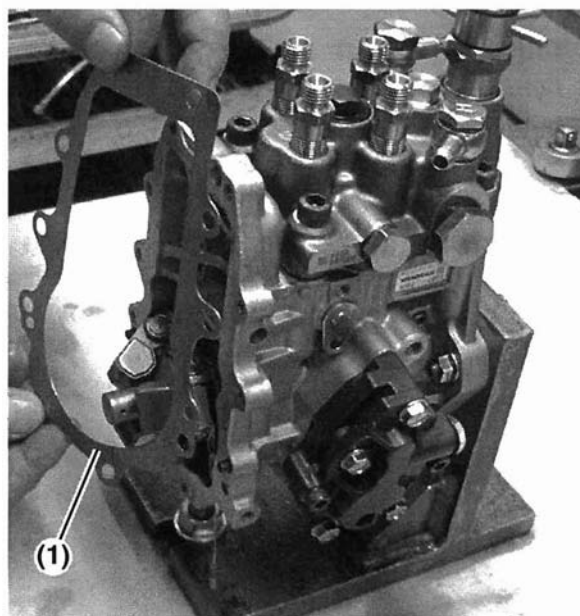


0001251a

Figure 5-82

Note: Be careful not to bend or damage the governor housing gasket.

3. Align and install a new governor housing gasket (**Figure 5-83, (1)**).



0001300a

Figure 5-83

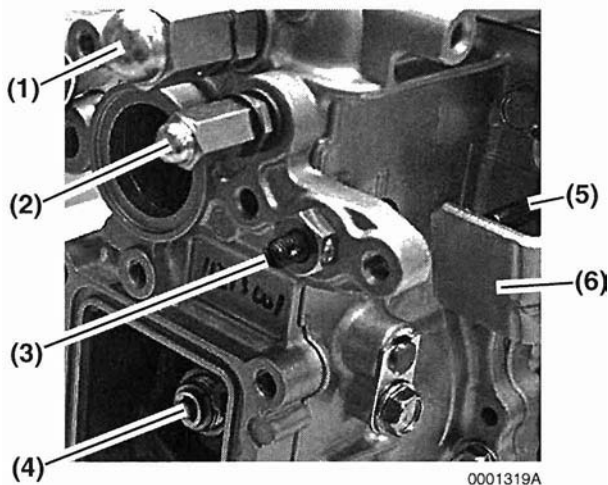
ADJUSTMENT

The adjustment of fuel delivery requires correct specifications. Before performing any of the adjustments in this section, obtain the correct calibration data sheet for the fuel injection pump being tested. Contact your Yanmar Fuel Injection Equipment Central Distributor to obtain the data sheet.

Adjustments must be performed in the following order when adjusting the governor:

1. High Idle Fuel Delivery
2. Rated Fuel Delivery
3. Torque Fuel Delivery
4. Reverse Angleich Spring Adjustment
5. Low Idle Fuel Delivery
6. Starting Fuel Delivery
7. Stop Fuel Delivery
8. Re-check Rated Fuel Delivery
9. Tamper-Proof Cap Installation

Component Identification



1. Rated Fuel Limiter Adjustment Assembly
2. Starting Fuel Adjustment Assembly
3. High Idle Speed Limit Bolt
4. Reverse Angleich Adjustment Assembly
5. Low Idle Speed Limit Bolt
6. Control Lever

Figure 6-5

High Idle Fuel Delivery

1. Set the fuel pump speed at the high idle speed specified. (*See Calibration Data Sheet*).
2. Set the control lever (**Figure 6-5, (6)**) to the high idle position while turning the high idle speed limit bolt (**Figure 6-5, (3)**) to obtain the specified injection amount. (*See Calibration Data Sheet*).
3. Tighten the lock nut after completing the adjustment to lock the high idle speed limit bolt from turning.

Rated Fuel Delivery

The MP2 pump has a rated fuel limiter adjustment assembly **Figure 6-6** as standard equipment.

1. Remove the tamper-proof cap and screw in the fuel limiter assembly (**Figure 6-6, (1)**) until it contacts the governor tension lever and then back off one-quarter (1/4) turn.

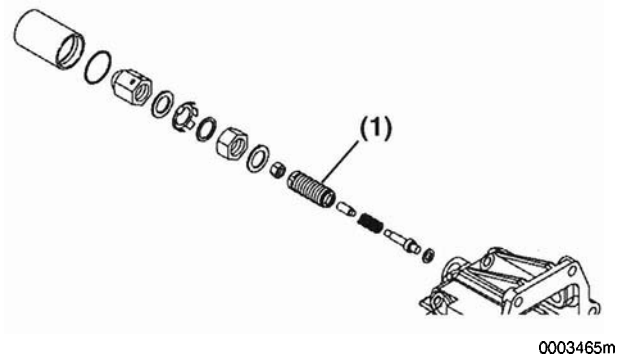


Figure 6-6

2. Set the pump speed at the rated speed (*see Calibration Data Sheet*) and move the control lever until it contacts the high idle speed limit bolt (**Figure 6-5, (3)**).
3. Adjust the rated injection amount by turning the fuel limiter assembly (**Figure 6-6, (1)**) in or out to obtain the correct specification, (*See Calibration Data Sheet*).

FUEL INJECTION NOZZLE

INTRODUCTION

This section of the *Service Manual* describes the operation and procedures necessary to disassemble and reassemble the fuel injection nozzles.

Yanmar MP fuel injection pumps are designed for use on TNV (DI) Direct Injection engines, equipped with hole type nozzles. A list of Yanmar MP fuel injection pump equipped engines is provided in the following chart.

Yanmar Engines equipped with MP Fuel Injection Pumps

MP2	3TNV82A	
	3TNV84	3TNV84T
	3TNV88	
	4TNV84	4TNV84T
	4TNV88	
MP4	4TNV94L	
	4TNV98	4TNV98T
	4TNV106	4TNV106T

SPECIFICATIONS

All TNV fuel injectors have a three character identification mark (**Figure 7-1, (1)**). The first character starts with "V" or "W".

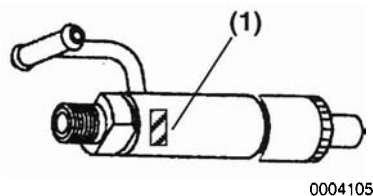


Figure 7-1

Model	Engine Class	Injector ID mark	Fuel Injector Opening Pressure
3TNV82A 4TNV88	CL	W	2843 - 2988 psi (19.6 - 20.6 MPa; 200 - 210 kgf/cm ²)
3TNV82A 4TNV88	VM	W*	2843 - 2988 psi (19.6 - 20.6 MPa; 200 - 210 kgf/cm ²)
		or	or
3TNV84AT 4TNV84T		V*	3133 - 3278 psi (21.6 - 22.6 MPa; 220 - 230 kgf/cm ²)
4TNV94L 4TNV106 4TNV98T 4TNV106T	CL VM	V	3133 - 3278 psi (21.6 - 22.6 MPa; 220 - 230 kgf/cm ²)

- * Fuel injector identification is critical as each engine has a unique fuel injection pressure. The fuel nozzle is specifically matched to the fuel injector by engine model and engine speed.

Note: Fuel injection pressure of a new fuel injector is reduced approximately 72.5 psi (0.5 MPa; 5.0 kgf/cm²) after about 5 hours of operation due to the initial break in of the spring.

When adjusting a new fuel injector or after it has been disassembled for service, adjust the fuel injector 72.5 psi (0.5 MPa; 5.0 kgf/cm²) higher than the above standard.

Cleaning

Note: Before inspecting or assembling, all components must be washed with clean diesel fuel or standard cleaning solution and completely clean and free of contaminants.

1. Clean carbon from outside of nozzle body using a brass brush.
2. Clean nozzle opening with small length of deburred steel 0.0055 in. (0.14 mm) wire (Figure 7-6, (1)).

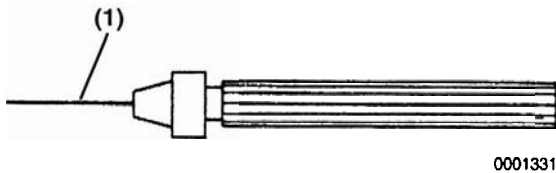


Figure 7-6

3. Clean nozzle seat with cleaning spray.

Note: An ultra sonic cleaner can be used to effectively clean the injector body and inner components after loose material is removed.

Inspection

1. Inspect oil seal surfaces for abnormal scratches or wear, replace as necessary.
2. Inspect nozzle body for scratches and wear on nozzle body and tip. Replace the nozzle if the nozzle sliding surface or seat are scratched or abnormally worn.
3. Rotate and slide the nozzle to check for smooth movement (Figure 7-8), replace the nozzle assembly if the nozzle does not slide smoothly.

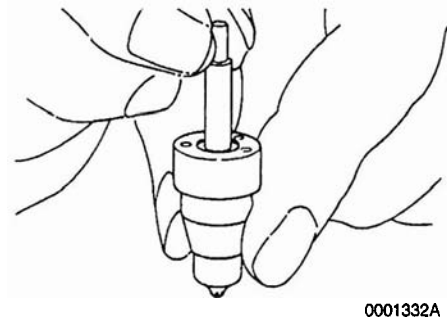


Figure 7-7

4. Inspect the nozzle valve stop for scratches and/or wear at the sealing surfaces on both sides. Check for abnormal wear at stop plate center hole where it makes contact with the nozzle (Figure 7-8, (1)), replace if worn.

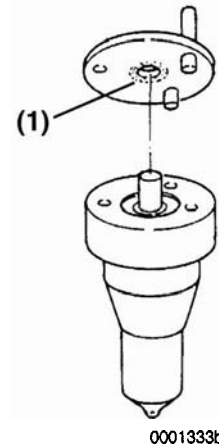


Figure 7-8

5. Inspect the nozzle spring, replace it if deformed, or the surface is scratched or rusted.

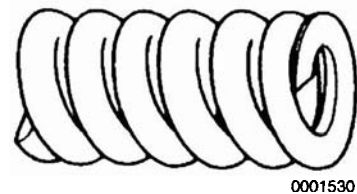


Figure 7-9

6. Inspect the nozzle oil sealing surface for scratches and/or wear, replace it if wear is excessive.