

DENSO

**For DENSO Authorized
ECD Service Dealer Only**

Diesel injection Pump

SERVICE MANUAL

**Common Rail System Supply Pump (HP3)
Overhaul Instruction Manual**

REPAIR

October, 2005

DENSO CORPORATION

00400553E




© 2005 DENSO CORPORATION

All Rights Reserved. This book may not be reproduced or copied, in whole or in part, without the written permission of the publisher.

Foreword

This manual describes the procedures for assembling and disassembling the supply pump (HP3) for the common rail type electronically controlled fuel injection system. Also, the procedures below are explained using a 294000-001# as a reference. If working on a different model of pump, be sure to verify the component parts against the parts list before beginning. Please read the contents thoroughly and apply them carefully in your service and maintenance work.

To ensure a safe operation, this manual indicates the particulars that must be adhered to in the following manner:

WARNING	Failure to adhere to the precautions could cause accidents, which could lead to serious injury or death.
NOTE	Failure to adhere to the precautions could cause accidents, injury, or damage to the vehicle or product.
ADVICE	Gives reference information regarding the operation.
	Items marked like this must not be done.

WARNING

- Be careful with any fuel or oil leaks, as they could cause a fire.
- Be careful with hot fuel, as it could cause burns.
- The fuel in the fuel pipe reaches an extremely high pressure. Therefore gradually reduce the fuel pressure (to atmospheric pressure) before disconnecting parts or high pressure pipes during a test.

NOTE

- Foreign particles such as dust or debris (less than 0.1mm) in the supply pump can cause a malfunction, so please observe the following:
 - [1] Avoid bringing foreign particles into the work area by thoroughly cleaning any dust or debris on the outside of any pump to be repaired before overhauling it.
 - [2] The workbench should be covered with unpainted stainless steel.
 - [3] The workbench and all tools should be vacuum cleaned before overhauling.
 - [4] All parts, including new ones, should be cleaned with clean diesel fuel before installation. If exposed for long periods after cleaning, dust may accumulate so parts should be installed immediately after cleaning. Also, when cleaning parts in the punching metal case, carry the entire case back to the work area and do not leave it on the workbench. If punching metal is not used in the parts case, foreign particles could be left in the case.
 - [5] Always wash your hands before disassembling and reassembling a pump.
- Do not reuse O-rings and gaskets.
- Always use the appropriate tools.
- Always apply proper tightening torque to parts.
- Do not carry a pump by the pipe as shown at right.



QD0952

Contents

1. Disassembly-Reassembly STT List -----	1
2. Disassembly Diagram -----	4
3. Disassembly Outline -----	5
3.1 Securing the Supply Pump -----	5
3.2 Removing the Pipes -----	5
3.3 Removing the SCV (Suction Control Valve) -----	6
3.4 Removing the Feed Pump -----	7
3.5 Removing the Fuel Temperature Sensor-----	8
3.6 Removing the Regulating Valve -----	9
3.7 Removing the Filter Sub-Assembly -----	9
3.8 Removing the Element Sub-Assembly, Plunger, and Spring -----	10
3.9 Element Sub-Assembly Foreign Particle Check -----	14
3.10 Pump Body Disassembly -----	14
3.11 Removing the Oil Seal -----	18
4. Assembly Outline -----	19
4.1 Assembling the Oil Seal -----	19
4.2 Drive Shaft Thrust Measurement -----	19
4.3 Assembling the Pump Body -----	22
4.4 Assembling the Element Sub-Assembly, Plunger, and Spring -----	25
4.5 Installing the Regulating Valve -----	28
4.6 Installing the Filter Sub-Assembly -----	29
4.7 Installing the Fuel Temperature Sensor -----	30
4.8 Assembling the Feed Pump -----	30
4.9 Installing the SCV (Suction Control Valve) -----	33
4.10 Installing the Pipes -----	34
5. Troubleshooting -----	35
5.1 Procedure -----	35
5.2 Boundary samples for disassembly checks -----	36
6. Tightening Torque List -----	38



Revision History

Date	Revision Contents
May. 2003	• First edition (publication code: QZZAD-09)
January. 2004	• Publication code change from “QZZAD-09” to “00400237Z”
September. 2005	<ul style="list-style-type: none">• Publication code change from “00400237Z” to “00400553E” (refer to cover page)• "Removing the SCV (Suction Control Valve)", "NOTE" added (p6: refer to 3.3 (2))• "Removing the Regulating Valve", "NOTE" added (p9: refer to 3.6 (2))• "Installing the Regulating Valve", "NOTE" added (p28: refer to 4.5 (2))• "Installing the Filter Sub-Assembly", "NOTE" added (p29: refer to 4.6 (1))• "Installing the SCV (Suction Control Valve)", "NOTE" added (p33: refer to 4.9 (2))• "Installing the pipe", "Tightening Torque Value", added and revised (p34: refer to 4.10 (2))• "Regulating Valve Check Method and Judgment Criterion" revised (p35: refer to 5.1)• "Retaining Nut Torque Value" added and revised (p38: refer to 6)

1. Disassembly-Reassembly STT List

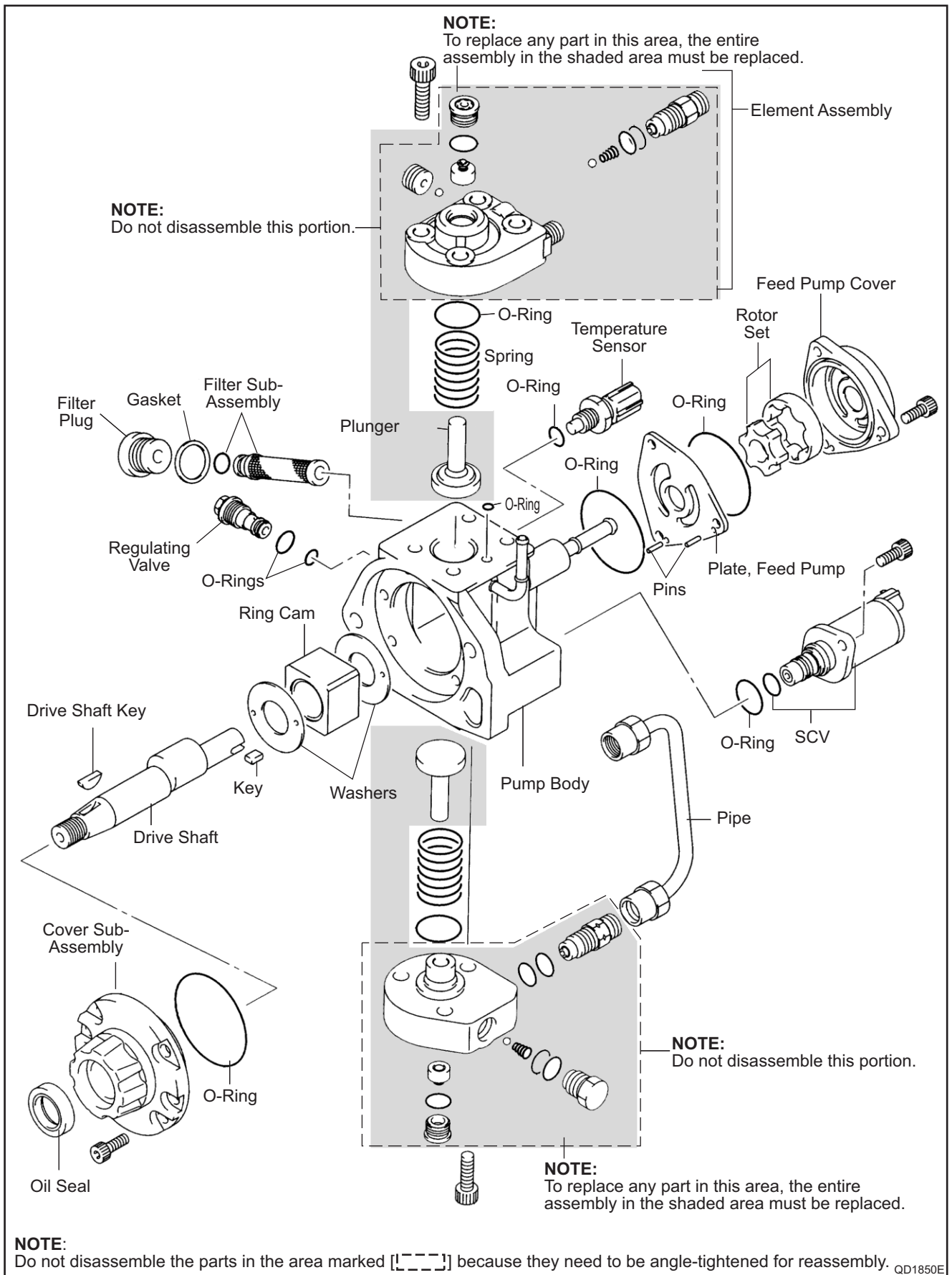
Part Name	DENSO P/N	Exterior Appearance
Nozzle Retaining Nut Wrench	95092-10500	 <p>A metal wrench with a C-shaped end and a square hole on the other side. The part number QD0851 is visible in the bottom right corner of the image.</p>
Pump Plate Assembly * New STT	95096-10620	 <p>A square metal plate with a central circular opening and several small holes around the perimeter. The part number QD0852 is visible in the bottom right corner of the image.</p>
Coupling (Shaft Diameter ϕ 20)	95095-20110	 <p>A metal coupling with a flange on one end and a threaded section on the other. The part number QD0853 is visible in the bottom right corner of the image.</p>
Driver Chuck	95992-10130	 <p>A small, cylindrical metal component with a textured surface. The part number QD0854 is visible in the bottom right corner of the image.</p>
Hexagonal Bit (6mm)	95993-10040	 <p>A long, thin metal hexagonal bit. The part number QD0855 is visible in the bottom right corner of the image.</p>
Hexagonal Bit (5mm)	95993-10030	 <p>A long, thin metal hexagonal bit, shorter than the 6mm version. The part number QD0856 is visible in the bottom right corner of the image.</p>

Part Name	DENSO P/N	Exterior Appearance
Oil Seal Presser	95096-10240	 <p>A cylindrical metal tool with a textured surface, used for pressing oil seals. It has a small notch on one end. QD0857</p>
Oil Seal Remover	95096-10220	 <p>A long, thin metal rod with a curved end, used for removing oil seals. QD0858</p>
Torque Wrench	95813-10010	 <p>A torque wrench with a long handle and a circular head, used for applying a specific torque to a bolt or nut. QD0859</p>
Torque Wrench	95813-10020	 <p>A torque wrench with a long handle and a circular head, similar to the previous one but with a different handle design. QD0860</p>
Regulating Valve Socket Wrench	95096-10181	 <p>A small, cylindrical metal socket wrench used for regulating valves. QD0861</p>
<p>Pipe (Inner Diameter of Corresponding Parts ϕ 20 to ϕ 40, Length: 40mm and above) * New STT</p>	95092-11480	 <p>A short, cylindrical metal pipe. QD0862</p>

Part Name	DENSO P/N	Exterior Appearance
Filter Presser * New STT	95096-10630	
Camshaft Clearance Measurer	95092-10930	

2. Disassembly Chart

This disassembly chart uses pump No. 294000-001# as a reference. When working on another model, please refer to the parts list.

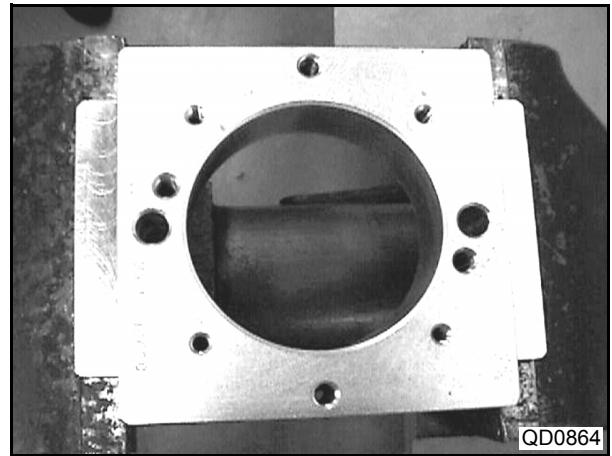


3. Disassembly Outline

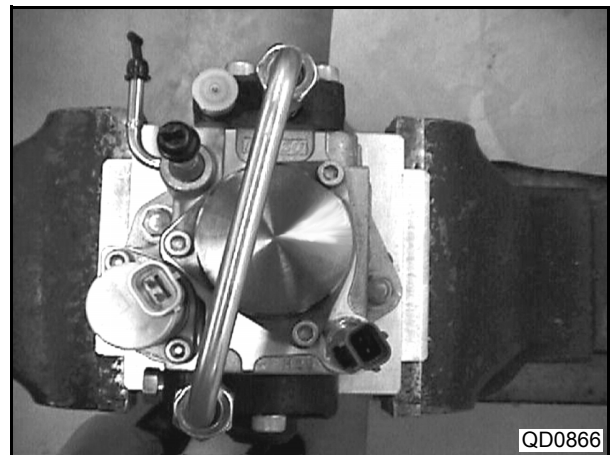
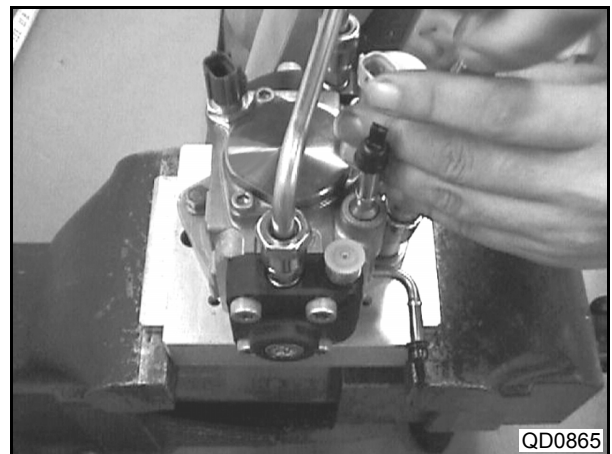
3.1 Securing the Supply Pump

(1) The pump plate assembly (STT) is secured in a vise.

- STT: Pump Plate Assembly (95096-10620)



(2) Using two bolts, install the pump body on the pump plate assembly (STT).

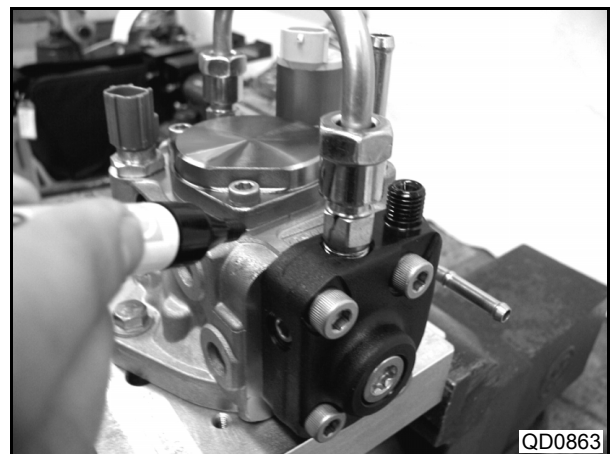


3.2 Removing the Pipes

(1) Before removing the pipes, use tape to indicate the directions in which the pipes and element sub-assembly should be reassembled.

ADVICE:

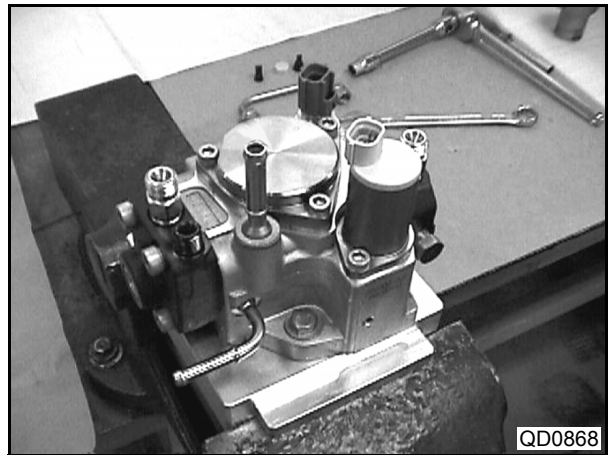
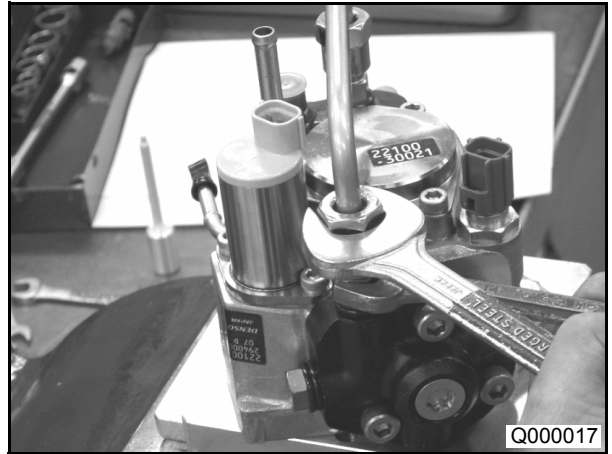
When working on a pump that does not use pipes, proceed to "3.3 Removing the SCV (Suction Control Valve)".



(2) Loosen the pipe nuts, and remove the pipes.

NOTE:

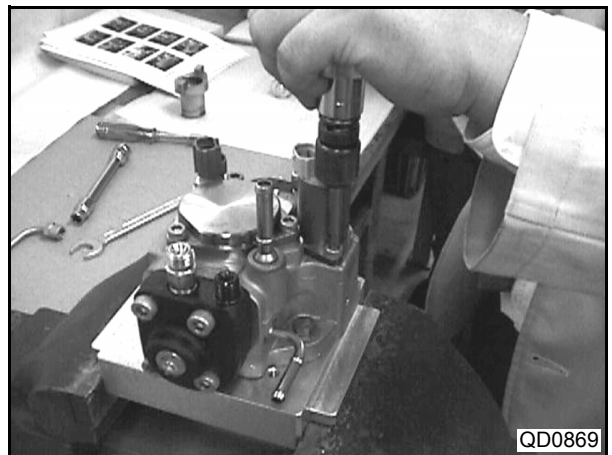
When loosening the nut, please use two spanners simultaneously.



3.3 Removing the SCV (Suction Control Valve)

(1) Using the hexagonal bit, remove the two hexagonal bolts securing the SCV.

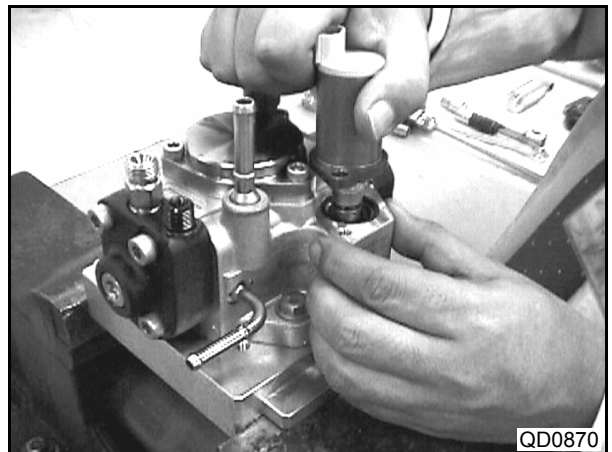
- STT: Hexagonal Bit (95093-10030)
- STT: Driver Chuck (95992-10130)



(2) Take the SCV straight off.

NOTE:

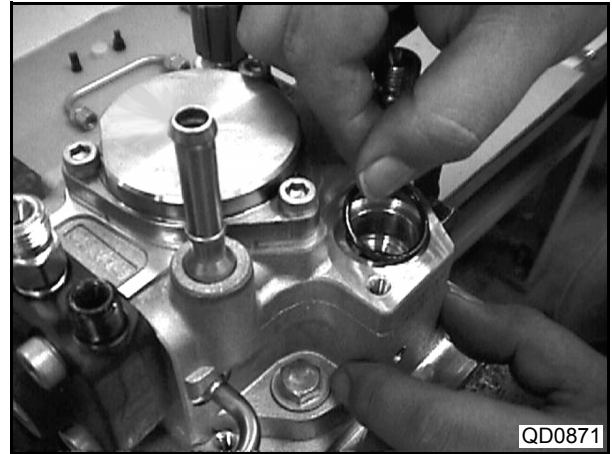
Record the SCV installation position.
For example, record the connector position (facing in/facing out) by marking with a pen, writing a memo, etc.
(Added Sept. 2005)



(3) Remove the O-ring.

NOTE:

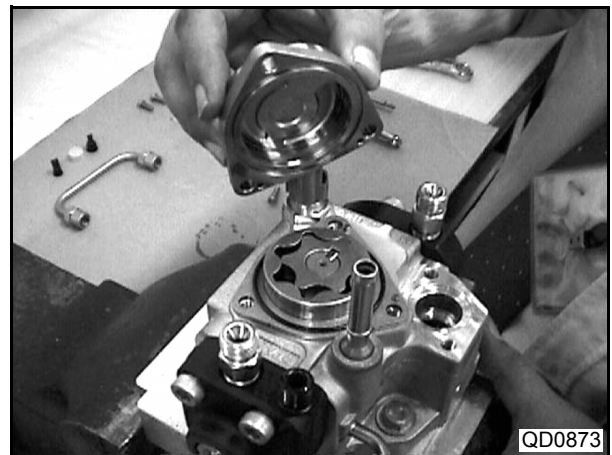
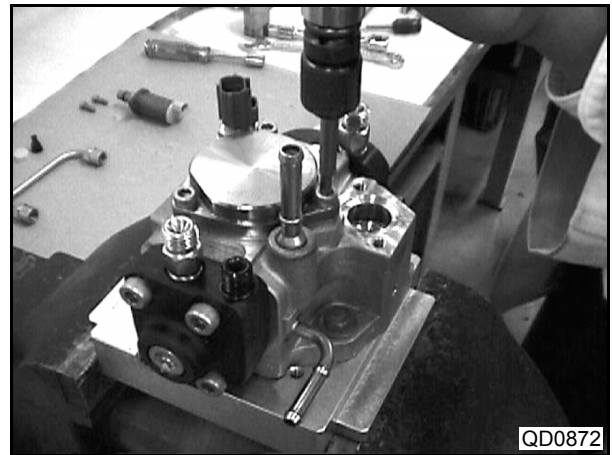
O-rings can not be reused.



3.4 Removing the Feed Pump

(1) Remove the three hexagonal bolts on the feed pump cover.

- STT: Hexagonal Bit (95093-10030)
- STT: Driver Chuck (95992-10130)



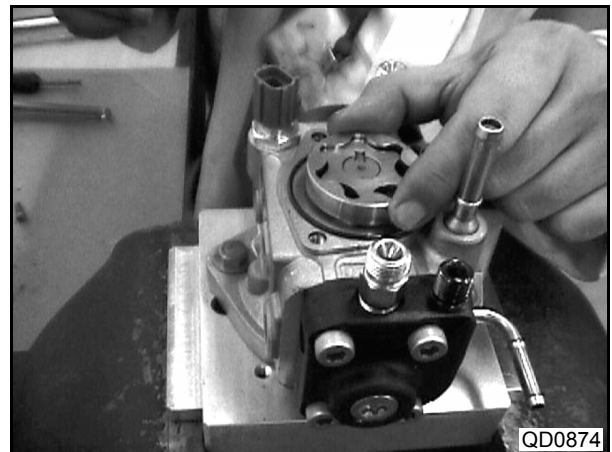
(2) Remove the feed pump rotor set.

NOTE:

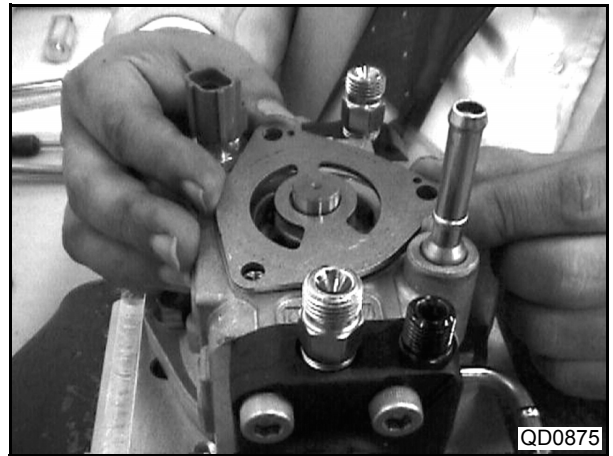
Please keep the rotor set in the same condition (as a set).

NOTE:

Have the stamped side facing outward.



(3) Remove the feed pump plate.



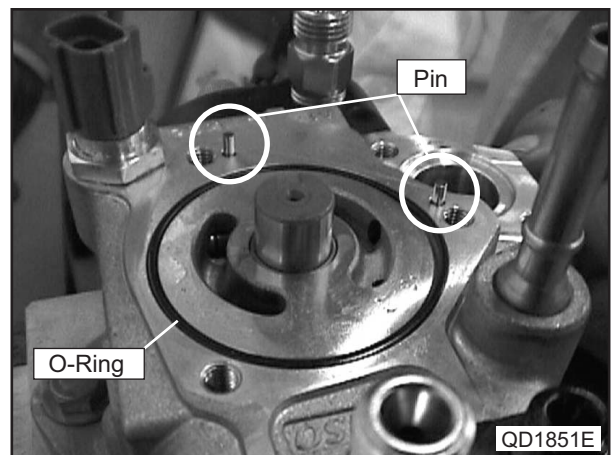
(4) Remove the O-ring and two pins.

NOTE:

O-rings can not be reused.

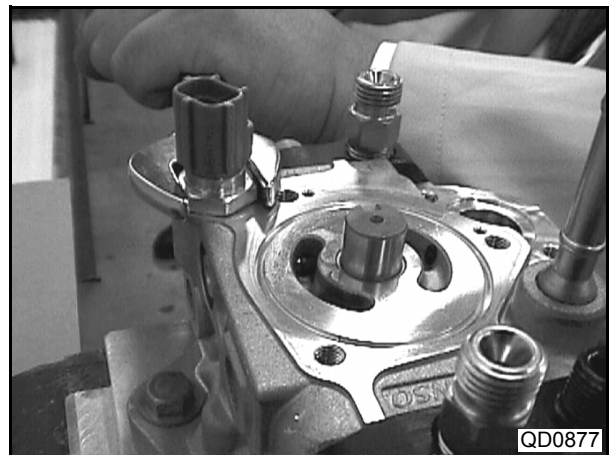
NOTE:

When removing the O-ring, be careful not to damage the part's O-ring groove. (Please do not use sharp metal objects to remove.)



3.5 Removing the Fuel Temperature Sensor

(1) Using a spanner, remove the fuel temperature sensor.



3.6 Removing the Regulating Valve

(1) Using the regulating valve socket wrench (STT), remove the regulating valve.

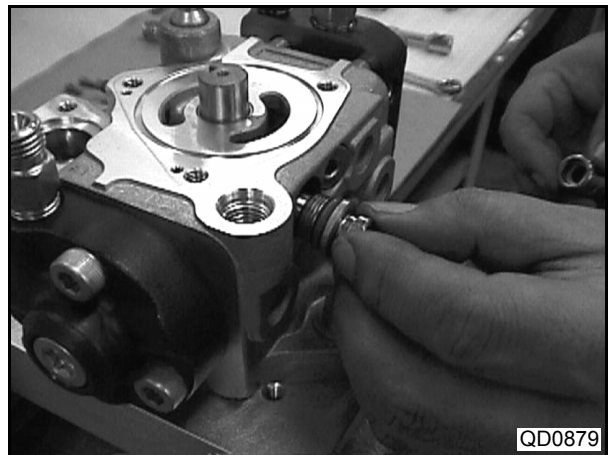
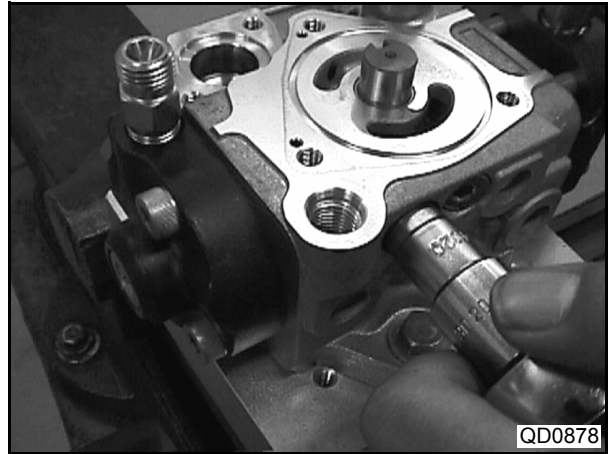
- **STT: Regulating Valve Socket Wrench (95096-10181)**

NOTE:

The regulating valve should only be removed when there is some sort of abnormality with the valve.

If there is no abnormality, do not remove the valve.

Replace the regulating valve with a new valve if, during the supply performance test it is determined that the regulating valve is malfunctioning. (Added Sept. 2005)

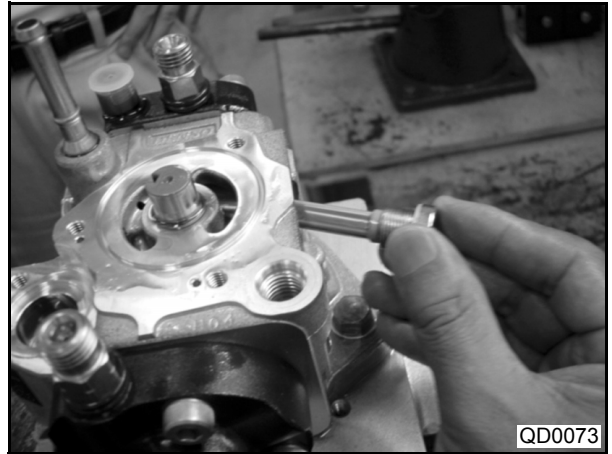


3.7 Removing the Filter Sub-Assembly

(1) Using a hexagonal wrench, remove the filter plugs securing the filter sub-assembly.

- **Tool: Hexagonal Bit (8mm)**





(2) Using the filter presser (STT), remove the filter sub-assembly from the filter plug.

- **STT: Filter Presser (95096-10630)**

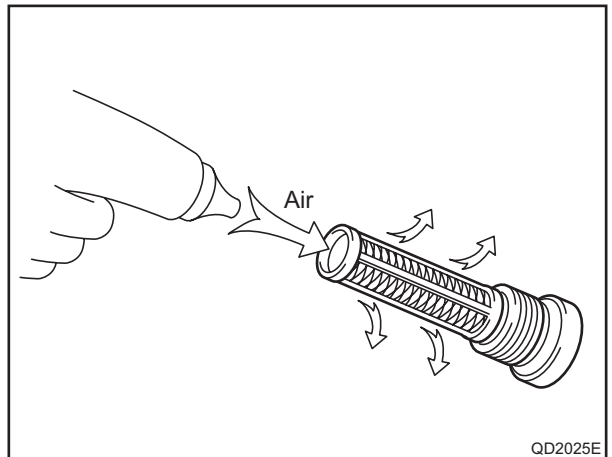
NOTE:

Once a filter sub-assembly is removed, do not reuse it. (Because of the danger of deformation of the O-ring or the plastic contact surface)



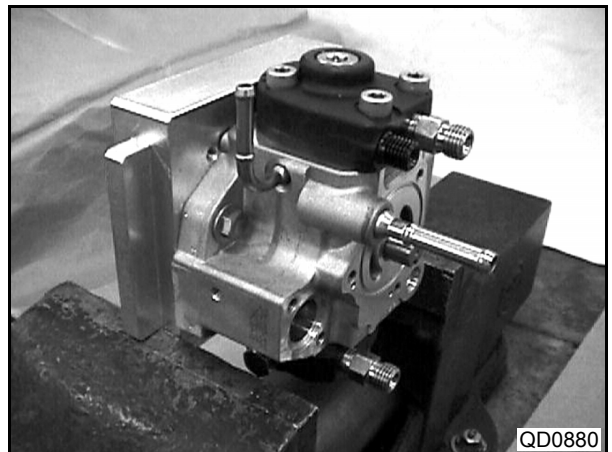
NOTE:

Do not remove it unless it needs to be replaced. When not removing the filter from the plug, use an air gun to blow it out with air as in the figure on the right.



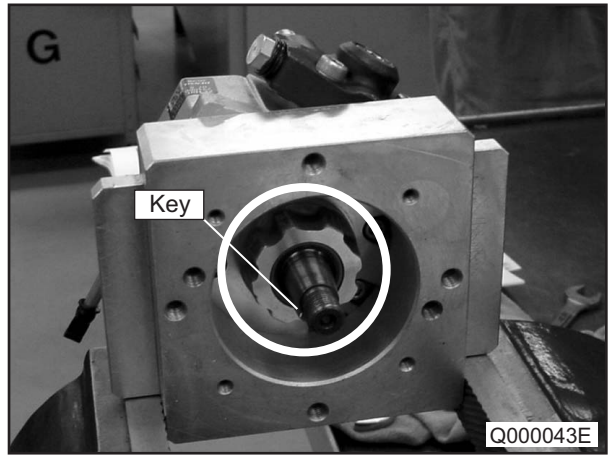
3.8 Removing the Element Sub-Assembly, Plunger, and Spring

(1) Secure the pump as shown to the right.



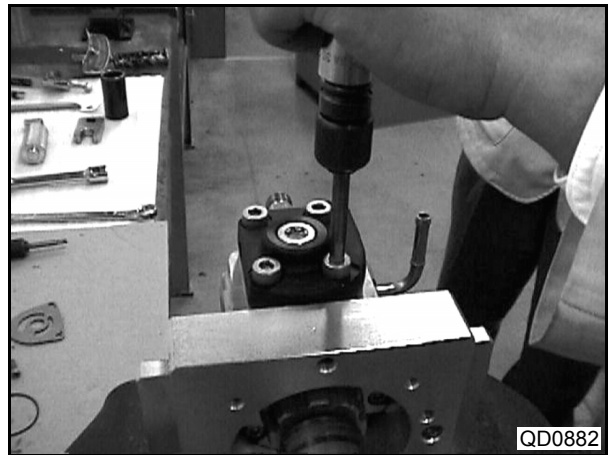
(2) Using the coupling (STT), rotate the drive shaft until it is directly opposite (180 degrees) from the element to remove.

- STT: Coupling (95095-20110)



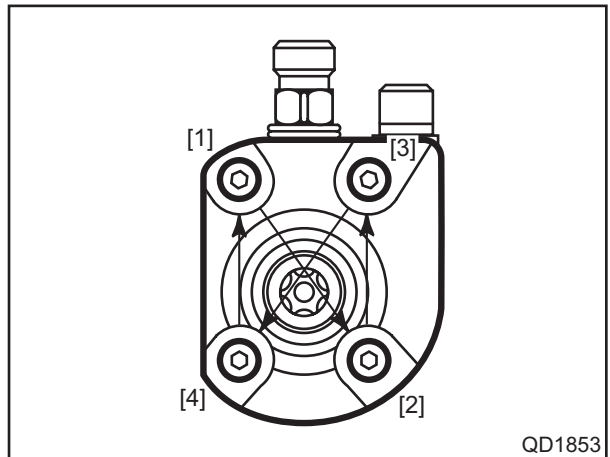
(3) Loosen the four hexagonal bolts on top of the element sub-assembly.

- STT: Hexagonal Bit (95093-10040)
- STT: Driver Chuck (95992-10130)



NOTE:

Loosen them uniformly in order as shown at right.



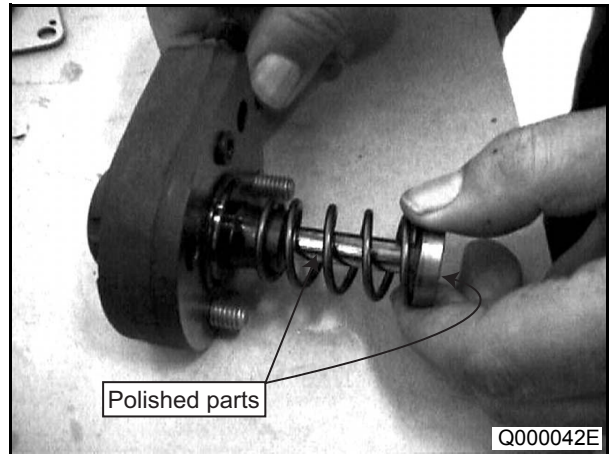
(4) Pull the element sub-assembly until it faces straight up and remove the element sub-assembly, plunger, and spring.



- (5) Taking the plunger straight out of the element sub-assembly, remove the plunger and the spring.

NOTE:

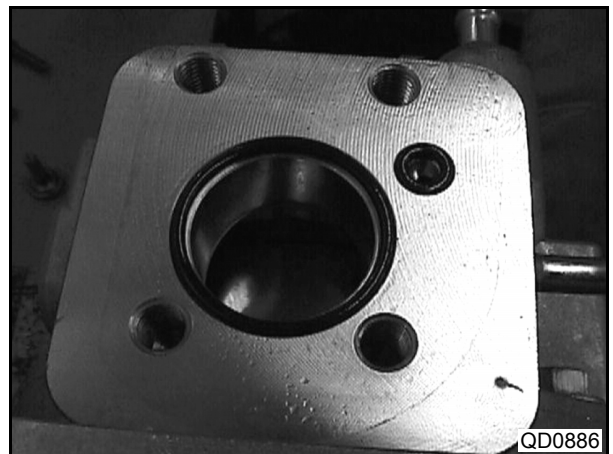
As much as possible, avoid touching the polished parts of the plungers and the surfaces that contact the ring cam.



- (6) Remove three O-rings from pump body (or from the side of the element sub-assembly, if attached).

NOTE:

When removing the O-ring, be careful not to damage the part's O-ring groove. (Please do not use sharp metal objects to remove.)

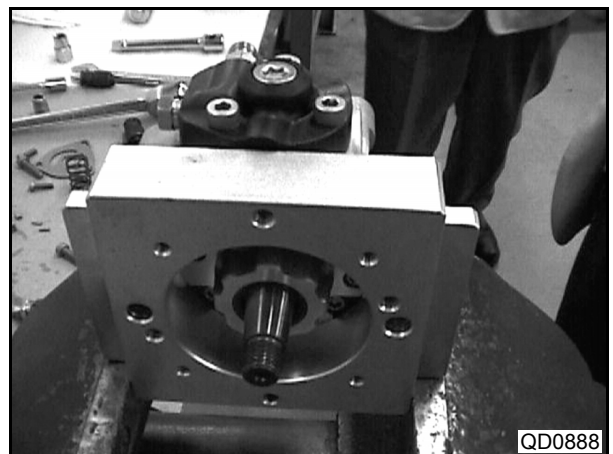


ADVICE:

The illustration on the right shows the element sub-assembly with O-rings attached.

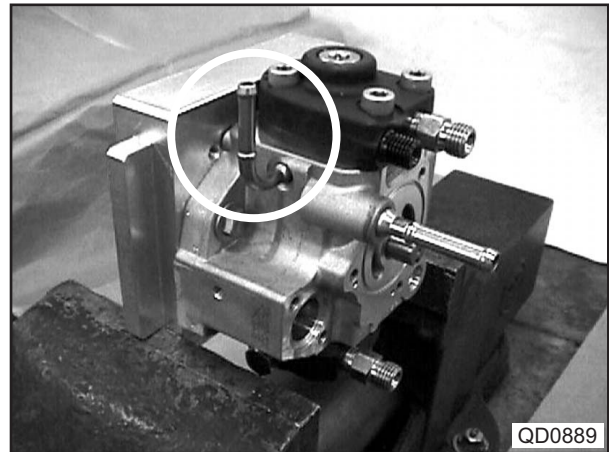


- (7) Secure the pump as shown at right to remove the element sub-assembly on the opposite side.



NOTE:

Please secure it so that the vise will not touch the circled part at right.

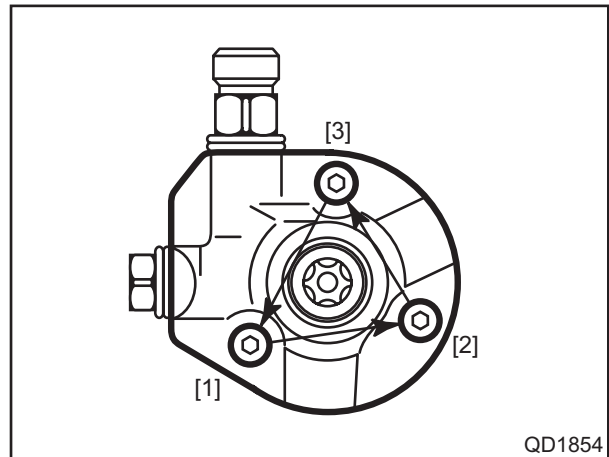


- (8) Loosen the three hexagonal bolts on top of the element sub-assembly.

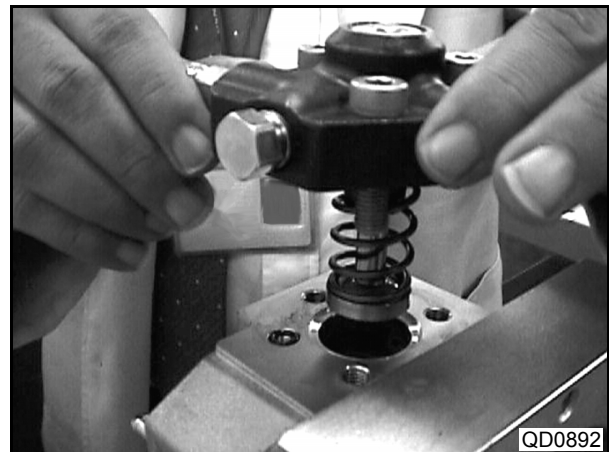


NOTE:

Loosen them uniformly in order as shown at right.



- (9) Pull the element sub-assembly until it faces straight up and remove the element sub-assembly, plunger, and spring.



- (10) Pull the element sub-assembly until it faces straight up and remove the element sub-assembly, plunger, and spring in the same way as step (5).

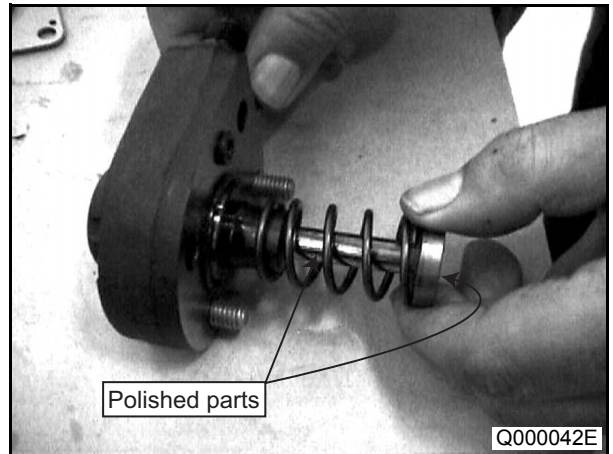
NOTE:

As much as possible, avoid touching the polished parts of the plungers and the surfaces that contact the ring cam.

ADVICE:

The illustration at right is for step (5).

- (11) Remove the O-ring in the same way as step (6).



3.9 Element Sub-Assembly Foreign Particles Check

- (1) Insert the plunger into the disassembled element sub-assembly.

NOTE:

Do not install the spring at this time. As much as possible, avoid touching the surfaces that contact the ring cam.



- (2) Slowly pull the plunger back out. If you can feel a vacuum then it is in normal condition.

NOTE:

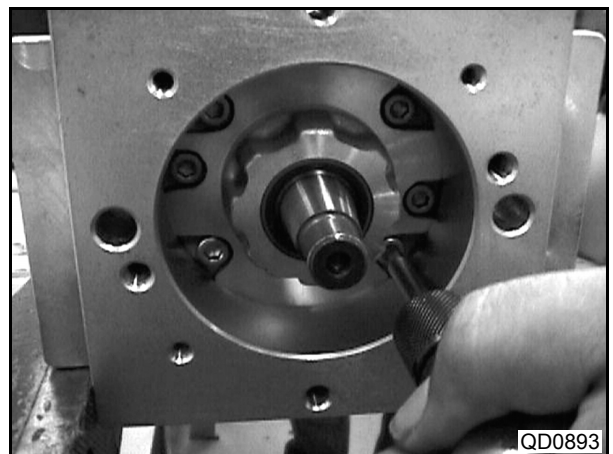
If you can not feel a vacuum, foreign particles have entered the element sub-assembly and it must be changed.



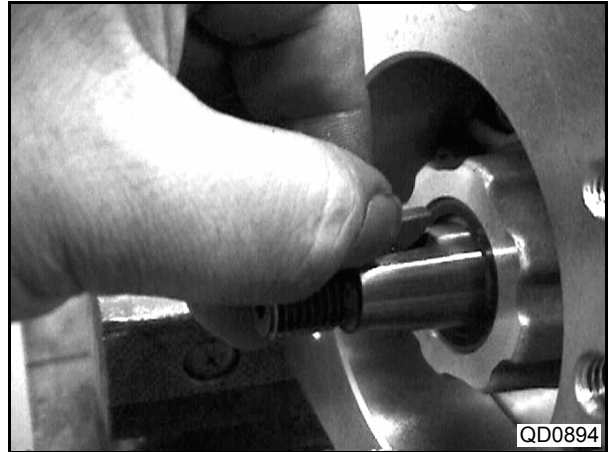
3.10 Disassembling the Pump Body

- (1) Partially loosen (two or three turns) the six hexagonal bolts on top of the cover sub-assembly.

- STT: Hexagonal Bit (95093-10030)
- STT: Driver Chuck (95992-10130)

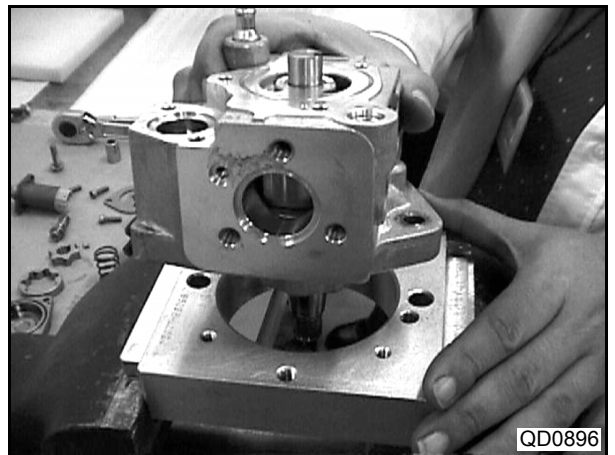
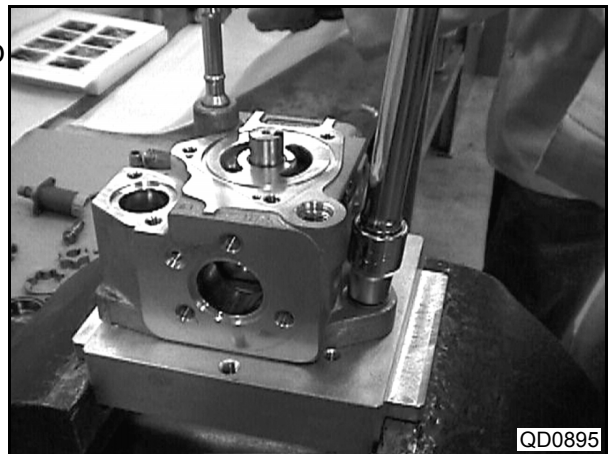


(2) Remove the key on top of the drive shaft.

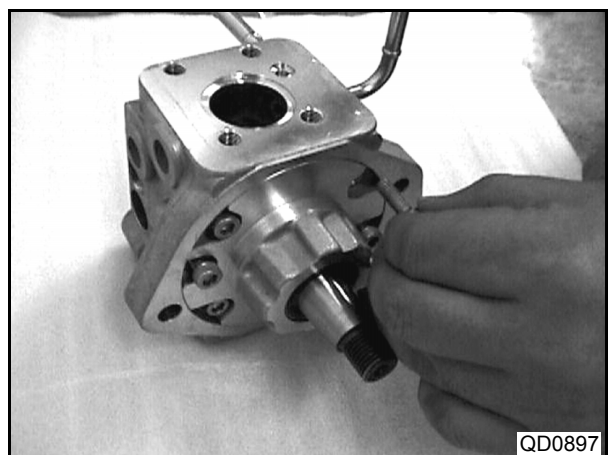


(3) Turn the pump as shown at right and remove the pump plate assembly (STT) from the pump body.

- STT: Pump Plate Assembly (95096-10620)



(4) Loosen the six hexagonal bolts completely, which are partially loosened in step (1).



- (5) Strike the drive shaft with a plastic hammer while holding down the pump body with one hand.

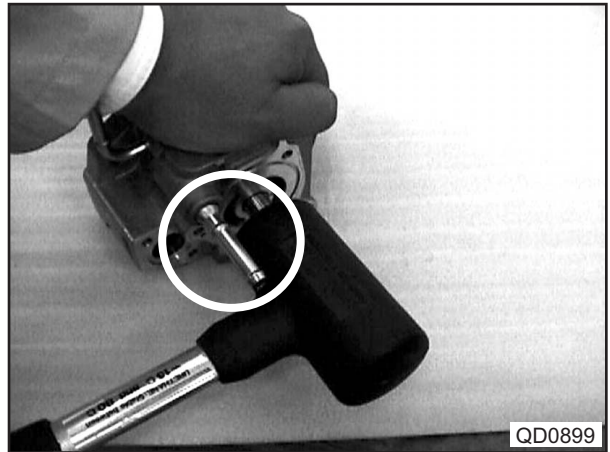
NOTE:

Make sure to use a plastic hammer.

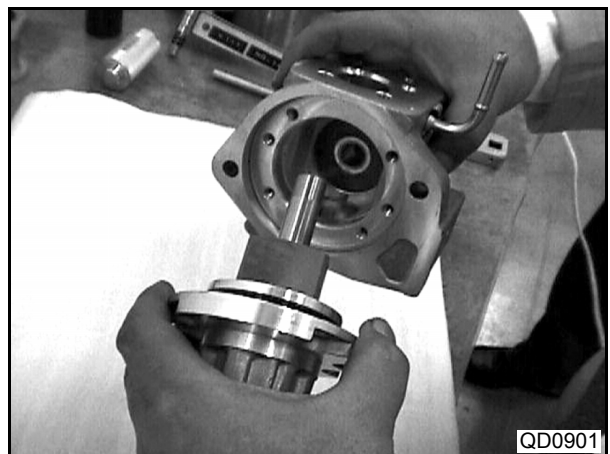


NOTE:

Be careful not to strike the pipe on the side of the drive shaft (circled at right).



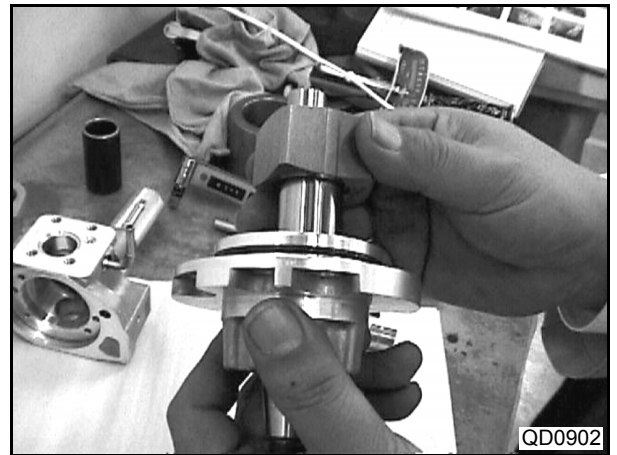
- (6) Remove the drive shaft from the feed pump side.



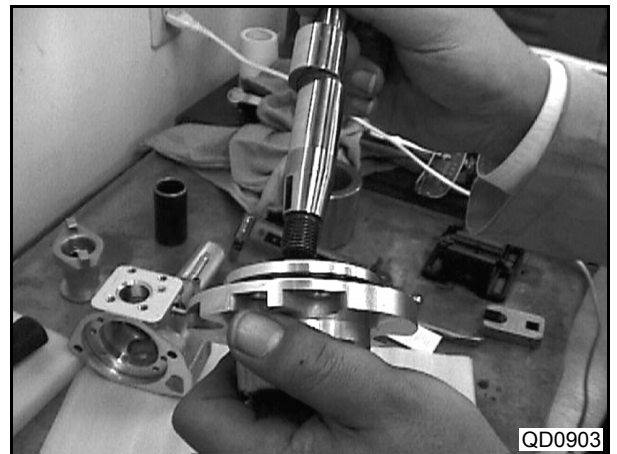
(7) Pull out the ring cam.

NOTE:

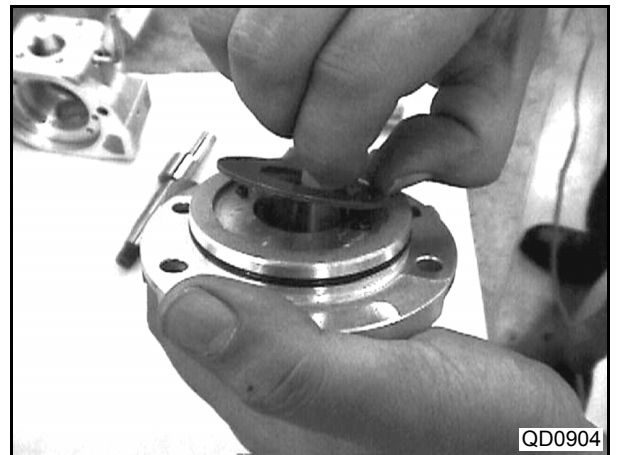
When removing the ring cam, be careful not to let it touch any surfaces which come in contact with the plunger (which has been polished).



(8) Remove the drive shaft.

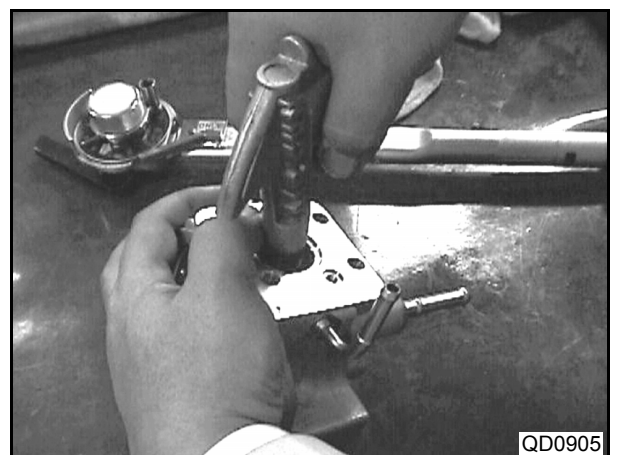


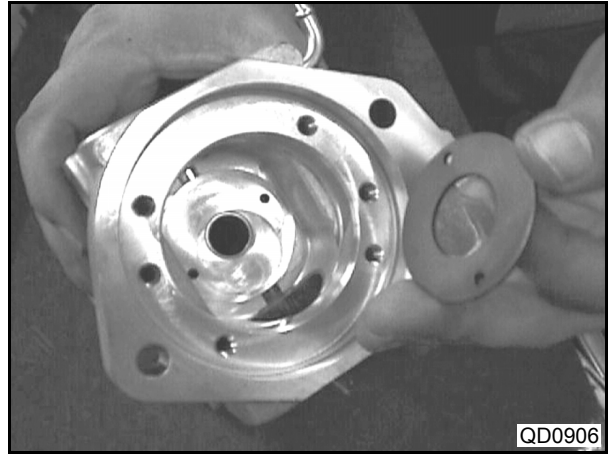
(9) Remove the washer.



ADVICE:

When removing the washer on the pump housing, use an air gun to remove it easily with air blasts.

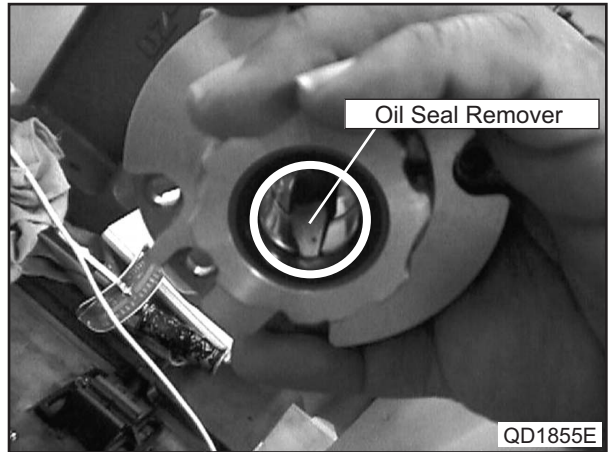




3.11 Removing the Oil Seal

(1) Using the oil seal remover (STT), remove the oil seal.

- STT: Oil Seal Remover (95096-11220)



4. Assembly Outline

4.1 Assembling the Oil Seal

- (1) Place the oil seal on the cover sub-assembly and use the oil seal presser (STT) to press it into the hydraulic press.

- STT: Oil Seal Presser (95096-10240)

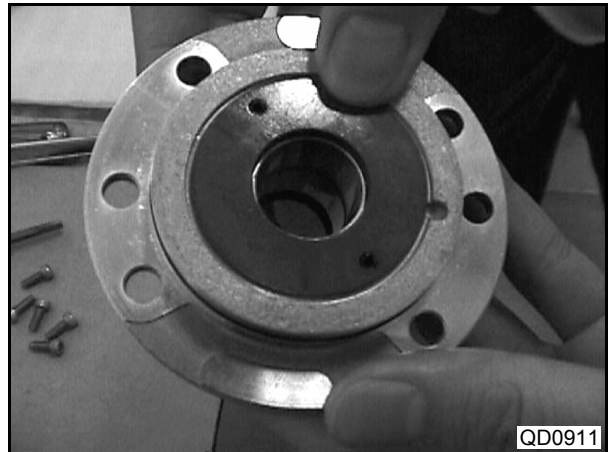
NOTE:

Once used, oil seals can not be reused.

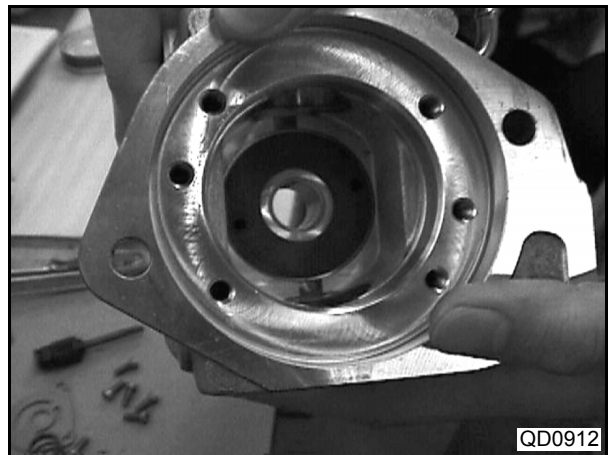


4.2 Measuring the Drive Shaft Thrust

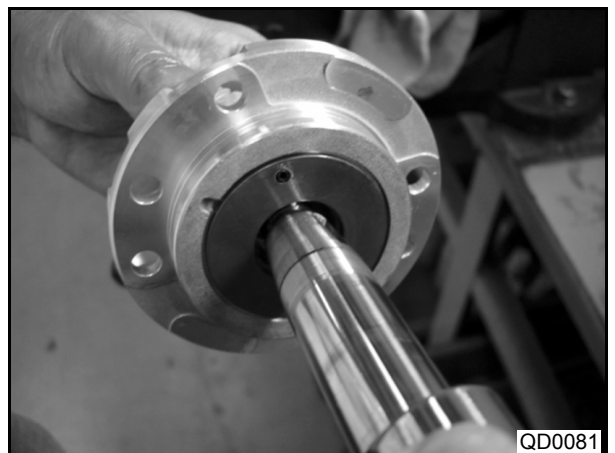
- (1) Install the washer on the cover sub-assembly.



- (2) Install a washer on the pump housing side as well.



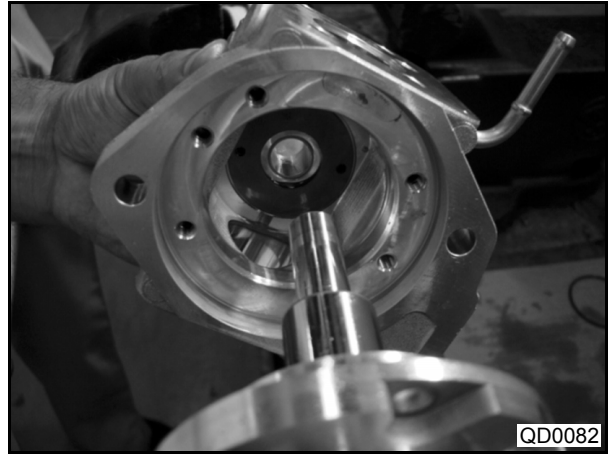
- (3) Install the drive shaft in the cover sub-assembly.



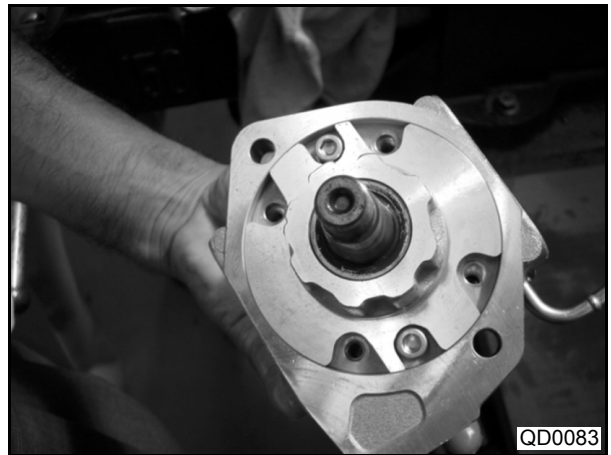
(4) Install the assembly from step (3) on the pump housing side.

NOTE:

Do not attach an O-ring to the cover sub-assembly at this time.

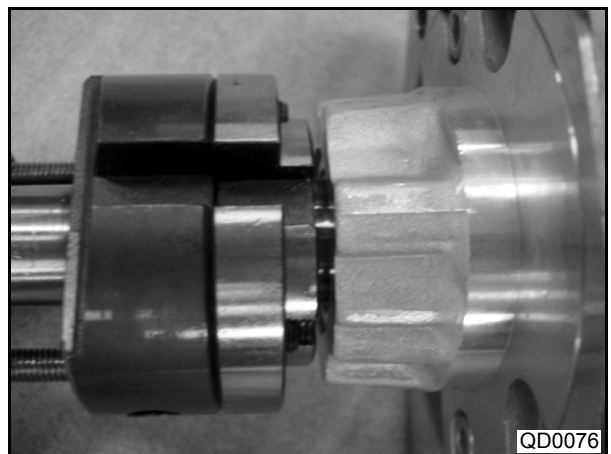
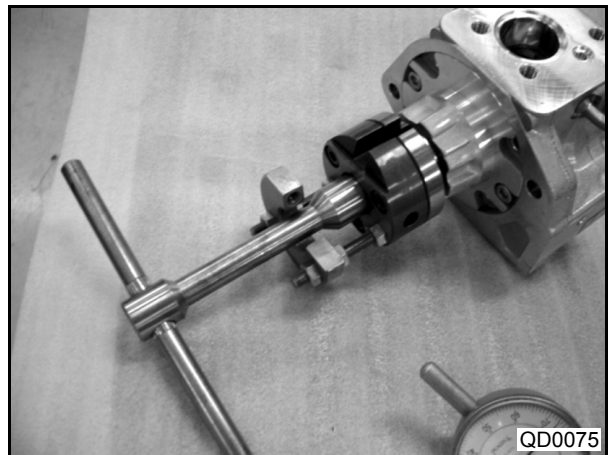


(5) Bolts are fastened to the cover sub-assembly in two places as shown at right.

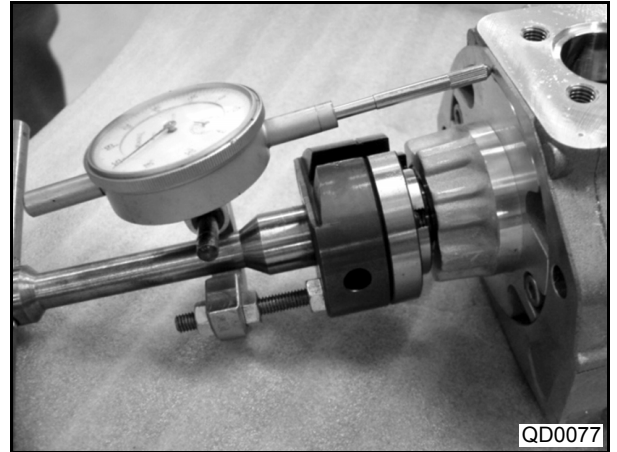


(6) Install the camshaft clearance measurer (STT) to the drive shaft.

- **STT: Camshaft Clearance Measurer (95092-10930)**



(7) Install the dial gauge on the camshaft clearance measurer.



(8) Pull the camshaft clearance measurer to set the dial gauge to 0.

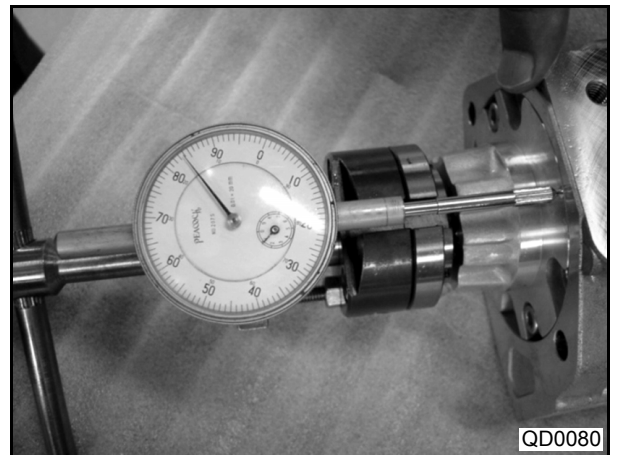


(9) Press the camshaft clearance measurer in to measure the drive shaft thrust.

• **Normal: $0.35 \pm 0.2\text{mm}$**

NOTE:

If the measurement does not meet the standard, replace the washer or cam shaft with a new one.

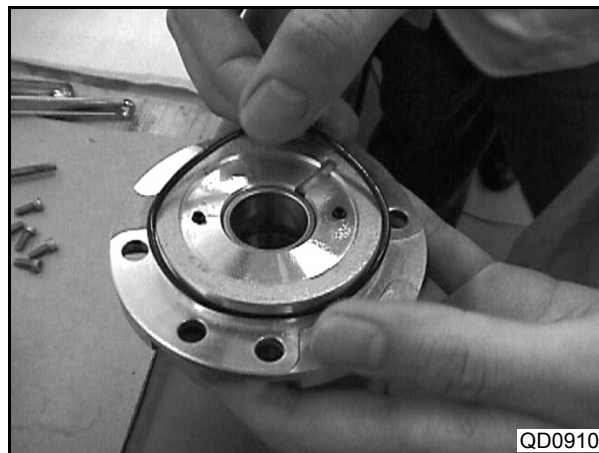


4.3 Assembling the Pump Body

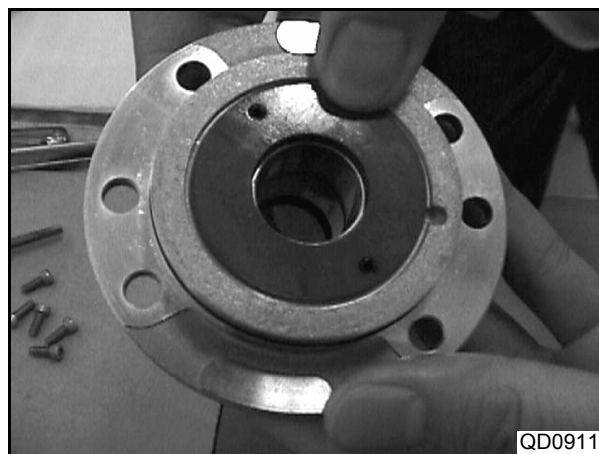
(1) Install an O-ring to the cover sub-assembly.

NOTE:

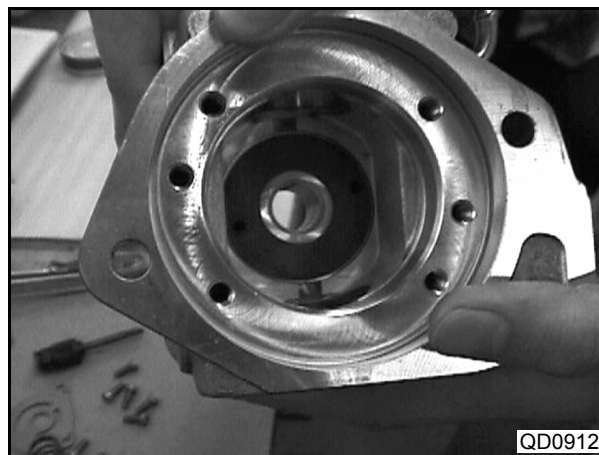
Always use a new O-ring.



(2) Install the washer on the cover sub-assembly.



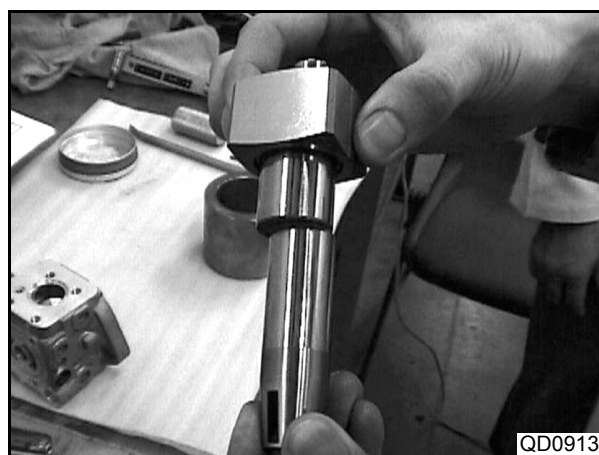
(3) Install a washer on the pump housing side as well.



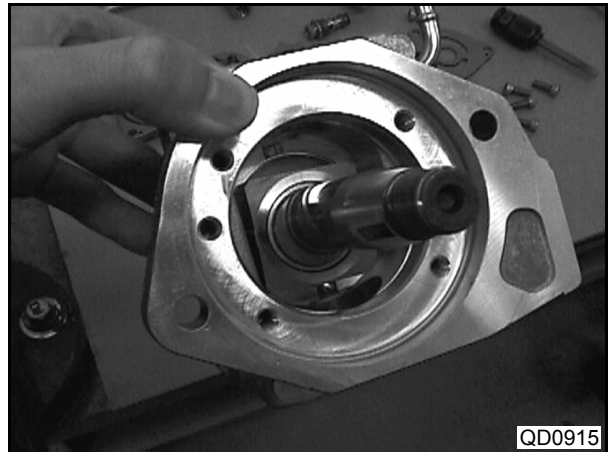
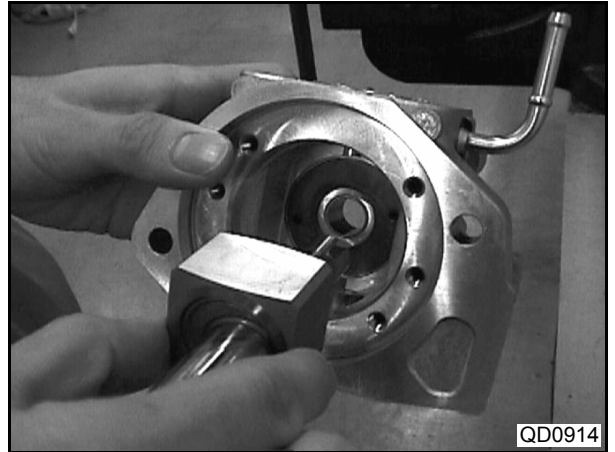
(4) Install the ring cam to the drive shaft.

NOTE:

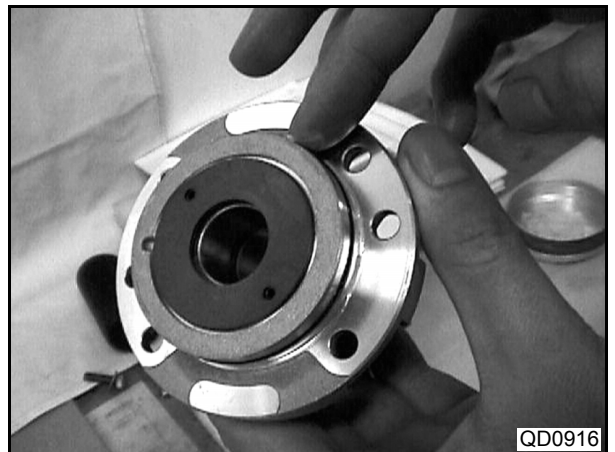
When removing the ring cam, be careful not to let it touch any surface which comes in contact with the plunger (which has been polished).



- (5) Install the parts (drive shaft and ring cam) assembled in step (4) to the pump housing.



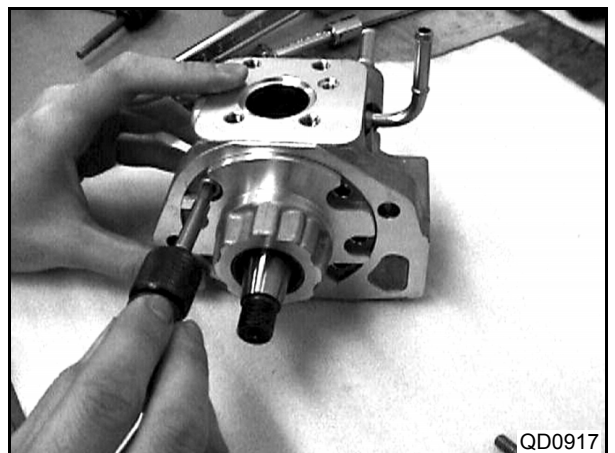
- (6) Apply grease to the cover sub-assembly.



- (7) Install the cover sub-assembly to the pump housing and partially tighten the six hexagonal bolts.

ADVICE:

Do not tighten the hexagonal bolts at this step.

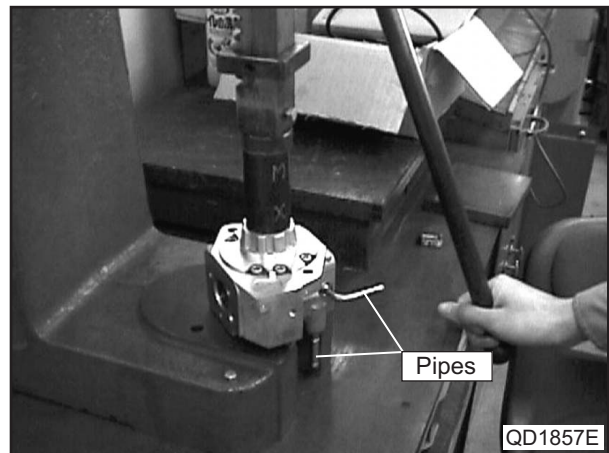
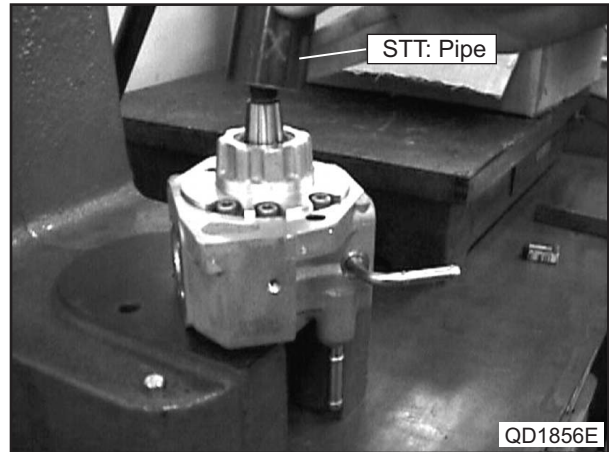


(8) With the pipe (STT) in the cover assembly, use the hydraulic press to press the cover sub-assembly into the pump housing.

- **STT: Pipe (95092-11480)**

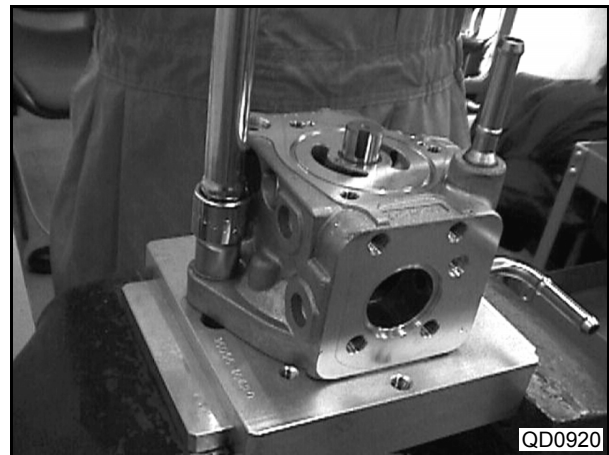
NOTE:

Please perform this step so that the pipes protruding from the pump body do not touch the hydraulic press or the workbench.



(9) Using two bolts, install the pump body on the pump plate (STT).

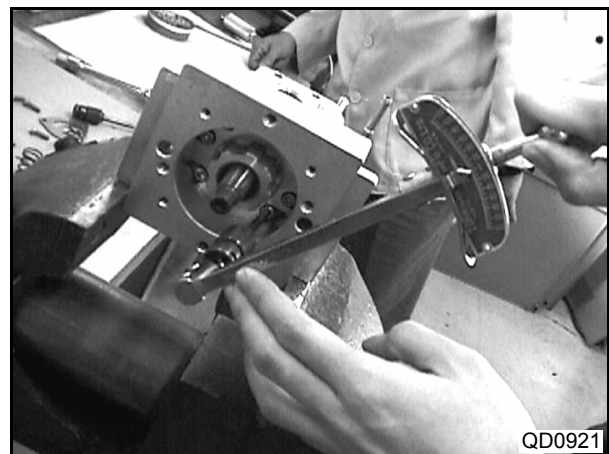
- **STT: Plate (95096-10620)**



(10) The pump body is secured with a vise as shown at right.

(11) Using the torque wrench (STT) and the hexagonal bit (STT), uniformly tighten the six hexagonal bolts on top of the cover sub-assembly.

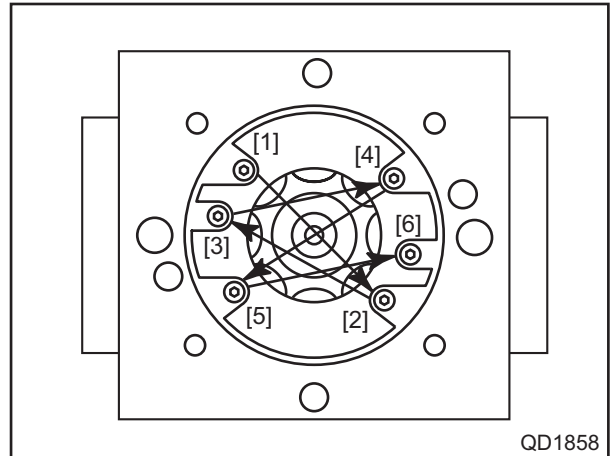
- **STT: Torque Wrench (95813-10010)**
- **STT: Hexagonal Bit (95993-10030)**
- **STT: Driver Chuck (95992-10130)**



NOTE:

Please tighten the six hexagonal bolts uniformly in the order shown at right.

- Tightening Torque: 6.9 to 10.8 N·m (0.7 to 1.1 kgf·m)

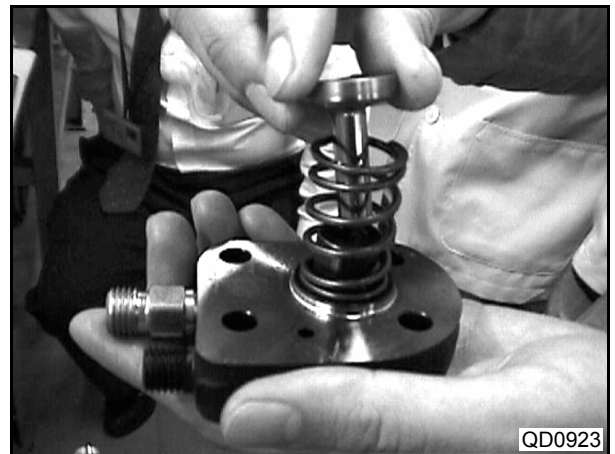


4.4 Assembling the Element Sub-Assembly, Plunger, and Spring

- (1) Install the spring and plunger in the element sub-assembly.

NOTE:

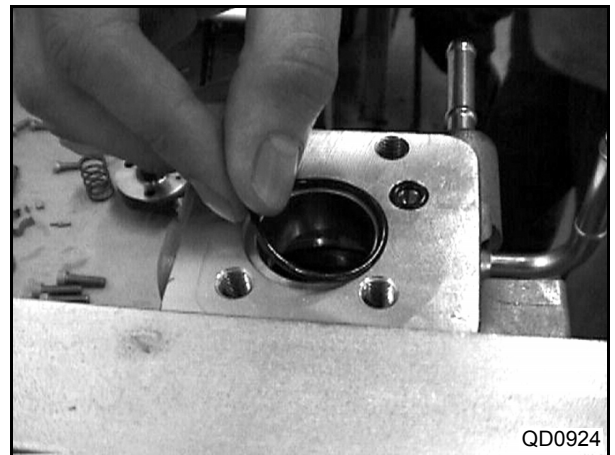
As much as possible, avoid touching the polished parts.



- (2) Install an O-ring to the pump body.

NOTE:

Always use a new O-ring.



- (3) Install the element sub-assembly assembled in step (1) to the pump body.

NOTE:

Before installing, make certain that the contact point between the ring cam and the plunger (which has been polished) faces upwards.

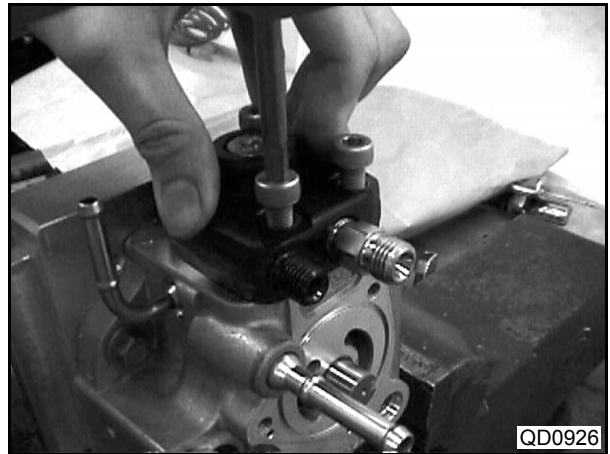
NOTE:

Check that the drive shaft key is 180 degrees from the element being installed.



(4) While pressing the element sub-assembly down, uniformly tighten the four hexagonal bolts using the torque wrench (STT) and the hexagonal bit (STT).

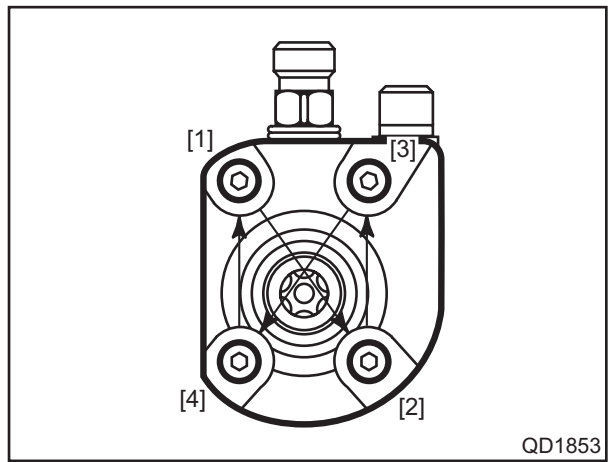
- STT: Torque Wrench (95813-10010)
- STT: Hexagonal Bit (95993-10040)
- STT: Driver Chuck (95992-10130)



NOTE:

Please tighten the four hexagonal bolts uniformly in the order shown at right.

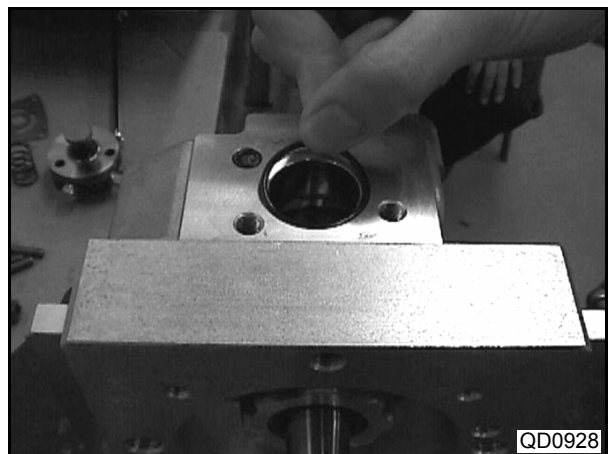
- Tightening Torque: 15.68 to 23.52 N·m
(1.6 to 2.4 kgf·m)



(5) Install an O-ring on the pump body on the opposite side of where the element sub-assembly will be installed.

NOTE:

Always use a new O-ring.



- (6) Install the spring and plunger in the opposite side of the element sub-assembly.

NOTE:

As much as possible, avoid touching the polished parts.



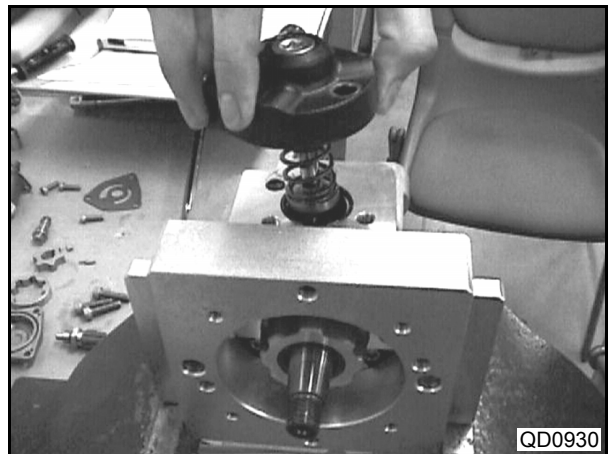
- (7) Install the element sub-assembly assembled in step (6) to the pump body.

NOTE:

Before installing, make certain that the contact point between the ring cam and the plunger (which has been polished) faces upwards.

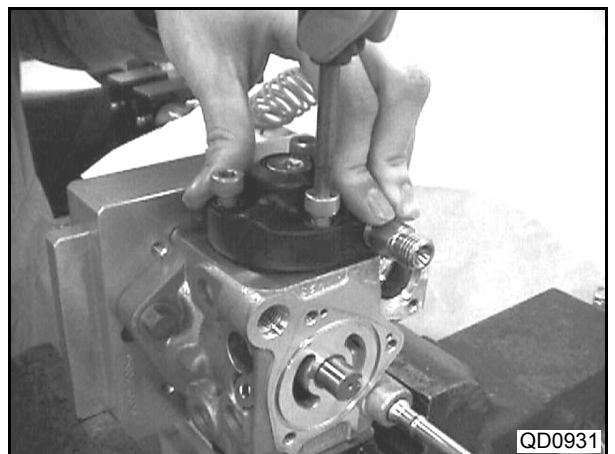
NOTE:

Check that the drive shaft key is 180 degrees from the element being installed.



- (8) While pressing the element sub-assembly down, uniformly tighten the three hexagonal bolts using the torque wrench (STT) and the hexagonal bit (STT).

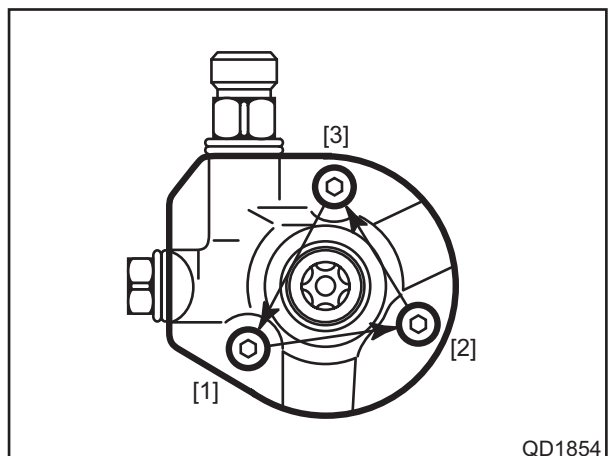
- STT: Torque Wrench (95813-10020)
- STT: Hexagonal Bit (95993-10040)
- STT: Driver Chuck (95992-10130)



NOTE:

Please tighten the three hexagonal bolts uniformly in the order shown at right.

- Tightening Torque: 15.68 to 23.52 N·m
(1.6 to 2.4 kgf·m)



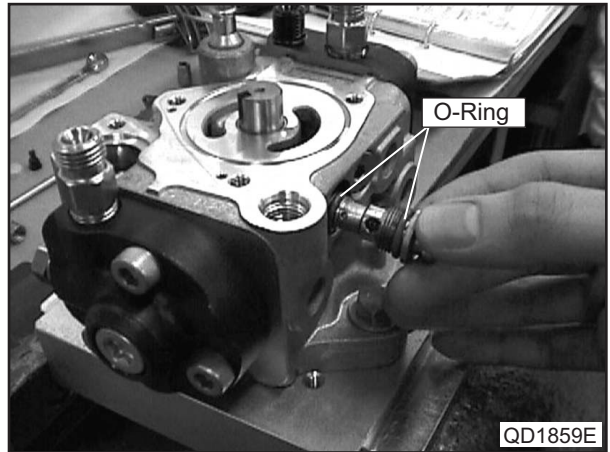


4.5 Installing the Regulating Valve

- (1) Secure the pump as shown at right.
- (2) Install the regulating valve.

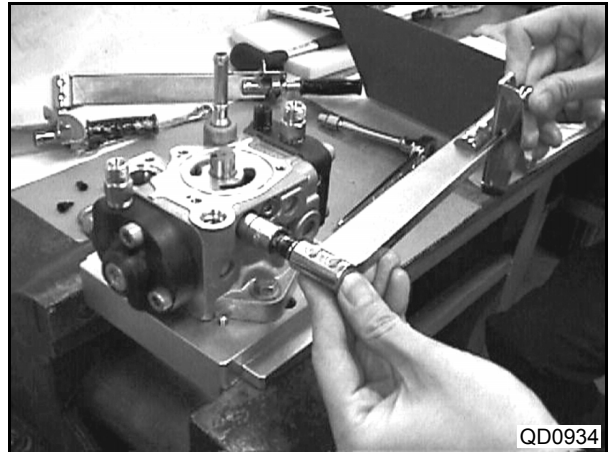
NOTE:

- In cases where it is necessary to replace the regulating valve refer to p.9, "3.6 Removing the Regulating Valve" (Added Sept. 2005)
- Always use a new O-ring.
- The regulating valve cannot be adjusted.



- (3) Using the torque wrench (STT) and regulating valve socket wrench (STT), install the regulating valve.

- **STT: Torque Wrench (95813-10010)**
- **STT: Regulating Valve Socket Wrench (95096-10181)**
- **Tightening Torque: 7.9 to 11.8 N·m (0.8 to 1.2 kgf·m)**



4.6 Installing the Filter Sub-Assembly

- (1) Using the filter presser, attach the filter sub-assembly.

NOTE:

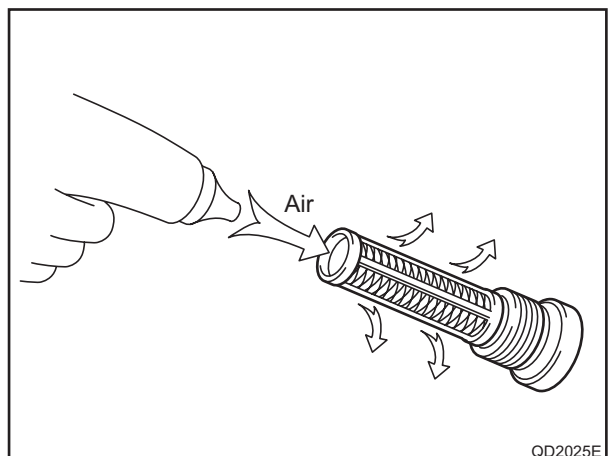
When attaching, be careful not to tear the filter sub assembly mesh.



NOTE:

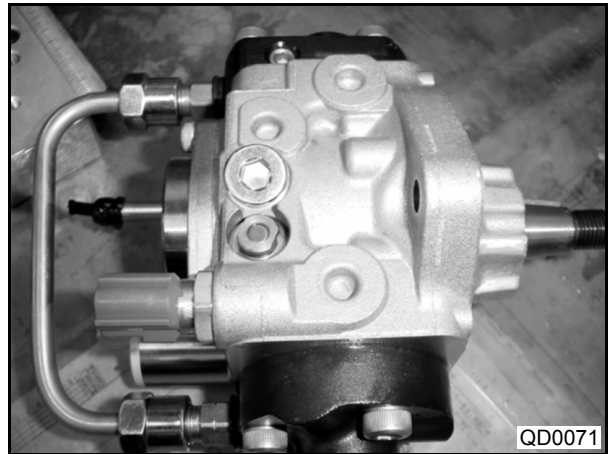
Verify the new filter by sight. If there is by chance any foreign material in the filter, remove it with an air gun.

(Revised Sept. 2005)



(2) Using the hexagonal bit and the torque wrench (STT), install the filter plug.

- Tool: Hexagonal Bit (8mm)
- STT: Torque Wrench (95096-10020)
- Tightening Torque: 14.8 to 22.8 N·m (1.5 to 2.3 kgf·m)

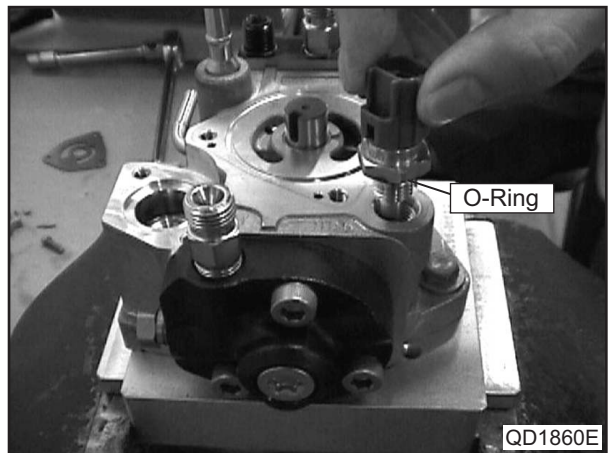


4.7 Installing the Fuel Temperature Sensor

(1) Install the fuel temperature sensor.

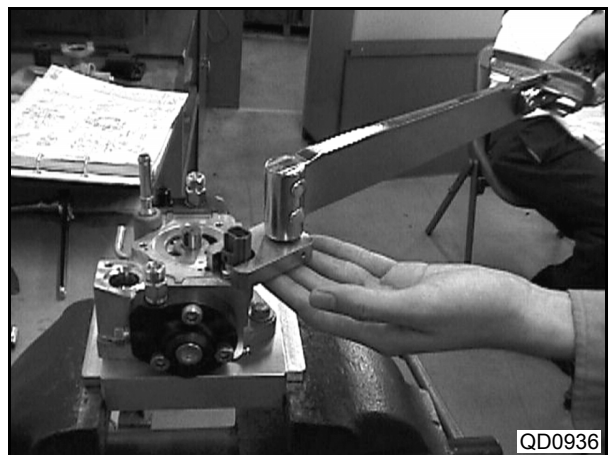
NOTE:

Always use a new O-ring.



(2) Using the torque wrench (STT) and nozzle holder, and the retaining nut wrench (STT), fasten the fuel temperature sensor.

- STT: Torque Wrench (95813-10020)
- STT: Nozzle Holder, Retaining Nut Wrench (95092-10500)
- Tightening Torque: 17.6 to 26.5 N·m (1.8 to 2.7 kgf·m)

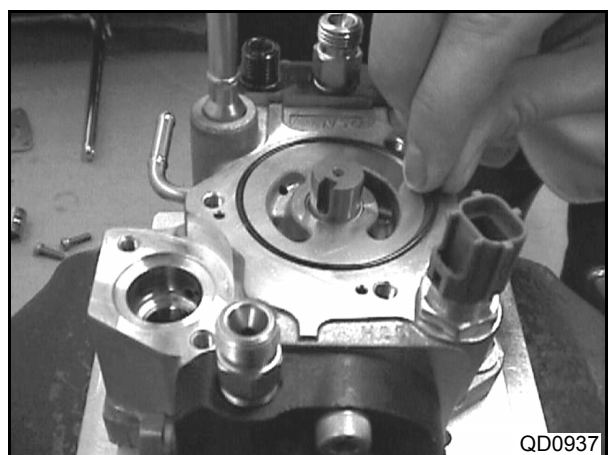


4.8 Assembling the Feed Pump

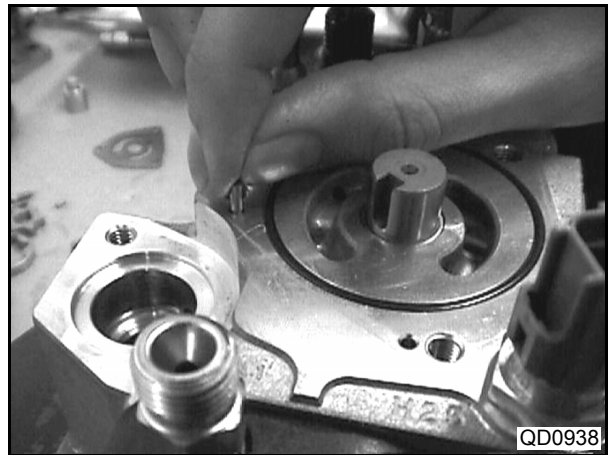
(1) Install an O-ring.

NOTE:

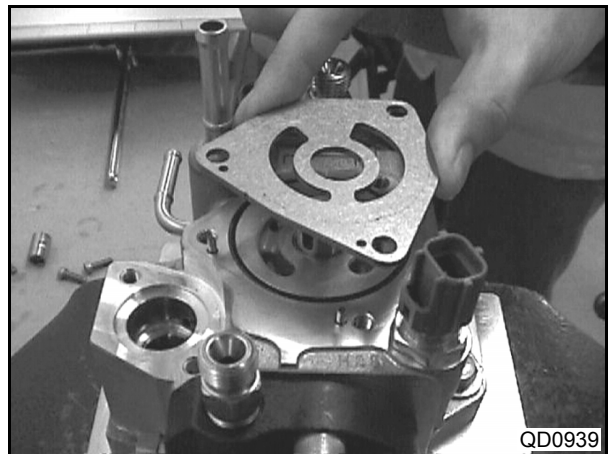
Always use a new O-ring.



(2) Install position-holding pins in two places.

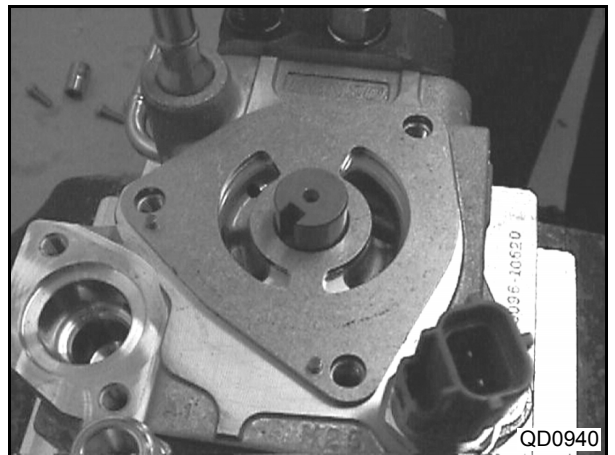


(3) Align the plate and the feed pump to the position-holding pins, and fasten them.

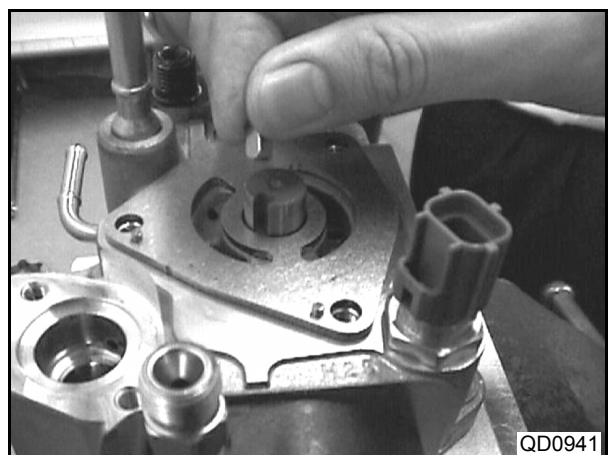


NOTE:

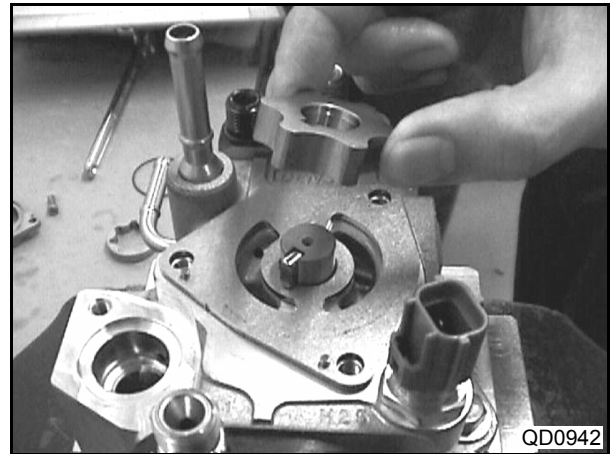
Be careful about front and rear. The intake hole and exhaust hole should be visible.



(4) Install the feed pump key.

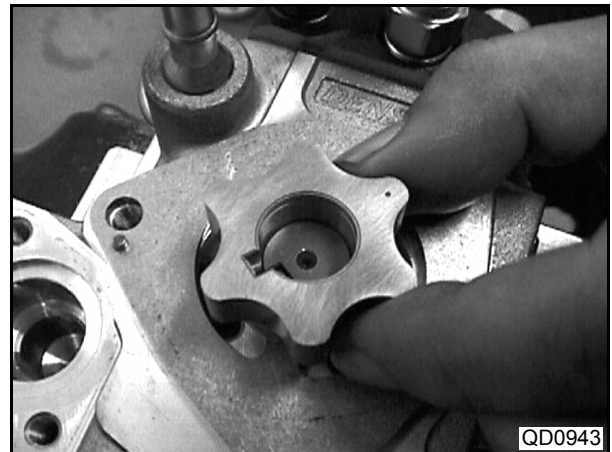


(5) Install the inner rotor.



NOTE:

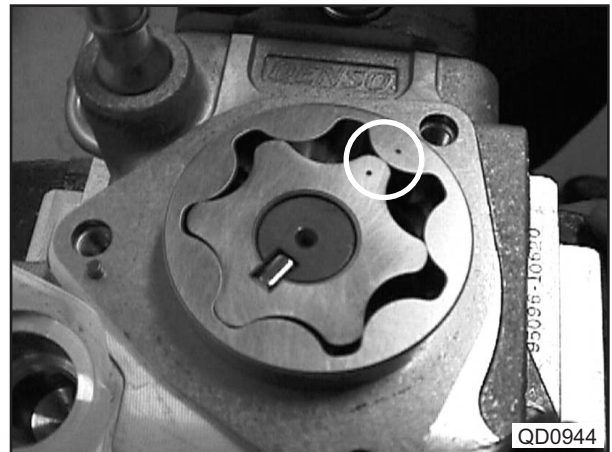
Please make sure the inner rotor key and the feed pump key are aligned.



(6) Install the outer rotor.

NOTE:

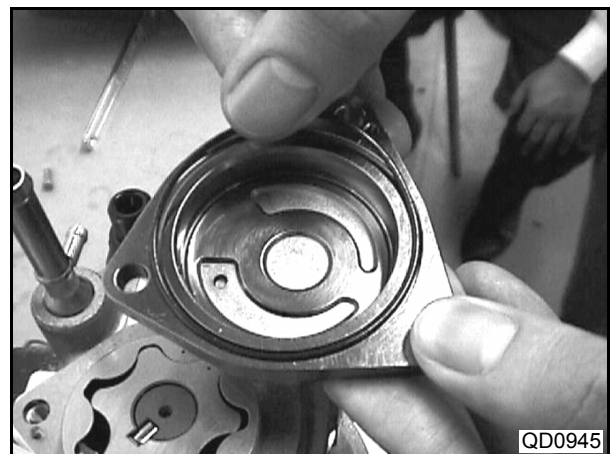
Please make sure the outer and inner rotor protrusions (circled at right) are aligned.



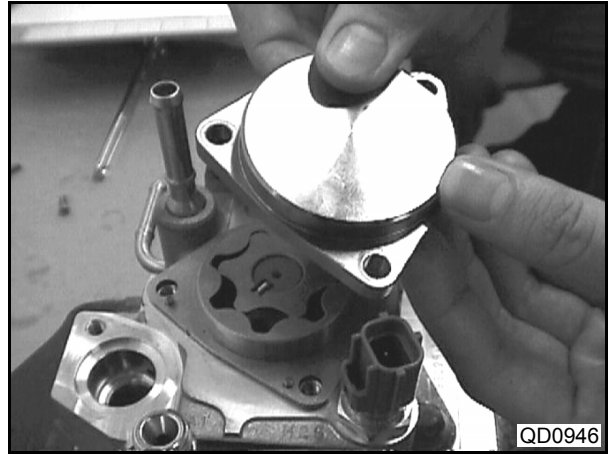
(7) Install an O-ring to the cover and the feed pump.

NOTE:

Always use a new O-ring.

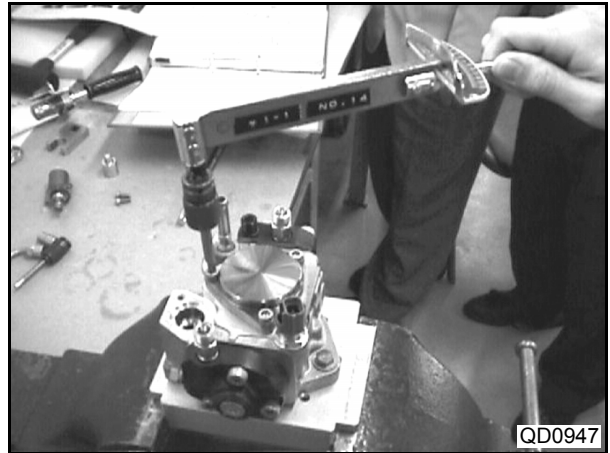


(8) Align the cover and the feed pump to the position-holding pins, and fasten them.



(9) Using the torque wrench (STT) and the hexagonal bit (STT), tighten the three hexagonal bolts.

- STT: Torque Wrench (95813-10010)
- STT: Hexagonal Bit (95993-10030)
- STT: Driver Chuck (95992-10130)
- Tightening Torque: 6.9 to 10.8 N·m (0.7 to 1.1 kgf·m)



4.9 Installing the SCV (Suction Control Valve)

(1) Install an O-ring.

NOTE:

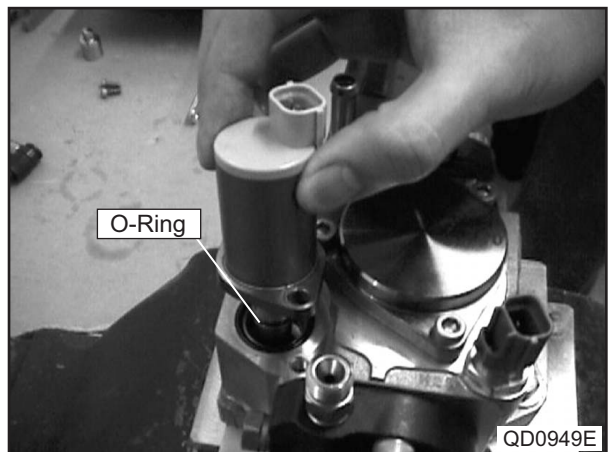
Always use a new O-ring.



(2) Install the SCV.

NOTE:

- Always use a new O-ring.
- Install the SCV in the position recorded during removal (recorded connector position "facing in/facing out", refer to p.63 (1)). If the pump is attached to the vehicle with the SCV not installed in the correct position, it is possible that the wiring harness will become twisted, severing the connection with the SCV. (Added Sept. 2005)



(3) Using the torque wrench (STT) and the hexagonal bit (STT), tighten the two hexagonal bolts.

- STT: Torque Wrench (95813-10010)
 - STT: Hexagonal Bit (95993-10030)
 - STT: Driver Chuck (95992-10130)
- Tightening Torque: 6.9 to 10.8 N·m (0.7 to 1.1 kgf·m)



4.10 Installing the Pipe

(1) Install the pipe.

NOTE:

Please attach the pipe in the same direction as indicated when removing it.

NOTE:

The pipe must be fastened in the right direction, please make sure the pipe end fits when attaching.

- STT: Nozzle Retaining Nut Wrench (95092-10500)

• Tightening Torque:

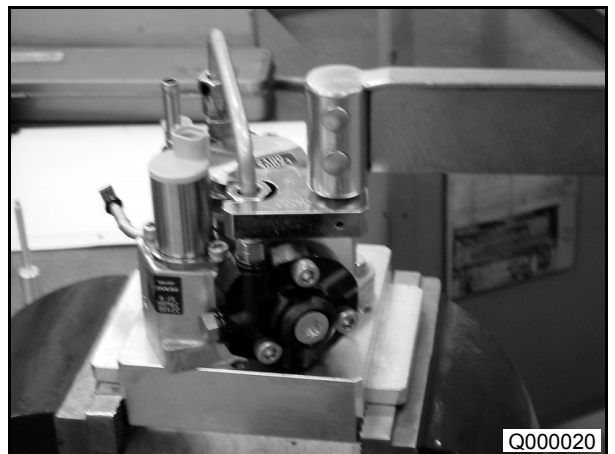
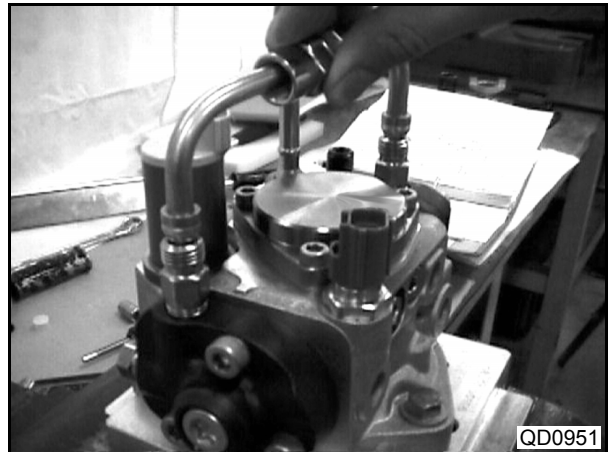
○ 19 : 39.2 to 49.0 N·m (4.0 to 5.0 kgf·m)

○ 17 : 24.0 to 30.0 N·m (2.5 to 3.1 kgf·m)

(Revised and Added Sept. 2005)

ADVICE:

When working on a pump that does not use pipes, this step is unnecessary.



5. Troubleshooting

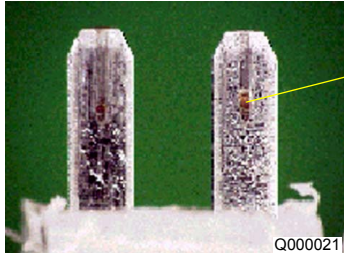
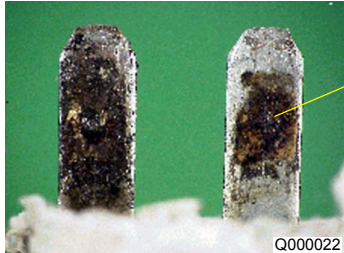
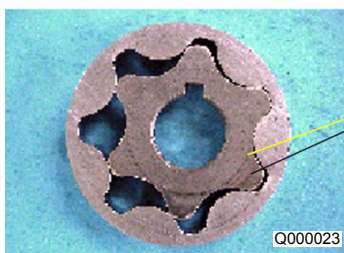
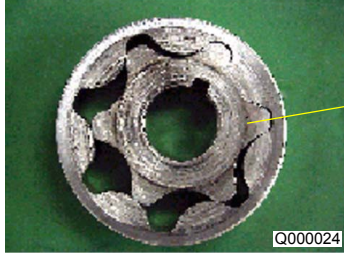
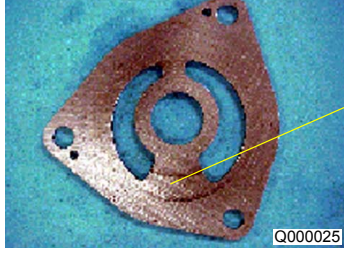
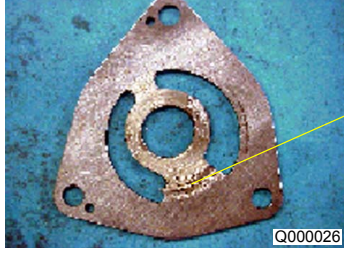
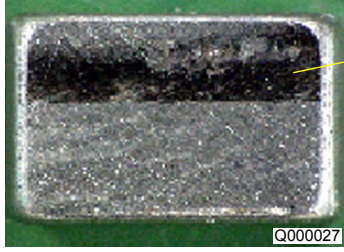
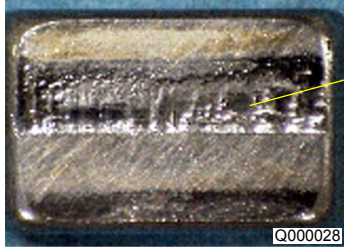
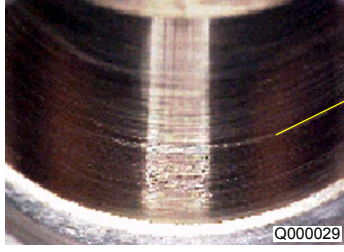
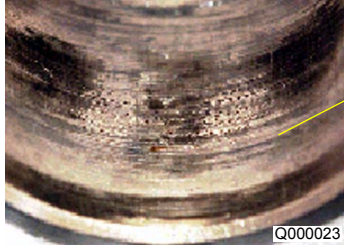
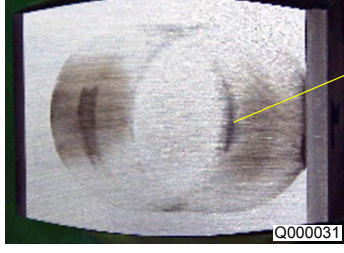
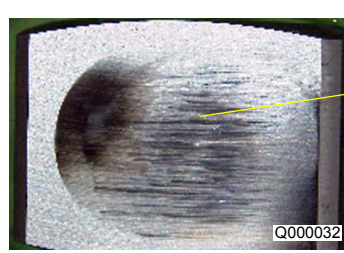
5.1 Procedure

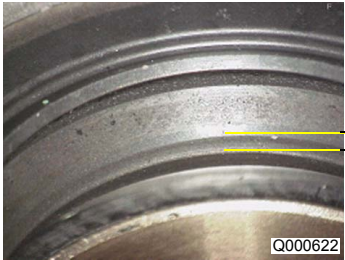
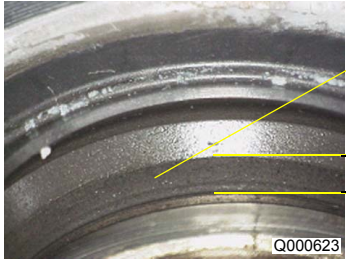
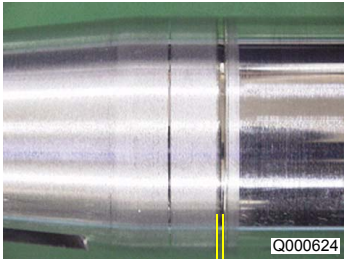
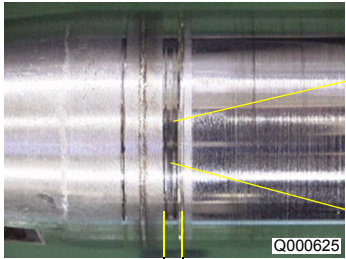
Part investigated	Symptom (No: Check priority)						Check method	Judgment criterion	Solution
	Overflow amount abnormality		Discharge performance abnormality	Pressure feed precision abnormality		High-speed no-pressure feed abnormality			
	Excess flow	Insufficient flow		Insufficient discharge	Insufficient discharge				
Pump assembly		1	1	1	1	1	Check for fuel leaks to the outside.	Leak (See note below.)	Replace the leak section.
							Measure the resistance between the SCV terminals.	Does not meet the standard. (See the standard in the investigation standards table.)	Replace the SCV.
SCV			2		2		Remove the SCV and check.	Foreign matter caught in valve port	Replace the SCV.
				2		2		The terminal is abnormally worn or scorched. (Visual check: See the boundary sample.)	Replace the SCV.
								The O ring is cut.	Replace the O ring.
								The O ring is cut.	Replace the O ring.
Pump filter		6	6		6		Remove the filter and check.	Foreign matter clog	Clean or replace.
				4				The filter is broken.	Replace the filter.
Regulating valve		4	5		5	4	Individual check unnecessary. (Revised Sept. 2005)	In the case of a malfunction, replace with a new part. (Revised Sept. 2005)	Replace.
	1			3		4			
Feed pump							Remove the feed pump and check.	The rotor is abnormally worn. (Visual check: See the boundary sample.)	Replace.
		5	4		4			The cover and plate are abnormally worn. (Visual check: See the boundary sample.)	Replace.
								The key is abnormally worn. (Visual check: See the boundary sample.)	Replace.
Element							Remove the element and check.	The plunger slide surface is scorched. (Visual check: See the boundary sample.)	Replace the element kit.
								The cylinder is cracked. (Visual check: See the boundary sample.)	Replace the element kit.
								The Plunger SP breakage (Visual check: See the boundary sample.)	Replace.
			3		3			Pump the plunger.	The plunger is loose and does not return.
Pump housing		3					Check inside the housing.	The overflow port is clogged with foreign matter.	Replace the O ring.
		2						The cam chamber orifice is clogged with foreign matter.	Replace the O ring.
						3		3	The zero orifice is clogged with foreign matter.
Cam ring					7		Remove and check.	The bushing is abnormally worn or scorched. (Visual check: See the boundary sample.)	Replace. (Replace the partner part too.)
								The plunger slide surface is abnormally worn or scorched. (Visual check: See the boundary sample.)	Replace. (Replace the partner part too.)

NOTE:

If there is fuel leaking from the oil seal, visually check the oil seal and shaft shoulder for wear. (See the boundary sample.)

5.2 Boundary samples for disassembly checks

Location	Normal	Abnormal
SCV terminal	 <p>Some degree of contact from partner connector</p> <p>Q000021</p>	 <p>Spark marks (black discoloring) on the connector surface</p> <p>Q000022</p>
Feed pump rotor	 <p>Some degree of initial contact</p> <p>Q000023</p>	 <p>Fine cracks</p> <p>Q000024</p>
Feed pump plate and cover	 <p>Some degree of initial contact</p> <p>This also applies to the feed pump cover</p> <p>Q000025</p>	 <p>Fine cracks</p> <p>This also applies to the feed pump cover</p> <p>Q000026</p>
Feed pump key	 <p>Some degree of initial contact</p> <p>Q000027</p>	 <p>The contact surface is rough and abnormally worn.</p> <p>Q000028</p>
Metal bushing	 <p>Rotational scratches with some degree of initial contact</p> <p>Q000029</p>	 <p>The rotational scratches are severe and the surface is rough.</p> <p>Q000030</p>
Cam ring	 <p>Some degree of initial contact</p> <p>Q000031</p>	 <p>There are countless scratches from trapped foreign matter.</p> <p>Q000032</p>

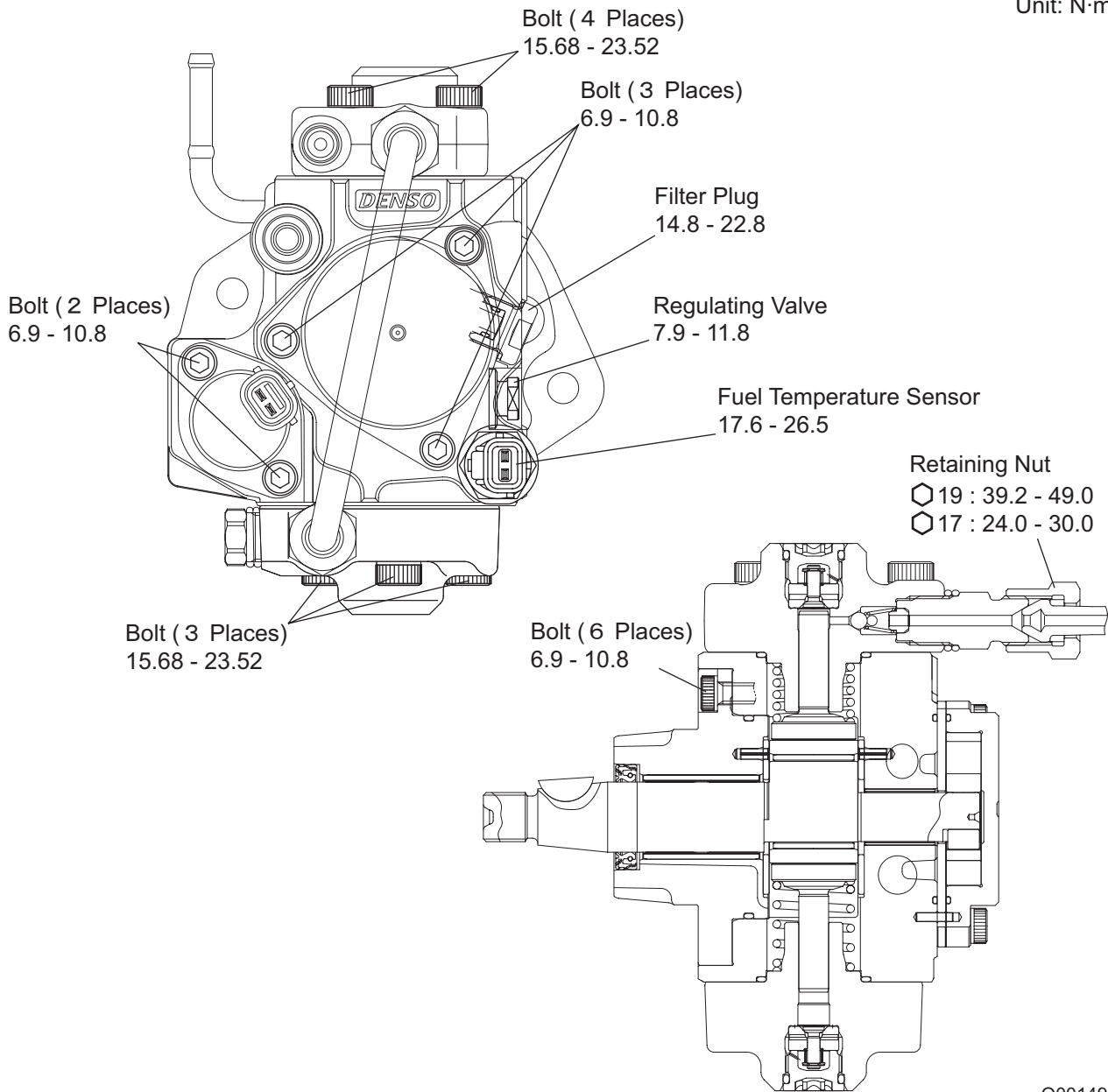
Location	Normal	Abnormal
Oil Seal	 <p>Small Wear Width</p> <p>Q000622</p>	 <p>Main Lip Contact</p> <p>Large Wear Width</p> <p>Q000623</p>
Camshaft	 <p>Small wear width (Reference: approximately 1mm or less)</p> <p>Wear exists, but the contact width is small and the surface is good.</p> <p>Q000624</p>	 <p>Main Lip Contact</p> <p>Rough Surface</p> <p>Large wear width: approximately 1.5mm (step wear)</p> <p>The wear width is large and the surface rough.</p> <p>Q000625</p>

NOTE:

During the disassembly check, replace the camshaft and oil seal as a set when wear on these parts has reached the abnormal wear limits (steps, roughness) shown in the samples above.

6. Tightening Torque List (Example: for 244000-001#)

Unit: N·m



Q001494E

Published : May 2003

Second Issur: October 2005

Edited and published by:

DENSO CORPORATION

Service Department

1-1 Showa-cho, Kariya, Aichi Prefecture, Japan

Printed in Japan *****