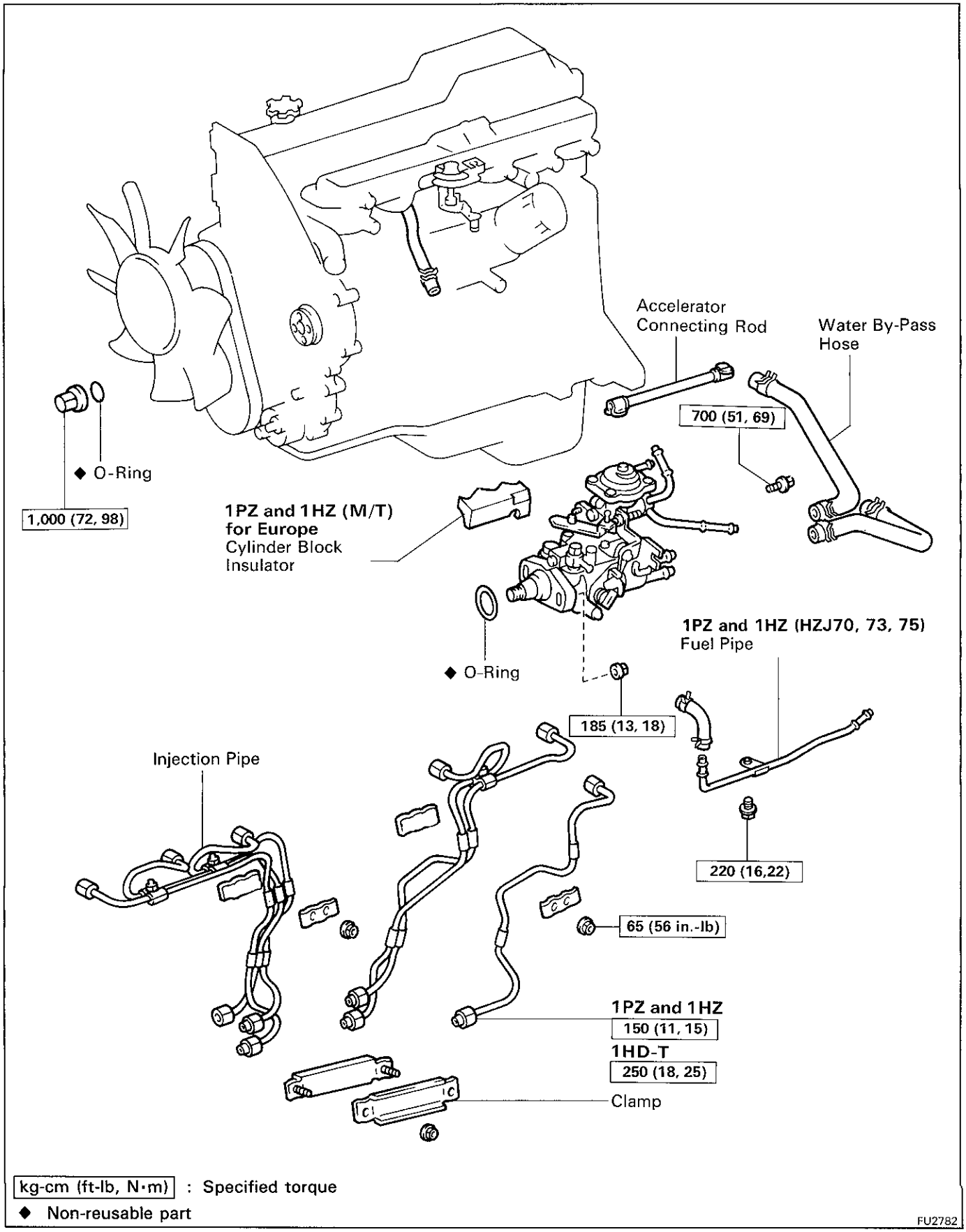
INJECTION PUMP

REMOVAL OF INJECTION PUMP



kg-cm (ft-lb, N·m) : Specified torque

◆ Non-reusable part

FU2782

1. (w/ ACSD)
DRAIN COOLANT (See page CO-5)

2. REMOVE TIMING BELT
(See steps 1 to 3 on pages EM-33 to 34)

3. REMOVE NO.2 CAMSHAFT TIMING PULLEY
(See step 5 on pages EM-34)

4. DISCONNECT ACCELERATOR CONNECTING ROD

5. (A/T)
DISCONNECT THROTTLE CABLE

6. (w/ A/C)
DISCONNECT A/C IDLE-UP VACUUM HOSE

7. (w/ ACSD)
DISCONNECT WATER BY-PASS HOSES FROM THERMO WAX

8. DISCONNECT INJECTION PUMP CONNECTOR

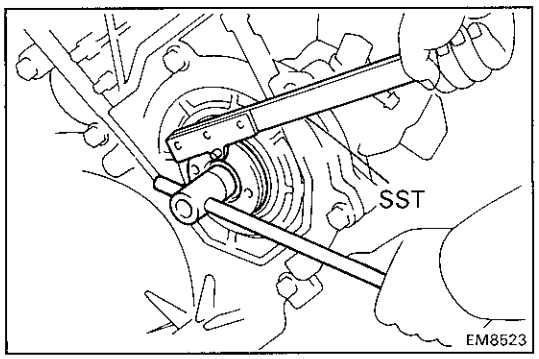
9. DISCONNECT FUEL HOSES FROM INJECTION PUMP

10. (1HD-T)
DISCONNECT BOOST COMPENSATOR HOSE

11. (w/ PCS)
DISCONNECT PCS VACUUM HOSE

12. (w/ BACS)
DISCONNECT BACS VACUUM HOSE

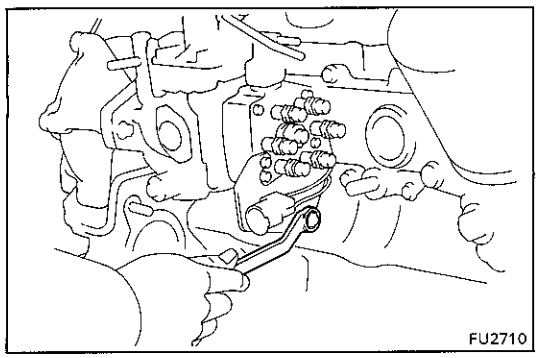
13. REMOVE INJECTION PIPES
(See step 2 on page FU-9)



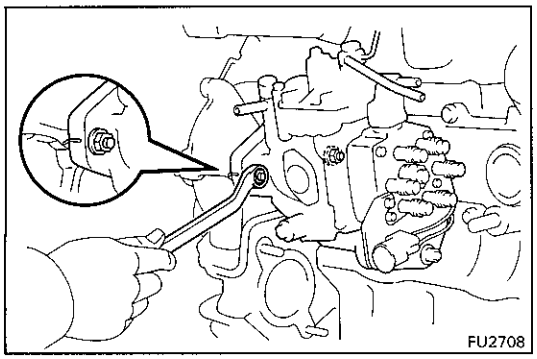
14. REMOVE INJECTION PUMP

(a) Using SST, remove the injection pump drive gear set nut.

SST 09330-00021



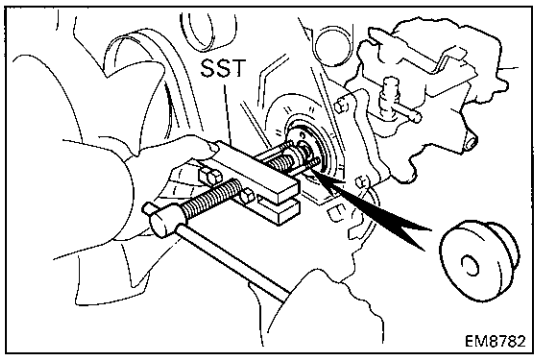
(b) Remove the bolt holding the injection pump to pump stay.



(c) Before removing the injection pump, check if the period lines are aligned.

If not, place new matchmarks for reinstallation.

(d) Remove the two nuts holding the injection pump to the timing gear case.



(e) Using SST, remove the injection pump.

SST 09213-60017 (09213-00020, 09213-00030, 09213-00060) and 09950-20017

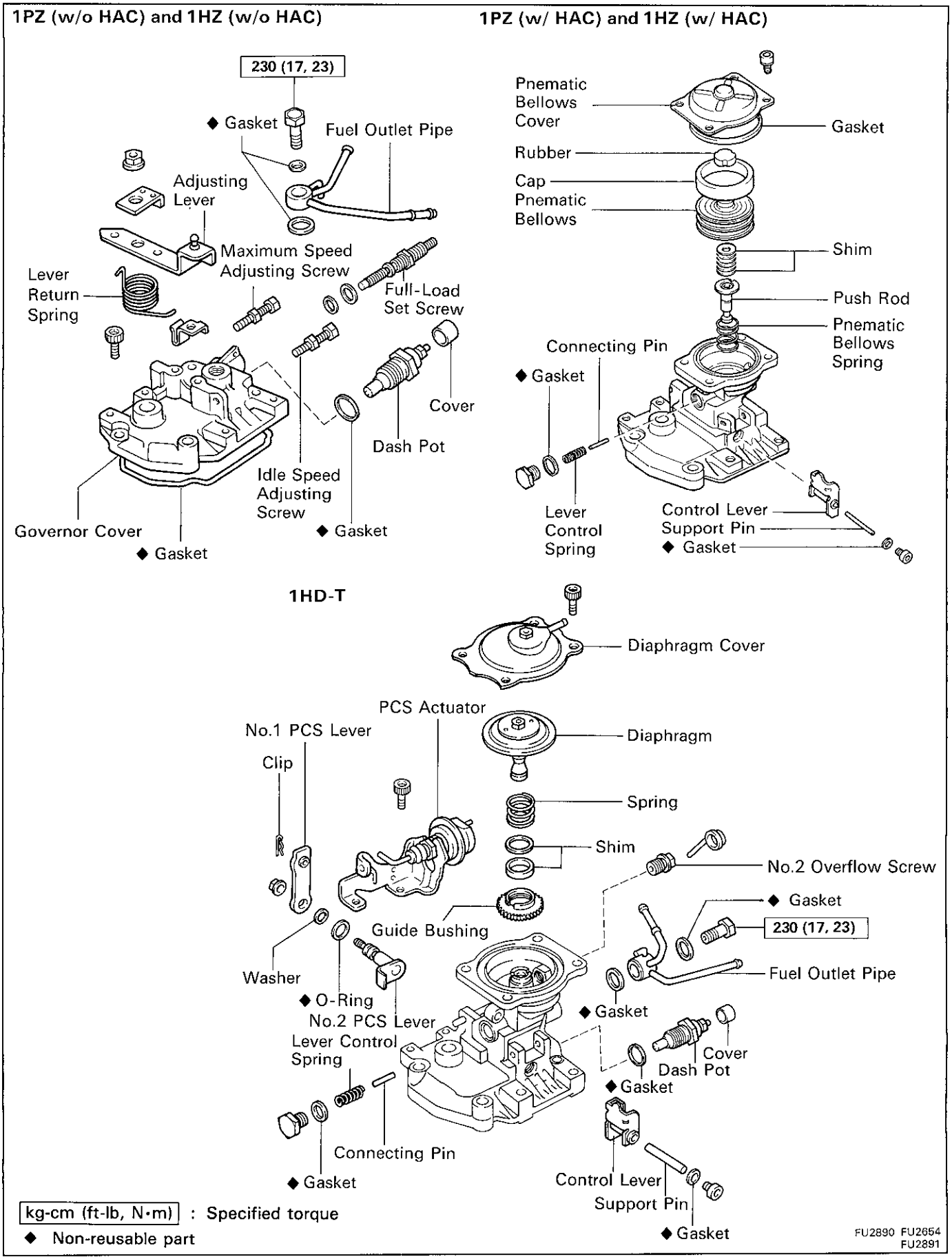
NOTICE:

- **Tighten the two bolts more than 8 mm (0.31 in.).**
- **Set SST so that it is balanced.**
- **Do not hold or carry the injection pump by the adjusting lever.**
- **Do not put the injection pump (with HAC, or for the 1HD-T) at an angle more than 45° from the horizontal.**

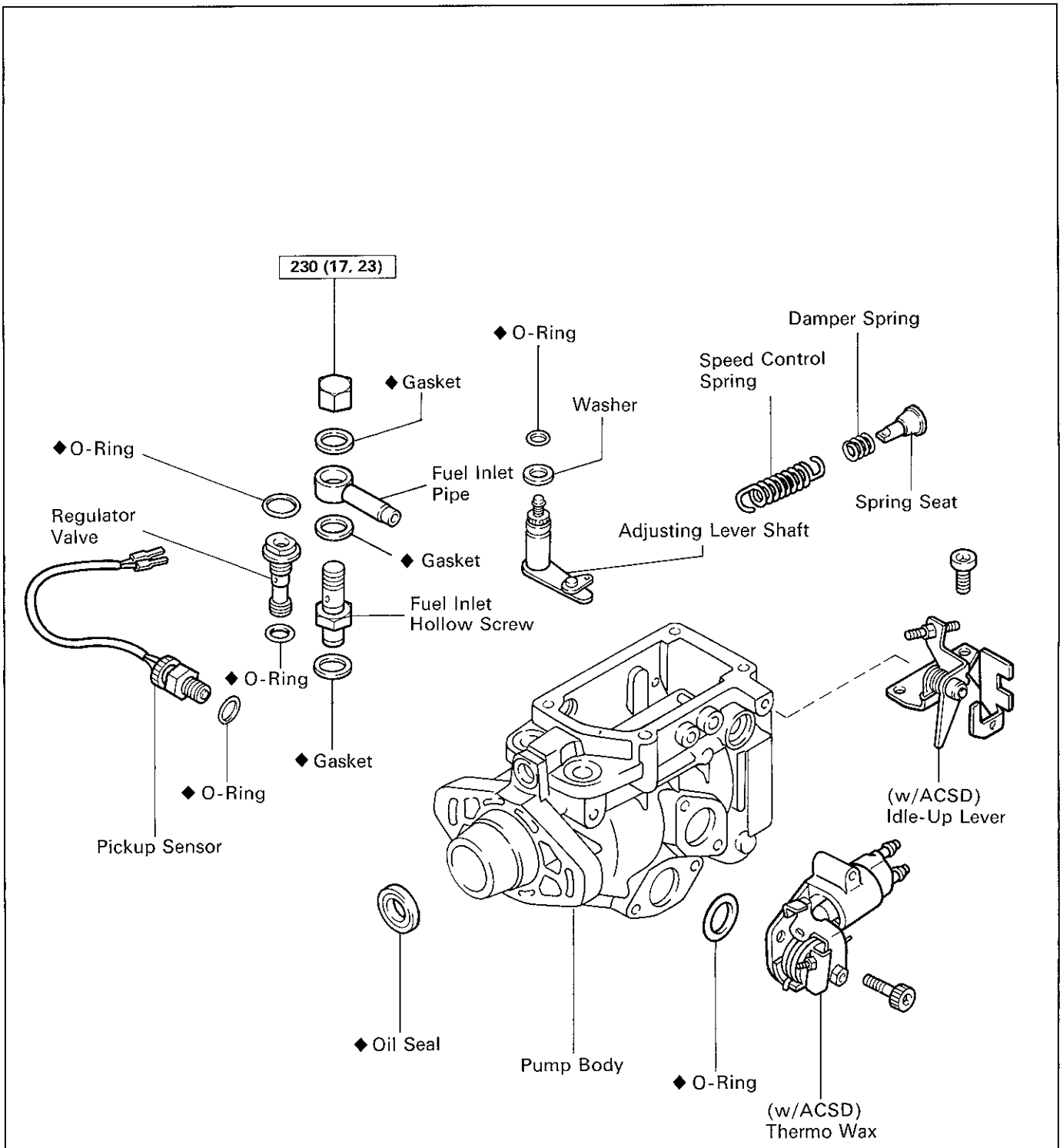
(f) Remove the cylinder block insulator (1PZ and 1HZ (M/T) for Europe).

(g) Remove the O-ring from the injection pump.

COMPONENTS


1PZ (w/o HAC) and 1HZ (w/o HAC)
230 (17, 23)
◆ Gasket
Fuel Outlet Pipe
Adjusting Lever
Maximum Speed Adjusting Screw
Lever Return Spring
Full-Load Set Screw
Cover
Dash Pot
Idle Speed Adjusting Screw
Governor Cover
◆ Gasket
◆ Gasket
1PZ (w/ HAC) and 1HZ (w/ HAC)
Pnematic Bellows Cover
Gasket
Rubber
Cap
Pnematic Bellows
Shim
Push Rod
Pnematic Bellows Spring
Connecting Pin
◆ Gasket
Lever Control Spring
Control Lever Support Pin
◆ Gasket
1HD-T
Diaphragm Cover
PCS Actuator
No.1 PCS Lever
Clip
Diaphragm
Spring
Shim
No.2 Overflow Screw
◆ Gasket
230 (17, 23)
Guide Bushing
Fuel Outlet Pipe
Washer
◆ O-Ring
No.2 PCS Lever
Lever Control Spring
◆ Gasket
Cover
Dash Pot
◆ Gasket
Connecting Pin
◆ Gasket
Control Lever Support Pin
◆ Gasket
kg-cm (ft-lb, N·m) : Specified torque
◆ Non-reusable part
FU2890 FU2654 FU2891

COMPONENTS (Cont'd)

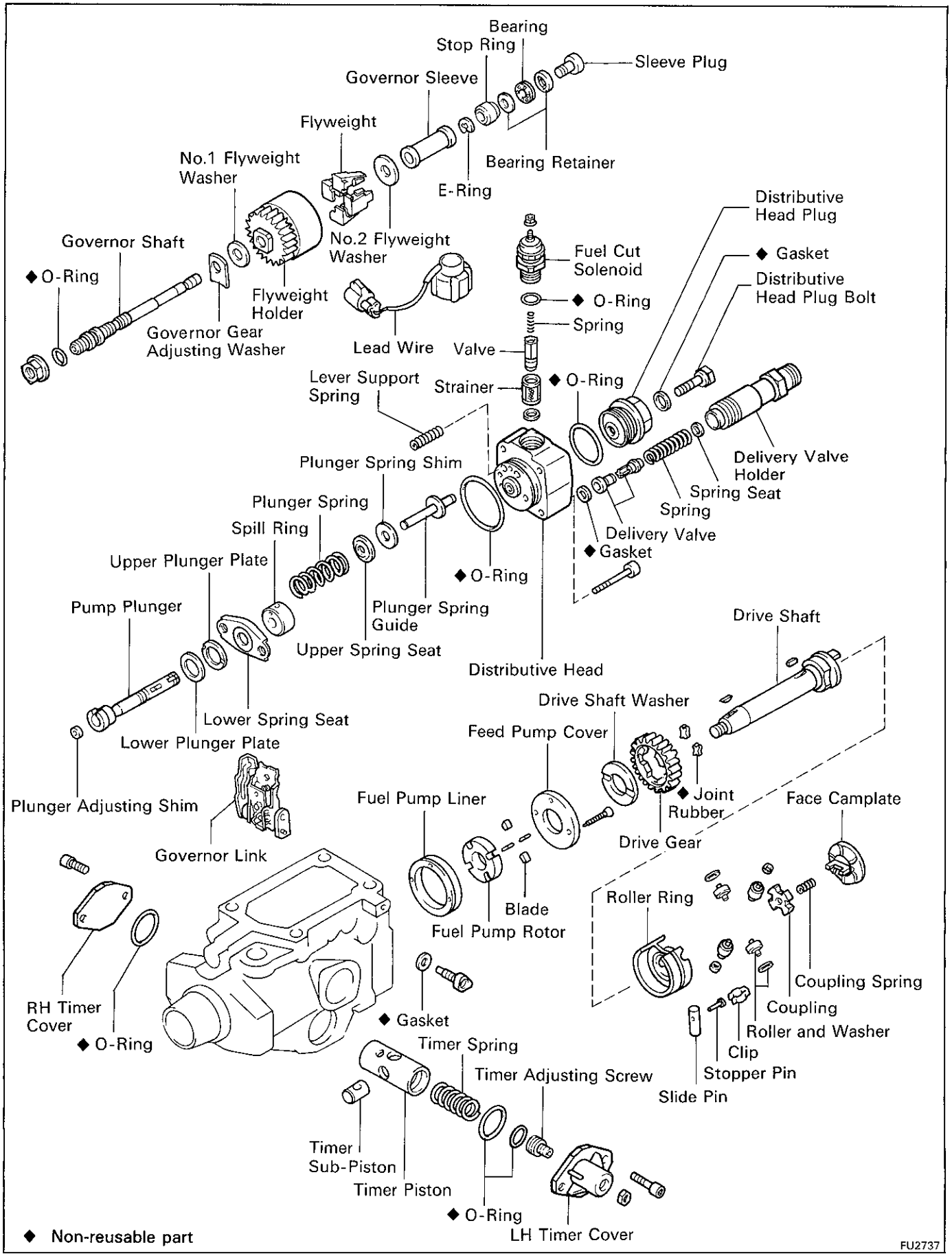


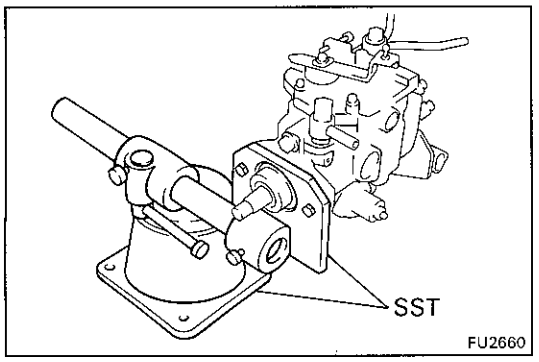
kg-cm (ft-lb, N·m) : Specified torque

◆ Non-reusable part

FU2773

COMPONENTS (Cont'd)





DISASSEMBLY OF INJECTION PUMP

(See pages FU-30, 31 and 32)

1. MOUNT PUMP ASSEMBLY TO SST (STAND)

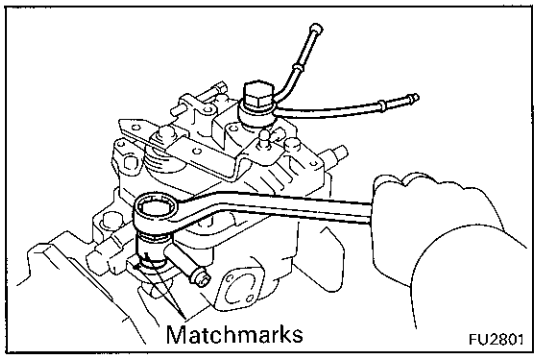
SST 09241-76022 and 09245-54010

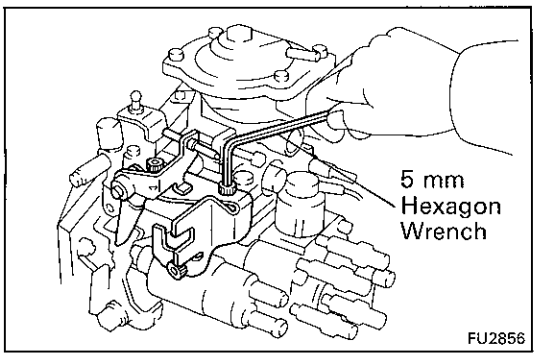
2. REMOVE SET KEY OF DRIVE PULLEY FROM DRIVE SHAFT

3. (w/ A/C)
REMOVE IDLE-UP ACTUATOR

4. REMOVE TWO FUEL PIPES

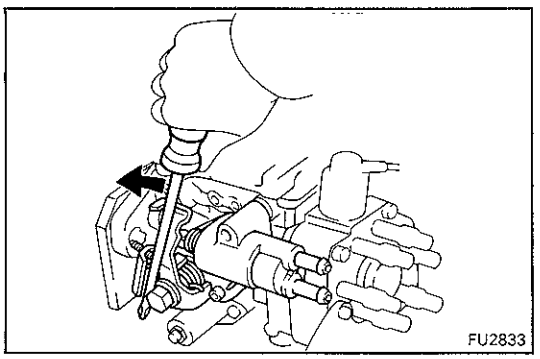
Place the matchmarks on the fuel inlet pipe and governor cover.





5. (w/ ACSD)
REMOVE IDLE-UP LEVER

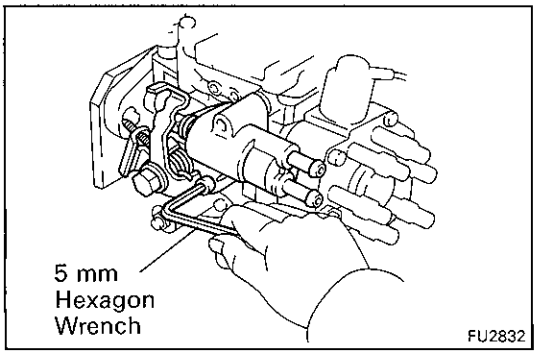
Using a 5 mm hexagon wrench, remove the three bolts and idle-up lever.



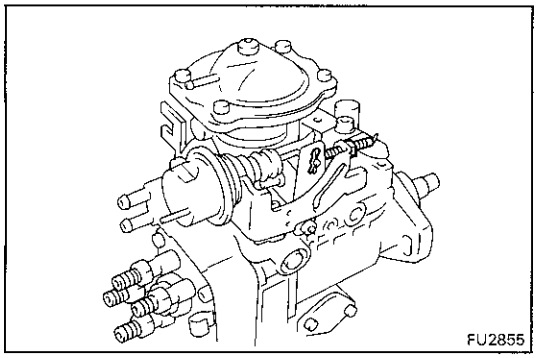
6. (w/ ACSD)
REMOVE THERMO WAX

(a) Using a screwdriver, turn the cold starting lever counterclockwise approx. 20°.

(b) Put a metal plate (thickness of 3.5 – 7.5 mm) (0.138 – 0.295 in.) between the cold starting lever and thermo wax plunger.



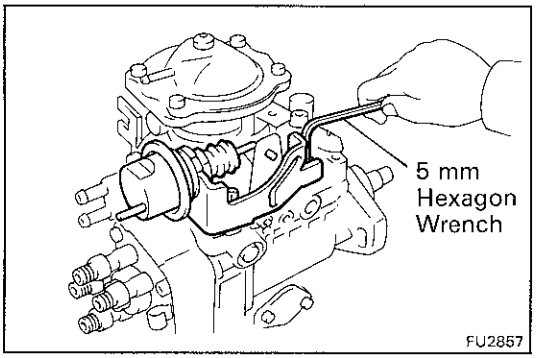
(c) Using a 5 mm hexagon wrench, remove the two bolts, thermo wax and O-ring.



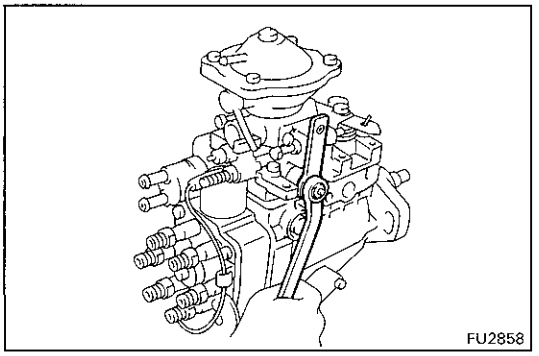
7. (w/ PCS)
REMOVE PCS ACTUATOR

(a) Remove the PCS adjusting screw.

(b) Remove the clip.

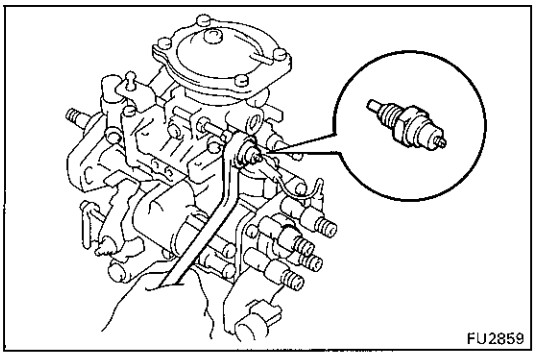


(c) Using a 5 mm hexagon wrench, remove the two bolts and PCS actuator assembly.



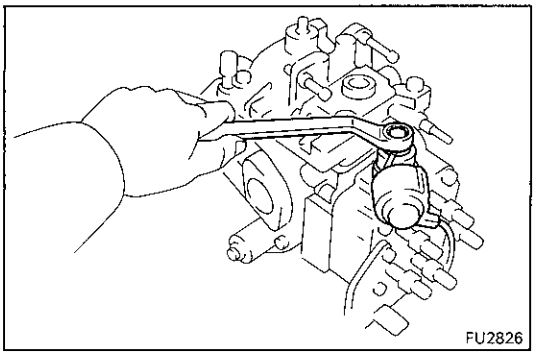
8. (w/ PCS)
REMOVE NO.1 PCS LEVER

Remove the nut and No.1 PCS lever.



9. (w/ Dash Pot)
REMOVE DASH POT

Remove the dash pot and gasket.

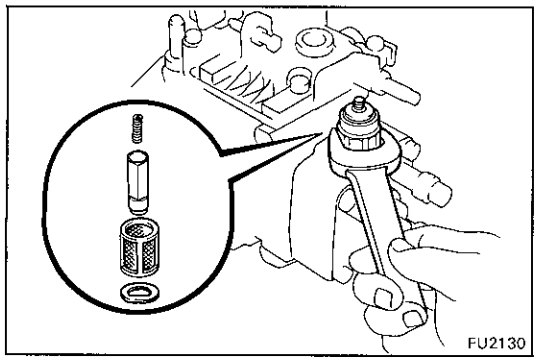


10. **REMOVE FUEL CUT SOLENOID**

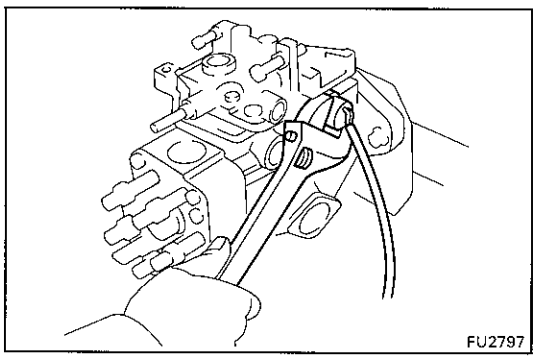
(a) Disconnect the lead wire connector from the bracket.

(b) Disconnect the dust cover from the fuel cut solenoid.

(c) Remove the nut, lead wire and dust cover.

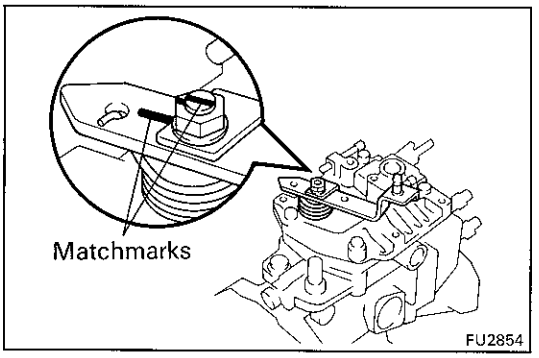


(d) Remove the fuel cut solenoid, O-ring, spring, valve, strainer and wave washer.



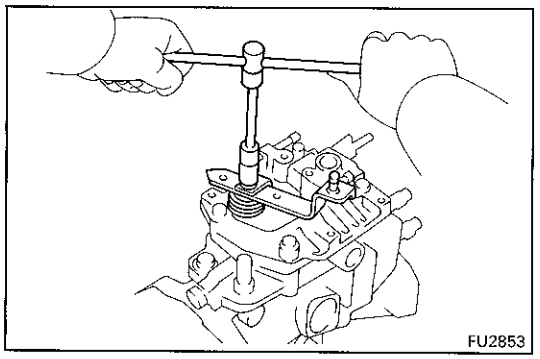
11. (w/ TACHOMETER)
REMOVE PICKUP SENSOR

Remove the pickup sensor and O-ring.

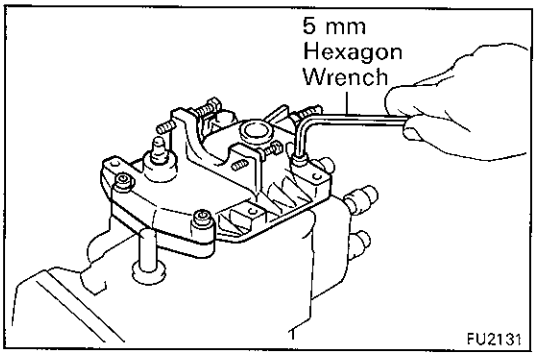


12. REMOVE ADJUSTING LEVER

(a) Place the matchmarks on adjusting lever and shaft.



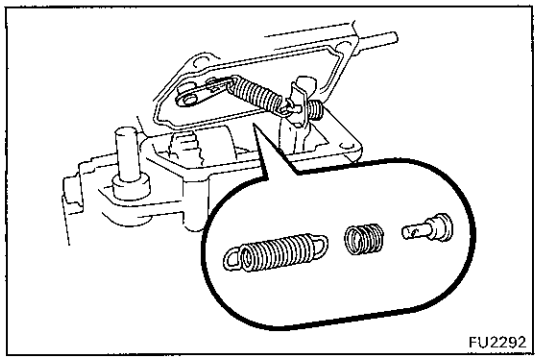
(b) Remove the nut, return spring guide, adjusting lever and return spring.



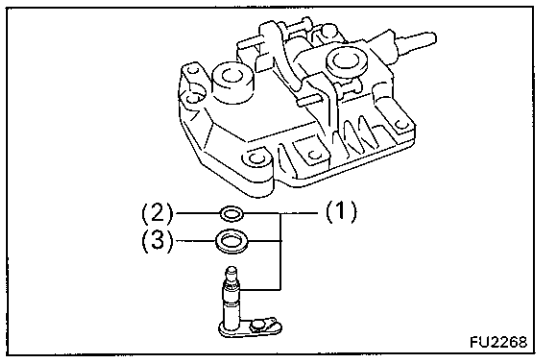
13. REMOVE GOVERNOR COVER

(a) (w/ HAC and 1HD-T)
Remove the idle speed adjusting screw.

(b) Using a 5 mm hexagon wrench, remove the four bolts.



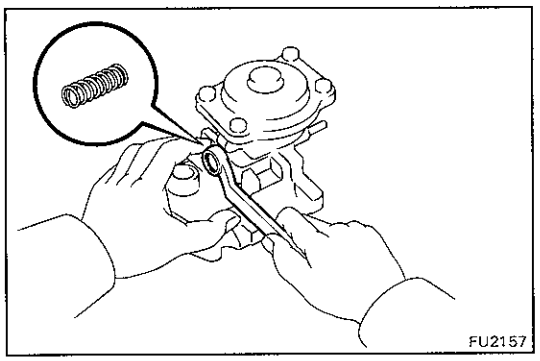
(c) Disconnect the speed control spring from the spring seat, and remove the spring seat, damper spring, speed control spring, the governor cover and adjusting lever shaft assembly and gasket.



14. REMOVE GOVERNOR ADJUSTING LEVER SHAFT FROM GOVERNOR COVER

Remove the following parts from the governor cover.

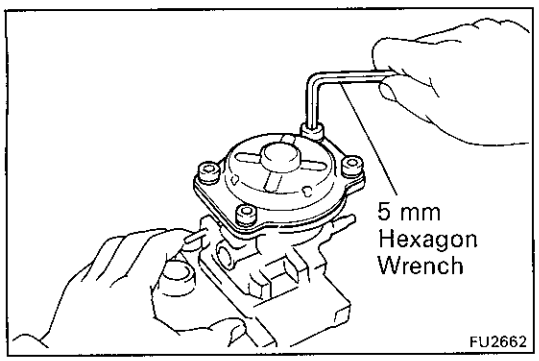
(1) Adjusting lever shaft, O-ring and washer assembly
(2) O-ring
(3) Washer



15. (1PZ (w/ HAC) and 1HZ (w/ HAC)) DISASSEMBLE HIGH ALTITUDE COMPENSATOR

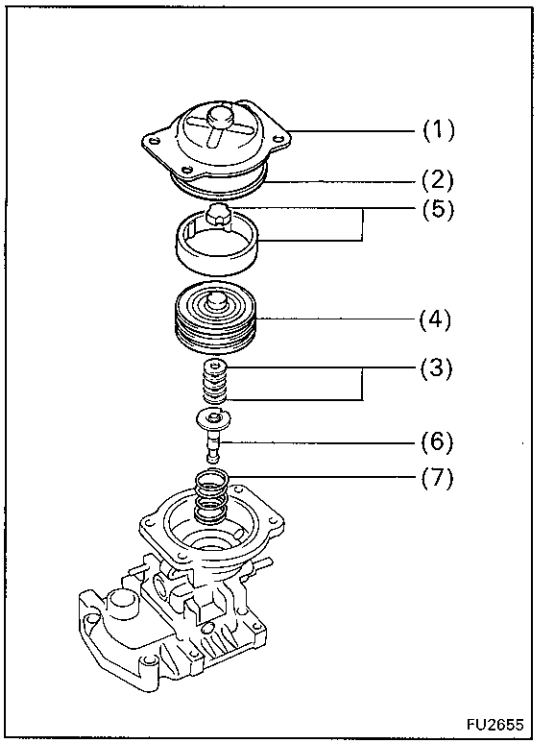
A. Remove lever control spring

Remove the bolt, gasket and lever control spring.



B. Remove pneumatic bellows

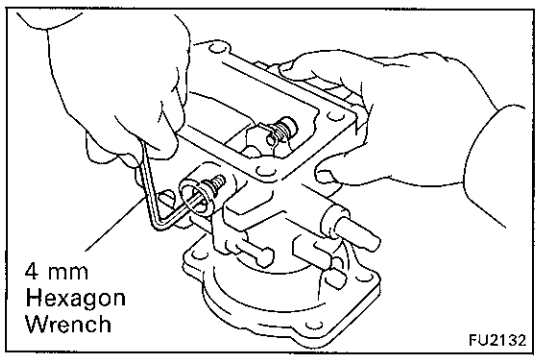
(a) Using a 5 mm hexagon wrench, remove the four bolts.



(b) Remove the following parts:
(1) Pneumatic bellows cover
(2) Gasket
(3) Shims

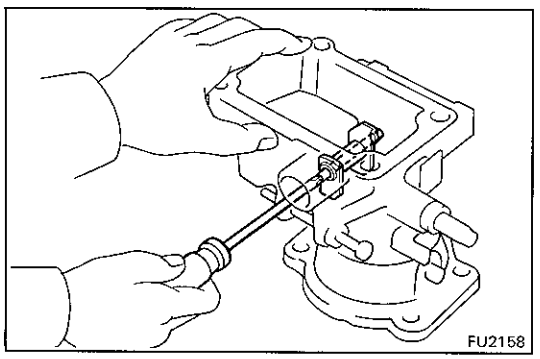
NOTICE: Note the number of the shims.

(4) Pneumatic bellows
(5) Two rubber caps
(6) Push rod
(7) Pneumatic bellows spring

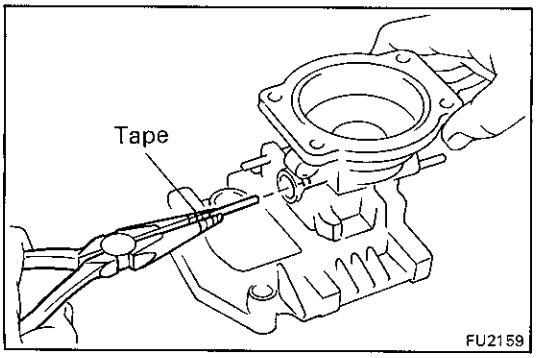


C. Remove control lever

(a) Using a 4 mm hexagon wrench, remove the two bolts and gaskets.

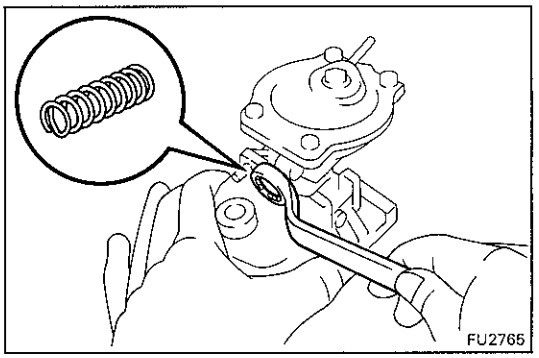


(b) Using a small screwdriver, push out the support pin and remove the control lever.



(c) Using needle nose pliers, remove the connecting pin.

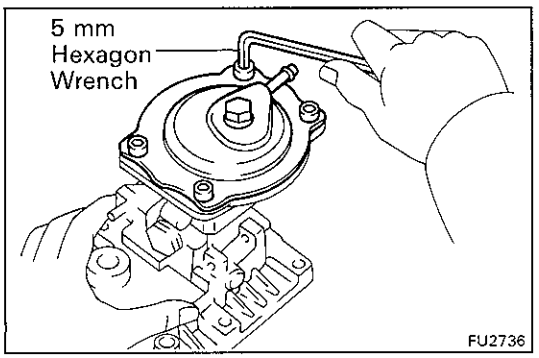
NOTICE: Be careful not to damage the connecting. Tape the tip of the pliers.



16. (1HD-T)
DISASSEMBLE BOOST COMPENSATOR

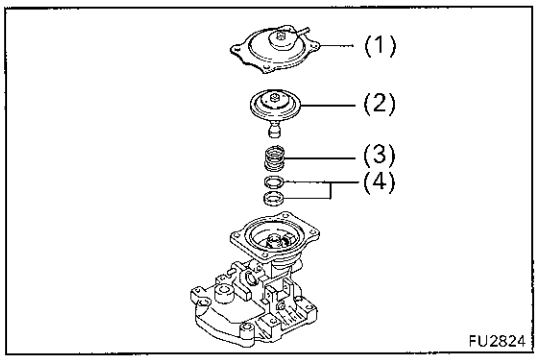
A. Remove lever control spring

Remove the bolt, gasket and lever control spring.

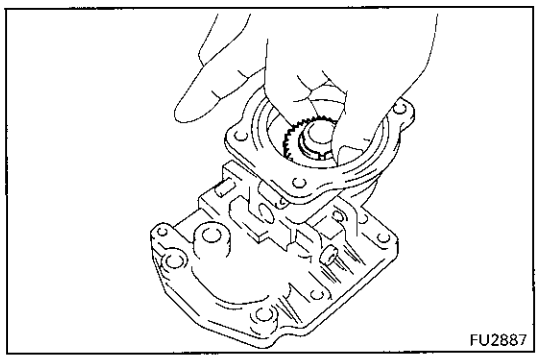


B. Remove boost compensator diaphragm

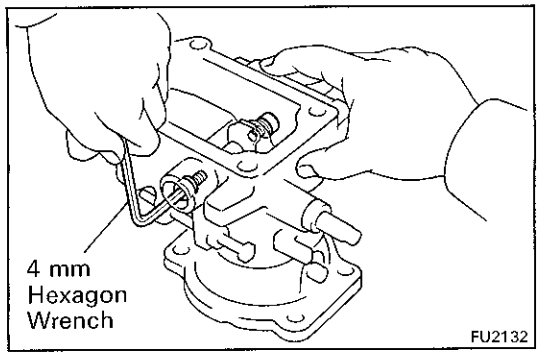
(a) Using a 5 mm hexagon wrench, remove the four bolts.



(b) Remove the following parts:
(1) Diaphragm cover
(2) Diaphragm
(3) Spring
(4) Boost compensator shim

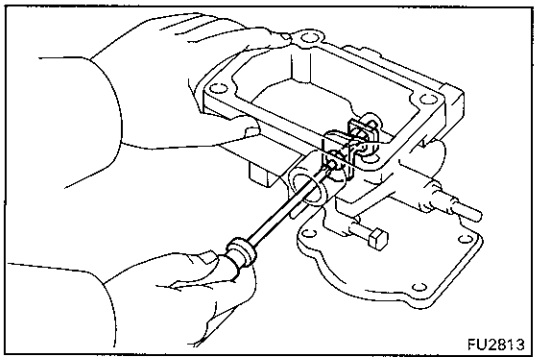


C. Remove guide bushing

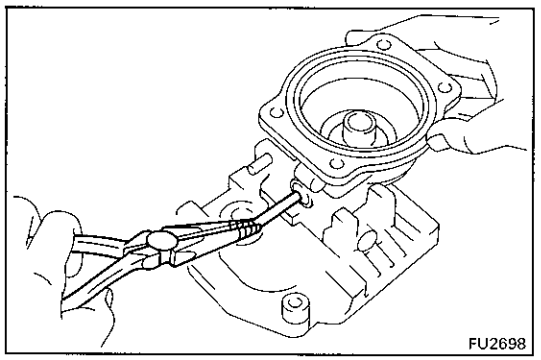


D. Remove control lever

(a) Using a 4 mm hexagon wrench, remove the two bolts and gaskets.

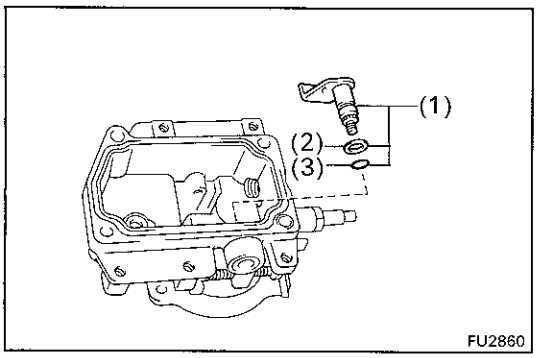


(b) Using a small screwdriver, push out the support pin and remove the control lever.



(c) Using needle nose pliers, remove the connecting pin.

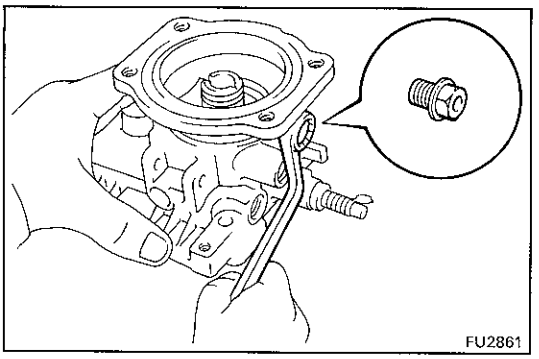
NOTICE: Be careful not to damage the connecting pin. Tape the tip of the pliers.



E. Remove No.2 PCS lever

Remove the following pars from the the governor cover.

(1) No.2 lever, O-ring and washer assembly
(2) O-ring
(3) Washer

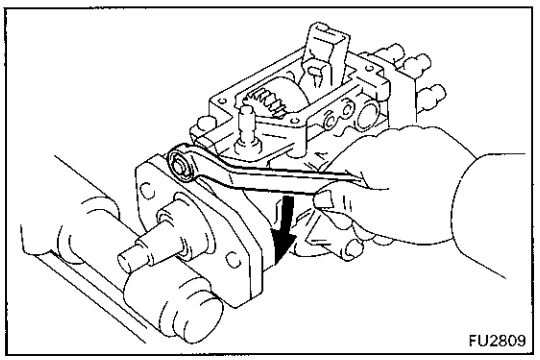


F. Remove No.2 overflow screw

Remove the cover and No.2 overflow screw.

17. CHECK FLYWEIGHT HOLDER THRUST CLEARANCE (See step 20 on page FU-58)

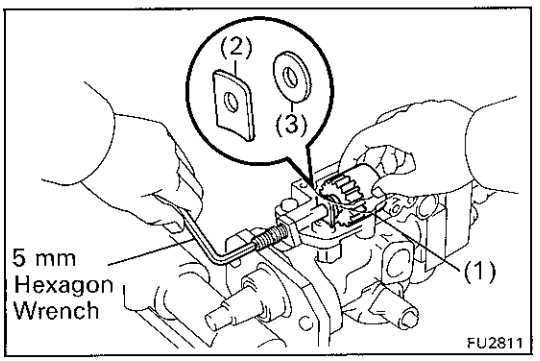
Thrust clearance: 0.15 – 0.35 mm (0.0059 – 0.0138 in.)



18. REMOVE GOVERNOR SHAFT AND FLYWEIGHT HOLDER

(a) Remove the governor shaft lock nut by turning it clockwise.

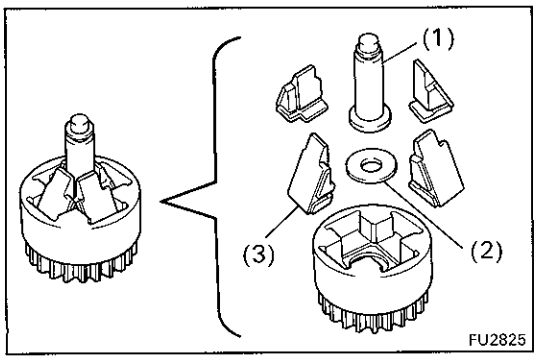
NOTICE: The governor shaft and lock nut have LH threads.



(b) Using a 5 mm hexagon wrench, remove the governor shaft clockwise, and remove the following part:

(1) Flyweight holder assembly
(2) No.1 flyweight washer
(3) Governor gear adjusting washer

HINT: Be careful not to drop the two washers into the pump housing.

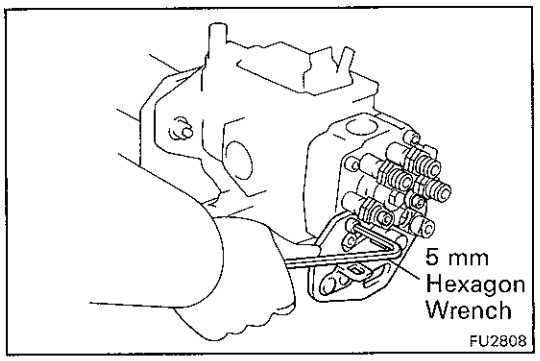


(c) Remove the following parts from the flyweight holder.

(1) Governor sleeve
(2) No.2 flyweight washer
(3) Four flyweights

19. REMOVE INJECTION PUMP STAY

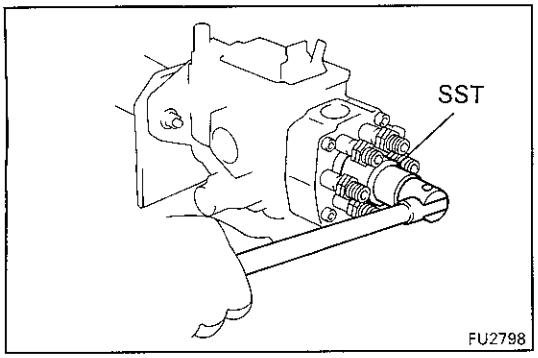
Using a 5 mm hexagon wrench, remove the three bolts and stay.

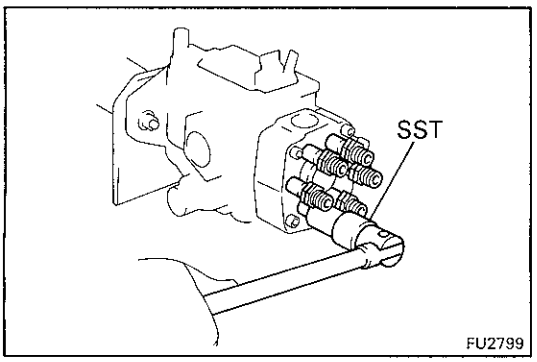


20. REMOVE DISTRIBUTIVE HEAD PLUG

Using SST, remove the distributive head plug.

SST 09260-54012 (09262-54010)



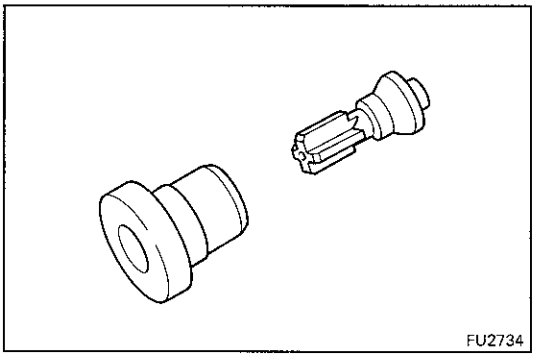


21. REMOVE DELIVERY VALVE HOLDERS

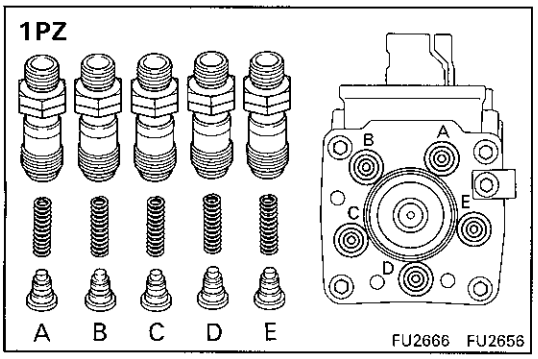
(a) Using SST, remove the delivery valve holders, springs and spring seats.

SST 09260-54012 (09269-54020)

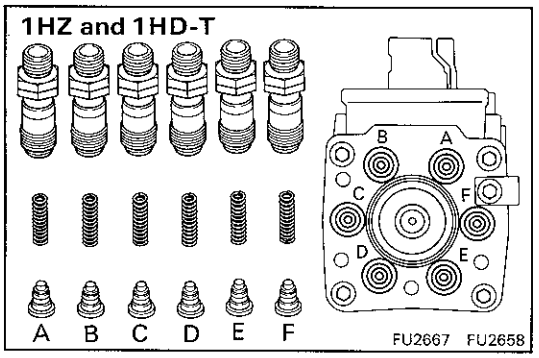
(b) Remove the delivery valves and gaskets.



NOTICE: Do not touch the sliding surfaces of the delivery valve with your hand.

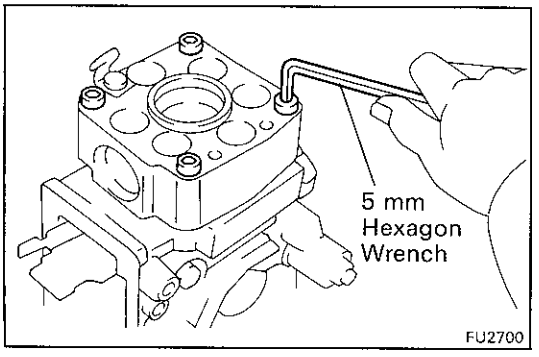


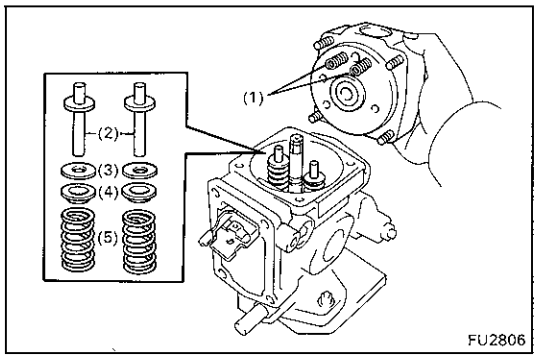
HINT: Arrange the delivery valves, springs, spring seats and holders in order.



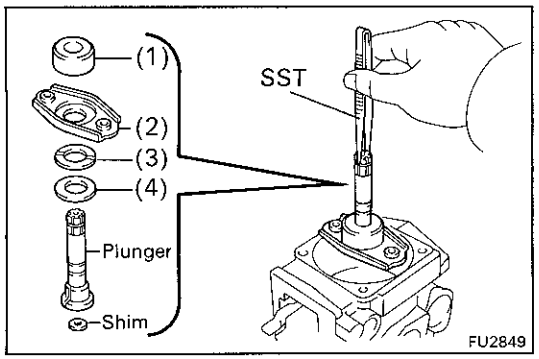
22. REMOVE DISTRIBUTIVE HEAD

(a) Using a 5 mm hexagon wrench, remove the four bolts.





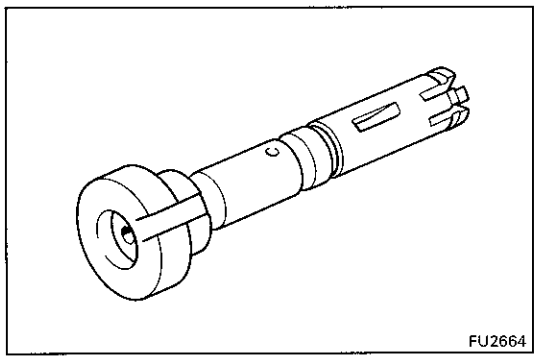
(b) Remove the distributive head and following parts:
(1) Two lever support springs
(2) Two plunger spring guides
(3) Two plunger spring shims
(4) Two upper spring seats
(5) Two plunger springs



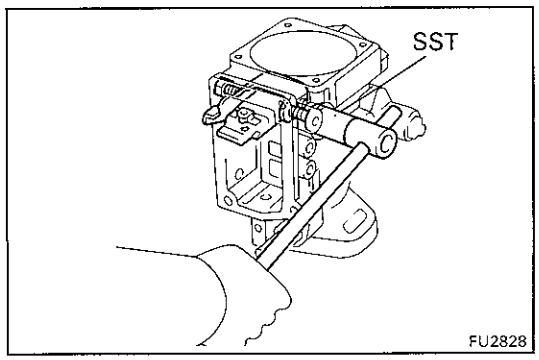
23. REMOVE PUMP PLUNGER

Using SST, remove the pump plunger and plunger adjusting shim together with the following parts:
(1) Spill ring
(2) Lower spring seat
(3) Upper plunger plate
(4) Lower plunger plate

SST 09260-54012 (09269-54030)



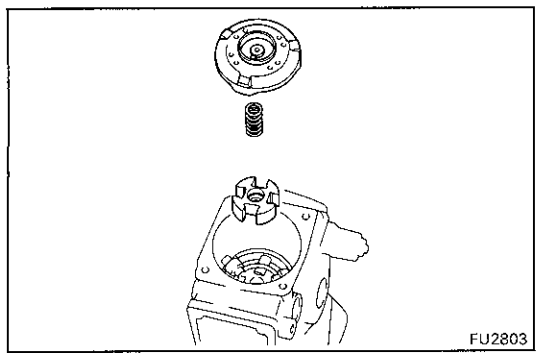
NOTICE: Do not touch the sliding surfaces of the pump plunger with your hand.



24. REMOVE GOVERNOR LINK

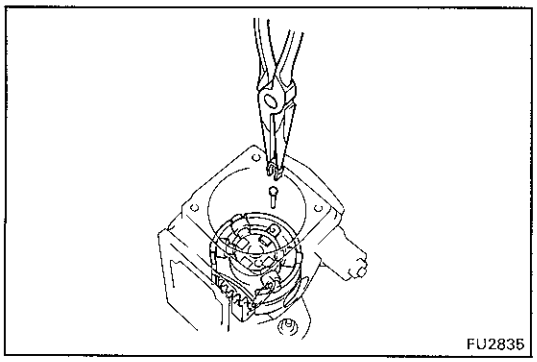
Using SST, remove the two support bolts, gaskets and governor link.

SST 09260-54012 (09269-54040)



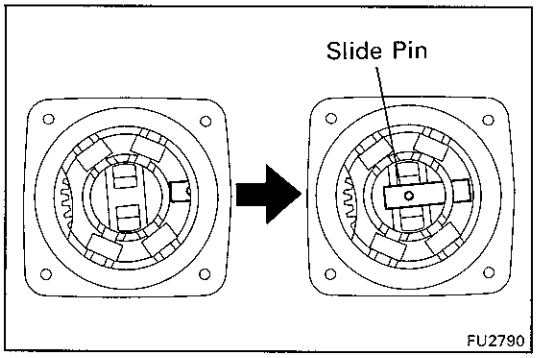
25. REMOVE FACE CAMPLATE AND COUPLING

Remove the face camplate, spring and coupling.

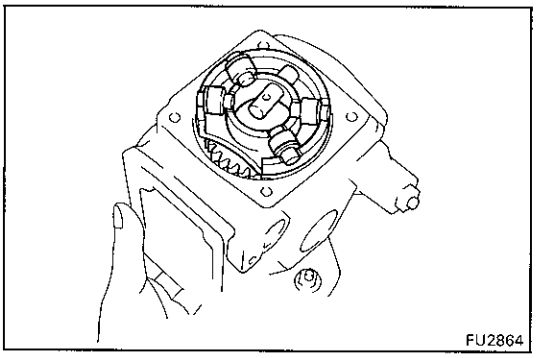


26. REMOVE ROLLER RING AND DRIVE SHAFT

(a) Remove the timer clip and stopper pin.



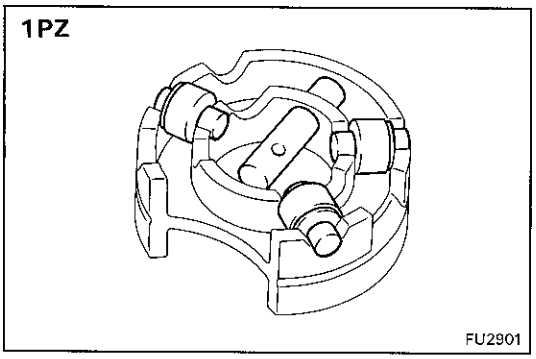
(b) Push the slide pin toward inside.



(c) (1PZ)
Push the drive shaft, and remove the roller ring, three rollers and shims assembly.

(1HZ and 1HD-T)
Push the drive shaft, and remove the roller ring, four rollers and shims assembly.

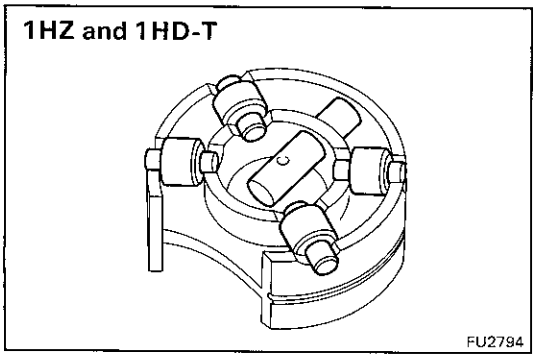
1PZ

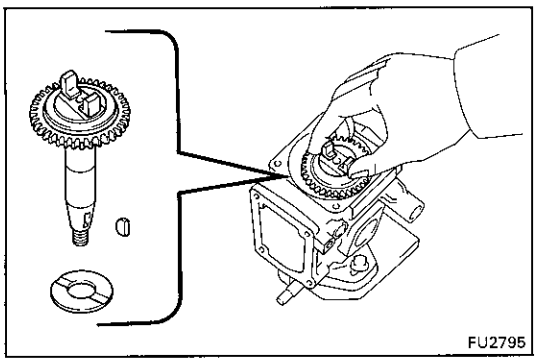


NOTICE:

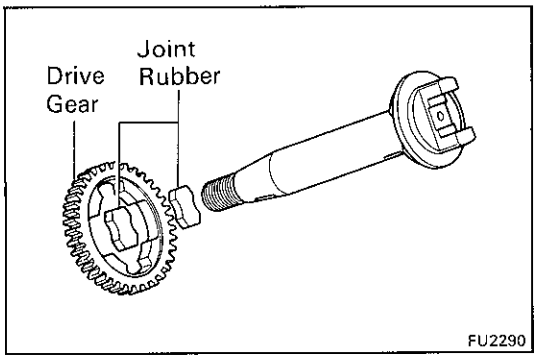
- **Be careful not to drop the rollers.**
- **Do not alter the position or assembly of the rollers.**

1HZ and 1HD-T



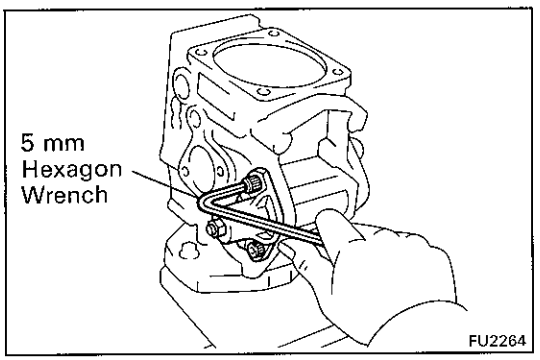


(d) Remove the drive shaft, governor drive gear, two joint rubbers assembly, set key and drive shaft washer.

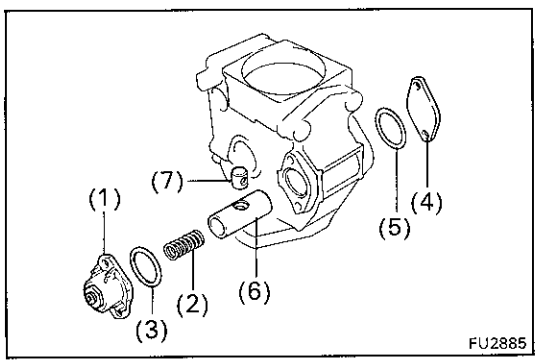


(e) Remove the drive gear and two joint rubbers from the drive shaft.

27. REMOVE TIMER

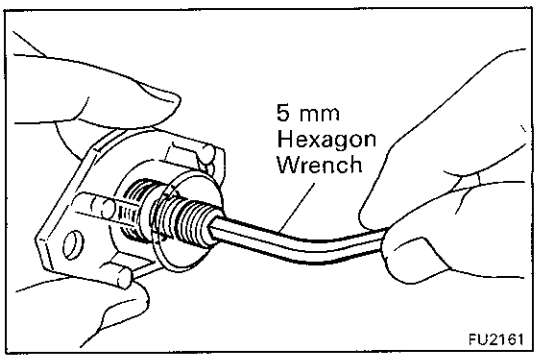


(a) Using a 5 mm hexagon wrench, remove the four bolts.



(b) Remove the following parts:

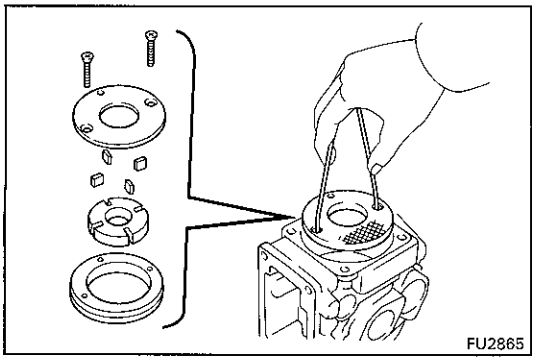
(1) LH timer cover, timer adjusting screw and nut assembly
(2) Spring
(3) O-ring
(4) RH timer cover
(5) O-ring
(6) Piston
(7) Sub-piston



(c) Remove the nut from the LH timer cover.

(d) Using a 5 mm hexagon wrench, remove the timer adjusting screw.

(e) Remove the O-ring from the timer adjusting ring.



28. REMOVE FUEL FEED PUMP

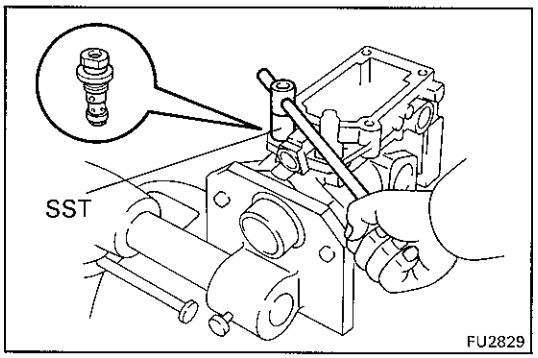
(a) Remove the two screws.

(b) Using a piece of wire, remove the feed pump cover.

(c) Remove the feed pump rotor, four blades and liner.

NOTICE:

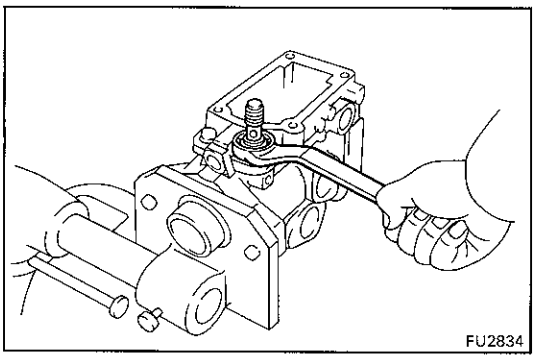
- **Be careful not to interchange the blade positions.**
- **Be careful not to damage the pump body.**



29. REMOVE REGULATOR VALVE

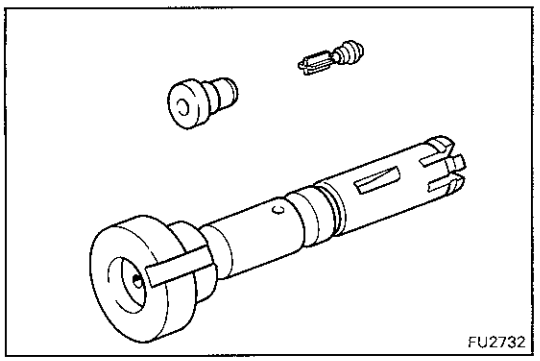
Using SST, remove the regulator valve and two O-rings.

SST 09260-54012 (09262-54020)



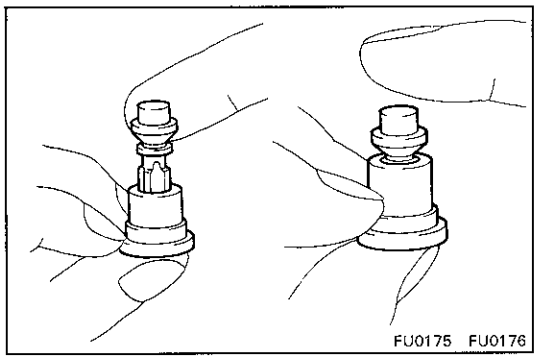
30. REMOVE FUEL INLET HOLLOW SCREW

Remove the hollow screw and gasket.



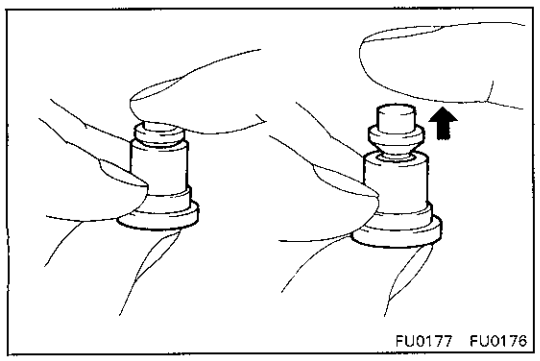
INSPECTION OF INJECTION PUMP COMPONENTS

NOTICE: Do not touch the sliding surfaces of the pump plunger and delivery valves.

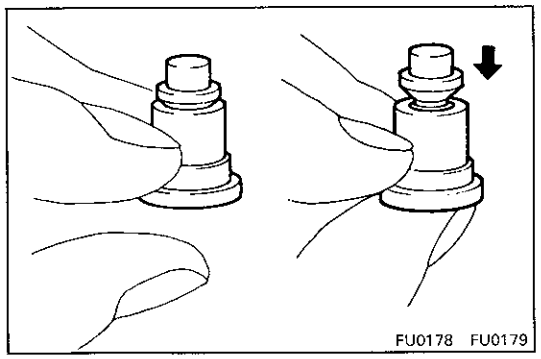


1. INSPECT DELIVERY VALVES (1PZ and 1HZ)

(a) Pull up the valve and close the hole at the valve seat bottom end with your thumb.
When the valve is released, it should sink down quickly and stop at the position where the relief ring closes the valve seat hole.



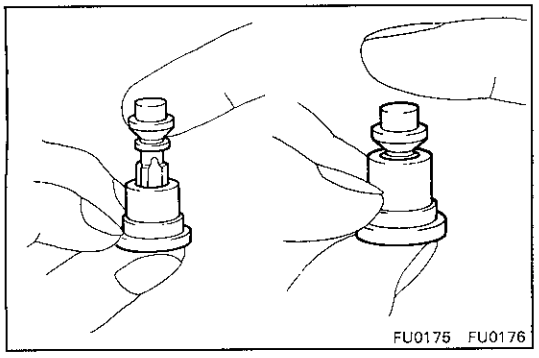
(b) Close the hole at the valve seat bottom end with your thumb.
Insert the valve into the valve seat and press down with your finger. When your finger is released, the valve should rise back to its original position.



(c) Remove your thumb from the valve seat hole.
The valve should close completely by its own weight.

If operation is not as specified, replace the valve as a set.

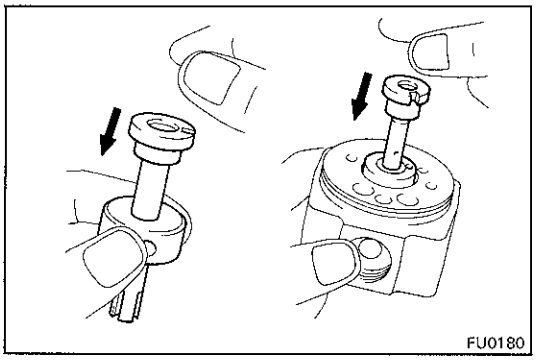
HINT: Before using a new valve set, wash off the rust prevention compound with light oil or gasoline. Then re-wash with diesel fuel and perform the above tests.

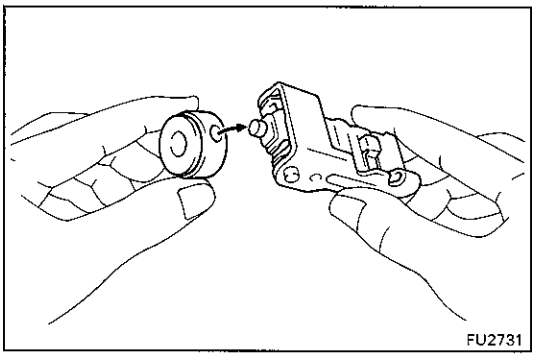


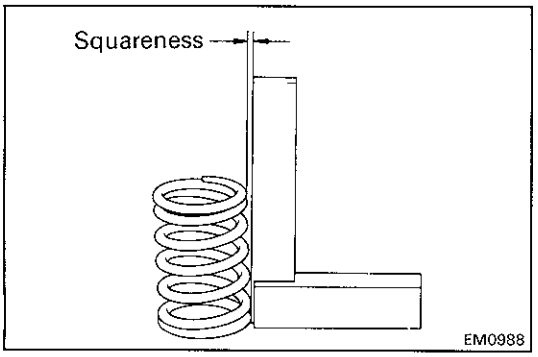
(1HD-T)

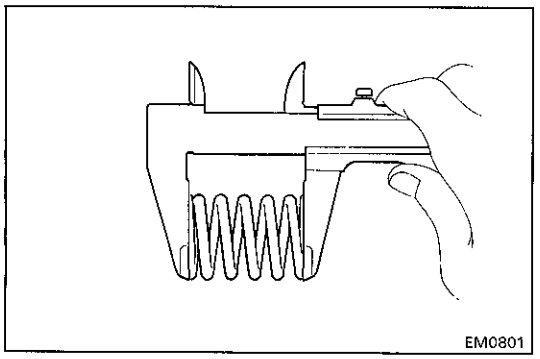
Pull up the valve. When the valve is released, it should sink down quickly.
If operation is not as specified, replace the valve as a set.

HINT: Before using a new valve set, wash off the rust prevention compound with light oil or gasoline. Then re-wash with diesel fuel and perform the above tests.









2. INSPECT PUMP PLUNGER, SPILL RING AND DISTRIBUTIVE HEAD

(a) Tilt the spill ring (distributive head) slightly and pull out the plunger.

(b) When released, the plunger should sink down smoothly into the spill ring (distributive head) by its own weight.

(c) Rotate the plunger and repeat the test at various positions.

If the plunger sticks at any position, replace the parts as a set.

(d) Insert the governor link ball pin into the spill ring and check that it moves smoothly without any play.

3. INSPECT PLUNGER SPRINGS FOR SQUARENESS

Using a steel square, check the squareness of the plunger springs.

Maximum squareness: 2.0 mm (0.079 in.)

If squareness is greater than maximum, replace the springs.

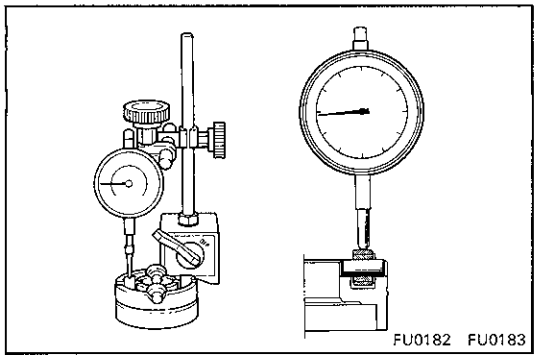
4. INSPECT SPRING LENGTH

Using vernier calipers, measure the free length of each spring.

Spring free length:

Delivery valve spring	
1PZ and 1HZ	**24.4 mm (0.961 in.)**
1HD-T	**19.1 mm (0.752 in.)**
Plunger spring	
1PZ and 1HZ	**30.0 mm (1.181 in.)**
1HD-T	**31.2 mm (1.228 in.)**
Coupling spring	
1PZ and 1HZ	**16.6 mm (0.654 in.)**
1HD-T	**15.5 mm (0.610 in.)**
Pneumatic bellows spring (w/ HAC)	
1PZ and 1HZ (w/ HAC)	**35.0 mm (1.378 in.)**
Boost compensator spring	
1HD-T (Europe)	**19.7 mm (0.776 in.)**
1HD-T (Others w/o BACS)	**19.6 mm (0.772 in.)**
1HD-T (Others w/ BACS)	**21.8 mm (0.858 in.)**

If the free length is not as specified, replace the spring(s).

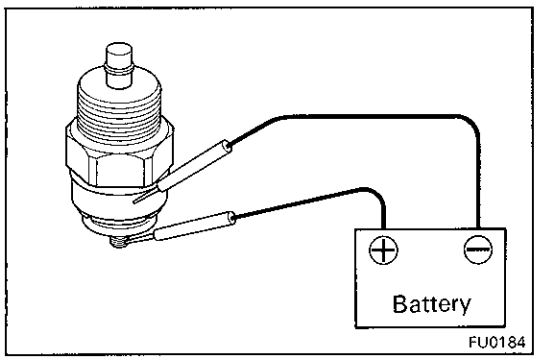


5. INSPECT ROLLER RING AND ROLLERS

Using a dial indicator, measure the roller height.

Roller height variation: 0.02 mm (0.0008 in.)

If the variation is greater than specification, replace the roller ring and roller as a set.

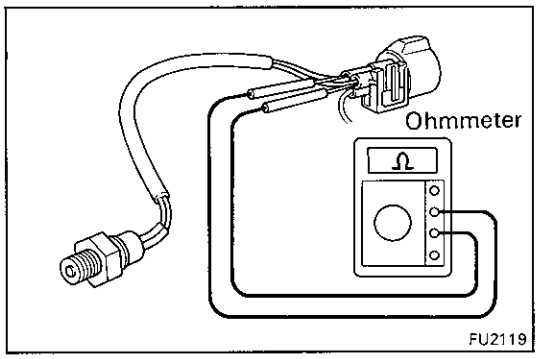


6. INSPECT FUEL CUT SOLENOID

(a) Connect the solenoid valve body and terminal to the battery terminals.

(b) You should feel the click from the solenoid valve when the battery power is connected and disconnected.

If the solenoid valve is not operating properly, replace it.

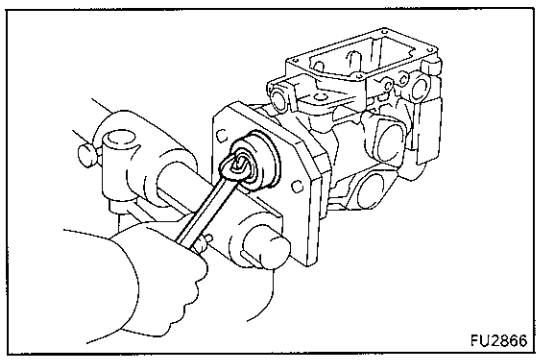


7. INSPECT PICKUP SENSOR

Using an ohmmeter, measure the resistance between the terminals.

Resistance: 600 – 800 Ω

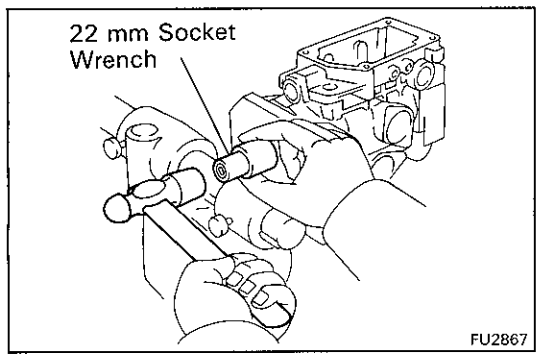
If resistance is not as specified, replace the sensor.



8. IF NECESSARY, REPLACE OIL SEAL

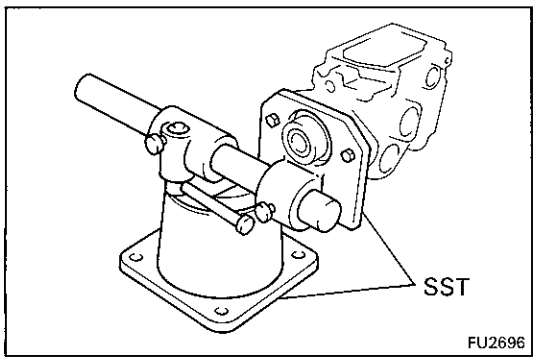
(a) Using a wrench, pry out the oil seal.

NOTICE: Be careful not to damage to the pump body.



(b) Apply MP grease to the lip of a new oil seal.

(c) Using a 22 mm socket wrench, tap in the oil seal until its surface is flush with the pump housing.

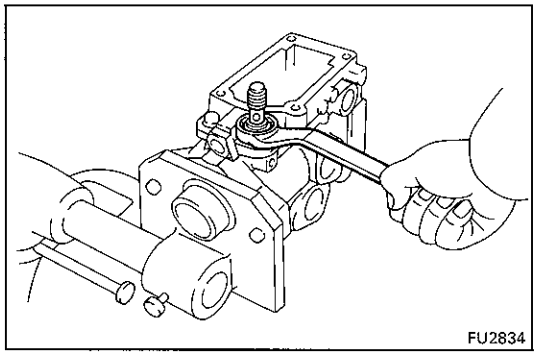


ASSEMBLY OF INJECTION PUMP

(See pages FU-30, 31, 32)

1. MOUNT PUMP BODY TO SST (STAND)

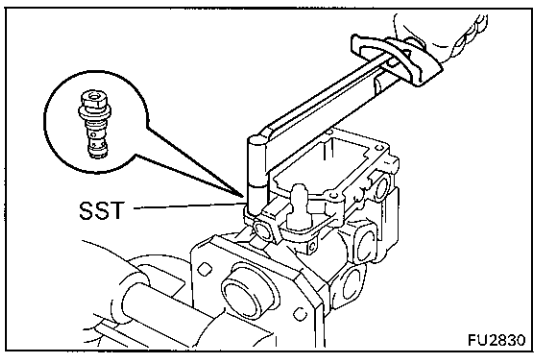
SST 09241-76022 and 09245-54010



2. INSTALL FUEL INLET HOLLOW SCREW

Install a new gasket and the hollow screw.

Torque: 375 kg-cm (27 ft-lb, 37 N·m)



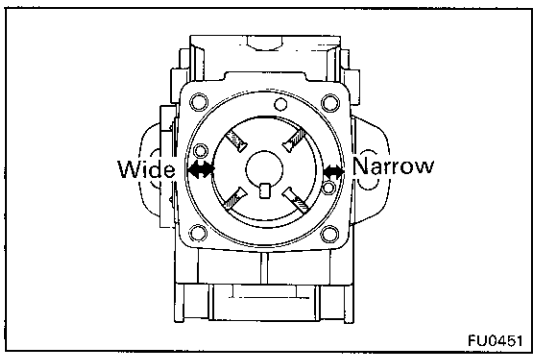
3. INSTALL REGULATOR VALVE

(a) Install the two O-rings to the regulator valve.

(b) Using SST, install the regulator valve.

SST 09260-54012 (09262-54020)

Torque: 90 kg-cm (78 in.-lb, 8.8 N·m)



4. INSTALL FUEL FEED PUMP

(a) Install the liner, rotor and four blades.

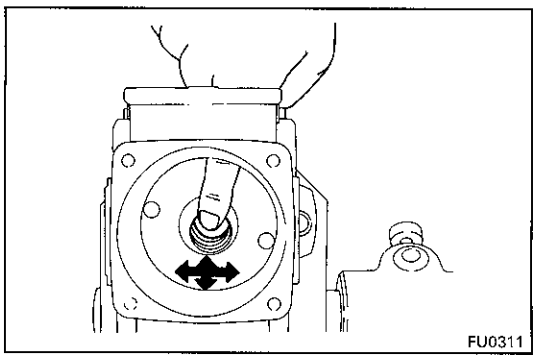
(b) Check that the liner and blades are facing in the correct direction, as shown.

(c) Check that the blades move smoothly.

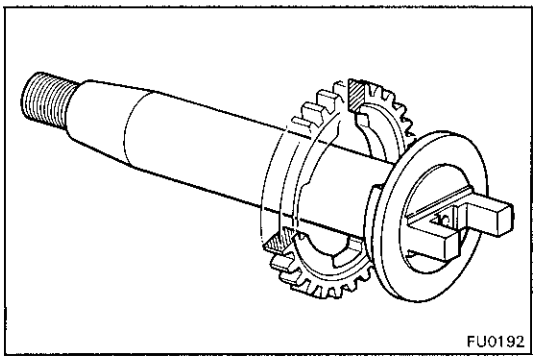
(d) Align the fuel outlet holes of the cover and liner.

(e) Install the pump cover with the two screws.

Torque: 25 kg-cm (22 in.-lb, 2.5 N·m)

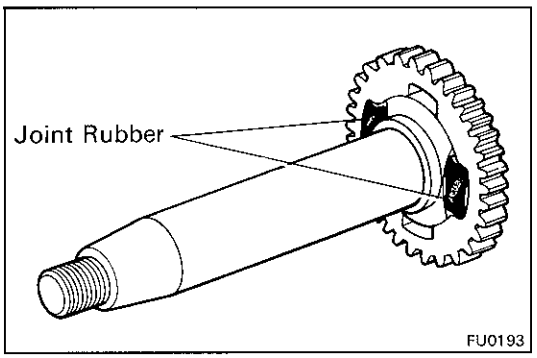


(f) Check that the rotor moves smoothly.

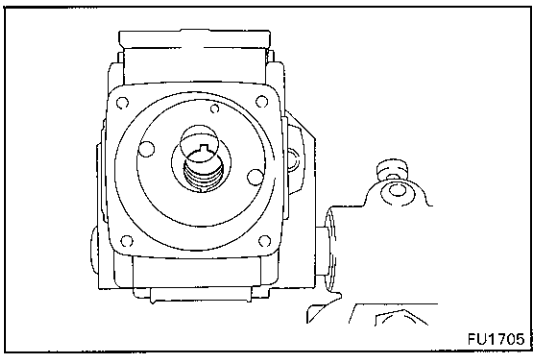


5. INSTALL DRIVE SHAFT

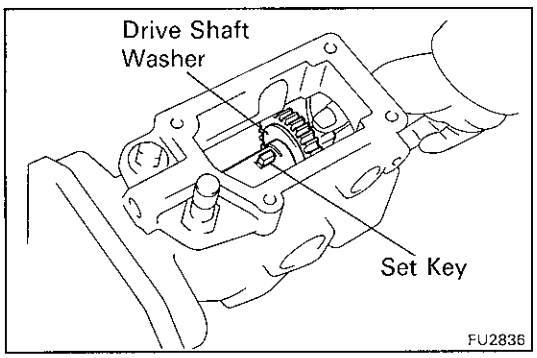
(a) Install the drive gear on the drive shaft as shown.



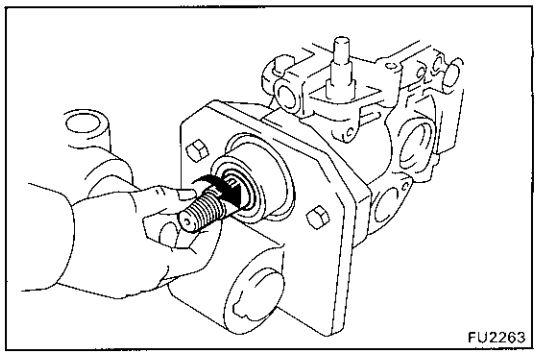
(b) Install two new joint rubbers into the drive gear.



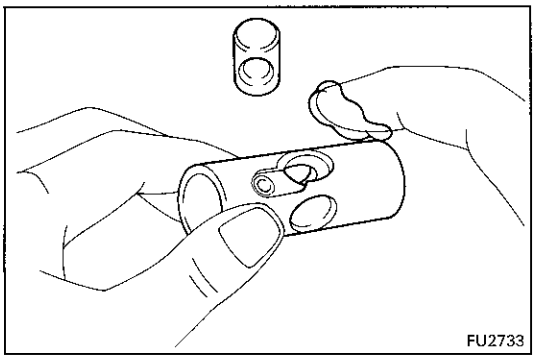
(c) Position the key groove of the feed pump rotor upward.



(d) Install the set key and drive shaft washer on the drive shaft and insert the drive shaft assembly into the pump housing.



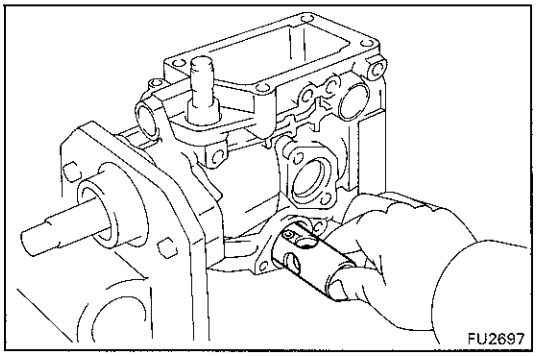
(e) Check that the drive shaft turns without catching.



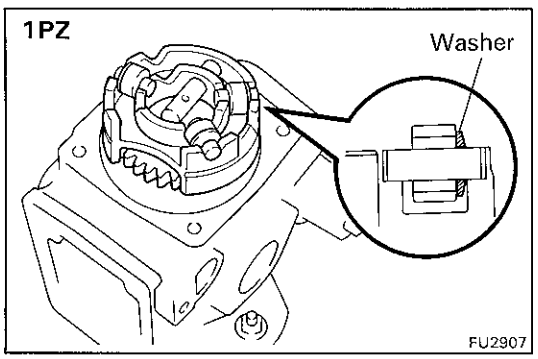
6. INSTALL TIMER PISTON

(a) Apply No. 50 DENSO grease to the timer piston.

(b) Install the sub-piston into the timer piston.

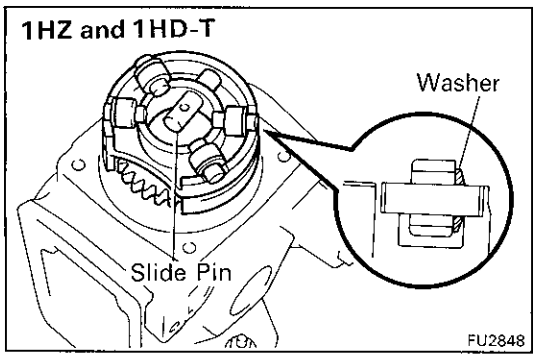


(c) Insert the timer piston into the pump housing.



7. INSTALL ROLLER RING

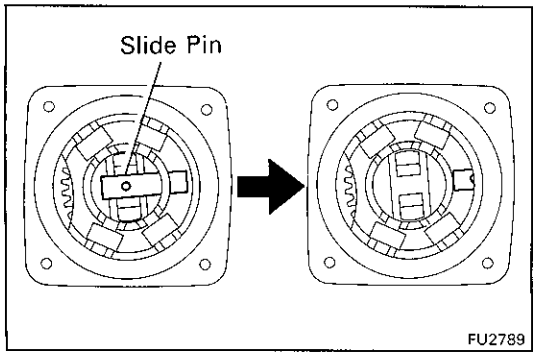
(a) (1PZ)
Install the slide pin, three rollers and washers on the roller ring as shown in the illustration.



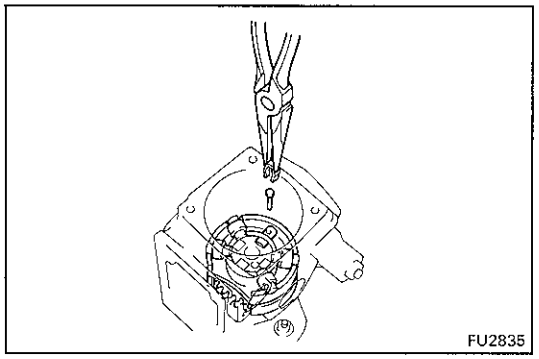
(b) (1HZ and 1HD-T)
Install the slide pin, four rollers and washers on the roller ring.

(c) Check that the roller is facing the flat surface of the washer.

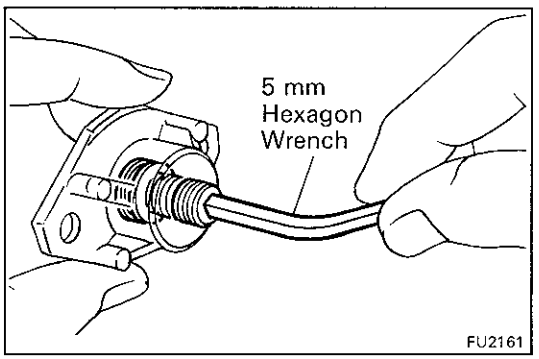
(d) Install the roller ring into the pump housing.



(e) Carefully install the slide pin into the sub-piston.



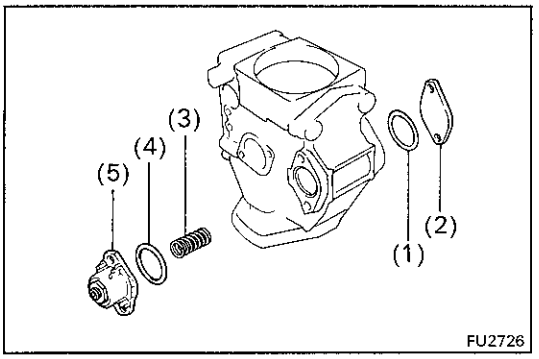
(e) Install the stopper pin and clip.



8. INSTALL TIMER SPRING

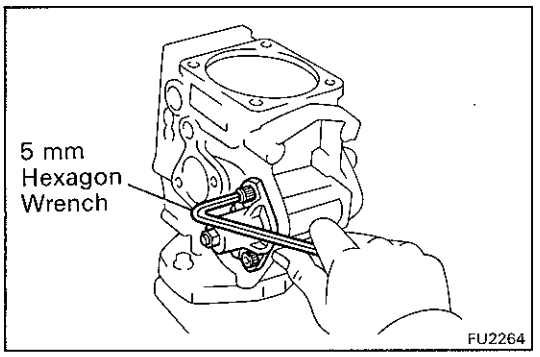
(a) Install a new O-ring to the timer adjusting screw.

(b) Using a 5 mm hexagon wrench, install the timer adjusting screw to the LH timer cover and temporarily install the nut.

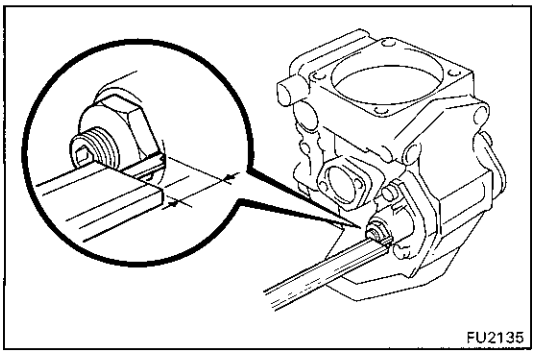


(c) Install the following parts:

(1) New O-ring
(2) RH timer cover
(3) Timer spring
(4) New O-ring
(5) LH timer cover, timer adjusting screw and nut assembly



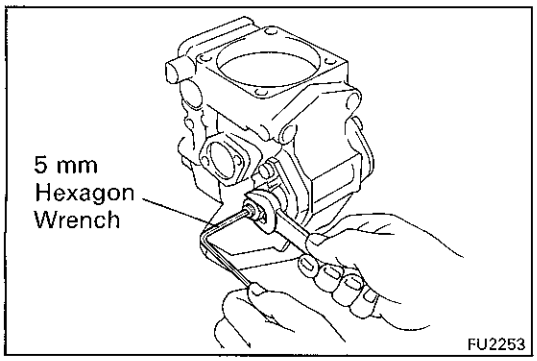
(d) Using a 5 mm hexagon wrench, install the the four bolts.

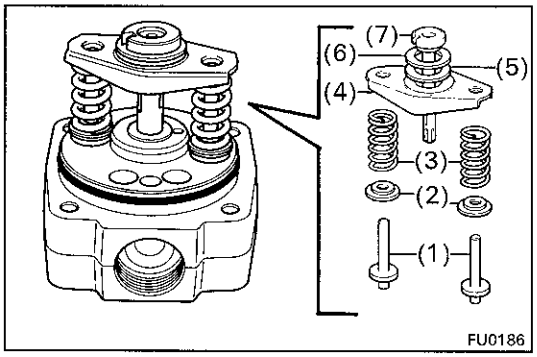


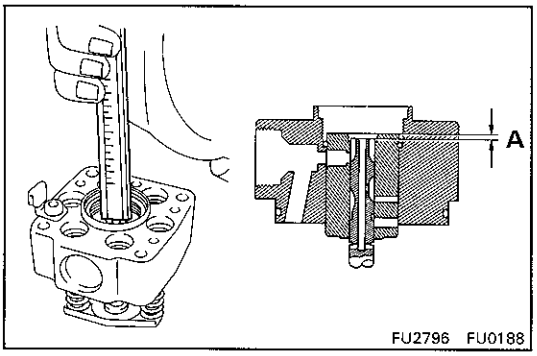
9. PRESET TIMER ADJUSTING SCREW

(a) Using vernier calipers, measure the protrusion of the adjusting screw from the timer cover.

Protrusion: 7.5 – 8.0 mm (0.295 – 0.315 in.)







(b) Using a 5 mm hexagon wrench, adjust the protrusion of the adjusting screw from the timer cover.

10. ADJUST PLUNGER SPRING SHIM

(a) Install the following parts to the distributive head:

(1) Two plunger spring guides
(2) Two upper spring seats
(3) Two plunger springs
(4) Lower spring seat
(5) Upper plunger plate
(6) Lower plunger plate
(7) Pump plunger

HINT: Do not assemble the plunger spring shims at this time.

(b) Using vernier calipers, measure clearance A indicated in the illustration.

(c) Determine the plunger spring shim size by using the following formula and chart.

1PZ and 1HZ

New plunger spring shim thickness = 5.8 – A

1HD-T

New plunger spring shim thickness = 5.1 – A

A .... Measured plunger position

Plunger spring shim selection chart for 1PZ and 1HZ

mm (in.)

Measured clearance	Shim thickness	Measured clearance	Shim thickness
More than 5.3 (0.209)	0.5 (0.020)	4.3 – 4.5 (0.169 – 0.177)	1.5 (0.059)
5.0 – 5.2 (0.196 – 0.205)	0.8 (0.031)	4.0 – 4.2 (0.157 – 0.165)	1.8 (0.071)
4.8 – 4.9 (0.189 – 1.193)	1.0 (0.039)	Less than 3.9 (0.154)	2.0 (0.079)
4.6 – 4.7 (0.181 – 0.185)	1.2 (0.047)	–	–

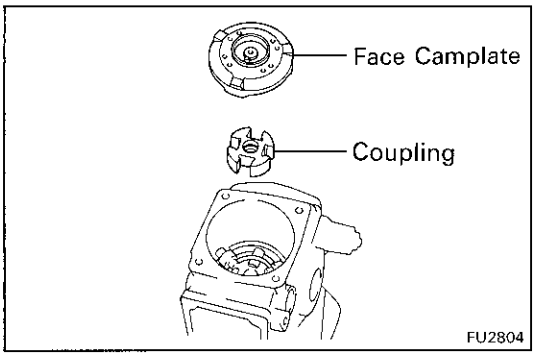
Plunger spring shim selection chart for 1HD-T

mm (in.)

Measured clearance	Shim thickness	Measured clearance	Shim thickness
More than 4.6 (0.181)	0.5 (0.020)	3.6 – 3.8 (0.142 – 0.150)	1.5 (0.059)
4.3 – 4.5 (0.169 – 0.177)	0.8 (0.031)	3.3 – 3.5 (0.130 – 0.138)	1.8 (0.071)
4.1 – 4.2 (0.161 – 0.165)	1.0 (0.039)	Less than 3.2 (0.126)	2.0 (0.079)
3.9 – 4.0 (0.154 – 0.157)	1.2 (0.047)	–	–

HINT:

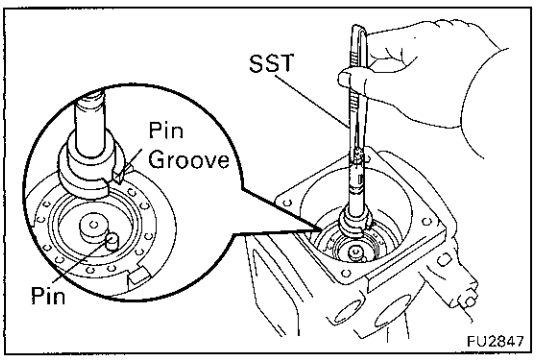
- For a measurement between listed sizes, use the next larger size. Ex. If thickness is 1.1 mm (0.043 in.) by calculation, use a 1.2 mm (0.047 in.) shim.
- Select two shims which have the same thickness.



11. (1PZ only)
ADJUST PLUNGER ADJUSTING SHIM

(a) Install the coupling and face camplate.

HINT: Do not assemble the coupling spring.

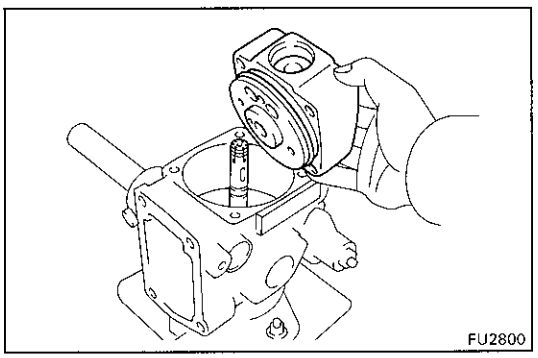


(b) Clean the plunger adjusting shim and contacting surface area.

(c) Align the pin groove of the pump plunger with the face camplate pin.

(d) Using SST, install the used plunger adjusting shim and pump plunger.

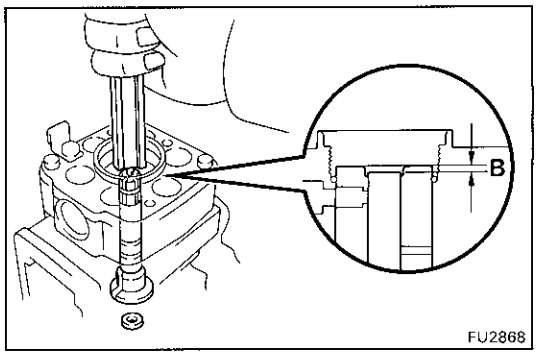
SST 09260-54012 (09269-54030)



(e) Install the distributive head with the four bolts.

Torque: 120 kg-cm (9 ft-lb, 12 N·m)

NOTICE: Be careful not to damage the pump plunger.



(f) Using vernier calipers, measure dimension B indicated in the illustration.

(g) Determine the plunger adjusting shim size by using the following formula and chart.

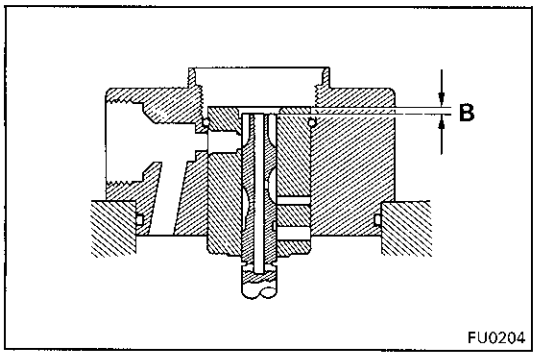
New adjusting shim thickness = T + (B – 3.3)
T ... Thickness of used shim
B ... Measured plunger position

Plunger adjusting shim selection chart

Installed shim mm	Measured clearance mm																			
	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2 – 3.4	3.5	3.6	**3.7**	3.8	3.9	4.0	4.1	4.2	4.3	4.4
1.9											2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.9
2.0									1.9		2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.9	
2.1								1.9	1.9		2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.9		
2.2							1.9	1.9	2.0		2.4	2.5	2.6	2.7	2.8	2.9	2.9			
2.3						1.9	1.9	2.0	2.1		2.5	2.6	2.7	2.8	2.9	2.9				
2.4					1.9	1.9	2.0	2.1	2.2		2.6	2.7	**2.8**	2.9	2.9					
2.5				1.9	1.9	2.0	2.1	2.2	2.3		2.7	2.8	2.9	2.9						
2.6			1.9	1.9	2.0	2.1	2.2	2.3	2.4		2.8	2.9	2.9							
2.7		1.9	1.9	2.0	2.1	2.2	2.3	2.4	2.5		2.9	2.9								
2.8	1.9	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6		2.9									
2.9	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7											

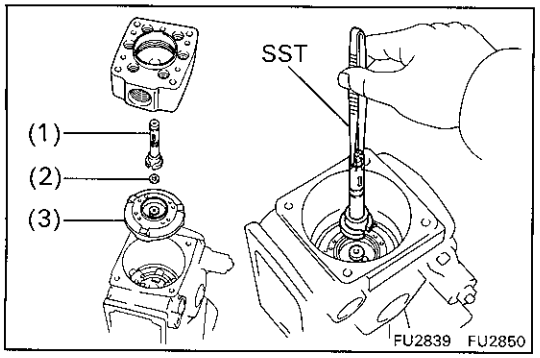
Plunger adjusting shim thickness mm (in.)	1.9 (0.075)	2.0 (0.079)	2.1 (0.083)	2.2 (0.087)	2.3 (0.091)	2.4 (0.094)	2.5 (0.098)	2.6 (0.102)	2.7 (0.106)	2.8 (0.110)	2.9 (0.114)

EXAMPLE: The 2.4 mm (0.094 in.) shim is installed and measured clearance is 3.7 mm (0.146 in.). Replace the 2.4 mm (0.094 in.) shim with a 2.8 mm (0.110 in.) shim.



(h) Install a new plunger adjusting shim and recheck dimension B.

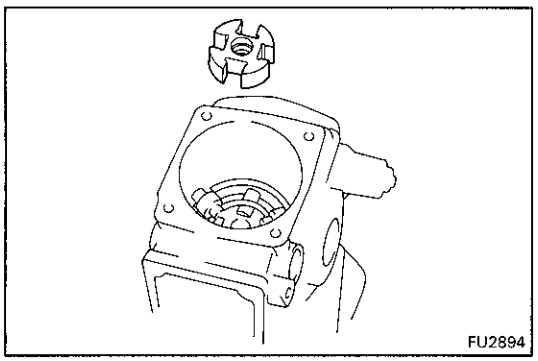
Dimension B: 3.2 – 3.4 mm (0.126 – 0.134 in.)



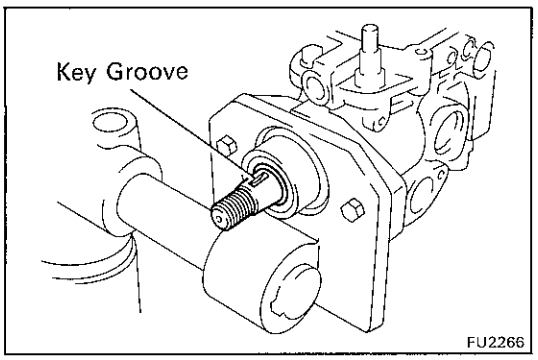
(i) Remove the distributive head.

(j) Using SST, remove the following parts:
(1) Pump plunger
(2) Plunger adjusting shim
(3) Face camplate

SST 09260-54012 (09269-54030)

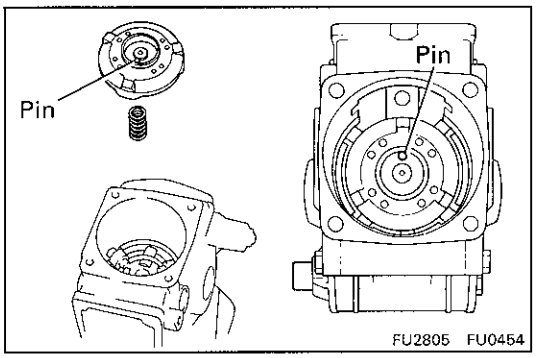


12. (1HZ and 1HD-T) INSTALL COUPLING

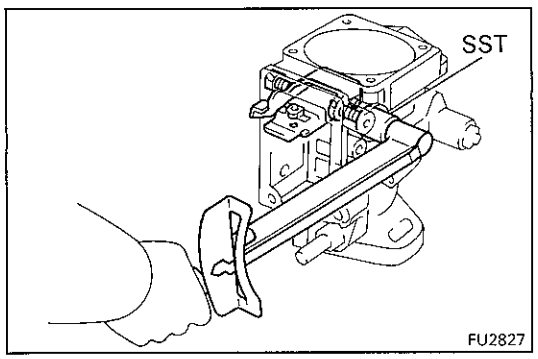


13. INSTALL FACE CAMPLATE

(a) Face the drive shaft with the key groove facing upward.



(b) Install the coupling spring and camplate with the camplate pin facing the governor cover side.



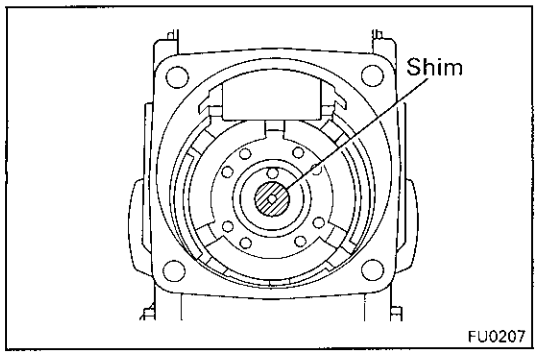
14. INSTALL GOVERNOR LINK

(a) Using SST, install the governor link with two new gaskets and the two support bolts.

Torque: 140 kg-cm (10 ft-lb, 14 N·m)

SST 09260-54012 (09269-54040)

(b) Check that the governor link moves smoothly.

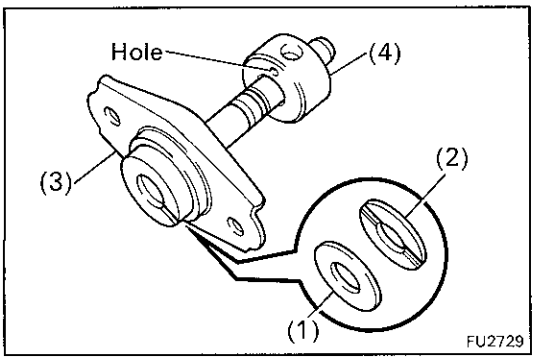


15. INSTALL PUMP PLUNGER

(a) (1PZ)
Place the previously used plunger adjusting shim on center of the camplate.

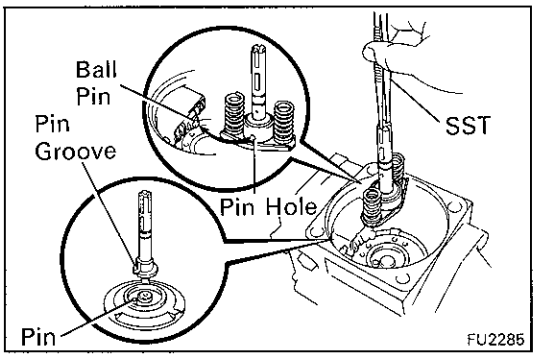
(1HZ and 1HD-T)
Place the previously used plunger adjusting shim on the center of the camplate.

NOTICE: Do not apply grease to the shim.



(b) Install the following parts to the pump plunger:
(1) Lower plunger plate
(2) Upper plunger plate
(3) Lower spring seat
(4) Spill ring

HINT: Face the spill ring with the hole facing the lower spring seat.



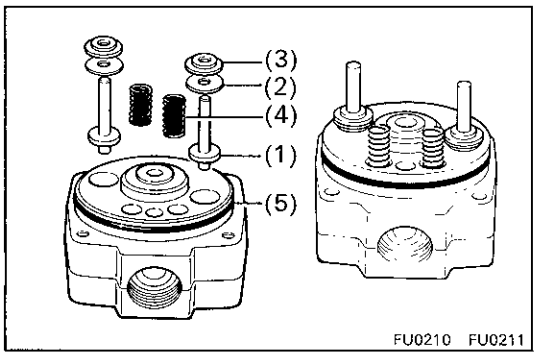
(c) Align the pin groove of the plunger with the pin of the face camplate.

(d) Align the ball pin of the governor link with the pin hole of the spill ring.

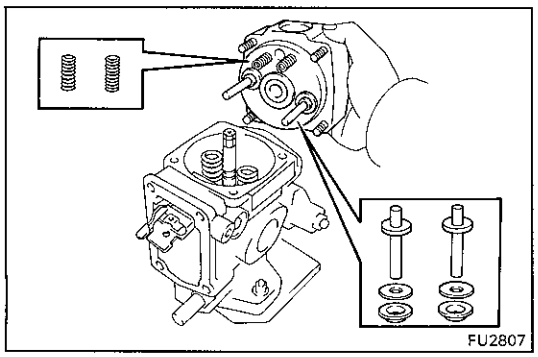
(e) Using SST, install the pump plunger and two plunger springs.

SST 09260-54012 (09269-54030)

16. INSTALL DISTRIBUTIVE HEAD

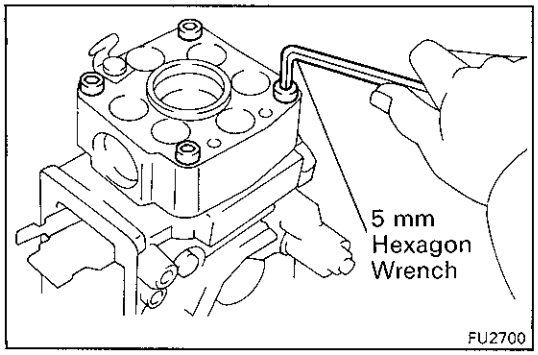


(a) Apply No.50 DENSO grease to the following parts and install them to the distributive head:
(1) Two plunger spring guides
(2) Two new selected plunger spring shims
(3) Two upper spring seats
(4) Two lever support springs
(5) New O-ring



(b) Install the distributive head.

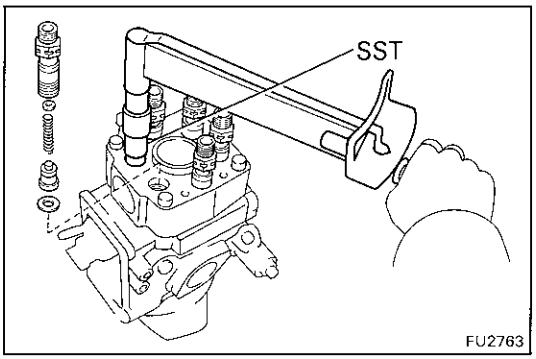
NOTICE: Be careful not to damage the pump plunger.



(c) Using 5 mm hexagon wrench, install the four bolts.

Torque: 120 kg-cm (9 ft-lb, 12 N·m)

HINT: Use the bolt which is 45 mm (1.77 in.) in length.



17. INSTALL DELIVERY VALVE HOLDERS

(a) Install new gaskets and the valves into the distributive head.

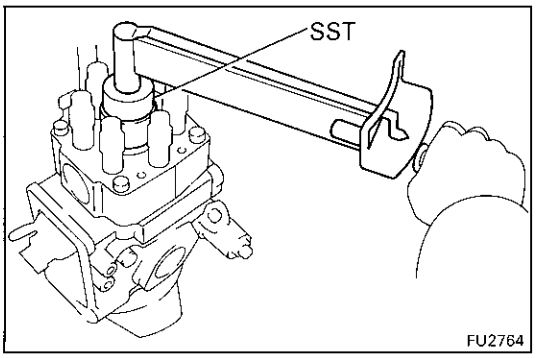
(b) Install the spring seats and springs into the delivery valve holders.

(c) Using SST, install the delivery valve holders.

SST 09260-54012 (09269-54020)

Torque:

1PZ and 1HZ	**500 kg-cm (36 ft-lb, 49 N·m)**
1HD-T	**550 kg-cm (40 ft-lb, 54 N·m)**



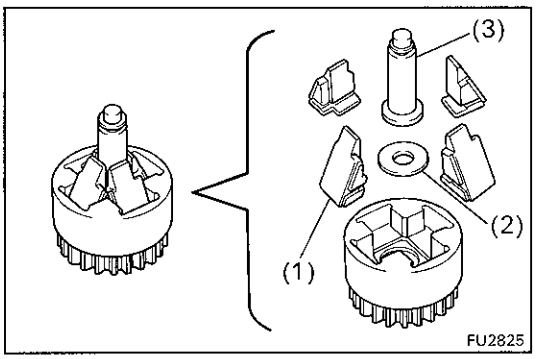
18. (1PZ only) INSTALL DISTRIBUTIVE HEAD PLUG

(a) Install a new O-ring to the head plug.

(b) Using SST, install the head plug.

SST 09260-54012 (09262-54010)

Torque: 700 kg-cm (51 ft-lb, 69 N·m)



19. INSTALL GOVERNOR SHAFT AND FLYWEIGHT HOLDER

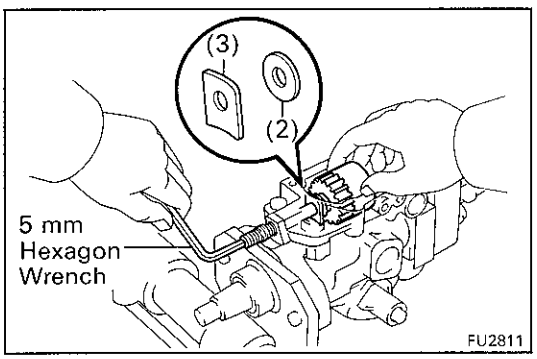
(a) Install the following parts to the flyweight holder:

(1) Four flyweight

(2) No.2 flyweight washer

(3) Governor sleeve

HINT: Replace the four flyweights as a set.

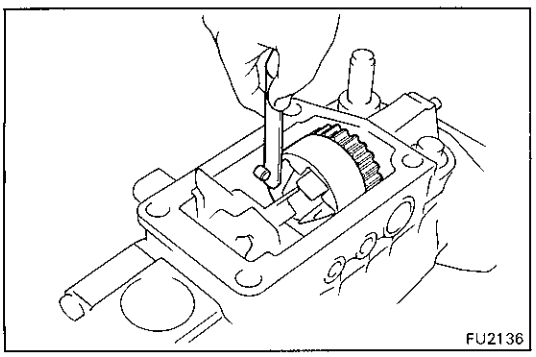


(b) Install a new O-ring to the governor shaft.

(c) Place the flyweight holder assembly (1) in position, and install the No.1 flyweight washer (2) and governor gear adjusting washer (3) between the flyweight holder and pump housing.

(d) Install the governor shaft through the governor gear adjusting washer, No.1 flyweight washer and flyweight holder assembly.

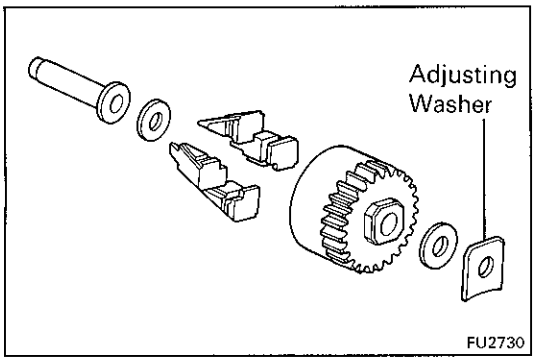
(e) Using a 5 mm hexagon wrench, turn the governor shaft counterclockwise.



20. CHECK FLYWEIGHT HOLDER THRUST CLEARANCE

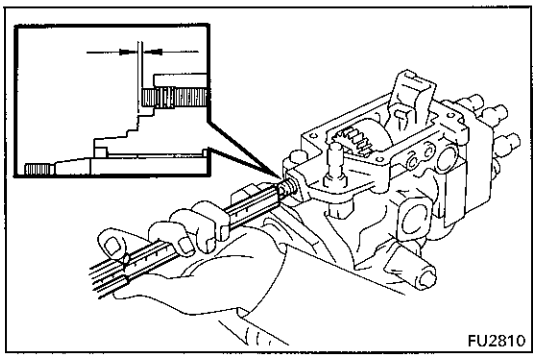
Using a thickness gauge, measure the thrust clearance between the housing pin and flyweight holder.

Thrust clearance: 0.15 – 0.35 mm (0.0059 – 0.0138 in.)



If the thrust clearance is not as specified, adjust with a governor gear adjusting washer.

Governor gear adjusting washer thickness:
1.05 mm (0.0413 in.)
1.25 mm (0.0492 in.)
1.45 mm (0.0571 in.)
1.65 mm (0.0650 in.)
1.85 mm (0.0728 in.)

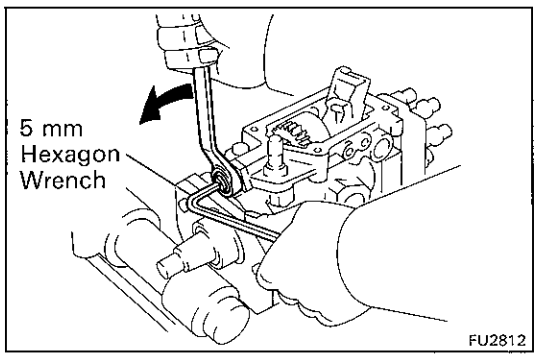


21. ADJUST PROTRUSION OF GOVERNOR SHAFT

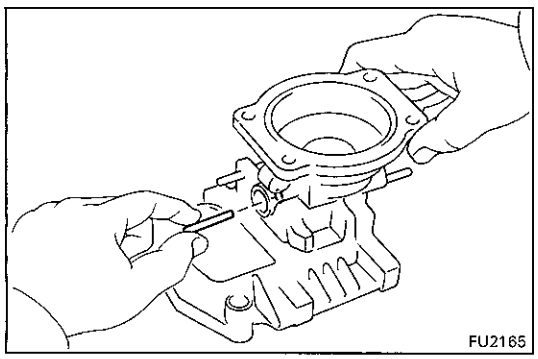
(a) Using vernier calipers, measure the protrusion of the governor shaft.

Protrusion: 0.5 – 2.0 mm (0.020 – 0.079 in.)

If the protrusion is not as specified, adjust by turning the governor shaft.



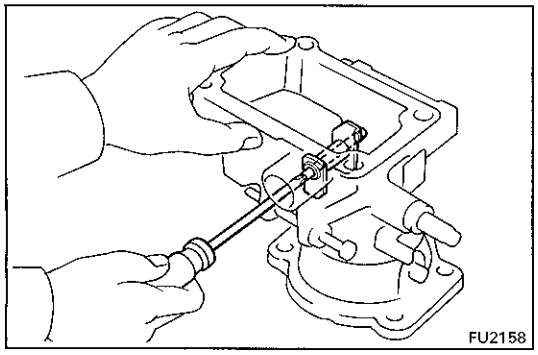
(b) Install and tighten the nut while holding the governor shaft with a 5 mm hexagon wrench.



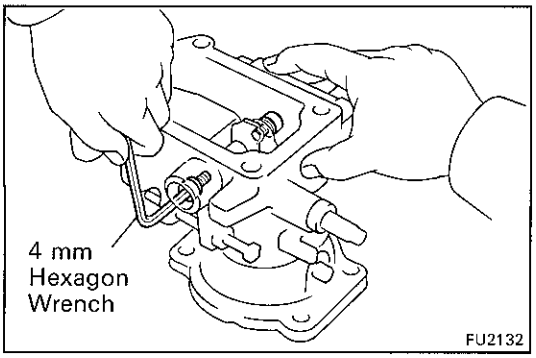
22. (1PZ (w/ HAC) and 1HZ (w/ HAC)) ASSEMBLE HIGH ALTITUDE COMPENSATOR

Install control lever

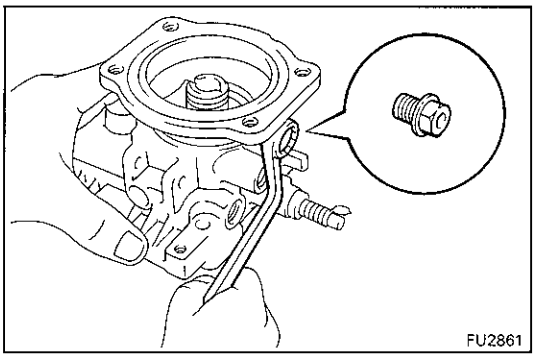
(a) Insert the connecting pin into governor cover.



(b) Using a small screwdriver, install the control lever with the support pin.



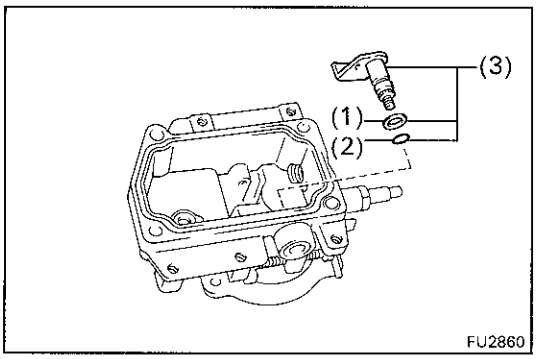
(c) Using a 4 mm hexagon wrench, install two new gaskets and the two bolts.



23. (1HD-T)
ASSEMBLE BOOST COMPENSATOR

A. Install No.2 overflow screw

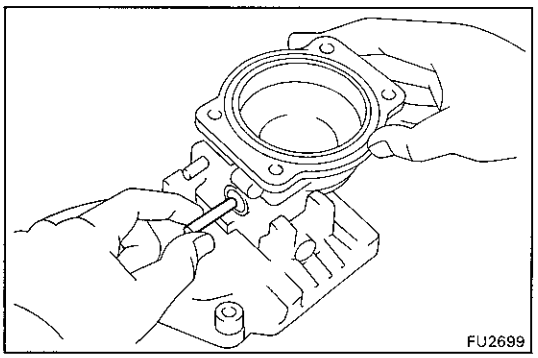
Install the No.2 overflow screw and cover.



B. Install No.2 PCS lever

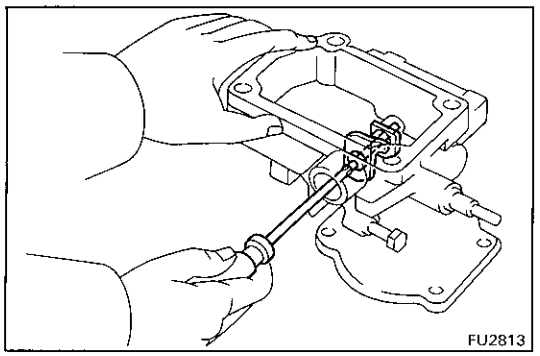
Install the following parts to the governor cover:

(1) Plate washer
(2) O-ring
(3) No.2 lever, O-ring and washer assembly

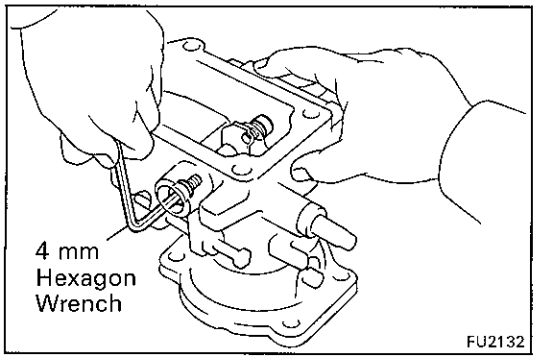


C. Install control lever

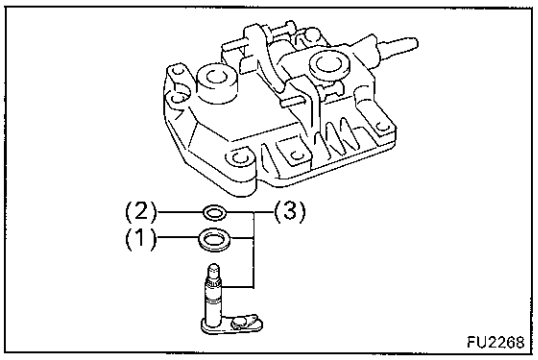
(a) Insert the connecting pin into governor cover.



(b) Using a small screwdriver, install the control lever with the support pin.



(c) Using a 4 mm hexagon wrench, install two new gaskets and the two bolts.



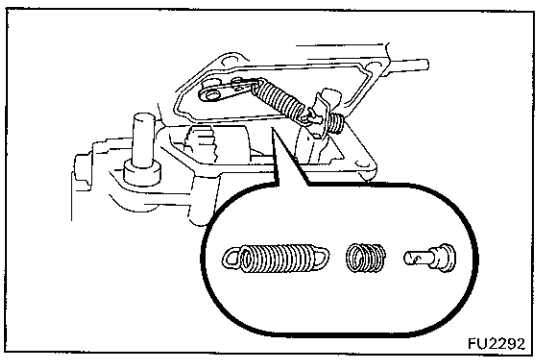
24. INSTALL ADJUSTING LEVER SHAFT TO GOVERNOR SHAFT

Install the following parts to the governor cover:

(1) Plate washer

(2) New O-ring

(3) Adjusting lever shaft, O-ring and plate washer assembly

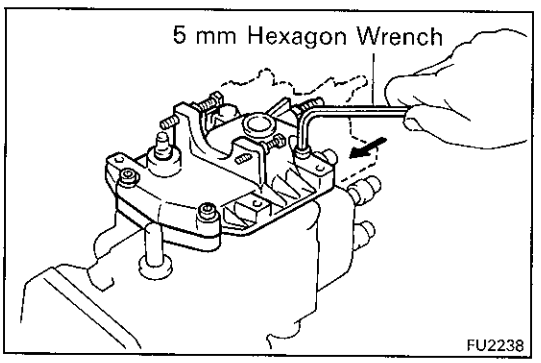


25. INSTALL GOVERNOR COVER

(a) Install the speed control spring to the adjusting shaft.

(b) Install a new gasket to the groove of the governor cover.

(c) Install the damper spring and spring seat, and connect the speed control spring to the spring seat.

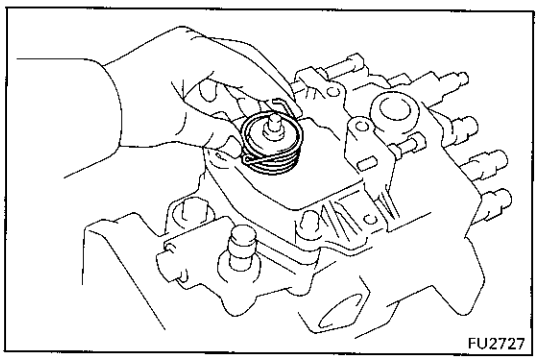


(d) Using a 5 mm hexagon wrench, install the governor cover with the four bolts.

Torque: 85 kg-cm (74 in.-lb, 8.3 N·m)

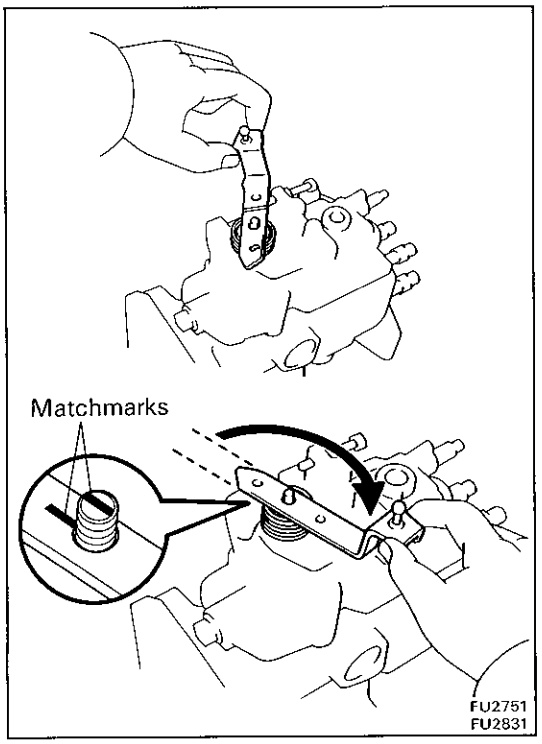
HINT: Use the bolt which is 35 mm (1.38 in.) in length.

(e) (w/ HAC and 1HD-T)
Install the idle speed adjusting screw.



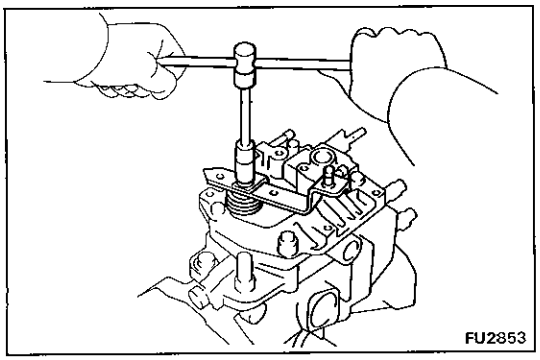
26. INSTALL ADJUSTING LEVER

(a) Place the return spring on the governor cover.

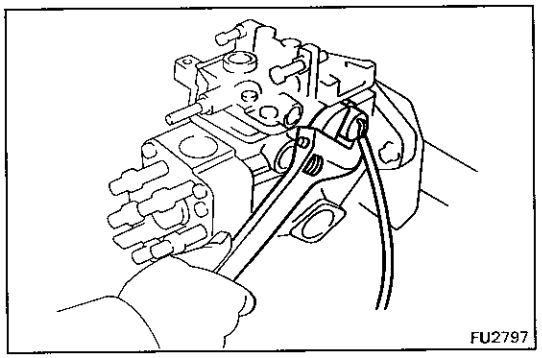


(b) Hook the return spring to the adjusting lever, and turn and place the adjusting lever on the governor shaft.

(c) Align the lines of the adjusting lever shaft and adjusting lever.



(d) Install the adjusting lever with the spring guide and nut.

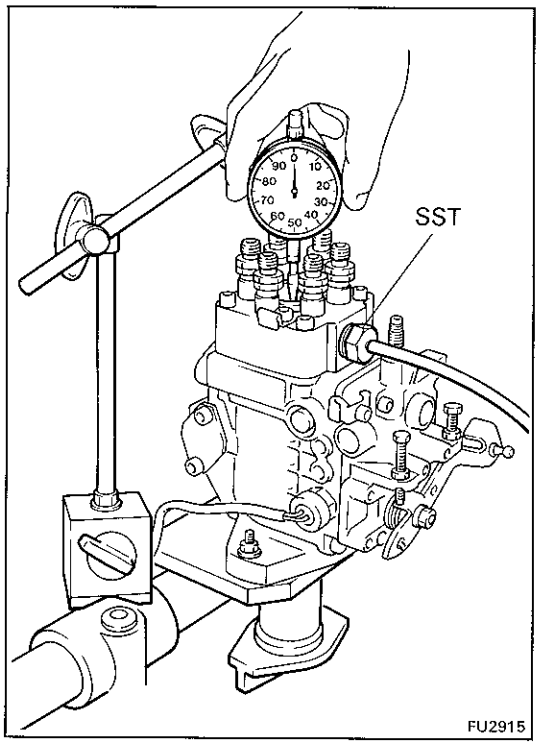


27. (w/ TACHOMETER)
INSTALL PICKUP SENSOR

(a) Install a new O-ring and pickup sensor.

(b) Connect the two lead wires to the connector.

Torque: 210 kg-cm (15 ft-lb, 21 N·m)



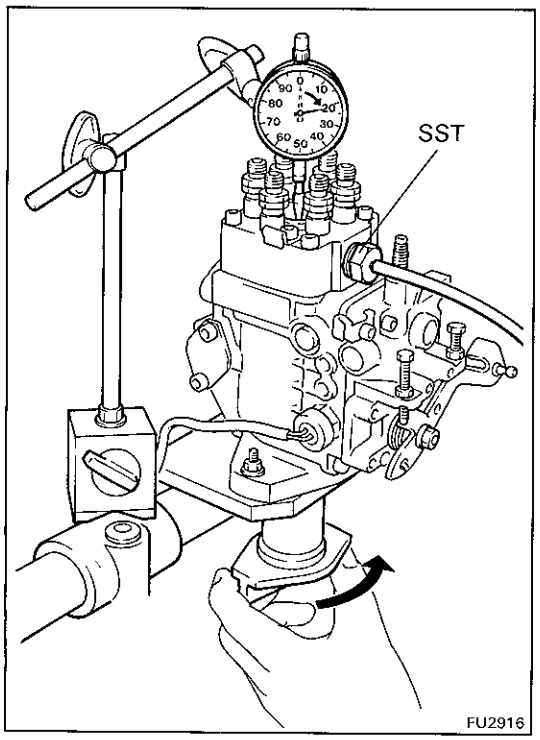
28. (1HZ and 1HD-T only)
ADJUST PLUNGER PRE-STROKE

(a) Install SST to the fuel cut solenoid installation screw section.

SST 09275-17010

(b) Set the dial indicator so that the tip of the dial indicator push rod touches the upper surface of the plunger.

(c) Rotate the drive shaft, set the plunger to BDC and set the scale on the dial indicator to 0 mm (0 in.)



(d) Apply a few drops of light oil (diesel fuel) to the top surface of the plunger, and when 0.1 kg/cm^2 (1.4 psi, 49 kPa) of air is applied to SST, bubbles appear on the upper surface of the plunger.

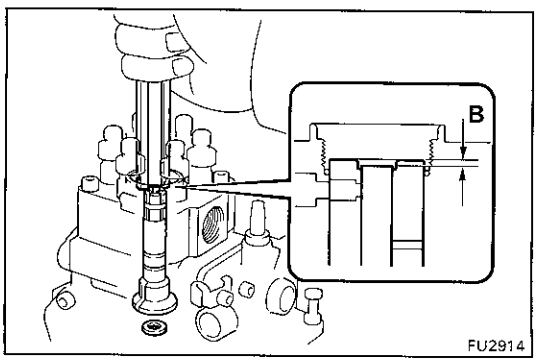
SST 09275-17010

(e) Slowly rotate the drive shaft in the pump rotation direction (clockwise) and read the dial indicator when the bubbles on the top of the plunger disappear.

Pre-stroke: 0.15 – 0.25 mm (0.0059 – 0.0098 in.)

If the pre-stroke is not as specified, replace the plunger adjusting shim under the plunger with a different sized shim.

Adjusting thim thickness		mm (in.)
1.90 (0.0748)	2.35 (0.0925)	2.80 (0.1102)
1.95 (0.0768)	2.40 (0.0945)	2.85 (0.1122)
2.00 (0.0787)	2.45 (0.0965)	2.90 (0.1142)
2.05 (0.0807)	2.50 (0.0984)	2.94 (0.1157)
2.10 (0.0827)	2.55 (0.1004)	2.99 (0.1177)
2.15 (0.0846)	2.60 (0.1024)	3.04 (0.1197)
2.20 (0.0866)	2.65 (0.1043)	3.09 (0.1216)
2.25 (0.0886)	2.70 (0.1063)	3.14 (0.1236)
2.30 (0.0906)	2.75 (0.1083)	3.19 (0.1256)

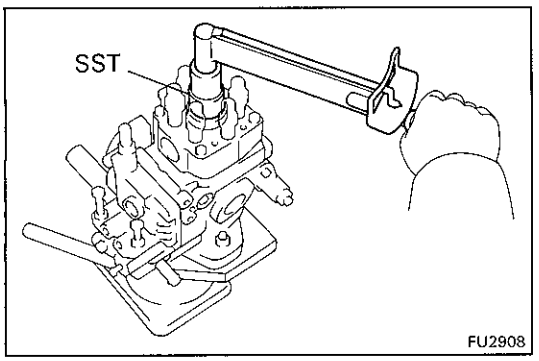


HINT: If the shim is made thicker, the pre-stroke is decreased

(f) After completing the pre-stroke adjustment, check that dimension B is within specifications.

Dimension B: 2.8 – 3.2 mm (0.110 – 0.126 in.)

If dimension B is not within the specification, replace the distributor head.



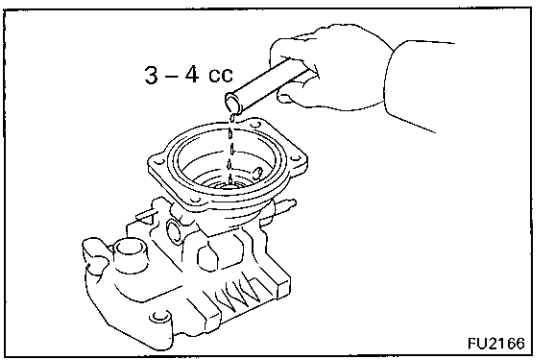
29. (1HZ and 1HD-T)
INSTALL DISTRIBUTIVE HEAD PLUG

(a) Install a new O-ring to the head plug.

(b) Using SST, install the head plug.

SST 09260-54012 (09262-54010)

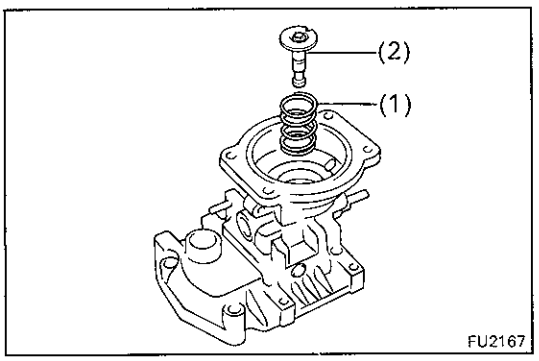
Torque: 1HZ 700 kg-cm (51 ft-lb, 69 N·m)
1HD-T 900 kg-cm (65 ft-lb, 88 N·m)



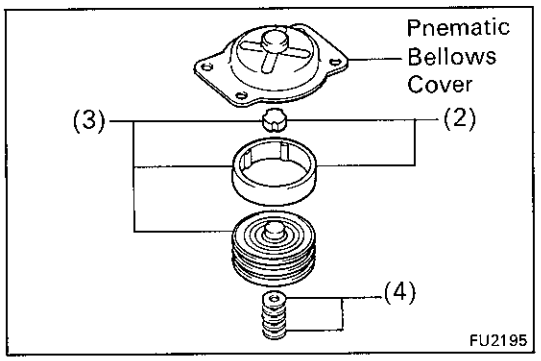
30. (1PZ (w/ HAC) and 1HZ (w/ HAC))
ASSEMBLE HIGH ALTITUDE COMPENSATOR

A. Install pneumatic bellows

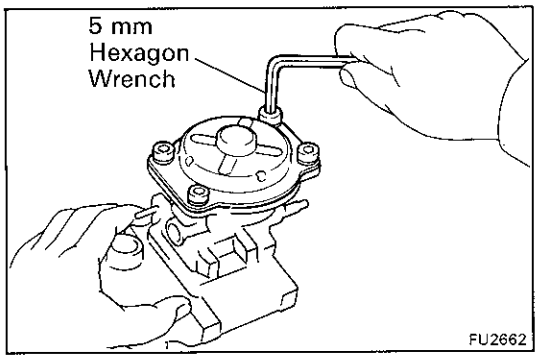
(a) Insert 3 – 4 cc (0.18 – 0.24 cu in.) of engine oil into the bushing hole.



(b) Place the following parts on the governor cover:
(1) Pneumatic bellows spring
(2) Push rod

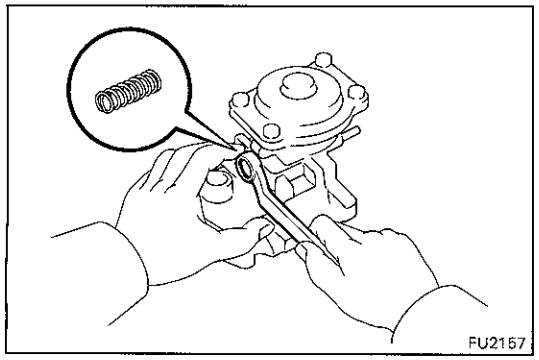


(c) Install the following parts to the pneumatic bellows cover:
(1) Pneumatic bellows
(2) Two rubber caps
(3) Pneumatic bellows and two rubber caps assembly
(4) Shims



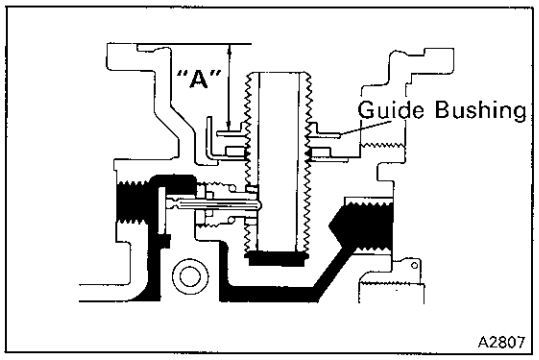
(d) Install a new gasket and the pneumatic bellows and bellows cover assembly to the governor cover.

(e) Using a 5 mm hexagom wrench, install the four bolts.



B. Install lever control spring

Install the lever control spring with a new gasket and the bolt.

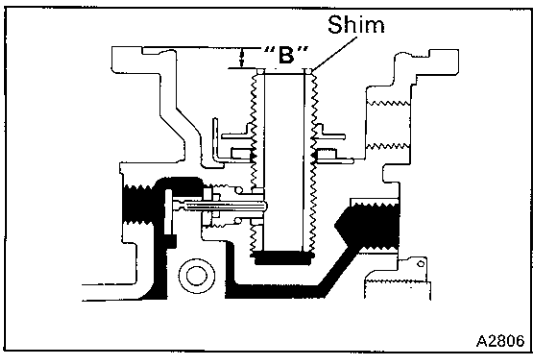


31. (1HD-T)
ASSEMBLE BOOST COMPENSATOR

A. Install guide bushing

Install and adjust the guide bushing to the dimension "A" as shown in the illustration.

Dimension "A":
Europe 19.2 – 19.3 mm (0.755 – 0.760 in.)
Others 18.6 – 18.7 mm (0.732 – 0.736 in.)



B. Install boost compensator diaphragm

(a) Adjust boost compensator shim

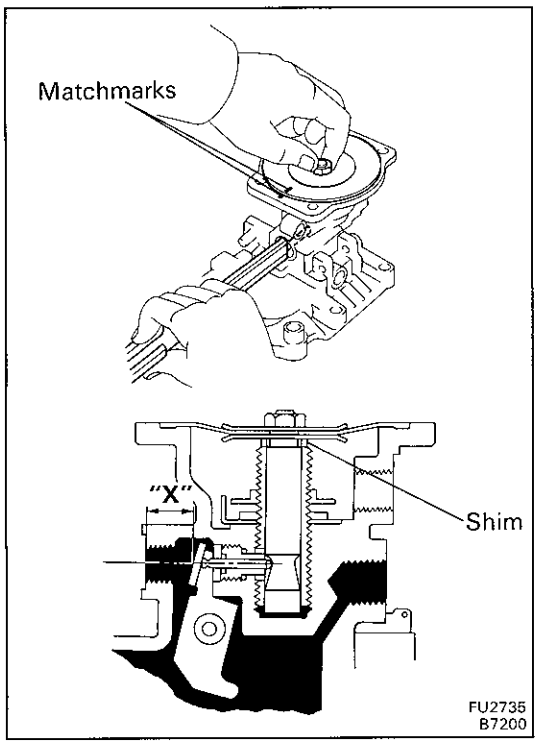
(1) Place the shim on the guide bushing

(2) Using vernier calipers, measure the dimension "B" as shown in the illustration.

Dimension "B":
Europe 4.8 – 5.0 mm (0.189 – 0.197 in.)
Others 6.0 – 6.2 mm (0.236 – 0.244 in.)

If the dimension is not within specification, select and install the correct shim.

Adjusting shim thickness:
1.1 mm (0.043 in.)
1.3 mm (0.051 in.)
1.5 mm (0.059 in.)
1.7 mm (0.067 in.)
1.9 mm (0.075 in.)
2.1 mm (0.083 in.)
2.3 mm (0.090 in.)
2.5 mm (0.098 in.)
2.7 mm (0.106 in.)
2.9 mm (0.114 in.)
3.1 mm (0.122 in.)
3.3 mm (0.130 in.)



(b) Adjust the installation direction of boost compensator diaphragm.

(1) Install the shim and diaphragm.

HINT: Do not assemble the spring.

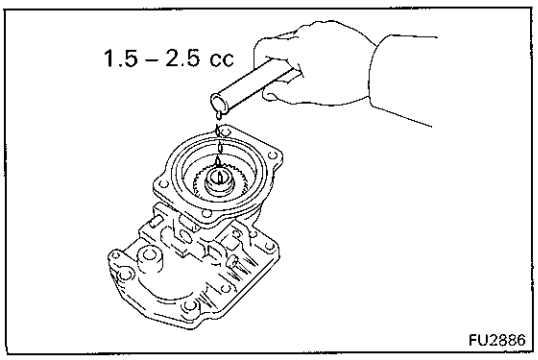
(2) While pushing on the diaphragm, measure dimension "X" with vernier calipers as shown.

Dimension "X": 6.9 – 7.1 mm (0.272 – 0.280 in.)

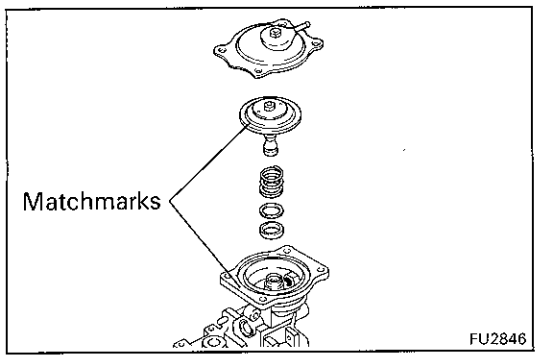
HINT: Measure at the center of the hole.

(3) Place matchmarks on the diaphragm and governor cover.

(4) Remove the diaphragm.

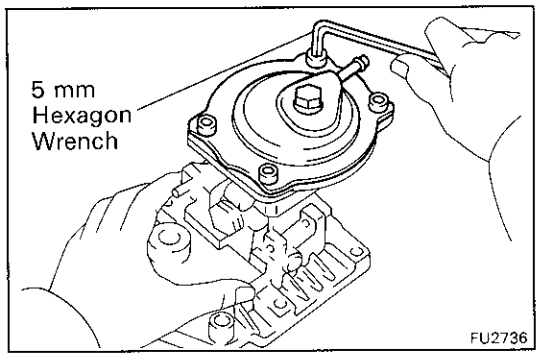


(c) Insert 1.5 – 2.5 cc (0.09 – 0.15 cu in.) of engine oil into the bushing hole.

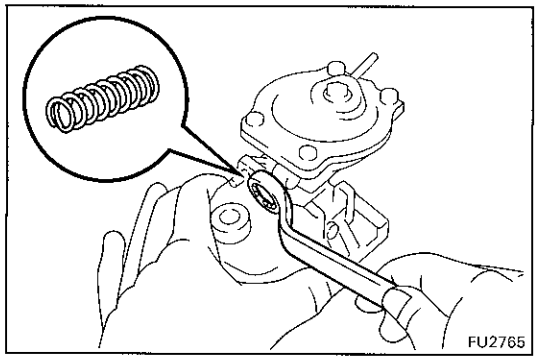


(d) Install spring, shim and diaphragm.

(e) Align the matchmarks on the diaphragm and governor cover.

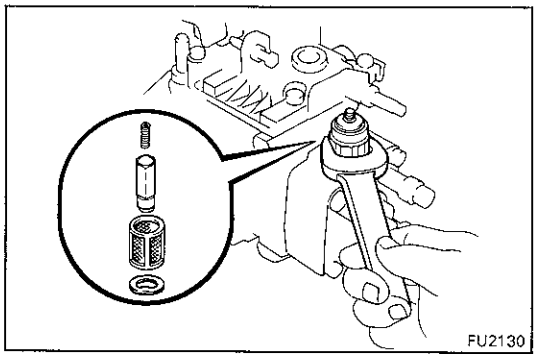


(f) Using a 5 mm hexagon wrench, install the four bolts.



C. Install lever control spring

Install the lever control spring with a new gasket and the bolt.

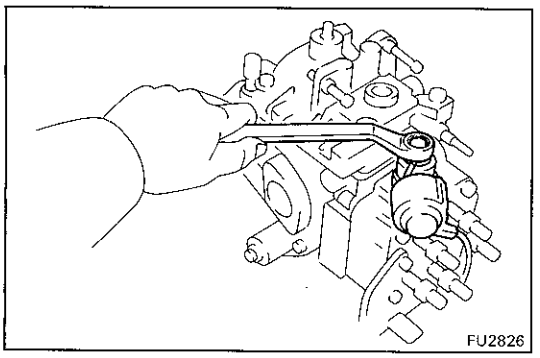


32. INSTALL FUEL CUT SOLENOID

(a) Install a new O-ring on the fuel cut solenoid.

(b) Install the strainer, valve, spring, a new gasket and the fuel cut solenoid.

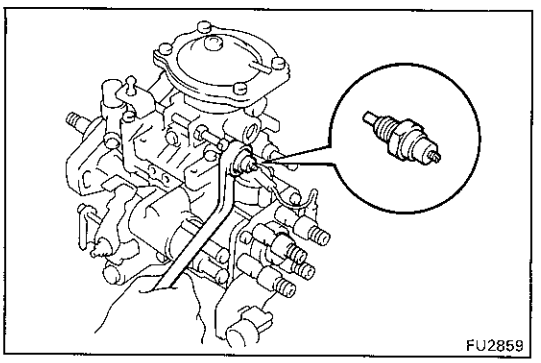
Torque: 225 kg-cm (16 ft-lb, 22 N·m)



(c) Install the lead wire to the fuel cut solenoid with the nut.

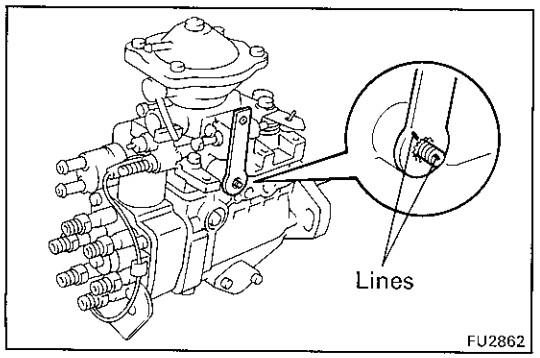
(d) Install the dust cover to the fuel cut solenoid.

(e) Install the lead wire connector to bracket.



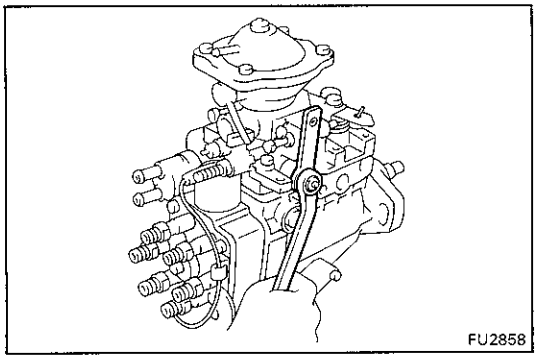
33. (w/ Dash Pot)
INSTALL DASH POT

Install the dash pot and gasket.

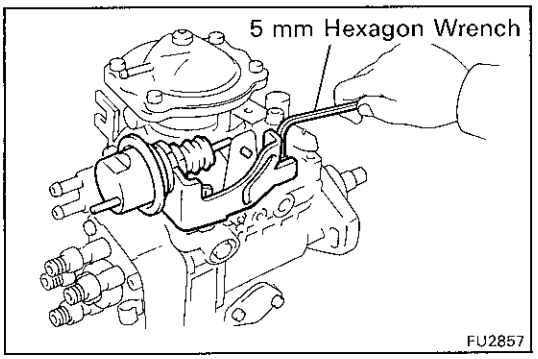


34. (w/ PCS)
INSTALL NO.1 PCS LEVER

(a) Align the lines of the levers.

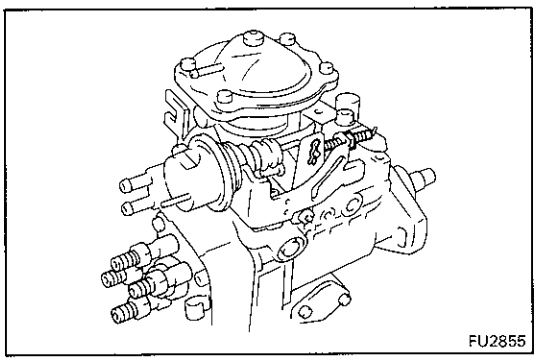


(b) Install the nut.



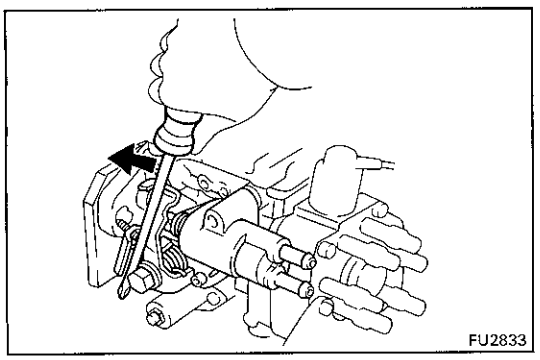
35. (w/ PCS)
INSTALL PCS ACTUATOR

(a) Using a 5 mm hexagon wrench, install the PCS actuator assembly with the two bolts.



(b) Install the clip.

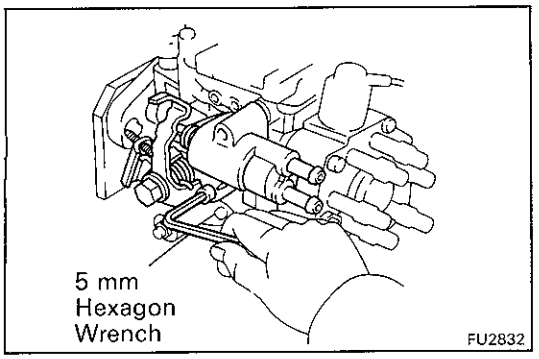
(c) Install the PCS adjusting screw.



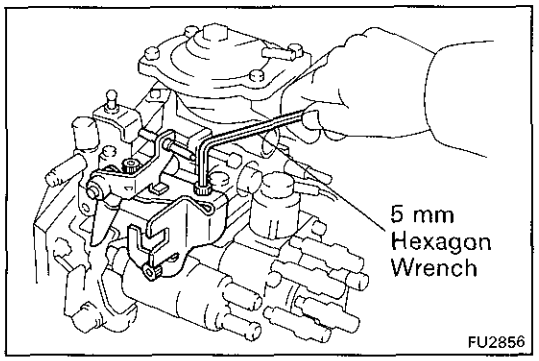
36. (w/ ACSD)
INSTALL THERMO WAX

(a) Using a screwdriver, turn the cold starting lever counterclockwise approx. 20°.

(b) Put a metal plate (thickness of 3.5 – 7.5 mm (0.138 – 0.295 in.)) between the cold starting lever and thermo wax plunger.



(c) Install a new O-ring and the thermo wax with the two bolts.



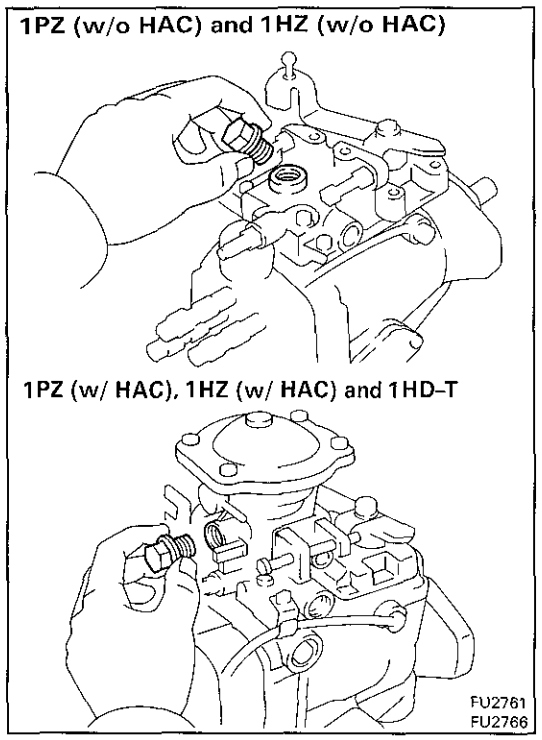
37. (w/ ACSD)
INSTALL IDLE-UP LEVER

Using a 5 mm hexagon wrench, install the idle-up lever with the three bolts.

38. (w/ A/C)
INSTALL IDLE-UP ACTUATOR

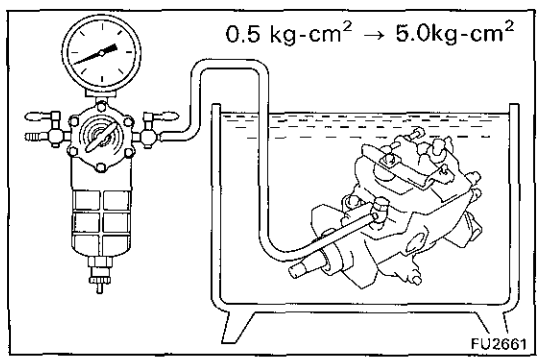
39. **REMOVE INJECTION PUMP FROM SST (STAND)**

SST 09241-76022 and 09245-54010



40. **PERFORM AIR TIGHT TEST**

(a) Install a bolt to the overflow port.

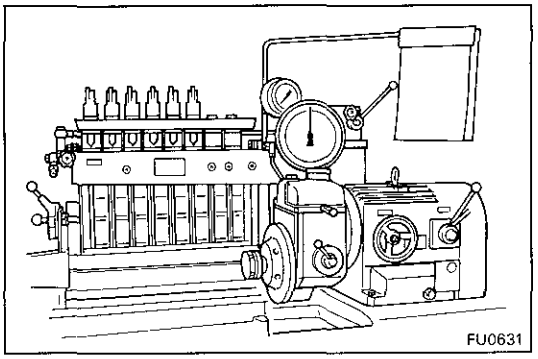


(b) Connect an air hose to the fuel inlet pipe and place the injection pump into diesel fuel.

(c) Apply 0.5 kg/cm^2 (7 psi, 49 kPa) of pressure and confirm that there are no leaks.

(d) Next check that there are no leaks with 5.0 kg/cm^2 (71 psi, 490 kPa) of pressure applied.

41. **INSTALL SET KEY OF INJECTION PUMP DRIVE PULLEY ON DRIVE SHAFT**


FU0631

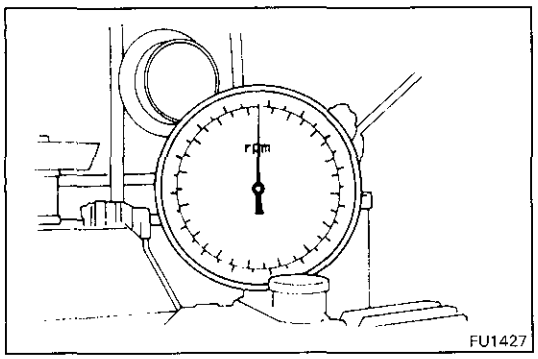
ADJUSTMENT OF INJECTION PUMP

1. PRE-TEST CHECK AND PREPARATION

(a) The specifications for test nozzle and nozzle holders are as follows.

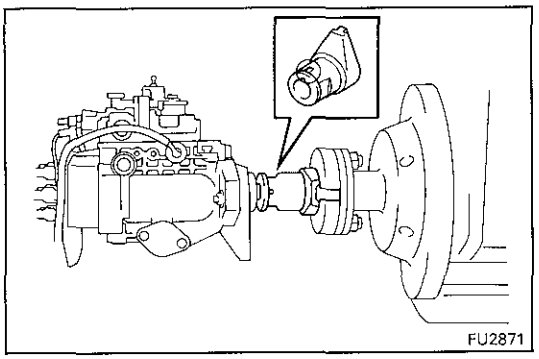
Test nozzle: DN12SD12 (NIPPONDENSO)

Test nozzle opening pressure:
145 – 155 kg/cm^2
(2,062 – 2,205 psi, 14,220 – 15,200 kPa)


FU1427

(b) Check the accuracy of the tachometer.

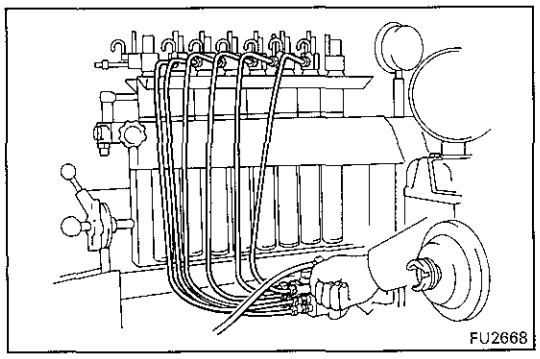
Allowable error: ± 40 rpm


FU2871

(c) Install the angle gauge stand.

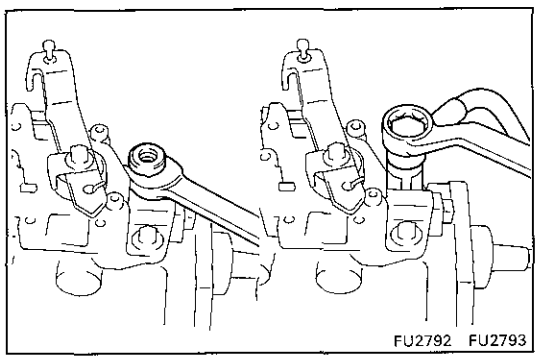
(d) Mount the injection pump body on the pump tester.

HINT: Place a mark on the key groove portion of the coupling.


FU2668

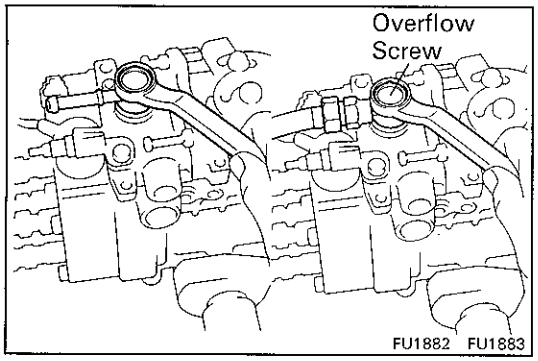
(e) Install an injection pipe with the following specifications.

Outer diameter:	**6.0 mm (0.236 in.)**
Inner diameter:	**2.0 mm (0.079 in.)**
Length:	**840 mm (33.07 in.)**
Minimum bending radius:	**25 mm (0.98 in.) or more**


FU2792 FU2793

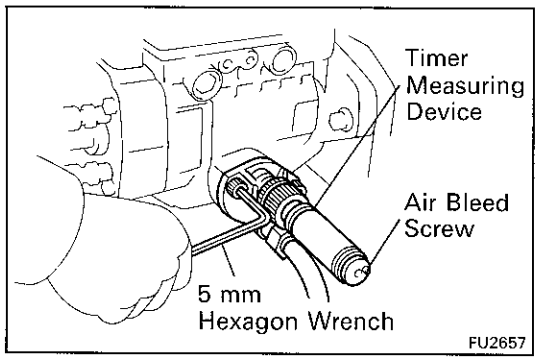
(f) Remove the fuel inlet hollow screw.

(g) Connect the fuel inlet pipe with an adapter.



(h) Install the overflow hose with the overflow screw.

HINT: Always use the overflow screw installed on the pump to be adjusted.



(i) Using a 5 mm hexagon wrench, remove the two bolts and RH timer cover.

(j) Install the inner pressure gauge with the timer measuring device.

Part No. 95095-10220 and 95095-10231

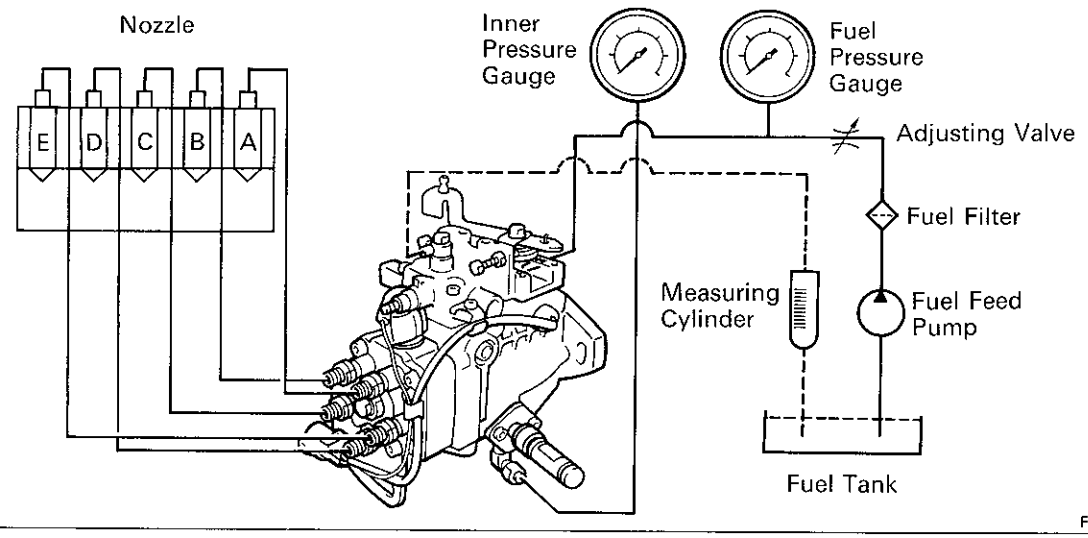
(NIPPONDENSO)

HINT: Bleed the air by the air bleed screw.

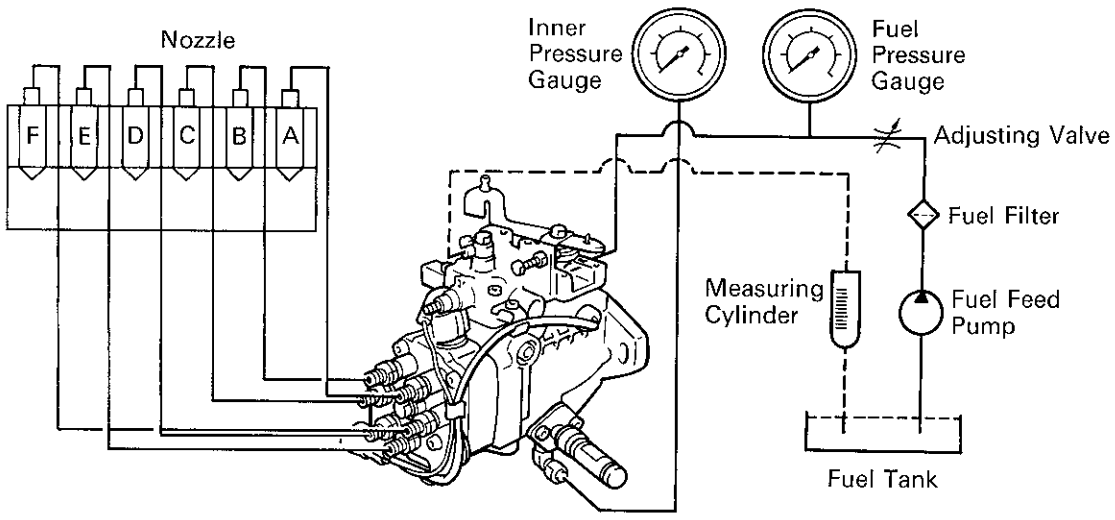
(k) (1HD-T)
Connect SST (turbocharger pressure gauge) to the boost compensator.

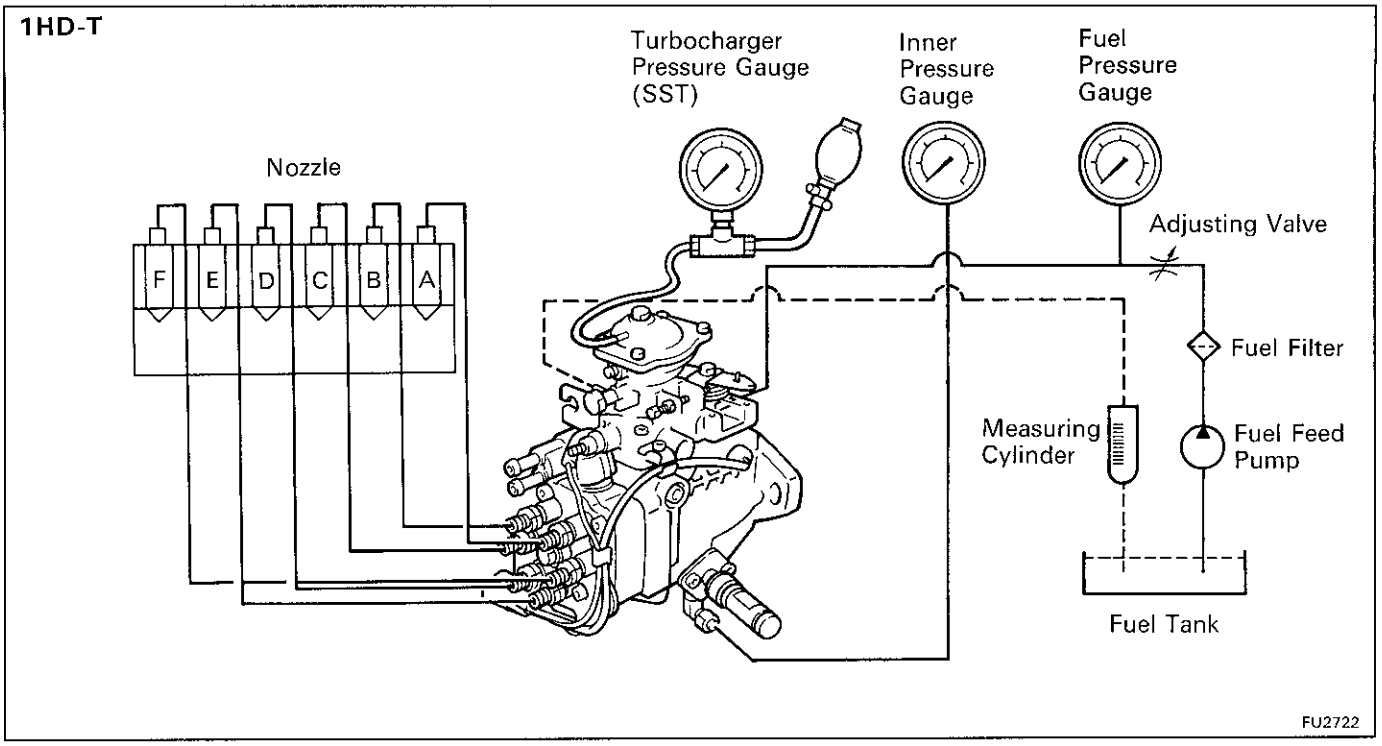
SST 09992-00241

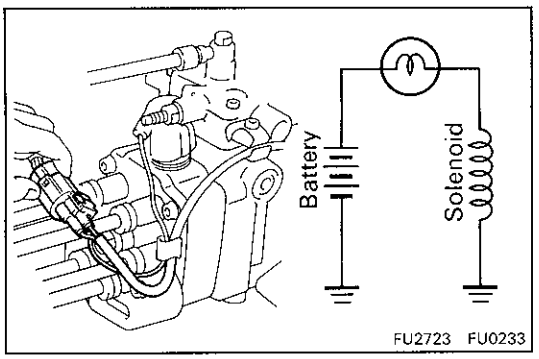
1PZ



1HZ





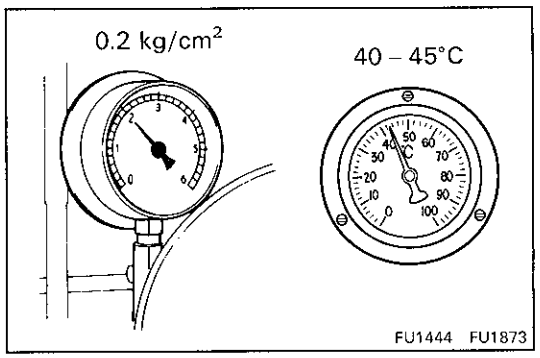


(l) (12 V type)
Apply approx. 6 volts of DC power to the fuel cut solenoid.

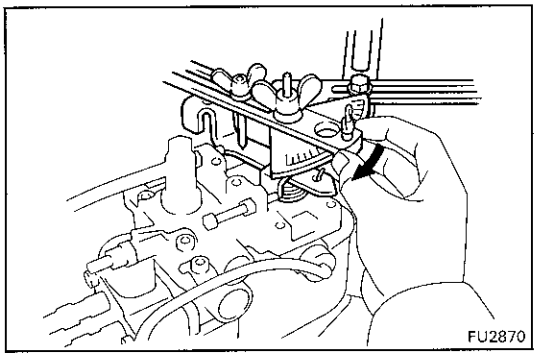
(m) (24 V type)
Apply approx. 12 volts of DC power to the fuel cut solenoid.

NOTICE:

- **When applying voltage to the solenoid, position the battery as far away from the solenoid as possible so that a spark does not occur.**
- **When connecting the battery cable, connect the solenoid side first.**

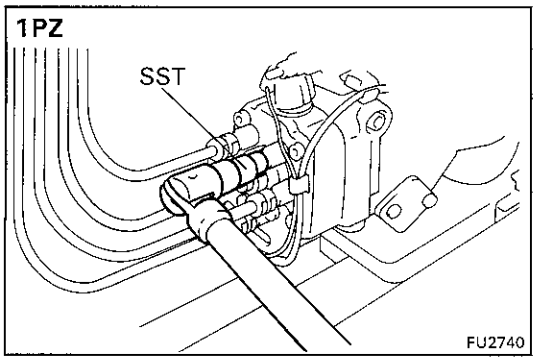


(n) The pressure for feeding fuel to the injection pump should be 0.2 kg/cm² (2.8 psi, 20 kPa). The fuel temperature for pump testing should be 40 – 45°C (104 – 113°F).



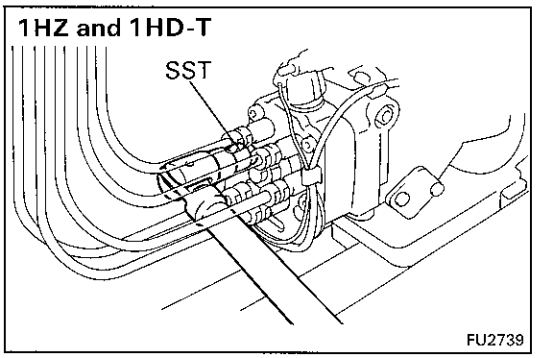
(o) Install an angle gauge to the stand and set it to the adjusting lever.

(p) Secure the adjusting lever fully on the maximum speed side.



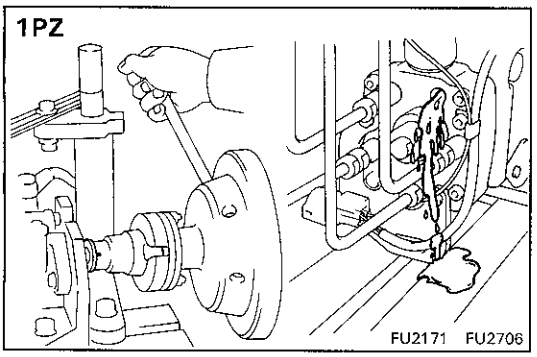
(q) Check the installation direction of the camplate as follow:

- (1PZ)
  Disconnect the injection pipe from the position marked "A" on the distributive head.



- (1HZ and 1HD-T)
  Disconnect the injection pipe from the position marked "C" on the distributive head.
- Using SST, remove the delivery valve holder.

SST 09260-54012 (09269-54020)

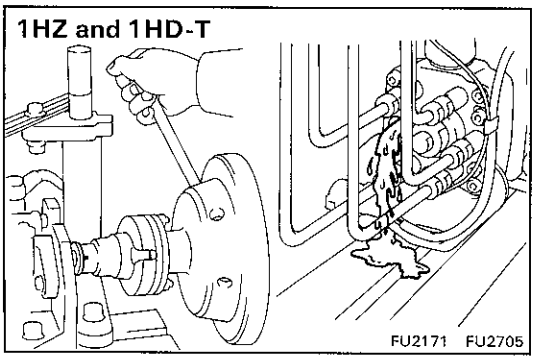


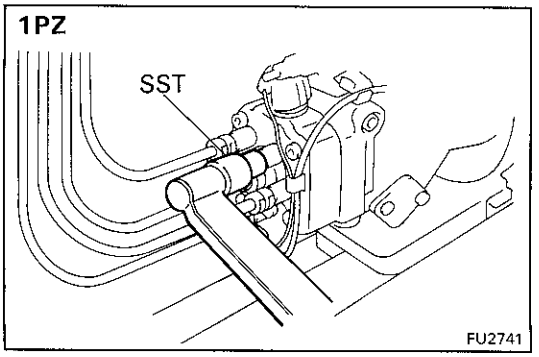
- Check that fuel is flowing out when the mark is in the position shown in the illustration.

If not, it is improperly assembled.

- Disassemble and change the camplate position 180° in the opposite direction.

HINT: At this time, disconnect the fuel cut solenoid wire harness.

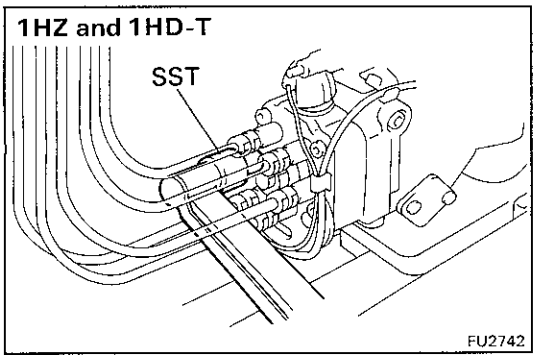


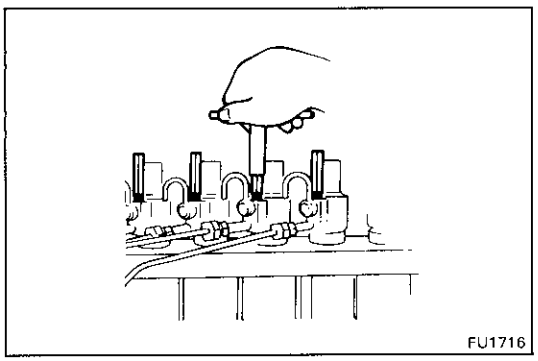


- Using SST, install the delivery valve holder.

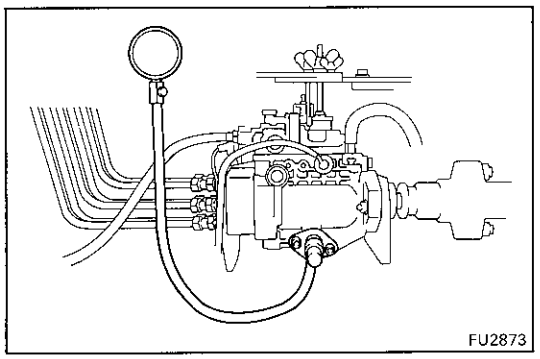
SST 09260-54012 (09269-54020)

- Connect the injection pipe.



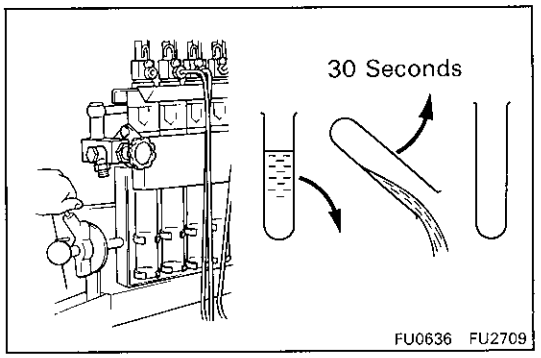


(r) Bleed the air from the injection pipes.



(s) Race the injection pump for 5 minutes at 2,000 rpm.

NOTICE: Check that there is no fuel leakage or abnormal noise.



HINT:

- Measure the volume of each injection cylinder with a measuring cylinder.
- Before measuring the injection volume first hold the cylinder tilted for at least 30 seconds to discard all the fuel.

2. PRE-SET FULL LOAD INJECTION VOLUME

(a) Set the adjusting lever to maximum position.

(b) (1PZ (w/ HAC) and 1HZ (w/ HAC))
Apply 760 ± 1.5 mmHg (29.92 ± 0.06 in.Hg, 101.3 ± 0.2 kPa) absolute pressure.

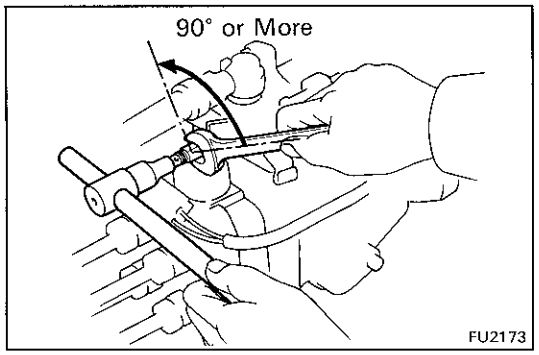
(c) (1HD-T (w/o BACS))
Apply 0.81 kg/cm^2 (11.5 psi, 79 kPa) of pressure to the boost compensator.

(d) (1HD-T (w/ BACS))
Apply 1.29 kg/cm^2 (18.3 psi, 127 kPa) of pressure to the boost compensator.

(e) (1HD-T (w/ PCS))
Apply vacuum to the PCS actuator.

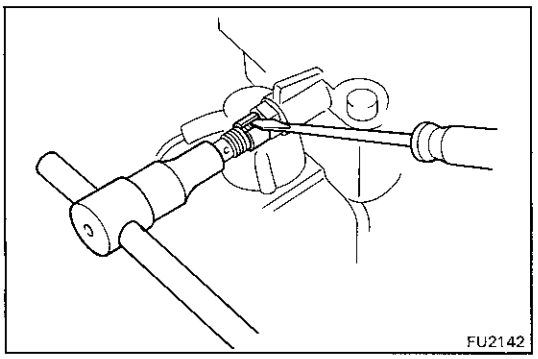
(f) Measure the injection volume.

Item	Pump rpm	No. of measuring strokes	Injection volume cc (cu in.)
1PZ	1,200	200	11.78 – 12.18 (0.72 – 0.74)
1HZ	1,200	200	11.80 – 12.20 (0.72 – 0.74)
1HD-T (w/o BACS)	1,800	200	13.58 – 14.18 (0.83 – 0.87)
1HD (w/ BACS)	1,800	200	13.14 – 13.74 (0.80 – 0.84)



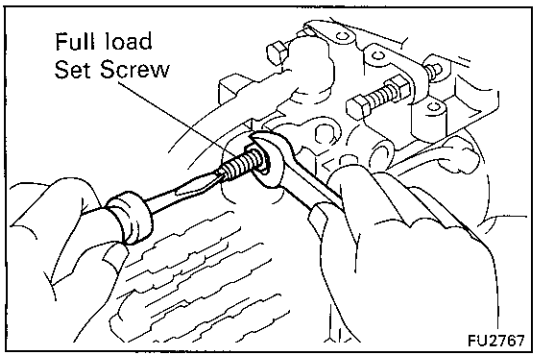
(g) Remove the collar seal as follows:

- Hold the full load set screw, and release the collar seal from the spot weld by turning the lock nut counterclockwise by 90° or more.



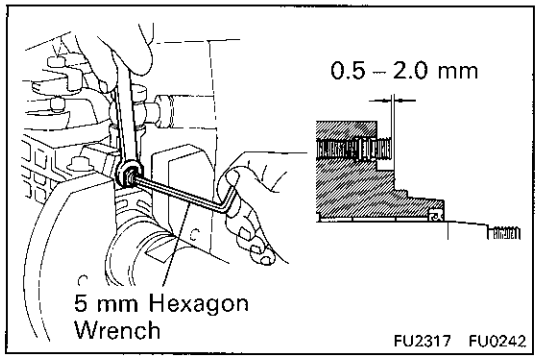
- Using a screwdriver, remove the collar seal.

(h) (w/ Wire Seal Type)
Cut off the wire seal.



(i) Adjust by turning the full load set screw.

HINT: The injection volume will increase about 3 cc (0.18 cu in.) with each 1/2 turn of the screw.



3. (w/o HIGH ALTITUDE) PRE-SETTING OF LOAD SENSING TIMER

Using a 5 mm hexagon wrench, adjust the protrusion of the governor shaft.

Protrusion: 0.5 – 2.0 mm (0.020 – 0.079 in.)

4. PRE-SET MAXIMUM SPEED

(a) Set the adjusting lever to maximum position.

(b) (1PZ (w/ HAC) and 1HZ (w/ HAC))
Apply 760 ± 1.5 mmHg (29.92 ± 0.06 in.Hg, 101.3 ± 0.2 kPa) absolute pressure.

(c) (1HD-T (w/o BACS))
Apply 0.81 kg/cm^2 (11.5 psi, 79 kPa) of pressure to the boost compensator.

(d) (1HD-T (w/ BACS))
Apply 1.29 kg/cm^2 (18.3 psi, 127 kPa) of pressure to the boost compensator.

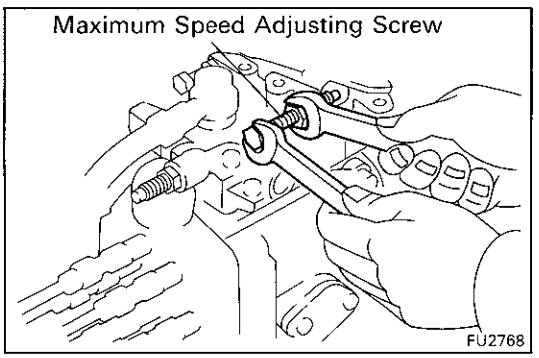
(e) (1HD-T (w/ PCS))
Apply vacuum to the PCS actuator.

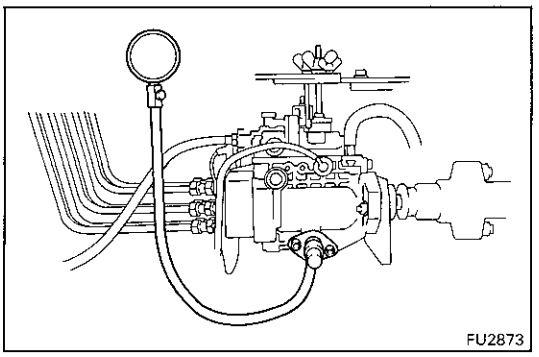
(f) Measure the injection volume.

Item	Pump rpm	No. of measuring strokes	Injection volume cc (cu in.)
1PZ	2,300	200	4.0 – 6.0 (0.24 – 0.37)
1HZ	2,300	200	3.0 – 5.0 (0.18 – 0.31)
1HD-T	2,200	200	3.0 – 5.0 (0.18 – 0.31)

(g) Cut off the seal wire.

(h) Adjust the injection volume with the maximum speed adjusting screw.

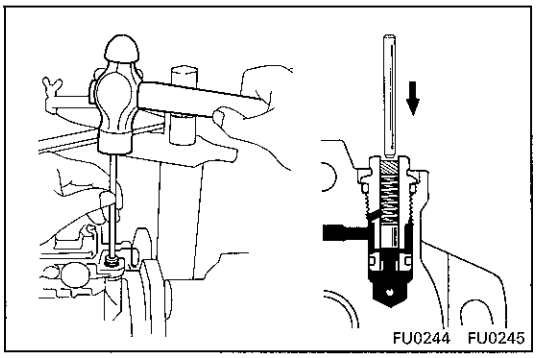




5. ADJUST PUMP INNER PRESSURE

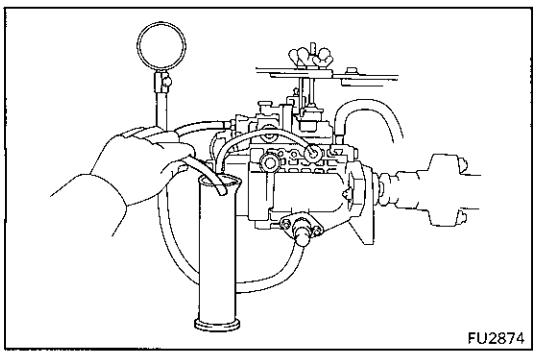
(a) Measure the pump inner pressure at the below listed rpm.

Item	Pump rpm	Inner pressure kg/cm² (psi, kPa)
1PZ	500	2.45 – 3.05 (35 – 43, 240 – 299)
	2,000	6.4 – 7.0 (91 – 100, 628 – 686)
1HZ	500	2.5 – 3.1 (36 – 44, 245 – 304)
	2,000	7.1 – 7.7 (101 – 110, 696 – 755)
1HD-T (w/o BACS)	400	2.2 – 3.1 (31 – 44, 216 – 304)
	1,900	8.1 – 8.4 (115 – 119, 794 – 824)
	2,200	9.0 (128, 883) or less
1HD-T (w/ BACS)	400	2.7 – 3.6 (38 – 51, 265 – 353)
	2,200	8.7 – 9.0 (124 – 128, 853 – 893)


FU0244 FU0245

(b) If the pressure is low, adjust by lightly tapping the regulator valve piston while watching the pressure gauge.

HINT: If the pressure is too high or if the regulator valve was tapped in too far, the regulator valve must be replaced.

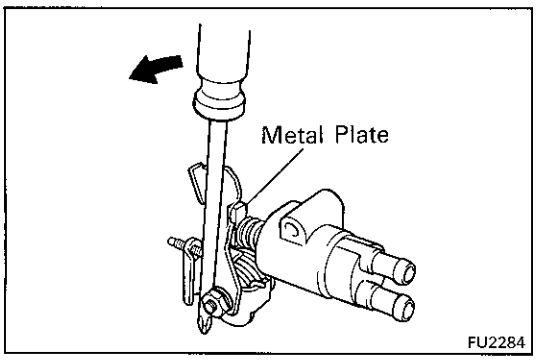

FU2874

6. CHECK OVERFLOW VOLUME

Measure the overflow volume at the below listed rpm.

Item	Pump rpm	Overflow volume cc/min. (cc in./min.)
1PZ and 1HZ	2,000	366 – 800 (22.3 – 48.8)
1HD-T	1,900	583 – 1,083 (35.6 – 66.1)

HINT: Always use the overflow screw installed on the pump to be adjusted.



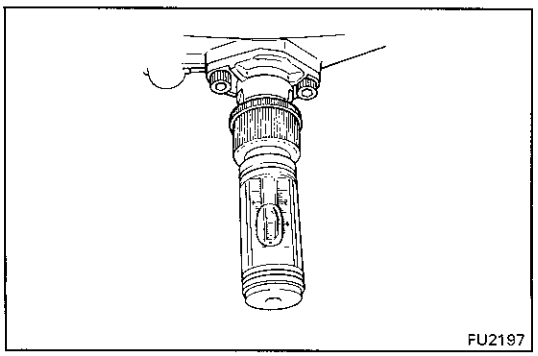
FU2284

7. (w/ ACSD) RELEASE COLD STARTING SYSTEM FOR NEXT INSPECTIONS

(a) Using a screwdriver, turn the cold starting lever counterclockwise approx. 20°.

(b) Put a metal plate (thickness of 3.5 – 7.5 mm (0.138 – 0.295 in.)) between the cold starting lever and thermo wax plunger.

HINT: Keep the cold starting system released until all measurements and adjustments are finished.


FU2197

8. ADJUST TIMER

(a) Set the timer measuring device at zero.

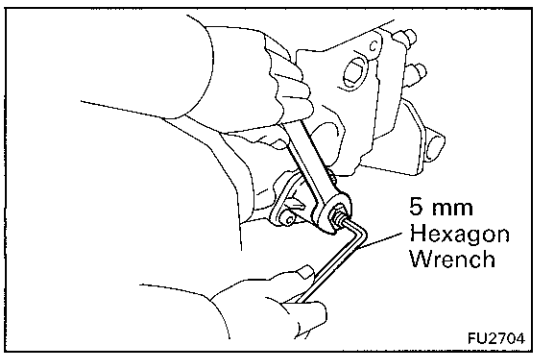
(b) Measure the timer piston stroke at the below listed rpms.

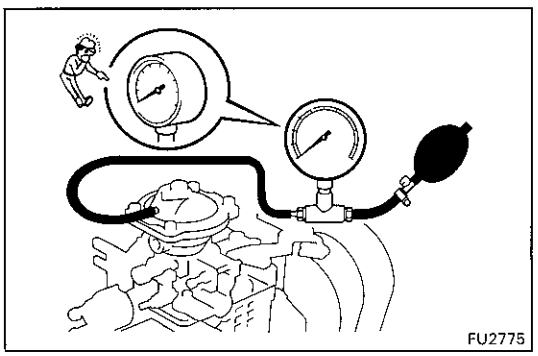
Item	Pump rpm	Timer piston stroke mm (in.)
1PZ	600	0.58 – 1.58 (0.0288 – 0.0622)
	1,200	3.02 – 4.02 (0.1189 – 0.1583)
	1,600	4.65 – 5.65 (0.1830 – 0.2224)
	2,000	6.28 – 7.28 (0.2472 – 0.2866)
	2,500	6.88 – 7.88 (0.2709 – 0.3102) (LST non-opeational)
1HZ	600	0.43 – 1.43 (0.0169 – 0.0563)
	1,200	3.23 – 4.23 (0.1272 – 0.1665)
	1,600	5.09 – 6.09 (0.2004 – 0.2398)
	2,000	6.88 – 7.88 (0.2709 – 0.3102)
	2,500	6.88 – 7.88 (0.2709 – 0.3102) (LST non-opeational)
1HD-T (Europe)	1,300	1.4 – 2.4 (0.055 – 0094)
	1,440	3.0 – 4.0 (0.118 – 0.157)
	1,700	5.9 – 6.9 (0.232 – 0.272)
	1,900	7.7 – 8.7 (0.303 – 0.343)
1HD-T (Others)	800	1.05 – 2.05 (0.0413 – 0.0807)
	1,400	4.9 – 5.9 (0.193 – 0.232)
	1,700	6.42 – 7.42 (0.2528 – 0.2921)
	1,900	7.7 – 8.7 (0.303 – 0.343)

HINT: Check that the hysteresis is within 0.3 mm (0.012 in.)

(c) Using a 5 mm hexagon wrench, adjust by the timer adjusting screw.

HINT: The stroke will decrease with turn to clockwise and increase with turn to counterclockwise.



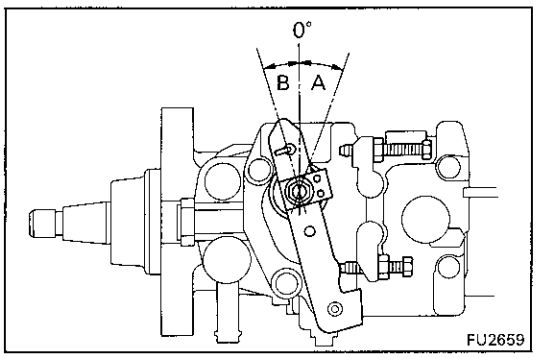


9. (1HD-T)
CHECK AIR TIGHTNESS OF BOOST COMPENSATOR

(a) Apply 1.00 kg/cm^2 (14.2 psi, 98 kPa) of pressure to the boost compensator.

(b) Measure the time it takes for the pressure to drop to 0.97 kg/cm^2 (13.8 psi, 95 kPa).

Pressure drop: 10 seconds or more



10. ADJUST FULL LOAD INJECTION VOLUME

(a) The adjusting lever angle for the adjustment below should be as shown in the illustration.

Adjusting lever angle	
A (Maximum speed side)	B (Idle speed side)
Plus 21 – 31°	Minus 12 – 22°

(b) (1PZ (w/ HAC) and 1HZ (w/ HAC))
Apply 760 ± 1.5 mmHg (29.92 ± 0.06 in.Hg, 101.3 ± 0.2 kPa) absolute pressure.

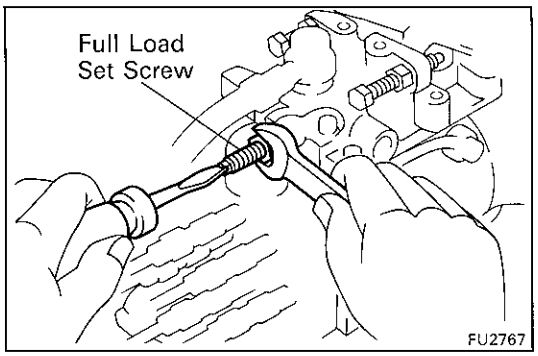
(c) (1HD-T (w/o BACS))
Apply 081 kg/cm^2 (11.5 psi, 79 kPa) of pressure to the boost compensator.

(d) (1HD-T (w/ BACS))
Apply 1.29 kg/cm^2 (18.3 psi, 127 kPa) of pressure to the boost compensator.

(e) (1HD-T (w/ PCS))
Apply vacuum to the PCS actuator.

(f) Measure the full load injection volume.

Item	Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume cc (cc in.)
1PZ	Plus 21 – 31°	1,200	200	11.78 – 12.18 (0.72 – 0.74)
1HZ	Plus 21 – 31°	1,200	200	11.80 – 12.20 (0.72 – 0.74)
1HD-T (w/o BACS)	Plus 21 – 31°	1,100	200	13.58 – 14.18 (0.83 – 0.87)
1HD-T (w/ BACS)	Plus 21 – 31°	1,100	200	13.14 – 13.74 (0.80 – 1.84)



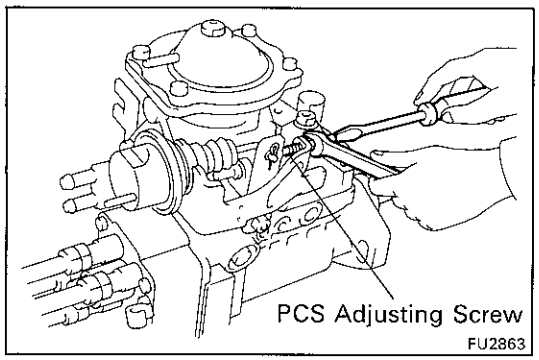
(g) Adjust by turning the full load set screw.

HINT: The injection volume will increase about 3 cc (0.18 cu in.) with each 1/2 turn of the screw.

(h) (1HD-T (w/ PCS))
Release the vacuum to the PCS actuator.

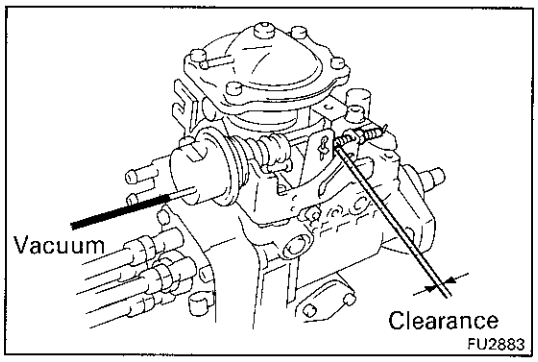
(i) (1HD-T (w/ PCS))
Measure the injection volume.

Pump rpm	No. of measuring strokes	Injection volume cc (cu in.)
1,100	200	11.0 – 12.2 (0.67 – 0.74)



(j) (1HD-T (w/ PCS))
Adjust by turning the PCS adjusting screw.

HINT: By screwing in the adjusting screw, the injection volume is increased; unscrewing the adjusting screw decreases the injection volume.



(k) (1HD-T (w/ PCS))
Apply vacuum to the PCS actuator and check that the clearance between No.1 PCS lever and adjusting screw at least 3 mm (0.12 in.).

11. ADJUST MAXIMUM SPEED

(a) (1PZ (w/ HAC) and 1HZ (w/ HAC))
Apply 760 ± 1.5 mmHg (29.92 ± 0.06 in.Hg, 101.3 ± 0.2 kPa) absolute pressure.

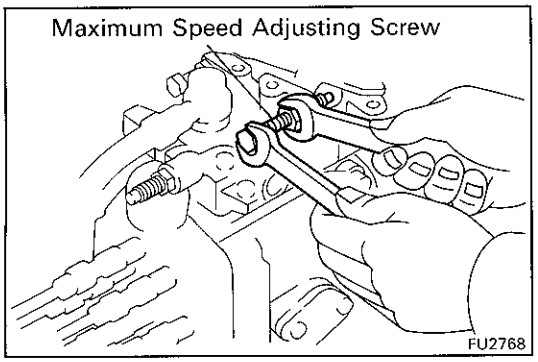
(b) (1HD-T (w/o BACS))
Apply 0.81 kg/cm^2 (11.5 psi, 79 kPa) of pressure to the boost compensator.

(c) (1HD-T (w/ BACS))
Apply 1.29 kg/cm^2 (18.3 psi, 127 kPa) of pressure to the boost compensator.

(d) (1HD-T (w/ PCS))
Apply vacuum to the PCS actuator.

(e) Measure the injection volume at each pump rpm.

Item	Adjusting lever angle	pump rmp	No. of measuring strokes	Injection volume cc (cu in.)	Remarks
1PZ	Plus 21 – 31°	2,300	200	4.0 – 6.0 (0.24 – 0.37)	Adjust
		2,500		1.0 (0.06) or less	–
1HZ	Plus 21 – 31°	2,300	200	3.0 – 5.0 (0.18 – 0.31)	Adjust
		2,550		1.0 (0.06) or less	–
1HD-T	Plus 21 – 31°	2,200	200	3.0 – 5.0 (0.18 – 0.31)	Adjust
		2,350		1.0 (0.06) or less	–



(f) Adjust by turning the maximum speed adjusting screw.

12. CHECK INJECTION VOLUME

(a) (1PZ (w/ HAC) and 1HZ (w/ HAC))
Apply 760 ± 1.5 mmHg (29.92 ± 0.06 in.Hg, 101.3 ± 0.2 kPa) absolute pressure.

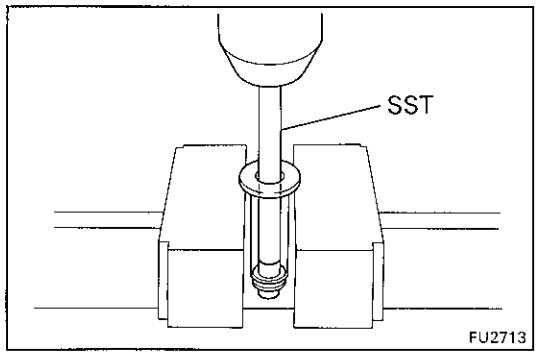
(b) (1PZ and 1HZ)
Measure the injection volume at each pump rpm.

Item	Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume cc (cu in.)	Variation limit cc (cu in.)	Remarks
1PZ	Plus 21 – 31°	1,200	200	11.78 – 12.18 (0.72 – 0.74)	0.4 (0.02)	Basic full-load injection volume
		100		9.60 – 14.40 (0.59 – 0.88)	1.2 (0.07)	Volume during starting
		500		10.56 – 11.76 (0.64 – 0.72)	0.6 (0.04)	–
		2,000		11.62 – 12.82 (0.71 – 0.78)	0.6 (0.04)	–
1HZ	Plus 21 – 31°	1,200	200	11.80 – 12.20 (0.72 – 0.74)	0.4 (0.03)	Basic full-load injection volume
		100		9.60 – 14.40 (0.59 – 0.88)	1.2 (0.07)	Volume during starting
		500		9.74 – 10.94 (0.59 – 0.67)	0.6 (0.04)	–
		2,000		10.96 – 12.16 (0.67 – 0.74)	0.6 (0.04)	–

(c) (1HD-T (w/ PCS))
Apply vacuum to the PCS actuator.

(d) (1HD-T)
Measure the injection volume at each pump rpm and boost pressure.

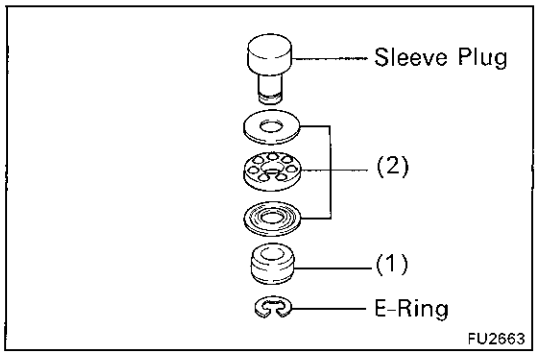
Item	Adjusting lever angle	Pump rpm	Boost pressure kg/cm^2 (psi, kPa)	No. of measuring strokes	Injection volume cc (cu in.)	Variation limit cc (cu in.)	Remarks
1HD-T (Europe)	Plus 21 – 31°	1,100	0.81 (11.5, 79)	200	13.52 – 14.72 (0.83 – 0.90)	0.6 (0.04)	Basic full-load injection volume
		100	0 (0, 0)		11.60 – 16.40 (0.71 – 1.00)	1.2 (0.07)	Volume during starting
		500	0 (0, 0)		8.32 – 9.12 (0.51 – 0.56)	0.6 (0.04)	–
		1,800	0.81 (11.5, 79)		13.58 – 14.18 (0.83 – 0.87)	1.2 (0.07)	–
1HD-T (Others) (w/o BACS)	Plus 21 – 31°	1,100	0.81 (11.5, 79)	200	11.70 – 12.90 (0.71 – 0.79)	0.6 (0.04)	Basic full-load injection volume
		100	0 (0, 0)		11.60 – 16.40 (0.71 – 1.00)	1.2 (0.07)	Volume during starting
		500	0 (0, 0)		8.68 – 9.48 (0.53 – 0.58)	0.6 (0.04)	–
		1,800	0.81 (11.5, 79)		13.58 – 14.18 (0.83 – 0.87)	1.2 (0.07)	–
1HD-T (Others) (w/ BACS)	Plus 21 – 31°	1,100	1.29 (18.3, 127)	200	11.70 – 12.90 (0.71 – 0.79)	0.6 (0.04)	Basic full-load injection volume
		100	0.50 (7.1, 49)		11.60 – 16.40 (0.71 – 1.00)	1.2 (0.07)	Volume during starting
		500	0.50 (7.1, 49)		8.20 – 9.20 (0.50 – 0.56)	0.6 (0.04)	–
		1,800	1.29 (18.3, 127)		13.14 – 14.74 (0.80 – 0.84)	1.2 (0.07)	–



If the injection volume at 100 rpm is not as specified, replace the governor sleeve plug as follows:

- Using SST and a press, press out the sleeve plug assembly from the governor sleeve.

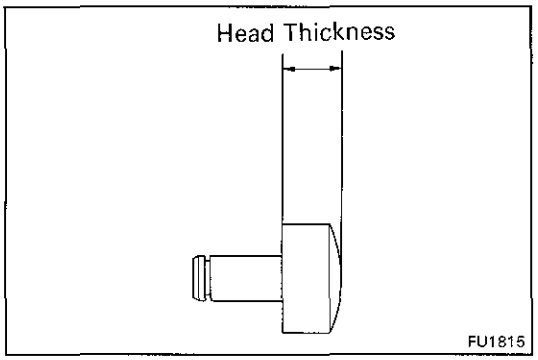
SST 09236-00101 (09237-00070)



- Remove the E-ring and following parts from the sleeve plug:

(1) Stop ring

(2) Bearing and two bearing retainers

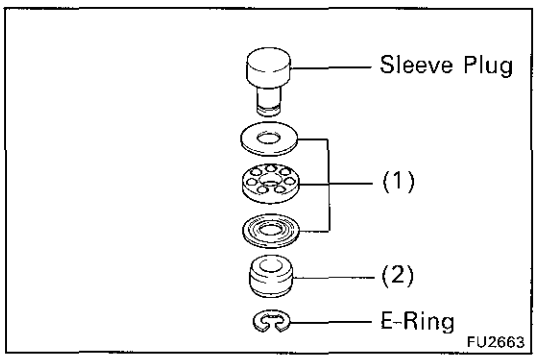


- Measure the head thickness of the sleeve plug, and select a new sleeve plug.

Sleeve plug head thichness for 1PZ and 1HZ mm (in.)		
3.0 (0.118)	3.5 (0.138)	4.0 (0.158)
3.1 (0.122)	3.6 (0.142)	4.1 (0.161)
3.2 (0.126)	3.7 (0.146)	4.2 (0.165)
3.3 (0.130)	3.8 (0.150)	
3.4 (0.134)	3.9 (0.154)	

Sleeve plug head thichness for 1HD-T mm (in.)		
3.0 (0.118)	4.3 (0.169)	5.6 (0.220)
3.1 (0.122)	4.4 (0.173)	5.7 (0.224)
3.2 (0.126)	4.5 (0.177)	5.8 (0.228)
3.3 (0.130)	4.6 (0.181)	5.9 (0.232)
3.4 (0.134)	4.7 (0.185)	6.0 (0.236)
3.5 (0.138)	4.8 (0.189)	6.1 (0.240)
3.6 (0.142)	4.9 (0.193)	6.2 (0.244)
3.7 (0.146)	5.0 (0.197)	6.3 (0.248)
3.8 (0.150)	5.1 (0.201)	6.4 (0.252)
3.9 (0.154)	5.2 (0.205)	6.5 (0.256)
4.0 (0.158)	5.3 (0.209)	6.6 (0.260)
4.1 (0.161)	5.4 (0.213)	
4.2 (0.165)	5.5 (0.216)	

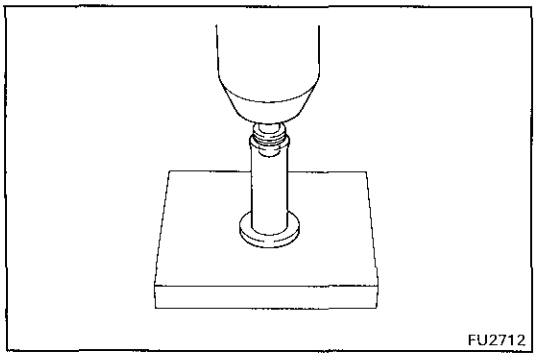
HINT: Lengthening the plug 0.1 mm (0.004 in.) will decrease injection volume by 0.6 cc (0.04 cu in.).



- Install the following parts to the new sleeve plug with a new E-ring:

(1) Bearing and two retainers

(2) Stop ring



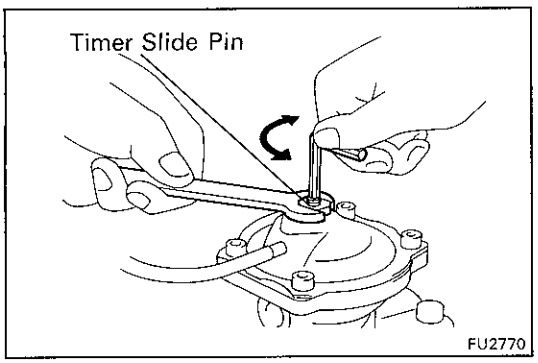
- Using a press, press in the sleeve plug assembly to the governor sleeve.

13. (1HD-T)
ADJUST FULL LOAD MINIMUM INJECTION VOLUME

(a) Measure the injection volume.

Item	Pump rpm	No. of measuring strokes	Injection volume cc (cu in.)
Europe	500	200	8.32 – 9.12 (0.51 – 0.56)
Others (w/o BACS)	500	200	8.68 – 9.48 (0.53 – 0.58)
Others (w/ BACS)	500	200	7.54 – 8.34 (0.46 – 0.51)

(b) Using a hexagon wrench, adjust the timer slide pin.

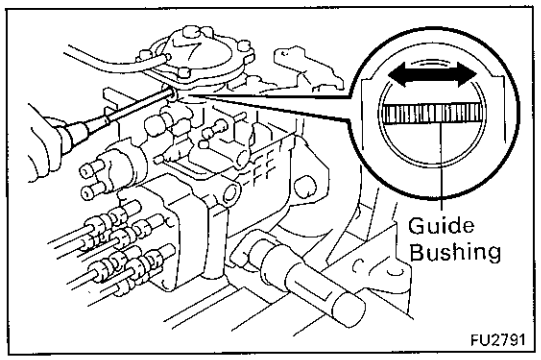


14. (1HD-T)
ADJUST BOOST COMPENSATOR CHARACTERISTIC

(a) Apply pressure to the boost compensator.

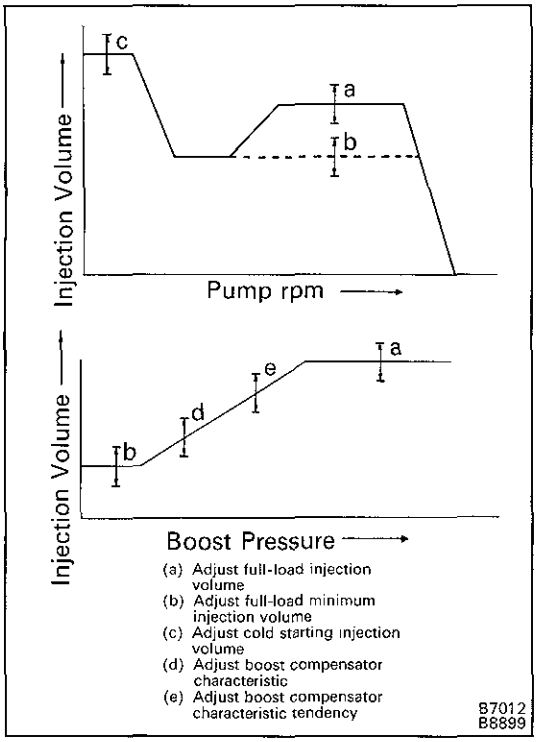
(b) Measure the injection volume bushing.

Item	Pump rpm	Boost pressure kg/cm^2 (psi, kPa)	No. of measuring strokes	Injection volume cc (cu in.)
Europe	1,100	0.48 (6.8, 47)	200	12.44 – 13.44 (0.76 – 0.82)
Others (w/o BACS)	1,100	0.54 (7.7, 53)	200	10.86 – 11.86 (0.66 – 0.72)
Others (w/ BACS)	500	0.50 (7.1, 49)	200	8.20 – 9.20 (0.50 – 0.56)



(c) Using a screwdriver, adjust the guide bushing.

HINT: When the guide bushing is turned clockwise, as seen from above, the injection volume will increase.



15. (1HD-T)
INSPECT BOOST COMPENSATOR CHARACTERISTIC TENDENCY

(a) Apply pressure to the boost compensator.

(b) Measure injection volume.

Item	Pump rpm	Boost pressure kg/cm^2 (psi, kPa)	No. of measuring strokes	Injection volume cc (cu in.)
Europe	1,100	0.27 (3.8, 26)	200	10.50 – 11.70 (0.64 – 0.71)
Others (w/o BACS)	1,100	0.41 (5.8, 40)	200	9.48 – 10.68 (0.58 – 0.65)
Others (w/ BACS)	500	0.81 (11.5, 79)	200	9.80 – 11.00 (0.60 – 0.67)

16. (1HD-T)
CHECK HYSTERESIS

(w/o BACS)

Compare the injection volume when the boost compensator pressure is lowered from 0.81 kg/cm^2 (11.5 psi, 79 kPa) to 0 kg/cm^2 (0 psi, 0 kPa) and, conversely, when it is raised from zero.

(w/ BACS)

Compare the injection volume when the boost compensator pressure is lowered from 1.25 kg/cm^2 (18.3 psi, 127 kPa) to 0 kg/cm^2 (0 psi, 0 kPa) and, conversely, when it is raised from zero.

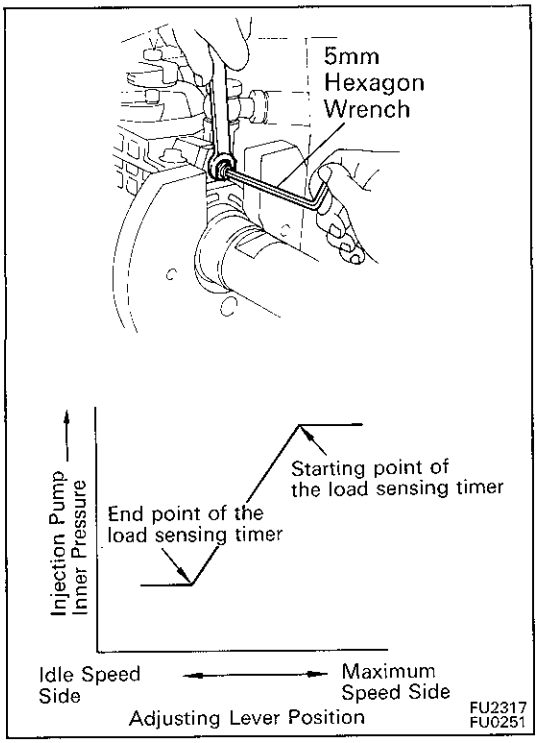
HINT: Make measurements after moving the adjusting lever between idle and maximum three times for each lowering of the pressure.

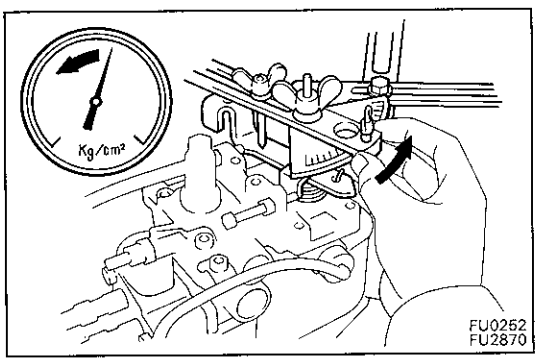
Item	Pump rpm	Boost pressure kg/cm^2 (psi, kPa)	No. of measuring strokes	Injection volume cc (cu in.)	Hysteresis cc (cu in.)
Europe	1,100	0.81 (11.5, 79)	200	13.52 – 14.72 (0.82 – 0.90)	–
	1,100	0.48 (6.8, 47)	200	12.44 – 13.44 (0.76 – 0.82)	–
	1,100	0.27 (3.8, 26)	200	10.50 – 11.70 (0.64 – 0.71)	0.3 (0.02) or less
	1,100	0 (0, 0)	200	9.70 – 11.10 (0.59 – 0.68)	–
Others (w/o BACS)	1,100	0.81 (11.5, 79)	200	11.70 – 12.90 (0.71 – 0.79)	–
	1,100	0.54 (7.7, 53)	200	10.86 – 11.86 (0.66 – 0.72)	–
	1,100	0.41 (5.8, 40)	200	9.48 – 10.68 (0.58 – 0.65)	0.3 (0.02) or less
	1,100	0 (0, 0)	200	8.62 – 10.02 (0.53 – 0.61)	–

Cont'd

Item	Pump rpm	Boost pressure kg/cm² (psi, kPa)	No. of measuring strokes	Injection volume cc (cu in.)	Hysteresis cc (cu in.)
Others (w/ BACS)	1,100	1.29 (18.3, 127)	200	11.70 – 12.90 (0.71 – 0.79)	–
	500	0.81 (11.5, 79)	200	9.80 – 11.00 (0.60 – 0.67)	0.3 (0.02) or less
	500	0.50 (7.1, 49)	200	8.20 – 9.20 (0.50 – 0.56)	–
	500	0 (0, 0)	200	7.54 – 8.34 (0.46 – 0.51)	–

If not within standard value, check each sliding part of the boost compensator and check whether or not there is any oil.





17. (w/o HIGH ALTITUDE)
ADJUST LOAD SENSING TIMER

(a) Using a 5 mm hexagon wrench, adjust the starting and end points of the load sensing timer by turning the governor shaft.

(b) (1PZ (w/ HAC) and 1HZ (w/ HAC))
Apply 760 ± 1.5 mmHg (29.92 ± 0.06 in.Hg, 101.3 ± 0.2 kPa) absolute pressure.

(c) (1HD-T (w/o BACS))
Apply 0.81 kg/cm² (11.5 psi, 79 kPa) of pressure to the boost compensator.

(d) (1HD-T (w/ BACS))
Apply 1.29 kg/cm² (18.3 psi, 127 kPa) of pressure to the boost compensator.

(e) (1HD-T (w/ PCS))
Apply vacuum to the PCS actuator.

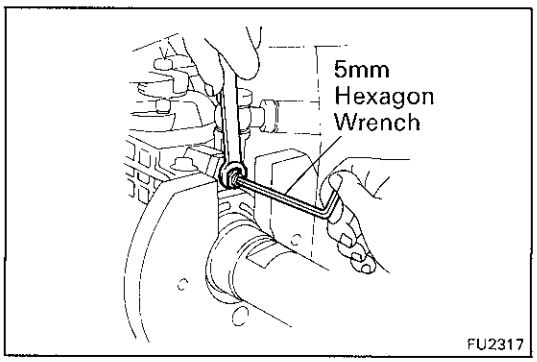
(f) Measure the injection volume.

Item	Adjusting lever position	Pump rpm	No. of measuring strokes
1PZ, 1HZ	Maximum speed side	1,600	200
1HD-T		1,800	

(g) Slowly move the adjusting lever from the maximum speed side to the idle speed side, and secure it at the point where the pump inner pressure begins to drop.

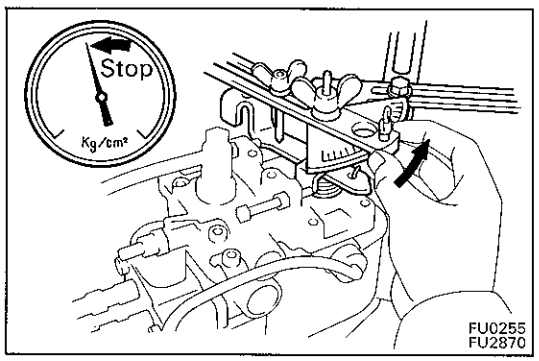
(h) Measure the injection volume at the drop point (starting point).

Item	Pump rpm	No. of measuring strokes	Injection volume cc (cu in.)
1PZ	1,600	200	Measured value at step (f) minus 1.4 (0.09) ± 0.3 (0.02)
1HZ	1,600	200	Measured value at step (f) minus 1.4 (0.09) ± 0.3 (0.02)
1HD-T (Europe)	1,800	200	Measured value at step (f) minus 1.6 (0.10) ± 0.6 (0.04)
1HD-T (Others)	1,800	200	Measured value at step (f) minus 1.2 (0.07) ± 0.2 (0.01)



(i) Using a 5 mm hexagon wrench, adjust by turning the governor shaft, and perform the measurement again it is as specified.

HINT: The injection volume will increase approx. 3 cc (0.2 cu in.) with each 1/2 turn of the governor shaft.



(j) (1PZ and 1HZ)
Check the end point injection volume by slowly moving the adjusting lever from the maximum speed side to the idle speed side, and secure it at the point where the pump inner pressure stops dropping.

Item	Pump rpm	No. of measuring strokes	Injection volume cc (cu in.)
1PZ	1,600	200	9.08 – 9.88 (0.55 – 0.60)
1HZ	1,600	200	8.2 (0.50) or more

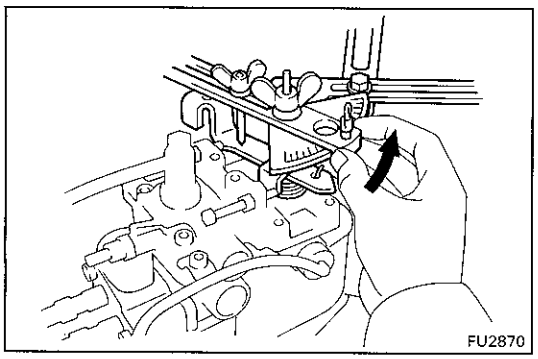
(k) (1HD-T (Europe))
Check the timer piston stroke when the the pump rpm is 1,440 rpm and injection volume is 8.4 – 9.2 cc (0.51 – 0.56 cu in.).

Timer piston stroke: 2.0 mm (0.079 in.) or less

(l) (1HD-T (Others))
Check the injection volume when the pump rpm is 1,440 rpm and timer piston stroke is 3.7 – 4.3 mm (0.146 – 0.169 in.).

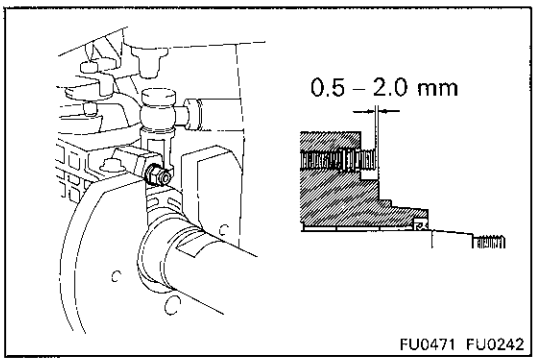
Injection volume: 6 cc (0.37 cu in.)

HINT: The end point for 1HD-T engine is hard to identify, so use the methods used in (k) or (l) above.



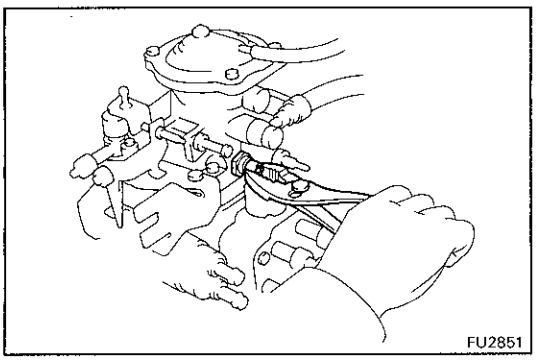
(m) Check the timer piston fluctuation when the adjusting lever is moved from the maximum speed side to the idle speed side.

Item	Pump rpm	Timer piston fluctuation mm (in.)
1PZ	1,600	2.19 – 3.19 (0.0862 – 0.1256)
1HZ	1,600	2.73 – 3.73 (0.1075 – 0.1469)
1HD-T (Europe)	1,440	0.70 – 1.70 (0.0276 – 0,0669)
1HD-T (Others)	1,440	1.96 – 2.96 (0.0772 – 0.1165)



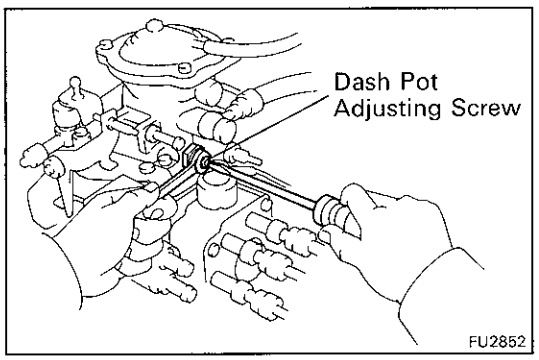
(n) Check the protrusion of the governor shaft.

Protrusion: 0.5 – 2.0 mm (0.020 – 0.079 in.)



18. ADJUST IDLE SPEED

(a) (w/ Dash Pot)
Using pliers, remove the dash pot cover.



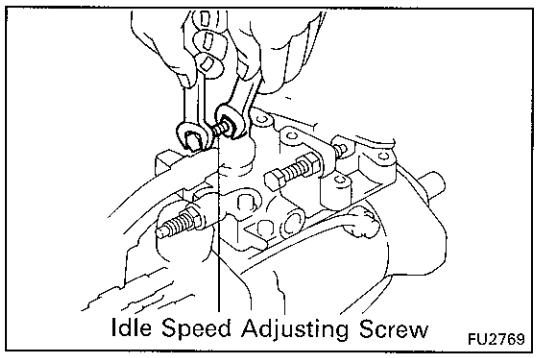
(b) (w/ Dash Pot)
Fully loosen the dash pot adjusting screw.

(c) Measure the injection volume for each pump rpm.

Item	Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume cc (cu in.)	Variation limit cc (cu in.)	Remarks
1PZ	Minus 12 – 22°	325	200	q = 2.94 ~ 3.94 (0.18 ~ 0.24)	0.4 (0.02)	Adjust
		300		More than q Plus 0.5 (0.03)	–	–
		400		q Minus 1.2 ~ 2.2 (0.07 ~ 0.13)	–	
1HZ (M/T)	Minus 12 – 22°	375	200	q = 2.3 ~ 3.3 (0.14 ~ 0.20)	0.4 (0.02)	Pre-set
		350		More than q Plus 0.5 (0.03)	–	–
		450		q Minus 1.2 ~ 2.2 (0.07 ~ 0.13)	–	
		325		2.60 ~ 3.60 (0.16 ~ 0.22)	0.4 (0.02)	Adjust
1HZ (A/T)	Minus 12 – 22°	375	200	q = 2.3 ~ 3.3 (0.14 ~ 0.20)	0.4 (0.02)	Pre-set
		350		More than q Plus 0.5 (0.03)	–	–
		450		q Minus 1.2 ~ 2.2 (0.07 ~ 0.13)	–	
		375		1.64 ~ 2.64 (0.10 ~ 0.16)	0.4 (0.02)	Adjust

Cont'd

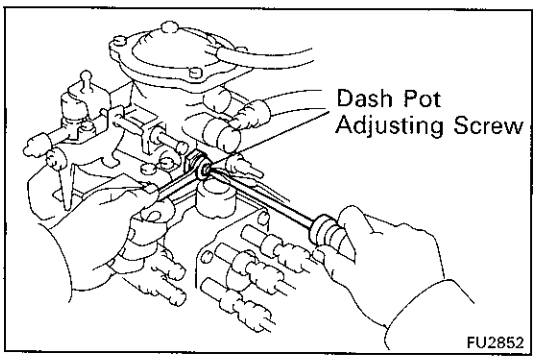
Item	Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume cc (cu in.)	Variation limit cc (cu in.)	Remarks
1HD-T (Europe M/T)	Full position	400	200	9.32 ~ 11.72 (0.57 ~ 0.72)	–	–
	Minus 12 – 22°	325		q = 3.70 ~ 4.70 (0.23 ~ 0.29)	0.4 (0.02)	Adjust
		300		More than q Plus 0.5 (0.03)	–	–
1HD-T (Europe A/T)	Full position	400	200	10.30 ~ 12.70 (0.69 ~ 0.77)	–	–
	Minus 12 – 22°	325		q = 2.84 ~ 3.84 (0.17 ~ 0.23)	0.4 (0.02)	Adjust
		300		More than q Plus 0.5 (0.03)	–	–
1HD-T (Others M/T)	Full position	400	200	9.20 ~ 11.60 (0.56 ~ 0.71)	–	–
	Minus 12 – 22°	325		q = 3.70 ~ 4.70 (0.23 ~ 0.29)	0.4 (0.02)	Adjust
		300		More than q Plus 0.5 (0.03)	–	–
1HD-T (Others A/T)	Full position	400	200	10.18 ~ 12.58 (0.62 ~ 0.77)	–	–
	Minus 12 – 22°	325		q = 2.84 ~ 3.84 (0.17 ~ 0.23)	0.4 (0.02)	Adjust
		300		More than q Plus 0.5 (0.03)	–	–



(d) Adjust by turning the idle speed adjusting screw.

(e) (w/ Dash Pot)
Set the adjusting lever to the angle for the injection volume shown below.

Item	Pump rpm	No. of measuring strokes	Injection volume cc (cu in.)
1HZ	700	200	q = 0.5 ~ 0.9 (0.03 ~ 0.05)
1HD-T	400	200	q = 0.1 ~ 0.3 (0.01 ~ 0.02)

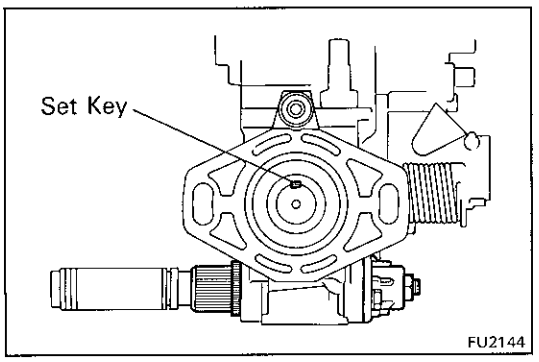


(f) (w/ Dash Pot)
Adjust the injection volume with the dash pot adjusting screw.

HINT: The stroke will decrease with turn to clockwise and increase with turn to counterclockwise.

Item	Pump rpm	No. of measuring strokes	Injection volume cc (cu in.)
1HZ	700	200	q Plus 0.2 ~ 0.3 (0.01 ~ 0.02)
1HD-T	400	200	q Plus 0.1 ~ 0.3 (0.01 ~ 0.02)

(g) (w/ Dash Pot)
Install the dash pot cover.



19. (w/ ACSD)
ADJUST COLD STARTING SYSTEM

(a) Remove the overflow screw and check the fuel temperature in the fuel pump.

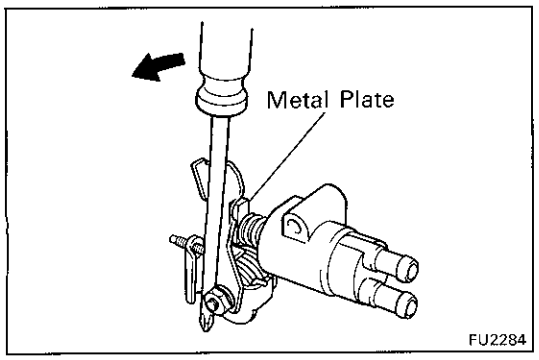
Fuel temperature: 15 – 35°C (59 – 95 °F)

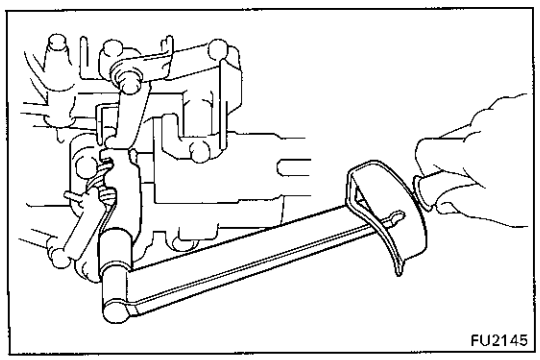
(b) Set the set key of the pump drive shaft in a vertical or horizontal position.

(c) Set the scale of the timer measuring device to zero.

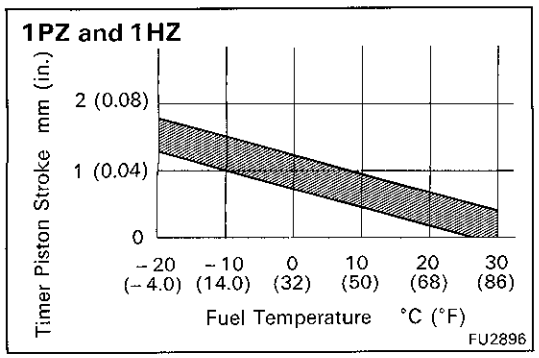
(d) Check the adjusting lever opening angle and consider this angle as zero.

(e) Remove the metal plate between the cold starting lever and thermo wax plunger.

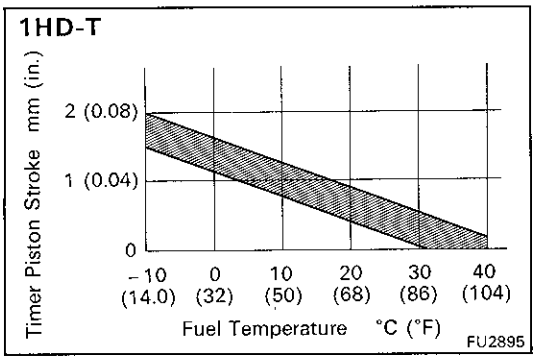


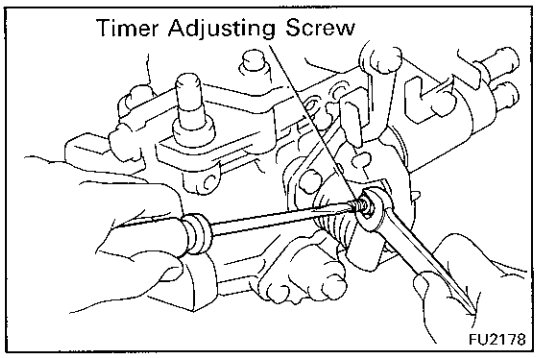


(f) Torque the cold starting lever clockwise to approx. 50 kg-cm (43 in.-lb, 4.9 N·m) and keep the lever tightened for about 10 seconds. Then release the torque.



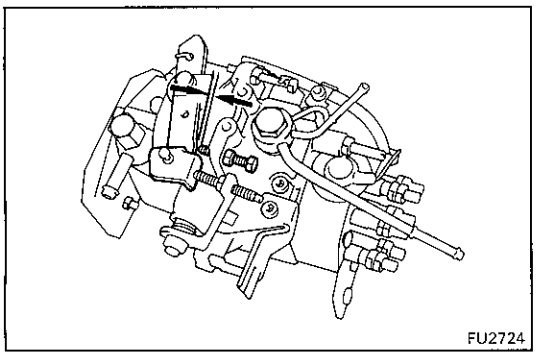
(g) Measure the timer piston stroke.





(h) Adjust by turning the timer adjusting screw.

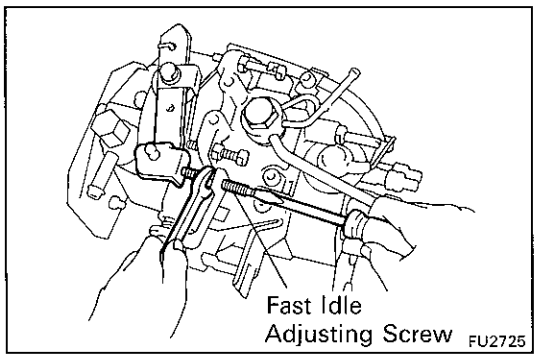
HINT: Screw in for stroke decrease.



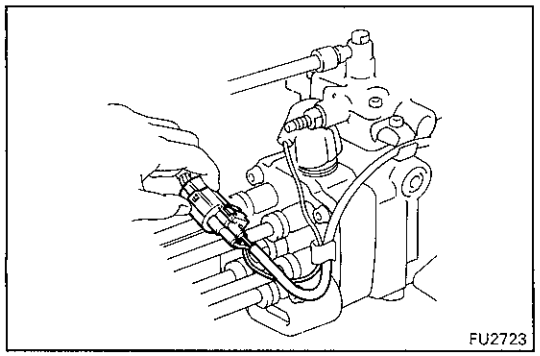
20. (w/ ACSD)
ADJUST FAST IDLE

(a) Measure the clearance between the adjusting lever and idle speed adjusting screw.

Item	Fuel temperature	Clearance
1PZ and 1HZ	15°C (59°F)	1.3 mm (0.051 in.)
	30°C (86°F)	0 mm (0 in.)
1HD-T	15°C (59°F)	1.6 mm (0.063 in.)
	40°C (104°F)	0 mm (0 in.)



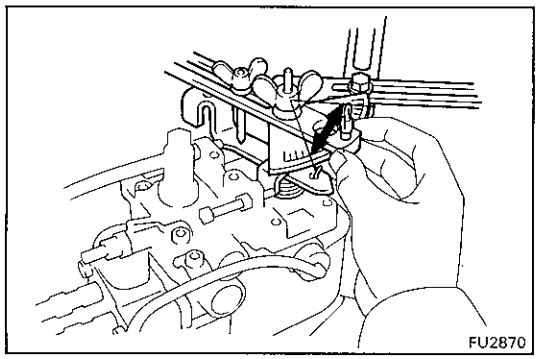
(b) Adjust by turning the fast idle adjusting screw.



21. POST ADJUSTMENT CHECK

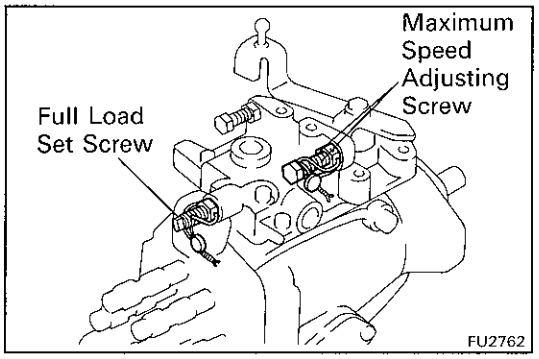
(a) Check that injection stops when the fuel cut solenoid harness is removed.

Pump revolution: 100 rpm



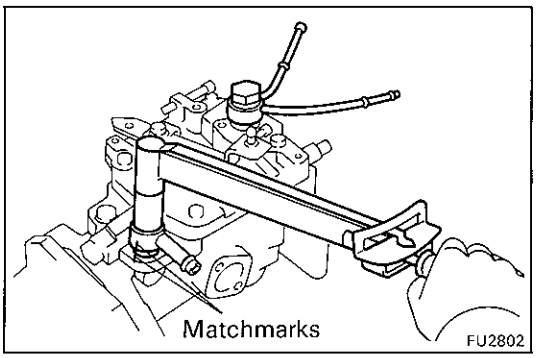
(b) Check the adjusting lever movement.

Adjusting lever angle: 38 – 48°



22. SEAL PARTS

Seal the maximum speed adjusting screw and full load set screws with new lead seals.

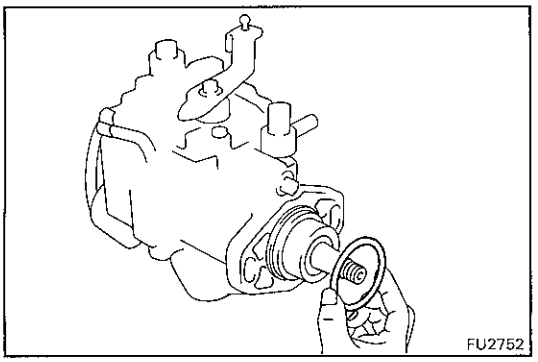


23. INSTALL TWO FUEL PIPES

Torque:

Inlet	**250 kg-cm (18 ft-lb, 25 N·m)**
Outlet	**225 kg-cm (16 ft-lb, 22 N·m)**

24. INSTALL INJECTION PUMP STAY



INSTALLATION OF INJECTION PUMP

(See page FU-27)

1. INSTALL INJECTION PUMP

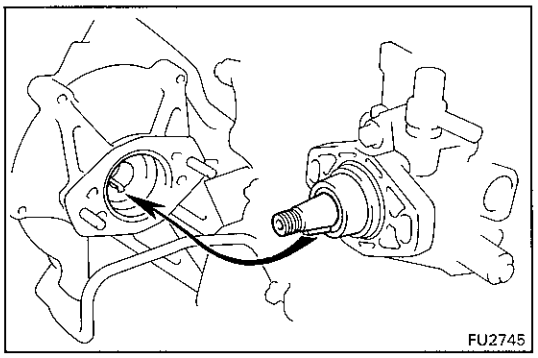
NOTICE: Do not put the injection pump (with HAC, or for the 1HD-T) at an angle more than 45° from the horizontal.

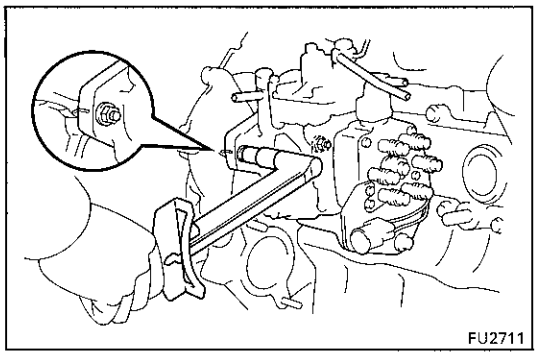
(a) (1PZ and 1HZ (M/T for Europe))
Place the cylinder block insulator in position.

(b) Install a new O-ring to the pump.

(c) Apply a light coat of engine oil on the O-ring.

(d) Align the set key on the drive shaft and groove of the injection pump drive gear.

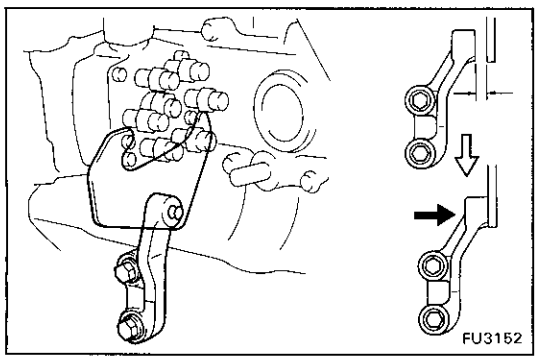




(e) Align the period lines (or matchmarks) of the injection pump and timing belt case.

(f) Install the two nuts holding the injection pump to the timing gear case.

Torque: 185 kg-cm (13 ft-lb, 18 N·m)

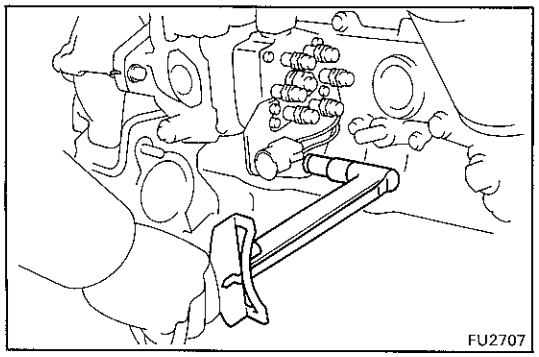


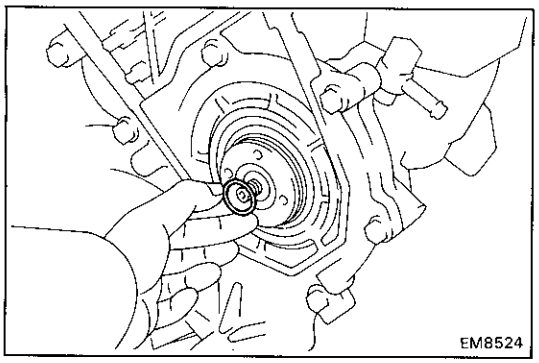
(g) Install the pump stay mount bolt.

Torque: 700 kg-cm (51 ft-lb, 69 N·m)

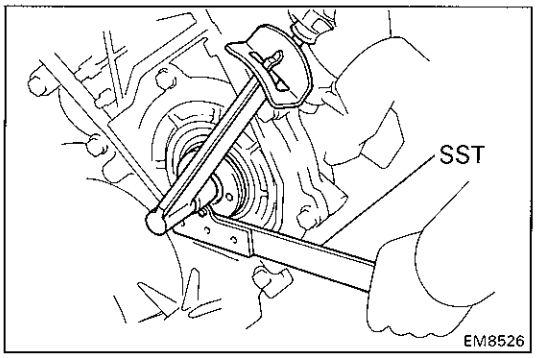
NOTICE: Before tightening to the standard torque, check whether the pumpstay is up against the pump braket.

If there is a gap, loosen the bolts joining the pump stay to the cylinder block and set the pump stay against the pump bracket.





(h) Install a new O-ring to the injection pump drive gear.



(i) Install the injection pump drive gear set nut.

(j) Using SST, torque the nut.

SST 09330-00021

Torque: 1,000 kg-cm (72 ft-lb, 98 N·m)

2. **CHECK INJECTION TIMING (See page EM-24)**

3. **INSTALL INJECTION PIPES**
   (See step 3 on page FU-15)

   Torque:
   1PZ and 1HZ 150 kg-cm (11 ft-lb, 15 N·m)
   1HD-T 250 kg-cm (18 ft-lb, 25 N·m)

4. **(w/ BACS)**
   CONNECT BACS VACUUM HOSE

5. **(w/ PCS)**
   CONNECT PCS VACUUM HOSE

6. **(1HD-T)**
   CONNECT BOOST COMPENSATOR HOSE

7. **CONNECT FUEL HOSES TO INJECTION PUMP**

8. **CONNECT INJECTION PUMP CONNECTOR**

9. **(w/ ACSD)**
   CONNECT WATER BY-PASS HOSES TO THERMO WAX

10. **(w/ A/C)**
    CONNECT A/C IDLE-UP VACUUM HOSE

11. **(A/T)**
    CONNECT THROTTLE CABLE

12. **CONNECT ACCELERATOR CONNECTING ROD**

13. **INSTALL NO.2 CAMSHAFT TIMING PULLEY**
    (See step 4 on page EM-39)

14. **INSTALL TIMING BELT**
    (See steps 6 to 9 on pages EM-39 to 41)