

FUEL SYSTEM

	Page
REPLACEMENT OF FUEL FILTER	FU-2
FUEL FILTER WARNING SWITCH	FU-3
FUEL HEATER	FU-5
INJECTION NOZZLES	FU-7
INJECTION PUMP	FU-13

FU

FU-2

FUEL SYSTEM — Replacement of Fuel Filter

REPLACEMENT OF FUEL FILTER**Standard type****1. REPLACE FUEL FILTER**

(a) Using SST, remove the fuel filter and O-ring.

SST 09228-34010

(b) Install a new fuel filter with a new O-ring.

- Put a light coat of fuel on the O-ring.

- Lightly screw in the fuel filter to where you feel resistance.

- Using SST, tighten the fuel filter an extra 3/4 turn.

SST 09228-34010

2. FILL FUEL FILTER WITH FUEL

(a) Turn the hand pump counterclockwise to free it.

(b) Operate the hand pump until you feel more resistance.

(c) Turn the hand pump clockwise and tighten it.

3. START ENGINE AND CHECK FOR FUEL LEAKS**w/ Sedimenter Type****1. REMOVE FUEL FILTER WARNING SWITCH**
(See steps 1 to 3 on page FU-4)**2. REPLACE FUEL FILTER**

(a) Using SST, remove the fuel filter and O-ring.

SST 09228-64010

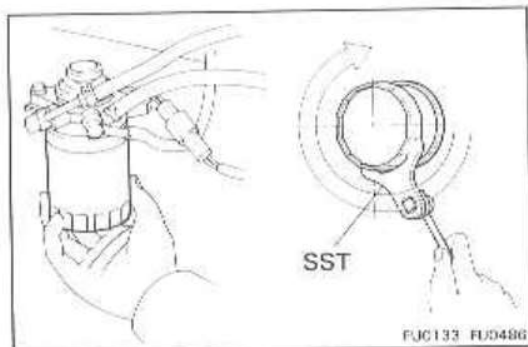
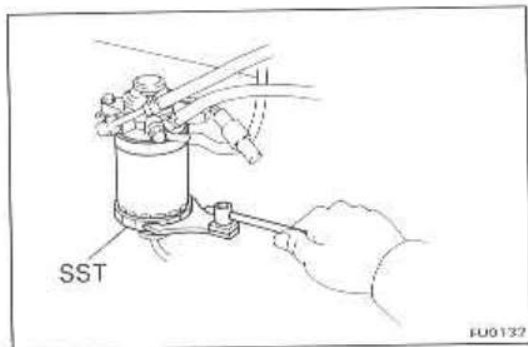
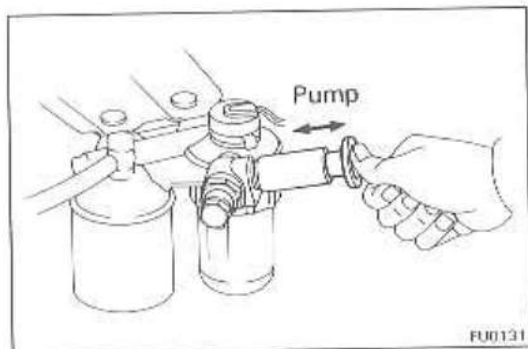
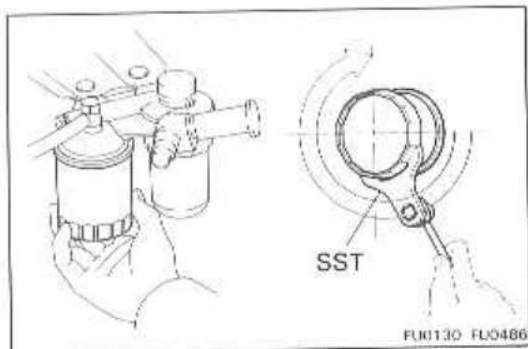
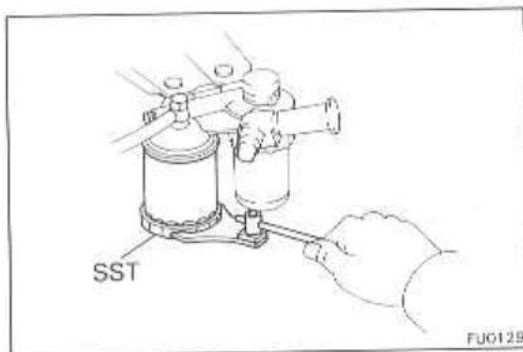
(b) Install the fuel filter with a new O-ring.

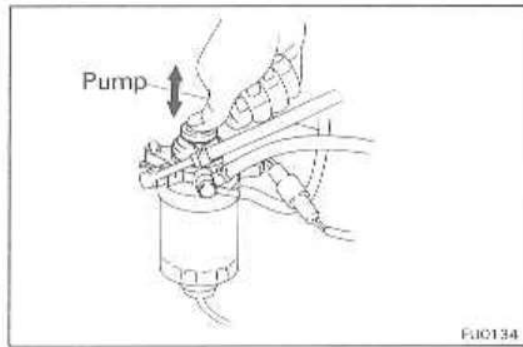
- Put a light coat of fuel on the O-ring.

- Lightly screw in the filter to where you feel resistance.

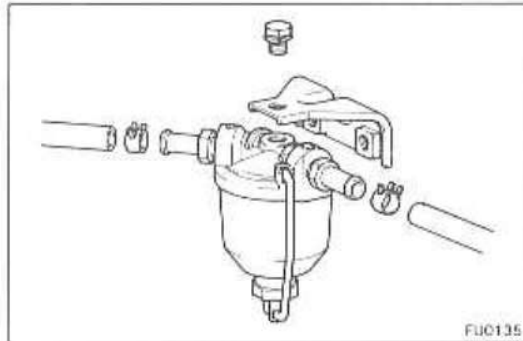
- Using SST, tighten the fuel filter an extra 3/4 turn.

SST 09228-64010

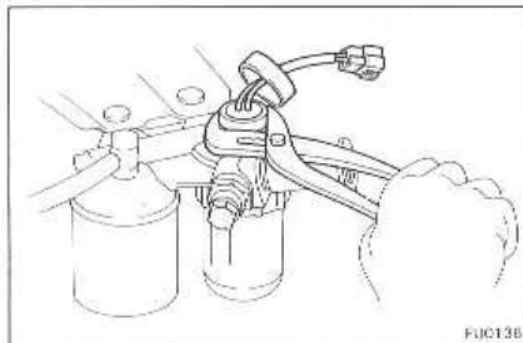


FUEL SYSTEM — Replacement of Fuel Filter, Fuel Filter Warning Switch**FU-3****3. FILL FUEL FILTER WITH FUEL**

Operate the hand pump until you feel more resistance.

**FUEL FILTER (LF only)****REPLACE FUEL FILTER**

- (a) Disconnect the fuel hoses from the fuel filter.
- (b) Remove the bolt and fuel filter.
- (c) Install a new filter with the bolt.
- (d) Connect the fuel hoses.

**FUEL FILTER WARNING SWITCH****INSPECTION OF FUEL FILTER WARNING SWITCH****Standard Type**

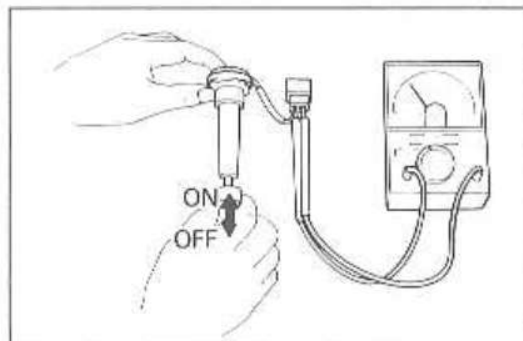
- 1. DISCONNECT WARNING SWITCH CONNECTOR**
- 2. REMOVE WARNING SWITCH**

Using pliers, remove the warning switch and gasket.

3. INSPECT WARNING SWITCH

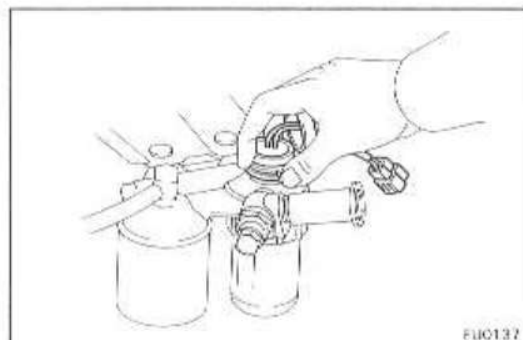
- (a) Check that there is continuity between terminals when the warning switch is ON (float up).
- (b) Check that there is no continuity between terminals when the warning switch is OFF (float down).

If operation is not as specified, replace the warning switch.

**4. INSTALL WARNING SWITCH**

Install the warning switch with a new gasket.

- Put a light coat of fuel on the gasket.
- Hand tighten ONLY. DO NOT use pliers to tighten the filter.

5. CONNECT WARNING SWITCH**6. START ENGINE AND CHECK FOR FUEL LEAKS**

FU-4

FUEL SYSTEM — Fuel Filter Warning Switch

w/ Sedimenter Type

1. DRAIN FUEL FROM FILTER

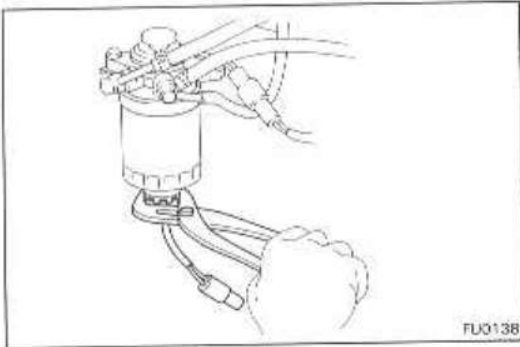
Remove the drain plug and drain the fuel.

NOTE: Put a suitable container or shop towel under the filter.

2. DISCONNECT WARNING SWITCH CONNECTOR

3. REMOVE WARNING SWITCH

Using pliers, remove the warning switch and gasket.

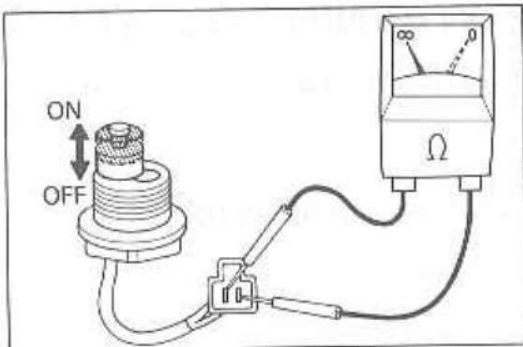


4. INSPECT WARNING SWITCH

(a) Check that there is continuity between the terminals when the warning switch is ON (float up).

(b) Check that there is no continuity between the terminals when the warning switch is OFF (float down).

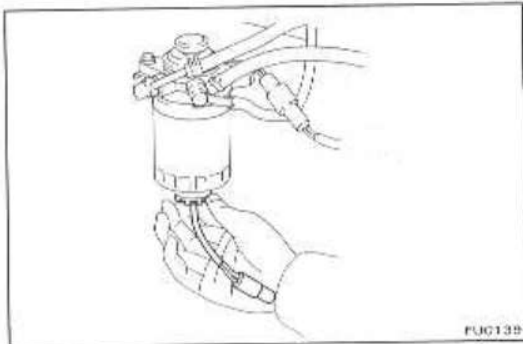
If operation is not as specified, replace the warning switch.



5. INSTALL WARNING SWITCH

Install the warning switch with a new gasket

- Put a little fuel on the gasket.
- Hand tighten ONLY. DO NOT use pliers to tighten the filter.



6. CONNECT WARNING SWITCH CONNECTOR

7. INSTALL DRAIN PLUG

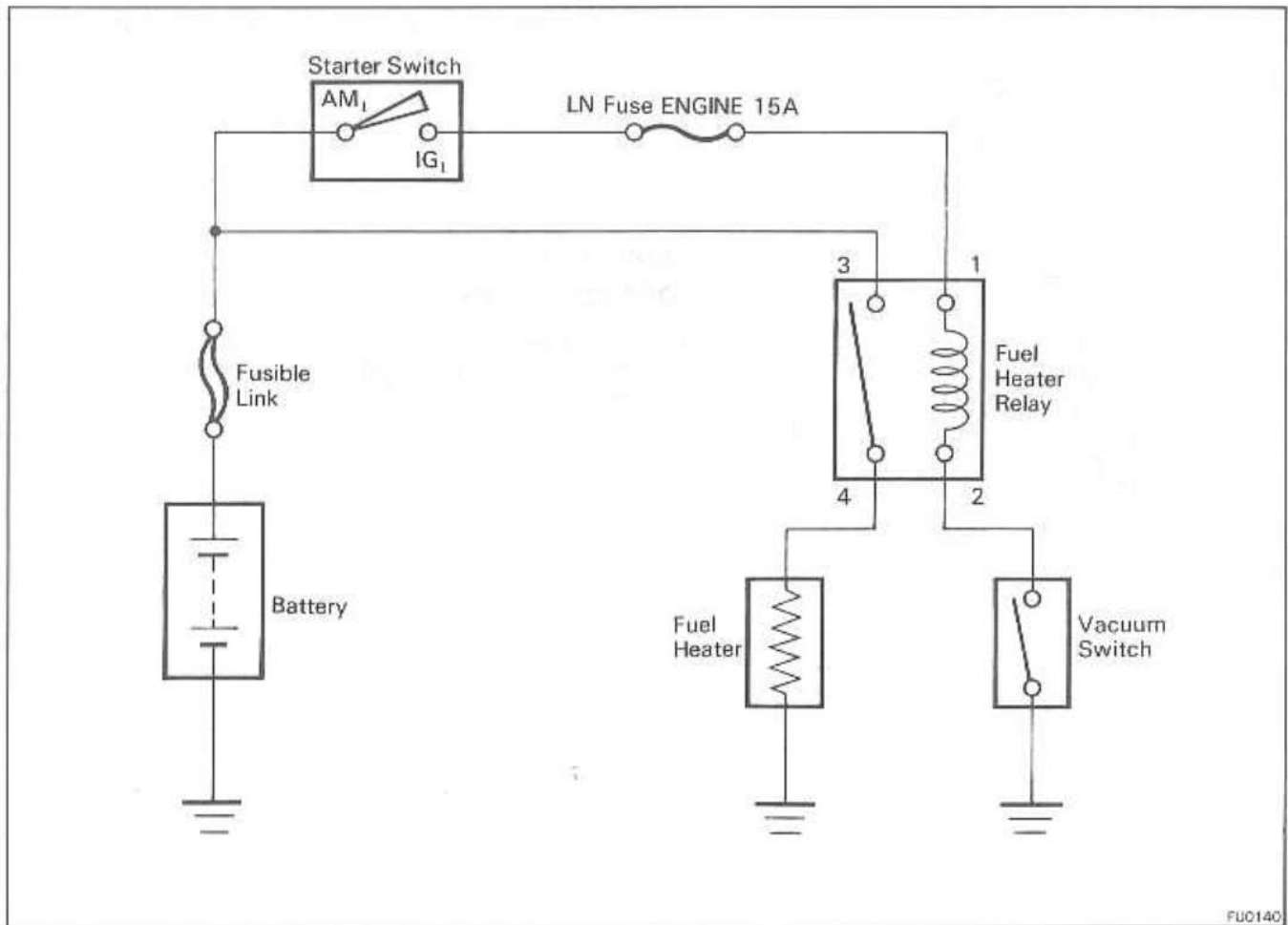
Install the drain plug with a new gasket.

8. FILL FUEL FILTER WITH FUEL
(See step 3 on page FU-3)

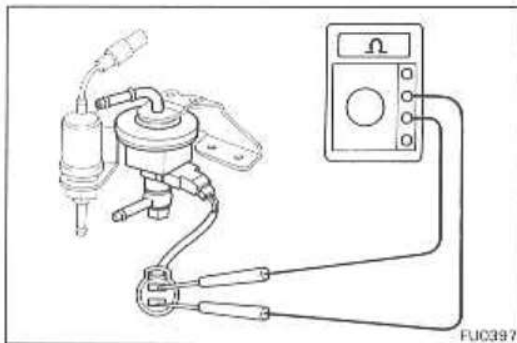
9. START ENGINE AND CHECK FOR FUEL LEAKS

FUEL SYSTEM — Fuel Heater

FU-5

FUEL HEATER
SYSTEM CIRCUIT

FU0140

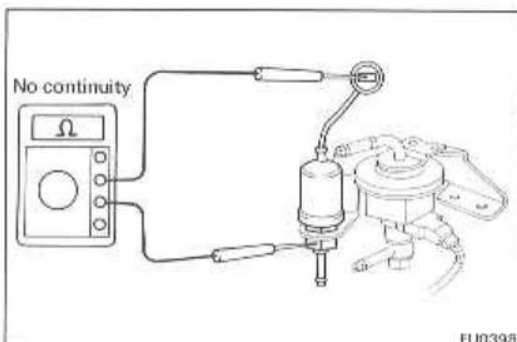


INSPECTION OF FUEL HEATER

1. INSPECT FUEL HEATER

Using an ohmmeter, measure the resistance between the terminals.

Resistance: $0.73 \pm 0.29 \Omega$ at 20°C (68°F)

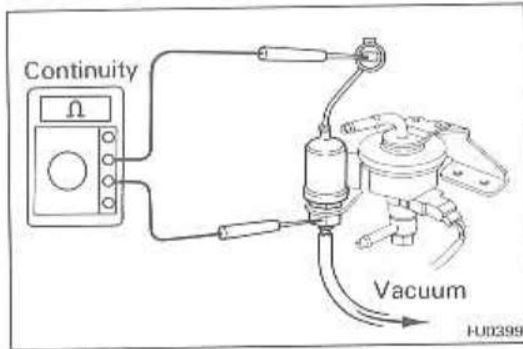


2. INSPECT VACUUM SWITCH

- (a) Using an ohmmeter, check that there is no continuity between the switch terminal and switch body.

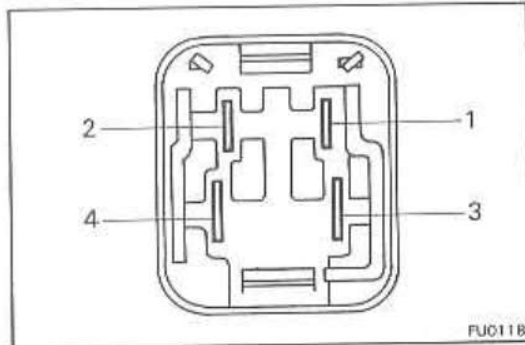
FU-6

FUEL SYSTEM — Fuel Heater



- (b) With a vacuum of 200 ± 60 mmHg (7.87 ± 2.36 in.Hg, 26.7 ± 8.0 kPa) or above, check that there is continuity between the switch terminal and switch body.

If continuity is not as specified, replace the switch.



3. INSPECT FUEL HEATER RELAY

LOCATION: In the engine compartment relay box.

- (a) Using an ohmmeter, check for continuity between the following terminals:

- 1 ↔ 2 **Continuity**
- 3 ↔ 4 **No continuity**

- (b) Apply battery voltage between terminals 1 and 2.

- 3 ↔ 4 **Continuity**

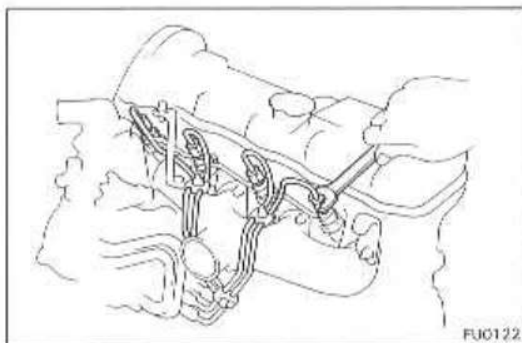
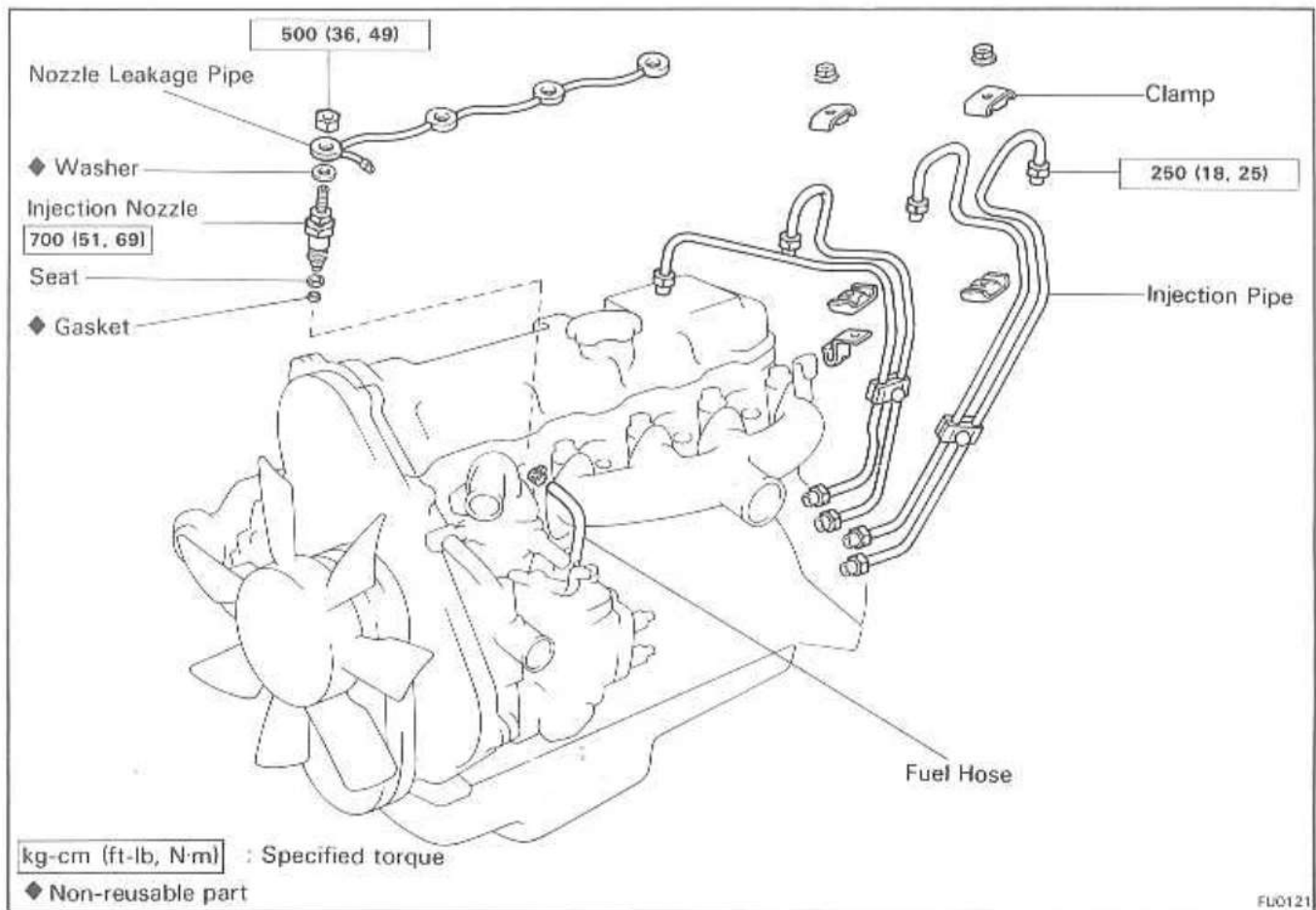
If continuity is not as specified, replace relay.

FUEL SYSTEM — Injection Nozzles

FU-7

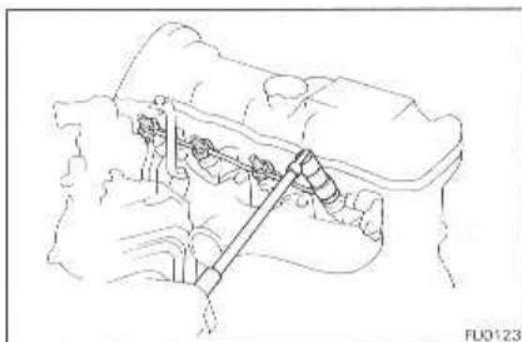
INJECTION NOZZLES

REMOVAL AND TEST OF INJECTION NOZZLES



1. REMOVE FOUR INJECTION PIPES

- Remove the two nuts holding the four injection pipes to the intake manifold.
- Remove the four injection pipes and clamps.

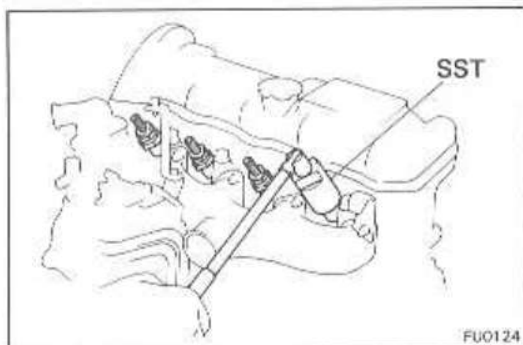


2. REMOVE NOZZLE LEAKAGE PIPE

- Disconnect the fuel hose from the leakage pipe.
- Remove the four nuts, leakage pipe and four washers.

FU-8

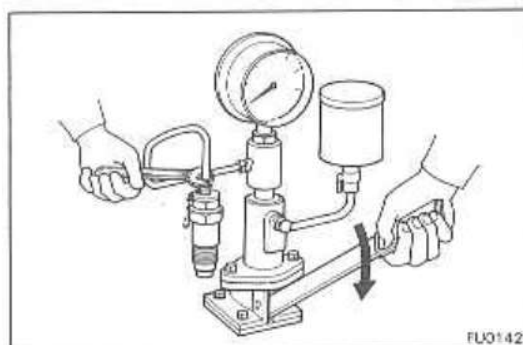
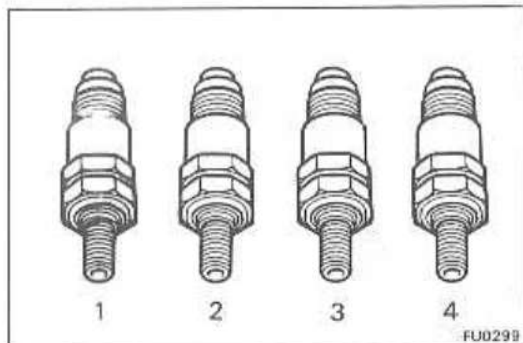
FUEL SYSTEM — Injection Nozzles



3. REMOVE FOUR INJECTION NOZZLES

Using SST, remove the four nozzles, seats and gaskets.
SST 09260-46012

NOTE: Arrange the nozzles in order.

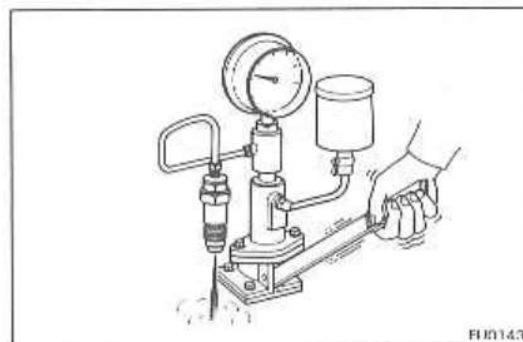


4. INJECTION PRESSURE TEST

- (a) Install the nozzle to an injection nozzle hand tester and bleed the air from the union nut.

WARNING: Do not place your finger over the nozzle injection hole.

- (b) Pump the tester handle a few times as fast as possible by hand to discharge the carbon from the injection hole.



- (c) Pump the tester handle slowly and observe the pressure gauge.
(d) Read the pressure gauge when the injection pressure just begins to drop.

Opening pressure:

Reused nozzle

L, 2L (ex. LS Hong Kong & Singapore), 2L-T

105 – 125 kg/cm²

(1,493 – 1,778 psi, 10,297 – 12,258 kPa)

2L (LS Hong Kong & Singapore)

145 – 168 kg/cm²

(2,062 – 2,389 psi, 14,220 – 16,475 kPa)

New nozzle

L, 2L (ex. LS Hong Kong & Singapore), 2L-T

115 – 125 kg/cm²

(1,636 – 1,778 psi, 11,278 – 12,258 kPa)

2L (LS Hong Kong & Singapore)

160 – 168 kg/cm²

(2,276 – 2,389 psi, 15,691 – 16,475 kPa)

NOTE: Proper nozzle operation can be determined by a swishing sound.

FUEL SYSTEM — Injection Nozzles**FU-9**

If the opening pressure is not within specification, disassemble the nozzle and change the adjusting shim on the top of the pressure spring.

Adjusted opening pressure:

L, 2L (ex. LS Hong Kong & Singapore)

and 2L-T (A) type

110 – 125 kg/cm²

(1,565 – 1,778 psi, 10,787 – 12,258 kPa)

2L (LS Hong Kong & Singapore) (B) type

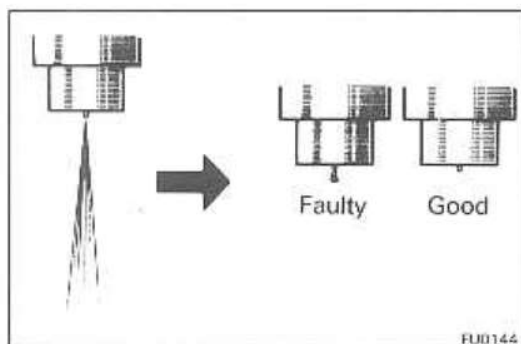
160 – 168 kg/cm²

(2,276 – 2,389 psi, 15,691 – 16,475 kPa)

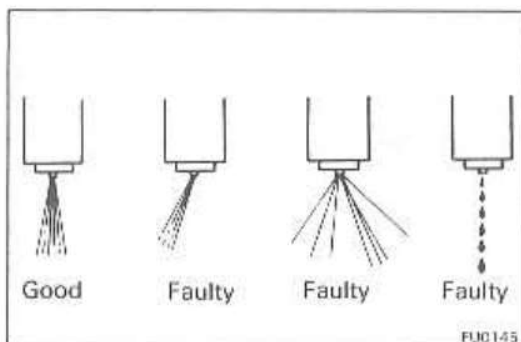
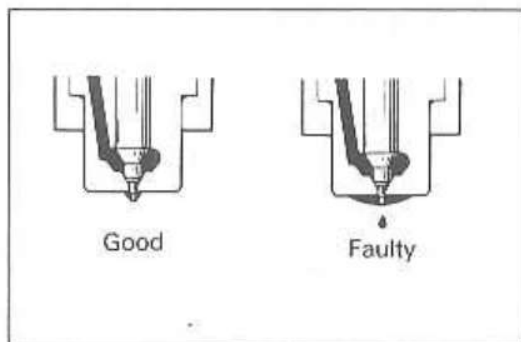
Adjusting shims

mm (in.)

Nozzle type	Shim thickness	Nozzle type	Shim thickness
(B)	0.70 (0.0276)	(A) (B)	1.35 (0.0531)
(B)	0.75 (0.0295)	(A) (B)	1.40 (0.0551)
(B)	0.80 (0.0315)	(A) (B)	1.45 (0.0571)
(B)	0.85 (0.0335)	(A) (B)	1.50 (0.0591)
(B)	0.90 (0.0354)	(A) (B)	1.55 (0.0610)
(B)	0.95 (0.0374)	(A) (B)	1.60 (0.0630)
(A) (B)	1.00 (0.0394)	(A) (B)	1.65 (0.0650)
(A) (B)	1.05 (0.0413)	(A) (B)	1.70 (0.0669)
(A) (B)	1.10 (0.0433)	(A) (B)	1.75 (0.0689)
(A) (B)	1.15 (0.0453)	(A)	1.80 (0.0709)
(A) (B)	1.20 (0.0472)	(A)	1.85 (0.0728)
(A) (B)	1.25 (0.0492)	(A)	1.90 (0.0748)
(A) (B)	1.30 (0.0512)	(A)	1.95 (0.0768)



FU0144



FU0145

NOTE:

- Varying the adjusting shim thickness by 0.05 mm (0.0020 in.) changes the injection pressure by about 6.4 kg/cm² (91 psi, 628 kPa).
- Only one adjusting shim should be used.
- (e) There should be no dripping after injection.

5. LEAKAGE TEST

While maintaining pressure at about 10.0 – 20.0 kg/cm² (142 – 284 psi, 981 – 1,961 kPa) below opening pressure (adjust by tester handle), check that there is no dripping for 10 seconds from the injection hole or around the retaining nut.

If the nozzle drips within 10 seconds, replace it or clean and overhaul the nozzle assembly.

6. SPRAY PATTERN TEST

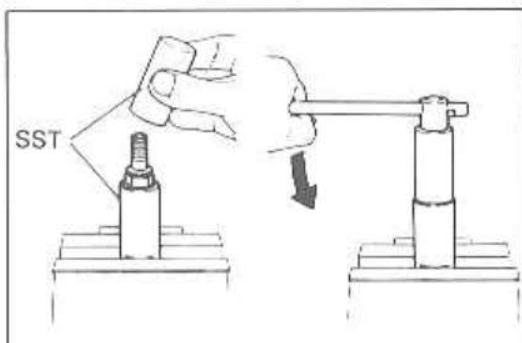
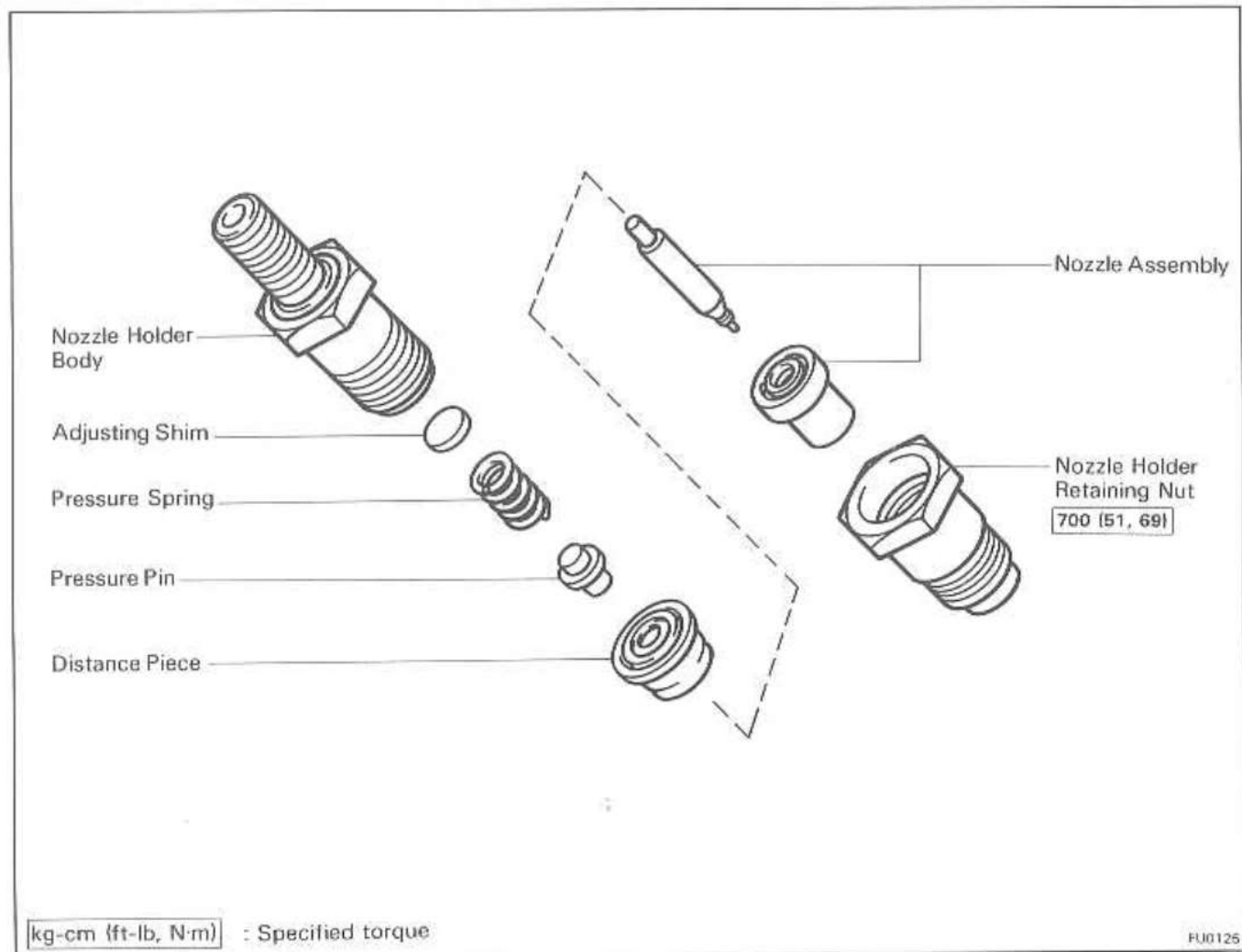
- The injection nozzle should shudder at a pumping speed between 15 – 60 times (old nozzle) or 30 – 60 times (new nozzle) per minute.
- Check the spray pattern during shuddering.

If the spray pattern is not correct during shuddering, the nozzle must be replaced or cleaned.

FU-10

FUEL SYSTEM — Injection Nozzles

COMPONENTS



DISASSEMBLY, CLEANING AND TEST OF INJECTION NOZZLE

1. DISASSEMBLE INJECTION NOZZLE

- (a) Using SST, unscrew the nozzle holder body.
SST 09260-46012

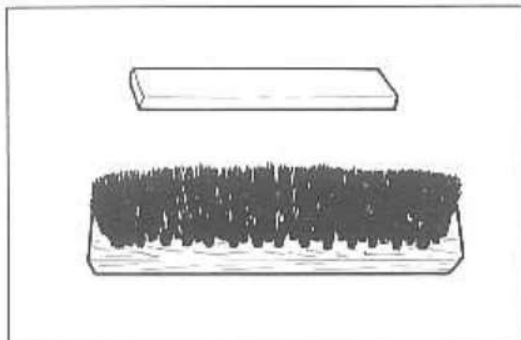
CAUTION: When disassembling the nozzle holder, be careful not to drop the inner parts.

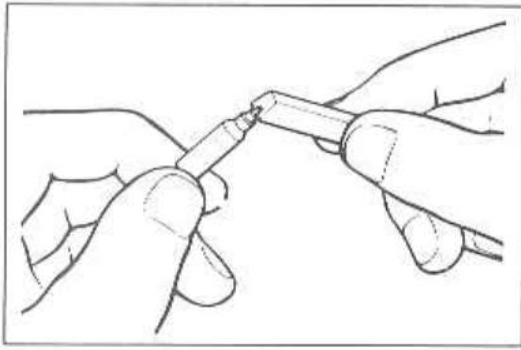
- (b) Remove the pressure spring, shim, pressure pin, distance piece and nozzle assembly.

2. NOZZLE CLEANING

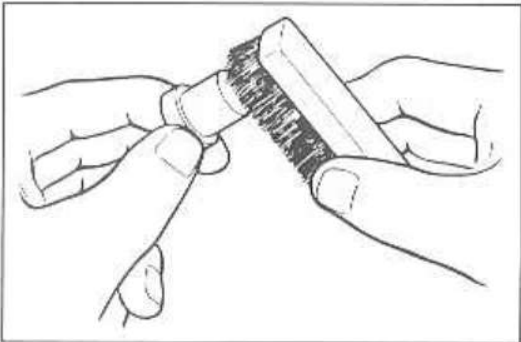
- (a) To wash the nozzles, use a wooden stick and brass brush. Wash in clean diesel fuel.

NOTE: Do not touch the nozzle mating surfaces with your fingers.

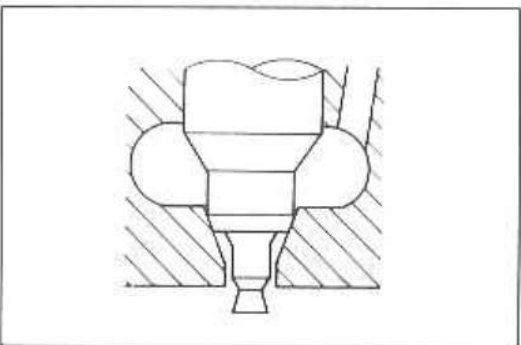


FUEL SYSTEM — Injection Nozzles**FU-11**

- (b) Remove the carbon adhering to the nozzle needle tip with a wooden stick.



- (c) Remove the carbon from the exterior of the nozzle body with a brass brush.



- (d) Inspect the seat of the nozzle body for burns or corrosion.

- (e) Inspect the nozzle needle tip for damage or corrosion.

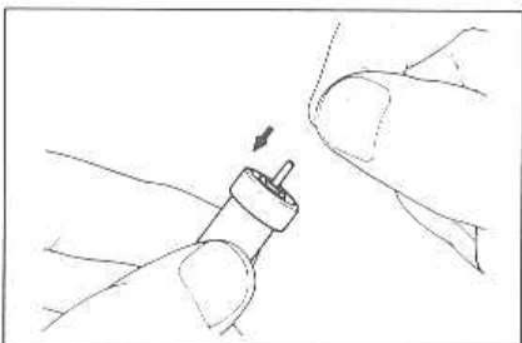
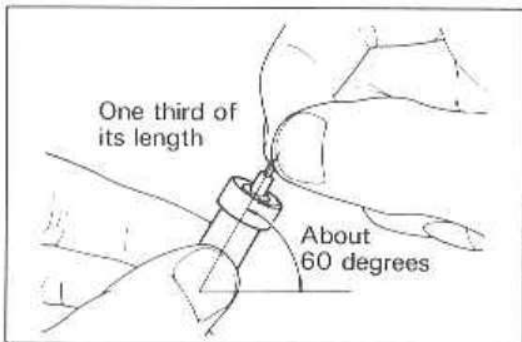
If any of these conditions are present, replace the nozzle assembly.

3. SINKING TEST

- (a) Wash the nozzle in clean diesel fuel.

NOTE: Do not touch the nozzle mating surfaces with your fingers.

- (b) Tilt the nozzle body about 60 degrees and pull the needle out about one third of its length.



- (c) When released, the needle should sink down into the body vent smoothly by its own weight.

- (d) Repeat this test, rotating the needle slightly each time.

If the needle does not sink freely, replace the nozzle assembly.

FU-12

FUEL SYSTEM — Injection Nozzles

ASSEMBLY AND INSTALLATION OF INJECTION NOZZLE

(See page FU-10)

1. ASSEMBLE INJECTION NOZZLE

- Assemble the nozzle holder retaining nut, nozzle assembly, distance piece, pressure pin, pressure spring, adjusting shim and nozzle holder body, and finger tighten the nut.

- Using SST, torque the retaining nut.

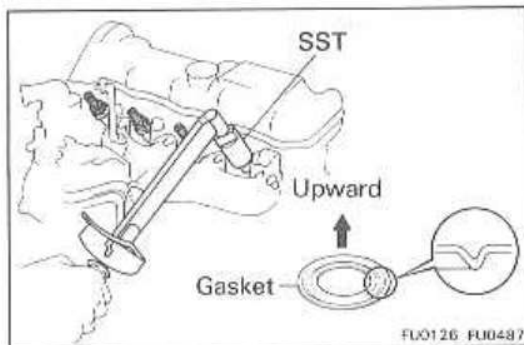
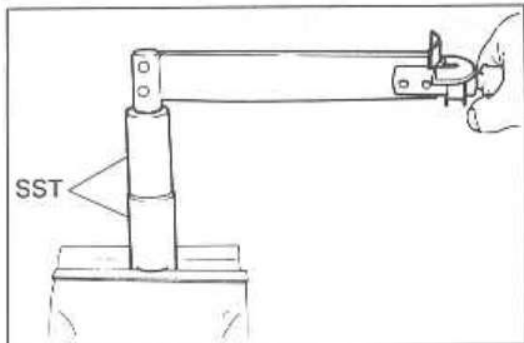
SST 09260-46012

Torque: 700 kg-cm (51 ft-lb, 69 N·m)

CAUTION: Over torquing could cause nozzle deformation and needle adhesion or other defects.

2. PERFORM PRESSURE AND SPRAY PATTERN TEST

(See steps 4 to 6 on pages FU-8 and 9)



3. INSTALL FOUR INJECTION NOZZLES

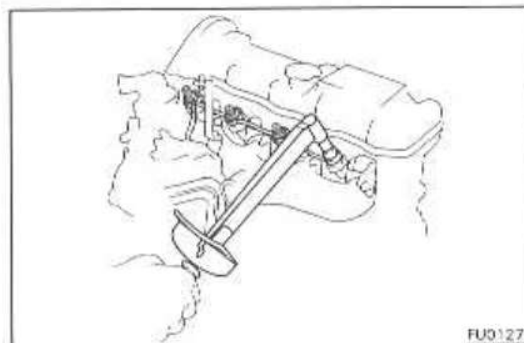
- Place four new gaskets and the nozzle seats in the cylinder head.

- Using SST, install and torque the four nozzles.

SST 09260-46012

Torque: 700 kg-cm (51 ft-lb, 69 N·m)

CAUTION: Over torquing could cause nozzle deformation and needle adhesion or other defects.

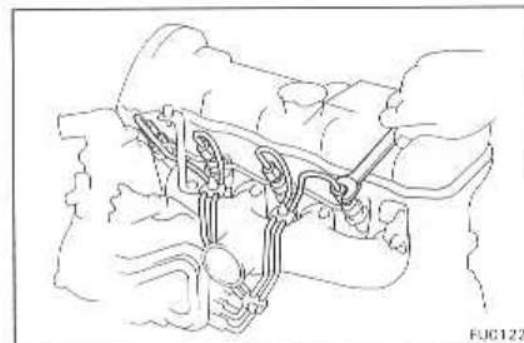


4. INSTALL NOZZLE LEAKAGE PIPE

- Install four new washers and the leakage pipe with the four nuts. Torque the nuts.

Torque: 500 kg-cm (36 ft-lb, 49 N·m)

- Connect the fuel hose to the leakage pipe.



5. INSTALL FOUR INJECTION PIPES

- Place the two lower clamps in the intake manifold.

- Install and torque the four injection pipes.

Torque: 250 kg-cm (18 ft-lb, 25 N·m)

- Secure the injection pipes with the two upper clamp and nuts.

6. START ENGINE AND CHECK FOR FUEL LEAKS

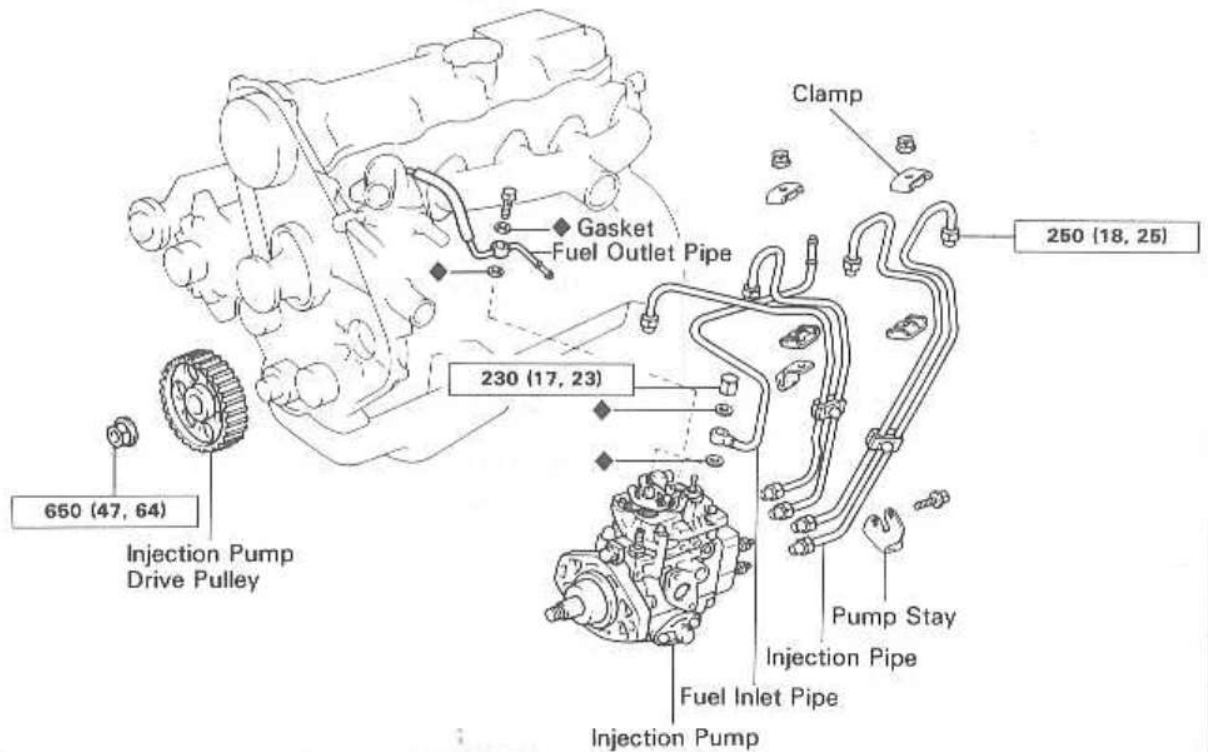
FUEL SYSTEM — Injection Pump

FU-13

INJECTION PUMP

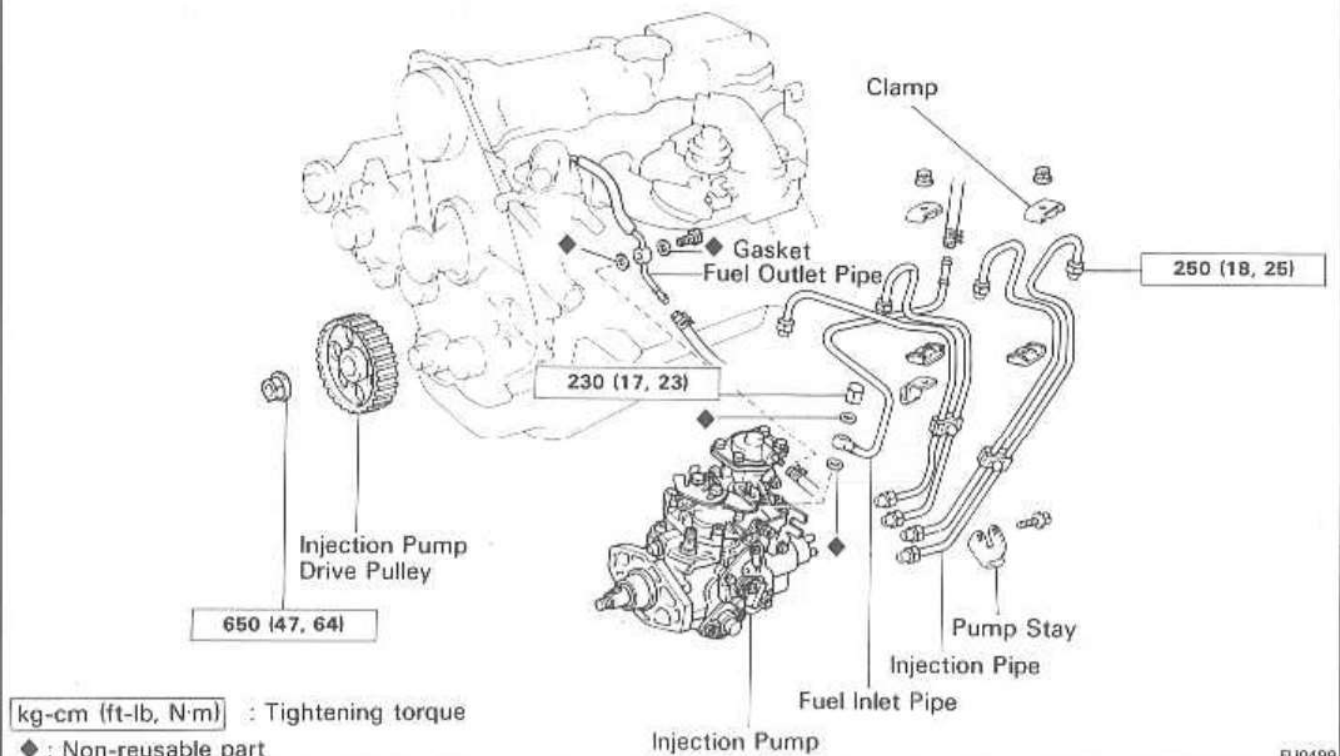
REMOVAL OF INJECTION PUMP

L, 2L (w/o HAC)



FU0440

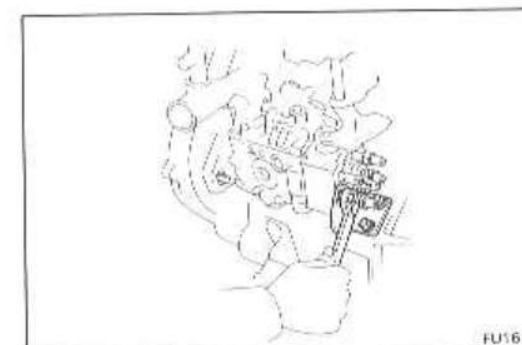
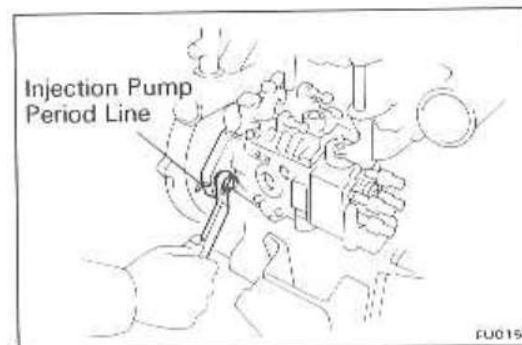
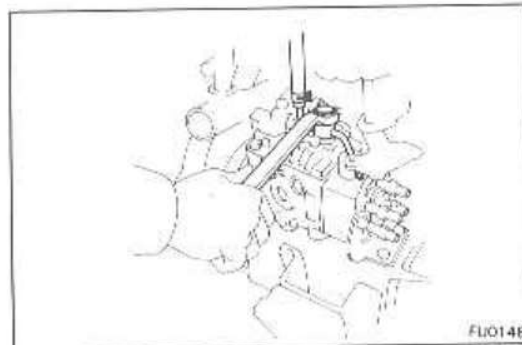
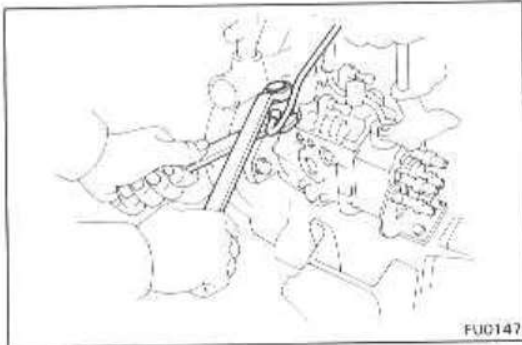
L, 2L (w/HAC), 2L-T



FU0499

FU-14

FUEL SYSTEM — Injection Pump

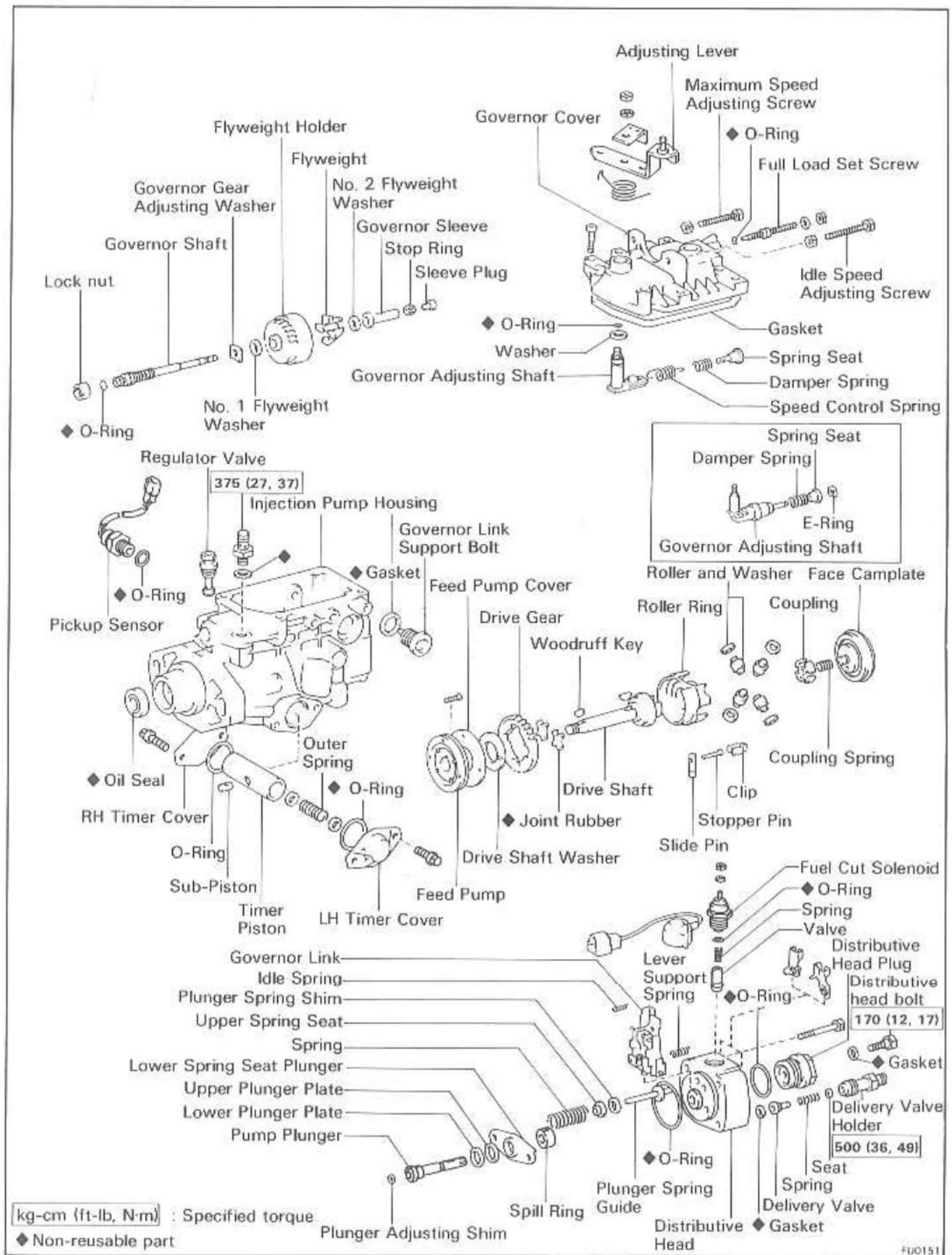


1. [LX]
DRAIN COOLANT
2. [2L-T]
DISCONNECT BOOST COMPENSATOR HOSE
3. DISCONNECT FUEL CUT SOLENOID CONNECTOR
4. DISCONNECT PICKUP SENSOR CONNECTOR
5. DISCONNECT FUEL HOSES FROM INLET AND OUTLET FUEL PIPES
6. REMOVE ACCELERATOR CONNECTING ROD
7. [LX]
DISCONNECT NO. 1 AND NO. 2 WATER BY-PASS HOSES
8. [2L-T]
REMOVE ACCELERATOR LINK
9. REMOVE FOUR INJECTION PIPES
(See page FU-7)
10. REMOVE FUEL INLET PIPE
Remove the union nut, gaskets and inlet pipe.
11. REMOVE FUEL OUTLET PIPE
Remove the union bolt, gaskets and outlet pipe.
12. REMOVE TIMING BELT
(See steps 1 to 8 on pages EM-20 to 22)
13. REMOVE INJECTION PUMP DRIVE PULLEY
(See page EM-23)
14. REMOVE INJECTION PUMP
 - (a) Check the position of the injection period line before removing the injection pump.
 - (b) Remove the two nuts and injection pump.
 - (c) Remove the four bolts and pump stay.

FUEL SYSTEM — Injection Pump

FU-15

COMPONENTS



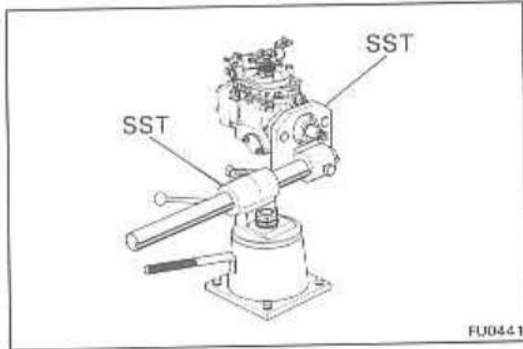
FU0151

FU-16

FUEL SYSTEM — Injection Pump

DISASSEMBLY OF INJECTION PUMP

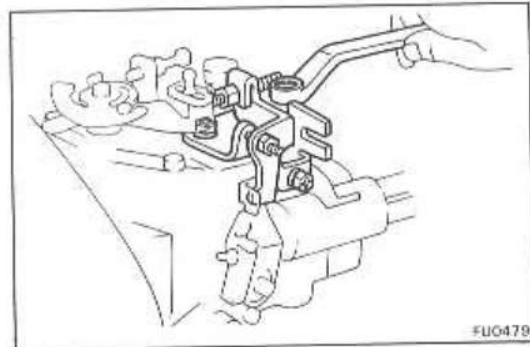
(See page FU-15)



1. **MOUNT INJECTION PUMP TO STAND (SST) FOR DISASSEMBLY**

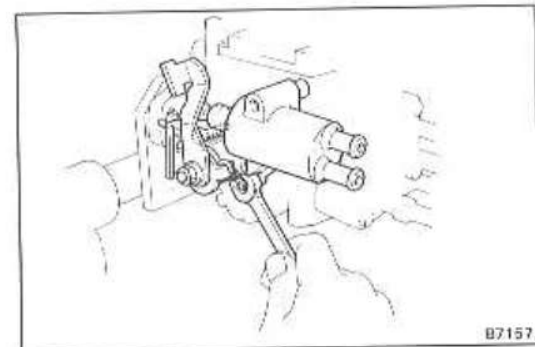
SST 09241-76022 and 09245-54010

2. **REMOVE WOODRUFF KEY FROM DRIVE SHAFT**
3. **REMOVE PICKUP SENSOR**



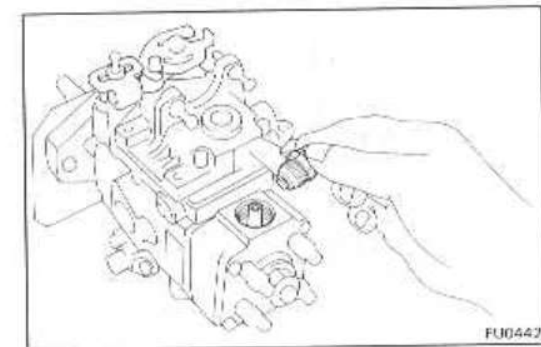
4. **[LX]
REMOVE IDLE-UP**

Remove the three bolts and idle-up.



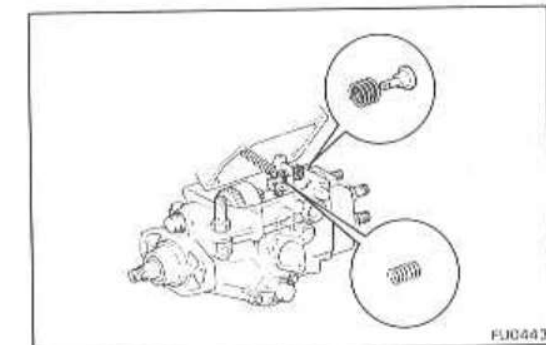
5. **[LX]
REMOVE THERMO WAX**

Remove the two bolts, thermo wax and O-ring.



6. **REMOVE FUEL CUT SOLENOID**

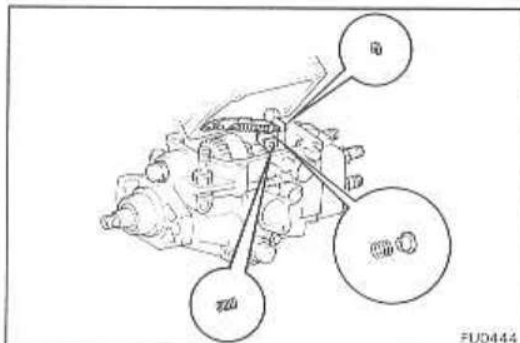
- (a) Remove the lead wire.
- (b) Remove the lead wire connector from brackets.
- (c) Remove the fuel cut solenoid, spring and valve.



7. **REMOVE GOVERNOR COVER**

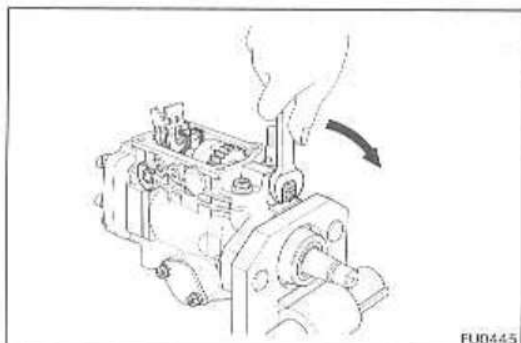
- (a) Using an allen wrench, remove the four bolts.
- (b) **[M/T (ex. LX)]**
Disconnect the speed control spring from the governor spring seat and remove the governor cover, spring seat, damper spring and idle spring.

CAUTION: Be careful not to lose the idle spring.

FUEL SYSTEM — Injection Pump**FU-17****[M/T (LX) & A/T]**

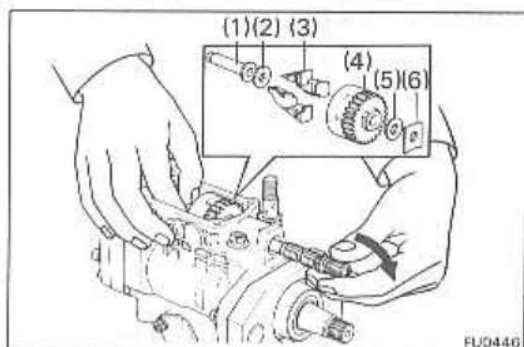
Remove the E-ring, governor spring seat, damper spring and idle spring.

CAUTION: Be careful not to lose the idle spring.



8. REMOVE GOVERNOR SHAFT AND FLYWEIGHT HOLDER

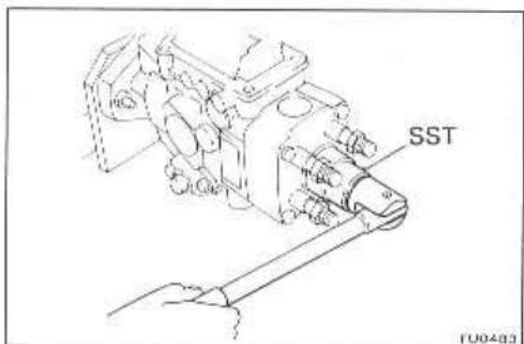
(a) Remove the governor shaft lock nut by turning it clockwise.



(b) Turn the governor shaft clockwise and remove it and the following parts:

- (1) Governor sleeve
- (2) No. 2 flyweight washer
- (3) Four flyweights
- (4) Flyweight holder
- (5) No. 1 flyweight washer
- (6) Governor gear adjusting washer

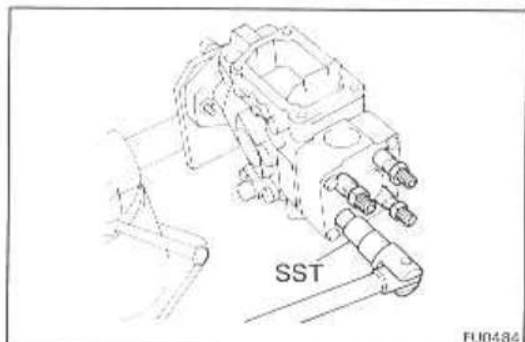
NOTE: Be careful not to drop the washers into the pump housing.



9. REMOVE DISTRIBUTIVE HEAD PLUG

Using SST, remove the distributive head plug.

SST 09260-54012



10. REMOVE FOUR DELIVERY VALVE HOLDERS

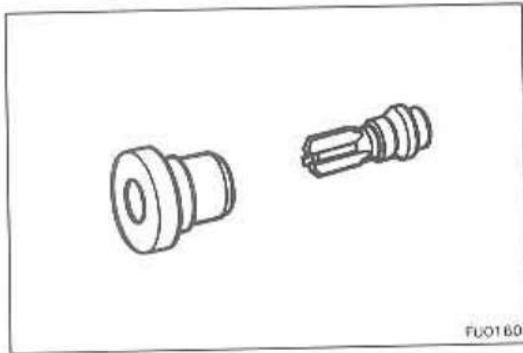
(a) Using SST, remove the four delivery valve holders, springs and seats.

SST 09260-54012

(b) Remove the four delivery valves and gaskets.

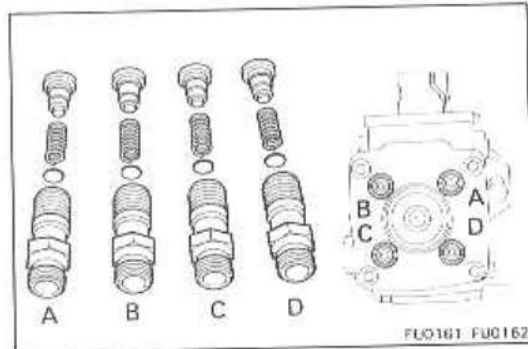
FU-18

FUEL SYSTEM — Injection Pump

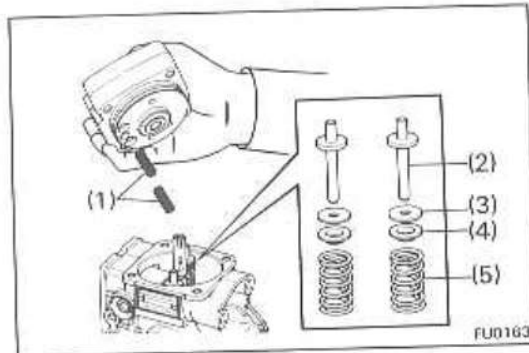


NOTE:

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



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

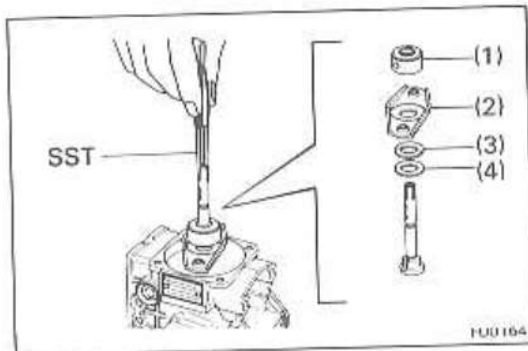


11. REMOVE DISTRIBUTIVE HEAD

Remove the four bolts, wire connector bracket, 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

CAUTION: Be careful not to lose the lever support spring.



12. REMOVE PUMP PLUNGER

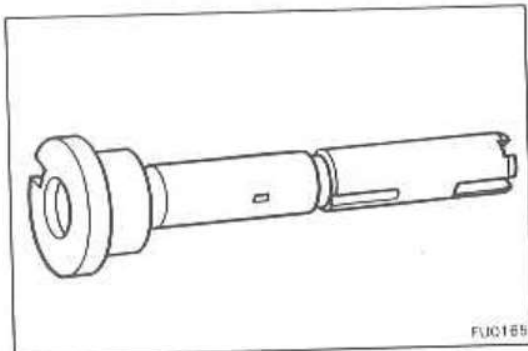
(a) Using SST, remove the pump plunger with the following parts:

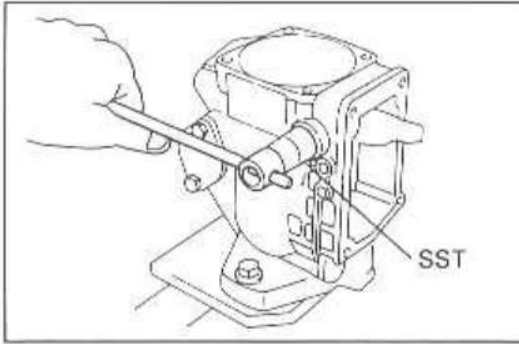
- (1) Spill ring
- (2) Lower spring seat
- (3) Upper plunger plate
- (4) Lower plunger plate

SST 09260-54012

(b) Remove the plunger adjusting shim.

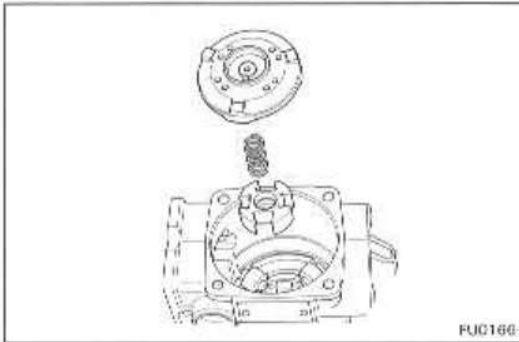
NOTE: Do not touch the sliding surfaces of the pump plunger with your hand.



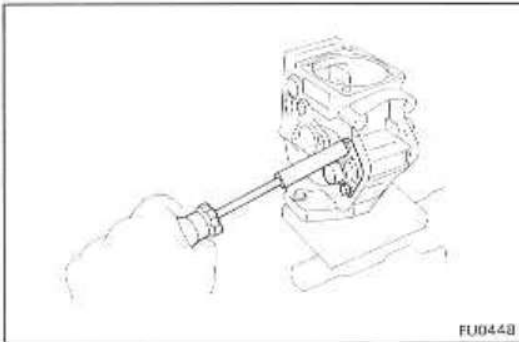
FUEL SYSTEM — Injection Pump**FU-19****13. REMOVE GOVERNOR LINK**

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

SST 09260-54012

**14. REMOVE FACE CAMPLATE AND COUPLING**

Remove the face camplate, spring and coupling.

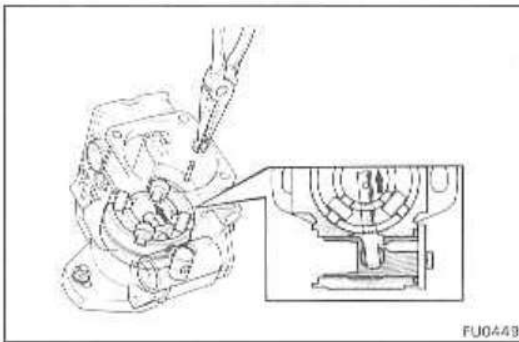
**15. REMOVE ROLLER RING, DRIVE SHAFT AND TIMER**

(a) Remove the two bolts and following parts:

- (1) LH timer cover
- (2) O-ring
- (3) Timer outer spring
- (4) Washer

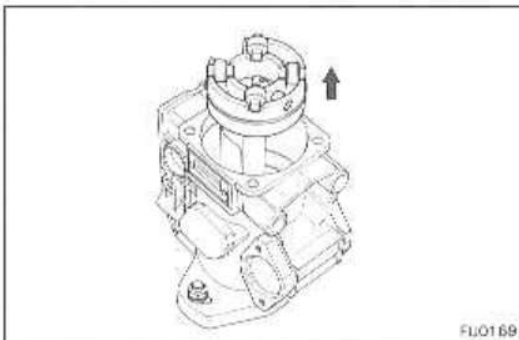
(b) Remove the timer clip and stopper pin.

(c) Push on the slide pin as shown.



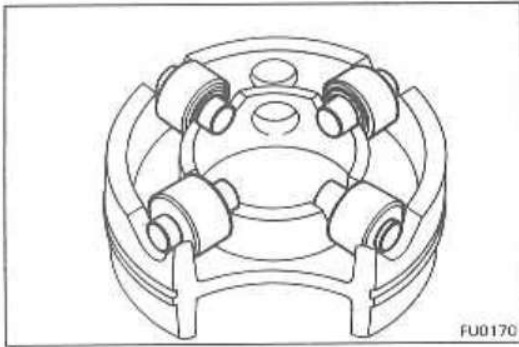
(d) Push out the drive shaft with the roller ring.

(e) Remove the drive shaft washer.



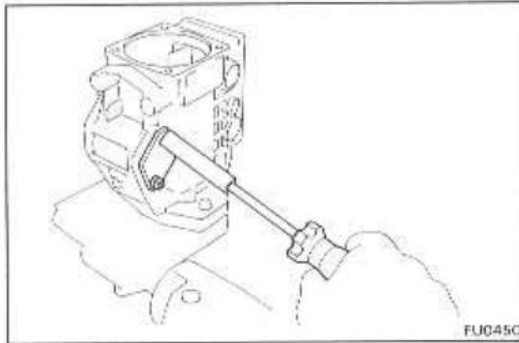
FU-20

FUEL SYSTEM — Injection Pump



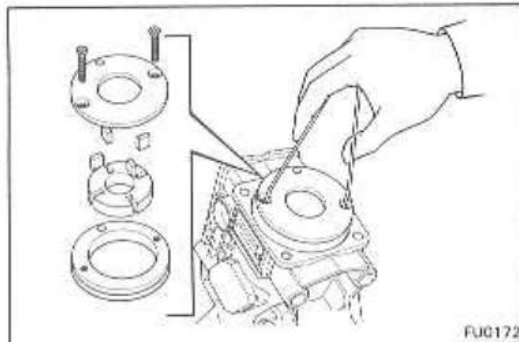
NOTE:

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



(f) Remove the two bolts and following parts.

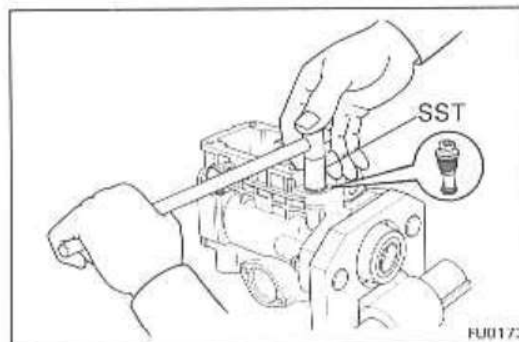
- (1) RH timer cover
- (2) O-ring
- (3) Timer piston
- (4) Sub-piston



16. REMOVE FEED PUMP

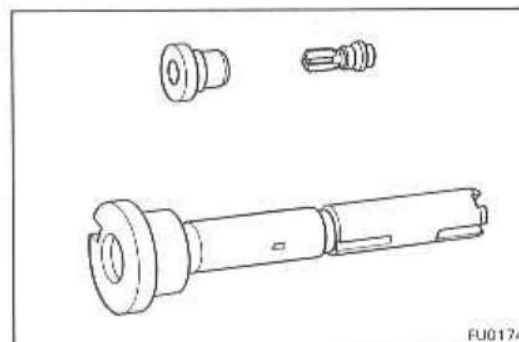
- (a) Remove the two screws.
- (b) Using a piece of wire, remove the feed pump cover.
- (c) Remove the feed pump rotor, four blades and liner.

CAUTION: Be careful not to interchange the blade positions.



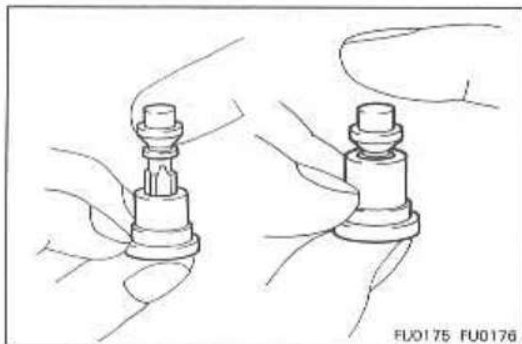
17. REMOVE REGULATOR VALVE

Using SST, remove the regulator valve.
SST 09260-54012



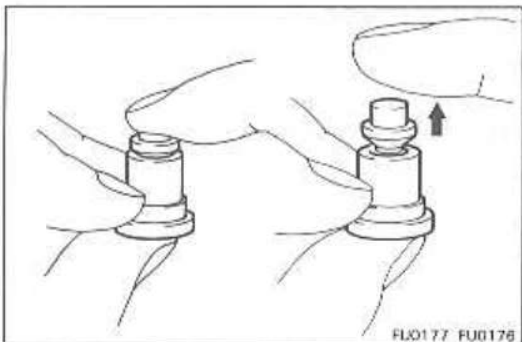
INSPECTION OF INJECTION PUMP COMPONENTS

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

FUEL SYSTEM — Injection Pump**FU-21****1. INSPECT DELIVERY VALVES**

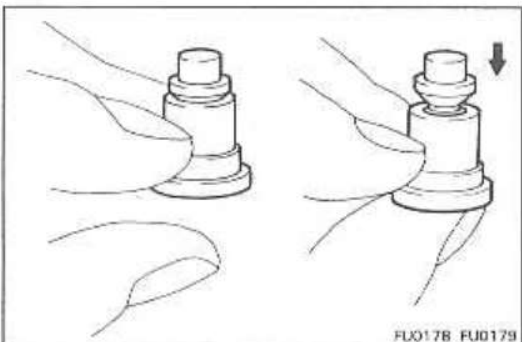
- (a) Pull up the valve and close the hole at the valve seat bottom end with your thumb. When the valve is released, it should sink down quickly and stop at the position where the relief ring closes the valve seat hole.

If defective, replace the valve as a set.



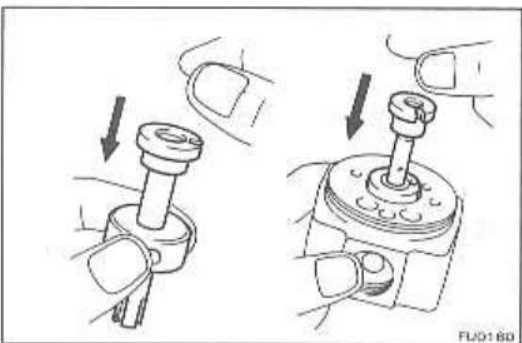
- (b) Close the hole at the valve seat bottom end with your thumb. Insert the valve into the valve seat and press down with your finger. When your finger is released, the valve should rise back to its original position.

Replace if defective.



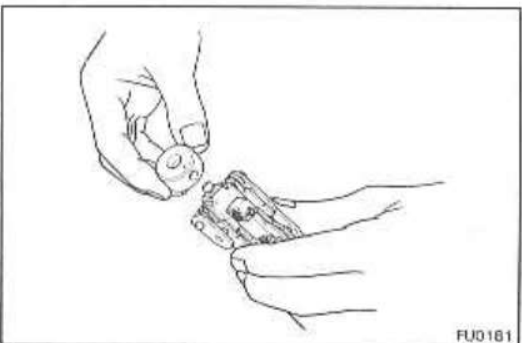
- (c) Remove your thumb from the valve seat hole. The valve should close completely by its own weight. If defective, replace the valve as a set.

NOTE: 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.

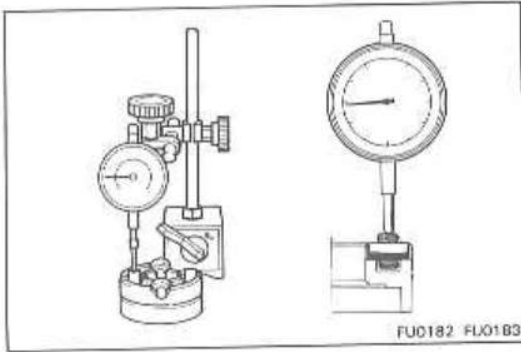
If the plunger sticks at any position, replace the parts as a set.



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

FU-22

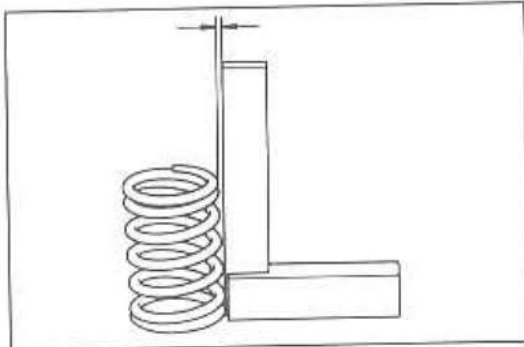
FUEL SYSTEM — Injection Pump

**3. INSPECT ROLLER RING AND ROLLERS**

Using a dial indicator, measure the roller height.

Roller height variation: 0.02 mm (0.0008 in.)

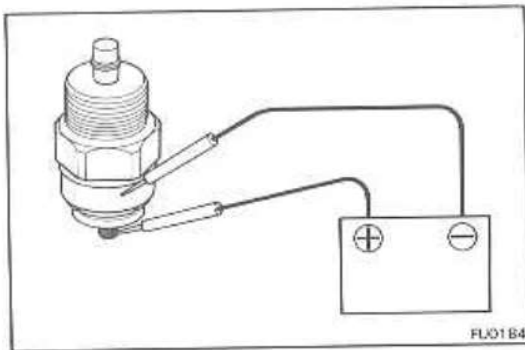
If not within specification, replace the roller ring and roller as a set.

**4. INSPECT PLUNGER SPRINGS**

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

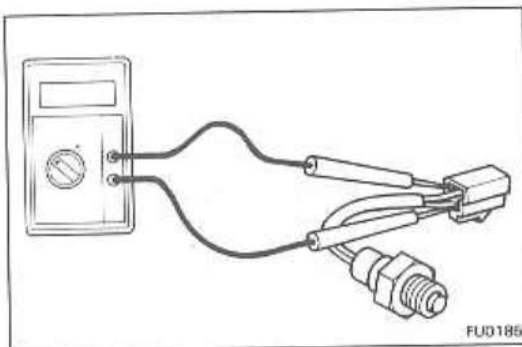
Maximum squareness: 2.0 mm (0.079 in.)

If squareness is greater than maximum, replace the plunger spring.

**5. INSPECT FUEL CUT SOLENOID**

- (a) Install the spring and valve to the solenoid valve body.
- (b) Connect the solenoid valve body and terminal to the battery terminals.
- (c) 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.

**6. INSPECT PICKUP SENSOR**

Using an ohmmeter, measure the resistance between terminals.

Resistance: 600 – 800 Ω

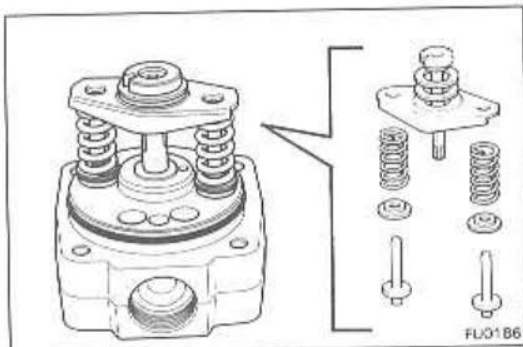
If not within specification, replace the sensor.

7. ADJUST PLUNGER SPRING SHIM

- (a) Install the following parts to the distributive head.

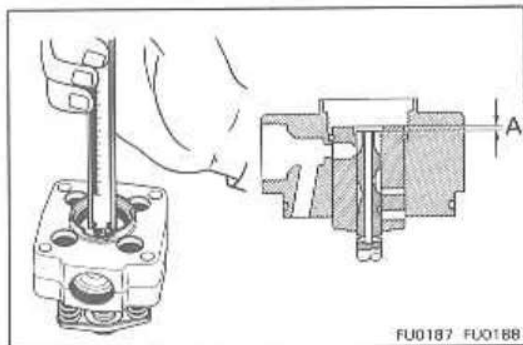
- (1) Two plunger spring guides
- (2) Two upper spring seats
- (3) Two plunger springs
- (4) Lower spring seat
- (5) Lower plunger plate
- (6) Upper plunger plate
- (7) Pump plunger

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



FUEL SYSTEM — Injection Pump

FU-23



- (b) Using calipers, measure the clearance A indicated in the figure.
- (c) Determine the selection shim size by using the following formula and chart.

$$\text{New shim thickness } L, 2L - T = 5.7 - A$$

$$2L = 5.8 - A$$

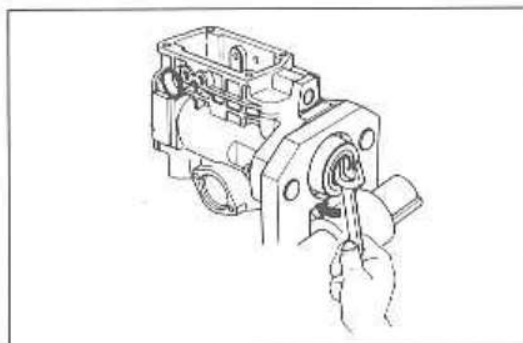
A Plunger position measured

Shim selection chart 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 (0.189–0.193)	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)	–	–

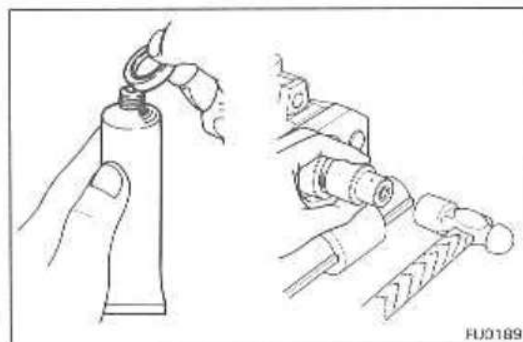
NOTE:

- 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.



8. IF NECESSARY, REPLACE OIL SEAL

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

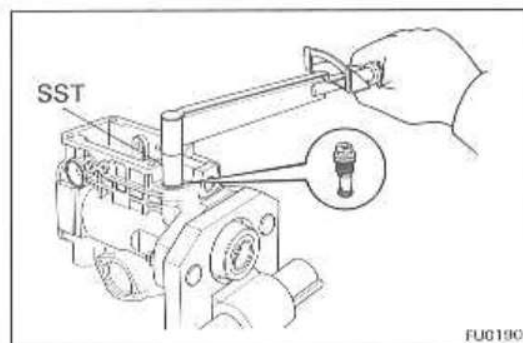


- (b) Apply MP grease to the lip of a new oil seal.

- (c) Apply liquid sealer to the outer circumference of the oil seal.

CAUTION: Do not apply liquid sealer to the lip of the oil seal.

- (d) Using a socket wrench, drive in the oil seal until its surface is flush with the pump housing.



ASSEMBLY OF INJECTION PUMP

(See page FU-15)

1. INSTALL REGULATOR VALVE

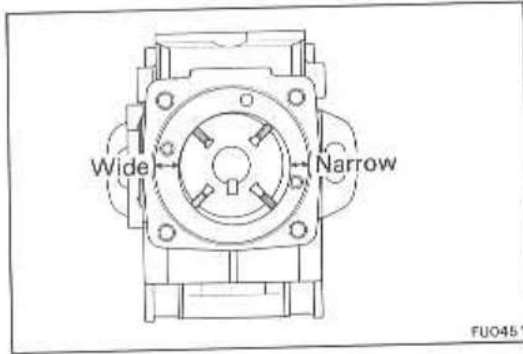
Using SST, install and torque the regulator valve with a new O-ring.

Torque: 90 kg-cm (78 in.-lb, 8.8 N·m)

SST 09260-54012

FU-24

FUEL SYSTEM — Injection Pump

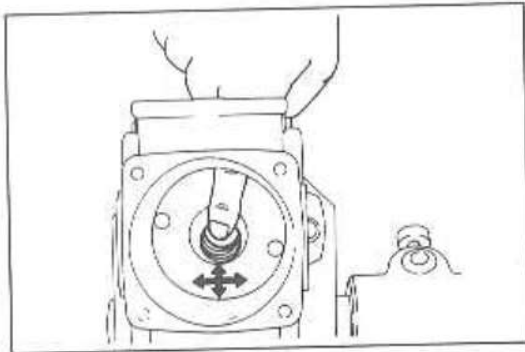


2. INSTALL FEED PUMP

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

NOTE:

- Check that the liner and blades are facing in the correct direction, as shown.
- Check that the blades move smoothly.

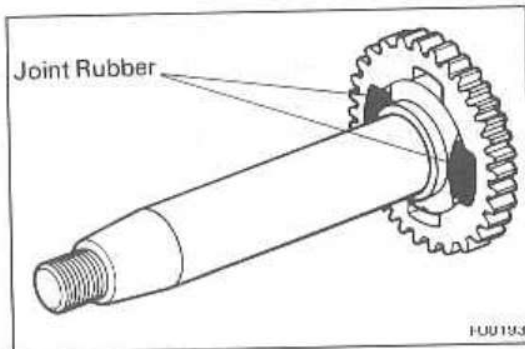
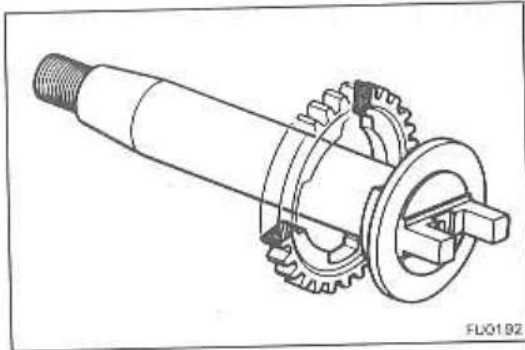


- (b) Install the pump cover with the two screws and check that the rotor moves smoothly.

NOTE: Check that the fuel outlet hole of the cover is aligned with the liner.

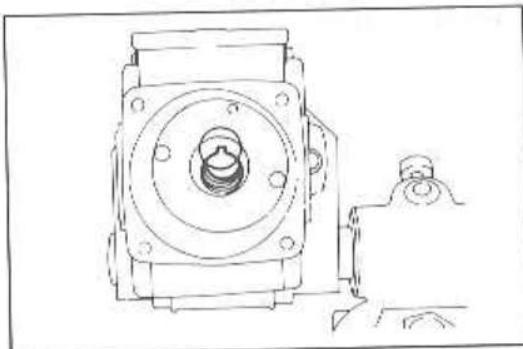
3. INSTALL DRIVE SHAFT

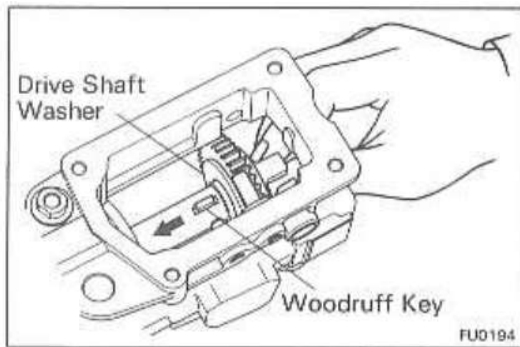
- (a) Install the drive gear on the drive shaft as shown.



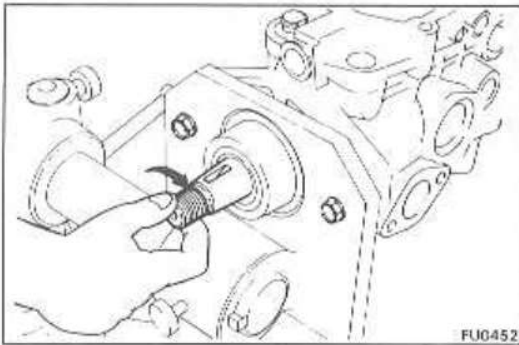
- (b) Install new two joint rubbers into the drive gear.
NOTE: Replace the joint rubber when overhauling.

- (c) Position the notch of the feed pump rotor upward.

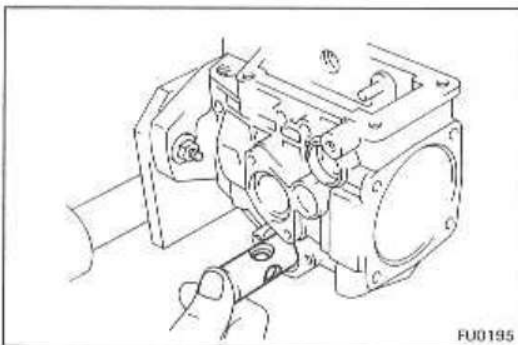


FUEL SYSTEM — Injection Pump**FU-25**

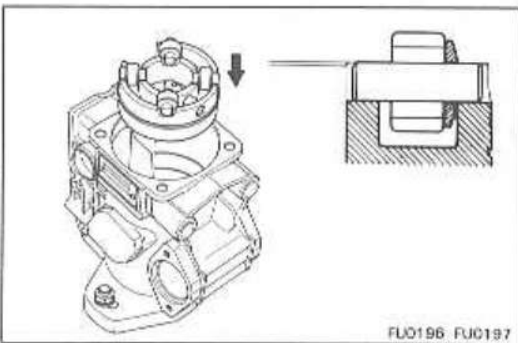
- (d) Install the woodruff key and drive shaft washer on the drive shaft and insert the drive shaft assembly into the pump housing.



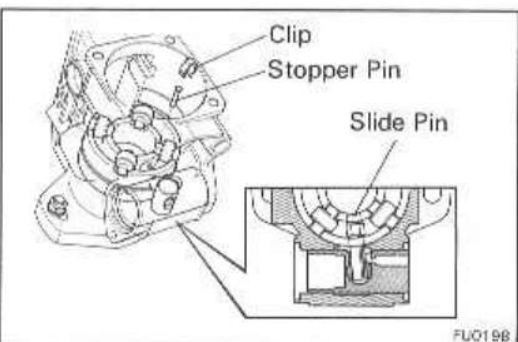
- (e) Check that the drive shaft turns without catching.

**4. INSTALL TIMER PISTON**

- (a) Apply No. 50 Denso grease to the timer piston.
 (b) Install the sub-piston in the timer piston.
 (c) Insert the timer piston into the pump housing.

**5. INSTALL ROLLER RING**

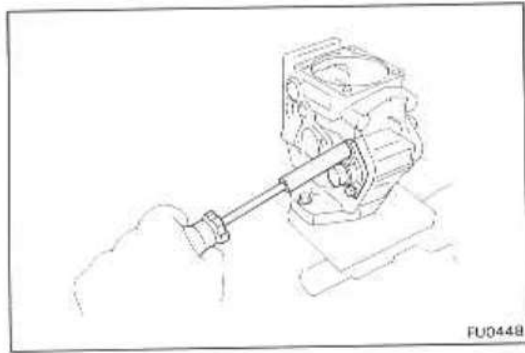
- (a) Install the four rollers and washers on the roller ring.
NOTE: Check that the roller is facing the flat surface of the washer.
 (b) Install the roller ring with slide pin in the pump housing.



- (c) Carefully push down the slide pin and install the stopper pin and clip.

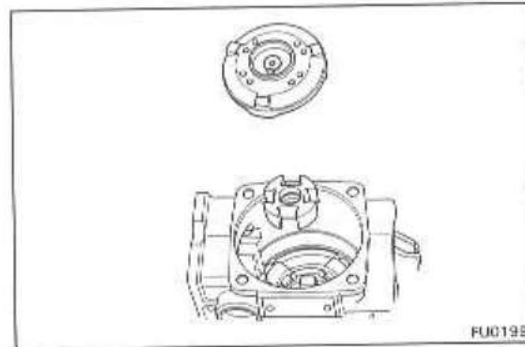
FU-26

FUEL SYSTEM — Injection Pump



- (d) Install a new O-ring and the RH timer cover with the two bolts.
- (e) Install a new O-ring, the outer spring, washer and LH timer cover with the two bolts.

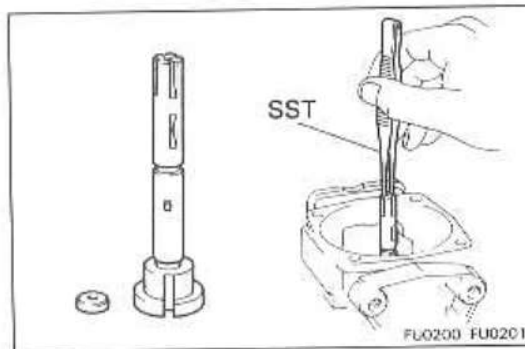
NOTE: Insert adjusting washer on each side of the spring.



6. ADJUST PLUNGER ADJUSTING SHIM

- (a) Install the coupling and face camplate.

NOTE: Do not assemble the coupling spring.

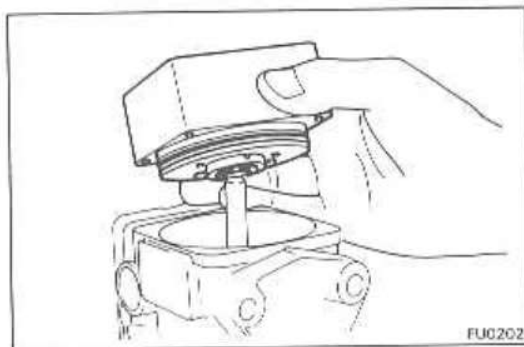


- (b) Using SST, install the used adjusting shim and pump plunger.

SST 09260-54012

NOTE:

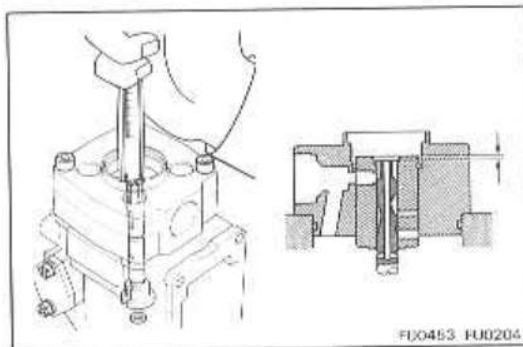
- Check that the notch on the pump plunger is aligned with the camplate pin.
- Check the adjusting shim and contacting surface area are clean.



- (c) Install the distributive head with the bolts.
Torque the bolts.

Torque: 120 kg-cm (9 ft-lb, 12 N-m)

CAUTION: Be careful not to damage the pump plunger when assembling.



- (d) Using calipers, measure the clearance B indicated in the figure.
- (e) Determine the selection shim size by using the following formula and chart.

$$\text{New shim thickness} = T + (B - 3.3)$$

T... Thickness of shim used

B... Plunger position measured

FUEL SYSTEM — Injection Pump**FU-27**

Shim selection chart

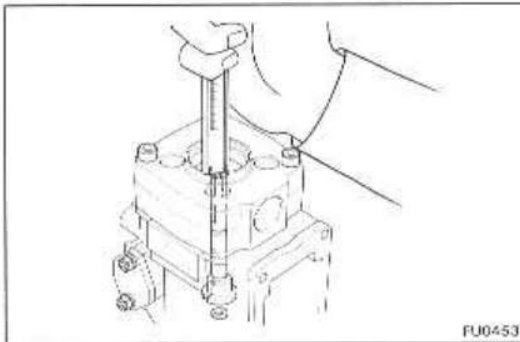
		Measured clearance																			(mm)				
		2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2 – 3.4		3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4			
Installed shim (mm)	1.9												2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.9			
	2.0									1.9			2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.9				
	2.1								1.9	1.9			2.3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

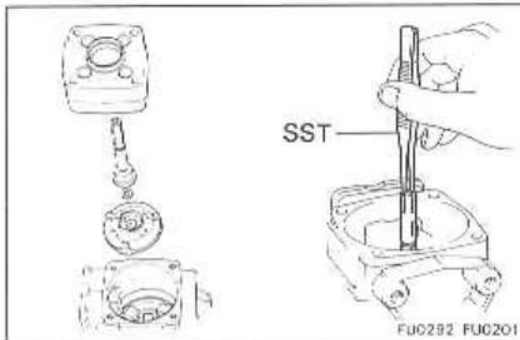
Example: 2.4 mm (0.094 in.) shim installed. Measured clearance is 3.7 mm (0.146 in.). Replace 2.4 mm (0.094 in.) with 2.8 mm (0.110 in.).

(f) Install a shim and recheck clearance B.

B: 3.2 – 3.4 mm (0.126 – 0.134 in.)



FU0453



FU0292 FU0201

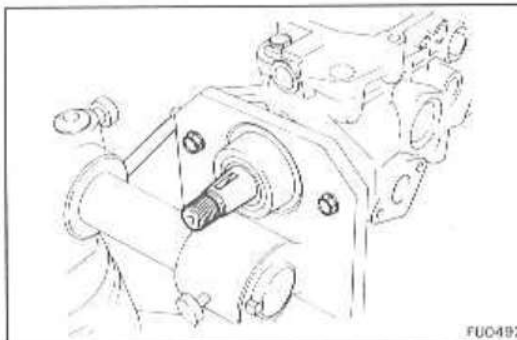
(g) Using SST, remove the following parts:

- (1) Distributive head
- (2) Pump plunger
- (3) Plunger adjusting shim
- (4) Face camplate

SST 09260-54012

7. INSTALL FACE CAMPLATE

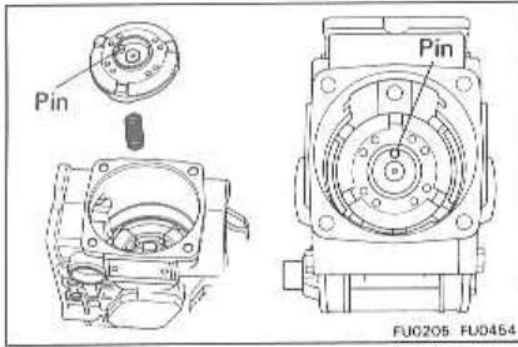
(a) Face the key groove of the drive shaft upward.



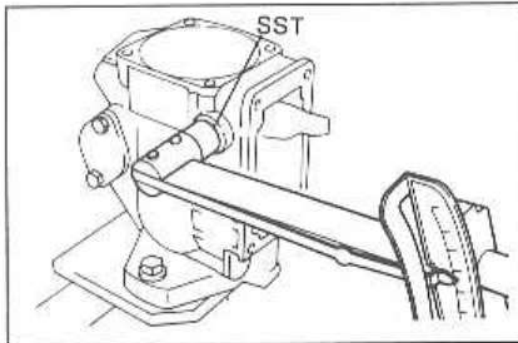
FU0492

FU-28

FUEL SYSTEM — Injection Pump



- (b) Install the coupling spring and camplate with the camplate pin facing upward.



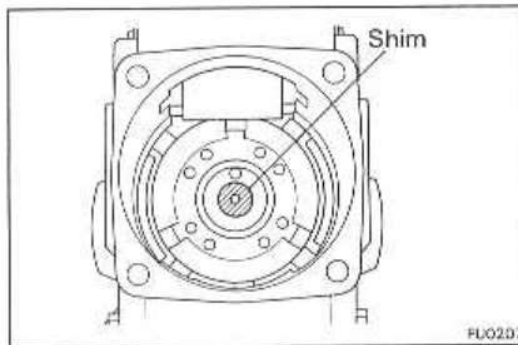
8. INSTALL GOVERNOR LINK

Using SST, install the governor link with the two bolts and new gaskets. Torque the bolts.

Torque: 115 kg-cm (8 ft-lb, 11 N·m)

SST 09260-54012

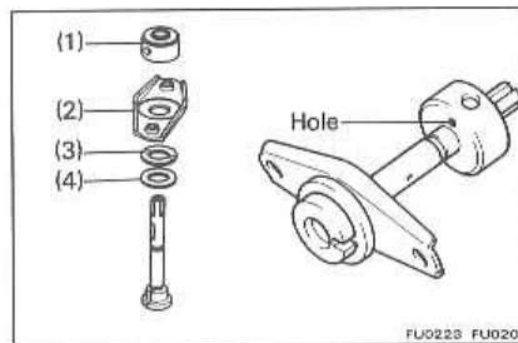
NOTE: Check that the governor link moves smoothly after assembly.



9. INSTALL PUMP PLUNGER

- (a) Place the selected plunger adjusting shim on the center of the camplate.

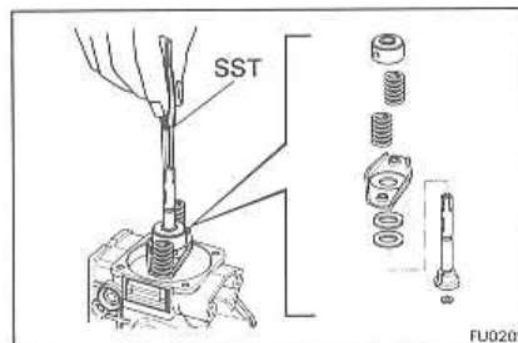
NOTE: Do not apply grease to the shim.



- (b) Install the following parts to the pump plunger:

- (1) Lower plunger plate
- (2) Upper plunger plate
- (3) Lower spring seat
- (4) Spill ring

NOTE: Face the spill ring with the hole side toward the lower seat.

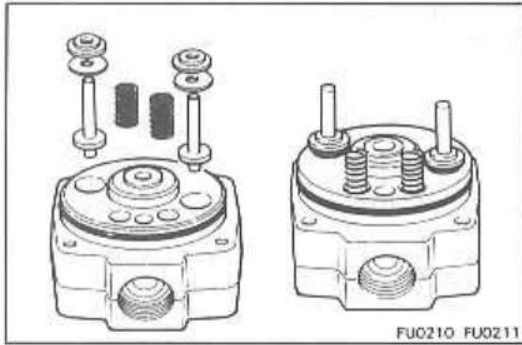


- (c) Using SST, install the pump plunger and plunger spring.

SST 09260-54012

NOTE:

- Check that the camplate pin and plunger notch are aligned.
- Check that the spill ring hole and governor link ball pin are aligned.

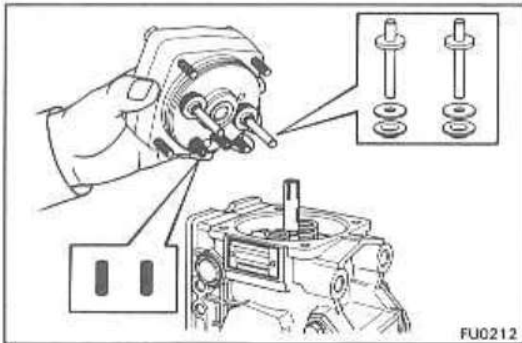
FUEL SYSTEM — Injection Pump**FU-29****10. INSTALL DISTRIBUTIVE HEAD**

- (a) Apply No. 50 Denso grease to the following parts and install them to the distributive head:

- (1) Two plunger spring guides
- (2) Two plunger spring shims
- (3) Two upper spring seats
- (4) Two lever support springs
- (5) New O-ring

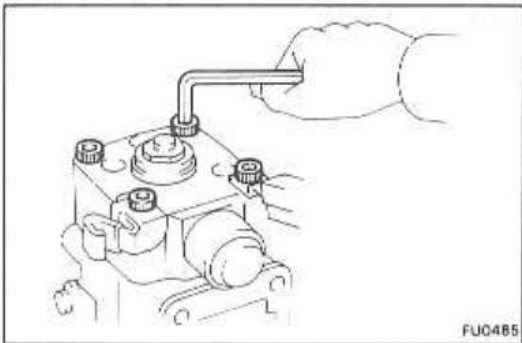
- (b) Install the distributive head.

CAUTION: Be careful not to damage the pump plunger.



- (c) Install and torque the four bolts and wire connector bracket.

Torque: 120 kg-cm (9 ft-lb, 12 N·m)

**11. INSTALL FOUR DELIVERY VALVE HOLDERS**

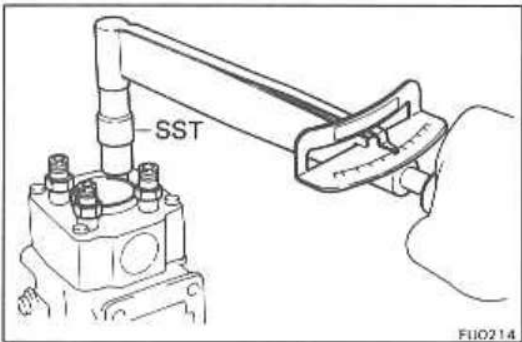
- (a) Install four new gaskets and the valves into the distributive head.

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

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

Torque: 500 kg-cm (36 ft-lb, 49 N·m)

SST 09260-54012

**12. INSTALL DISTRIBUTIVE HEAD PLUG**

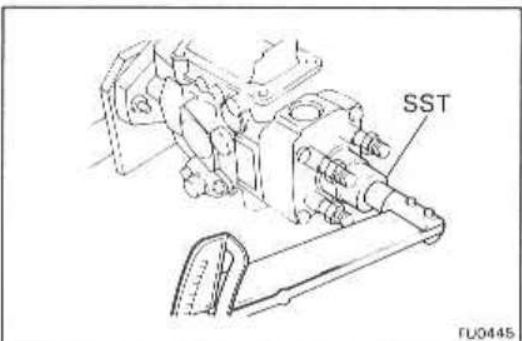
- (a) Install a new O-ring on the head plug.

- (b) Using SST, install and torque the head plug.

SST 09260-54012

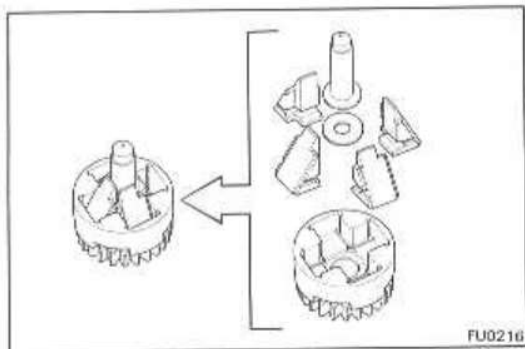
Torque: 700 kg-cm (51 ft-lb, 69 N·m)

CAUTION: If the head plug is removed, always replace the O-ring with a new one.



FU-30

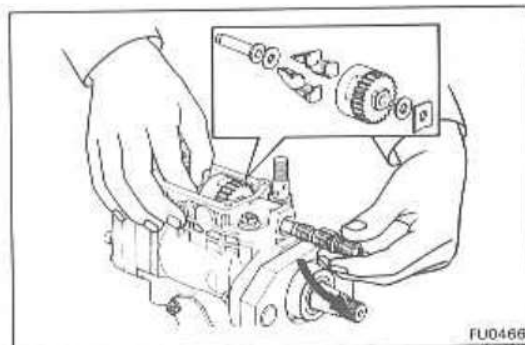
FUEL SYSTEM — Injection Pump

**13. INSTALL GOVERNOR SHAFT AND FLYWEIGHT HOLDER ASSEMBLY**

- (a) Install the four flyweights, No. 2 flyweight washer and governor sleeve on the flyweight holder.

NOTE: Replace the four flyweights as a set.

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

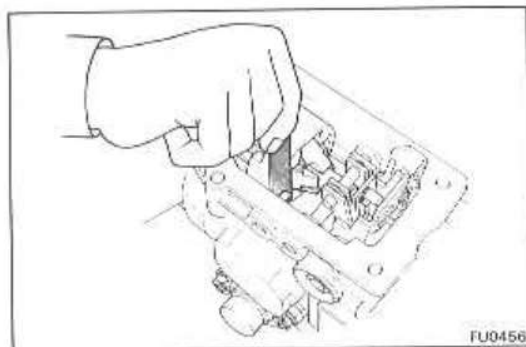


- (c) Install the governor shaft, gear adjusting washer, No. 1 flyweight washer and flyweight holder assembly together, and turn the governor shaft counterclockwise.

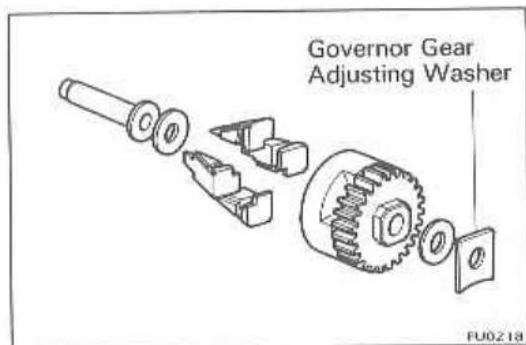
14. CHECK FLYWEIGHT HOLDER THRUST CLEARANCE

Using a feeler gauge, measure the flyweight holder thrust clearance.

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



If the thrust clearance is not within specification, adjust with an governor gear adjusting washer.



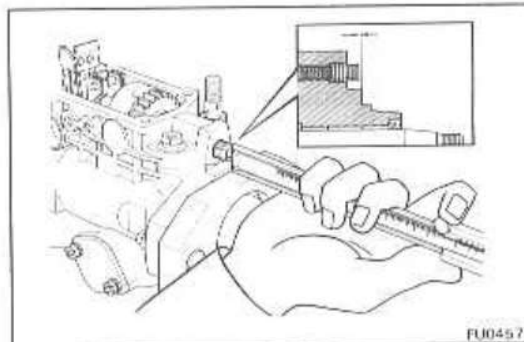
Governor gear adjusting washer thickness mm (in.)	
1.05 (0.0413)	1.65 (0.0650)
1.25 (0.0492)	1.85 (0.0728)
1.45 (0.0571)	

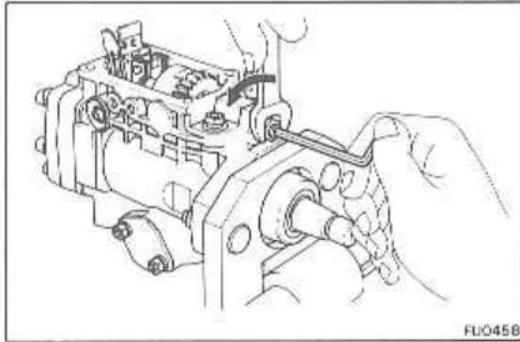
15. ADJUST PROTRUSION OF GOVERNOR SHAFT

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

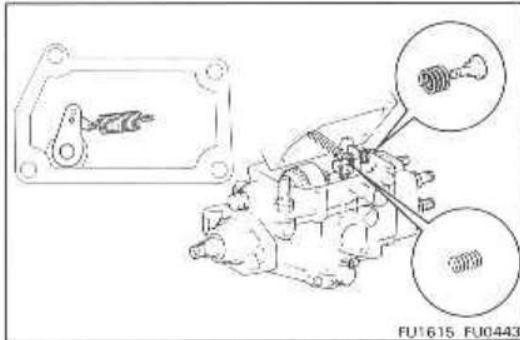
Protrusion: 2.0 – 2.5 mm (0.079 – 0.098 in.)

If the protrusion is not within specification, adjust by turning the governor shaft.

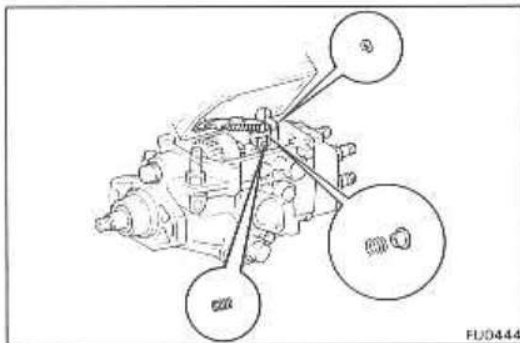


FUEL SYSTEM — Injection Pump**FU-31**

- (b) Install and torque the lock nut while holding the governor shaft with an allen wrench.

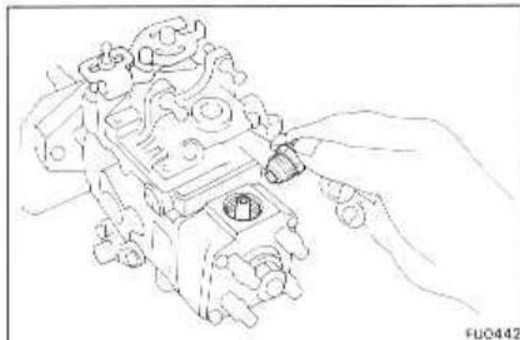
**16. INSTALL GOVERNOR COVER**

- (a) Install a new gasket into the groove of the governor cover.
- (b) [M/T (ex. LX)]
Install the damper spring and governor spring seat, and connect them with the control spring.

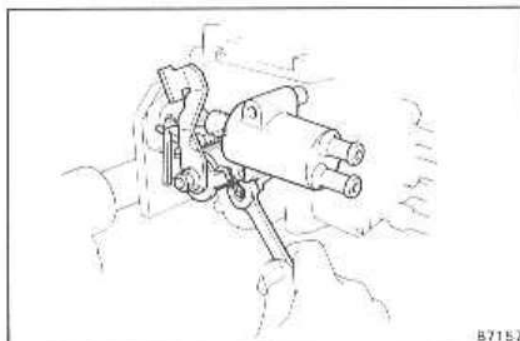
**[M/T (LX) & A/T]**

Install the damper spring and governor spring seat and connect them with the E-ring.

- (c) Install the governor cover with the four bolts.

**17. INSTALL FUEL CUT SOLENOID**

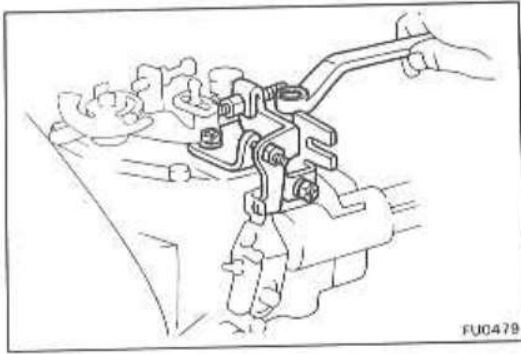
- (a) Install a new O-ring on the fuel cut solenoid.
- (b) Install the valve and spring.
- (c) Install the fuel cut solenoid.
- (d) Connect the lead wire to the fuel cut solenoid.
- (e) Install the lead wire connector to bracket.

18. INSTALL NEW GASKET AND PICKUP SENSOR**19. [LX]****INSTALL THERMO WAX**

Install a new O-ring and thermo wax with two bolts.

FU-32

FUEL SYSTEM — Injection Pump

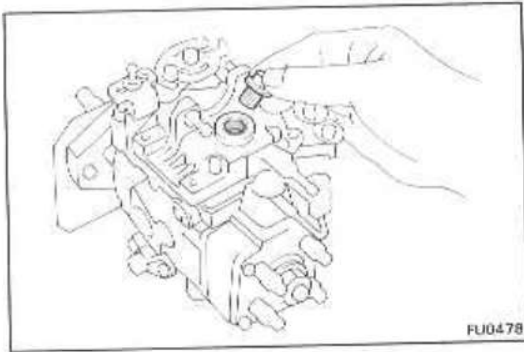


20. [LX]

INSTALL IDLE-UP

Install the idle-up with three bolts.

21. REMOVE INJECTION PUMP FROM STAND



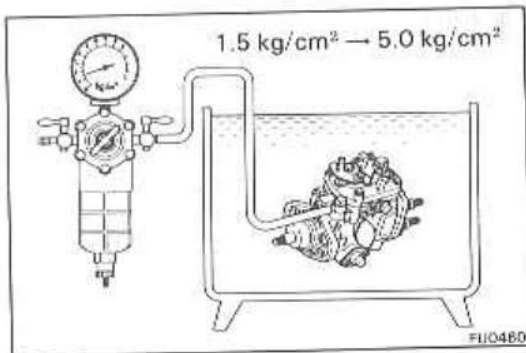
22. PERFORM AIR TIGHT TEST

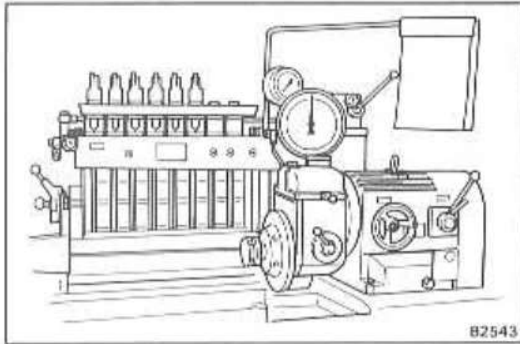
(a) Install a bolt to the overflow port.

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

(c) Apply 1.5 kg/cm² (21 psi, 147 kPa) of pressure and confirm that there are no leaks.

(d) Next check that there are no leaks with 5.0 kg/cm² (71 psi, 490 kPa) of pressure applied.



FUEL SYSTEM — Injection Pump**FU-33****ADJUSTMENT OF INJECTION PUMP****1. PRE-TEST CHECK AND PREPARATION**

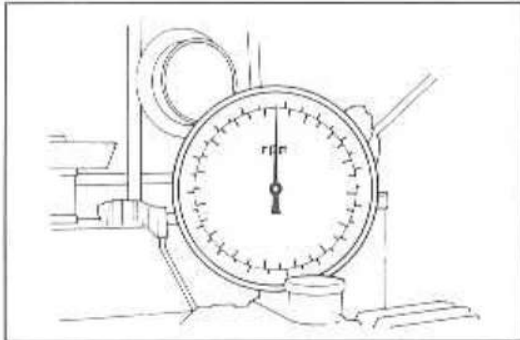
- (a) The specifications for test nozzle and nozzle holders are as follows.

Test nozzle: DN12SD12 (NIPPONDENSO)

Test nozzle holder valve opening pressure:

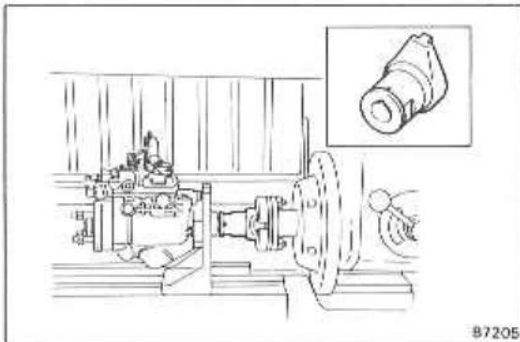
145 – 155 kg/cm²

(2,062 – 2,205 psi, 14,220 – 15,200 kPa)



- (b) Check the accuracy of the tachometer.

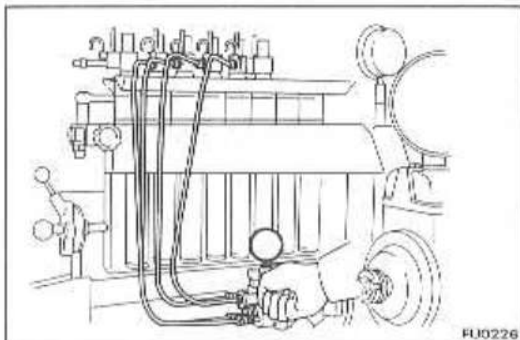
Allowable error: ± 40 rpm



- (c) Install the angle gauge stand.

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

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



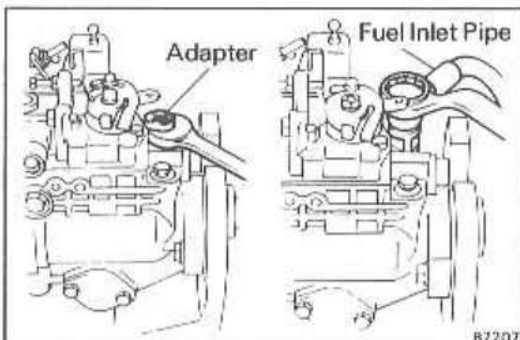
- (e) Connect the injection pump to the pump tester with high pressure pipes of the following dimensions.

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: More than 25 mm (0.98 in.)

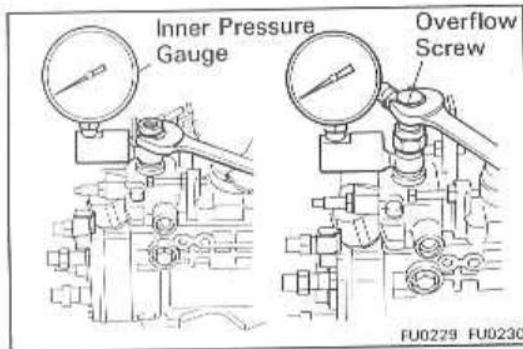


- (f) Remove the fuel inlet union.

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

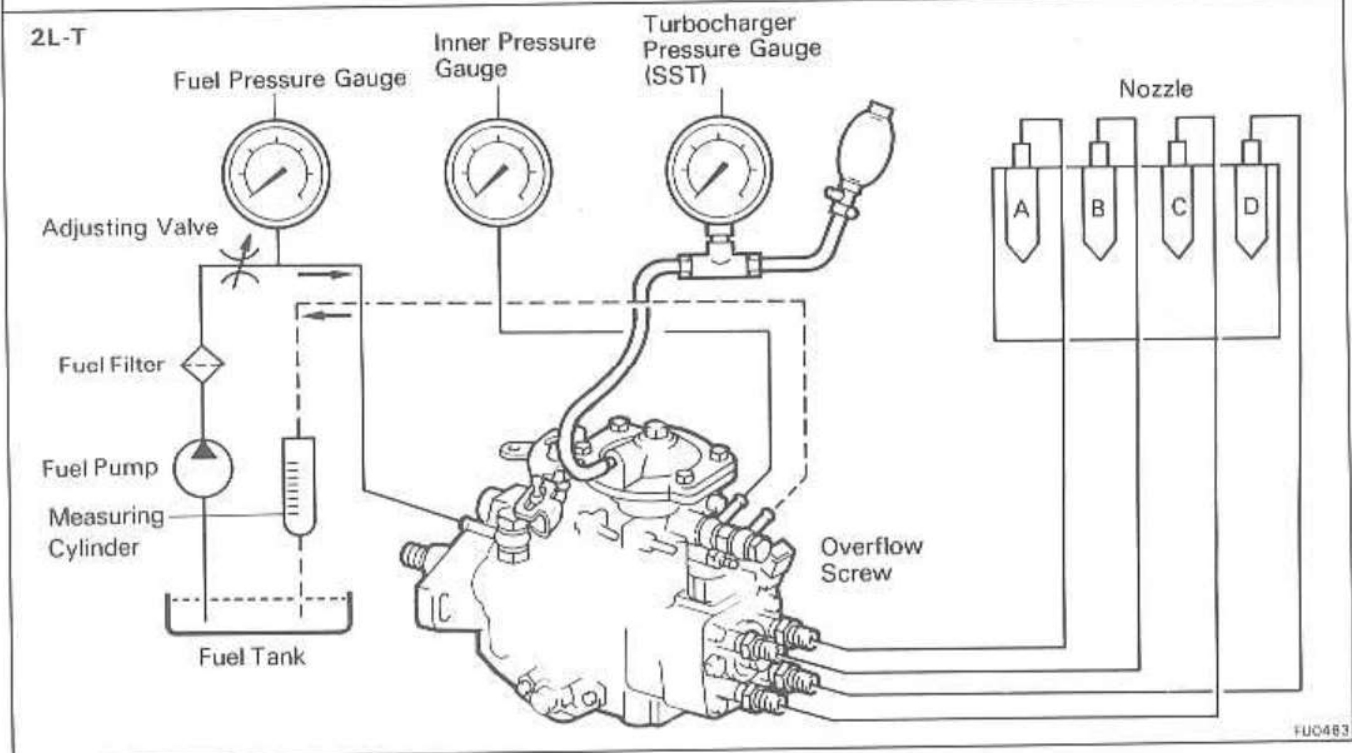
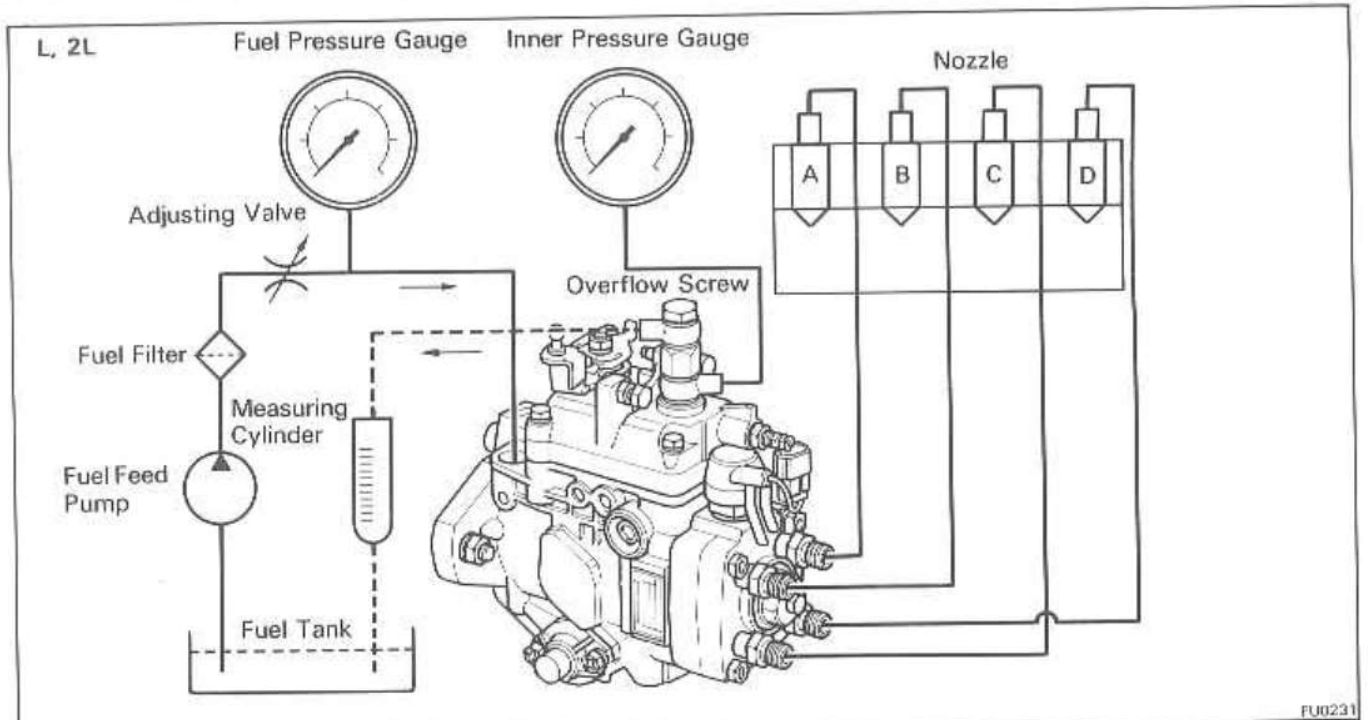
FU-34

FUEL SYSTEM — Injection Pump



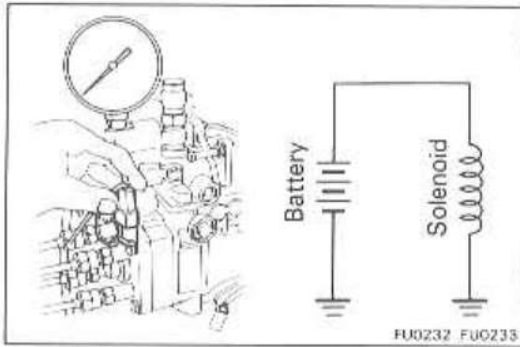
- (g) Install the inner pressure gauge with a hollow screw. On top, install an overflow hose with the overflow screw.

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



FUEL SYSTEM — Injection Pump

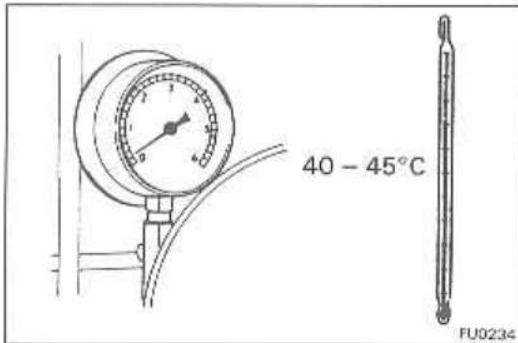
FU-35



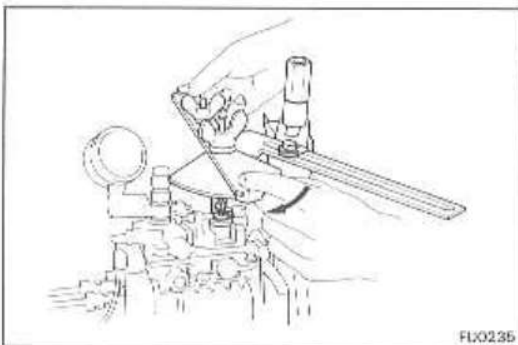
- (h) Apply about 12 volts of DC power to the fuel cut solenoid.

CAUTION:

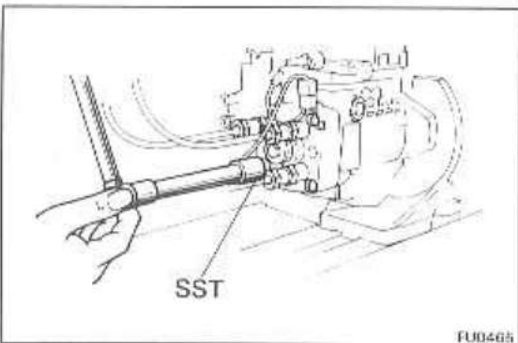
1. When applying voltage to the solenoid, position the battery as far away from the solenoid as possible so that a spark does not occur.
2. When connecting the battery cable, connect the solenoid side first.



- (i) 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).

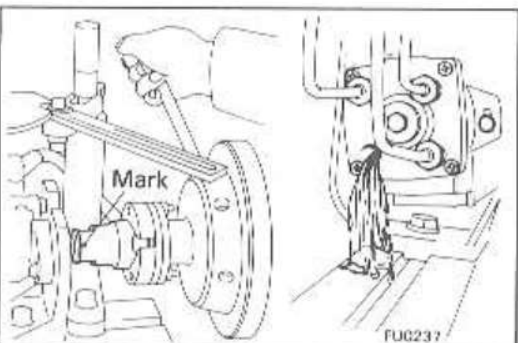


- (j) Install an angle gauge to the stand and set it to the adjusting lever.
(k) Secure the adjusting lever fully on the maximum speed side.



- (l) Check the installation direction of the camplate.
(1) Disconnect the injection pipe from the position marked "C" on the distributive head.
(2) Using SST, remove the delivery valve holder.

SST 09260-54012

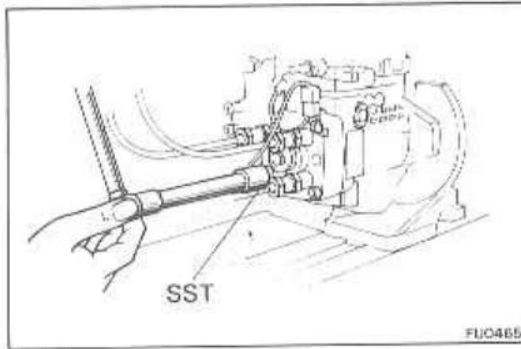


- (3) Check that fuel is flowing out when the mark is in the position shown in the figure. If not, it is improperly assembled.
(4) Disassemble and change the camplate position 180° in the opposite direction.

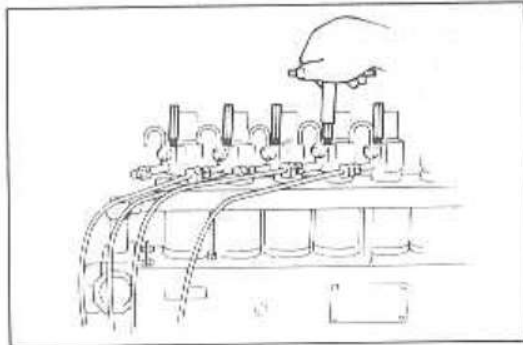
NOTE: Disconnect the fuel cut solenoid wire harness.

FU-36

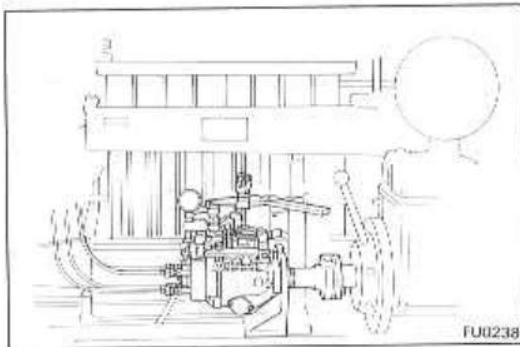
FUEL SYSTEM — Injection Pump



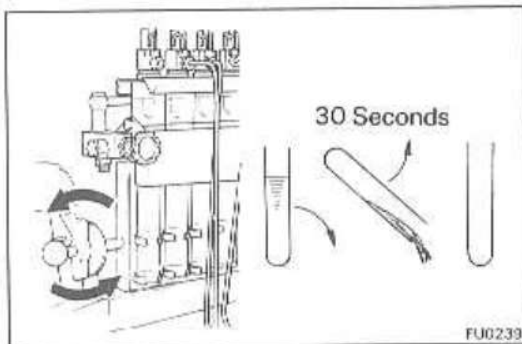
- (5) Using SST, install the delivery valve holder.
SST 09260-54012
- (6) Connect the injection pipe.



- (m) Bleed the air from the injection pipes.



- (n) Race the injection pump for 5 minutes at 2,000 rpm.
CAUTION: Check that there is no fuel leakage or abnormal noise.

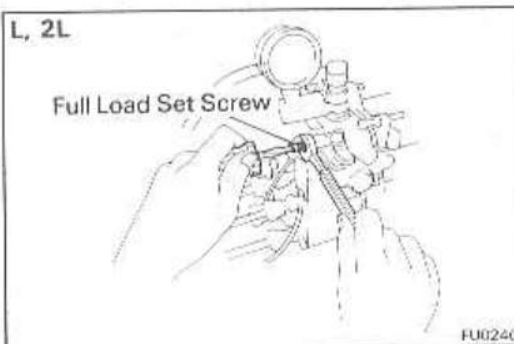


NOTE:

- 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.

L, 2L

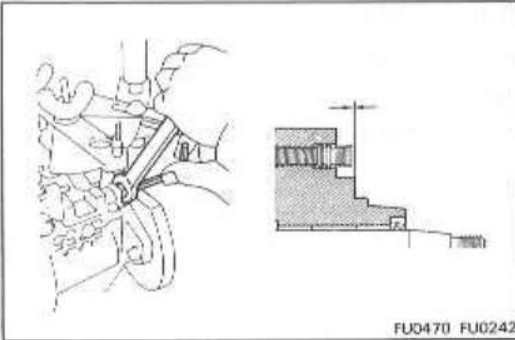
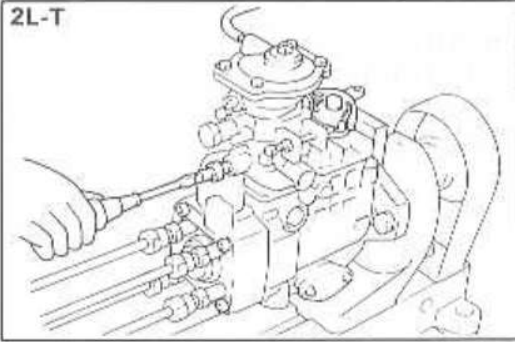
Full Load Set Screw



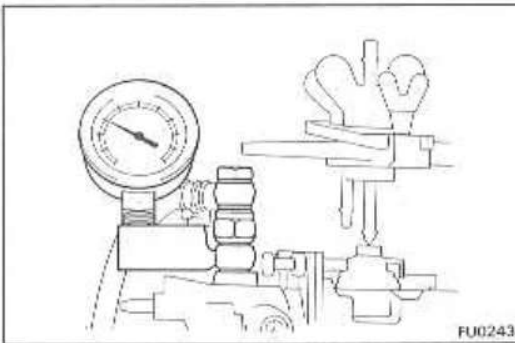
2. PRE-SETTING OF FULL LOAD INJECTION VOLUME

- (a) (2L-T)
Apply 0.48 kg/cm² (6.8 psi, 47 kPa) of pressure to the boost compensator.
- (b) Adjust the injection volume with the FULL LOAD SET SCREW.

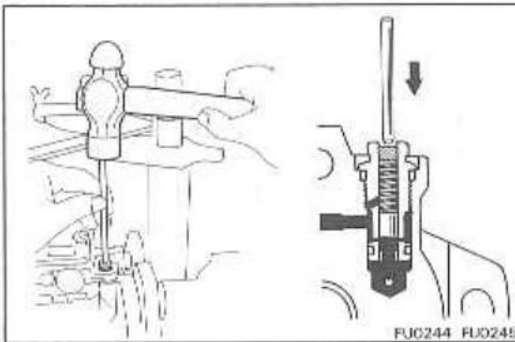
Item	Pump rpm	No. of measuring strokes	Injection volume cc (cu. in.)
L	1,200	200	7.54 – 7.86 (0.46 – 0.48)

FUEL SYSTEM — Injection Pump**FU-37****2L-T**

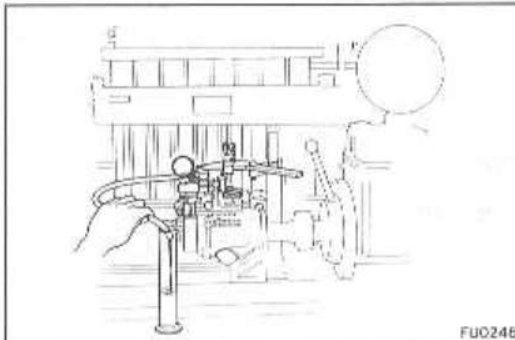
FU0470 FU0242



FU0243



FU0244 FU0245



FU0246

Cont'd

Item	Pump rpm	No. of measuring strokes	Injection volume cc (cu. in.)
2L	1,200	200	9.34 – 9.66 (0.57 – 0.59)
			9.24 – 9.56 (0.56 – 0.58)
2L-T	1,200	200	10.4 – 13.6 (0.63 – 0.83)

NOTE: The injection volume will increase about 3 cc (0.2 cu. in.) with each 1/2 turn of the screw.

3. PRE-SETTING OF LOAD SENSING TIMER

Adjust the protrusion of the governor shaft.

Protrusion: 2.0 – 2.5 mm (0.079 – 0.098 in.)

4. ADJUST PUMP INNER PRESSURE

Measure the pump inner pressure at each of the listed rpms.

Item	Pump rpm	Inner pressure kg/cm ² (psi, kPa)
2L	400	2.2 – 2.8 (31 – 40, 216 – 275)
		5.8 – 6.4 (82 – 91, 569 – 628)
	2,000	2.2 – 2.8 (31 – 40, 216 – 275)
		6.2 – 6.8 (88 – 97, 608 – 667)
Others	400	2.2 – 2.8 (31 – 40, 216 – 275)
	2,200	6.7 – 7.3 (95 – 104, 657 – 716)

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

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

5. CHECK OVERFLOW VOLUME

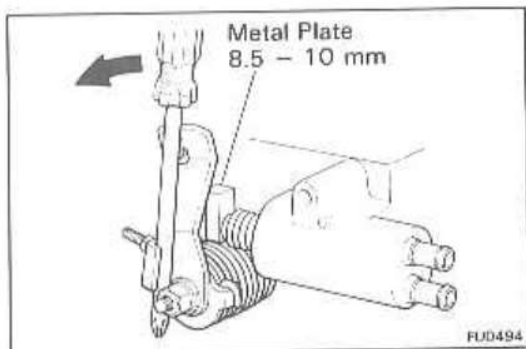
Measure the overflow volume at the below listed rpm.

Item	Pump rpm	Over flow volume cc/min. (cu. in./min.)
2L	1,850	330 – 750 (20.1 – 45.8)
	2,000	350 – 770 (21.4 – 47.0)
Others	2,200	370 – 800 (22.6 – 48.8)

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

FU-38

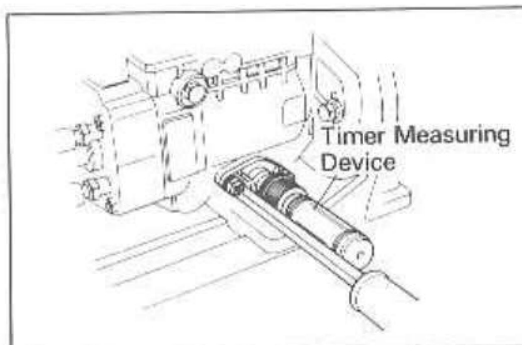
FUEL SYSTEM — Injection Pump



6. [LX] RELEASE COLD STARTING SYSTEM FOR FOLLOWING INSPECTIONS

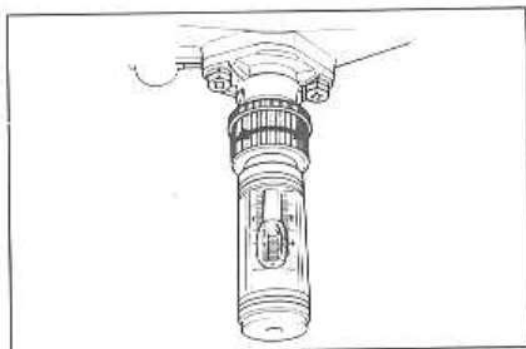
Using a screwdriver, turn the cold start lever counterclockwise and put a metal plate of 8.5 - 10 mm (0.335 - 0.394 in.) in thickness between the lever and thermo wax.

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



7. CHECK AND ADJUST TIMER

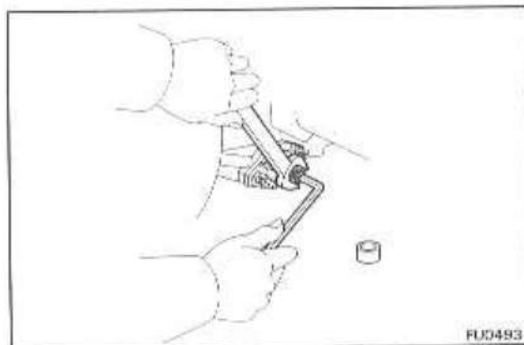
- Remove the timer cover.
- Install the timer measuring device.
Part No. 95095-10220 (NIPPONDENSO)
- Set the timer measuring device at zero.
- (2L-T)
Apply 0.48 kg/cm² (6.8 psi, 47 kPa) of pressure to the boost compensator.
- Measure the piston stroke at the below listed rpms.



Item	Pump rpm	Piston stroke	mm (in.)
L	800	0.8 - 1.6	(0.031 - 0.063)
	1,200	2.4 - 3.2	(0.094 - 0.126)
	2,000	5.6 - 6.4	(0.220 - 0.252)
	2,300	6.36 - 7.16	(0.2504 - 0.2819)
2L	LX	800	2.0 - 2.8 (0.079 - 0.110)
		1,200	3.6 - 4.4 (0.142 - 0.173)
		2,000	6.8 - 7.6 (0.268 - 0.299)
		2,300	7.6 - 8.4 (0.299 - 0.331)
	LS Hong kong & Singapore	800	0.8 - 1.6 (0.031 - 0.063)
		1,200	2.4 - 3.2 (0.094 - 0.126)
		1,750	4.55 - 5.35 (0.1791 - 0.2106)
	LN56 & LY Australia	800	0.8 - 1.6 (0.031 - 0.063)
		1,200	2.4 - 3.2 (0.094 - 0.126)
		1,900	5.2 - 6.0 (0.205 - 0.236)
	Others	800	0.8 - 1.6 (0.031 - 0.063)
		1,200	2.4 - 3.2 (0.094 - 0.126)
		2,000	5.6 - 6.4 (0.220 - 0.252)
		2,300	6.36 - 7.16 (0.2504 - 0.2819)
2L-T	800	1.9 - 2.7	(0.075 - 0.106)
	1,200	3.3 - 4.1	(0.130 - 0.161)
	2,000	6.1 - 6.9	(0.240 - 0.272)
	2,300	6.76 - 7.58	(0.2661 - 0.2984)

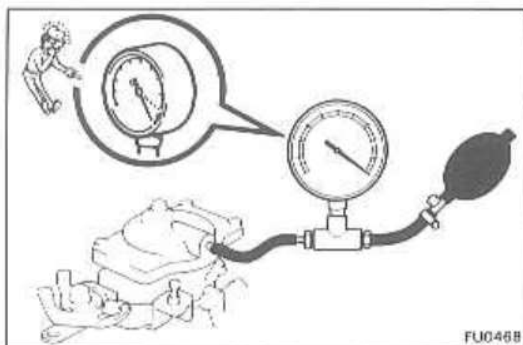
If any stroke is not within standard, adjust with the **TIMER ADJUSTING SCREW**.

CAUTION: Check that there is a washer on LH cover side of the spring.



FUEL SYSTEM — Injection Pump

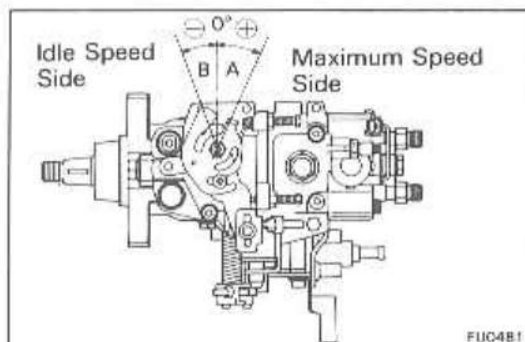
FU-39



8. [2L-T]

INSPECT AIR TIGHTNESS OF BOOST COMPENSATOR

- Apply 1.36 kg/cm² (19.3 psi, 133 kPa) of pressure to the boost compensator.
- Measure the time it takes for the pressure to drop to 1.33 kg/cm² (18.9 psi, 130 kPa).

Pressure drop: More than 10 seconds9. **CHECK AND ADJUST FULL LOAD INJECTION VOLUME**

- The adjusting lever angle for the adjustment below should be as shown in the figure.

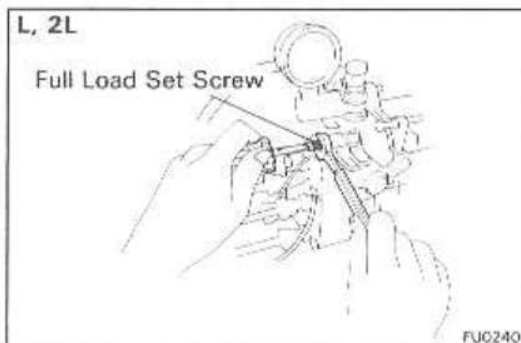
Item	Adjusting lever angle	
	A (Maximum speed side)	B (Idle speed side)
L	Plus 9.0 – 19.0°	Minus 14.0 – 24.0°
2L	LX & A/T	Plus 23.5 – 33.5°
	LS Hong Kong & Singapore	Plus 20.5 – 30.5°
	Others	Plus 23.5 – 33.5°
2L-T	Plus 23.5 – 33.5°	Minus 13.5 – 21.5°

(b) (2L-T)

Apply 0.48 kg/cm² (6.8 psi, 47 kPa) of pressure to the boost compensator.

- Measure the full load injection volume.

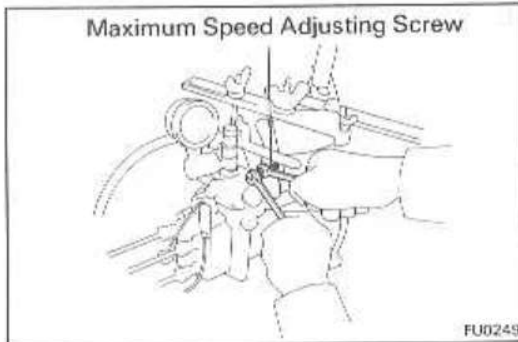
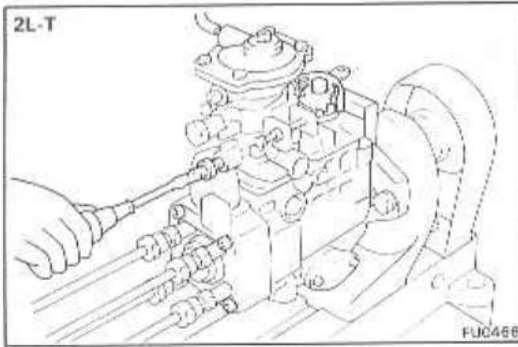
Item	Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume cc (cu. in.)
L	Plus 9.0 – 19.0°	1,200	200	7.54 – 7.86 (0.46 – 0.48)
2L	ex. LS Hong Kong & Singapore	1,200	200	9.34 – 9.66 (0.57 – 0.59)
	LS Hong Kong & Singapore	1,200	200	9.24 – 9.56 (0.56 – 0.58)
2L-T	Plus 23.5 – 33.5°	1,200	200	10.04 – 10.36 (0.61 – 0.63)



If any injection volume is not at standard value, adjust with the **FULL LOAD SET SCREW**.

FU-40

FUEL SYSTEM — Injection Pump



10. ADJUST MAXIMUM SPEED

Adjust to the standard value with the MAXIMUM SPEED ADJUSTING SCREW.

Item		Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume cc (cu. in.)	Remarks
L		Plus 9.0 – 19.0°	2,450	200	3.9 – 4.5 (0.24 – 0.27)	Adjust
			2,250	200	5.7 – 6.9 (0.35 – 0.42)	Check
			2,700	200	Less than 1.3 (0.08)	Check
2L	ex. LS Hong Kong & Singapore	Plus 23.5 – 33.5°	2,450	200	3.8 – 5.4 (0.23 – 0.33)	Adjust
			2,250	200	6.8 – 8.0 (0.41 – 0.49)	Check
			2,700	200	Less than 1.3 (0.08)	Check
	LS Hong Kong & Singapore	Plus 20.5 – 30.5°	2,250	200	3.8 – 5.4 (0.23 – 0.33)	Adjust
			2,000	200	7.4 – 8.6 (0.45 – 0.52)	Check
			2,500	200	Less than 1.3 (0.08)	Check
2L-T *	*	Plus 23.5 – 33.5°	2,450	200	3.2 – 5.2 (0.20 – 0.32)	Adjust
			2,250	200	6.7 – 8.5 (0.41 – 0.52)	Check
			2,700	200	Less than 1.3 (0.08)	Check

* Apply 0.48 kg/cm² (6.8 psi, 47 kPa) pressure

11. CHECK INJECTION VOLUME

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
L	Plus 9.0 – 19.0°	1,200	200	7.54 – 7.86 (0.46 – 0.48)	0.4 (0.02)	Basic full-load injection volume
		100	200	8.2 – 12.0 (0.50 – 0.73)	0.8 (0.05)	Volume during starting
		350	200	7.0 – 9.6 (0.43 – 0.59)	0.5 (0.03)	–
		500	200	6.3 – 7.3 (0.38 – 0.45)	0.5 (0.03)	–
		2,100	200	6.5 – 7.4 (0.40 – 0.45)	0.5 (0.03)	–

FUEL SYSTEM — Injection Pump

FU-41

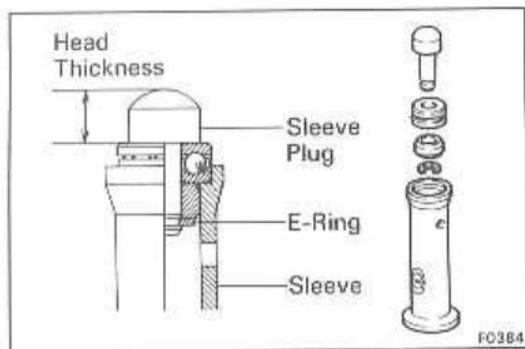
Cont'd

Item		Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume cc (cu. in.)	Variation limit cc (cu. in.)	Remarks
2L	LN56 & LY Australia	Plus 23.5 – 33.5°	1,200	200	9.34 – 9.66 (0.57 – 0.59)	0.4 (0.02)	Basic full-load injection volume
			100	200	8.6 – 12.4 (0.52 – 0.76)	0.8 (0.05)	Volume during starting
			500	200	7.2 – 8.2 (0.44 – 0.50)	0.5 (0.03)	–
			2,000	200	7.8 – 8.7 (0.48 – 0.53)	0.5 (0.03)	–
	LS Hong Kong & Singapore	Plus 20.5 – 30.5°	1,200	200	9.24 – 9.56 (0.56 – 0.58)	0.4 (0.02)	Basic full-load injection volume
			100	200	6.6 – 10.4 (0.40 – 0.63)	0.8 (0.05)	Volume during starting
			500	200	7.6 – 8.6 (0.46 – 0.52)	0.5 (0.03)	–
			1,850	200	8.1 – 9.0 (0.49 – 0.55)	0.5 (0.03)	–
	M/T, ex. LS Hong Kong, Singapore & Australia (LN56 & LY)	Plus 23.5 – 33.5°	1,200	200	9.34 – 9.66 (0.57 – 0.59)	0.4 (0.02)	Basic full-load injection volume
			100	200	8.6 – 12.4 (0.52 – 0.76)	0.8 (0.05)	Volume during starting
			500	200	7.2 – 8.2 (0.44 – 0.50)	0.5 (0.03)	–
			2,100	200	7.6 – 8.5 (0.46 – 0.52)	0.5 (0.03)	–
			350	200	7.7 – 10.3 (0.47 – 0.63)	0.5 (0.03)	–
	A/T & LX, ex. LS Hong Kong & Singapore	Plus 23.5 – 33.5°	1,200	200	9.34 – 9.66 (0.57 – 0.59)	0.4 (0.02)	Basic full-load injection volume
			100	200	8.6 – 12.4 (0.52 – 0.76)	0.8 (0.05)	Volume during starting
			500	200	7.2 – 8.2 (0.44 – 0.50)	0.5 (0.03)	–
2,100			200	7.6 – 8.5 (0.46 – 0.52)	0.5 (0.03)	–	
2L-T		Plus 23.5 – 33.5°	*1 1,200	200	10.04 – 10.36 (0.61 – 0.63)	0.4 (0.02)	Basic full-load injection volume
			100	200	10.2 – 13.6 (0.62 – 0.83)	0.8 (0.05)	Volume during starting
			*2 500	200	7.3 – 8.1 (0.45 – 0.49)	0.5 (0.03)	–
			*1 2,100	200	10.0 – 11.2 (0.61 – 0.68)	0.5 (0.03)	–

*1: Apply 0.48 kg/cm² (6.8 psi, 47 kPa) pressure*2: Apply 0.04 kg/cm² (0.57 psi, 3.9 kPa) pressure

FU-42

FUEL SYSTEM — Injection Pump

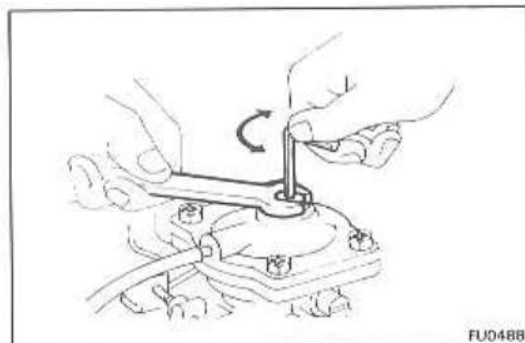


If the injection volume at 100 rpm is not within standard, replace the governor sleeve plug.

Governor sleeve plug head thickness mm (in.)	
3.3 (0.130)	3.7 (0.146)
3.4 (0.134)	3.8 (0.150)
3.5 (0.138)	3.9 (0.154)
3.6 (0.142)	4.0 (0.157)

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

If the variation limit exceeds specification, replace the delivery valve.



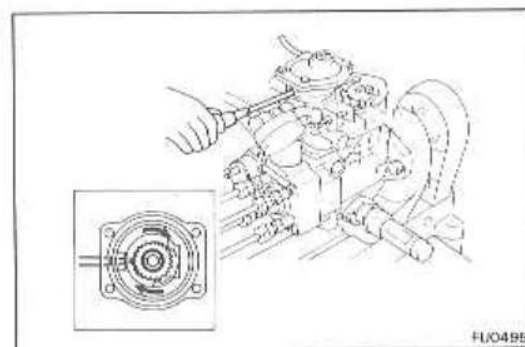
12. [2L-T]

MEASURE AND ADJUST FULL LOAD MINIMUM INJECTION VOLUME

- (a) Measure the injection volume.

Pump rpm	No. of measuring strokes	Injection volume cc (cu. in.)
1,200	200	7.9 – 8.7 (0.48 – 0.53)

- (b) Using an allen wrench, adjust the timer slide stopper.



13. [2L-T]

MEASURE AND ADJUST BOOST COMPENSATOR CHARACTERISTIC

- (a) Apply 0.14 kg/cm² (2.0 psi, 14 kPa) of pressure to the boost compensator.

- (b) Measure the injection volume.

Pump rpm	No. of measuring strokes	Injection volume cc (cu. in.)
1,200	200	8.3 – 9.1 (0.51 – 0.56)

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

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

14. [2L-T]

INSPECT BOOST COMPENSATOR CHARACTERISTIC TENDENCY

- (a) Apply 0.34 kg/cm² (4.8 psi, 33 kPa) of pressure to the boost compensator.

- (b) Measure the injection volume.

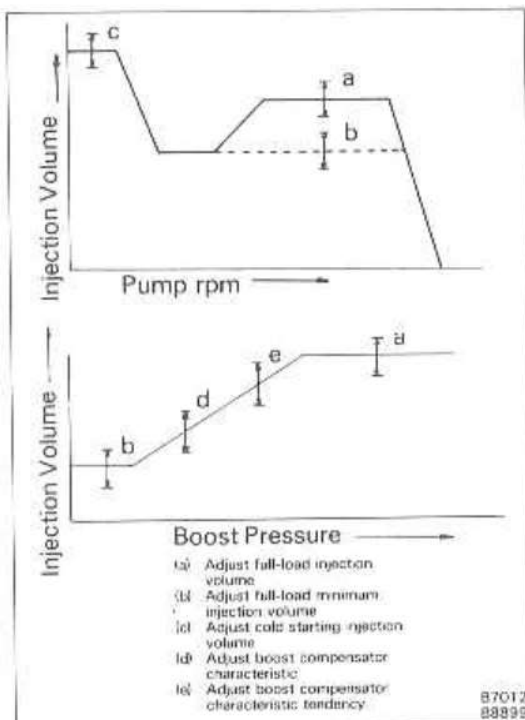
Pump rpm	No. of measuring strokes	Injection volume cc (cu. in.)
1,200	200	9.6 – 10.2 (0.59 – 0.62)

15. [2L-T]

CHECK HYSTERESIS

Compare the injection volume when the boost compensator pressure is lowered from 0.88 (12.5 psi, 86 kPa) to 0 kg/cm² and, conversely, when it is raised from zero.

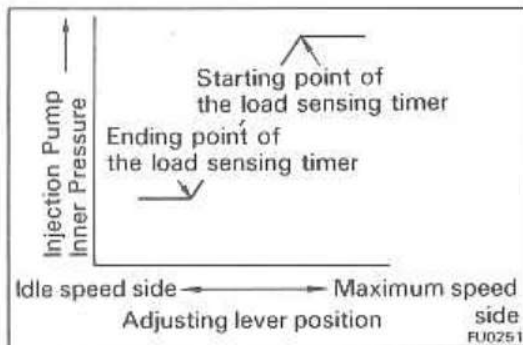
NOTE: Make measurements after moving the adjusting lever between idle and maximum three times for each lowering of the pressure.



FUEL SYSTEM — Injection Pump

FU-43

Pump rpm	Pressure kg/cm ² (psi, kPa)	No. of measuring strokes	Injection volume cc (cu. in.)	Hysteresis cc (cu. in.)
1,200	0.88 (12.5, 86)	200	7.6 – 9.0 (0.46 – 0.55)	—
1,200	0.61 (8.7, 60)	200	9.9 – 10.5 (0.60 – 0.64)	Less than 0.6 (0.04)
1,200	0.34 (4.8, 33)	200	9.6 – 10.2 (0.59 – 0.62)	—
1,200	0.14 (2.0, 14)	200	8.3 – 9.1 (0.51 – 0.56)	Less than 0.3 (0.02)
1,200	0 (0, 0)	200	7.9 – 8.7 (0.48 – 0.53)	—



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

16. ADJUST LOAD SENSING TIMER

- Adjust the starting and ending points of the load sensing timer with the GOVERNOR SHAFT.
- (2L-T)
Apply 0.48 kg/cm² (6.8 psi, 47 kPa) of pressure to the boost compensator.

- Measure the injection volume.

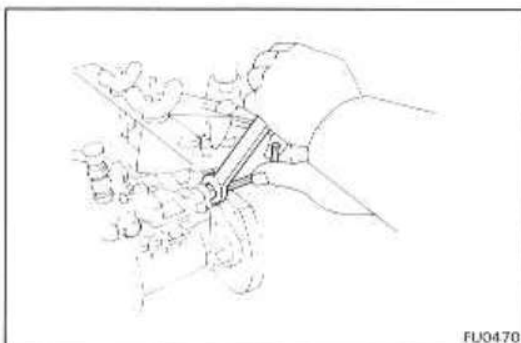
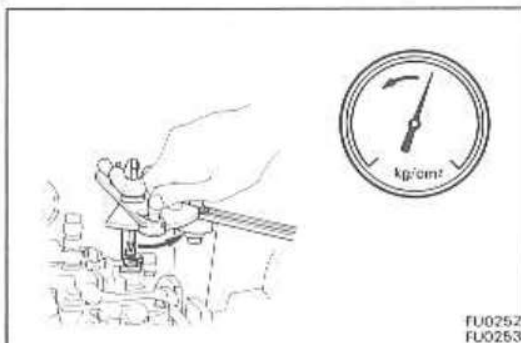
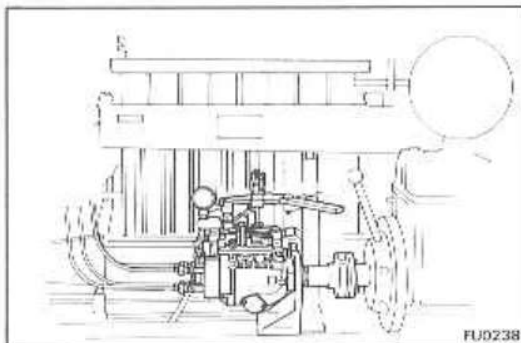
Item	Adjusting lever position	Pump rpm	No. of measuring strokes
L	Maximum speed side	1,200	200
2L		1,200	200
2L-T		1,750	200

- 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. Measure the injection volume at the drop point.

Item	Pump rpm	No. of measuring strokes	Injection volume cc (cu. in.)
L	1,200	200	Measured value at step (c) minus 1.4 (0.09) ± 0.4 (0.02)
2L	1,200	200	
2L-T	1,750	200	

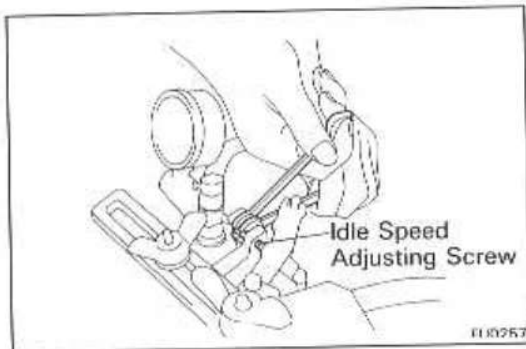
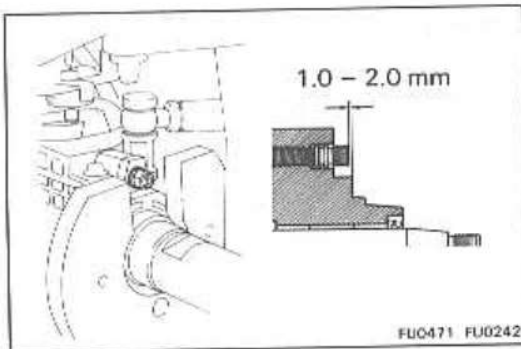
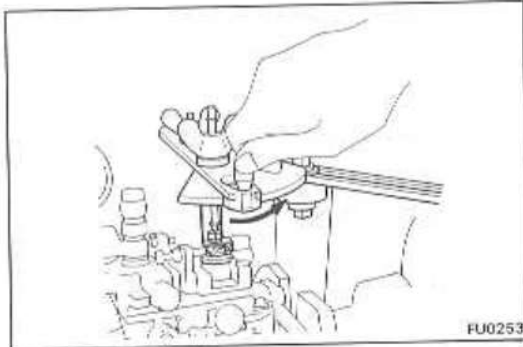
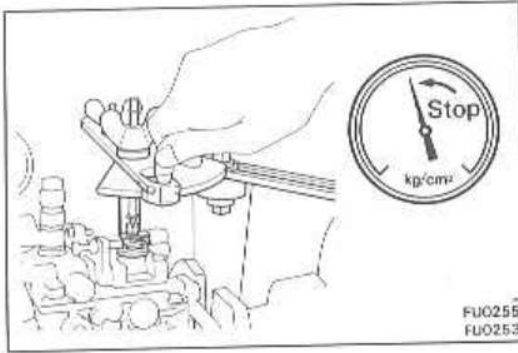
If the injection volume is not within standard, adjust by turning the GOVERNOR SHAFT and perform the measurement (step D) until it is within standard.

NOTE: One-half turn of the governor shaft will alter the injection volume by 3 cc (0.2 cu. in.).



FU-44

FUEL SYSTEM — Injection Pump



- (e) Check the ending 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.)
L	1,200	200	2.6 – 3.0 (0.16 – 0.18)
2L	1,200	200	6.2 – 6.6 (0.38 – 0.40)
2L-T	1,750	200	7.3 – 7.7 (0.45 – 0.47)

- (f) 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.)
L w/o HAC	1,200	1.2 – 1.6 (0.047 – 0.063)
2L w/ HAC	1,200	0.8 – 1.2 (0.031 – 0.047)
2L-T	1,750	1.2 – 1.6 (0.047 – 0.063)

- (g) Check the protrusion of the governor shaft.

Protrusion: 1.0 – 2.0 mm (0.039 – 0.079 in.)

17. ADJUST IDLE SPEED

Adjust the injection volume with the IDLE SPEED ADJUSTING SCREW.

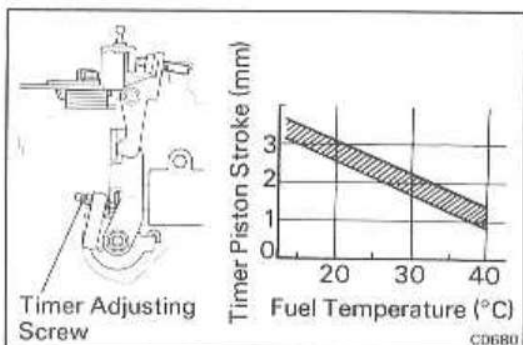
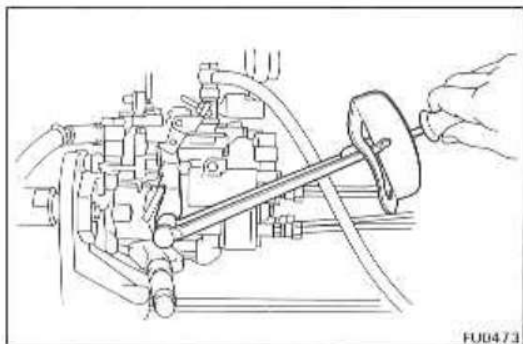
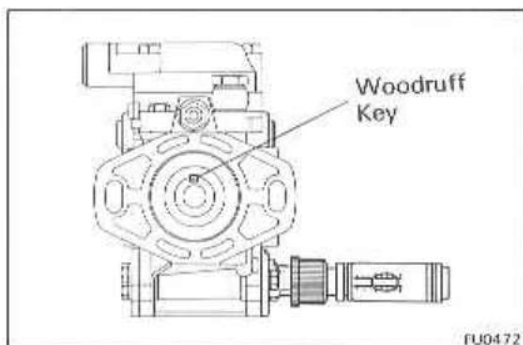
Item	Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume cc (cu. in.)	Variation limit cc (cu. in.)	Remarks
L	Minus 14.0 – 24.0°	350	200	1.1 – 2.1 (0.07 – 0.13)	–	Adjust
		525	200	Less than 0.3 (0.02)	–	Check

FUEL SYSTEM — Injection Pump

FU-45

Cont'd

Item	Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume cc (cu. in.)	Variation limit cc (cu. in.)	Remarks
2L	M/T, ex. LX	350	200	1.3 – 2.3 (0.08 – 0.14)	0.34 (0.021)	Adjust
		525	200	Less than 0.3 (0.02)	–	Check
	A/T & LX	400	200	A = 1.3 – 2.3 (0.08 – 0.14)	0.34 (0.021)	Adjust
		375	200	A add 0.36 (0.022)	–	Check
		475	200	A subtract 0.7 – 1.7 (0.04 – 0.10)	–	Check
2L-T	Minus 13.5 – 21.5°	400	200	A = 1.4 – 2.4 (0.09 – 0.15)	0.34 (0.021)	Adjust
		375	200	A add 0.36 (0.02)	–	Check
		525	200	A subtract 0.7 – 1.7 (0.04 – 0.10)	–	Check
		650	200	Less than 0.4 (0.02)	–	Check



18. [LX]

ADJUST COLD STARTING SYSTEM

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

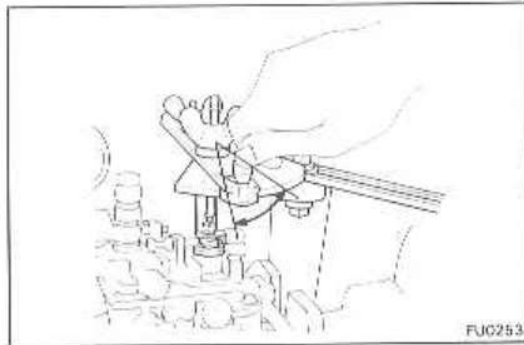
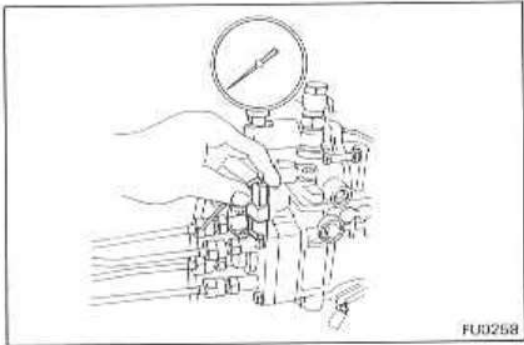
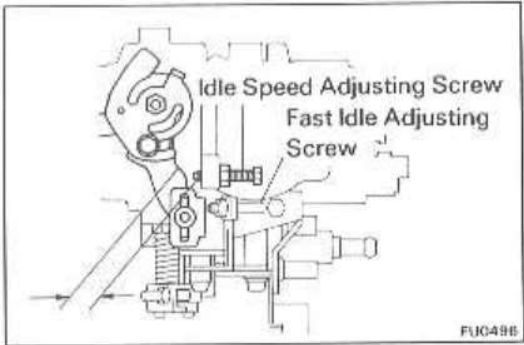
Fuel temperature: 15 – 35°C (59 – 95°F)

- (b) Set the woodruff key on 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 put between the cold starting lever and thermo wax.
- (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.

If not within specification, adjust with the timer adjusting screw.

NOTE: Screw in for stroke decrease.



19. [2L-T]
ADJUST FAST IDLE

Measure the clearance between the adjusting lever and idle speed adjusting screw.

Fuel temperature	Clearance
20°C (68°F)	6 mm (0.24 in.)
50°C (122°F)	0 mm (0 in.)

20. POST ADJUSTMENT CHECK

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

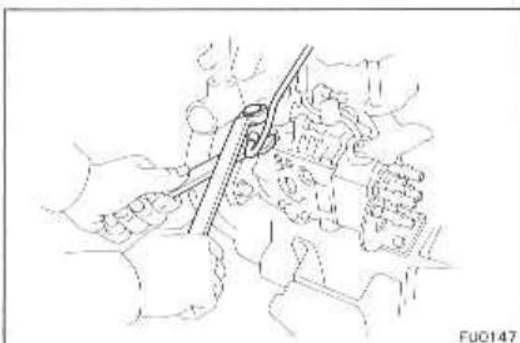
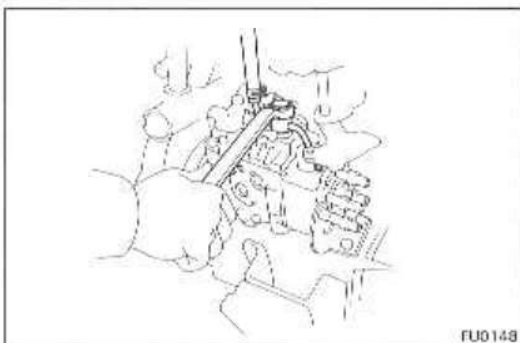
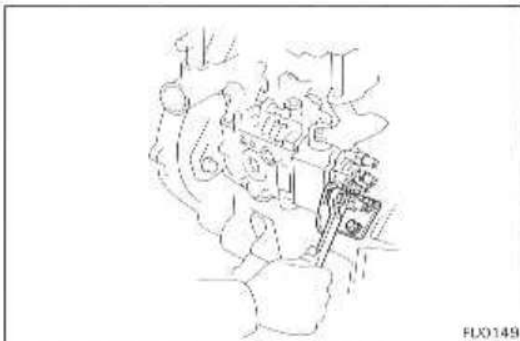
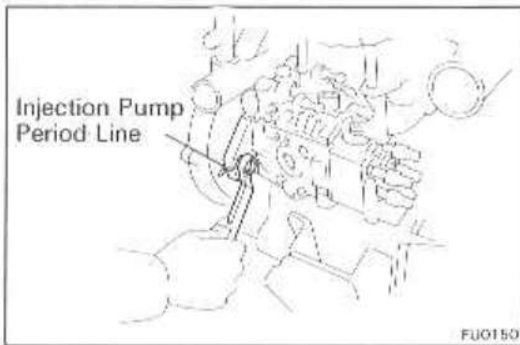
Pump revolution: 100 rpm

- (b) Check the idle adjusting lever movement.

Item		Adjusting lever angle
L		30 – 36°
2L 2L-T	2L A/T & LX70	41 – 51°
	2L M/T & LX71 ex. LS Hong Kong & Singapore	43 – 49°
	LS Hong Kong & Singapore	40 – 46°

FUEL SYSTEM — Injection Pump

FU-47

**INSTALLATION OF INJECTION PUMP**

(See page FU-13)

1. INSTALL INJECTION PUMP

- (a) Align the injection pump period lines on the injection pump and oil pump body.
- (b) Install and torque the two nuts holding the injection pump to the oil pump body.

Torque: 210 kg-cm (15 ft-lb, 21 N·m)

- (c) Install the pump stay with the four bolts. Torque the bolts.

Torque: 185 kg-cm (13 ft-lb, 18 N·m)**2. INSTALL INJECTION PUMP DRIVE PULLEY**
(See page EM-26)**3. INSTALL TIMING BELT**
(See steps 6 to 16 on pages EM-26 to 30)**4. INSTALL FUEL OUTLET PIPE**

Install new gaskets and the outlet pipe with the union bolt.
Torque the union bolt.

Torque: 230 kg-cm (17 ft-lb, 23 N·m)**5. INSTALL FUEL INLET PIPE**

Install new gaskets and the inlet pipe with the union nut.
Torque the union nut.

Torque: 230 kg-cm (17 ft-lb, 23 N·m)**6. INSTALL FOUR INJECTION PIPES**
(See page FU-12)**7. [2L-T]**
INSTALL ACCELERATOR LINK**8. [LX]**
CONNECT NO. 1 AND NO. 2 WATER BY-PASS HOSES**9. INSTALL ACCELERATOR CONNECTING ROD****10. CONNECT FUEL HOSES TO INLET AND OUTLET FUEL PIPES****11. CONNECT FUEL CUT SOLENOID CONNECTOR****12. CONNECT PICKUP SENSOR CONNECTOR****13. [2L-T]**
CONNECT BOOST COMPENSATOR HOSE**14. [LX]**
FILL WITH COOLANT

