
ENGINE FUEL

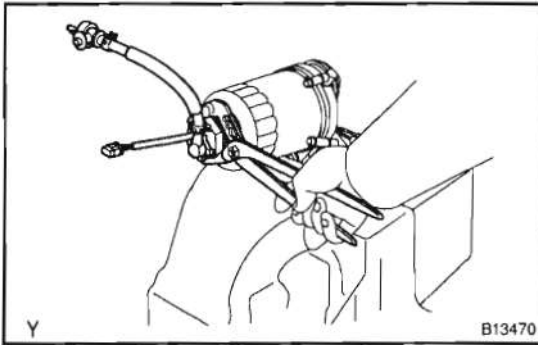
FUEL FILTER	FU-1
FUEL HEATER	FU-3
INJECTOR	FU-4
SUPPLY PUMP	FU-13
COMMON RAIL	FU-20
FUEL PRESSURE LIMITTER	FU-23

FUEL FILTER REPLACEMENT

FU00-01

1. REMOVE FUEL FILTER ASSEMBLY FROM FUEL FILTER SUPPORT
2. DRAIN FUEL FROM FUEL FILTER

Loosen the drain plug, and drain the fuel from the fuel filter.

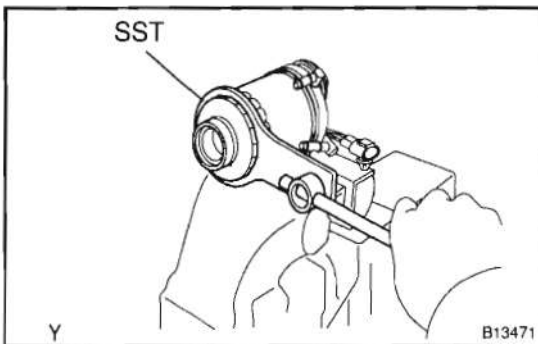


3. REMOVE FUEL FILTER WARNING SWITCH FROM FUEL FILTER

- (a) Mount the fuel filter in a soft jaw vise.
- (b) Using pliers, remove the warning switch and O-ring.

NOTICE:

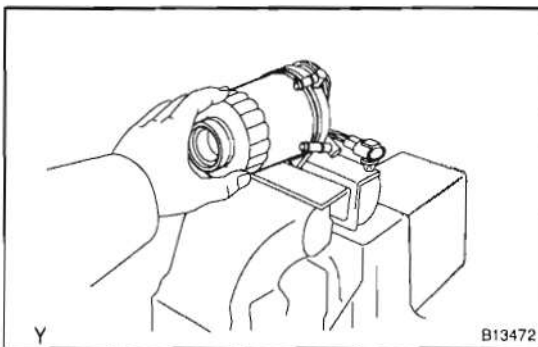
Be careful not to damage the warning switch.



4. REMOVE FUEL FILTER

Using SST, remove the fuel filter.

SST 09228-64010



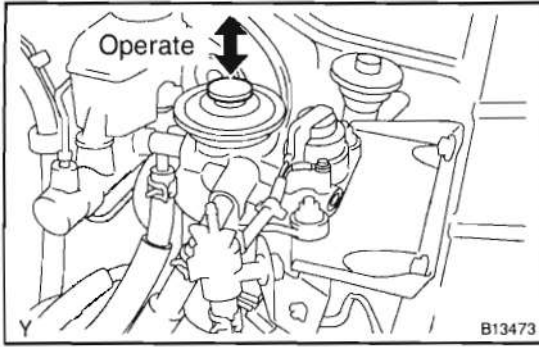
5. INSTALL NEW FUEL FILTER

- (a) Check and clean the fuel filter installation surface.
- (b) Apply fuel to the gasket of a new fuel filter.
- (c) Lightly screw the fuel filter into place, and tighten it until the gasket comes into contact with the seat.
- (d) Tighten it additional 3/4 turn by hand.

6. INSTALL FUEL FILTER WARNING SWITCH TO NEW FUEL FILTER

- (a) Install a new O-ring to the warning switch.
- (b) Apply fuel to the O-ring of the warning switch.
- (c) Install the warning switch to a new fuel filter by hand.

7. REINSTALL FUEL FILTER ASSEMBLY TO FUEL FILTER SUPPORT

**8. REFILL FUEL FILTER WITH FUEL**

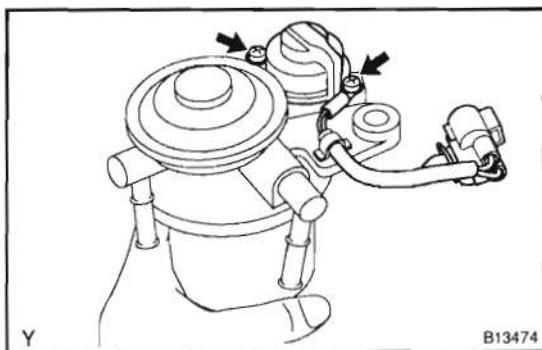
Operate the hand pump until you feel more resistance.

9. START ENGINE AND CHECK FOR FUEL LEAK

FUEL HEATER INSPECTION

FU08P-01

1. REMOVE FUEL HEATER

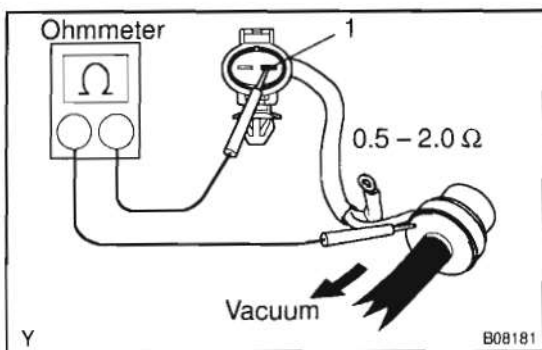


2. INSPECT FUEL HEATER

- Apply a vacuum of 34.7 ± 5.3 kPa (260 ± 40 mmHg, 10.24 ± 1.57 in.Hg) or more to the vacuum switch port.
- Using an ohmmeter, measure the resistance between terminal 1 and the switch body.

Resistance: $0.5 - 2.0 \Omega$ at 20°C (68°F)

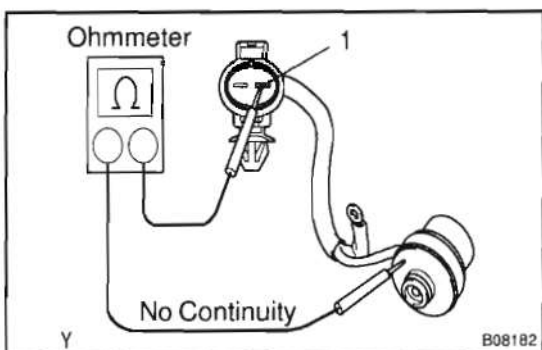
If the resistance is not as specified, replace the fuel heater and vacuum switch assembly.



3. INSPECT VACUUM SWITCH CONTINUITY

Using an ohmmeter, check that there is no continuity between terminal 1 and the switch body.

If continuity is not as specified, replace the fuel heater and vacuum switch assembly.



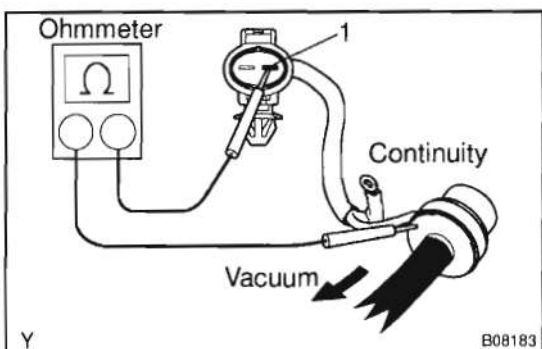
4. INSPECT VACUUM SWITCH OPERATION

- Apply a vacuum of 34.7 ± 5.3 kPa (260 ± 40 mmHg, 10.24 ± 1.57 in.Hg) or more to the vacuum switch port.
- Using an ohmmeter, check that there is continuity between terminal 1 and the switch body.

If operation is not as specified, replace the fuel heater and vacuum switch assembly.

5. REINSTALL FUEL HEATER

Torque: 1.96 N·m (20 kgf·cm, 17 in.-lbf)



INJECTOR

ON-VEHICLE INSPECTION

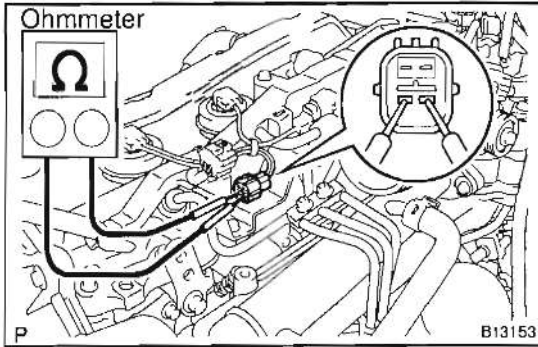
FU080-01

NOTICE:

In case of having the injectors replaced, must replace injection pipes, too.

1. REMOVE INTERCOOLER (See page TC-11)
2. INSPECT INJECTORS

(a) Disconnect the 4 injector connectors.



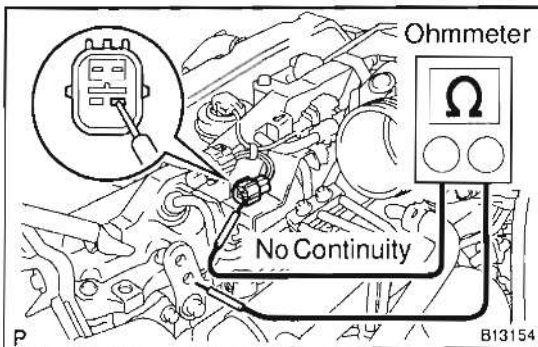
(b) Using an ohmmeter, measure the resistance between terminals as shown.

Resistance: 2.5 – 3.1 Ω at 20°C (68°F)

If the resistance is not specified, replace the injector.

(See page FU-6)

FU



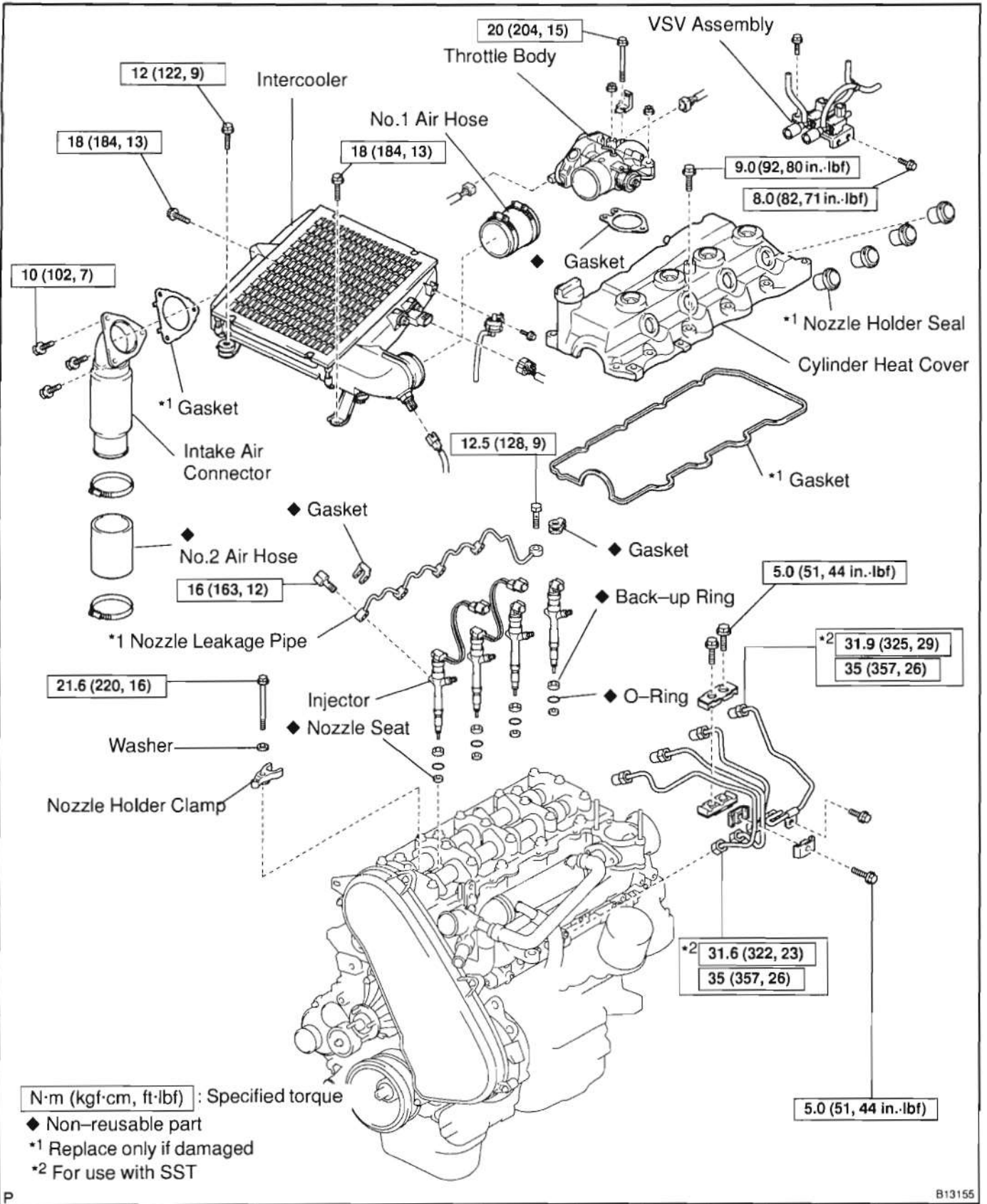
(c) Using an ohmmeter, check that there is no continuity between the injector terminal and ground as shown.

If there is continuity, replace the injector. (See page FU-6)

(d) Reconnect the 4 injector connectors.

3. REINSTALL INTERCOOLER (See page TC-12)

COMPONENTS



FU

P

B13155

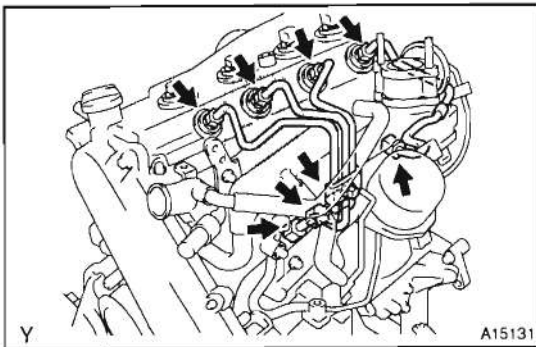
REMOVAL

NOTICE:

When removing the injection pipes, clean them up with a brush and compressed air.

1. REMOVE INTERCOOLER (See page TC-11)
2. DISCONNECT ENGINE WIRE
3. REMOVE DIESEL THROTTLE BODY
(See page ED-5)
4. REMOVE INJECTION PIPE
 - (a) Remove the 2 bolts and injection pipe clamp No. 3.
 - (b) Remove the bolt and injection pipe clamp No. 2
 - (c) Remove the bolt and injection pipe clamp.

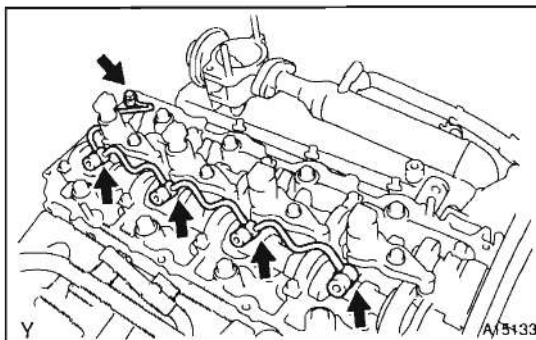
FU



- (d) Using SST, loosen the injection pipe unions of common rail side.
SST 09023-12900
- (e) Using SST, loosen the injection pipe unions of injector side.
SST 09023-12700

NOTICE:

- After removing the fuel pipe, affix the gum tape on the common rail for preventing dust from coming into them.
 - After removing the fuel pipe, put a vinyl bag and rubber band for preventing from mixing foreign objects over the injectors inlet.
5. REMOVE CYLINDER HEAD COVER
(See Page EM-11)



6. REMOVE NOZZLE LEAKAGE PIPE

Remove the union bolt, 4 hollow screws, nozzle leakage pipe and 5 gaskets from the cylinder head and injector.

NOTICE:

- When removing the return pipe, place the shop rag and the likes under pipe.
- Pay attention not to deform or scratch the union seal surface.

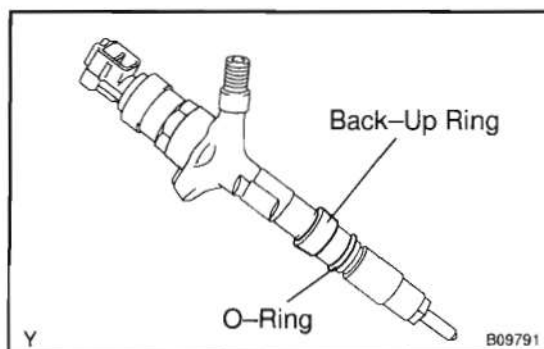
7. REMOVE INJECTORS

(a) Remove the 4 bolts, 4 washers and 4 nozzle holder clamps.

(b) Disconnect the 4 injectors from the cylinder head.

HINT:

Arrange the injectors, clamps, washers and bolts in correct order.



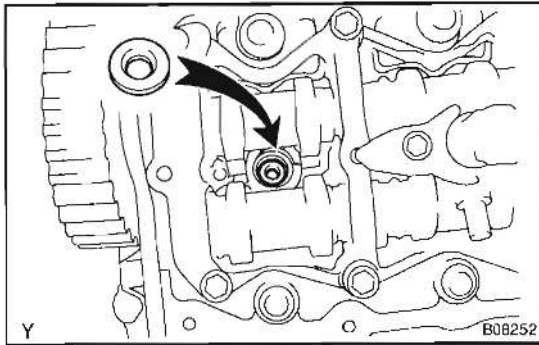
(c) Remove the O-ring and back-up ring from each injector.

(d) Remove the 4 nozzle seats from the cylinder head.

INSTALLATION

NOTICE:

- When installing, clean up the seal surface of the injector, injection pipe, fuel inlet pipe, supply pump and common rail with clean light oil.
- In case of having the common rail and/or injectors replaced, must replace injection pipes, too.
- In case of having the supply pump and/or common rail replaced, must replace fuel inlet pipe, too.



FU

1. INSTALL INJECTORS

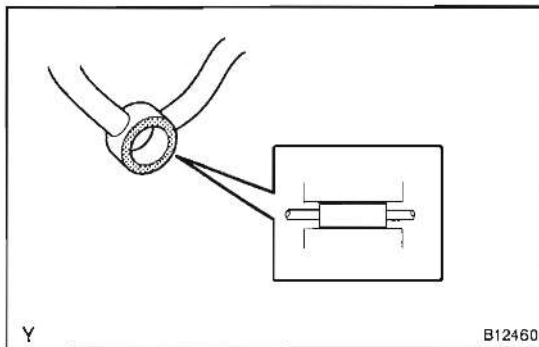
- Install 4 new nozzle seats to the cylinder head.
- Install a new back-up ring and O-ring to each injector.
- Apply a light coat of oil onto O-ring to each injector.
- Install the injector to cylinder head.

NOTICE:

- At this time, insert the injector until it touches the nozzle sheet surface.
 - When installing the injector to the cylinder head and in case that the injector comes to float up with the reaction of O-ring, pull out the injector once, install it again.
 - During the time after equipping the head cover and before installing the injection pipe, install the irregular object prevention cover.
 - Do not exchange the injector cylinder.
- Temporarily install the 4 injection pipes.

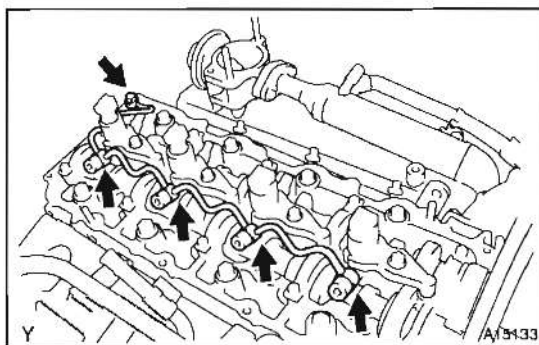
HINT:

For positioning of the infector, temporarily injection pipe.

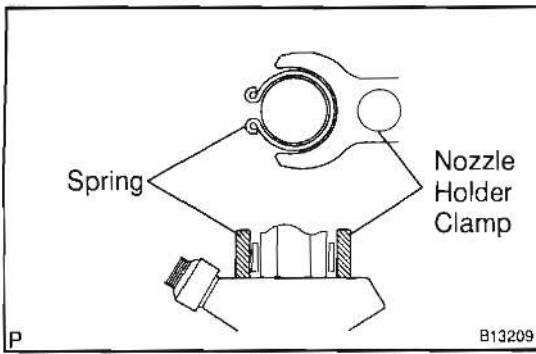


- Check before installing the nozzle leakage pipe using the straight edge that there is no scratch and deformation (dent) on the seal surface of the unions (at five positions). In case of having any scratch of deformation, change it to a new one.

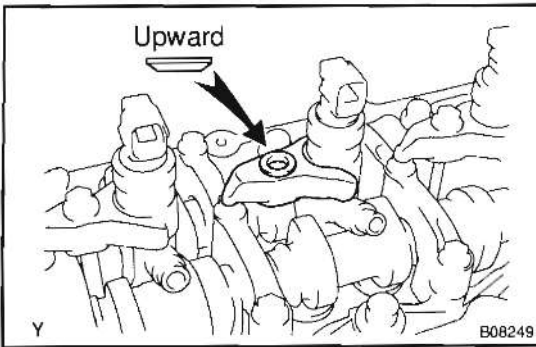
- Place the leakage pipe and 5 new gaskets.
- Apply a light coat of oil onto 4 hollow screws and union bolt.



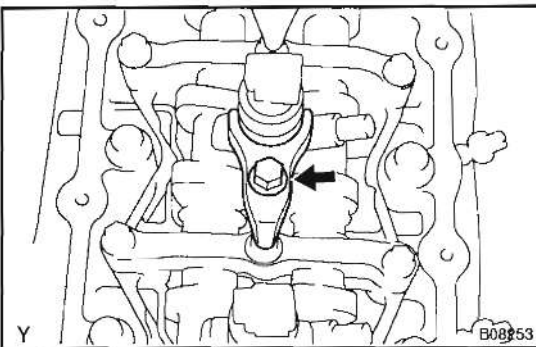
- Tighten the 4 hollow screws and union bolt by hand.



- (j) Set the spring to each injector as shown in the illustration.



- (k) Set the washer on the nozzle holder clamp as shown in the illustration.



- (l) Tighten the bolt.

HINT:

Apply a light coat of engine oil on the threads and under the heads of the nozzle holder clamp bolts.

Torque: 21.6 N·m (220 kgf·cm, 16 ft·lbf)

NOTICE:

- Clip the injector at the fork portion with a clamp which is set on the head of the cam cap bolt. At this time, check that the clamp does not hold the injector at the part where the spring is attached.
- To torque the clamp bolt, temporarily torque it with hand until the bearing surface of the bolt touches the washer, then tighten by the specified torque.
- In case of tighten by the specified torque, pay attention not to tilt the bolt and the clamp.

- (m) Tighten the 4 hollow screws and union bolt.

Torque:

Hollow screw:

16 N·m (163 kgf·cm, 12 ft·lbf)

Union bolt:

12.5 N·m (128 kgf·cm, 9 ft·lbf)

NOTICE:

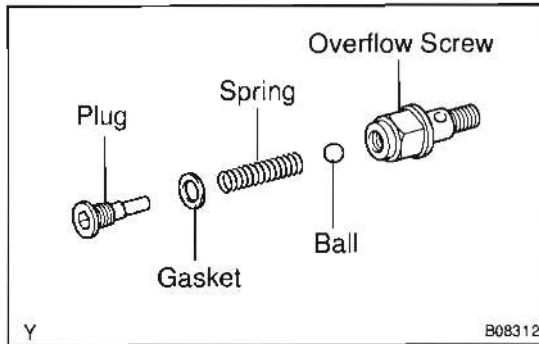
In case of over-torque, the nozzle leakage pipe can not be reused, so change it to new one.

- (n) Remove the 4 injection pipes.

- (o) Check that there are no leaks from nozzle leakage pipe connection.

- (1) Remove the 2 bolts, union bolt, check valve, No. 2 nozzle leakage pipe and 2 gaskets.

- (2) Purchase new check valve.
Part No. 23122 - 27010



- (3) Remove the plug, gasket, spring and ball.
- (4) Install the plug with the gasket to the overflow screw.

Torque: 9.8 N·m (100 kgf·cm, 87 in.-lbf)

- (5) Install the No.2 nozzle leakage pipe and gasket with the check valve to the cylinder head.

Torque: 21 N·m (214 kgf·cm, 15 ft.-lbf)

- (6) Apply a light coat of soapy water (any fluid to detect fuel leakage) on the nozzle leakage pipe connection.
- (7) Using SST (turbocharger pressure gauge), apply the SST to the fuel return side of the No.2 nozzle leakage pipe, and maintain 100 kPa (1.0 kgf/cm², 14.5 psi) of pressure for 60 seconds to check that there are no bubbles from applying the soapy water place.

NOTICE:

When checking the leakage, be sure to remove the ball and spring in the check valve before operating.

SST 09992-00242

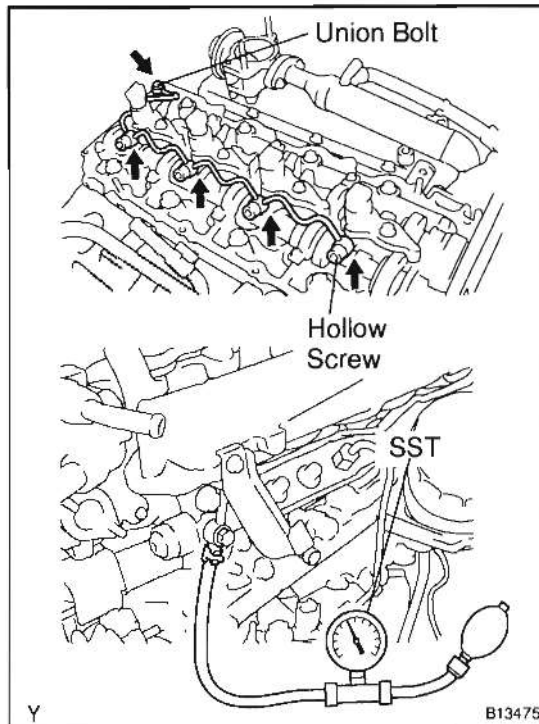
- (8) After checking fuel leaks, wipe off soapy water from nozzle leakage pipe connection.
- (9) Remove SST, check valve, No.2 nozzle leakage pipe and gasket.
- (10) Temporarily install the No. 2 nozzle leakage pipe and 2 new gaskets with the 2 bolts, union bolt and check valve.

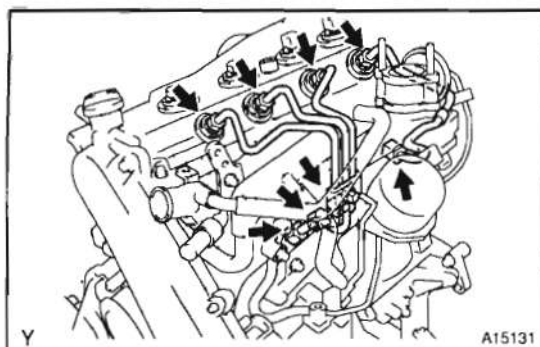
HINT:

Never reinstall the disassembled check valve on the engine.

2. INSTALL CYLINDER HEAD COVER

(See page EM-16)





3. INSTALL INJECTION PIPE

- (a) Temporarily install the 4 injection pipes.
- (b) Install the injection pipe clamp with the bolt.
Torque: 5.0 N·m (51 kgf·cm, 44 in.-lbf)
- (c) Install the injection pipe clamp No. 2 with the bolt.
Torque: 5.0 N·m (51 kgf·cm, 44 in.-lbf)
- (d) Install the injection pipe clamp No. 3 with the 2 bolts.
Torque: 5.0 N·m (51 kgf·cm, 44 in.-lbf)
- (e) Using SST, tighten the injection pipe union of common rail side.
SST 09023-12900
Torque:
31.6 N·m (322 kgf·cm, 23 ft.-lbf) for use with SST
35 N·m (357 kgf·cm, 26 ft.-lbf)

HINT:

Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).

- (f) Using SST, tighten the injection pipe union of injector side.
SST 09023-12700
Torque:
31.9 N·m (325 kgf·cm, 24 ft.-lbf) for use with SST
35 N·m (357 kgf·cm, 26 ft.-lbf)

HINT:

Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).

- (g) Tighten the 2 bolts, union bolt and check valve for No. 2 nozzle leakage pipe.
Torque:
Bolt: 12.7 N·m (130 kgf·cm, 9 ft.-lbf)
Union bolt: 12.7 N·m (130 kgf·cm, 9 ft.-lbf)
Check valve: 21 N·m (214 kgf·cm, 15 ft.-lbf)

4. INSTALL DIESEL THROTTLE BODY

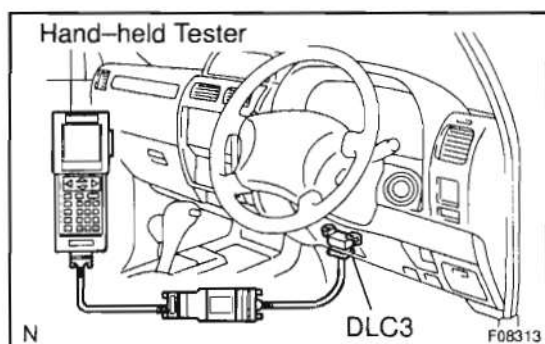
(See page ED-7)

5. CONNECT ENGINE WIRE

NOTICE:

When installing a wire for injector No. 1 and No. 2, check that the number of the wire agrees with that of the injector.

6. INSTALL INTERCOOLER (See page TC-12)



7. CHECK FUEL LEAK

CAUTION:

- During ACTIVE TEST mode, engine speed goes high and combustion noise becomes loud, so pay attention.
 - During ACTIVE TEST mode, fuel becomes high-pressure, so take much care for not expose your eyes, hands, or body to the escaped fuel.
- (a) Check that there are no leaks from any part of the fuel system at the engine stops.

If there is fuel leakage, replace these parts.

- (b) While cranking or start the engine, check that there are no leaks from any part of the fuel system.

If there is fuel leakage, replace these parts.

- (c) Disconnect the return hose from the common rail.
- (d) While cranking the engine, check fuel leaks from the return pipe.

If there is fuel leakage, replace the common rail assembly. (See page FU-21)

- (e) Connect the hand-held tester to the DLC3.
- (f) Start the engine and push the hand-held tester main switch ON.
- (g) Select the FUEL LEAK test of ACTIVE TEST mode on the hand-held tester.
- (h) If you have no hand-held tester, depress the accelerator pedal quickly and fully to increase the engine speed at maximum and keep it for 2 seconds. Repeat this operation several times.
- (i) Check that there are no leaks from any part of the fuel system.

NOTICE:

However, if the leakage from the return pipe is less than 10 cc (0.6 cu in.) in a minute, it is acceptable.

If there is fuel leakage, replace these parts.

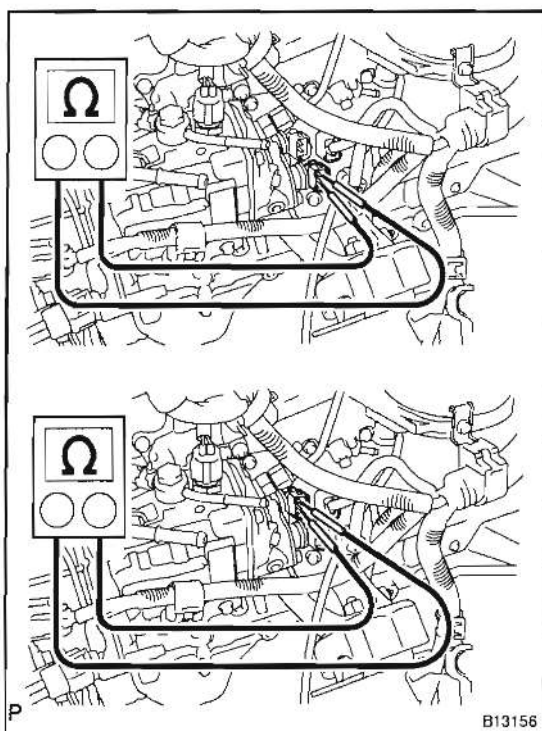
- (j) Reconnect the return hose to the common rail.

SUPPLY PUMP ON-VEHICLE INSPECTION

FU08U-01

INSPECT SCV1 AND SCV2

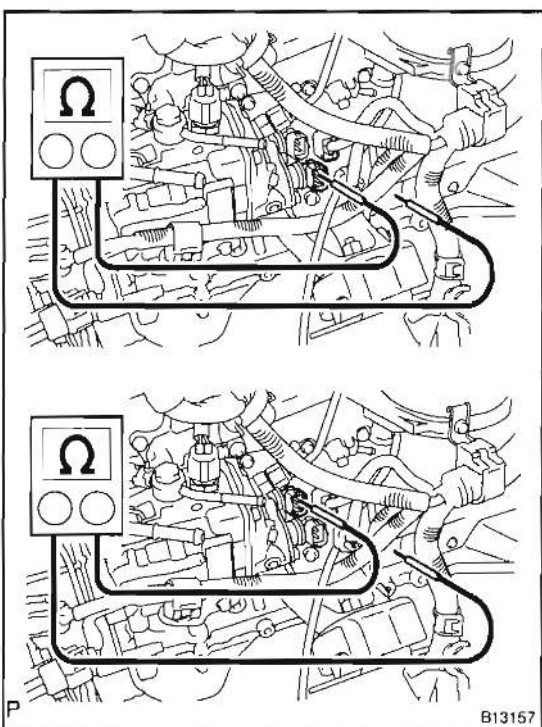
(a) Disconnect the SCV1 and SCV2 connectors.



(b) Using an ohmmeter, measure the resistance between terminals as shown.

Resistance: 1.5 – 1.7 Ω at 20°C (68°F)

If the resistance is not specified, replace the pump
(See page FU-14).

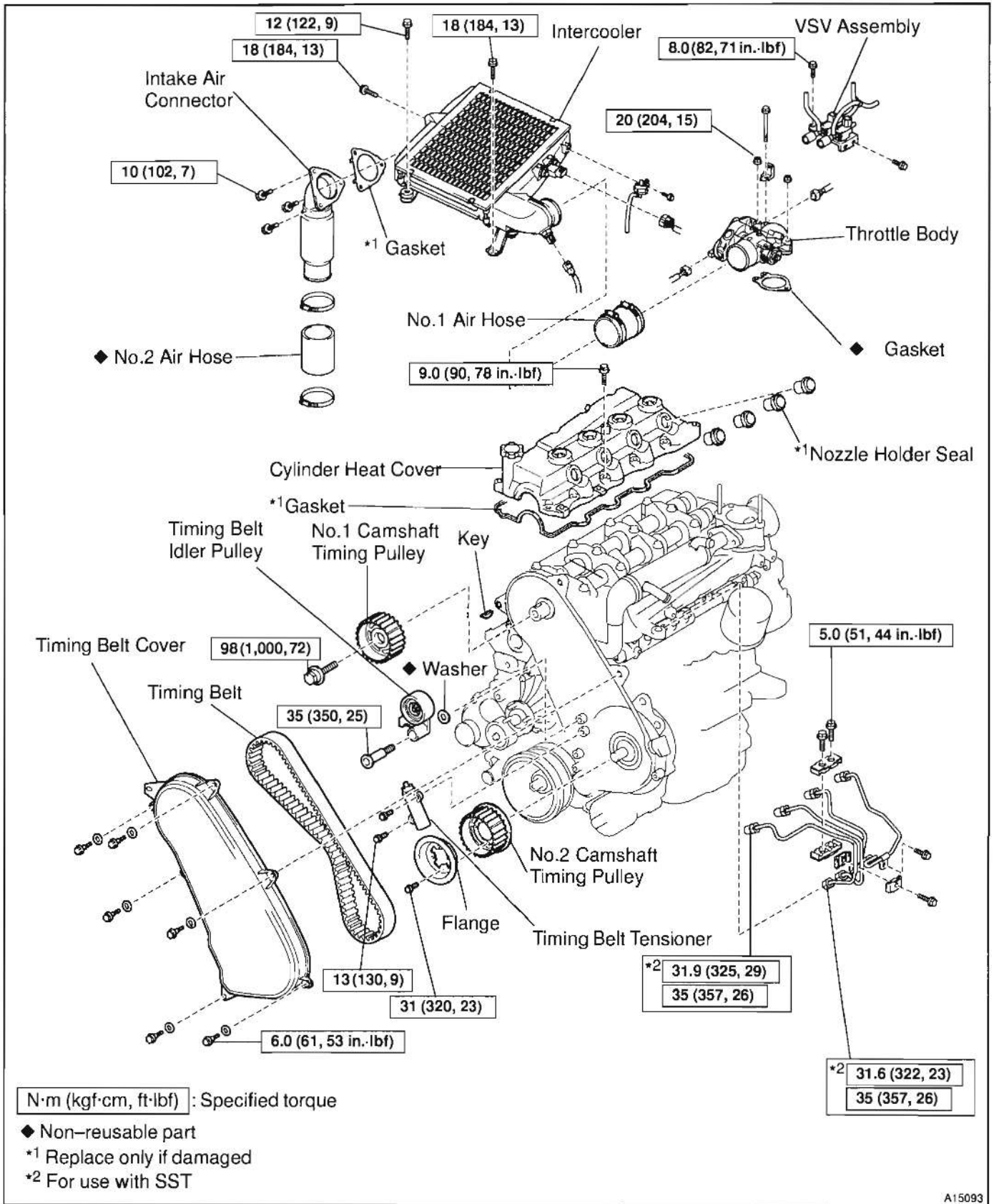


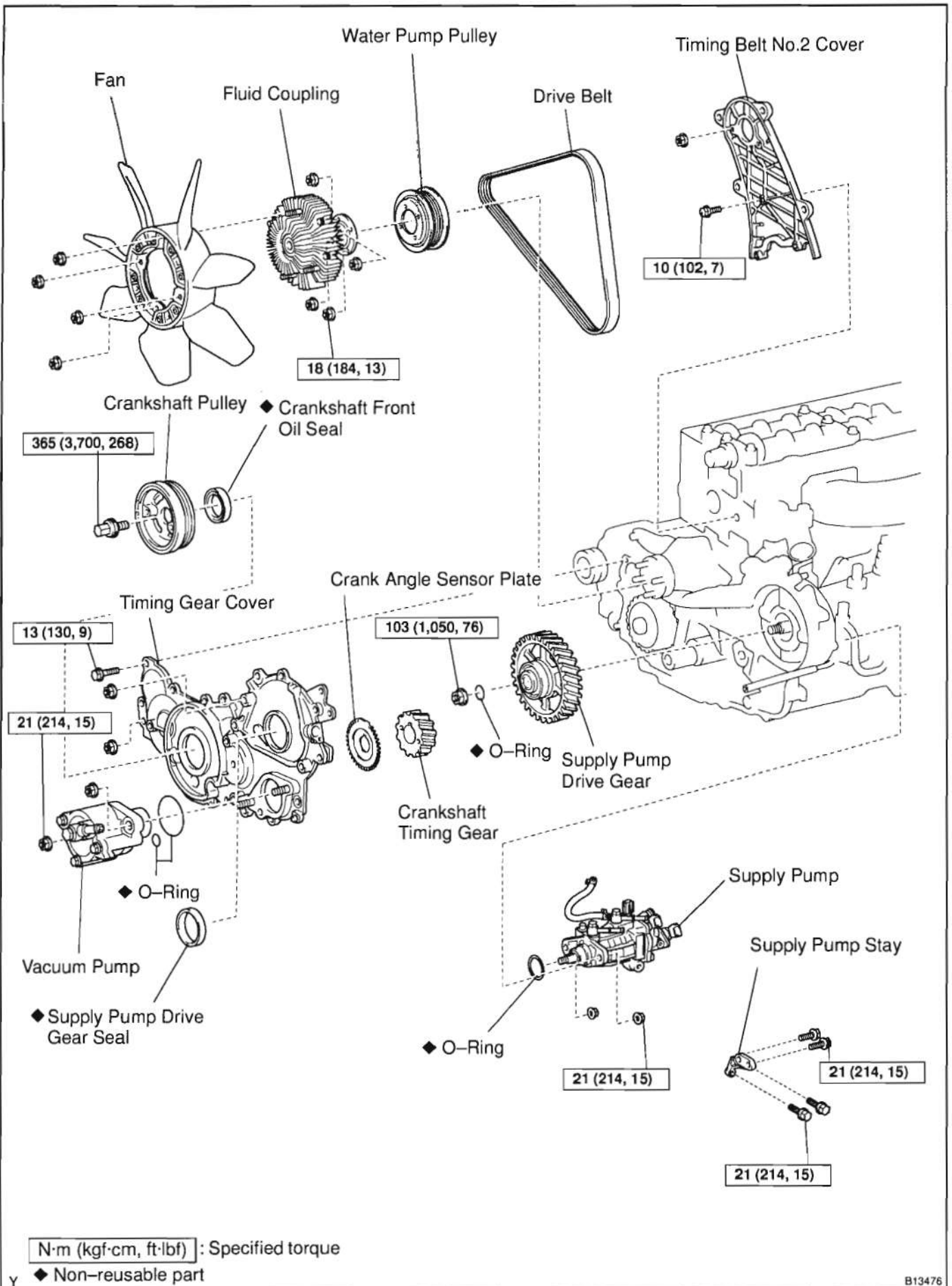
(c) Using an ohmmeter, check that there is no continuity between the terminal and ground as shown.

If there is continuity replace the pump
(See page FU-14).

(d) Reconnect the SCV1 and SCV2 connectors.

COMPONENTS



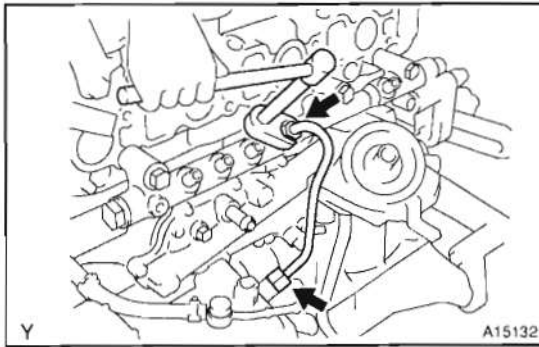


REMOVAL

NOTICE:

When removing the injection pipes and fuel inlet pipe, clean them up with a brush and compressed air.

1. REMOVE INTERCOOLER (See page TC-11)
2. REMOVE TIMING BELT COVER (See page EM-11)
3. REMOVE SUPPLY PUMP DRIVE PULLEY
(See page EM-21)
4. REMOVE INJECTION PIPE (See page FU-6)



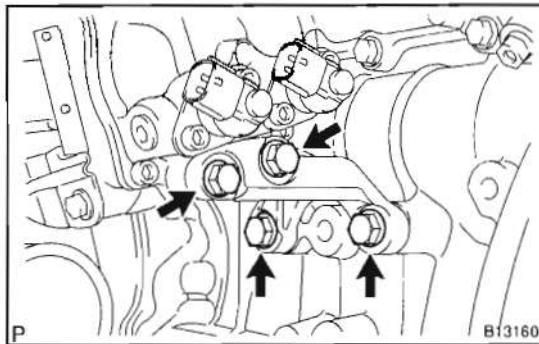
5. REMOVE FUEL INLET PIPE

- (a) Using SST, loosen the fuel inlet union of common rail side.
- (b) Using SST, loosen the fuel inlet pipe union of pump side.
SST 09023-12700
- (c) Remove the fuel inlet pipe.

NOTICE:

After removing the fuel pipe, affix the gum tape on the pump, common rail, and the whole injector installation area of the cylinder head cover for preventing dust from coming into them.

6. REMOVE SUPPLY PUMP DRIVE GEAR
(See page EM-21)

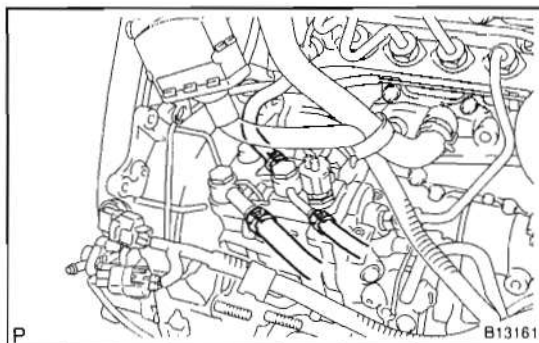


7. REMOVE SUPPLY PUMP STAY

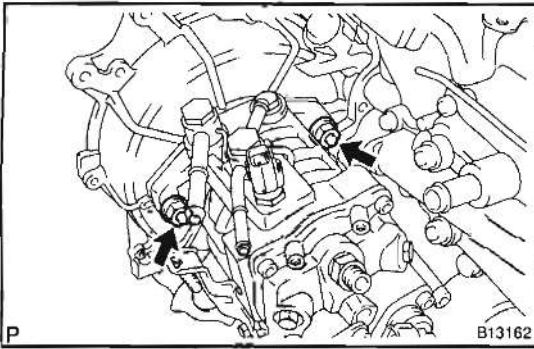
Remove the 4 bolts and supply pump stay.

8. REMOVE SUPPLY PUMP

- (a) Disconnect the 3 connectors from the supply pump.



- (b) Disconnect the 3 fuel hoses from the supply pump.



(c) Remove the 2 nuts and supply pump.

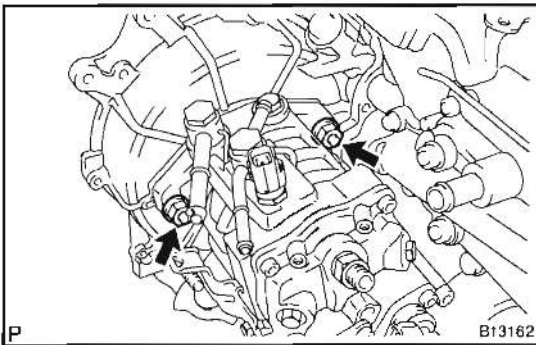
INSTALLATION

NOTICE:

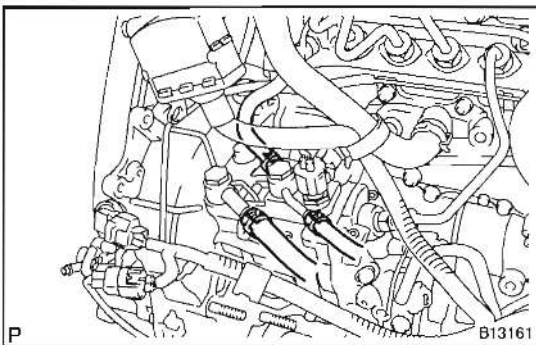
- When installing, clean up the seal surface of the injector, injection pipe, fuel inlet pipe, supply pump and common rail with clean light oil.
- In case of having the common rail and/or injectors replaced, must replace injection pipes, too.
- In case of having the supply pump and/or common rail replaced, must replace fuel inlet pipe, too.

1. INSTALL SUPPLY PUMP

- Install a new O-ring to the supply pump.
- Align the key position with the match mark on the pump housing.

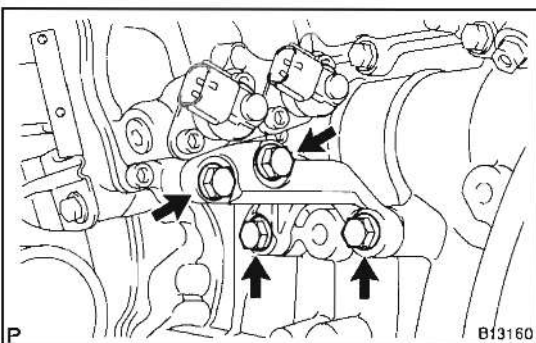


- Temporarily install the supply pump with the 2 nuts.
- Remove the gum tape from the fuel pipe.



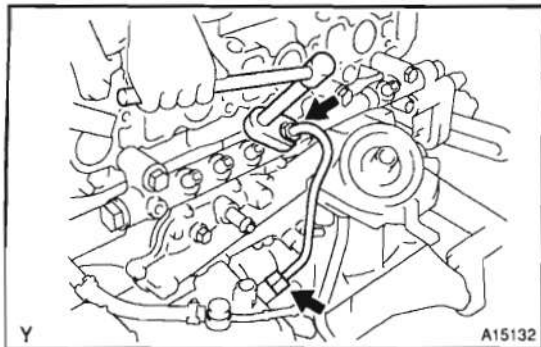
- Connect the 3 fuel hoses to the supply pump.

2. INSTALL SUPPLY PUMP DRIVE GEAR (See page EM-31)



3. INSTALL SUPPLY PUMP STAY

- Tighten the 2 bolts at the supply pump side until 2 or 3 threads of a screw.
- Stick the supply pump stay to both of the cylinder block and supply pump and torque the both sides.
Torque: 21 N·m (214 kgf·cm, 15 ft·lbf)
- Torque the supply pump.
Torque: 21 N·m (214 kgf·cm, 15 ft·lbf)



4. INSTALL FUEL INLET PIPE

- (a) Temporarily install the fuel inlet pipe.
- (b) Using SST, tighten the fuel inlet pipe union of common rail side.

SST 09023-12900

Torque:

31.6 N·m (322 kgf·cm, 23 ft·lbf) for use with SST

35 N·m (357 kgf·cm, 26 ft·lbf)

HINT:

Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).

- (c) Using SST, tighten the fuel inlet pipe union of supply pump side.

SST 09023-12700

Torque:

31.9 N·m (325 kgf·cm, 24 ft·lbf) for use with SST

35 N·m (357 kgf·cm, 26 ft·lbf)

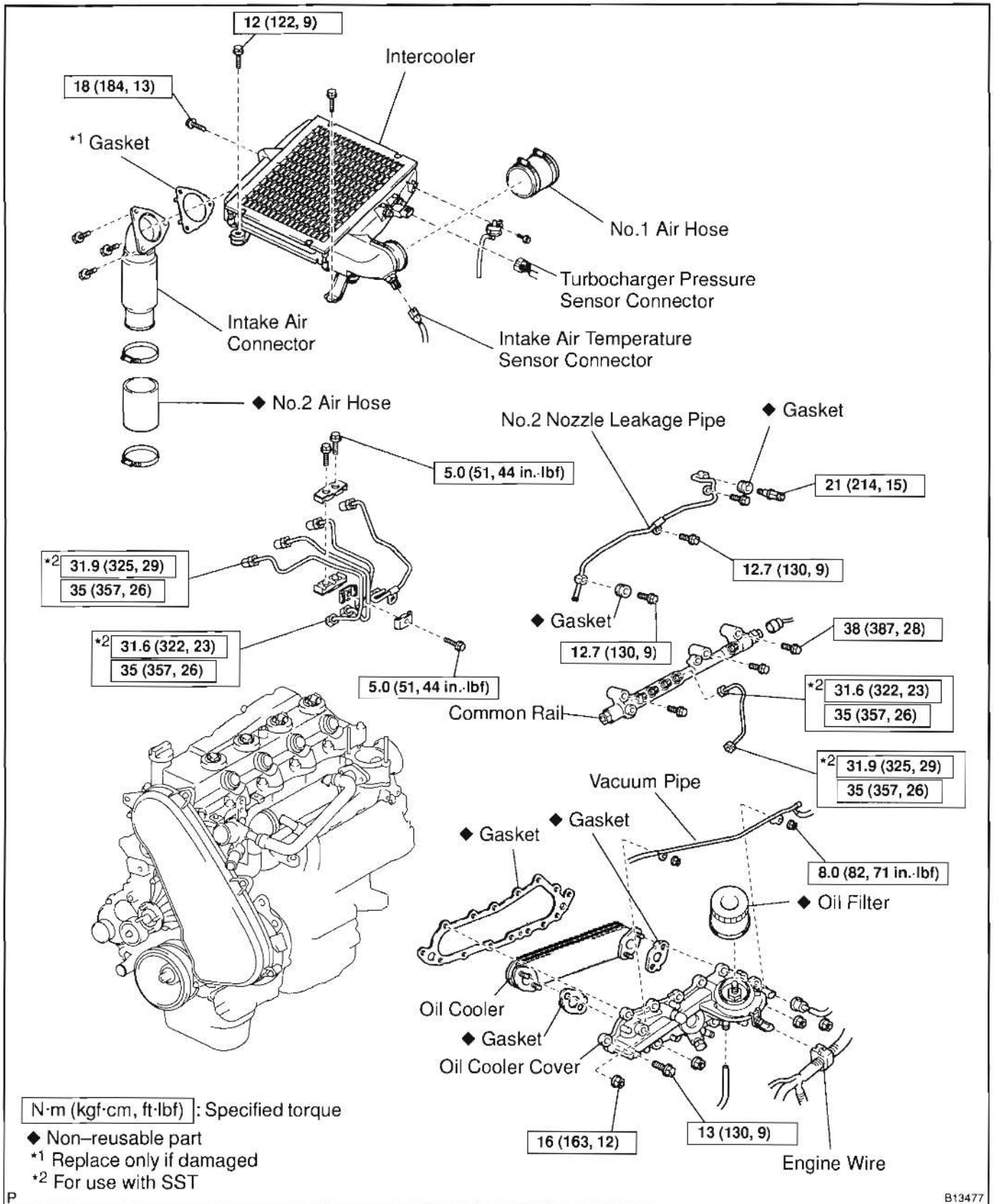
HINT:

Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).

- 5. **INSTALL INJECTION PIPE (See page FU-8)**
- 6. **INSTALL SUPPLY PUMP DRIVE PULLEY (See page EM-31)**
- 7. **INSTALL INTERCOOLER (See page TC-12)**
- 8. **CHECK FUEL LEAK (See page FU-8)**

COMMON RAIL COMPONENTS

FU08Y-01



REMOVAL

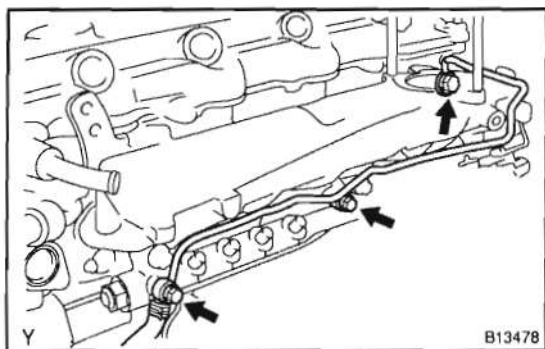
NOTICE:

When removing the injection pipes and fuel inlet pipe, clean them up with a brush and compressed air.

1. REMOVE INJECTION PIPE (See page FU-6)
2. REMOVE FUEL INLET PIPE (See page FU-16)

3. REMOVE NO.2 NOZZLE LEAKAGE PIPE

- (a) Disconnect the fuel hose from the No. 2 nozzle leakage pipe.
- (b) Remove the 2 bolts, union bolt, check valve, No. 2 nozzle leakage pipe and 2 gasket.

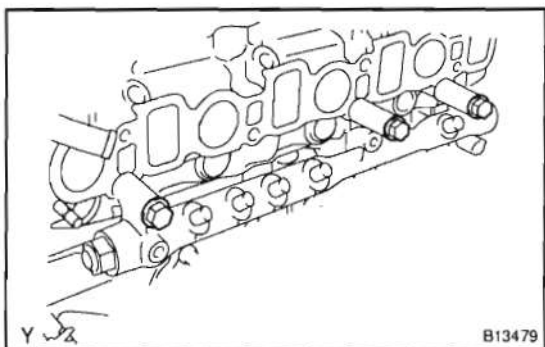


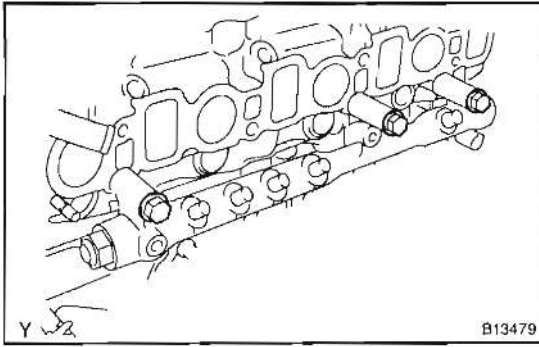
4. REMOVE COMMON RAIL

- (a) Disconnect the fuel pressure sensor connector.
- (b) Remove the 3 bolts and common rail.

NOTICE:

- Do not remove the pressure limiter.
- Do not reuse the fuel pressure sensor.





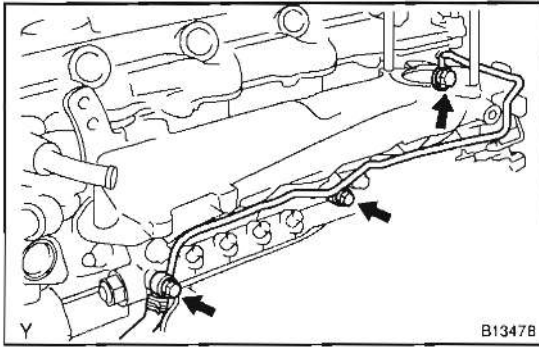
INSTALLATION

NOTICE:

In case of having the common rail, must replace injection pipes and fuel inlet pipe, too.

1. INSTALL COMMON RAIL

- (a) Install the common rail with the 3 bolts.
Torque: 38 N·m (387 kgf·cm, 28 ft·lbf)
- (b) Connect the fuel pressure sensor connector.



2. INSTALL NO. 2 NOZZLE LEAKAGE PIPE

Torque:

Bolt: 12.7 N·m (130 kgf·cm, 9 ft·lbf)

Union bolt: 12.7 N·m (130 kgf·cm, 9 ft·lbf)

Check valve: 21 N·m (214 kgf·cm, 15 ft·lbf)

3. INSTALL FUEL INLET PIPE (See page FU-18)
4. INSTALL INJECTION PIPE (See page FU-8)
5. CHECK FUEL LEAK (See page FU-8)

FUEL PRESSURE LIMITER ON-VEHICLE INSPECTION

FU091-01

CAUTION:

- During **ACTIVE TEST** mode, engine speed goes high and combustion noise becomes loud, so pay attention.
- During **ACTIVE TEST** mode, fuel becomes high-pressured, so take much care for not expose your eyes, hands, or body to the escaped fuel.

NOTICE:

- In case of having the common rail and/or injectors replaced, must replace injection pipes, too.
- In case of having the common rail replaced, must replace fuel inlet pipe, too.

INSPECT FUEL PRESSURE LIMITER

- (a) Check that there are no leaks from any part of the fuel system at the engine stops.

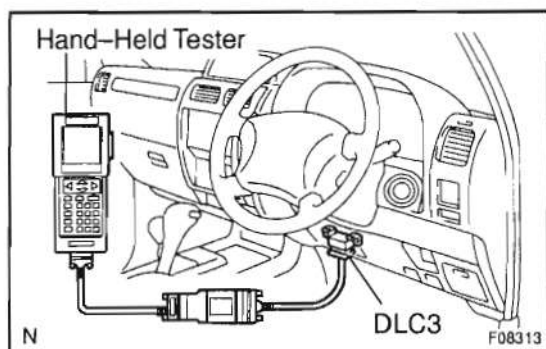
If there is fuel leakage, replace these parts.

- (b) While cranking or start the engine, check that there are no leaks from any part of the fuel system.

If there is fuel leakage, replace these parts.

- (c) Disconnect the return hose from the common rail.
- (d) While cranking the engine, check fuel leaks from the return pipe.

If there is fuel leakage, replace the common rail assembly.
(See page FU-20)



- (e) Connect the hand-held tester to the DLC3.
- (f) Start the engine and push the hand-held tester main switch ON.
- (g) Select the FUEL LEAK test of ACTIVE TEST mode on the hand-held tester.
- (h) If you have no hand-held tester, depress the accelerator pedal quickly and fully to increase the engine speed at maximum and keep it for 2 seconds. Repeat this operation several times.
- (i) Check that there are no leaks from any part of the fuel system.

NOTICE:

However, if the leakage from the return pipe is less than 10 cc (0.6 cu in.) in a minute, it is acceptable.

If there is fuel leakage, replace these parts.

- (j) Reconnect the return hose to the common rail.

