
ENGINE FUEL

FUEL FILTER	FU-1
FUEL HEATER	FU-3
INJECTOR	FU-4
SUPPLY PUMP	FU-13
COMMON RAIL	FU-21
FUEL PRESSURE LIMITTER	FU-24

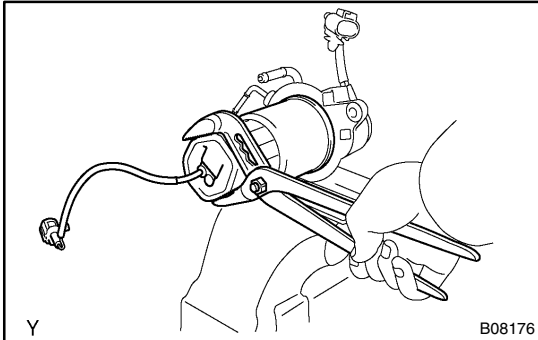


FUEL FILTER REPLACEMENT

FU064-01

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.

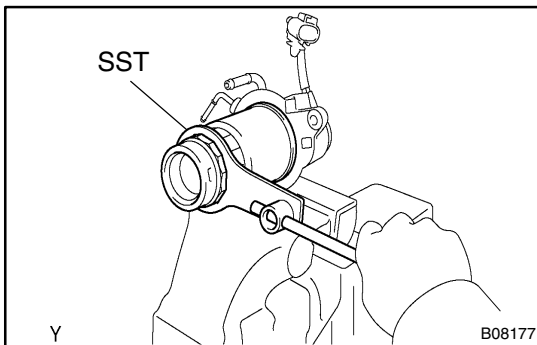


3. **REMOVE FUEL FILTER WARNING SWITCH FROM FUEL FILTER**

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

NOTICE:

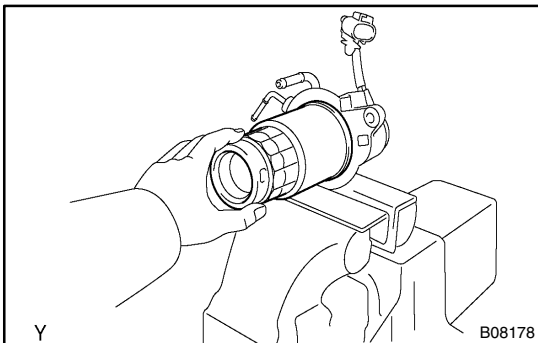
Be careful not to damage the warning switch.



4. **REMOVE FUEL FILTER**

Using SST, remove the fuel filter.

SST 09228-64030



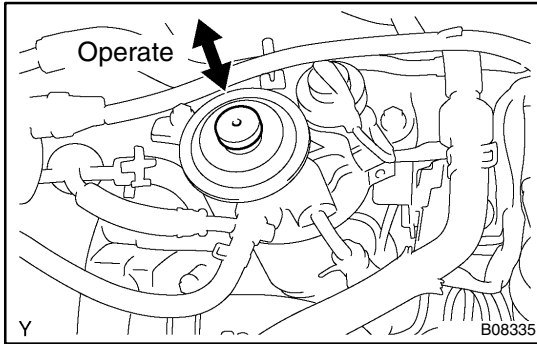
5. **INSTALL NEW FUEL FILTER**

- (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**

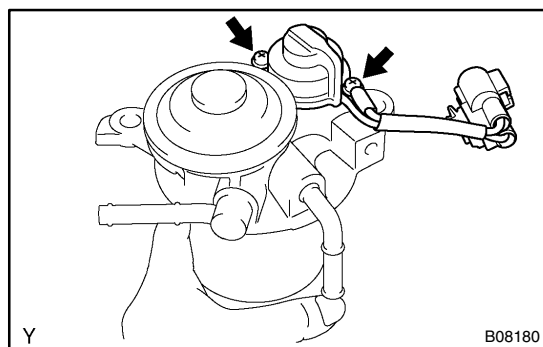
- (a) Install a new O-ring to the warning switch.
- (b) Apply fuel to the O-ring of the warning switch.
- (c) Install the warning switch to a new fuel filter by hand.

7. **REINSTALL FUEL FILTER ASSEMBLY TO FUEL FILTER SUPPORT**

**8. REFILL FUEL FILTER WITH FUEL**

Operate the hand pump until you feel more resistance.

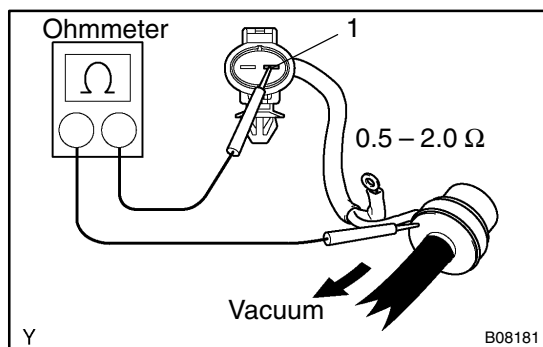
9. START ENGINE AND CHECK FOR FUEL LEAK



FUEL HEATER INSPECTION

FU065-01

1. REMOVE FUEL HEATER

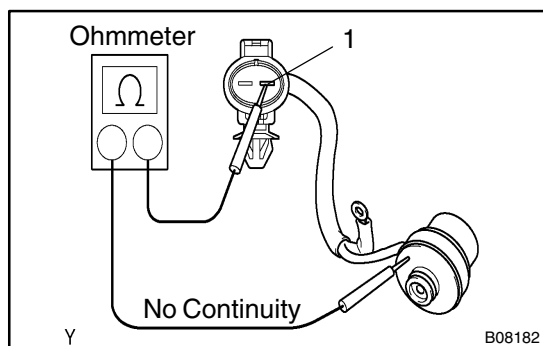


2. INSPECT FUEL HEATER

- 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)

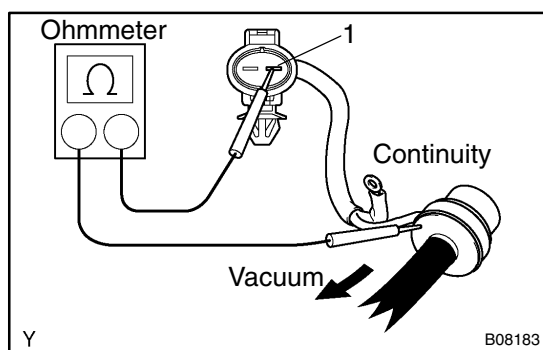
If the resistance is not as specified, replace the fuel heater and vacuum switch assembly.



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: $1.96 \text{ N}\cdot\text{m}$ ($20 \text{ kgf}\cdot\text{cm}$, $17 \text{ in}\cdot\text{lb}$)

INJECTOR ON-VEHICLE INSPECTION

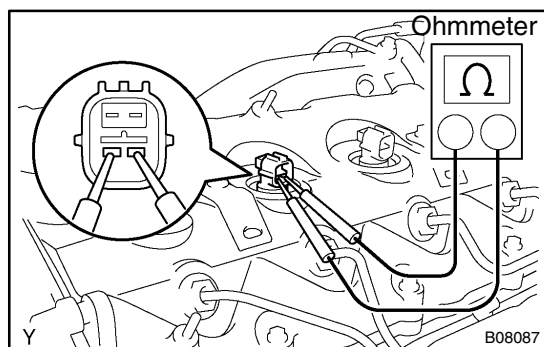
FU066-01

NOTICE:

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

INSPECT INJECTORS

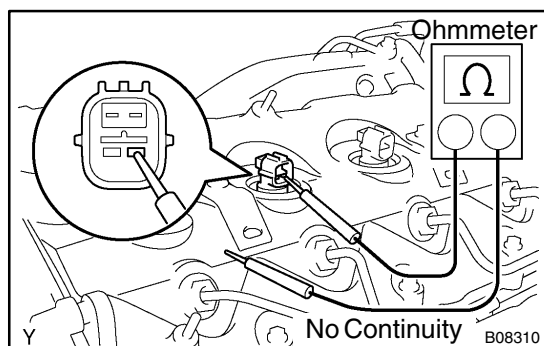
- (a) Disconnect the 4 injector connectors.



- (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)

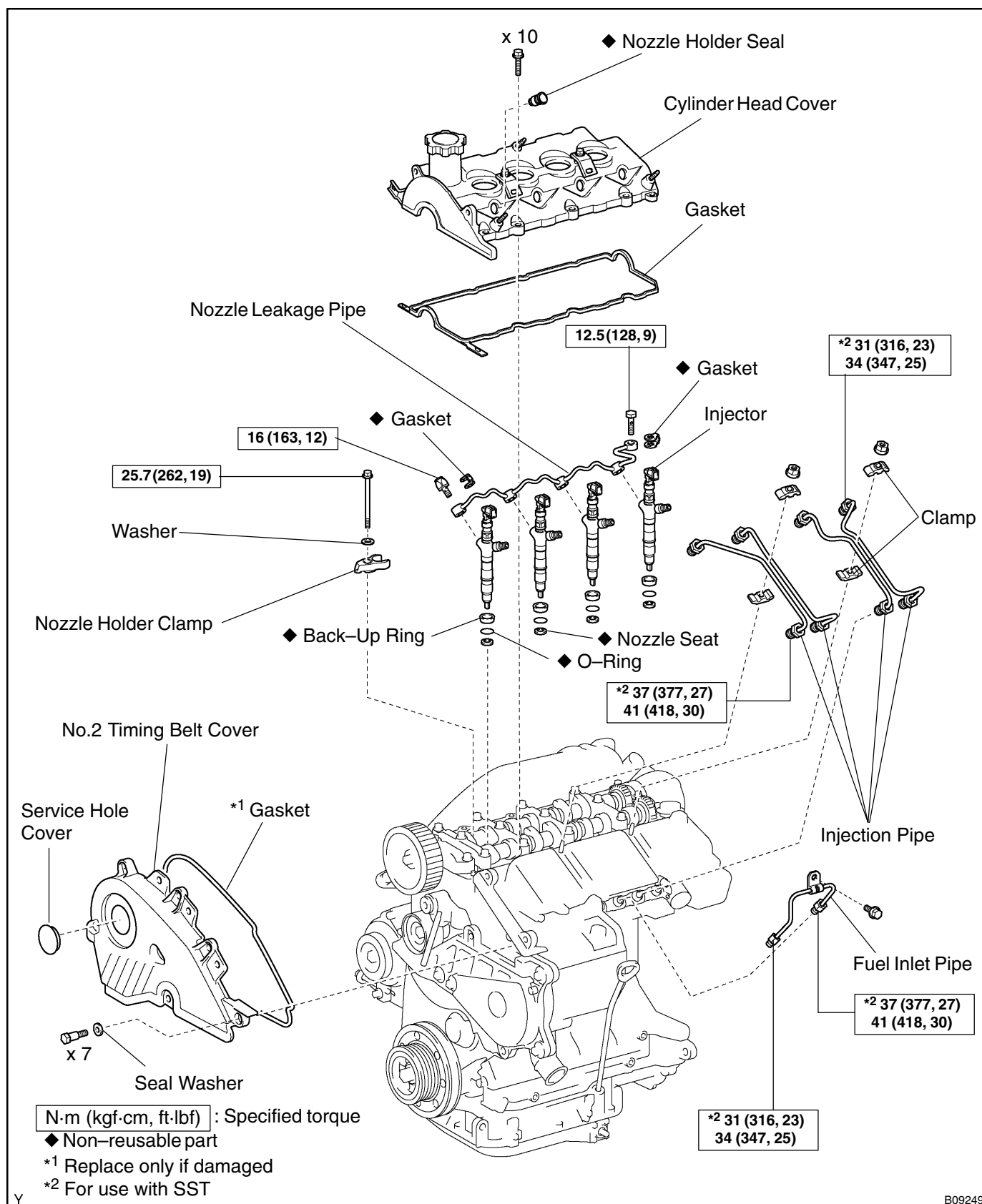


- (c) Using an ohmmeter, check that there is no continuity between the injector terminal and ground as shown.

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

- (d) Reconnect the 4 injector connectors.

COMPONENTS



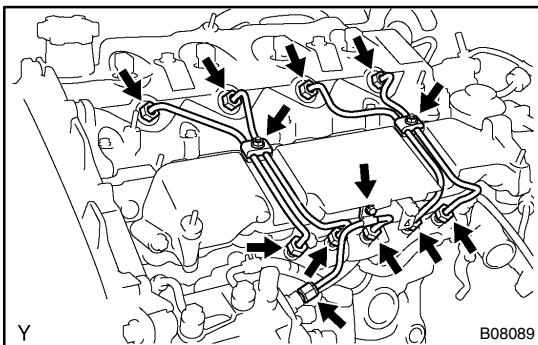
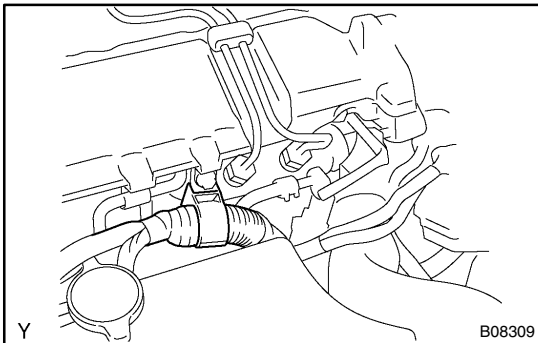
REMOVAL

NOTICE:

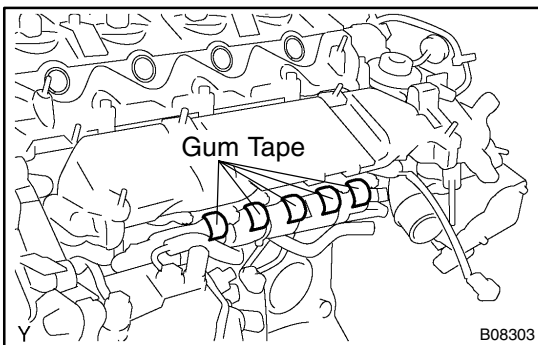
When removing the injection pipes, clean them up with a brush and compressed air.

1. REMOVE INJECTION PIPES

- (a) Remove the reservoir tank.
- (b) Remove the wire bracket and slide the engine wire.

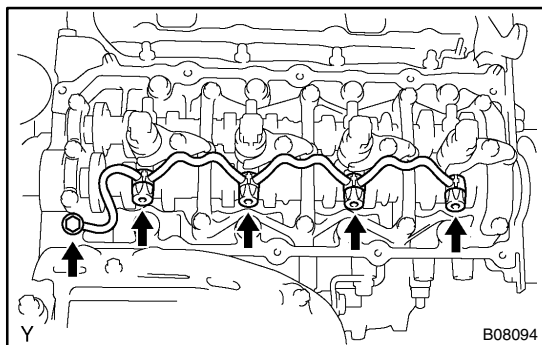


- (c) Remove the fuel inlet pipe. (See page FU-16)
- (d) Remove the 2 nuts and 2 upper injection pipe clamps from the intake manifold.
- (e) Using SST, remove the injection pipe from the common rail side.
SST 09023-12900
- (f) Using SST, remove the injection pipe from the injector side.
SST 09023-12700



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.
- (g) Remove the 2 lower injection pipe clamps from the intake manifold.
2. REMOVE NO.2 TIMING BELT COVER (See page EM-12)
 3. REMOVE CYLINDER HEAD COVER (See page EM-28)

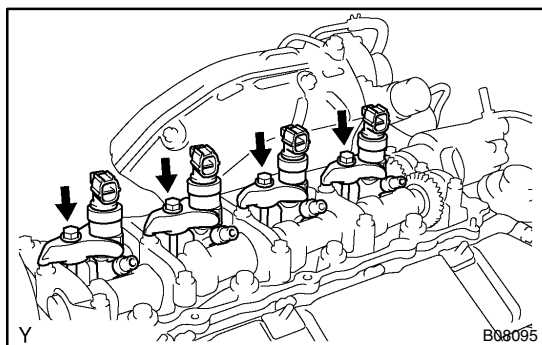


4. REMOVE NOZZLE LEAKAGE PIPE

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.



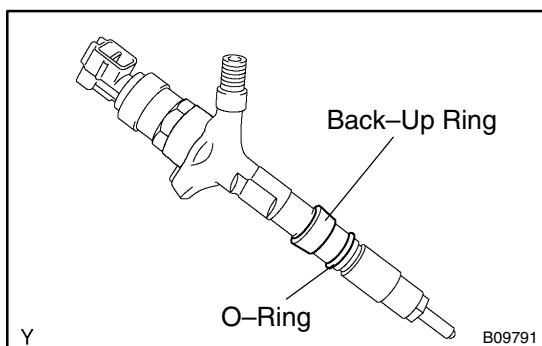
5. REMOVE INJECTORS

(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 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.

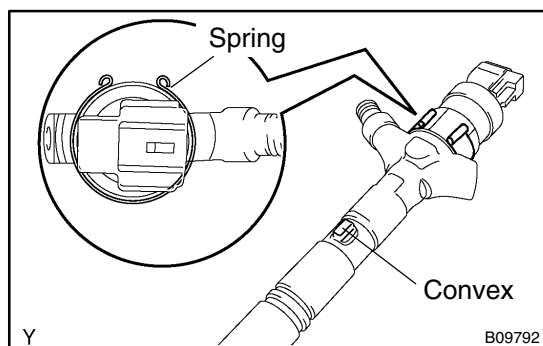
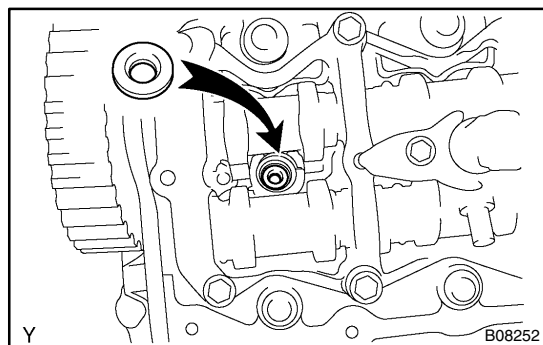
INSTALLATION

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.

1. INSTALL INJECTORS

- (a) Install 4 new nozzle seats to the cylinder head.

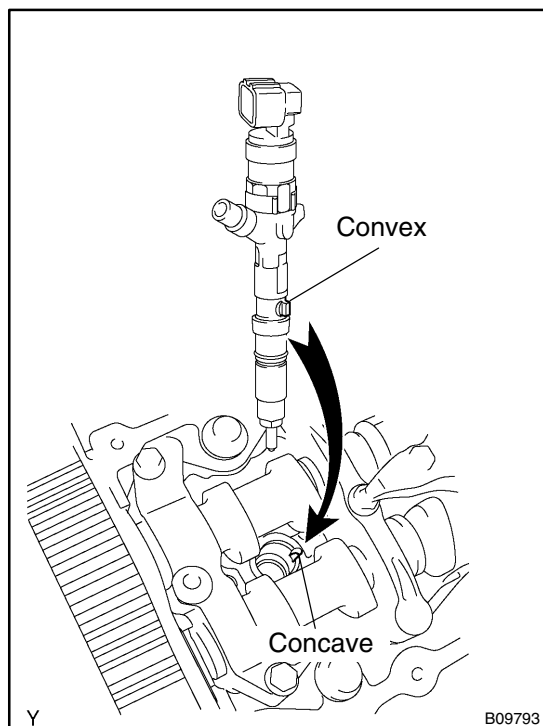


- (b) Set the spring to each injector.

NOTICE:

Be sure to make the opening direction of the spring and the direction of the injector positioning convex meet.

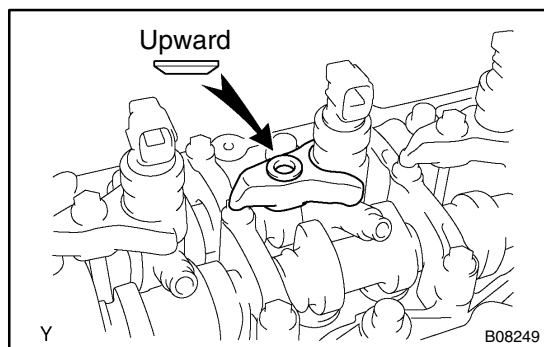
- (c) Install a new back-up ring and O-ring to each injector.
 (d) Apply a light coat of oil onto O-ring to each injector.



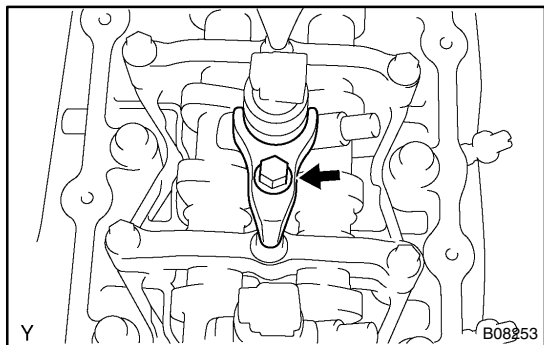
- (e) Meet the injector positioning convex to the positioning concave at the cylinder head side and install the injector to the cylinder head.

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.
- (f) Place the 4 nozzle holder clamps to each injector.



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



- (h) Tighten the bolt.

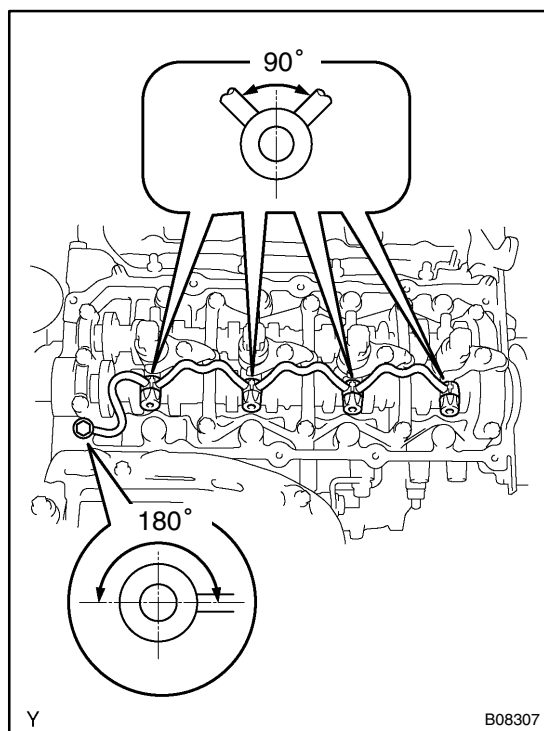
HINT:

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

Torque: 25.7 N·m (262 kgf·cm, 19 ft·lbf)

NOTICE:

At this time, the clamp has its cam cap bolt as a fulcrum and clip the injector at the fork portion.



2. INSTALL NOZZLE LEAKAGE PIPE

- (a) Place the leakage pipe and 5 new gaskets.

NOTICE:

Do the installation of the gasket crew within the angle range shown in the illustration.

- (b) Apply a light coat of oil onto 4 hollow screws and union bolt.
 (c) Tighten the 4 hollow screws and union bolt by hand.
 (d) Tighten the 4 hollow screws and union bolt.

Torque:

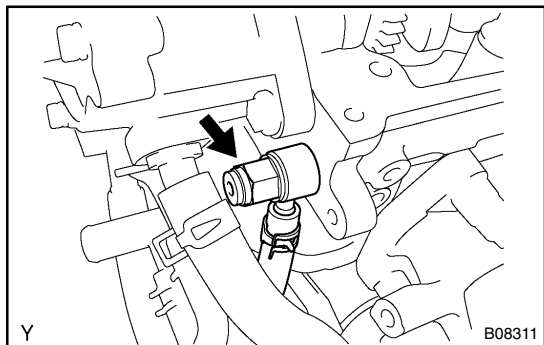
Hollow screw:

16 N·m (163 kgf·cm, 12 ft·lbf)

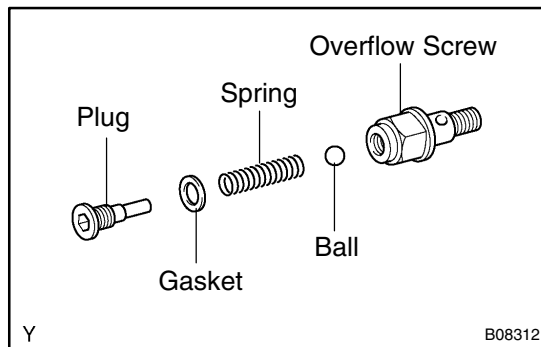
Union bolt:

12.5 N·m (128 kgf·cm, 9 ft·lbf)

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



- (1) Disconnect the fuel hose, and remove the check valve, No.2 nozzle leakage pipe and gasket.
 (2) Purchase a 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)

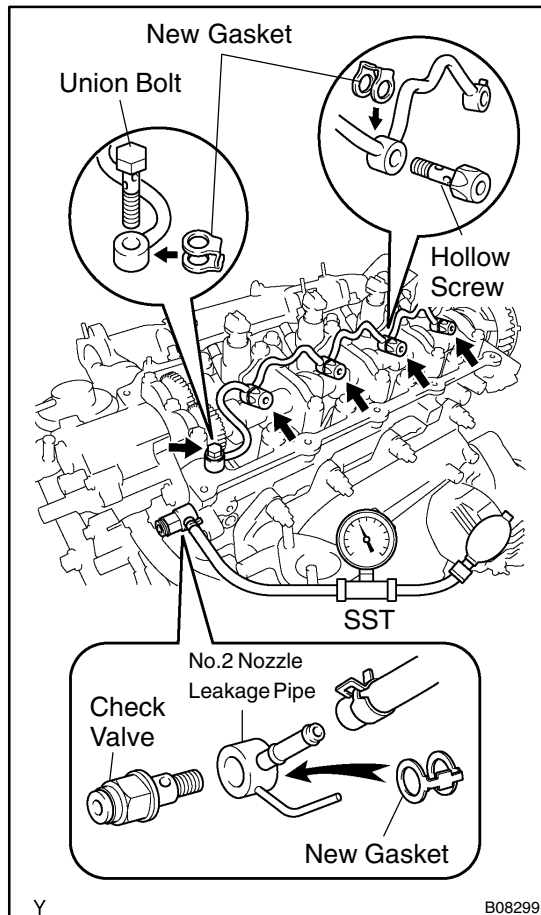
- (5) Install the No.2 nozzle leakage pipe and gasket with the check valve to the cylinder head.

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 kgf/cm², 14.5 psi) of pressure for 600 seconds to check that there are no bubbles from applying the soapy water place.

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) Reinstall the No.2 nozzle leakage pipe and a new gasket with the check valve.

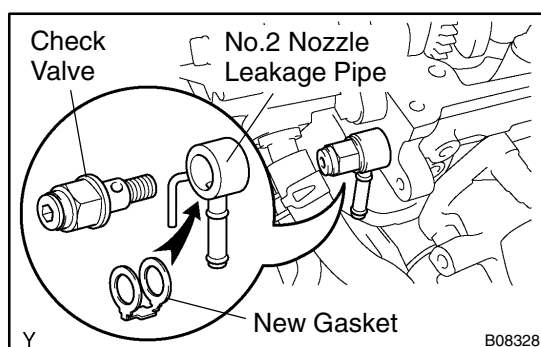
Torque: 21 N·m (214 kgf·cm, 15 ft·lbf)

HINT:

Never reinstall the disassembled check valve on the engine.

- (11) Reconnect the fuel hose to the No.2 nozzle leakage pipe.

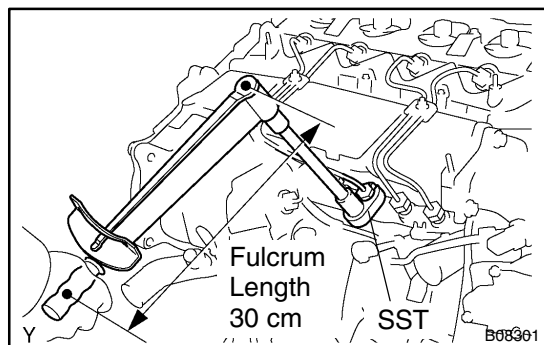
3. INSTALL CYLINDER HEAD COVER (See page EM-46)



4. INSTALL NO.2 TIMING BELT COVER (See page EM-18)

5. INSTALL INJECTION PIPE

- (a) Install the 2 lower injection pipe clamps to the intake manifold.
- (b) Remove the vinyl bag and rubber band from the injectors.
- (c) Remove the gum tape from the common rail.
- (d) Temporarily tighten the injection pipe.



- (e) Using SST, tighten the injection pipe from the common rail side.

SST 09023-12900

Torque:

37 N·m (377 kgf·cm, 27 ft·lbf) for use with SST

41 N·m (418 kgf·cm, 30 ft·lbf)

HINT:

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

- (f) Using SST, tighten the injection pipe from the injector side.

SST 09023-12700

Torque:

31 N·m (316 kgf·cm, 23 ft·lbf) for use with SST

34 N·m (347 kgf·cm, 25 ft·lbf)

HINT:

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

- (g) Install the 2 upper injection pipe clamps and 2 nuts.

Torque: 5 N·m (51 kgf·cm, 44 in·lbf)

- (h) Install the fuel inlet pipe (See page FU-18)
- (i) Install the engine wire.
- (j) Install the reservoir tank.

6. CHECK FUEL LEAK

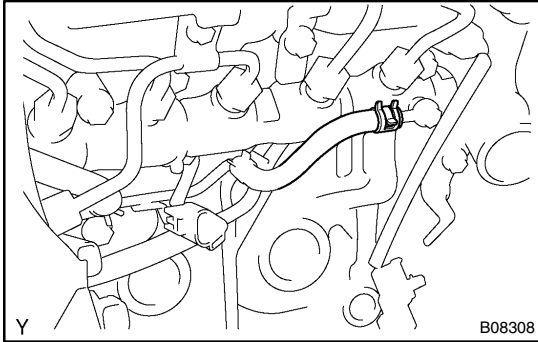
CAUTION:

- 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.

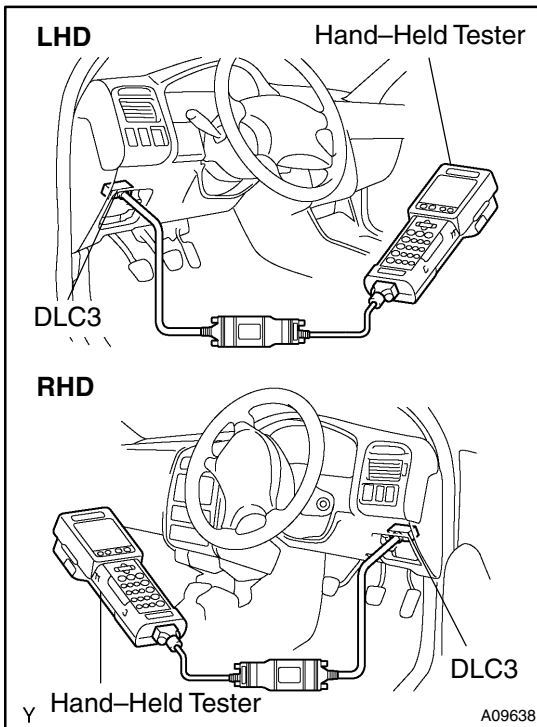
- (b) While cranking or start the engine, check that there are no leaks from any part of the fuel system.

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-22)



- (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.

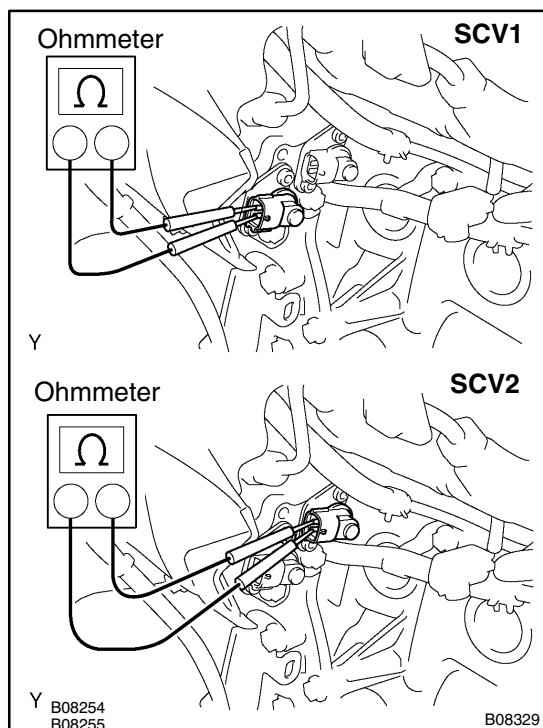
- (j) Reconnect the return hose to the common rail.

SUPPLY PUMP ON-VEHICLE INSPECTION

FU06A-01

INSPECT SCV1 AND SCV2

(a) Disconnect the SCV1 and SCV2 connectors.

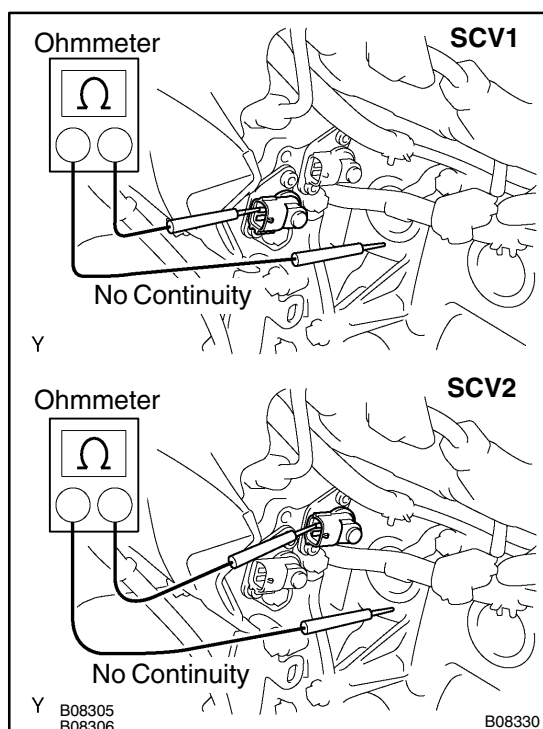


(b) Using an ohmmeter, measure the resistance between terminals as shown.

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

If the resistance is not specified, replace the pump.

(See page FU-16)



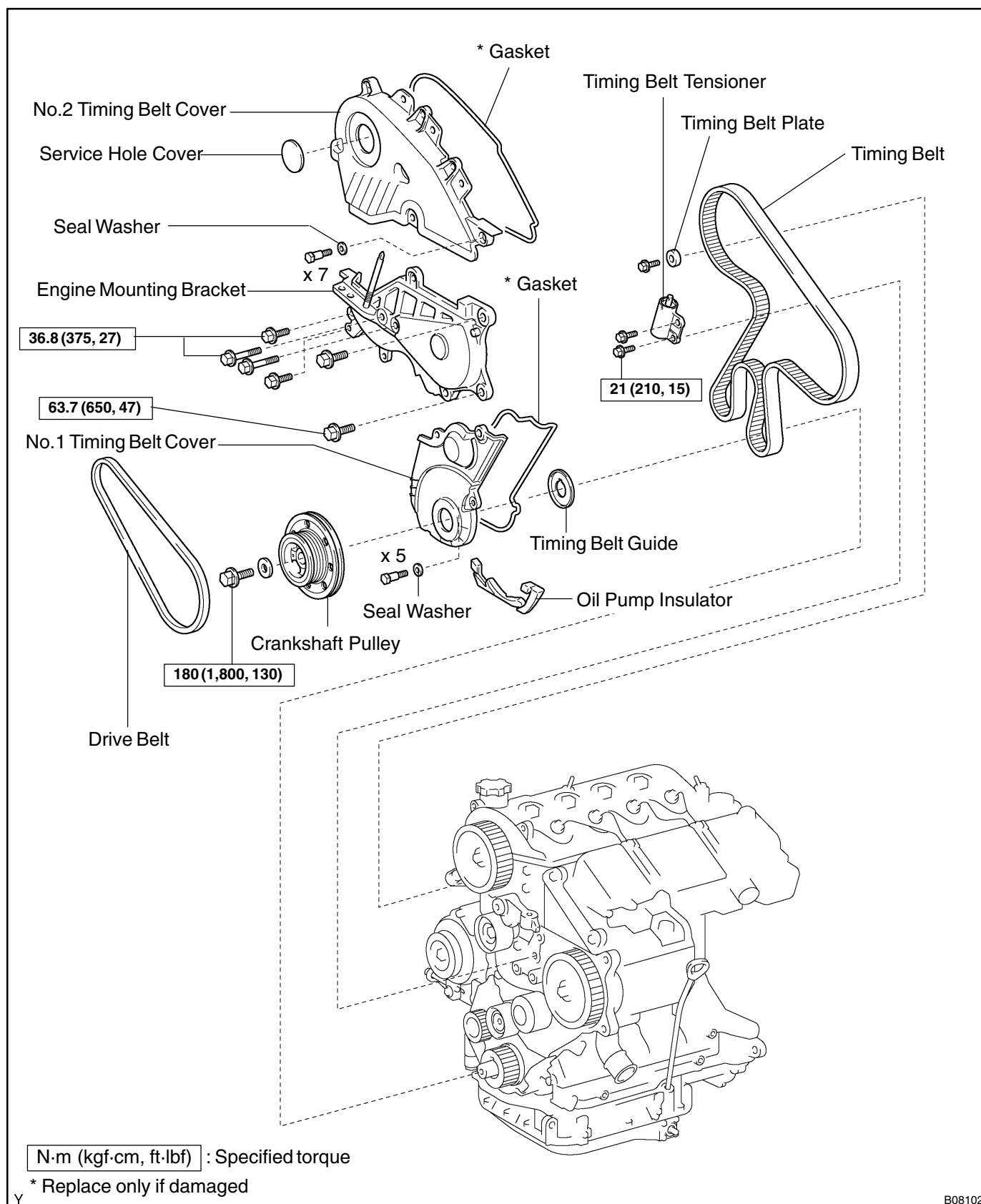
(c) Using an ohmmeter, check that there is no continuity between the terminal and ground as shown.

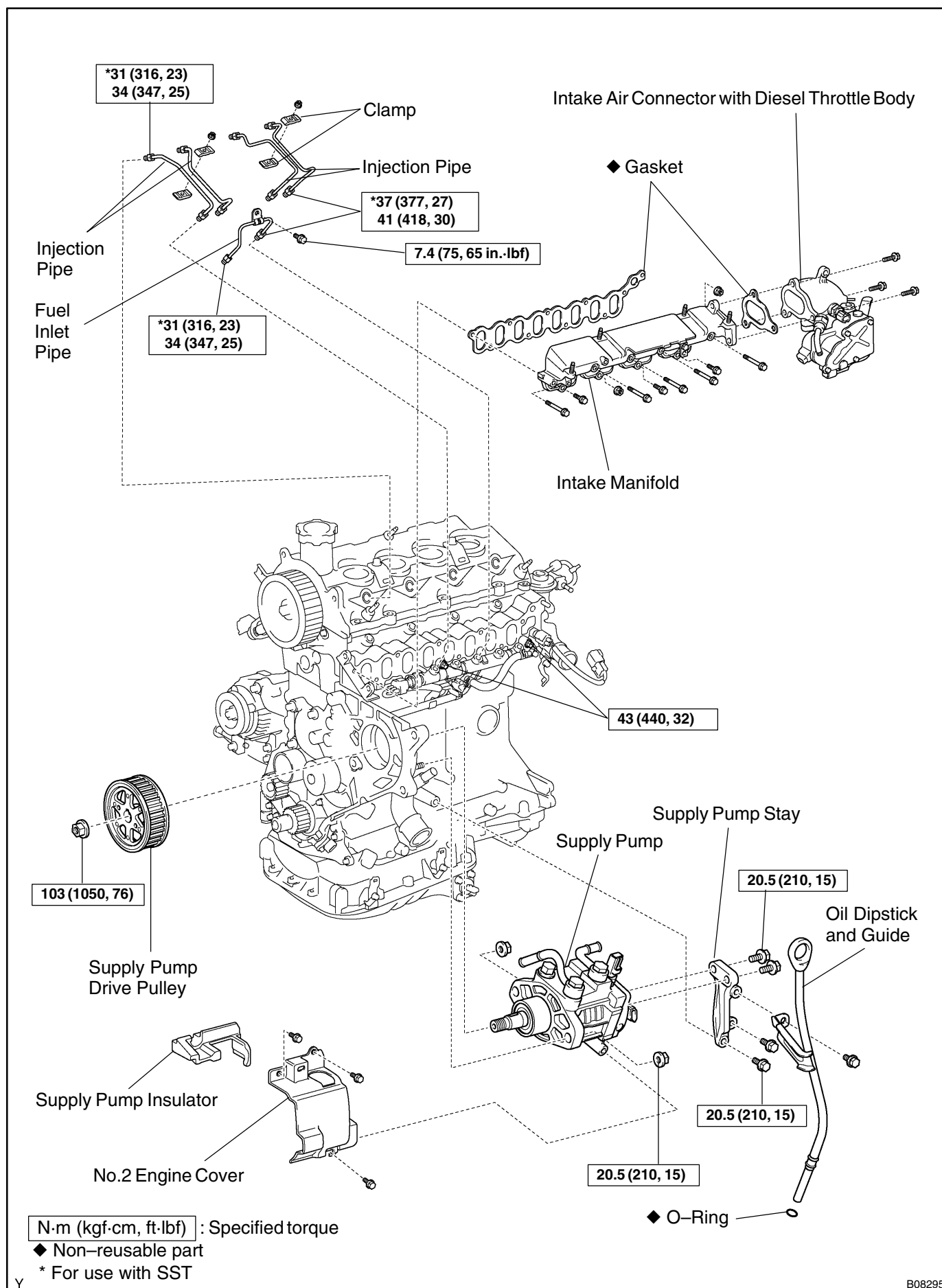
If there is continuity replace the pump.

(See page FU-16)

(d) Reconnect the SCV1 and SCV2 connectors.

COMPONENTS



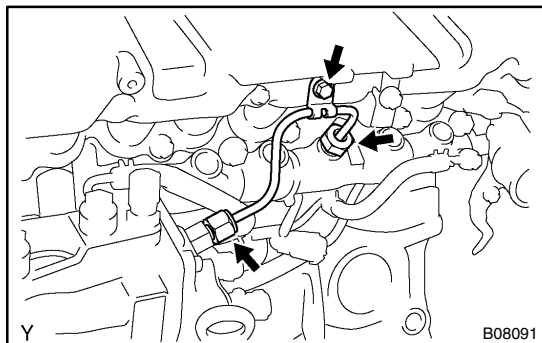


REMOVAL

NOTICE:

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

1. REMOVE CRANKSHAFT PULLEY (See page EM-12)
2. REMOVE TIMING BELT COVER AND ENGINE MOUNTING BRACKET (See page EM-12)
3. REMOVE TIMING BELT (See page EM-12)
4. REMOVE INJECTION PIPE (See page FU-6)



5. REMOVE FUEL INLET PIPE

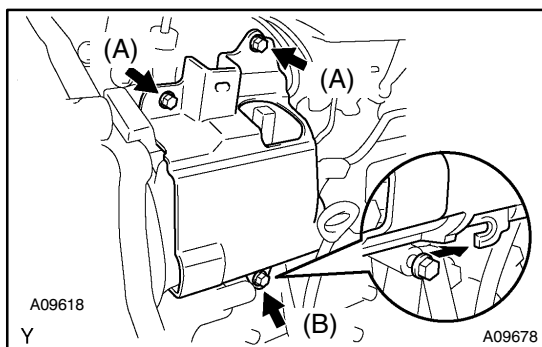
- (a) Remove the pipe clamp bolt from the intake manifold.
- (b) Using SST, remove the fuel inlet pipe from the common rail side.

SST 09023-12900

- (c) Using SST, remove the fuel inlet pipe from the pump side.
- SST 09023-12700

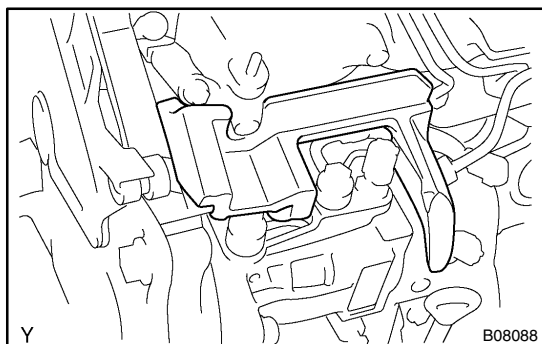
NOTICE:

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.

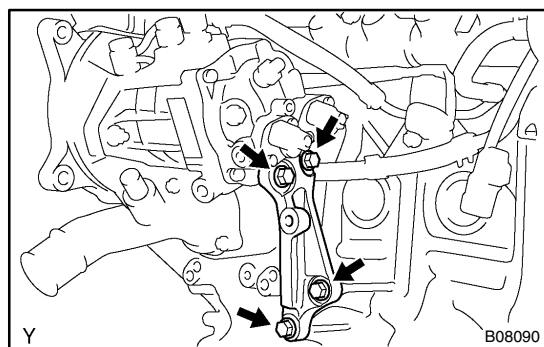


6. REMOVE NO.2 ENGINE COVER

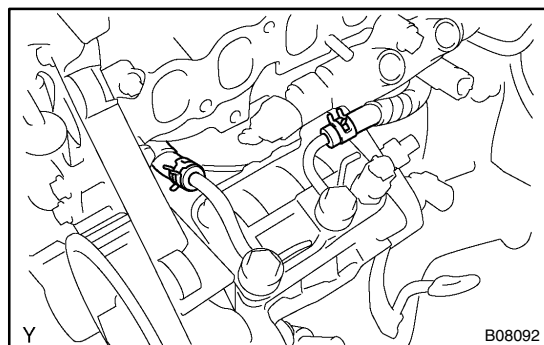
- (a) Remove the 2 bolts (A).
- (b) Loosen the bolt (B) and remove the cover.



7. REMOVE SUPPLY PUMP INSULATOR
8. LOOSEN COMMON RAIL 2 BOLTS
9. REMOVE INTAKE AIR CONNECTOR WITH DIESEL THROTTLE BODY (See page EM-28)
10. REMOVE INTAKE MANIFOLD (See page EM-28)
11. REMOVE SUPPLY PUMP DRIVE PULLEY (See page EM-12)
12. REMOVE OIL DIPSTICK AND GUIDE (See page LU-7)

**13. REMOVE SUPPLY PUMP STAY**

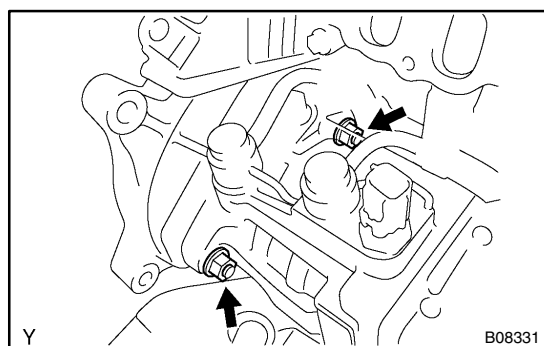
Remove the 4 bolts and supply pump stay.

14. REMOVE SUPPLY PUMP

(a) Disconnect the 2 fuel hoses from the pump.

NOTICE:

After disconnecting the fuel hose, affix the gum tape on the No.2 fuel pipe for preventing dust from coming into them.

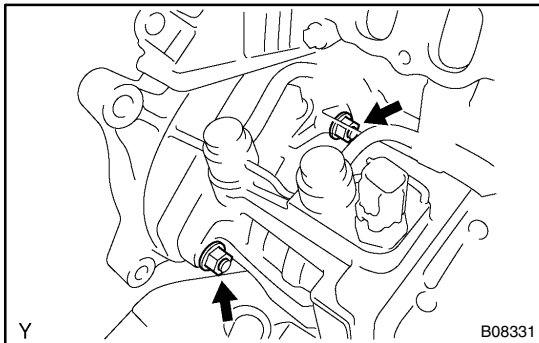


(b) Remove the 2 nuts and pump.

INSTALLATION

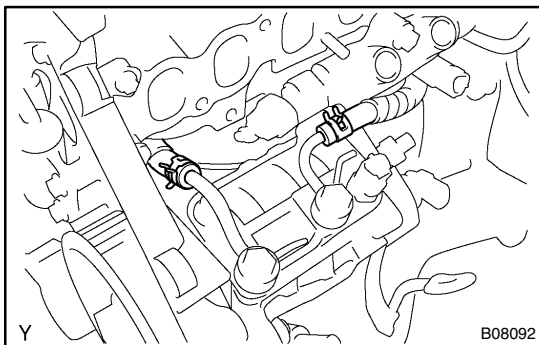
NOTICE:

- 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.

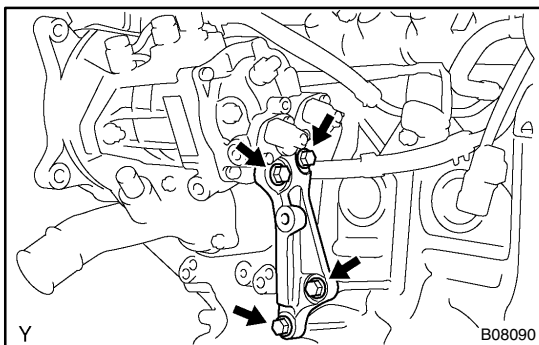


1. INSTALL SUPPLY PUMP

- Install the pump with the 2 nuts.
Torque: 20.5 N·m (210 kgf·cm, 15 ft·lb)
- Remove the gum tape from the No.2 fuel pipe.



- Connect the 2 fuel hoses to the pump.



2. 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 cylinder block side.
Torque: 20.5 N·m (210 kgf·cm, 15 ft·lbf)
- Torque the supply pump side.
Torque: 20.5 N·m (210 kgf·cm, 15 ft·lbf)

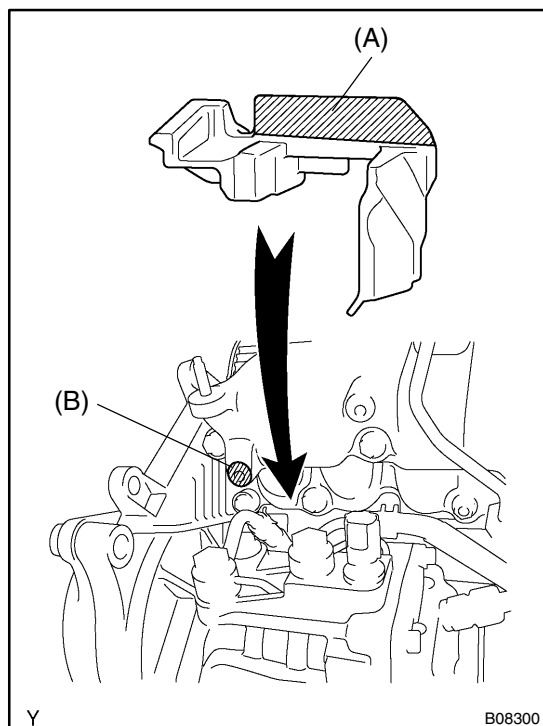
3. INSTALL OIL DIPSTICK AND GUIDE (See page LU-14)

4. INSTALL SUPPLY PUMP DRIVE PULLEY (See page EM-18)

5. INSTALL INTAKE MANIFOLD (See page EM-46)

6. INSTALL INTAKE AIR CONNECTOR WITH DIESEL THROTTLE BODY (See page EM-46)

7. TIGHTEN COMMON RAIL 2 BOLTS **Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)**



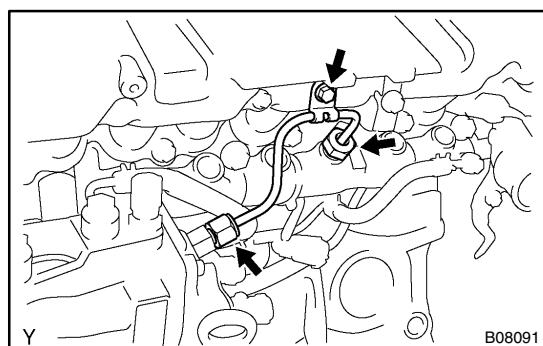
8. INSTALL SUPPLY PUMP INSULATOR

Set your standard to equalize the surfaces of the shaded portion (A) of the supply pump insulator and the shaded portion (B) of the intake manifold shown in the illustration.

NOTICE:

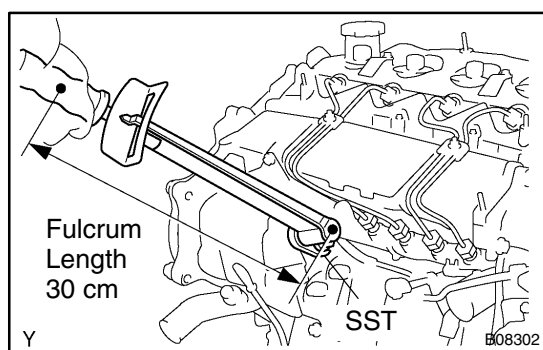
Check that the insulator is not touching the union bolt of the pump.

9. INSTALL NO.2 ENGINE COVER



10. INSTALL FUEL INLET PIPE

- Remove the gum tape from the common rail and supply pump.
- Temporarily tighten the inlet pipe and pipe clamp bolt.



- Using SST, tighten the inlet pipe from the common rail side.

Torque:

37 N·m (377 kgf·cm, 27 ft·lbf) for use with SST

41 N·m (418 kgf·cm, 30 ft·lbf)

SST 09023-12900

HINT:

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

- Using SST, tighten the inlet pipe from the pump side.

Torque:

31 N·m (316 kgf·cm, 23 ft·lbf) for use with SST

34 N·m (347 kgf·cm, 25 ft·lbf)

SST 09023-12700

HINT:

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

- Tighten the pipe clamp bolt.

Torque: 7.4 N·m (75 kgf·cm, 65 in·lbf)

11. INSTALL INJECTION PIPE (See page FU-8)

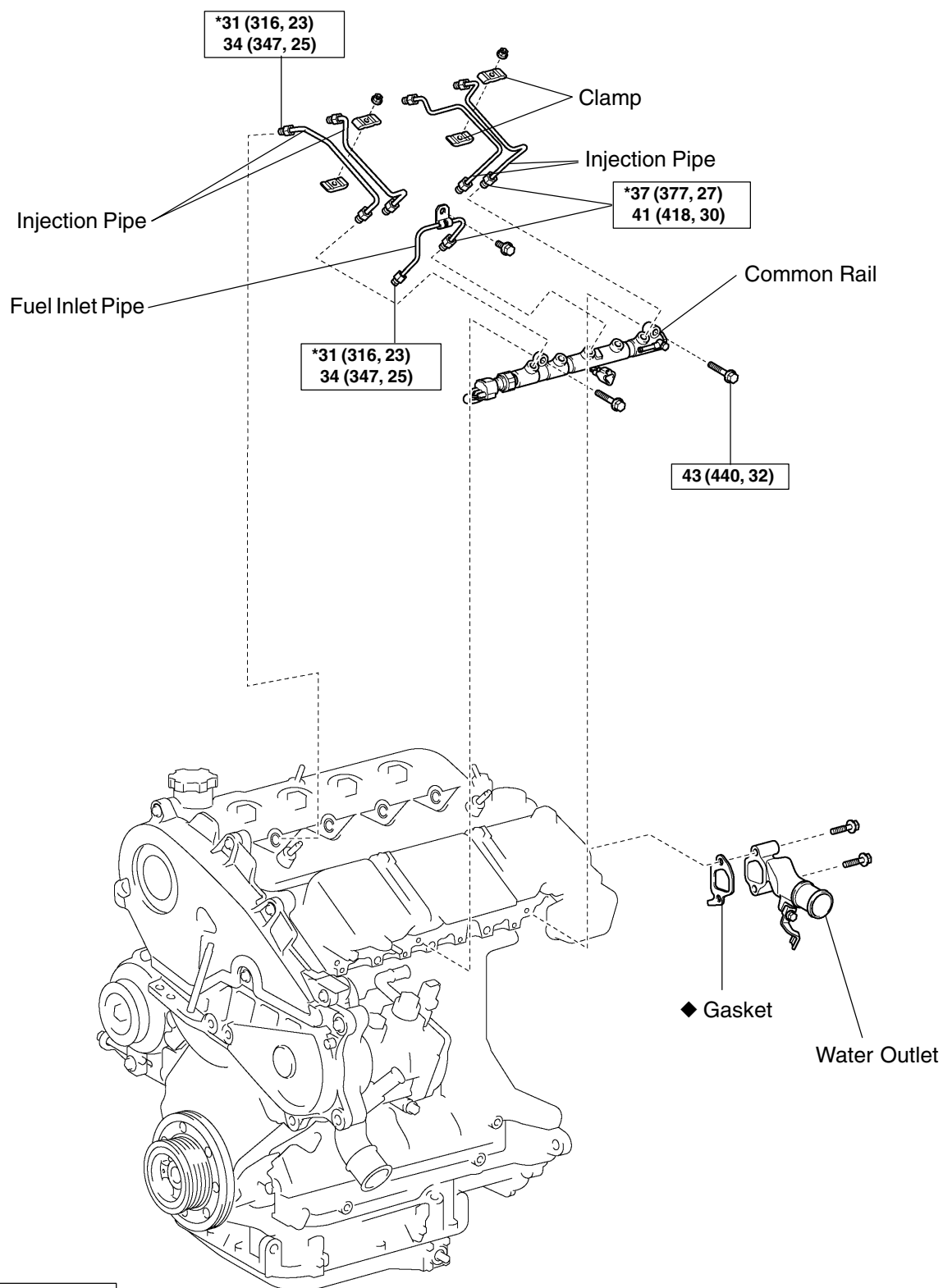
HINT:

Remove the gum tape from the cylinder head cover.

12. **INSTALL TIMING BELT (See page EM-18)**
13. **INSTALL ENGINE MOUNTING BRACKET AND TIMING BELT COVER (See page EM-18)**
14. **INSTALL CRANKSHAFT PULLEY (See page EM-18)**
15. **CHECK FUEL LEAK (See page FU-8)**

COMMON RAIL COMPONENTS

FU06E-01



N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

* For use with SST

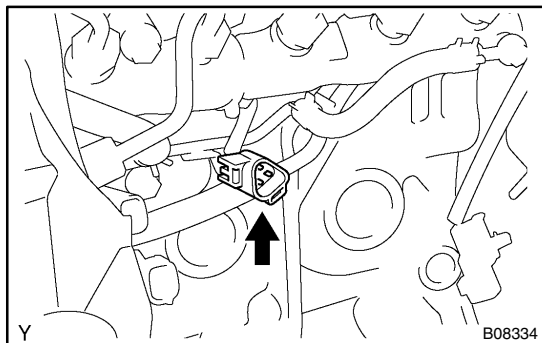
B08296

REMOVAL

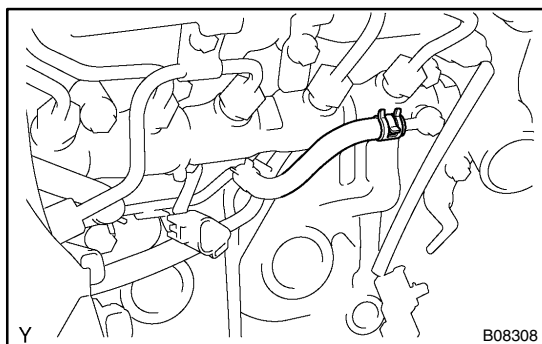
NOTICE:

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

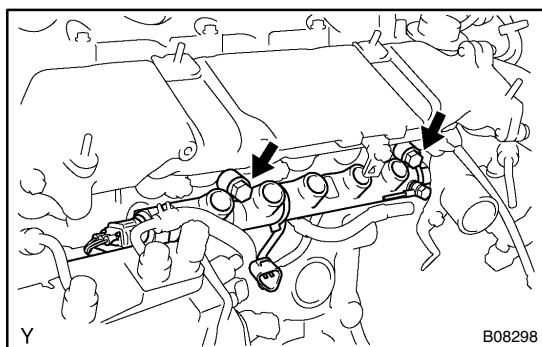
1. REMOVE INJECTION PIPE (See page FU-6)
2. REMOVE FUEL INLET PIPE (See page FU-16)
3. REMOVE WATER OUTLET (See page EM-28)
4. REMOVE COMMON RAIL



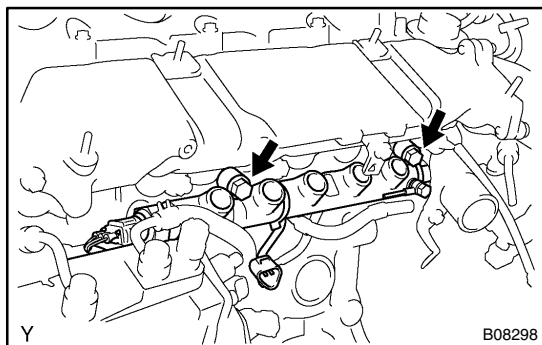
- (a) Disconnect the fuel pressure sensor connector from the bracket.



- (b) Disconnect the return hose from the common rail.



- (c) Remove the 2 bolts and common rail.



INSTALLATION

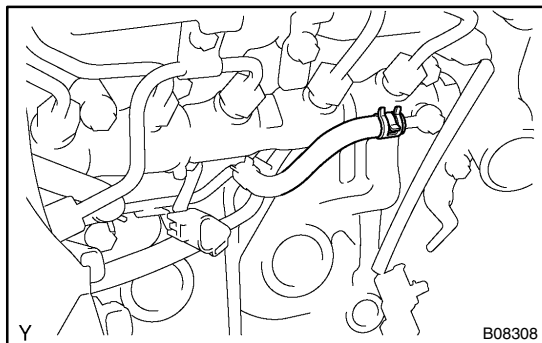
NOTICE:

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

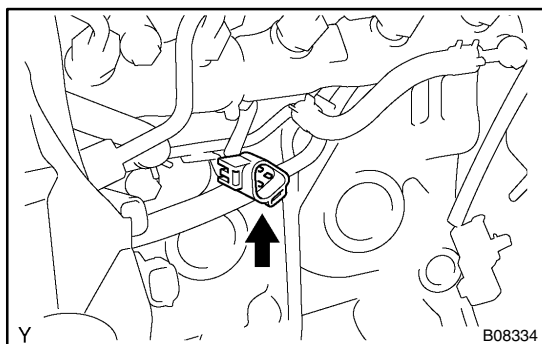
1. INSTALL COMMON RAIL

- (a) Install the common rail with the 2 bolts.

Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)



- (b) Connect the return hose to the common rail.



- (c) Connect the fuel pressure sensor connector to the bracket.

2. **INSTALL WATER OUTLET** (See page EM-46)
3. **INSTALL INJECTION PIPE** (See page FU-8)
4. **INSTALL FUEL INLET PIPE** (See page FU-18)
5. **CHECK FUEL LEAK** (See page FU-8)

FUEL PRESSURE LIMITTER ON-VEHICLE INSPECTION

FU06H-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-pressure, 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.

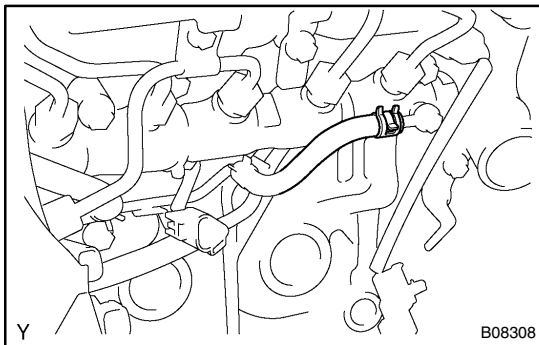
INSPECT FUEL PRESSURE LIMITTER

- (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.

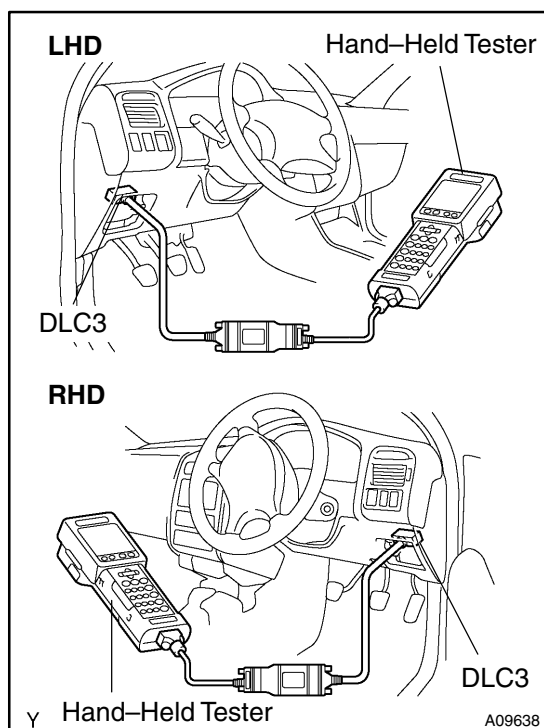
- (b) While cranking or start the engine, check that there are no leaks from any part of the fuel system.

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-22)



- (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.