

DAIHATSU
F70,F75,F77

**Service
manual**

FUEL SYSTEM

DAIHATSU MOTOR CO., LTD.

NO.9703-FE

DAIHATSU

F70, F75, F77

FUEL SYSTEM

PRECAUTIONS	FU- 2
TROUBLE SHOOTING	FU- 2
OUTLINE OF FUEL SYSTEM	FU- 3
INJECTION PUMP	FU- 4
FUEL FILTER	FU-10
INJECTION NOZZLE	FU-14
SST	FU-18
SPECIFICATIONS	FU-19

WRE91-FU001

PRECAUTIONS

1. Before working on the fuel system, be sure to disconnect the ground cable from the negative (-) terminal of the battery.
2. When working on the fuel system, never allow any naked fire to be brought near the working site. Also, never smoke cigarette or the like.
3. Do not allow the fuel to get to any parts made of rubber or resin.
4. Do not work on the fuel system of more than one vehicle at the same time.
5. Be certain to keep each part of the fuel system from contamination.
6. Be very careful not to allow any dirt or the like be mixed into the fuel system during the servicing operation.
7. Make sure to keep the working site clean. Also, be sure not to loose any part, specifically small parts.
8. Never loose nor mix up those pins, clips and springs with each other.

TROUBLE SHOOTING

WRE91-FU002

Problem	Possible cases	Remedy	Page
Engine will not start/Hard to start (Only cases where cranking by starter motor is normal)	Fuel line clogged Fuel line bent or kinked Fuel filter clogged Incorrect injection timing Injection nozzle faulty Injection pump faulty	Reset injection timing Check injection nozzle Inspect injection pump	FU-3 EM-11
Rough idle/Engine stalls	Incorrect valve clearance Incorrect idle speed Incorrect injection timing Fuel leakage • Injection pipe • Injection nozzle • Delivery valve Injection pump faulty	Adjust valve clearance Adjust idle speed Reset injection timing Check fuel line Inspect injection pump	EM-10 EM-13 EM-11 FU-3 FU-4
Lack of power	Incorrect injection timing Fuel leakage • Injection pipe • Injection nozzle • Delivery valve Injection pump faulty	Reset injection timing Check fuel line Inspect injection pump	EM-10 FU-4
Engine emits large quantity of exhaust smoke	Incorrect injection timing Injection nozzle faulty Injection pump faulty	Reset injection timing Check injection nozzle Inspect injection pump	EM-10 FU-4

WRE91-FU003

OUTLINE OF FUEL SYSTEM

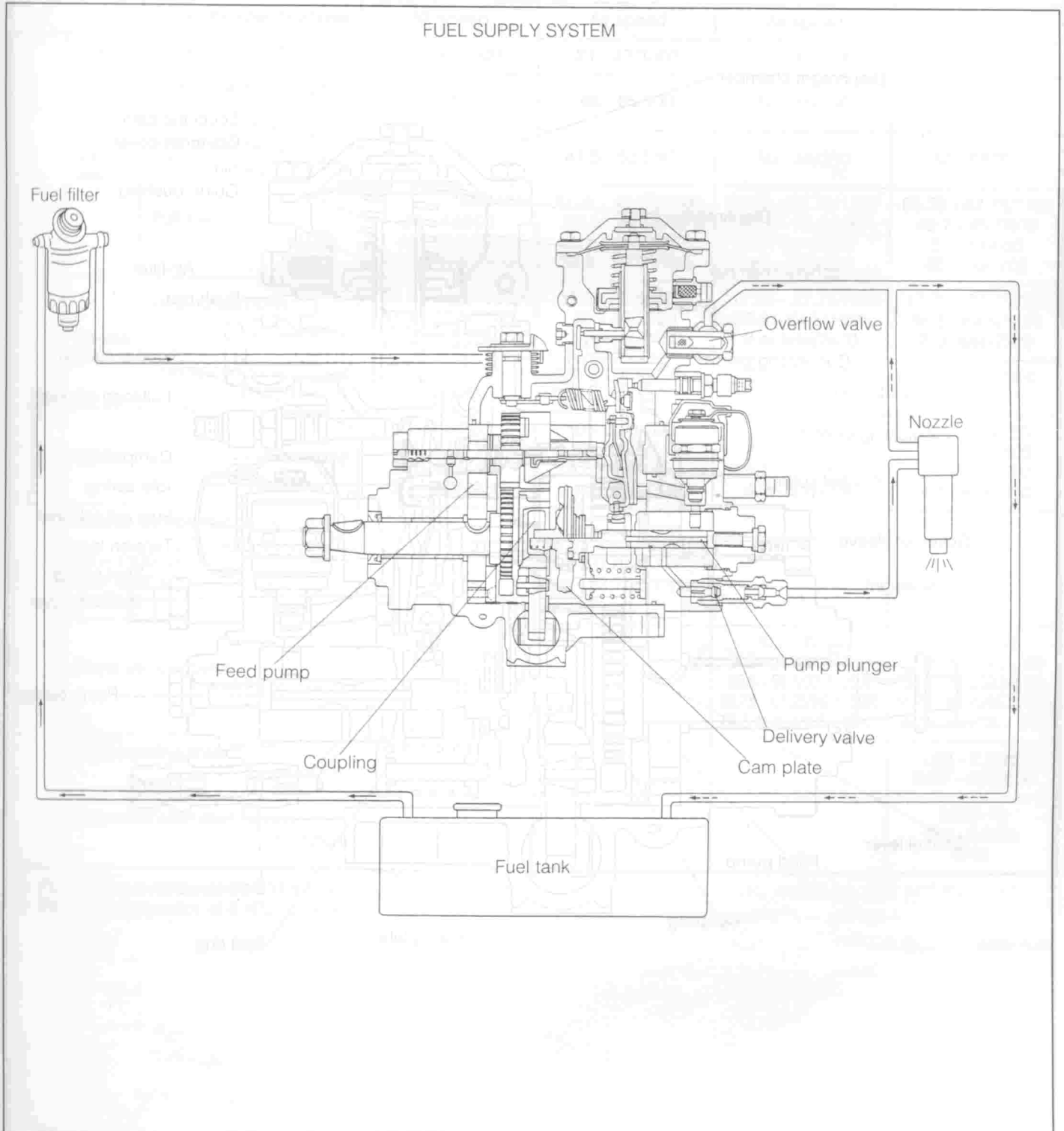
Fuel is sucked from the fuel tank by means of a feed pump through a sedimentor and a fuel filter. The feed pump, which is built inside the injection pump, sends fuel directly to the pump housing so as to lubricate the sliding section.

Then, the pump plunger causes the fuel to be injected from the injection nozzle under a high pressure in accordance with the injection order. On the other hand, any excess fuel inside the pump housing returns to the fuel tank through an overflow pipe.

In this way, cooling and lubrication take place in the injection pump by the fuel recirculation.

On the other hand, the fuel is recirculated inside the pump during cold season.

As a result, the fuel is warmed up, thereby preventing it from becoming a wax state.

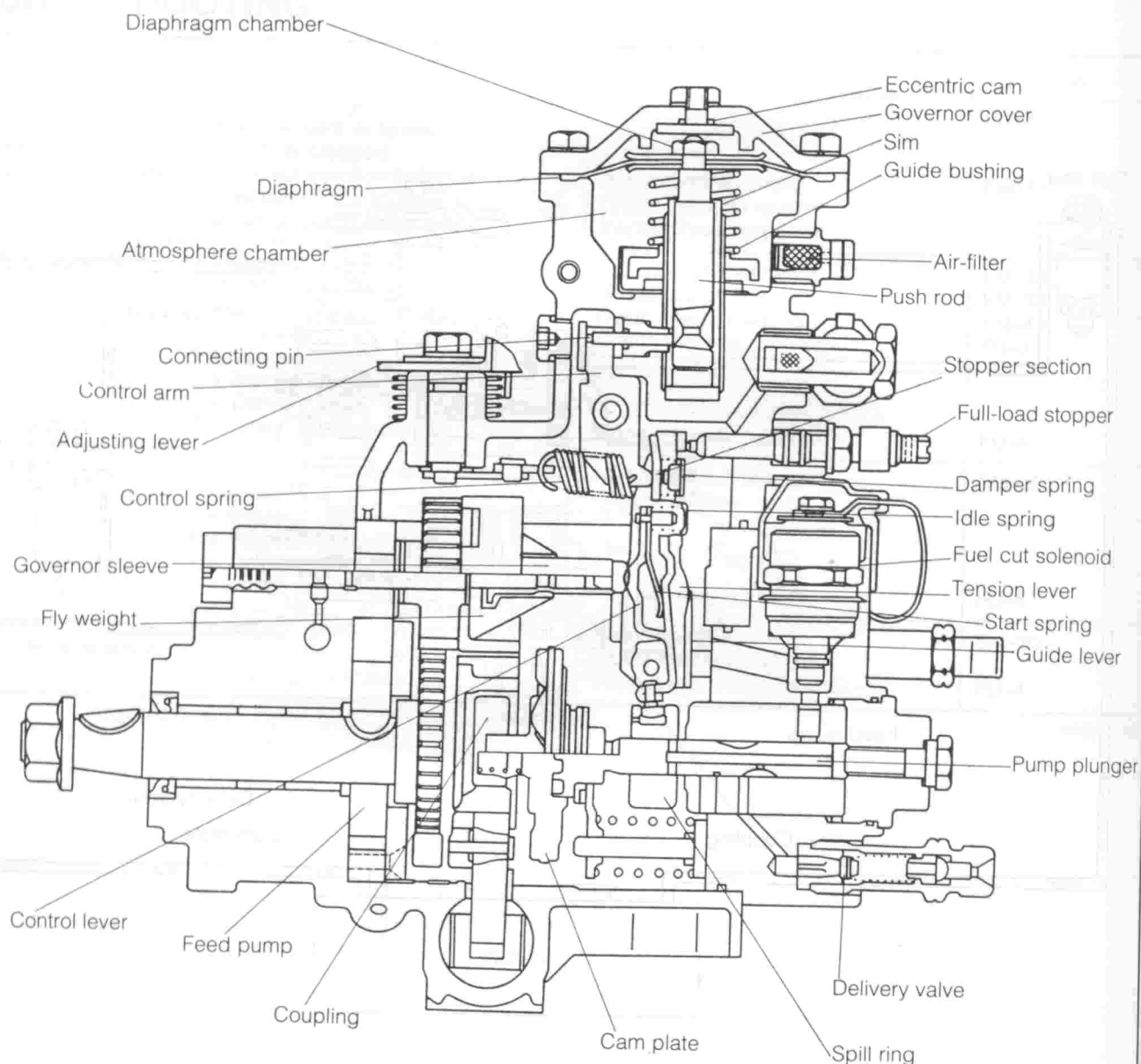


WRE91-FU004

INJECTION PUMP

As for the injection pump, Type VE injection pump is employed.

Two types of the injection pump have been provided for each of Type DL-42 engine and Type DL-52 engine. Consequently, an optimum fuel supply is achieved for the respective engines.



MAIN SPECIFICATIONS OF INJECTION PUMP

		DL-42		DL-52	
		STD	OPT	General	Austria-Switzerland
Pump specifications	Plunger diameter mm	9	9	9	9
	Cam lift mm	2.2	2.2	2.2	2.2
	Fuel return amount mm ³	40	40	37.5	37.5
	Injection order	ABCD	ABCD	ABCD	ABCD
	Governor specifications	All speed	All speed	All speed	All speed
Characteristics	Overflow amount (L/h/rpm)	21 - 47/1900	21 - 47/1900	17 - 37/1700	17 - 37/1700
	Injection amount	Fuel increase at starting (mm ³ /st/rpm)	66 - 85/100	66 - 85/100	66 - 85/100
		End of fuel increase effect (mm ³ /st/rpm)	41.5 - 50.5/400	41.5 - 50.5/400	50 - 58/350
		Full load (mm ³ /st/rpm)	42.15 - 43.65/1100 38 - 43/500 44 - 49/1450 40.5 - 44.5/1900	39.25 - 40.75/1100 35.1 - 40.1/500 41.1 - 46.1/1450 38.6 - 43.6/1900	65.75 - 67.75/1100 42.7 - 45.7/500 51 - 54/680 65 - 70/1700
	Governor	High-speed side (mm ³ /st/rpm)	16.5 - 24.5/2250 24.5 - 32.5/2100 2 or less/2600	17.5 - 23.5/2250 35 - 43/2100 2 or less/2450	¹ 17.75 - 27.75/2250 56.5 - 64.5/1800 2 or less/2500
		Low-speed side (mm ³ /st/rpm)	6.5 - 11.5/350 2 or less/500	6.5 - 11.5/350 2 or less/500	² 6.5 - 11.5/350 2 or less/500
	Timer (mm/rpm)	0 - 1.0/700 2.0 - 3.0/1100 3.7 - 4.7/1450 5.7 - 6.5/2250	0 - 0.98/700 1.85 - 2.85/1100 3.5 - 4.5/1450 6.15 - 6.95/2250	¹ 0.7 - 1.7/700 2.3 - 3.3/1100 4.1 - 5.1/1500 4.9 - 5.7/1750	¹ 0.6 - 1.6/750 2.2 - 3.2/1100 3.4 - 4.4/1500 4.1 - 4.9/1600
	Altitude compensation device (mm ³ /st/kPa(mmHg)) (N = 1100 rpm With lever set to full stroke position)	— — —	38.5 - 41/94.6 (710) 33.8 - 37.8/82.7 (620) 30.3 - 33.7/70.7 (530)	— — —	— — —
	Boost compensator (mm/kPa (mmHg))	— — — —	— — — —	42.7 - 49.7/0 51.2 - 55.2/24.0 (180) 55.6 - 59.6/33.3 (250) 65.75 - 67.25/66.7 (500) 66.5 or less/106.7 (800)	42.7 - 49.7/0 51.2 - 55.2/24.0 (180) 55.6 - 59.6/33.3 (250) 65.75 - 67.25/66.7 (500) 66.5 or less/106.7 (800)
	Load sensing timer mm/mm ³ /st	— —	— —	— —	1.53 - 2.53/50 3.38 - 4.38/Full
	Automatic cold start device (mm/°C)	— — —	— — —	— — —	2.05/-10 0.6 - 0.9/25 0/45

* 1: Pb = Characteristics at 66.7 kPa (500 mmHg)

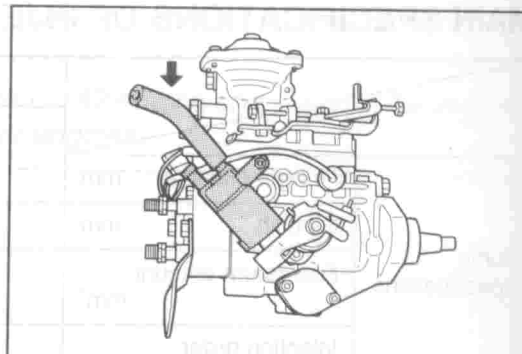
* 2: Pb = Characteristics at 0 kPa (0 mmHg)

WRE91-FU006

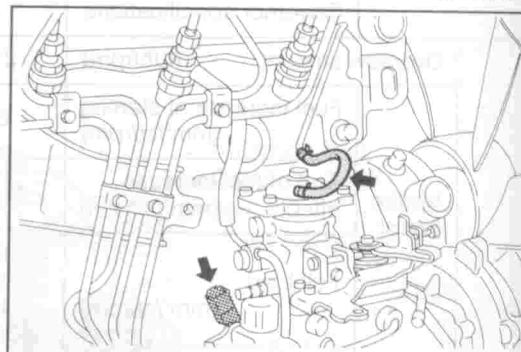
FUEL SYSTEM

REMOVAL OF INJECTION PUMP

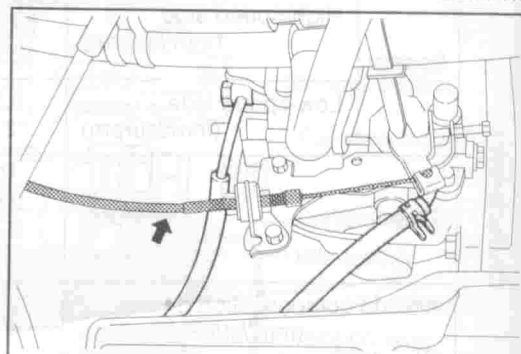
1. Drain the coolant.
(ACSD equipped vehicle only)
2. Disconnect the water hose from ACSD.
(ACSD equipped vehicle only)
3. Disconnect the boost compensator hose.
(DL-52 engine only)
4. Disconnect the connector for fuel cut solenoid
5. Remove the accelerator cable.
6. Disconnect the fuel hoses from inlet and outlet fuel pipes.
7. Remove the four injection pipes.
Disconnect the injection pipe from the injection pump and the injection nozzle.



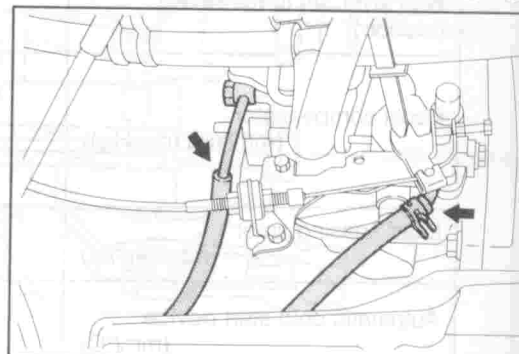
WRE91-FU008



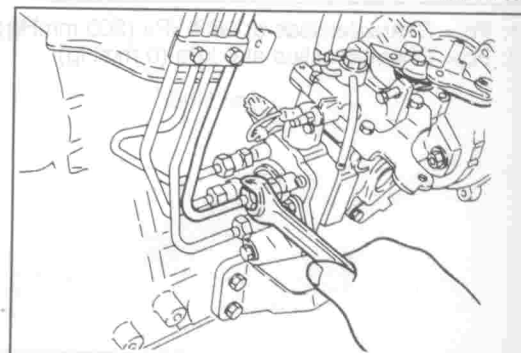
WRE91-FU009



WRE91-FU010

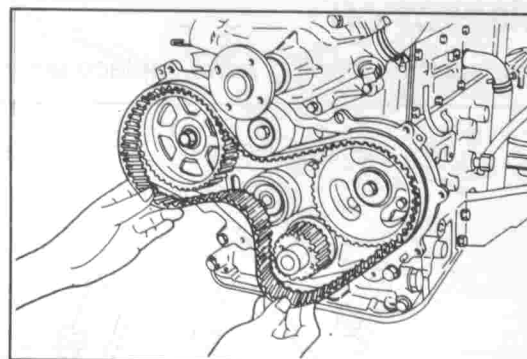


WRE91-FU051



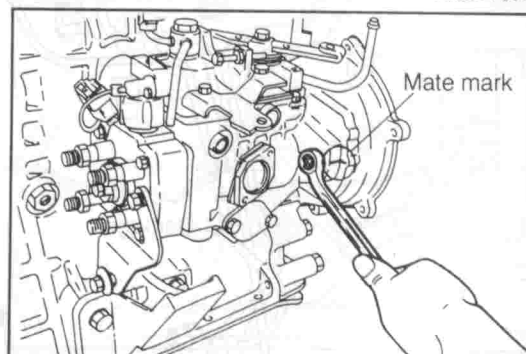
WRE91-FU011

8. Remove the timing belt.
(See page EM-30.)



WRE91-FU012

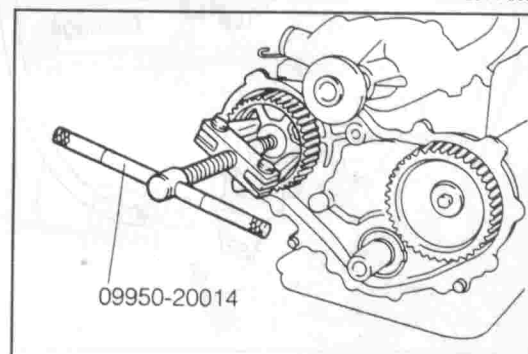
9. Remove the injection pump timing belt pulley.



WRE91-FU052

10. Remove the injection pump by loosen three attaching nuts.
NOTE:

- Check the position of the injection period line before removing the injection pump.

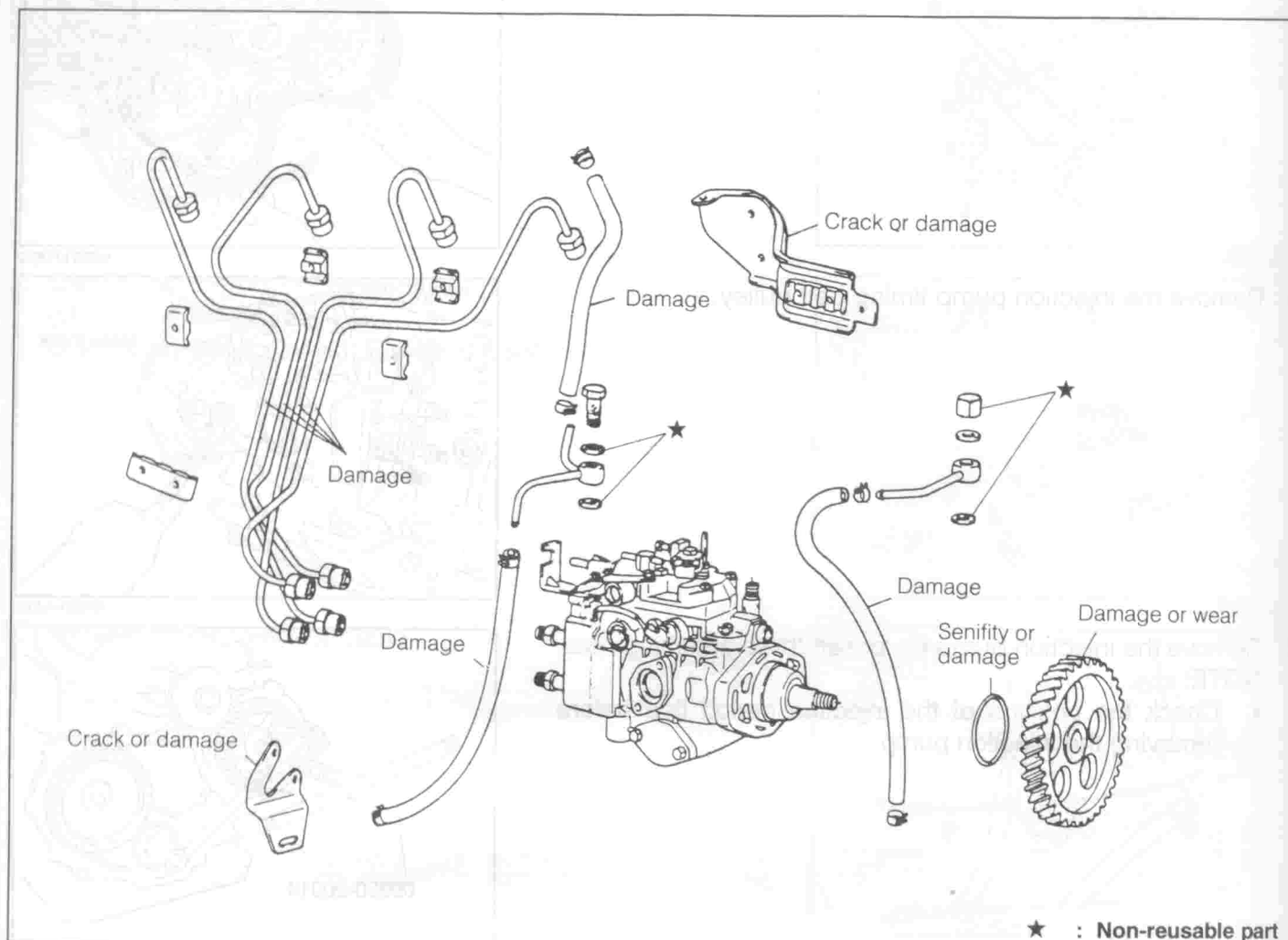


WRE91-FU013

FUEL SYSTEM

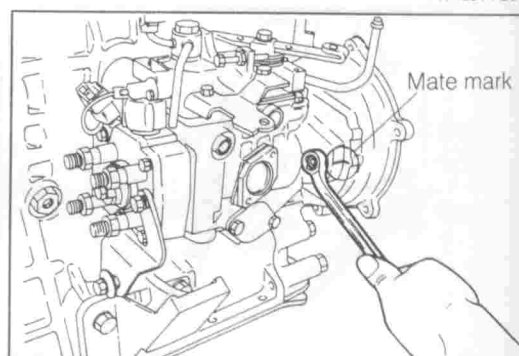
INSPECTION

Inspect the following parts, replace any part that exhibits defects.



INSTALLATION OF INJECTION PUMP

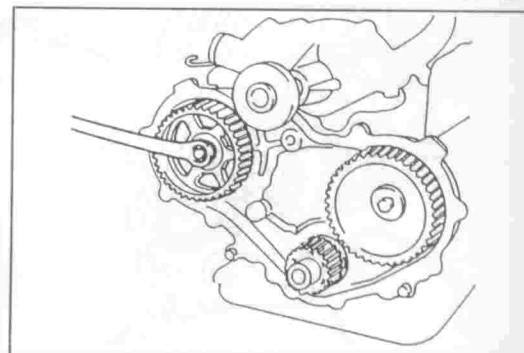
1. Install the injection pump.
Align the mate mark on the injection pump with mate mark on timing gear case side.
Tighten the injection pump temporarily.



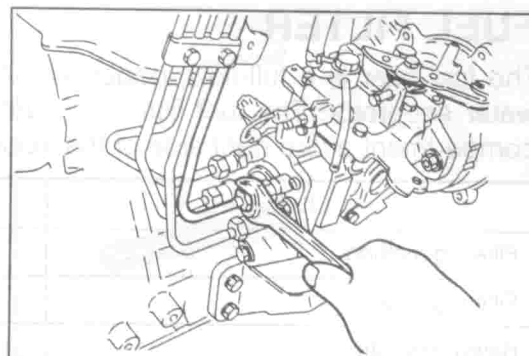
2. Install the timing belt and the injection pump timing belt pulley.

(See page EM-34.)

Tightening Torque: $83.4 \pm 4.9 \text{ N}\cdot\text{m}$
($8.50 \pm 0.50 \text{ kgf}\cdot\text{m}$)

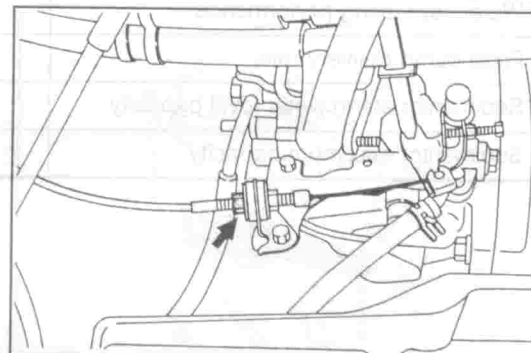


3. Install the four injection pipes.
Connect the injection pipe to the injection pump and the injection nozzle.



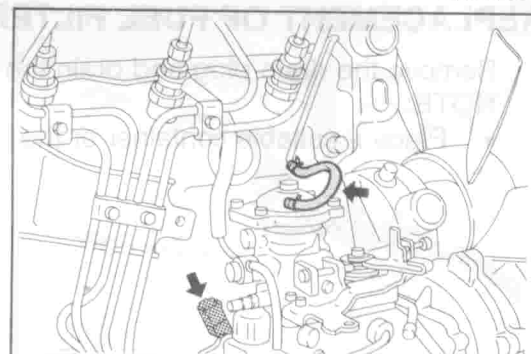
WRE91-FU017

4. Connect the fuel hoses to inlet and outlet fuel pipes.
5. Install the accelerator cable.



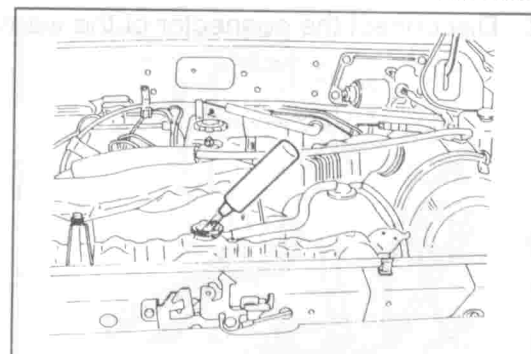
WRE91-FU018

6. Connect the connector for fuel cut solenoid valve.
7. Connect the boost compensator hose.
(DL-52 engine only)



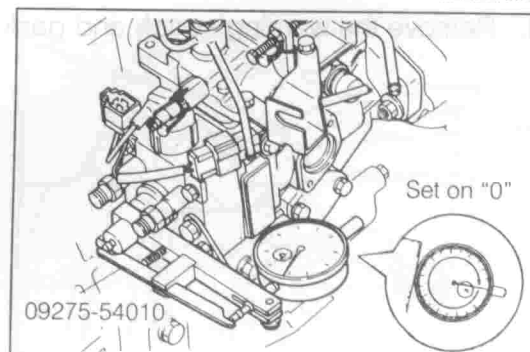
WRE91-FU019

8. Connect the water hoses for ACSD.
(ACSD equipped vehicle only)
9. Fill the coolant.



WRE91-FU020

10. Adjust the injection timing.
(See page EM-11.)
11. Start the engine.
12. Check the fuel leakage and repair it.



Set on "0"

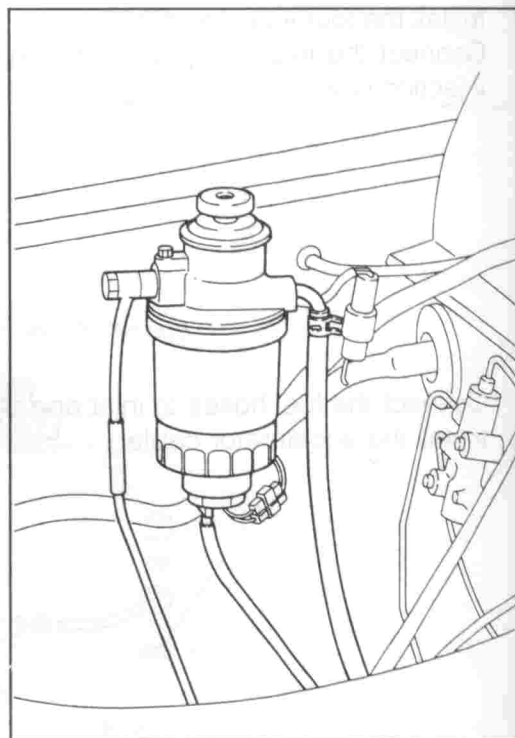
09275-54010

WRE91-FU021

FUEL FILTER

The fuel filter is a full-flow, paper filter type equipped with a water separator. The fuel filter is mounted inside the engine compartment at the right side of the vehicle.

Item	Specifications
Filtering method	Filter paper
Filtering area	0.4 m ²
Rated flow rate	1.2 dm ³ /min
Water separating performance	100 ppm or less
Feed pump delivery rate	15 cm ³ /st
Sedimentor alarm water level capacity	80 cm ³
Sedimentor maximum capacity	150 cm ³



WRE91-FU007

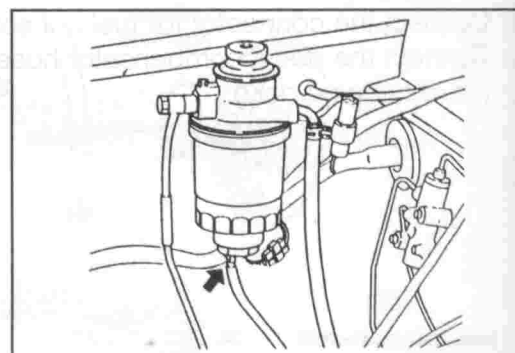
REPLACEMENT OF FUEL FILTER

1. Remove the drain plug and drain the fuel.

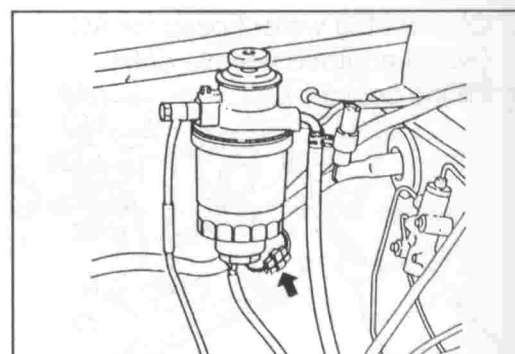
NOTE:

- Place a suitable container or the like under the filter.

2. Disconnect the connector of the warning switch.

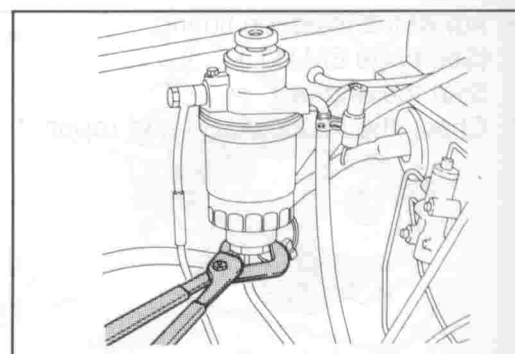


WRE91-FU023



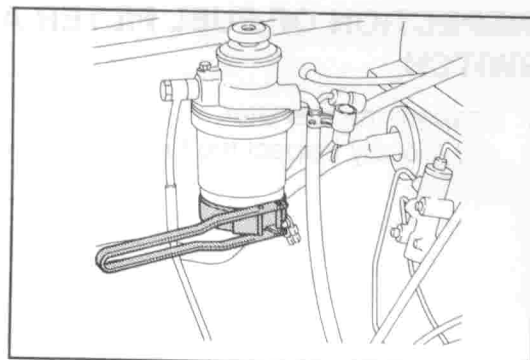
WRE91-FU024

3. Remove the warning switch and gasket, using pliers.



WRE91-FU025

4. Remove the fuel filter and "O" ring, using a filter wrench.



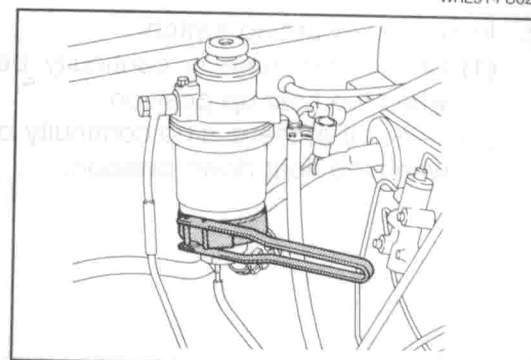
WRE91-FU026

5. Install a new fuel filter with a new "O" ring.

NOTE:

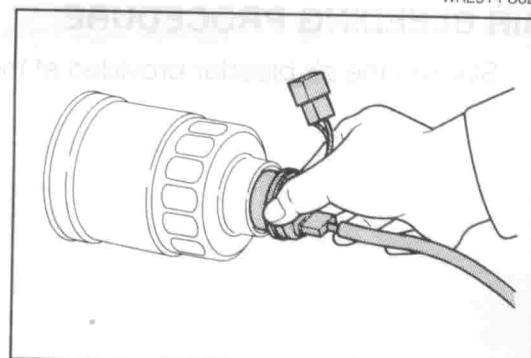
- Apply a thin film of alcohol to the "O" ring.
- Slowly screw-in the fuel filter by your hands, until you feel a light resistance.
- Tighten the fuel filter to the specified torque by means of a filter wrench.

Tightening Torque: $12.7 \pm 2.0 \text{ N}\cdot\text{m}$ ($1.30 \pm 0.20 \text{ kgf}\cdot\text{m}$)



WRE91-FU027

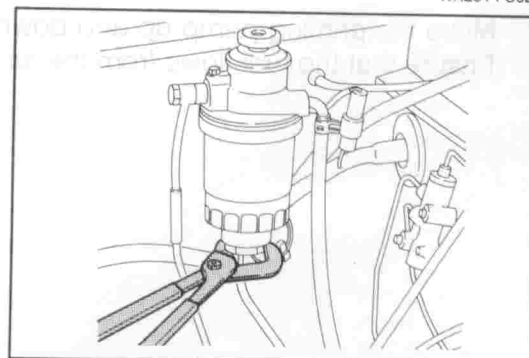
6. Install the warning switch with a new gasket by hand.



WRE91-FU028

7. Connect the connector of warning switch.

8. Install the drain plug with a new gasket.

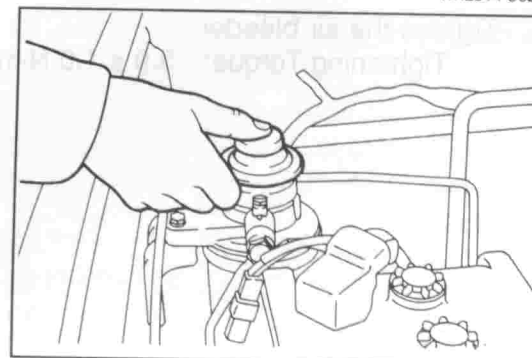


WRE91-FU029

9. Fill the fuel pump with fuel.

Operate the hand pump until you feel more resistance.

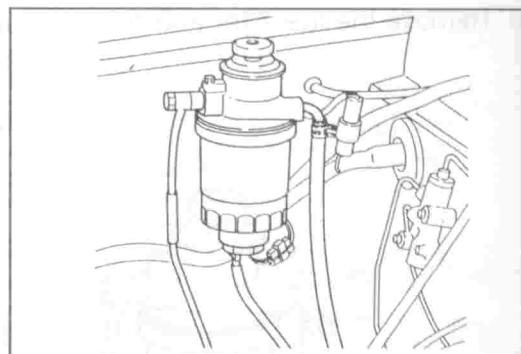
10. Start the engine.
- Check for fuel leaks.



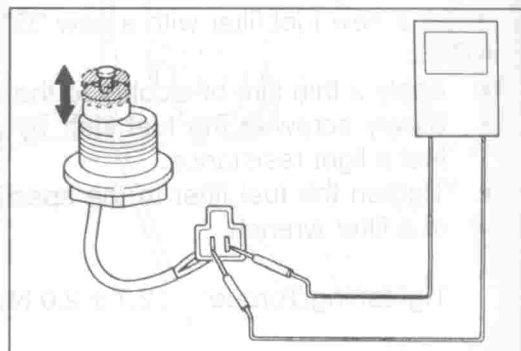
WRE91-FU030

INSPECTION OF FUEL FILTER AND WARNING SWITCH

1. Inspect the fuel filter
 - (1) Visually inspect the fuel filter for fuel leaks and damage.
2. Inspect the warning switch
 - (1) Check that there is continuity between the terminals when the float up position.
 - (2) Check that there is no continuity between the terminals when the float down position.



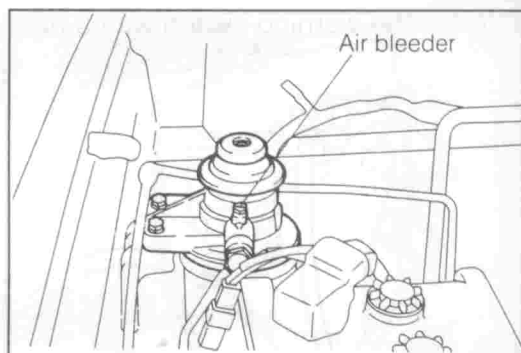
WRE91-FU031



WRE91-FU032

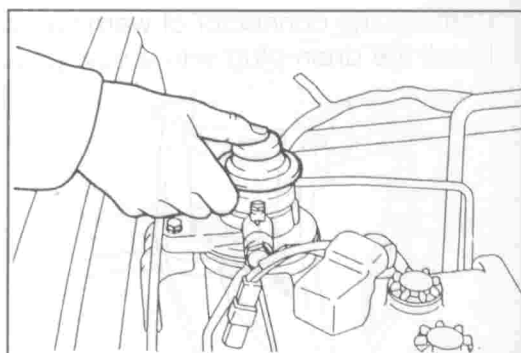
AIR BLEEDING PROCEDURE

1. Slacken the air bleeder provided at the top of the fuel filter.



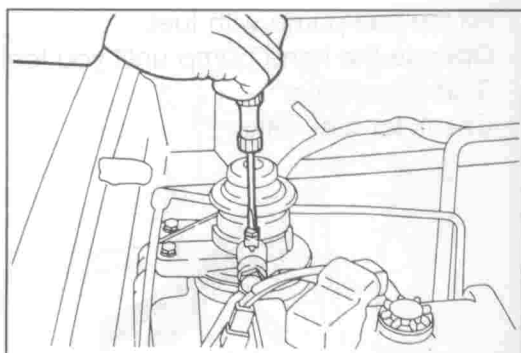
WRE91-FU034

2. Move the priming pump up and down. Ensure that the fuel flows from the air bleeder.



WRE91-FU035

3. Tighten the air bleeder.
Tightening Torque: $3.9 \pm 1.0 \text{ N}\cdot\text{m}$ ($0.40 \pm 0.10 \text{ kgf}\cdot\text{m}$)



WRE91-FU036

4. Move the priming pump up and down, until it becomes heavy to operate.
5. Start the engine. Ensure that no fuel leaks from the air bleeder section.

WRE91-FU037

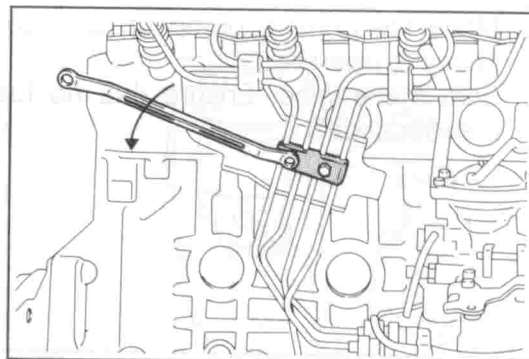


FUEL SYSTEM

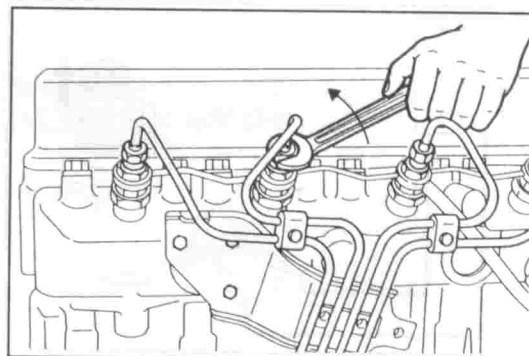
INJECTION NOZZLE

REMOVAL OF INJECTION NOZZLE

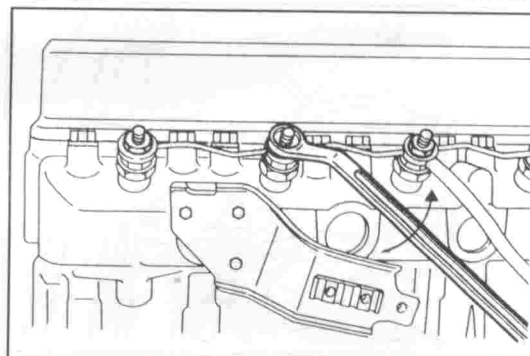
1. Remove the two bolts holding the four injection pipes to the cylinder block.
2. Disconnect the injection pipe from the injection nozzle and the injection pump.
3. Remove the injection pipes.
4. Remove the nozzle leakage pipe by loosen four nuts.
5. Remove the injection nozzle and nozzle holder.
NOTE:
 - Arrange the nozzle in order.



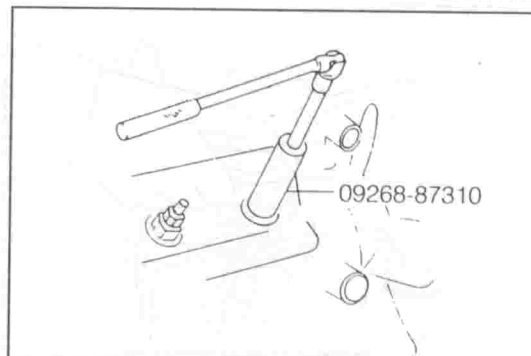
WRE91-FU038



WRE91-FU039



WRE91-FU040



WRE91-FU041

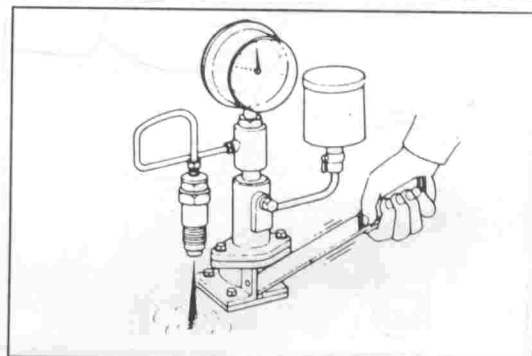
INSPECTION

1. Checking of injection pressure
Attach the nozzle on the tester. Operate the tester lever at a rate of 15 to 20 times per minute. Take the reading of the pressure gauge at the moment when the gauge's pointer drops suddenly.

Specified Pressure:

DL-42: 10788 ± 980 kPa (110 ± 10 kgf/cm²)

DL-52: 12749 ± 980 kPa (130 ± 10 kgf/cm²)

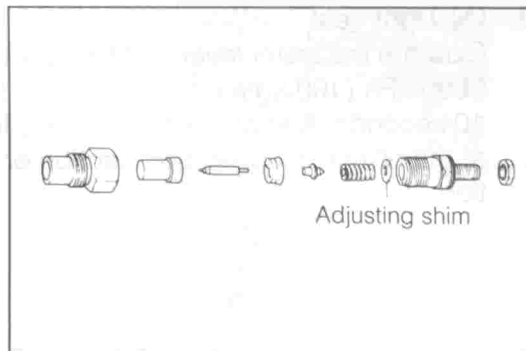


WRE91-FU042

2. Adjustment of injection pressure

To adjust the injection pressure, first disassemble the injection nozzle and increase or decrease the shim, as required.

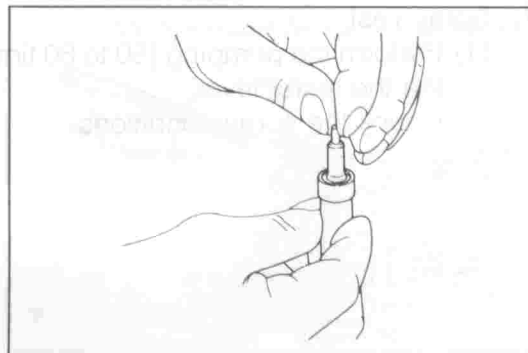
- (1) The variation of 0.05 mm in shim thickness will cause the injection pressure to change approximately 490 kPa (5 kgf/cm²).
- (2) The adjusting shims are available in 20 different kinds from 1.00 mm to 1.95 mm in increments of 0.5 mm.



WRE91-FU043

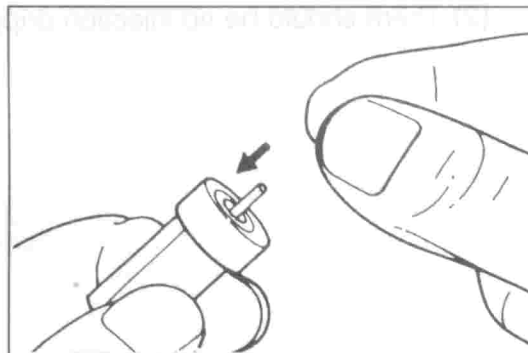
3. Sliding Test

- (1) First, wash the needle and body in clean light oil. With the needle body held vertically, pull out the needle about one third of the whole stroke. Release the needle from that position.



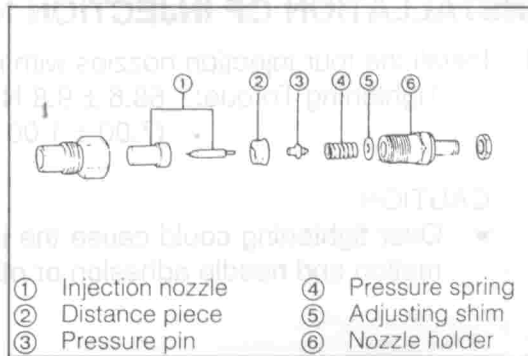
WRE91-FU044

- (2) The needle should drop to the valve seat position by its own weight.



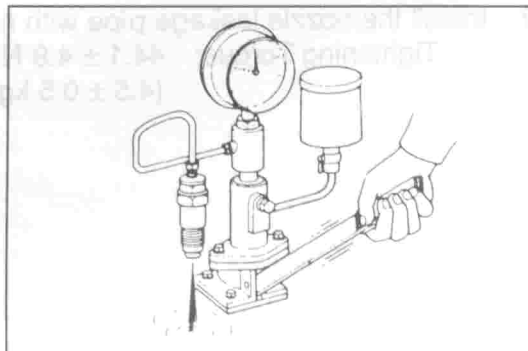
WRE91-FU045

4. Assemble the parts as shown in the right figure. Tighten them to the specified torque.



WRE91-FU046

5. After the injection nozzle has been assembled, carry out the injection test. Adjust the injection nozzle, as required.

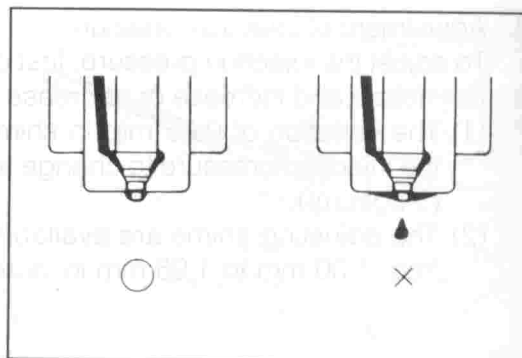


WRE91-FU047

FUEL SYSTEM

6. Oil-Tight Test

Operate the tester lever, until the pressure rises up to about 9800 kPa (100 kgf/cm²). Then, hold this pressure for about 10 seconds. And check to see if any fuel leakage is present at the nozzle injection port section or the retaining nut section.

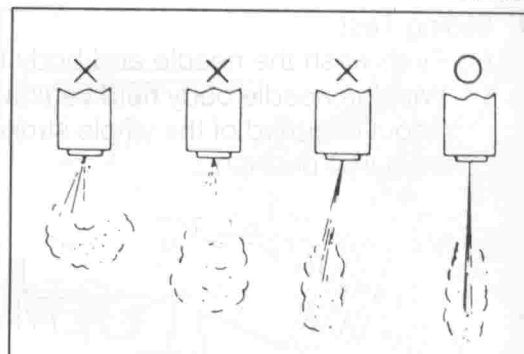


WRE91-FU048

7. Spray Test

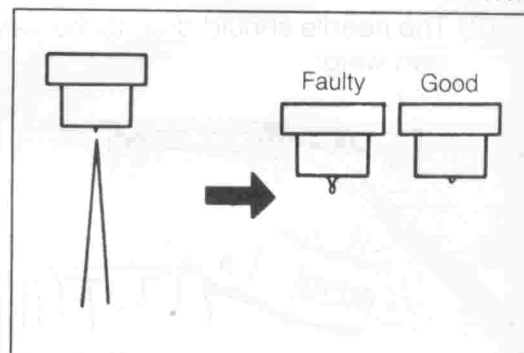
- (1) Perform the pumping (50 to 60 times/minute) by operating the tester lever.

Check the spray conditions.



WRE91-FU049

- (2) There should be no injection dripping.



WRE91-FU050

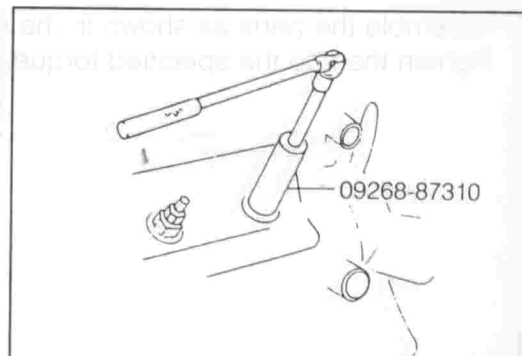
INSTALLATION OF INJECTION NOZZLE

1. Install the four injection nozzles with new gasket.

Tightening Torque: $68.6 \pm 9.8 \text{ N}\cdot\text{m}$
($7.00 \pm 1.00 \text{ kgf}\cdot\text{m}$)

CAUTION:

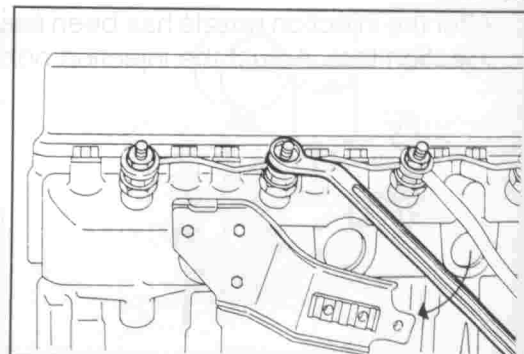
- Over tightening could cause the injection nozzle deformation and needle adhesion or other defects.



WRE91-FU051

2. Install the nozzle leakage pipe with new gasket.

Tightening Torque: $44.1 \pm 4.9 \text{ N}\cdot\text{m}$
($4.5 \pm 0.5 \text{ kgf}\cdot\text{m}$)

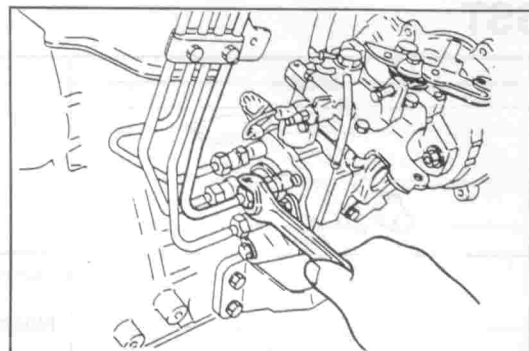


WRE91-FU052

3. Installation of injection pipes.

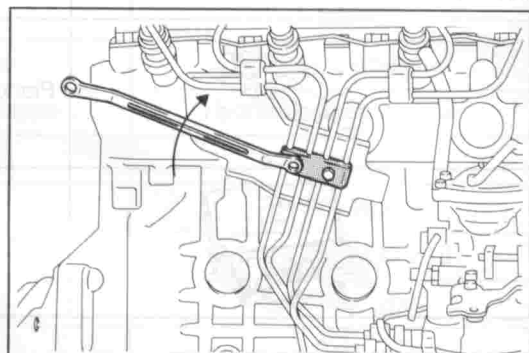
- (1) Install the four injection pipe to the injection nozzle and injection pump.

Tightening Torque: $24.5 \pm 4.9 \text{ N}\cdot\text{m}$
 $(2.5 \pm 0.5 \text{ kgf}\cdot\text{m})$



WRE91-FU053

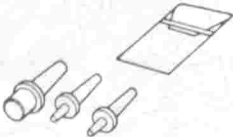
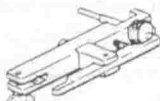
- (2) Place the clamp and tighten the two attaching bolts.



WRE91-FU054

FUEL SYSTEM

SST

Shape	Part number & name	Remark
	09258-00030-000 Plug set	Plugging rubber hose
	09268-87310-000 Nozzle holder wrench	Used for removing/installing injection nozzle
	09275-87701-000 Plunger stroke measuring tool	Used for injection timing
	09950-20017-000 Universal puller	Used for removing crankshaft gear

TIGHTENING TORQUE

WRE91-FU055

Tightening component	Tightening torque			Remark
	N-m	kgf-m	ft-lb	
Cylinder head x Nozzle holder	68.6 ± 9.8	7.00 ± 1.00	50.6 ± 7.2	
Cylinder head x Injection pipe bracket	18.1 ± 3.4	1.85 ± 0.35	13.4 ± 2.5	
Cylinder brock x Injection pump	18.1 ± 3.4	1.85 ± 0.35	13.4 ± 2.5	
Injection pump x Injection pump drive pulley	83.4 ± 4.9	8.50 ± 0.50	61.5 ± 3.6	
Injection pump x Injection pipe	24.5 ± 4.9	2.5 ± 0.50	18.1 ± 3.6	
Injection pump x Derivery valve holder	49.0 ± 4.9	5.00 ± 0.50	36.2 ± 3.6	
Injection pump x Nozzle leakage No. 2	36.8 ± 2.5	3.75 ± 0.25	27.1 ± 1.8	
Injection pump x Union fuel return	24.5 ± 4.9	2.50 ± 0.50	18.1 ± 3.6	
Injection pump x Union fuel return	24.5 ± 4.9	2.50 ± 0.50	18.1 ± 3.6	
Injection pump x Distributive head bolt	17.2 ± 2.9	1.75 ± 0.3	12.7 ± 2.2	
Injection pump x Screw Ay over flow	7.4 ± 1.5	0.75 ± 0.15	5.4 ± 1.1	
Nozzle holder x Injection pipe	24.5 ± 4.9	2.50 ± 0.5	18.1 ± 3.6	
Nozzle holder x Nozzle leakage No. 1	44.1 ± 4.9	4.50 ± 0.50	32.5 ± 3.6	

WRE91-FU056

SPECIFICATIONS

		DL-42	DL-52
Fuel tank capacity	dm ³	60	60
Injection pump	Type	Bosch VE type	←
	Injection timing	1° BTDC (High altitude compensator: 3° BTDC)	1° BTDC
	Plunger diameter	mm	9.0
	Cam lift	2.2	2.2
	Governor type	Centrifugal type	Centrifugal type
	Timer type	Hydraulic pressure type	Hydraulic pressure type
Injection Nozzle or injector	Nozzle retainer type	Screwed type	Screwed type
	Nozzle type	Throttle type	Throttle type
	Injection pressure	kPa (kgf/cm ²)	10,788 ± 980 (110 ± 10)
Fuel filter	Type	Paper filter type	Paper filter type
	Filtering area	m ²	0.4
	Rated flow rate	dm ³ /min	1.2
	Sedimentor alarm water level capacity	80	80
	Sedimentor maximum capacity	150	150

FUEL SYSTEM

INJECTION PUMP

			DL-42		DL-52	
			STD	OPT	General	Austria-Switzerland
Pump specifications	Plunger diameter	mm	9	9	9	9
	Cam lift	mm	2.2	2.2	2.2	2.2
	Fuel return amount	mm ³	40	40	37.5	37.5
	Injection order		ABCD	ABCD	ABCD	ABCD
	Governor specifications		All speed	All speed	All speed	All speed
Characteristics	Overflow amount	(L/h/rpm)	21 - 47/1900	21 - 47/1900	17 - 37/1700	17 - 37/1700
	Injection amount	Fuel increase at starting (mm ³ /st/rpm)	66 - 85/100	66 - 85/100	66 - 85/100	66 - 85/100
		End of fuel increase effect (mm ³ /st/rpm)	41.5 - 50.5/400	41.5 - 50.5/400	50 - 58/350	50 - 58/350
		Full load (mm ³ /st/rpm)	42.15 - 43.65/1100 38 - 43/500 44 - 49/1450 40.5 - 44.5/1900	39.25 - 40.75/1100 35.1 - 40.1/500 41.1 - 46.1/1450 38.6 - 43.6/1900	65.75 - 67.75/1100 42.7 - 45.7/500 51 - 54/680 65 - 70/1700	65.75 - 67.75/1100 42.7 - 45.7/500 51 - 54/680 65 - 70/1700
	Governor	High-speed side (mm ³ /st/rpm)	16.5 - 24.5/2250 24.5 - 32.5/2100 2 or less/2600	17.5 - 23.5/2250 35 - 43/2100 2 or less/2450	¹ 17.75 - 27.75/2250 56.5 - 64.5/1800 2 or less/2500	¹ 17.75 - 27.75/2250 56.5 - 64.5/1800 2 or less/2500
		Low-speed side (mm ³ /st/rpm)	6.5 - 11.5/350 2 or less/500	6.5 - 11.5/350 2 or less/500	² 6.5 - 11.5/350 2 or less/500	² 6.5 - 11.5/350 2 or less/500
	Timer	(mm/rpm)	0 - 1.0/700 2.0 - 3.0/1100 3.7 - 4.7/1450 5.7 - 6.5/2250	0 - 0.98/700 1.85 - 2.85/1100 3.5 - 4.5/1450 6.15 - 6.95/2250	¹ 0.7 - 1.7/700 2.3 - 3.3/1100 4.1 - 5.1/1500 4.9 - 5.7/1750	¹ 0.6 - 1.6/750 2.2 - 3.2/1100 3.4 - 4.4/1500 4.1 - 4.9/1600
	Altitude compensation device (mm ³ /st/kPa (mmHg)) (N = 1100 rpm With lever set to full stroke position)		— — —	38.5 - 41/94.6 (710) 33.8 - 37.8/82.7 (620) 30.3 - 33.7/70.7 (530)	— — —	— — —
	Boost compensator (mm/kPa (mmHg))		— — — —	— — — —	42.7 - 49.7/0 51.2 - 55.2/24.0 (180) 55.6 - 59.6/33.3 (250) 65.75 - 67.25/66.7 (500) 66.5 or less/106.7 (800)	42.7 - 49.7/0 51.2 - 55.2/24.0 (180) 55.6 - 59.6/33.3 (250) 65.75 - 67.25/66.7 (500) 66.5 or less/106.7 (800)
	Load sensing timer mm/mm ³ /st		— —	— —	— —	1.53 - 2.53/50 3.38 - 4.38/Full
	Automatic cold start device (mm/°C)		— — —	— — —	— — —	2.05/-10 0.6 - 0.9/25 0/45

* 1: Pb = Characteristics at 66.7 kPa (500 mmHg)

* 2: Pb = Characteristics at 0 kPa (0 mmHg)

WRE91-EM333