

DAIHATSU

F300

[HD-Engine]

LUBRICATION SYSTEM

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WFES0-LU001

LUBRICATION SYSTEM

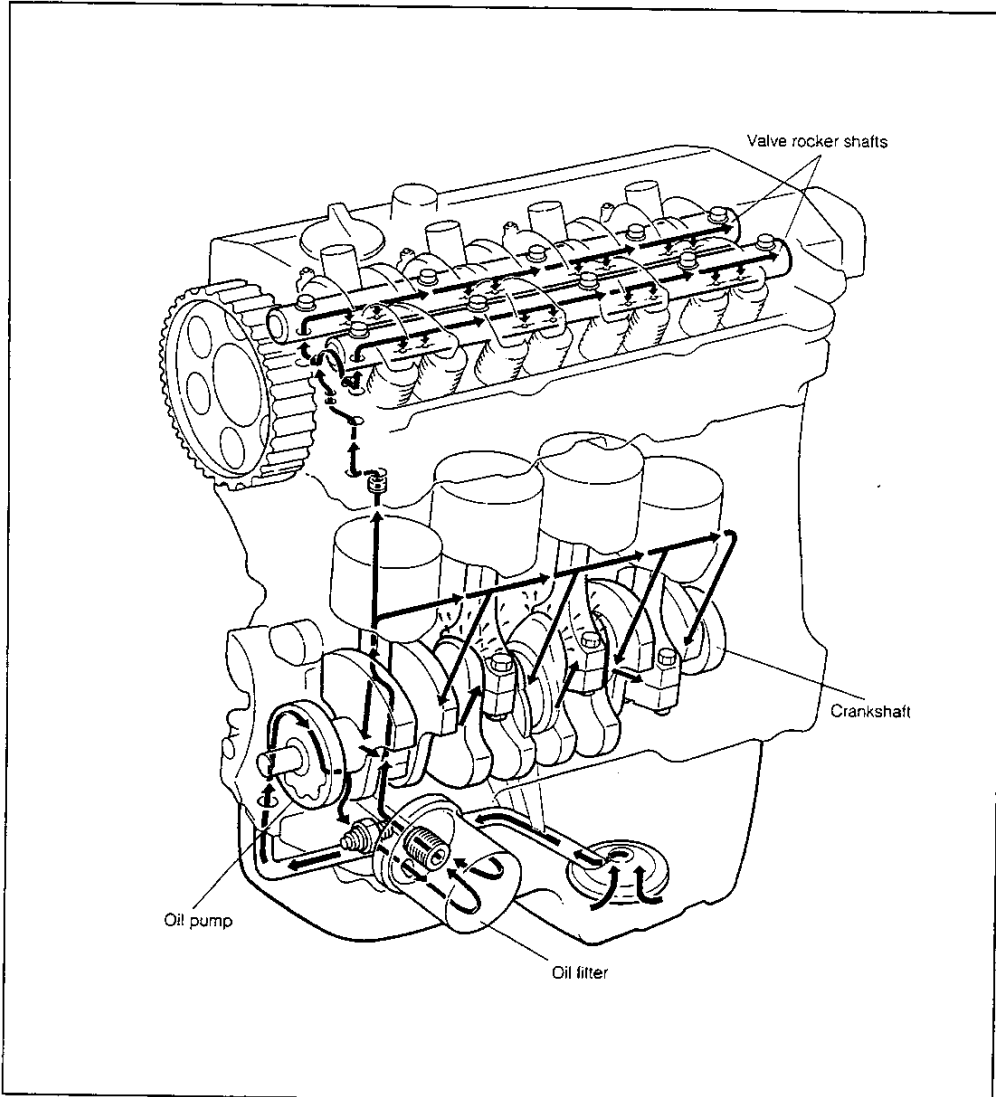
TROUBLE SHOOTING

Problem	Possible causes	Remedies	Page
Oil leakage	Cylinder head, cylinder block, oil cooler or oil pump body damaged or cracked Oil seal faulty Gasket faulty	Repair, if necessary. Replace oil seal. Replace gasket.	
Low oil pressure	Oil leakage Relief valve faulty Oil pump faulty Poor quality engine oil Crankshaft bearing faulty Connecting rod bearing faulty Oil filter clogged Check oil level	Repair, as necessary. Replace relief valve. Repair oil pump. Change engine oil Replace bearing. Replace bearing. Replace oil filter. Low oil level	EM-143 EM-143 LU-11 EM-128 EM-131 LU-11 LU-9
High oil pressure	Relief valve faulty	Replace relief valve.	EM-143

WFE90-LU002

LUBRICATION SYSTEM OUTLINE

The lubrication system employs a fully-forced feed, filtering method. The oil stored in the oil pan is sucked by an oil pump which is directly driven by the crankshaft. Then, the thus-sucked oil flows through an oil pump strainer and is filtered at an oil filter. After having passed through the passages of the cylinder block, it will be divided into two streams so as to lubricate various sections. One stream of the lubrication oil performs lubrication of various sections of the crankshaft and connecting rod- and piston-related parts. The other stream of the lubrication, oil rises to the cylinder head section. Then, it performs lubrication of the camshaft and valve rocker shaft-related parts.



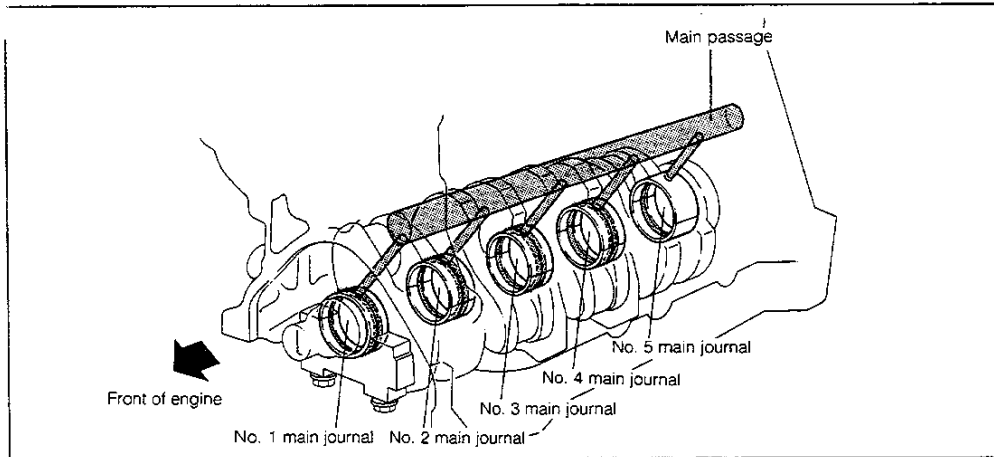
WF90-LJ003

LUBRICATION SYSTEM

LUBRICATION ROUTES

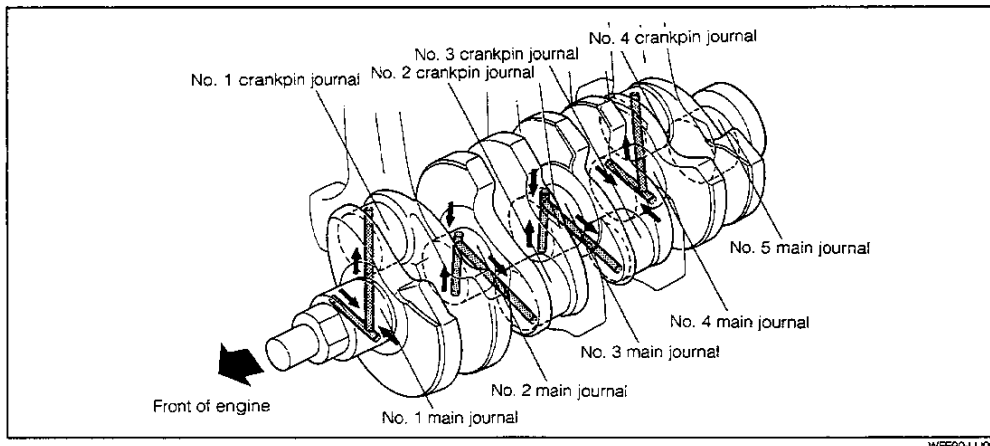
1. Crankshaft main journal sections

The oil which has been sent from the main passage provided inside the cylinder block to each crankshaft main journal under a pressurized state will be supplied to the crankshaft main journal sections through the bearing holes, via the oil grooves of the crankshaft main journal sections at the cylinder block side and the oil grooves of the crankshaft bearing caps. (However, in the case of the No. 5 main journal, no oil groove is provided both at the cylinder block side and at the crankshaft bearing cap side.) The thus-furnished oil is filled at the inner grooves of the bearings so as to lubricate the crankshaft main journal sections.



2. Crankpin journal sections

The oil which has been sent to each crankshaft main journal under a pressurized state will be sent to each crankpin journal via the inner passages of the crankshaft. Consequently, the lubrication takes place not only for the crankshaft main journal sections, but also for the crankpin journal sections. The inner passage of the crankshaft is connected from the No. 1 main journal to the No. 1 crankpin journal; from the No. 2 main journal to the No. 2 crankpin journal; from the No. 3 main journal to the No. 3 crankpin journal; and from the No. 4 main journal to the No. 4 crankpin journal, respectively.

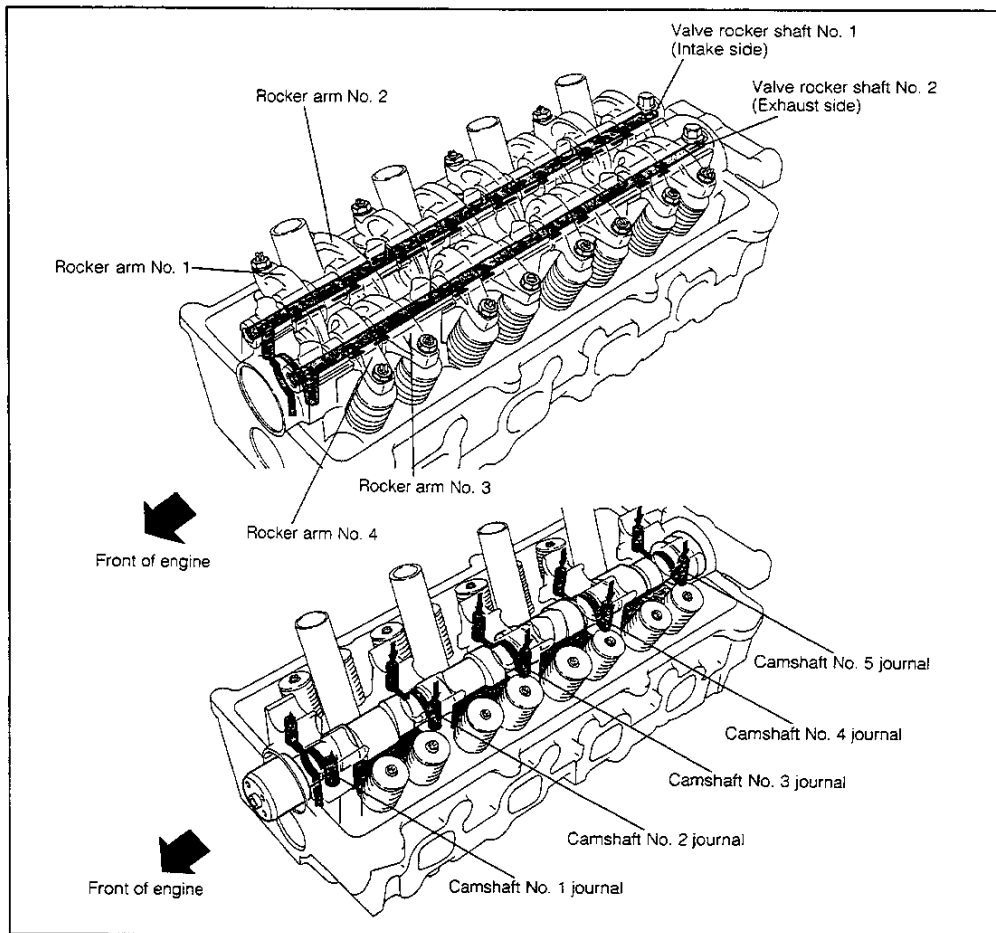


3. Cylinder head section

The oil fed from the cylinder block under a pressurized condition is filled in the groove of the camshaft bearing cap. Thus, the lubrication for the camshaft No. 1 journal takes place. Then, this oil travels upward around the camshaft journal No. 1 and oil passage provided beside rocker shaft attaching bolts, thus being supplied forcibly into the inner passage of the rocker shaft. As a result, the oil flows through the oil passage leading to the rocker arms, thereby lubricating the rocker arm sliding sections. To distribute the lubrication oil properly over the sliding surfaces, grooves are provided at the oil outlet of the rocker arm sliding surfaces of the rocker shaft.

For the lubrication for the No. 2 through No. 5 journal sections of the camshaft, the oil from the inner passage of the rocker shaft travels downward around the bolts, in the opposite way as with the lubrication from the No. 1 journal. Thus, the oil filled at the bearing cap groove will lubricate the aforesaid journal sections.

As regards the lubrication for the cam lobe surfaces, the oil which has lubricated the camshaft journal and rocker arm sliding sections will drop from both sides of the lubricating sections and it collects at the oil well provided at the cylinder head. Consequently, the camshaft lobe surfaces are lubricated by this oil bath lubrication which occurs each time the camshaft lobes dip into the oil well.



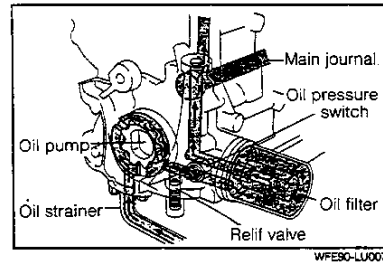
WF90-LU006

LUBRICATION SYSTEM

1. OIL PUMP

The oil pump is a trochoid type. This oil pump mounted at the front section of the engine is driven directly by the crankshaft. The oil pump is provided with a relief valve which starts functioning when the oil pressure rises excessively. Moreover, the oil pump is equipped with an oil pressure switch which lights the warning lamp when the oil pressure drops abnormally.

The relief valve detects the oil pressure at a point before the oil passes through the oil filter, whereas the oil pressure switch detects the oil pressure at a point after the oil passes through the oil filter.



WFES0-LU007

Oil pump specifications

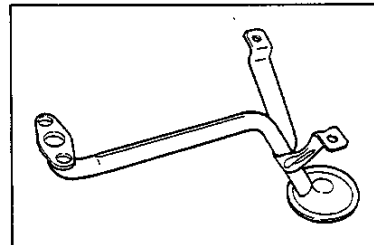
Item		Specifications
Type		Trochoid
Delivery output (at time of 5000 rpm 294 kPa (3 kgf/cm ²))	dm ³ /min	30 or more at time of oil temperature 60°C
Relief valve opening pressure (at time of 2000 rpm)	kPa (kgf/cm ²)	441.3 (4.5) at time of oil temperature 60°C
Number of teeth	Inner rotor	9
	Outer rotor	10

WFES0-LU008

OIL STRAINER

The oil strainer filtrates any dirt or foreign objects in the oil sucked from the oil pan.

The oil strainer bracket is supported at the journal No. 3 section of the crankshaft.

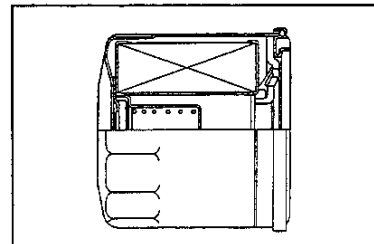


WFES0-LU009

OIL FILTER

The oil filter is a cartridge type which has a built-in bypass valve. This oil filter features a compact size and light weight.

Item	Specifications	Specifications	
		NIPPONDENSO	Tokyo Roki
Filtering area	cm ²	700	800
By-pass valve opening pressure	kPa (kgf/cm ²)	98.1 ± 19.6 (1 ± 0.2)	98.1 ± 19.6 (1 ± 0.2)

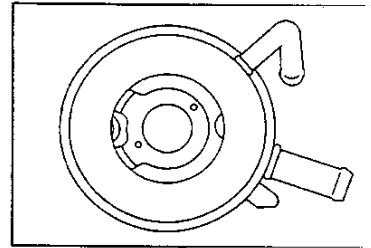


WFES0-LU010

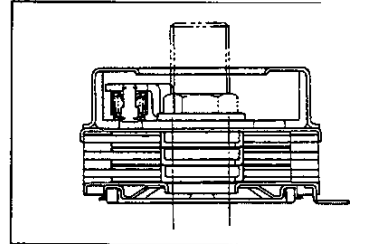
LUBRICATION SYSTEM

2. OIL COOLER

To prevent excessive temperature rise of the engine oil, an oil cooler is provided at the oil filter section so that an optimum temperature may be maintained at all times. The oil cooler incorporates a bypass valve for the oil cooler.



WF80-LU01



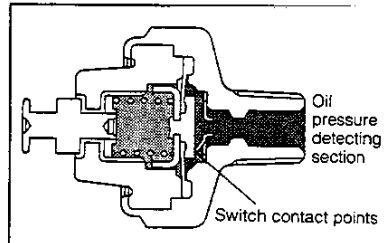
WF80-LU01

3. OIL PRESSURE SWITCH

The oil pressure switch is mounted on the oil pump body.

Specifications

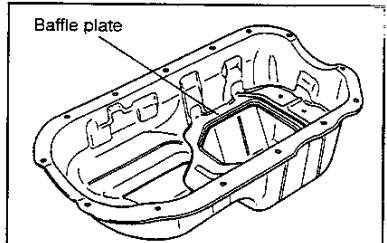
Item	Specifications
Operating pressure	kPa (kgf/cm ²) 19.6 (0.2)



WF80-LU02

4. OIL PAN

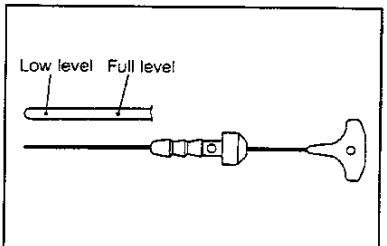
An oil pan made of steel sheet is employed. The oil pan is provided with a baffle plate.



WF80-LU04

5. OIL LEVEL GAUGE

The oil level gauge of a saber type is located at the exhaust side of the engine.



WF80-LU05

LUBRICATION SYSTEM

6. ENGINE OIL

Oil capacity

Item		Oil capacity
Oil capacity (whole)	dm ³	3.8
Full level	dm ³	3.3
Low level	dm ³	2.3

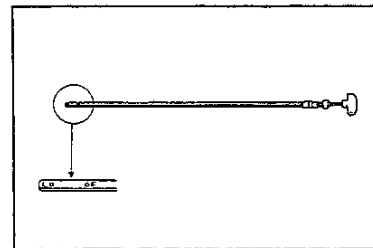
Recommended Oil

API classification: SF, SG

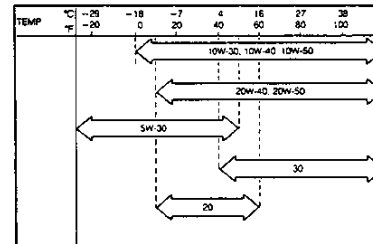
SAE: 10W-30

Engine Oil & Oil Filter Change Intervals (Normal condition)

Engine oil	Every 10,000 km or every 0.5 year
Oil filter	Every 10,000 km



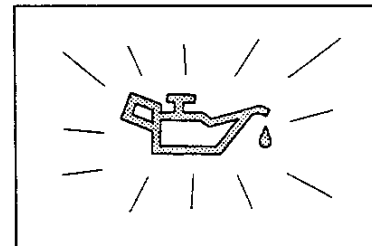
WFE90-LU016



WFE90-LU017

7. OIL PRESSURE WARNING DEVICE

If the oil pressure detected by the oil pressure switch is lower than 19.6 kPa (0.2 kgf/cm²), the warning lamp provided inside the combination meter goes on, thus telling the driver of the abnormality.

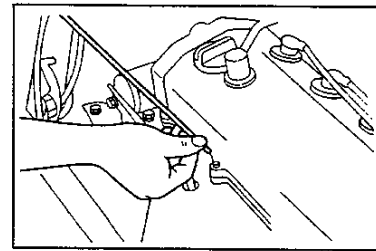


WFE90-LU018

OIL PRESSURE CHECK

1. Oil quality check

Check the oil for deterioration, ingress of water, discoloring or dilution.
If oil quality is poor, change the oil.
Use API grade SG or SF multigrade viscosity, fuel-efficient oil. (See page LU-8.)



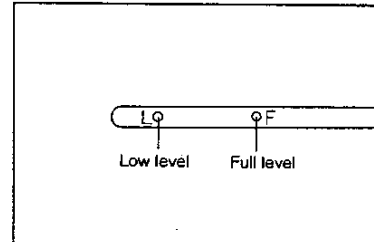
WFE90-LU019

2. Oil level check

The oil level should be between the L and F levels on the dipstick.
If the level is low, check to see if any oil leakage is present.
Add oil to the F level.

NOTE:

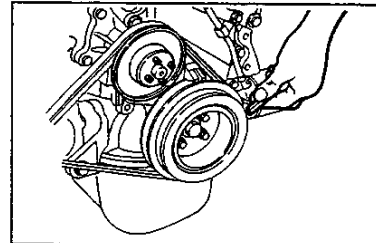
- The amount of oil between the [L] level and the [F] equals to one liter.



WFE90-LU020

3. Oil pressure check

- (1) Remove the air cleaner and air cleaner hose assembly. (Only HD-E Engine)
- (2) Disconnect the connector of oil pressure switch.

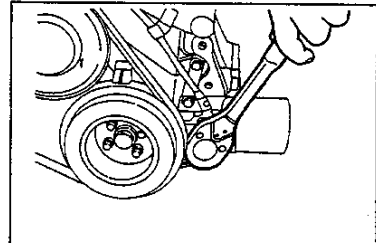


WFE90-LU021

- (3) Remove the oil pressure switch.

NOTE:

- Use a hexagonal long box wrench for the removal.



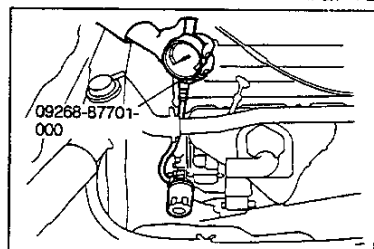
WFE90-LU022

- (4) Install the oil pressure gauge.

NOTE:

- The pressure gauge is available as a SST.
SST: 09268-87701-000

- (5) Install the air cleaner and air cleaner hose assembly. (Only HD-E Engine)



WFE90-LU023

LUBRICATION SYSTEM

- (6) Starting engine
Start the engine and warm it to the normal operating temperature.
At Idle Speed: More than 19.6 kPa (0.2 kgf/cm²)
At 3000 rpm: 245.2 - 490.4 kPa (2.5 - 5.0 kgf/cm²)
- If the measured value fails to conform to the specified value, check and repair the oil pump.
(See page EM-146.)
- (7) Stop the engine.
(8) Remove the air cleaner and air cleaner hose assembly.

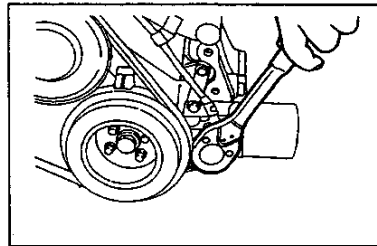
WFEB0-LU024

- (9) Remove the oil pressure gauge.
(10) Clean the threaded portion of the oil pressure switch.
Wind seal tape around the threaded portion. Install the oil pressure switch in the oil pump.
Tightening Torque: 11.8 - 19.6 N·m (1.2 - 2.0 kgf·m)

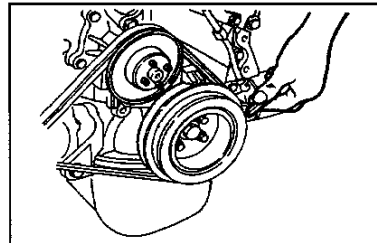
NOTE:

- Use a hexagonal long box wrench for the installation.
- The new oil pressure switch is coated with sealing materials.

- (11) Connect the connector of the oil pressure switch.
(12) Install the air cleaner and air cleaner hose assembly.
(13) Start the engine and check it for oil leakage.
Repair the leaky point if oil leakage exists.



WFEB0-LU025



WFEB0-LU026

ENGINE OIL CHANGE & OIL FILTER REPLACEMENT

1. Drain the engine oil as follows:
 - (1) Place a suitable container under the oil drain plug.
 - (2) Remove the engine under cover.
 - (3) Drain the oil by removing the oil drain plug.

WARNING:

- When the oil is still hot, care must be exercised to avoid getting scalded.

2. Oil filter replacement
 - (1) Remove the oil filter element, using the following SST.

SST: 09228-87201-000

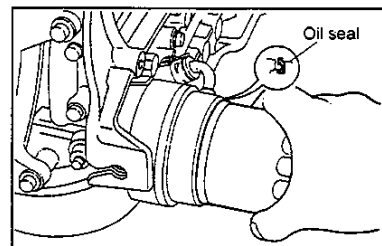
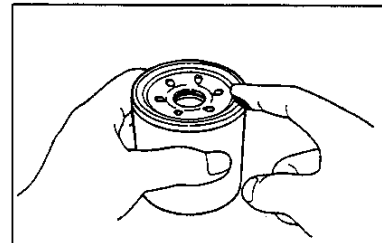
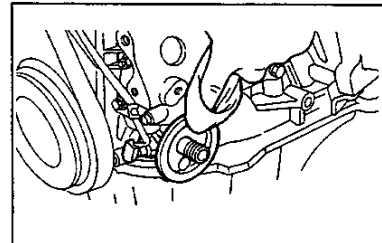
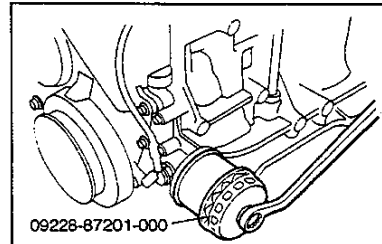
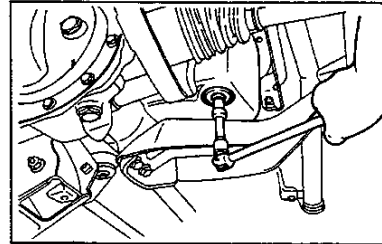
NOTE:

- Place a suitable container under the oil filter because the engine oil flows out.

- (2) Inspect and clean the oil filter installation surface.

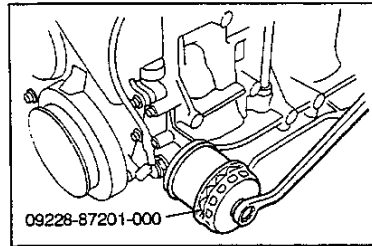
- (3) Thinly apply engine oil to the "O" ring of a new oil filter.

- (4) Screw in the oil filter by hand, until the "O" ring of the oil filter contacts the oil filter installing surface.



LUBRICATION SYSTEM

- (5) Tighten the oil filter three fourths to one complete turn, using the following SST.
SST: 09228-87201-000



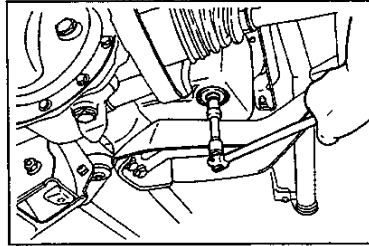
WF890-LU032

3. Filling engine oil

- (1) Clean the oil drain plug. Install it with a new gasket interposed.

NOTE:

- Remove any remaining gasket material from the oil pan, using a gasket scraper.
Tightening Torque: 19.6 - 29.4 N·m (2.0 - 3.0 kgf·m)



WF890-LU033

- (2) Fill the engine with engine oil.

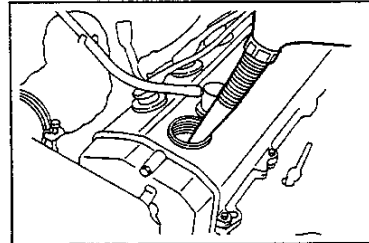
The oil should be API grade SG or SF multigrade viscosity, fuel-efficient oil.

Oil Capacity

When only engine oil is changed: 3.3 dm³

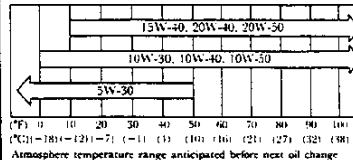
When engine oil is changed and oil filter is replaced: 3.5 dm³

After engine has been overhauled or when engine oil has been drained completely from engine: 3.8 dm³



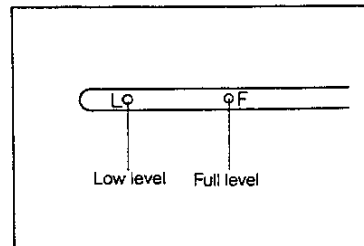
WF890-LU034

Classification API SG or SF



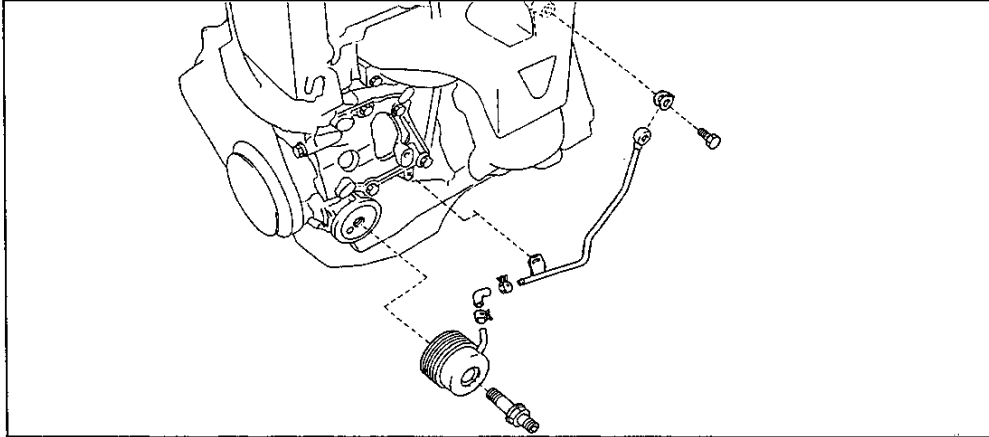
WF890-LU035

- (3) Start the engine and check it for leakage. Repair the leaky point if oil leakage exists.
(4) Stop the engine. After a lapse of two or three minutes, check the oil level. If oil level is less than the full level, replenish the oil to the full level.
(5) install the engine under cover.



WF890-LU036

**OIL COOLER
COMPONENTS**



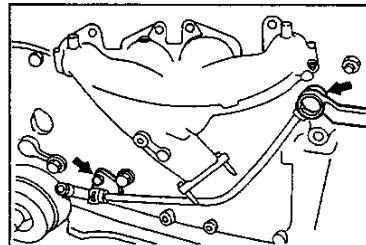
WFES0-LU037

REMOVAL OF OIL COOLER

1. Disconnect the battery ground cable from the negative (-) terminal of the battery.
2. Drain the coolant. (See page CO-3.)
3. Remove the air cleaner and the air cleaner hose assembly.
4. Remove the oil filter. (See page LU-4.)
5. Disconnect the oil cooler hose at the radiator side.

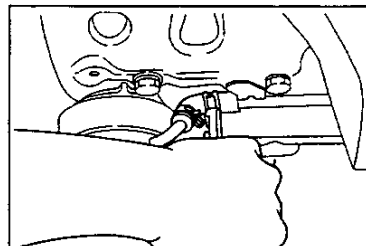
WFES0-LU038

6. Disconnect the oil cooler pipe from the cylinder block.



WFES0-LU039

7. Remove the oil cooler pipe from the hose by sliding the hose bands.



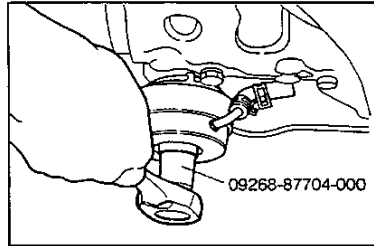
WFES0-LU040

LUBRICATION SYSTEM

8. Remove the oil cooler, using the following SST.
SST: 09268-87704-000

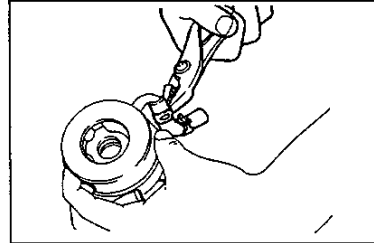
NOTE:

- Place a suitable container below the oil cooler attaching section so as to receive any oil and water flowing from the oil cooler.



WF90-LU041

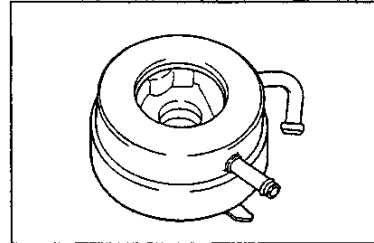
9. Disconnect the water hose from the oil cooler.



WF90-LU042

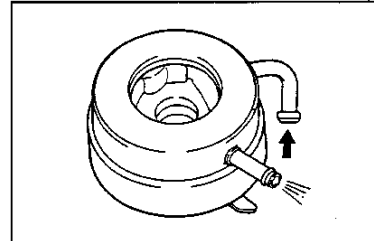
INSPECTION OF OIL COOLER

1. Check the oil cooler for damage.
Replace the oil cooler if the oil cooler exhibits damage.



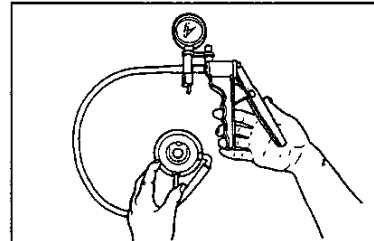
WF90-LU043

2. Blow air from one end of the oil cooler pipe.
Ensure that air continuity exists.



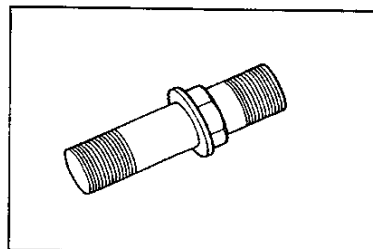
WF90-LU044

3. With one end of the oil cooler pipe plugged with your finger, apply a negative pressure of 13.3 kPa (100 mmHg) to the other end, using a MityVac or a vacuum pump. Ensure that the applied negative pressure is retained.
If the negative pressure is not kept, replace the oil cooler.



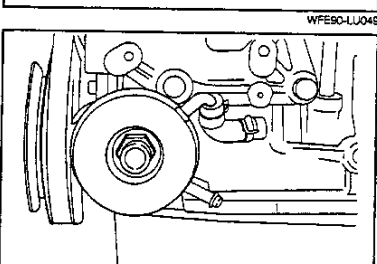
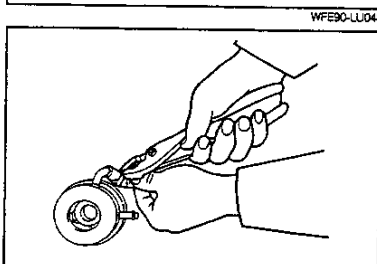
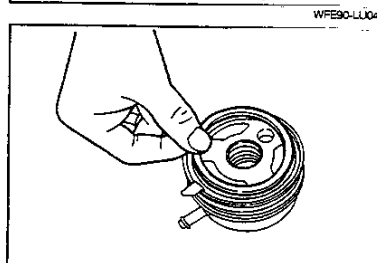
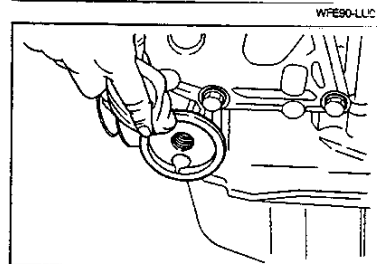
WF90-LU045

4. Check the oil cooler set bolt for damage.
Replace the oil cooler set bolt if it exhibits damage.



INSTALLATION OF OIL COOLER

1. Clean the oil cooler attaching surface of the oil pump.
2. Install the new "O" ring on the cooler.
3. Connect the water hose to the oil cooler. Attach the hose bands.
4. Using the set bolts, install the oil cooler by making the locating rib of the oil cooler contact with the cylinder block.
NOTE:
 - Care must be exercised to ensure that the "O" ring may not be displaced during the installation.

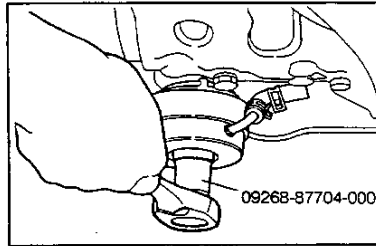


LUBRICATION SYSTEM

5. Tighten the set bolt to the specified torque, using the following SST.

SST: 09268-87704-000

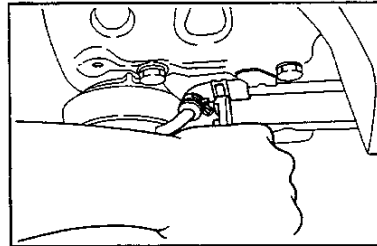
Tightening Torque: 24.5 - 34.3 N-m (2.5 - 3.5 kgf-m)



6. Connect the oil cooler inlet pipe to the oil cooler hose that has been installed on the oil cooler.

NOTE:

- Install the oil cooler pipe, by taking into consideration an angle at which it is mounted on the cylinder block.



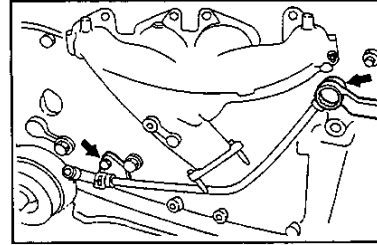
7. Install the oil cooler pipe on the cylinder block with a new gasket interposed.

Tightening Torque (Union bolt):

24.5 - 34.3 N-m (2.5 - 3.5 kgf-m)

NOTE:

- Never reuse the gasket.



8. Installation of oil filter

(1) Clean the oil filter installation surface of the oil cooler.


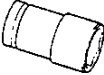
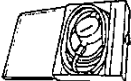
(2) Install the oil filter. (See page LU-11.)

9. Connect the oil cooler hose at the radiator side. Attach the hose bands.
10. Fill coolant. (See page CO-12.)
11. Install the air cleaner and air cleaner hose assembly.
12. Connect the battery ground cable to the negative (-) terminal of the battery.
13. Start the engine. Check to see if any oil leakage or fuel leakage is present.
If the engine exhibits any defect, repair it or replace the defective part, as required.
14. Stop the engine. After two or three minutes, check the engine oil level, using the oil level gauge. Replenish engine oil to the FULL level, as required. (See page LU-9.)

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LUBRICATION SYSTEM

SST [Special Service Tools]

Shape	Parts No. and Name	Purpose	Remarks
	09032-00100-000 Oil pan seal cutter	Removal of oil pan	
	09268-87704-000 Oil cooler set bolt box wrench	Removal and installation of oil cooler (only for oil cooler-equipped vehicle)	Only for oil cooler-equipped vehicle
	09990-87702-000 Engine oil pressure gauge	Measurement of engine oil pressure	

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TIGHTENING TORQUE

Tightening component	Tightening torque			Remark
	N·m	kgf·m	ft·lb	
Cylinder block × Oil pump	5.9 - 8.8	0.6 - 0.9	4.3 - 6.5	Dry
" × Rear oil seal retainer	5.9 - 8.8	0.6 - 0.9	4.3 - 6.5	Dry
" × Oil cooler pipe	24.5 - 34.3	2.5 - 3.5	18.1 - 25.3	Dry
Oil pump body × Oil cooler	24.5 - 34.3	2.5 - 3.5	18.1 - 25.3	Dry
Oil pump × Oil pressure switch	11.8 - 19.6	1.2 - 2.0	8.7 - 14.5	Dry
Oil pan	6.9 - 11.8	0.7 - 1.2	8.7 - 14.5	Dry
" × Drain plug	19.6 - 29.4	2.0 - 3.0	14.5 - 21.7	Dry
Oil pump body × Oil pump cover	7.8 - 12.7	0.8 - 1.3	5.8 - 9.4	Dry
Oil level gauge guide	18.6 - 30.4	1.9 - 3.1	13.7 - 22.4	Dry

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SERVICE SPECIFICATION

Engine oil capacity		
Whole amount		3.8 dm ³
When only oil is changed	Full level	3.3 dm ³
	Low level	2.3 dm ³
When oil and filter are changed		3.5 dm ³
NOTE If oil cooler equipped engine, add 79 cm ³ for whole amount.		
Oil pump	Compression spring free length	57 mm
	Body clearance	0.20 - 0.28 mm
	Tip clearance	0.16 - 0.24 mm
	Side clearance	0.035 - 0.085 mm
	Oil pressure	Idling 3000 rpm

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