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# **DAIHATSU**

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# **F300**

[HD Engine]

## **COOLING SYSTEM**

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WF30-C0001

## COOLING SYSTEM

### TROUBLE SHOOTING

Problem	Possible cause	Remedies	Page
Engine overheats	Poor quality coolant	Replenish coolant.	CO-12
	Water pump drive belt loose or missing	Adjust or replace belt.	
	Dirt, leaves or insects on radiator	Clean radiator.	CO-12
	Leaky hoses, water pump, thermostat housing, radiator, heater, core plugs or head gasket	Repair as necessary.	
	Thermostat faulty	Check thermostat.	CO-17
	Ignition timing retarded	Set timing.	EM-23
	Radiator hose plugged or deteriorated	Replace hose.	
	Water pump faulty	Replace water pump.	CO-14
	Radiator plugged or cap faulty	Check radiator.	CO-19
Cylinder head or block cracked or plugged	Repair as necessary.		

WFE90-C0002

### PRECAUTIONS

- As regards water to be used as cooling water, use soft water which does not contain salts of minerals, calcium, magnesium and so forth.
- If the coolant gets to the vehicle body, immediately flush away the coolant using water.
- Never open the radiator cap when the cooling water is hot.

#### WARNING:

- The inside of the radiator is under a pressurized condition when the cooling water is hot. Therefore, if the radiator cap should be removed, the cooling water will blow off, possibly causing injuries such as scald.

WFE90-C0003

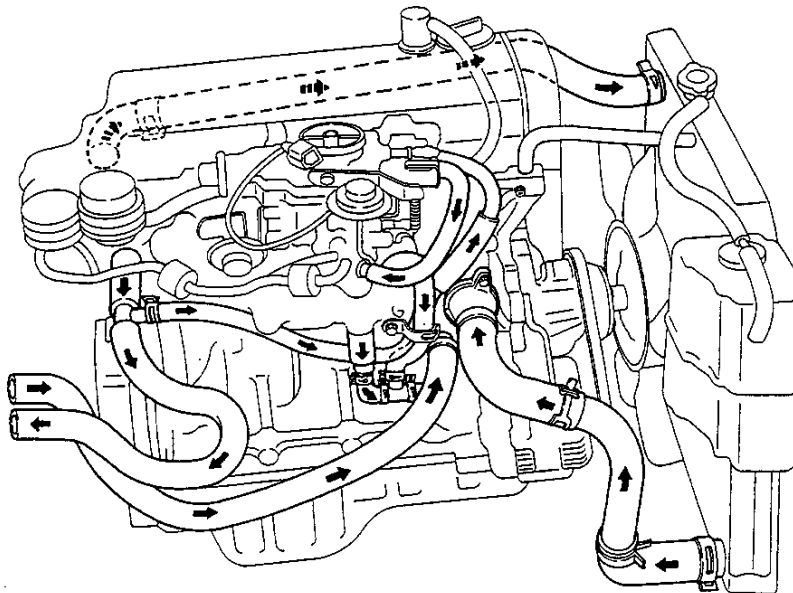
### COOLING SYSTEM OUTLINE

The cooling system is a water-cooled, forced-circulation type. Furthermore, it employs a fluid coupling fan. The cooling system employs a bottom by-pass type in which the thermostat equipped with a by-pass valve is provided at the inlet side.

The cooling system is composed of the radiator, water pump, thermostat, cylinder head, water jackets of cylinder block, water hoses and their connecting parts.

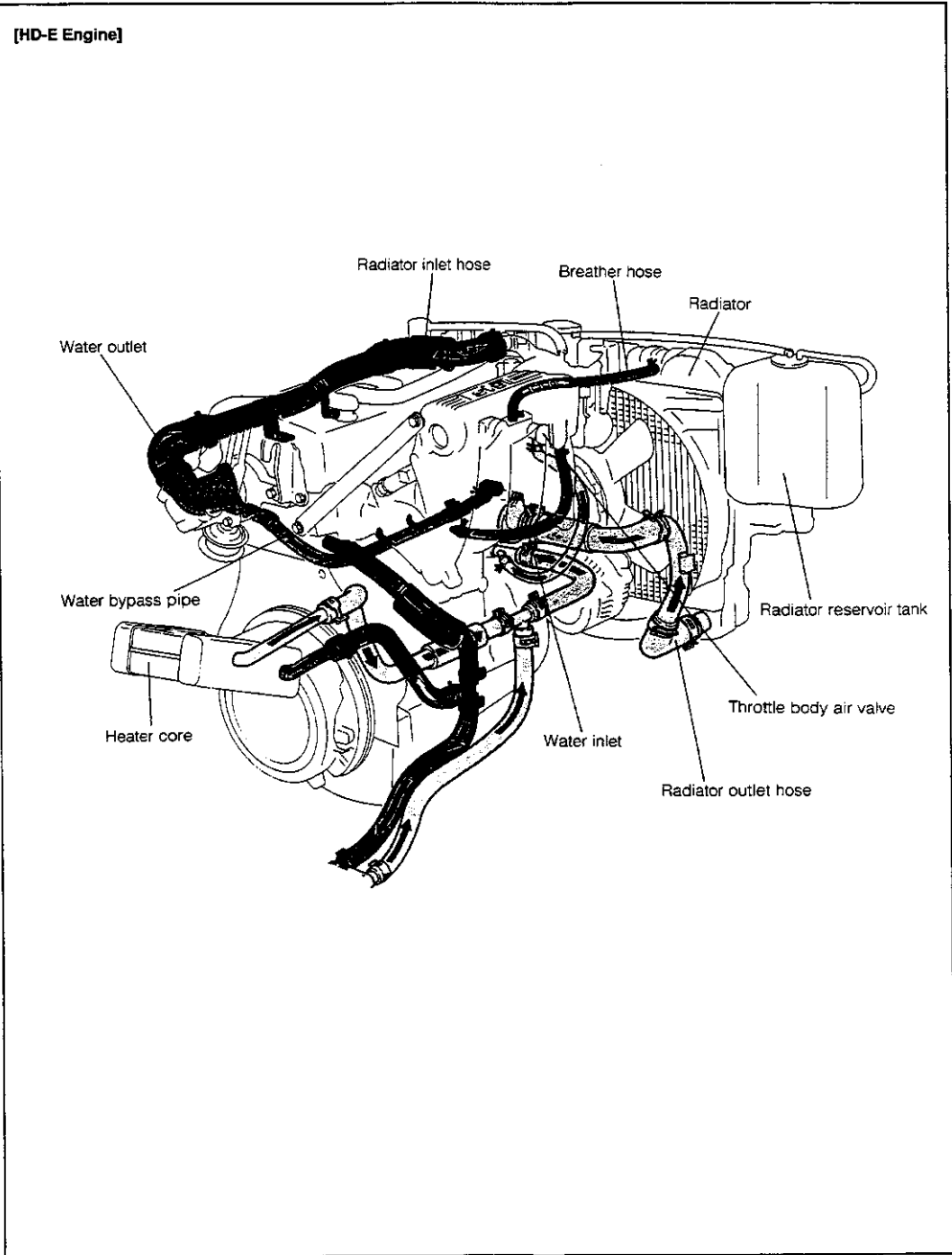
The total capacity of the cooling water is approximately 6.5 dm<sup>3</sup> (including one liter for the reserve tank.)

[HD-C Engine]



WF80-C0004

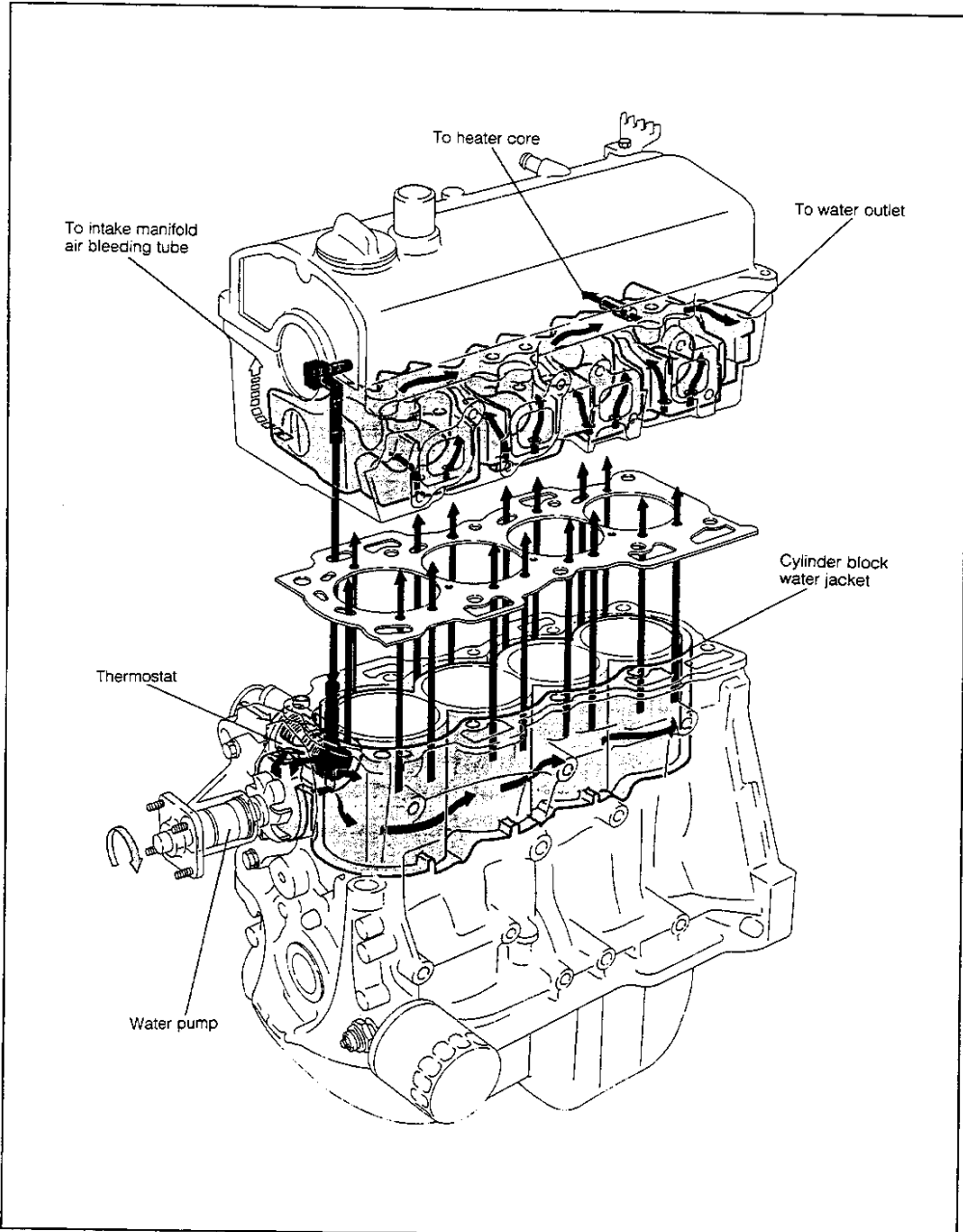
## COOLING SYSTEM



WFES0-C0005

**COOLING SYSTEM**

**SCHEMATIC DIAGRAM OF COOLING SYSTEM PASSAGE INSIDE ENGINE**

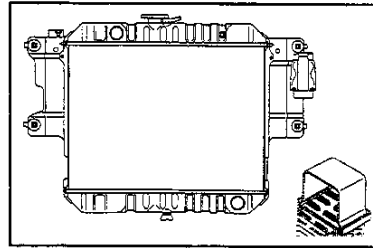


WFE90-C0006

## COOLING SYSTEM

### RADIATOR

The radiator core adopts a corrugated fin type double core.



WF80-C0007

#### Radiator specification

Item		Specification	
		General	Tropical & US. spc
Radiator water capacity	dm <sup>3</sup>	2.1	2.1
Heat radiating rate	KJ/h (kcal/h)	144445 (34500)	133954 (32000)
Core dimensions (width x height x thickness)	mm	488 x 350 x 32	488 x 350 x 32

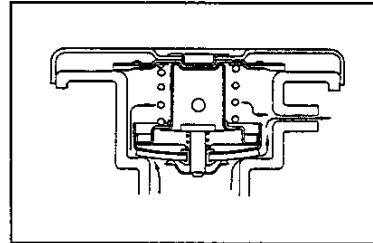
WF80-C0008

### RADIATOR CAP

A pressure type radiator cap is installed at the upper part of the radiator.

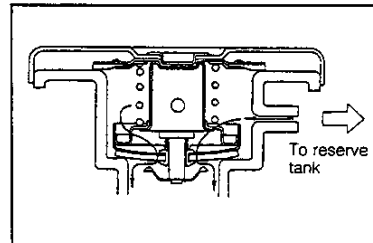
The radiator cap has two valves: a pressure regulating valve and a negative pressure valve.

When the pressure of the cooling system exceeds a specified limit, the rising pressure opens the pressure regulating valve of the radiator cap. As a result, the coolant in the radiator flows to the reserve tank.



WF80-C0008

On the other hand, the negative pressure valve opens when the inner pressure drops below the atmospheric pressure due to a dropped water temperature after the engine has stopped. Thus, the coolant returns from the reserve tank to the radiator.



WF80-C0010

#### Radiator cap specifications

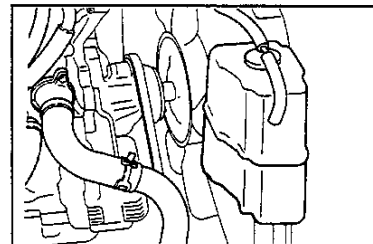
Item		Specifications
Radiator cap opening pressure	kPa (kgf/cm <sup>2</sup> )	8.83 (0.9)

### RADIATOR RESERVE TANK

A reserve tank with an overflow hose is employed. The radiator reserve tank is attached to the radiator side bracket.

#### Specifications

Total capacity	dm <sup>3</sup>	1.8 or more	
Cooling water capacity	dm <sup>3</sup>	F level	1.0
		L level	0.15



WF80-C0011

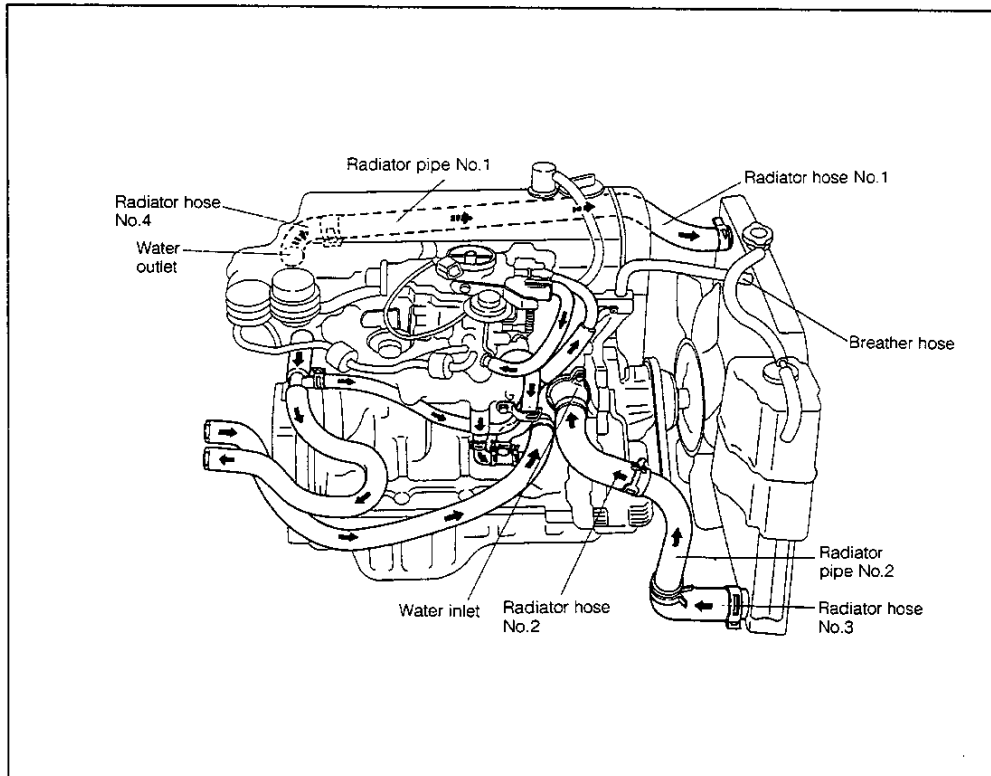
## COOLING SYSTEM

### RADIATOR HOSES & PIPES

These components come in four radiator hoses and two radiator pipe subassemblies.

Radiator hose	No.1	Radiator pipe No.1 to radiator upper tank
	No.2	Radiator pipe No.2 to inlet of cylinder block section
	No.3	Radiator lower tank to radiator pipe No.2
	No.4	Outlet at rear of cylinder head to radiator pipe No.1
Radiator pipe	No.1	Radiator hose No.4 to radiator hose No.1
	No.2	Radiator hose No.3 to radiator hose No.2

WFE90-C0012



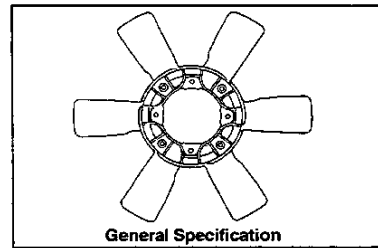
WFE90-C0013

## COOLING SYSTEM

### FAN-EQUIPPED FLUID COUPLING

The fan-equipped fluid coupling with a temperature control device is employed in order that the noise level may be reduced.

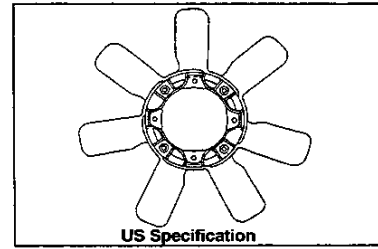
Furthermore, the drop in engine output due to the installation of cooling fan has been kept to a minimum level.



WFE90-C0014

#### 1. COOLING FAN

The fan made of propylene comes in two kinds: One is a six-blade fan and the other is a seven-blade fan.



WFE90-C0015

#### Specifications

		General	Tropical & the U.S.
Fan outer diameter	mm	360	360
Number of blades		6	7
Type		Axial flow	←
Air flow rate	m <sup>3</sup> /sec	0.36 at 1000 rpm	0.41 at 1000 rpm
		0.75 at 2000 rpm	0.86 at 2000 rpm

WFE90-C0016

#### 2. FLUID COUPLING WITH FAN

The fluid coupling employs a two-stage temperature control type.

The fluid coupling is available in three kinds. The optimum fluid coupling can be selected and installed in accordance with the vehicle specifications.

WFE90-C0017

#### Specifications

Item		Specifications		
		General	The U.S.	Tropical
Fluid coupling outer diameter	mm	127	136	136
Fan revolution speed (when engine revolution speed is 4000 rpm)	rpm	900 at 55°C	1300 at 70°C	1300 at 55°C
		2250 at 70°C	2500 at 80°C	3750 at 65°C
Cooling fan outer diameter x Number of blade	mm	360 x 6	360 x 7	360 x 7

WFE90-C0018



## COOLING SYSTEM

### Operation of coupling fan

#### During cold operation (Below about 55°C)

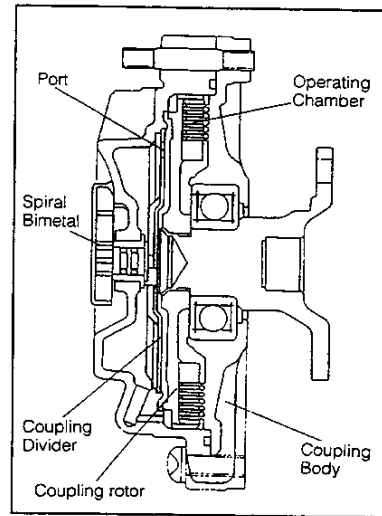
When the cooling water temperature is low, the port is closed by the coupling divider. Consequently, the silicon oil will not move into the operating chamber. Hence, the coupling body remains at its low speed operation.

#### During hot operation

##### (Above about 70°C; above about 65°C on tropical specifications)

When the spiral bimetal detects the temperature of the air passing through the radiator, this rotates the coupling divider integral with the bimetal shaft. As a result, the silicon oil flowing out from the port enters into the operating chamber, thus pushing the coupling rotor. Consequently, the coupling body is rotated.

As is explained above, the revolution speed of the coupling fan is switched over two stages. In this way, the output loss due to the cooling fan has been kept at a minimum level and the fan noise level has been reduced.

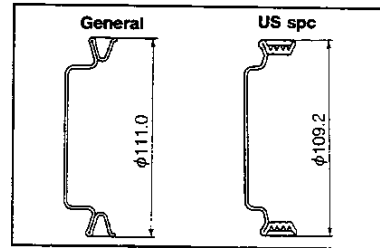


WFES0-C0019

### 3. WATER PUMP PULLEY

The water pump pulley made of sheet metal. This pulley is attached to water pump pulley seat along with the fluid coupling by means of four nuts.

The water pump pulley equipped with two kind pulley of right figure.



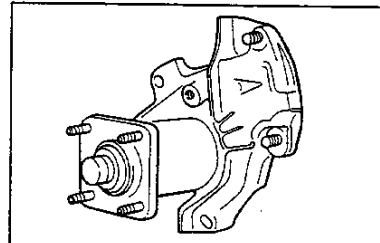
WFES0-C0020

### WATER PUMP

The water pump used for circulating the cooling water is installed at the front section of the cylinder block.

#### Specifications

Item	Specifications
Type	Centrifugal type
Delivery output (When shaft revolution speed is 200 rpm)	35 dm <sup>3</sup> /min
Rotor outer diameter	62 mm



WFES0-C0021

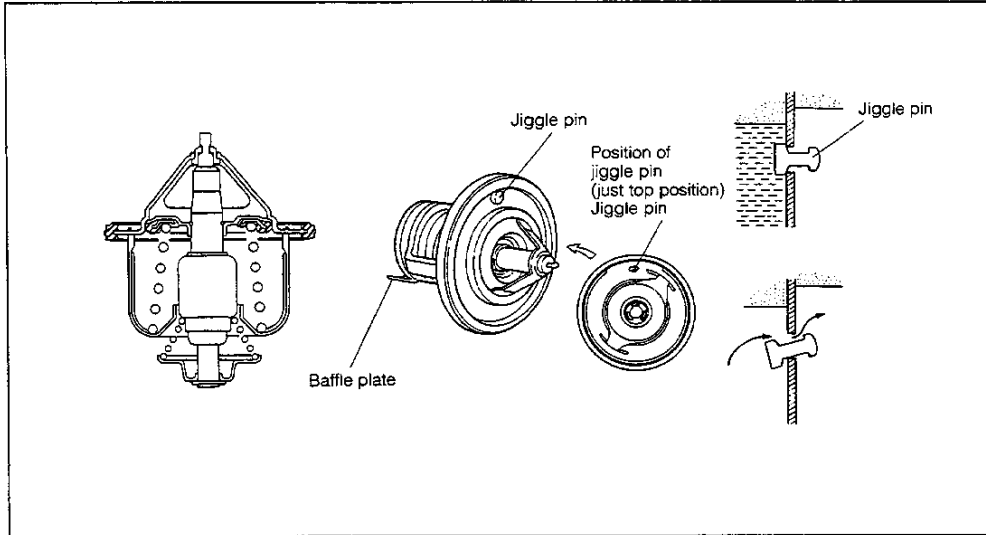
## COOLING SYSTEM

### THERMOSTAT

The thermostat is a wax type with a bypass valve. The thermostat helps the engine to warm up quickly by allowing the cooling water to be recirculated through the cylinder block and cylinder head without passing through the radiator.

Furthermore, the thermostat is equipped with a jiggle pin which performs the air bleeding while the engine is stopped. Also, the jiggle pin allows the temperature of the cooling water to rise quickly during the warming-up period.

Moreover, a baffle plate attached to the thermostat makes it possible to get better temperature sensing characteristics.



WFEB0-C0022

### Thermostat specifications

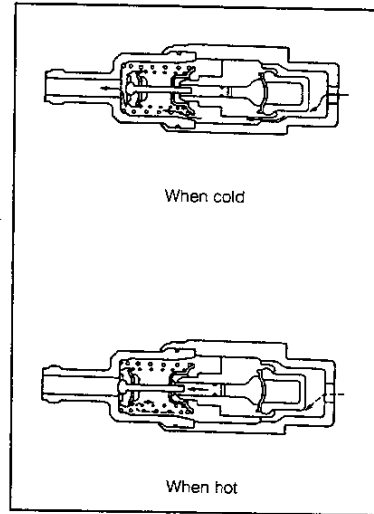
Item		Standard specifications	Cold region specifications
Type		Wax type	
Valve opening temperature	°C	78	84
Valve full opening temperature	°C	91	97

WFEB0-C0023

## COOLING SYSTEM

### Thermostat valve assembly (HD-C Engine only)

To promote atomization of the fuel, hot water is allowed to be circulated from the cylinder head to the riser section of the intake manifold during the cold operation. When the temperature of the recirculating water reaches about 60°C, the valve closes.



WFES0-C0024

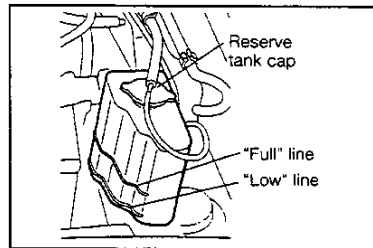
## COOLING SYSTEM

### CHECK & CHANGE OF ENGINE COOLANT

#### 1. Check of coolant level

Check to see if the coolant level is between the LOW and FULL lines of the reserve tank.

If the coolant level is near the low level or below the low level, add the coolant up to the full level.



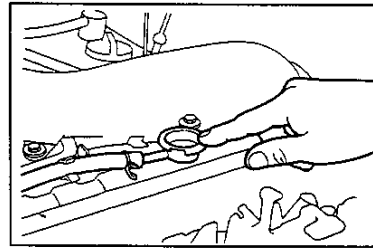
#### 2. Check of coolant quality

There should not be any excessive deposits of rust or water scales around the radiator cap or the radiator filler hole. Also, the coolant should be free of oil.

Change the coolant if it is excessively dirty or the time due to change the coolant has already arrived.

#### WARNING:

- Never open the radiator cap when the engine is hot.



#### 3. Change of engine coolant

(1) Remove the radiator cap.

#### WARNING:

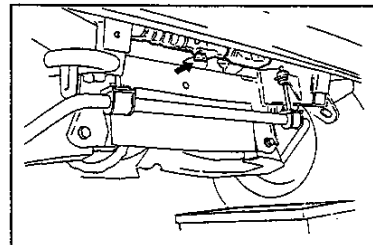
- Never open the radiator cap and/or the drain plug when the engine is still hot. Care must be exercised to avoid getting scalded.

WFES0-CO027

- (2) Remove the engine under cover.
- (3) Place an adequate container below the radiator drain plug. Drain the coolant by removing the drain plug.
- (4) Close the drain plug.
- (5) Fill the system with water.
- (6) Start the engine, and stop it.
- (7) Repeat the steps (1) through (5) two to three times.

#### NOTE:

- Replace the drain plug gasket with a new one.

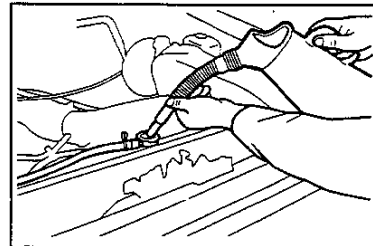


- (8) Fill the radiator and reserve tank with antifreeze solution in accordance with the instructions of the manufacturer of the antifreeze solution.

#### CAUTION:

- Use a Good brand of ethylene-glycol base antifreeze solution.

Coolant Capacity (Vehicle with front heater): 5.5 dm<sup>3</sup>  
[excluding 1.0 dm<sup>3</sup> for reserve tank]



## COOLING SYSTEM

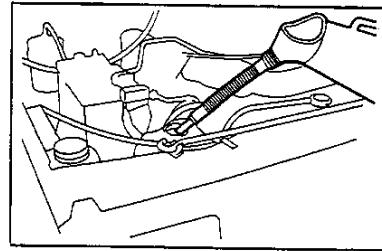
- (9) Fill the system with water.
- (10) Start the engine. Check the coolant level. Add water, as required.
- (11) Tighten the radiator cap.
- (12) Warm the engine. Afterwards, allow the coolant to cool down to the atmospheric temperature. Recheck the coolant level at the reserve tank. Add coolant to the full level, as required.

If no coolant remains at all in the reserve tank, recheck the coolant level in the radiator. Replenish the radiator with water, as required. Replenish the reserve tank with coolant up to the full level.

**NOTE:**

- Here, the coolant refers to the mixture of water and antifreeze that has been mixed in accordance with the instructions of the antifreeze manufacturer.

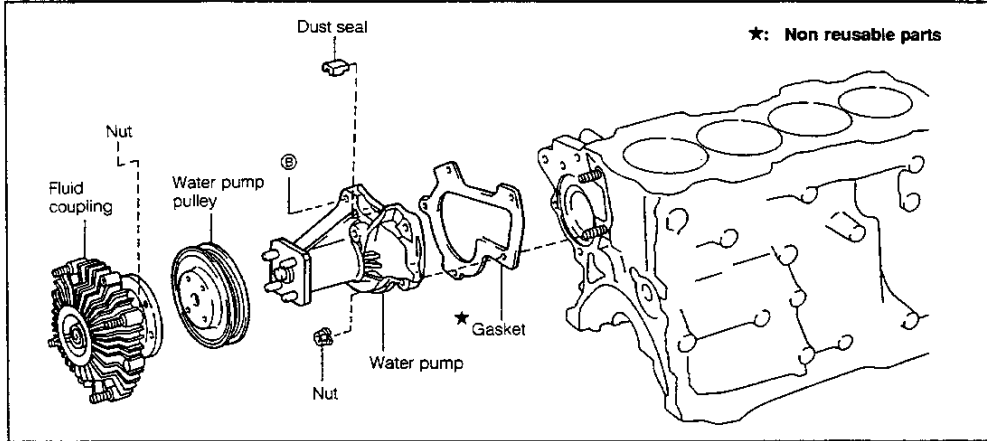
- (13) Install the engine under cover with attaching bolts.



WPB30-C0030

## COOLING SYSTEM

### WATER PUMP COMPONENTS



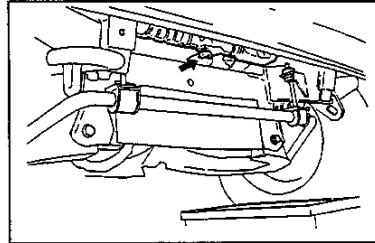
WF890-CO031

### REMOVAL OF WATER PUMP

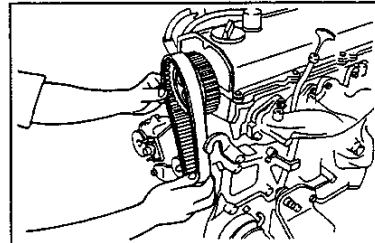
1. Disconnect the battery ground cable from the negative (-) terminal of the battery.
2. Drain the coolant. (See page CO-12.)  
Open the radiator cap and drain plug, and allow the coolant to drain into a clean container.

#### WARNING:

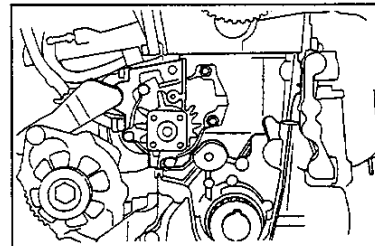
- Never open the radiator cap and/or drain plug when the engine is hot.



3. Remove the timing belt.  
(See pages EM-32.)

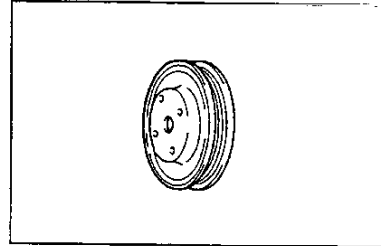


4. Remove the water pump by removing the attaching bolts and nuts of the water pump.

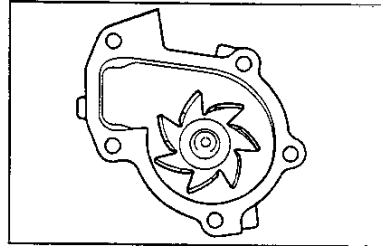


**INSPECTION OF WATER PUMP-RELATED PARTS**

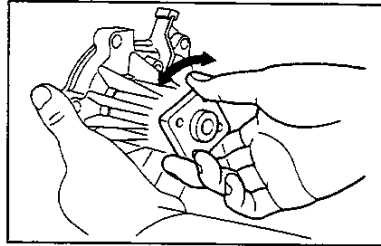
1. Check the water pump pulley for damage or deformation. Replace the water pump pulley if it exhibits damage or deformation.
2. Visually inspect the water pump rotor for damage or deformation. Replace the water pump if the water pump rotor exhibits damage or deformation.
3. Ensure that the water pump rotates smoothly by hand. Replace the water pump if it will not rotate smoothly.
4. Check the water pump cover section of the cylinder block for damage or wear. Replace the cylinder block if the water pump cover section exhibits damage or wear.



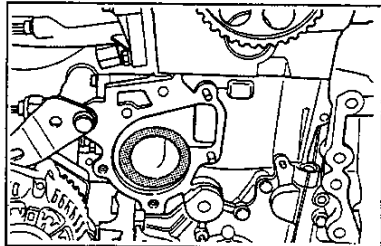
WF890-C0035



WF890-C0036



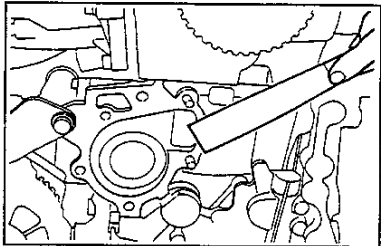
WF890-C0037



WF890-C0038

**INSTALLATION OF WATER PUMP**

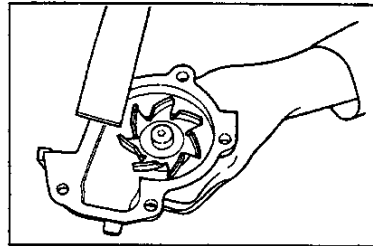
1. Remove the gasket material from the water pump installing surface of the cylinder block, using a gasket scraper.



WF890-C0039

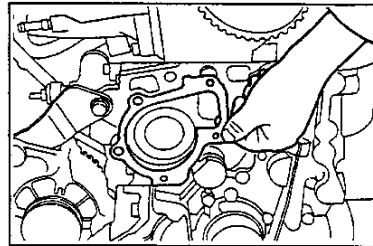
## COOLING SYSTEM

2. Remove the gasket material from the water pump, using a gasket scraper.



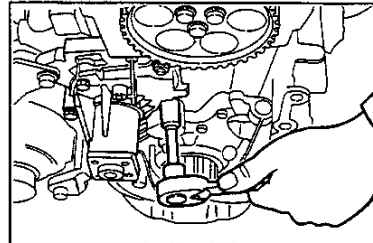
WFE90-CO040

3. Install a new gasket to the cylinder block.



WFE90-CO041

4. Install the water pump to the cylinder block. Tighten the attaching bolts and nuts evenly over two or three stages to the specified torque.  
Tightening Torque: 14.7 - 21.6 N·m (1.5 - 2.2 kgf·m)

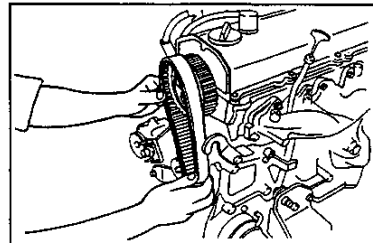


WFE90-CO042

**NOTE:**

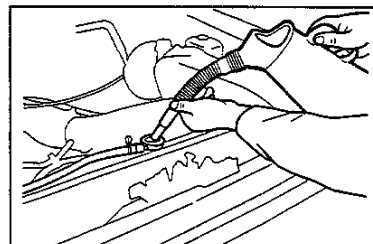
- After tightening bolts, ensure that the water pump rotates smoothly by hand.

5. Install the timing belt.  
(See page EM-32.)



WFE90-CO043

6. Fill coolant.  
(See page CO-12.)
7. Connect the battery ground cable to negative (-) terminal of the battery.



WFE90-CO044



## THERMOSTAT

### REMOVAL OF THERMOSTAT

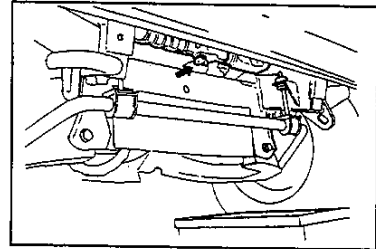
1. Disconnect the battery ground cable from the negative (-) terminal of the battery.
2. Drain the coolant  
(See page CO-12).

**WARNING:**

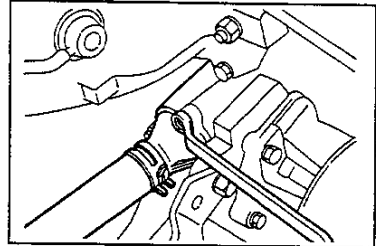
- Never open the radiator cap and/or drain plug when the coolant is hot.

3. Remove the power steering vane pump assembly.  
(See page EM-35).
4. Remove the radiator hose No. 2 from the water inlet.  
**CAUTION:**
  - Cover the alternator to prevent entering the cooling water to the alternator.

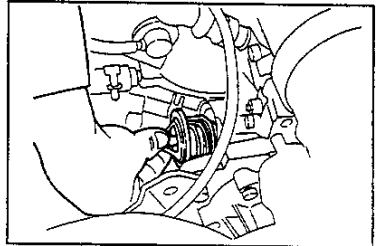
5. Remove the thermostat by removing the water inlet.



WFEB0-C0045



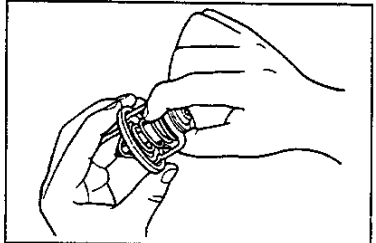
WFEB0-C0046



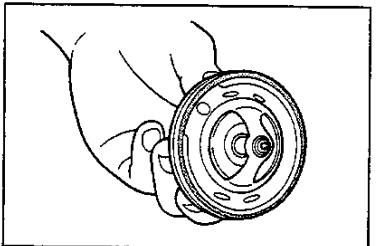
WFEB0-C0047

### INSPECTION OF THERMOSTAT

1. Ensure that the thermostat valve is closed completely at room temperature 20°C and the spring has no play.  
Replace the thermostat if the valve is open or the spring has a play.
2. Check the rubber grommet of the thermostat for damage or crack.  
Replace the thermostat if the rubber grommet exhibits damage or crack.



WFEB0-C0048



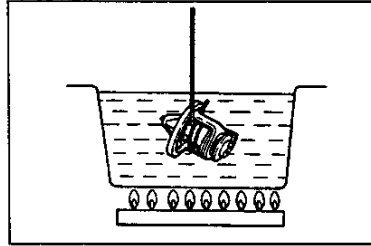
WFEB0-C0049

## COOLING SYSTEM

3. Immerse the thermostat in water, and check the valve opening temperature by heating the water gradually.

Specifications	Valve opening temperature °C	Valve lift
Standard specifications	76 - 80	8.5 mm or more at 91°C
Cold area specifications	82 - 86	8.5 mm or more at 97°C

Replace the thermostat if the valve operation fails to conform to the specifications.



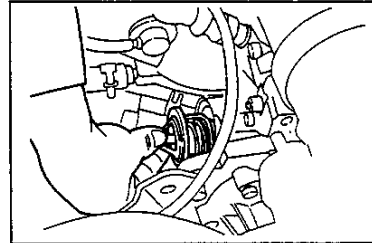
WFE90-C0050

## INSTALLATION OF THERMOSTAT

1. Assemble the thermostat in such a way that the jiggle pin comes exactly at the top of the engine.

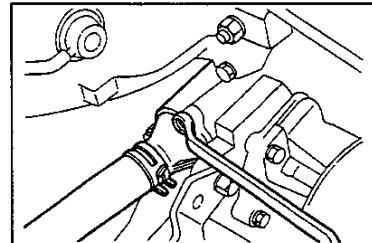
**NOTE:**

- The thermostat should be installed in such a way the jiggle pin may face upward. Failure to observe this caution may cause engine malfunction.

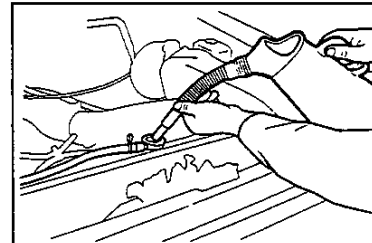


WFE90-C0051

2. Install the water inlet.  
Tightening Torque: 5.9 - 8.8 N·m (0.6 - 0.9 kgf·m)
3. Install the power steering vane pump assembly into position.  
(See page EM-35.)
4. Fill coolant.  
(See page CO-12.)
5. Connect the battery ground cable to the negative (-) terminal of the battery.
6. Start the engine and check it for leakage.  
Repair the leaky point if the leakage exists.



WFE90-C0052



WFE90-C0053

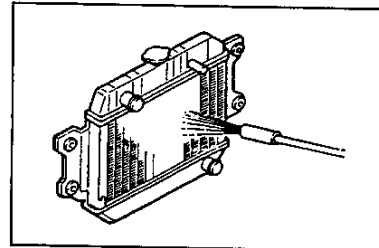
## RADIATOR

### CLEANING OF RADIATOR

Using water or steam cleaner, remove mud and dirt from the radiator core.

**CAUTION:**

- When using a high pressure type cleaner, be careful not to deform radiator core fins.
- Keep a distance of more than 40 - 50 cm between the radiator core and cleaner nozzle when the cleaner nozzle pressure is 2942 - 3433 kPa (30 - 35 kgf/cm<sup>2</sup>). Also, the injection angle of pressurized water should be right angles to the radiator.



WFE90-C005

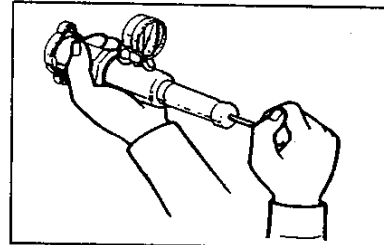
### INSPECTION OF RADIATOR

1. Check of radiator cap

- (1) Check the radiator cap by means of a radiator cap tester to see if the relief valve opens at a pressure of 73.6 - 103.0 kPa (0.75 - 1.05 kgf/cm<sup>2</sup>). If the radiator cap does not conform to the specification, replace the radiator cap.

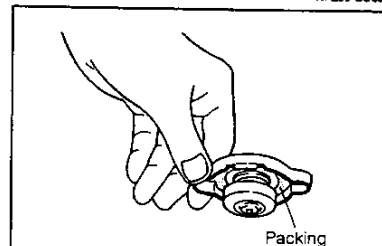
**WARNING:**

- Never open the radiator cap when the engine is hot.



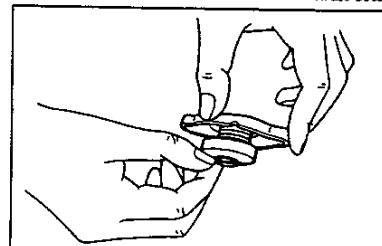
WFE90-C0055

- (2) Check the seal packing of the radiator cap for damage. Replace the radiator cap with a new one, if any damage exists.



WFE90-C0056

- (3) Lift the valve at the vacuum side with your fingers. Ensure that the valve is functioning properly. Replace the radiator cap with a new one, if the valve fails to function.



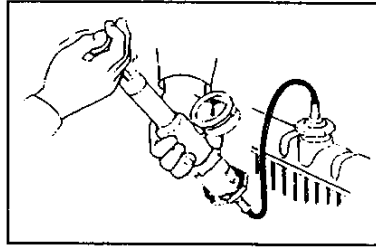
WFE90-C0057

## COOLING SYSTEM

2. Check of cooling system for leakage
  - (1) Fill the radiator with coolant. Attach a radiator cap tester.
  - (2) Warm up the engine.
  - (3) Apply a pressure of 117.7 kPa (1.2 kgf/cm<sup>2</sup>) to the cooling system by means of a radiator tester.  
If the pressure drops, check the hoses, radiator, water pump and heater for evidence of leakage.  
If no external leakage is found, check the heater core, cylinder block, cylinder head, oil cooler and throttle body for evidence of leakage.  
Check the hoses for deterioration, cracks, bulge or damage.  
Replace the defective part(s) if necessary.
  - (4) Remove the radiator cap tester from the radiator.

### WARNING:

- Never remove the radiator cap tester when the coolant temperature is high.



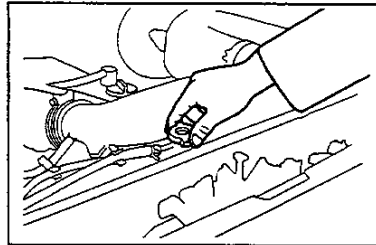
WFE90-C0058

## REMOVAL OF RADIATOR

1. Disconnect the ground cable terminal from the negative (-) terminal of the battery.
2. Drain the coolant as follows:
  - (1) Remove the radiator cap.

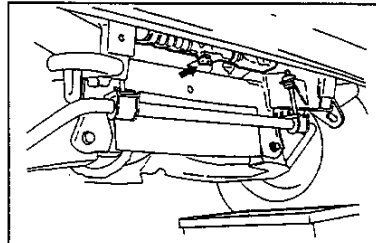
### WARNING:

- Never open the radiator cap and/or drain cap when the coolant is hot.



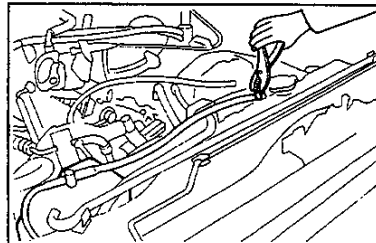
WFE90-C0059

- (2) Remove the engine under cover.
  - (3) Place a suitable container below the radiator drain plug.  
Drain the coolant by removing the drain plug.
  - (4) Tighten the drain plug.



WFE90-C0060

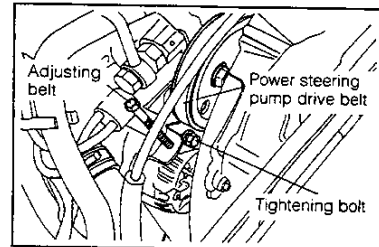
3. Removal of radiator
  - (1) Disconnect the radiator reserve tank hose from the radiator
  - (2) Pull up the radiator reserve tank together with hose.



WFE90-C0061

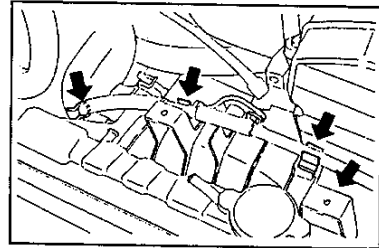
## COOLING SYSTEM

- (3) Loosen the adjusting bolt and two tightening bolts.  
Temporarily detach the power steering pump.



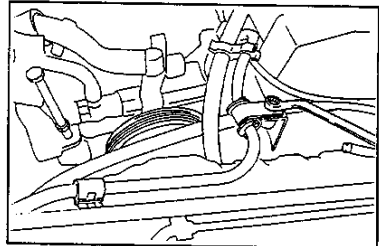
WFES0-C0062

- (4) Remove the three clamps for clutch cable provide on fan shroud.  
(5) Remove the aircleaner attaching bolt provide on fan shroud.



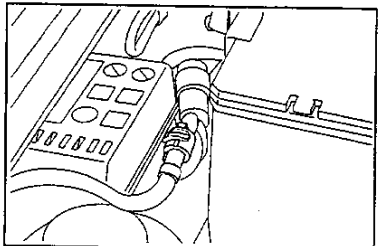
WFES0-C0063

- (6) Remove the clamping bolt and detach the clamp with lock. (HD-E Engine)



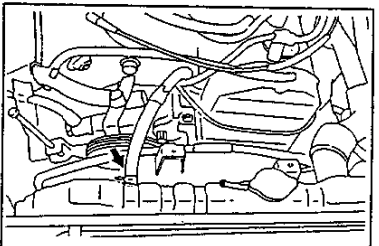
WFES0-C0064

- (7) Disconnect the main relay wire connector at the relay box side. (HD-E Engine)



WFES0-C0065

- (8) Disconnect the air breather hose from the radiator upper tank.



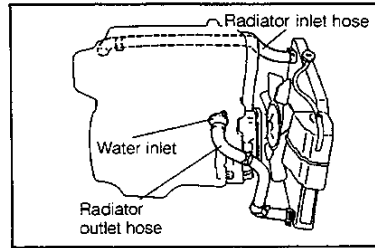
WFES0-C0066

## COOLING SYSTEM

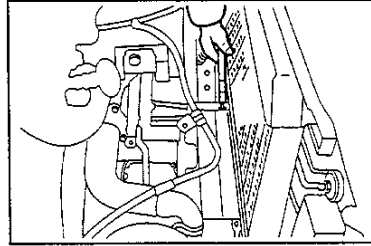
- (9) Remove the radiator inlet hose by disconnecting the radiator and water outlet side clamps.
- (10) Disconnect the radiator outlet hose at the center connection.

**CAUTION:**

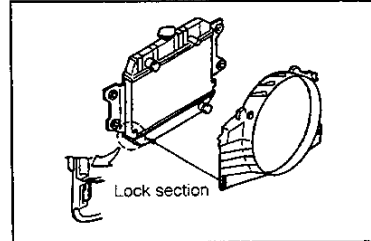
- When disconnecting the radiator outlet hose, take measures to prevent the coolant from entering the alternator.



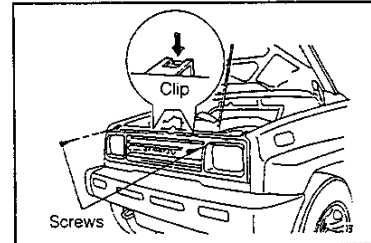
- (11) Disconnect the oil cooler hose from the radiator.  
(Oil cooler equipped vehicle only)



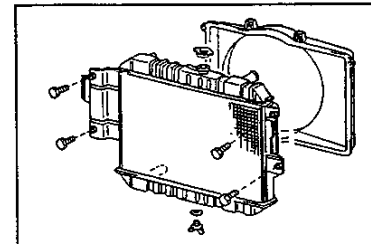
- (12) Remove the two attaching bolts of the fan shroud. Then, disconnect the lock section of the fan shroud from the radiator.



- (13) Remove the radiator grille.



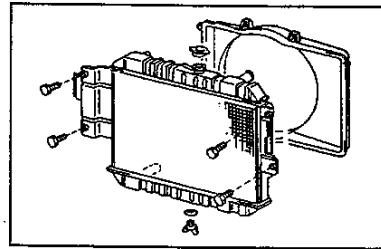
- (14) Remove the radiator by removing the four attaching bolts.



**INSTALLATION OF RADIATOR**

1. Radiator installation

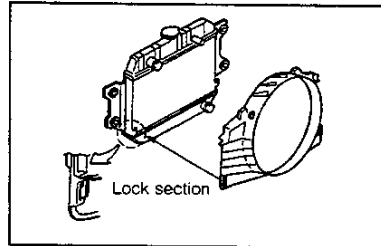
- (1) Place the radiator fan shroud to the cooling fan side.
- (2) Install the radiator in the engine compartment. Then, tighten the four attaching bolts.



WFES90-C0072

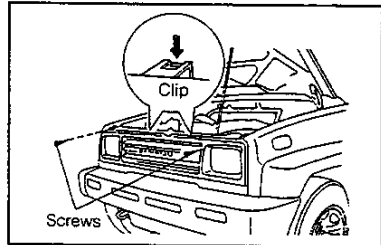
- (3) Install the radiator fan shroud with two attaching bolts.
- NOTE:**

- Before attaching the fan shroud to the radiator, insert the lock section of the fan shroud to the lower section of the radiator.



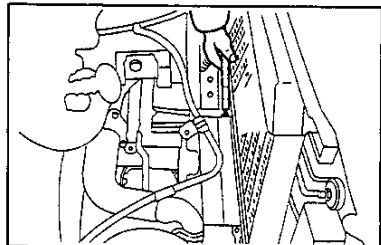
WFES90-C0073

- (4) Install the radiator grille.



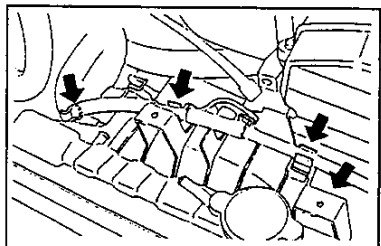
WFES90-C0074

- (5) Install the oil cooler hoses from the radiator. (Oil cooler equipped vehicle only)



WFES90-C0075

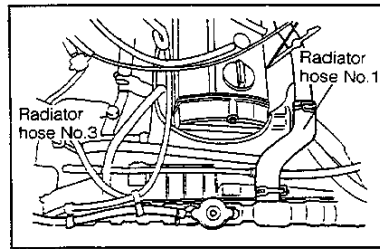
- (6) Clamp the clutch cable on the fan shroud with the two clamps.
- (7) Tighten the air cleaner hose attaching bolt of fan shroud.



WFES90-C0076

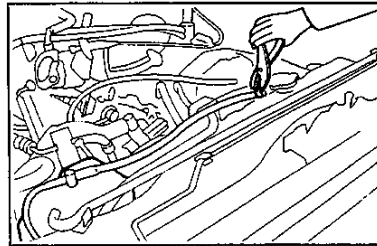
## COOLING SYSTEM

- (8) Connect the radiator hose No. 1 and breather hose to the radiator upper tank.
- (9) Connect the radiator hose No. 3 and oil cooler hose to the radiator lower tank.



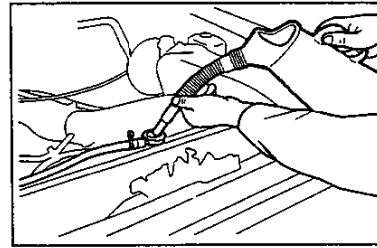
WFES90-CO077

- (10) Install the reserve tank to the radiator.
- (11) Connect the radiator reserve tank hose to the radiator.



WFES90-CO078

2. Fill the coolant.  
(See page CO-3.)
3. Connect the battery ground cable to the negative (-) terminal of the battery.
4. Start the engine and check it for leakage.  
Repair the leaky point if leakage exists.



WFES90-CO079



## COOLING SYSTEM

### TIGHTENING TORQUE

Tightening component	Tightening Torque			Remark
	N-m	kgf-m	ft-lb	
Cylinder head x Water temperature sensor (HD-E engine only)	24.5 - 34.3	2.5 - 3.5	18.1 - 23.5	Dry
Cylinder head x Water temperature sender gauge	11.8 - 19.6	1.2 - 2.0	10.8 - 15.9	Dry
Cylinder block x Water inlet	5.9 - 8.8	0.6 - 0.9	4.3 - 6.5	Dry
Cylinder block x Water pump	14.7 - 21.6	1.5 - 2.2	10.8 - 15.9	Dry
Fluid coupling x Water pump pulley x Water pump	9.8 - 17.6	1.0 - 1.8	7.2 - 13.0	Dry
Cooling fan x Fluid coupling	4.9 - 5.9	0.5 - 0.6	3.6 - 4.3	Dry

WFE90-C0080

### SERVICE SPECIFICATION

Coolant capacity w/heater [Excluding 1.0 dm <sup>3</sup> for reserve tank]		5.5 dm <sup>3</sup> [5.8 dm <sup>3</sup> for tropical specifications]
Radiator cap	Relief valve opening pressure Standard Minimum	73.5 - 103.0 kPa (0.75 - 1.05 kgf/cm <sup>2</sup> ) 58.8 kPa (0.6 kgf/cm <sup>2</sup> )
Thermostat	Valve opening temperature General specifications ECE & EEC specifications	76 - 86°C 82 - 86°C
	Valve lift General specifications ECE & EEC specifications	8.5 mm or more at 91°C 8.5 mm or more at 97°C

WFE90-C0081